



Commission for
Communications Regulation

Multi-band Spectrum Release

Release of the 800 MHz, 900 MHz and
1800 MHz Radio Spectrum Bands

Annexes to ComReg Document 12/25

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Annex 1: Glossary and Definitions

A1.1 Definitions

- A 1.1 The definitions in this glossary shall apply to this Response to Consultation and Decision Document as a whole save that they shall not apply to the Decision set out in chapter 8.
- A 1.2 Where a term in this glossary is defined by reference to a definition in a section or paragraph and an explanation of that term is provided in this glossary, the latter explanation is for convenience only and reference should be made to the appropriate part of the document for the definitive meaning of that term in its appropriate context.
- A 1.3 Any reference to any provision of any legislation shall include any modification re-enactment or extension thereof.
- A 1.4 Any reference to an Interested Party shall include that Interested Party's successors and assigns.
- A 1.5 The headings contained in this draft Information Memorandum are inserted for convenience of reference only and shall not in any way form part of or affect or be taken into account in the construction or interpretation of any provision of this draft Information Memorandum or the Annexes or Schedules hereto.
- A 1.6 Terms defined in this draft Information Memorandum shall, unless the context otherwise requires or admits, have the meaning set out below

Table 1: Definition of Terms

Term	Definition
3G Licence	A Licence issued under the Wireless Telegraphy (Third Generation and GSM Licence) Regulations, 2002 and 2003 (S.I. 345 of 2002 and S.I. No. 340 of 2003) for 3G services in the 2100 MHz band.
800MHz band	The frequency range 791-821MHz paired with 832-862MHz
900MHz band	The frequency range 880-915MHz paired with 925-960MHz
1800MHz band	The frequency range 1710-1785MHz paired with 1805-1880MHz
2100 MHz Band	1920 – 1980 MHz paired with 2110 – 2170 MHz, and 1900 – 1920 MHz
Activity	In a given Primary Bid Round, the number of eligibility points associated with the Bid submitted by a Bidder in that round.

Term	Definition
Activity Rules	Rules governing the Bids that each Bidder can make in successive rounds based on Bids submitted by the Bidder in previous rounds and their associated Activity.
Additional Price	The price associated with the Specific Lots in a Band assigned to a Winning Bidder. This price will be determined in the Assignment Stage using a second price rule, and will be no greater than the amount Bid by the Winning Bidder for these Specific Lots.
Administrative Application Form	The form set out in Annex 6 to the Draft Information Memorandum which sets out administrative information relating to an Applicant.
Aggregate Demand	The sum of demand for Lots in a Lot Category expressed by all Applicants at the Application Stage or by all Bidders in a Primary Bid Round in the Auction.
Applicant	An Entity that submits an Application to ComReg to be allocated at least one Lot of the Lots being made available in the Award Process.
Application	<p>The Application to participate in the Award Process made by an Applicant. The correct Application process shall comprise:</p> <ul style="list-style-type: none"> • delivering appropriately completed Application Forms along with any documents required to be annexed thereto; and • transferring the requisite deposit to ComReg’s nominated bank account by the deadlines set by ComReg, as same may have been varied by ComReg, in the exercise of its discretion.
Application Forms	<p>The set of application forms to be delivered as part of an Application consisting of:</p> <ul style="list-style-type: none"> • the Lot Application Form; • the Administrative Application Form; • the Ownership Structure Form; • the Auction Agreement Form; and • any supporting documentation required to be delivered therewith <p>and Application Form shall mean any of the foregoing.</p>
Application Stage	The stage of the Award Process described in subsection 3.3 of the draft Information Memorandum (11/75), which runs

Term	Definition
	from the day on which the Information Memorandum is published up to the point at which ComReg has identified which Applicants qualify to be entitled to participate in the Award Process.
Assign	Assignment of the rights and obligations under a Licence to a party who is not the Licensee
Assignee	The party to whom the rights and obligations under a Licence are assigned
Assignment Round	The single round of bidding in the Assignment Stage during which Winning Bidders in the Main Stage may submit one or more Bids to be assigned Specific Lots within the bands in which they have won Generic Lots.
Assignment Stage	The stage of the Auction where Winning Bidders are allocated Specific Lots in accordance with the number of Generic Lots they have been allocated.
Assignor	The party from which the rights and obligations under a Licence have been assigned
Associate	As defined in subsection 3.3.4 of the draft Information Memorandum (11/75).
Associated Bidders	As defined in subsection 3.3.4 of the draft Information Memorandum (11/75).
Auction	The mechanism within the Award Process used to determine Winning Bidders and Winning Prices in the event that there is insufficient supply in at least one Lot Category to meet the demand expressed by Applicants for Lots, overall and/or for Specific Lots, at the stated Reserve Prices at the Application stage of the Award Process.
Auction Agreement Form	<p>A form set out in of the draft Information Memorandum (11/75) by which an Applicant:</p> <ul style="list-style-type: none"> • certifies that all of the details on its Application Forms are correct; • agrees to be bound by the Auction Rules and other legal provisions in this Information Memorandum; and • certifies that Authorised Agents are appropriately authorised to bind the Applicant contractually. <p>This form shall be signed by an Authorised Agent.</p>
Auction Rules	Rules and procedures relating to the Auction, as presented in Chapters 3 and 4 of of the draft Information Memorandum (11/75).
Auctioneer	ComReg.

Term	Definition
Authorised Agent	A person who the Applicant has notified ComReg is entitled to bind an Applicant contractually in relation to the Award Process.
Award Process	The overall process through which it is intended that rights of use of spectrum will be awarded in the relevant bands in the event that at least one Applicant submits a valid Application for at least one Lot at the stated Reserve Prices.
Bands	The 800 MHz band, the 900 MHz band and the 1800 MHz band.
Base Price	The price to be paid by a Winning Bidder for the Package of Lots allocated to it in the Main Stage of the Auction (determined using a second price rule).
Bid	A binding offer to buy a Package of Lots for a specific monetary amount.
Bid Amount	The monetary amount associated with an offer made by a Bidder for a specified Package of Lots.
Bidder	An Interested Party that has both submitted an Application to ComReg to be allocated a Package of Lots in the Award Process (thereby becoming an Applicant) and had its Application approved by ComReg, qualifying it to either be allocated such Lots (where a Main Stage of the Award Process is not required) or to compete for Packages of Lots with the same or less associated Eligibility in the Auction.
Bidding Group	A Bidder and its Connected Persons as defined in subsection 3.3.4 of the draft Information Memorandum (11/75).
Binding Supplementary Bid	A Supplementary Bid at a non-discretionary level for a Package of Lots previously subject to a Primary Bid in a Primary Bid Round where the Bidder dropped Eligibility which is submitted alongside a Relaxed Primary Bid.
Business Day	A day on which the clearing banks are open for business in Ireland.
Communications Provider	A provider of electronic communications services as that term is defined in S.I. No. 333 of 2011 The European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011.
Confidential Information	Details of what may constitute Confidential Information for the purposes of this Award Process are provided in subsection, as defined in subsection 3.3.5 of the draft Information Memorandum (11/75).
Connected Person	Shall have the meaning ascribed to it in subsection 3.3.4 of the draft Information Memorandum (11/75).
Constraining Package	The Package of Lots whose Bid Amount determines the level of a Relative Cap applying to a Supplementary Bid. Shall have the meaning ascribed to it in Chapter 4 of the

Term	Definition
	draft Information Memorandum (11/75).
Controlled Person	As defined in subsection 3.3.4 of the draft Information Memorandum (11/75).
Controlling Person	As defined in subsection 3.3.4 of the draft Information Memorandum (11/75).
CPI	Consumer Price Index published by the Central Statistics Office.
Deposit	A monetary amount submitted by an Applicant as part of its Application to be allocated Lots in the Award Process. For an Application to be valid, the amount of an Applicant's Deposit must be equal to the sum of the Reserve Prices of Lots specified by the Applicant in its Lot Application Form. If a Main Stage of the Auction is required, ComReg may require that this Deposit be increased, as described in this Information Memorandum, during the Primary Bid Rounds to a level no greater than the value of the Bidder's highest Bid at the point in the Auction at which it increases such Deposit requirements.
Document 08/57	Liberalising the Use of the 900 MHz and 1800 MHz Spectrum Bands - Liberalisation of the GSM Spectrum Bands & Options for the Release of Spectrum in these Bands. Published 17 July 2008.
Document 09/14	Liberalising the Future Use of the 900 MHz and 1800 MHz Spectrum Bands & Spectrum Release Options - Response to Consultation 08/57 & Further Consultation. Published 10 March 2009.
Document 09/99	Liberalising the Future Use of the 900 MHz and 1800 MHz Spectrum Bands - Response to Consultation 09/14 and Further Consultation. Published 21 December 2009.
Document 09/99c	Liberalisation of spectrum in the 900MHz and 1800MHz bands. A report for ComReg by DotEcon. Published 21 December 2009.
Document 10/71	800 MHz, 900 MHz & 1800 MHz spectrum release. Published 17 September 2010.
Document 10/71a	Award of liberalised spectrum in the 900MHz and other bands - A report for ComReg by DotEcon. Published 17 September 2010.
Document 10/71b	Award of 800MHz and 900MHz spectrum - Update report on benchmarking. A report for ComReg by DotEcon. Published 17 September 2010.
Document 10/71c	Retuning and Relocating GSM900 Spectrum Assignments in Ireland. A report for ComReg by Red-M and Vilicom. Published 17 September 2010.

Term	Definition
Document 10/105	Inclusion of the 1800 MHz Band into the Proposed joint award of 800 MHz and 900 MHz Spectrum. Published 15 December 2010.
Document 10/105a	Inclusion of the 1800 MHz band in a joint award of spectrum in the 800 MHz and 900 MHz bands - A report for ComReg by DotEcon. Published 15 December 2010.
Document 10/105b	Retuning and Relocating GSM1800 Spectrum Assignments in Ireland - A report for ComReg by Red-M and Vilicom. Published 15 December 2010.
Document 11/11	Interim Licences for the 900 MHz band Consultation. Published 17 February 2011.
Document 11/29	Interim Licences for the 900 MHz Band Response to Consultation and Decision. Published 13 April 2011.
Document 11/57	Joint Technical Report, Mobile Operator Responses to 10/71, 10/105 and 11/11 - Prepared for ComReg by Red-M and Vilicom. Published 24 August 2011.
Document 11/58	Issues relating to the award of spectrum in multiple bands in Ireland - Prepared for ComReg by DotEcon (Non-confidential version). Published 24 August 2011.
Document 11/59	Award of 800MHz, 900MHz and 1800MHz spectrum - Further update report on benchmarking - Prepared for ComReg by DotEcon (non-confidential version). Published 24 August 2011.
Document 11/60	Multi-Band Spectrum Release - Release of the 800 MHz, 900 MHz and 1800 MHz radio spectrum bands. Response to Consultation and Draft Decision. Published 24 August 2011.
Document 11/60a	Multi-Band Spectrum Release. Annexes to Document 11/60. Published 24 August 2011.
Document 11/75	Multi-band Spectrum Release - Draft Information Memorandum. Published 24 October 2011.
Document 11/102	Spectrum Liberalisation - Publication of non-confidential responses to ComReg Document 11/60 and recent correspondence.
Document 12/21	Placeholder for Responses to 11/75
Document 12/22	Placeholder for Red-M/Vilicom report
Document 12/23	Placeholder for DotEcon benchmarking report
Document 12/24	Placeholder for DotEcon all issues report
Draft Information Memorandum	Means ComReg Document 11/75, the draft Information Memorandum on the “Multi-band Spectrum Release” including all the annexes and schedules to it,
Draft Regulations	Means the Wireless Telegraphy “Liberalised and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz bands” Draft Regulations as set out in Annex 7 of this document.

Term	Definition
Electronic Auction System (EAS)	The system used for running the Auction. Specifically, this will be used by Bidders to check and submit Bids during the Main Stage (where required) and the Assignment Stage of the Auction (except in exceptional circumstances).
Eligibility	<p>The extent of a Bidder's capacity to Bid for Lots in the current round of the Auction. This is expressed as a number of eligibility points and is equal to:</p> <ul style="list-style-type: none"> • In the first Primary Bid Round, the number of eligibility points associated with a Bidder's Application, as specified on its Lot Application Form (its initial eligibility); and • In subsequent Primary Bid Rounds, the number of eligibility points associated with a Bidder's Bid for Lots in the previous round.
Excess Demand	Demand for Lots in any one of Lot Categories 1 to 6 that exceeds supply of Lots in that Lot Category.
Extension	The increasing of the round end time, extending the deadline for submission of a Bid in the round (or Bids in the case of the Supplementary Bids Round) by up to 30 minutes for the Bidder (or Bidders) that have utilised an extension right in the round. An extension right of a Bidder will be exercised automatically in a round if the Bidder has at least one extension right remaining and has not submitted a Bid (or Bids in the Supplementary Bids Round) by the scheduled end time of the round.
Existing Licence	A Licence currently held under a Wireless Telegraphy Regulation.
Existing Mobile Network Operator or Existing MNO	Licensee who holds a GSM Licence or a 3G Licence on the date of publication of this Information Memorandum.
Final Price Cap	A cap applying to all Supplementary Bids limiting the maximum Bid Amount for a Package of Lots to the highest Bid made for the Final Primary Package plus the difference in value between the package in question and the Final Primary Package at the Round Prices applied in the final Primary Bid Round.
Final Primary Package	The Package of Lots Bid for by a Bidder in the final Primary Bid Round.
Generic Lot	A Lot of 2 x 5 MHz of spectrum in a specific band (the 800MHz, 900MHz or 1800MHz band) and in a specified Time Slice but not linked to specific frequencies within that band.

Term	Definition
General Authorisation	An authorisation for an undertaking to provide an electronic communications network or service under and in accordance with Regulation 4 of the Authorisation Regulations.
GSM900 MHz Licence	A Licence issued under the Wireless Telegraphy (GSM Mobile Telephony Licence) (Amendment) Regulations 2003 (S.I. 339 of 2003) for GSM use in the 900 MHz band.
GSM1800 MHz Licence	A Licence issued under the Wireless Telegraphy (GSM Mobile Telephony Licence) (Amendment) Regulations 2003 (S.I. 339 of 2003) for GSM use in the 1800 MHz band.
GSM Licence	A GSM900 MHz Licence or a GSM1800 MHz Licence or an Interim GSM900 MHz Licence as the case may be and GSM Licensee shall be construed accordingly.
Initial Eligibility	The number of eligibility points that a Bidder has in the first Primary Bid Round. This is based on the number of eligibility points associated with the Package of Lots the Bidder specified on its Lot Application Form, submitted to ComReg at the Application Stage.
Insider	Shall have the meaning ascribed to it in section 3.3.5 of the Draft Information Memorandum
Interest	As defined in subsection 3.3.4 of the draft Information Memorandum (11/75).
Interested Party	Includes, to the extent that the context requires or admits, any of the following: <ul style="list-style-type: none"> • a respondent to this draft Information Memorandum; • a prospective Bidder; • an Applicant; • a Qualified Bidder; or • an agent of any of the foregoing.
Interim GSM900 MHz Licence	a Licence issued under the Wireless Telegraphy (Interim GSM Mobile Telephony Licence) Regulations, 2011 (S.I. 189 of 2011) for GSM use in the 900 MHz band
Liberalised Use Licence (or a Liberalised Licence)	A Licence issued under Schedule 1 of the Draft Regulations in the form set out in Annex 7 of this document which entitles the holder to use certain Specific Lots of spectrum in the Bands, subject to the terms and conditions set out therein.
Licence	A Liberalised Use Licence, a Preparatory Licence or an Existing Licence as the case may be and “Existing Licensee”

Term	Definition
	and “Licensee” shall be construed accordingly.
Lot	A 2 × 5MHz block of spectrum in a specified band (the 800MHz, 900MHz or 1800MHz band). A Specific Lot or a Generic Lot as the case may be.
Lot Category	A number of Lots that are similar both as regards technical characteristics and bidding entitlements that are put together into a group of Generic Lots for the purposes of the Award Process.
Main Stage	The stage of the Auction that determines the Generic Lots allocated to different Bidders and the associated Prices in the case where there is excess demand for Lots in any Lot Category 1 to 6 expressed by Qualified Bidders at the Application Stage. This consists of a number of Primary Bid Rounds and a Supplementary Bids Round.
New Entrant	A Bidder that, in combination with its Connected Persons, does not currently hold a GSM Licence or a 3G Licence.
Notification and Grant Stage	The stage of the Award Process during which Upfront Prices are paid by Winning Bidders, less their Deposits (and Rebates where applicable), licences are granted to Winning Bidders and Deposits are returned to Unsuccessful Bidders.
Ownership Structure Form	A form as set out in Annex 6 of the Draft Information Memorandum setting out the ownership structure of the Applicant as required therein.
Package of Lots	<p>A selection of one or more Generic Lots:</p> <ul style="list-style-type: none"> • Specified in a Bidder’s Application; • Bid for in one or more Primary Bid Rounds; and/or • Bid for in the Supplementary Bids Round. <p>Such a selection of Generic Lots will only be considered in its entirety, in combination with the associated Bid Amount, in determining the Winning Combination of Bidders and associated Base Prices.</p>
Party-specific Lot	A Lot that can only be Bid for by one party.
Party-specific Lot Category	A Lot Category containing Lots whose usage rights will remain with their existing holder for the duration of the associated Time Slice. Such Lots can only be Bid for by the existing licensee as specified in the draft Information Memorandum (11/75). Where these Lots are won by their Existing Licensee within the Award Process, licence usage rights for the underlying spectrum will be liberalised. Where these Lots are not won by their Existing Licensee, licence usage rights of the existing licence holder will remain as

Term	Definition
	GSM-only.
Preparatory Licence	A Licence issued under Schedule 2 of the Draft Regulations in the form set out in Annex 7 which entitles the holder to possess and install equipment designed or configured for operation in certain Lots of spectrum in the Bands, but which does not permit any wireless telegraphy transmissions, subject to the terms and conditions set out therein.
Price Increment	<p>In the case of Lot Categories 1 to 6, the increase of the price of Generic Lots in a Lot Category based on demand expressed for Generic Lots in that category in the previous Primary Bid Round (or in the case of the price increment applicable to Reserve Prices for the first Primary Bid Round, demand expressed by Qualified Bidders at the Application Stage).</p> <p>In the case of Lot Categories 7 to 10, the increase of the price of Lots in a Lot Category based on demand expressed for the Lots in the corresponding General Category in the previous Primary Bid Round (or in the case of the price increment applicable to Reserve Prices for the first Primary Bid Round, demand expressed by Qualified Bidders at the Application Stage).</p>
Primary Bid	A Bid made by a Bidder in a Primary Bid Round.
Primary Bid Round	A round of the Main Stage during which Bidders each have the opportunity to submit a single Bid for a Package of Generic Lots for a Bid Amount equal to the sum of the Round Prices associated with each Lot within the Package of Lots upon which it submits a Bid.
Qualification Stage	A stage of the Award Process during which ComReg assesses Applications to be allocated Lots in the Award Process submitted before the deadline for Applications, evaluates which Applications are valid and determines which Applicants qualify to become Qualified Bidders in the Award Process. Based on the level of demand for Lots by Qualified Bidders, these Bidders will either be allocated the Lots in their respective Applications or Bid for Lots in the Main Stage of the Auction.
Qualified Bidder	An Applicant who, following consideration of its Application by ComReg, has been informed, in accordance subsection 3.4, of the draft Information Memorandum (11/75) that its Application is compliant and that it is entitled to participate in the Award Process.
Relative Cap	<p>A cap applying to a Supplementary Bid, which limits the Bid Amount for a Package of Lots to:</p> <ul style="list-style-type: none"> • the Price of the Package of Lots in the last Primary Bid Round in which the Bidder was

Term	Definition
	<p>eligible to Bid for the Package of Lots; plus</p> <ul style="list-style-type: none"> • the difference in value between that Package of Lots and the Package of Lots actually Bid for instead at the Round Prices prevailing in the same Primary Bid Round.
Relaxed Primary Bid	A Primary Bid submitted by a Bidder whose Activity exceeds the Bidder's Eligibility to Bid in one or more Time Slices but is permitted because it satisfies certain specified constraints.
Reserve Price	The minimum Bid for a Lot for such a Lot to be allocated. This minimum Bid might be met based on demand expressed by Applicants at the Application Stage or in the Main Stage of the Auction.
Round Price	The Price per Lot of each Generic Lot within a specified Lot Category in a given round.
Specific Frequencies	The frequency ranges associated with Specific Lots.
Specific Lot	A 2 x 5 MHz block of spectrum in one Time Slice in one of the Bands. Each Specific Lot has two specific frequency ranges associated with it, one of which is used for uplink and one of which is used for downlink.
Spectrum Caps	<p>Explicit maximum limits set on the amount of spectrum that any one Bidder can be awarded in the Award Process. These are:</p> <ul style="list-style-type: none"> • 2 x 20MHz of sub-1GHz spectrum in a Time Slice • 2 x 50MHz of spectrum in a Time Slice • 2 x 10MHz of 900MHz spectrum in the first Time Slice.
Supplementary Bid	A Bid submitted in the Supplementary Bids Round for a Package of Lots for a Bid Amount specified by the Bidder. The specified Bid Amount will be subject to a minimum and, in some cases, a maximum, as set out in the activity rules for the Auction.
Supplementary Bids Round	A single round of bidding during which each Bidder can submit multiple Bids, each for a Package of Generic Lots for an amount specified by the Bidder. The specified Bid Amount for each Supplementary Bid submitted in this round will be subject to a minimum and, in some cases, a maximum, as set out in the activity rules for the Auction.
Temporal Lot 1	A Lot in Time Slice 1.

Term	Definition
Temporal Lot 2	A Lot in Time Slice 2.
Time Slice	<p>Time Slice 1 or Time Slice 2 and each Licence shall be in respect of one Time Slice. A time period for which licences are being allocated within the Award Process. There are two distinct Time Slices for which Lots in all bands (800MHz, 900MHz, 1800MHz) are being allocated:</p> <ul style="list-style-type: none"> • 1 February 2013 – 12 July 2015 • 13 July 2015 – 12 July 2030
Time Slice 1	A time period from 1 February 2013 to 12 July 2015 (as may be amended by ComReg).
Time Slice 2	A time period from 13 July 2015 – 12 July 2030 (as may be amended by ComReg).
Technology	Any one of the standards for the implementation of Terrestrial Systems permitted for use in the 800 MHz, 900 MHz or 1800 MHz band, as applicable e.g. GSM, UMTS or LTE.
Terrestrial Systems	Systems capable of providing electronic communications services that are in compliance with the technical implementing measures adopted pursuant to Decision No. 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community ("Radio Spectrum Decision") each implemented using a Technology.
Unsuccessful Bidder	An Interested Party that submits an Application to ComReg to be allocated Lots in the Award Process, is declared a Qualified Bidder but is not allocated any Lots in the Auction.
Upfront Fee	The sum of the Base Price and any Additional Prices to be paid by a Winning Bidder for the spectrum assigned to it within the Award Process.
User manual	Manual provided to Qualified Bidders detailing the procedures for use of the Electronic Auction System, including for the checking and submission of Bids.
Valid Bid	A Bid submitted within the Auction or by way of the Lot Application Form that is in accordance with the Auction Rules.
Winning Bid	A Bid in respect of which a Winning Bidder is allocated at least one Lot in the Winning Scenario, such Bids are selected in accordance with subsection 3.5 of the draft Information Memorandum (11/75).
Winning Bidder	A Bidder that wins at least one Lot in the Award Process.
Winning Combination of Bidders	The final allocation of Generic Lots among Bidders as set out in section 4.3 of the draft Information Memorandum (11/75).

Term	Definition
Zero Bid	A Bid for no Lots with an associated Bid Amount of zero. Entry of a Zero Bid in the Primary Bid Rounds does not prevent the entry of Supplementary Bids.

A1.2 European and Governmental Bodies, Regulatory and Standardisation Organisations

Term	Organisation
ANFR	French Radio Spectrum Regulator
ARCEP	French Telecommunications Regulator
BNetzA	German Regulator
BEREC	Body of European Regulators for Electronic Communications
CEPT	European Conference of Postal and Telecommunications Administrations
CENELEC	European Committee for Electrotechnical Standardisation
CJEU	Court of Justice of the European Union
CoCom	Communications Committee of the European Commission
ComCom	Swiss Federal Commission for Communications ¹
ComReg	Commission for Communications Regulation
DCENR	Department of Communications, Energy and Natural Resources
EC	European Commission
ECC	Electronic Communications Committee of CEPT
ECJ	European Court of Justice – this has been renamed CJEU but older cases may use ECJ
ETSI	European Telecommunications Standards Institute
EU	European Union
ITU	International Telecommunications Union
NITA	Danish Regulator ²
NRA	National Regulatory Authority
OFCOM	Swiss Telecommunications and Spectrum Regulator ³
Ofcom	UK Regulator

¹ Independent of the Swiss Federal government and instructs OFCOM

² NITA is in the process of being wound down and its functions transferred to other Ministries.

³ OFCOM can be instructed by either ComCom or the Swiss Federal government under the auspices of the Department of the Environment Transport Energy and Communications and is also known as BAKOM in the German speaking areas of Switzerland

Term	Organisation
PTS	Swedish Regulator
RSC	The Radio Spectrum Committee of the European Commission
RSPG	Radio Spectrum Policy Group advising the European Commission

A1.3 Primary and Secondary Legislation

Term	Definition
SI	Statutory Instrument
2002 Act	The Communications Regulation Act 2002 (No. 20 of 2002), as amended ⁴
2009 Act	Broadcasting Act 2009 (No. 18 of 2009)
Access Regulations	European Communities (Electronic Communications Networks and Services) (Access) Regulations 2011 (S.I. No 334 of 2011)
Act of 1926	The Wireless Telegraphy Act 1926 (No. 45 of 1926) as amended
Act of 1972	The Wireless Telegraphy Act 1972 (No. 5 of 1972) as amended from time to time
Authorisation Regulations	European Communities (Electronic Communication Networks and Services) (Authorisation) Regulations 2011 (S.I. No 335 of 2011)
EC Decision 2009/766/EC	European Commission Decision on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community
EC Decision 2010/267/EU	European Commission Decision on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union
EC Decision 2011/251/EU	European Commission Decision, amending Decision 2009/766/EC, on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community

⁴ Includes the Communications Regulation (Amendment) Act 2007 and the Communications Regulation (Premium Rate Services and Electronic Communications Infrastructure) Act 2010.

Term	Definition
EMC Directive	Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004, on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC
Framework Directive	Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services, as amended
Framework Regulations	European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No 333 of 2011)
The Amending Directive	The Directive (2009/114/EC) amending Council Directive 87/372/EEC on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community.
The Minister	Minister for Communications, Energy and Natural Resources
TFEU	Treaty on the Functioning of the European Union
USO Regulations	European Communities (Electronic Communication Networks and Services) (Universal Service and Users' Rights) Regulations 2011 (S.I. No. 337 of 2011)
<i>WAPECS Recommendation</i>	Draft Commission Recommendation on the non-technical conditions attached to the rights of use for radio frequencies under the regulatory framework for electronic communications in the context of the Wireless Access Policy for Electronic Communications (WAPECS)

A1.4 Glossary of Technical Terms

Term	Definition
3G	Third Generation Mobile System (e.g. UMTS)
2G	Second generation mobile services (e.g. GSM)
2.5G	2G systems incorporating packet switched services
Apparatus	Apparatus for wireless telegraphy as defined in section 2 of the Act of 1926 for terrestrial systems capable of providing Electronic Communications Services in some or all of the 800 MHz band, the

Term	Definition
	900 MHz band and the 1800 MHz band, and, in relation to a Licence, means the particular apparatus for wireless telegraphy to which the Licence relates
ARPU	Average Revenue Per User
ASO	Analogue Switch-off (the switch-off of analogue TV transmissions to be replaced by DTT)
Beauty Competition or Beauty Contest	A licence award method involving comparative evaluation of applications
BEM	Block Edge Mask
BLER	Block Error Rate
BTS	Base Transceiver Station
Channels 21-59	The frequency range 470-782 MHz
Channel 60	The frequency range 782-790 MHz
CNR	Carrier-to-noise ratio
Combinatorial Clock Auction (CCA)	An auction format that progresses in two distinct phases. The first phase consists of a number of open rounds, which provide for price discovery (the 'primary Bid rounds'). This is followed by a single round of bidding (the 'Supplementary Bids round') during which bidders can express their demand for all packages of Lots that they value, subject to certain constraints.
CPI	Consumer Price Index
DECT	Digital Enhanced Cordless Telecommunications
Digital Dividend	Spectrum expected to be released following the cessation of analogue terrestrial television broadcasting services
DME	Aeronautical Distance Measuring Equipment
DTT	Digital Terrestrial Television
Ec/Io	The ratio of received pilot channel energy to total received Interference
ECN	Electronic Communications Network as defined under the Framework Regulations
ECS	Electronic Communications Service as defined under the Framework Regulations
EDGE	Enhanced Data for Global Evolution (an upgrade to GSM technology often referred to as 2.5G)
Eircom Group	Eircom, Meteor Mobile Communications or Meteor
EIRP (or eirp)	Equivalent Isotropically Radiated Power
EMC	Electromagnetic Compatibility
E nodeB	LTE Base Station
FDD	Frequency Division Duplex
FWALA	Fixed Wireless Access Local Area Network
FWPMA	Fixed Wireless Point to Multi-Point Access

Term	Definition
GDP	Gross Domestic Product
GHz	Giga Hertz (1,000,000,000 Hertz)
GNP	Gross National Product
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
Guard-band	Unused spectrum, or spectrum used only for services provided on a non-protected and non-interference basis, separating channels to prevent interference
Harmful Interference	Interference which endangers the functioning of a Radionavigation Service or other safety services or which otherwise seriously degrades, obstructs or repeatedly interrupts a Radiocommunication Service operating in accordance with a requirement under the International Telecommunication Union Radio Regulations, a regulation of an institution of the European Union or legislation giving effect to an Act, or provisions of an Act, adopted by an institution of the European Union relating to the provision of an electronic communications service, electronic communications network or an associated facility or the radio frequency spectrum, or regulations made under the Act of 1926
H3GI	Hutchison 3G Ireland
Hertz (Hz)	Unit of Frequency
HSDPA	High Speed Downlink Packet Access
IMT	International Mobile Telecommunications system
kHz	Kilo Hertz (1,000 Hertz)
LTE	Long Term Evolution of 3G
MCA	Mobile Communication Services on Aircraft
MCV	Mobile Communication Services on Vessels
METSAT	Meteorological Satellite
MHz	Megahertz (1,000,000 Hertz)
MIMO	Multiple In Multiple Out, a diversity antenna system
MMDS	Multipoint Microwave Distribution Service
MNO	Mobile Network Operator
MNP	Mobile Number Portability
MoU	Memorandum / Memoranda of Understanding
MVNO	Mobile Virtual Network Operator (a licensed mobile operator with no spectrum assignment and with or without network infrastructure)
NIR	Non-Ionising radiation
NodeB	UMTS Base Station
OCR	On Channel Repeater

Term	Definition
ODTR	Office of the Director of Telecommunications Regulation, established under the Telecommunications Miscellaneous Provisions Act 1996 and predecessor on ComReg.
OFDM	Orthogonal frequency division multiplexing
PMSE	Programme Making and Special Events
Porting	Number Portability is the process by which a consumer can transfer (port) from one service provider to another service provider while maintaining their existing telephone number
PDCCH	Physical Downlink Control Channel
QoS	Quality of Service
R&TTE	Radio Equipment And Telecommunications Terminal Equipment
RFID	Radio Frequency Identification
RIA	Regulatory Impact Assessment
SAF	Spectrum Access Fee
SBC	Sealed-bid Combinatorial Auction
Service Neutrality	An approach to granting of licences whereby any electronic communications service (ECS) may be provided in a frequency band over any type of electronic communications network
SINR	Signal to Interference plus Noise Ratio
SMP	Significant Market Power
SMRA	Simultaneous Multiple-Round Ascending Auction
SMRA/AS	Simultaneous Multiple-Round Ascending Auction with Augmented Switching
SNR	Signal to Noise Ratio
SRDs	Short Range Devices
SUF	Spectrum Usage Fee
TDD	Time Division Duplex
Technology Neutrality	An approach to granting of licences without specifying the technology to be deployed. However, certain technological requirements may be imposed to ensure compatibility with other services in the same or adjacent frequency bands
Telefónica	Telefónica O2 Communications (Ireland) Ltd
UE	User Equipment
UMTS	Universal Mobile Telecommunications System.
Vodafone	Vodafone Ireland Limited
WACC	Weighted Average Cost of Capital
WAPECS	Wireless Access Policy for Electronic Communications Services
WiMAX	Worldwide Interoperability for Microwave Access

Term	Definition

Annex 2: Legal Framework and Statutory Objectives

- A 2.1 The Communications Regulation Acts 2002-2010⁵ (the “2002 Act”), the Common Regulatory Framework (including the Framework and Authorisation Directives⁶ as transposed into Irish law by the corresponding Framework and Authorisation Regulations⁷), and the Wireless Telegraphy Acts⁸ set out, amongst other things, powers, functions, duties and objectives of ComReg that are relevant to this response to consultation and draft decision.
- A 2.2 It should be noted that the 2003 Framework and Authorisation Regulations which originally transposed the Framework and Authorisation Directives into Irish law were, on 1 July 2011, revoked and replaced by the following regulations which transpose the amended Framework and Authorisation Directives:
- the European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No. 333 of 2011); and
 - the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011 (S.I. No. 335 of 2011).
- A 2.3 References in this consultation document or in the appended draft decision to either the Framework or Authorisation Regulations should be understood as referring to the above 2011 regulations, unless the context suggests otherwise.
- A 2.4 Apart from licensing and making regulations in relation to licences, ComReg’s functions include the management of Ireland’s radio frequency spectrum in

⁵ The Communications Regulation Act 2002, the Communications Regulation (Amendment) Act 2007 and the Communications Regulation (Premium Rate Services and Electronic Communications Infrastructure) Act 2010.

⁶ Directive No. 2002/21/EC of the European Parliament and of the Council of 7 March 2002 (as amended by Regulation (EC) No. 717/2007 of 27 June 2007, Regulation (EC) No. 544/2009 of 18 June 2009 and Directive 2009/140/EC of the European Parliament and Council of 25 November 2009) (the “Framework Directive”) and Directive No. 2002/20/EC of the European Parliament and of the Council of 7 March 2002 (as amended by Directive 2009/140/EC) (the “Authorisation Directive”).

⁷ The European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No. 333 of 2011) and the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011 (S.I. No. 335 of 2011) respectively which revoke and replace S.I.307 of 2003 and S.I. 306 of 2003 respectively.

⁸ The Wireless Telegraphy Acts, 1926 and 1956, the Broadcasting Authority Acts, 1960 to 1971, in so far as they amend those Acts, the Wireless Telegraphy Act 1972, Sections 2, 9, 10,11,12,14,15,16,17 and 19 of the Broadcasting and Wireless Telegraphy Act 1988 and Sections 181 (1) to (7) and (9) and Section 182 of the Broadcasting Act 2009.

accordance with ministerial Policy Directions under Section 13 of the 2002 Act, having regard to its objectives under Section 12 of the 2002 Act, Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive. ComReg is to carry out its functions effectively, and in a manner serving to ensure that the allocation and assignment of radio frequencies is based on objective, transparent, non-discriminatory and proportionate criteria.

A 2.5 This annex is intended as a general guide as to ComReg’s role in this area, and not as a definitive or exhaustive legal exposition of that role. Further, this annex restricts itself to consideration of those powers, functions, duties and objectives of ComReg that appear most relevant to the matters at hand and by way of example excludes those in relation to premium rate services or market analysis.

A 2.6 All references in this annex to enactments are to the enactment as amended at the date hereof, unless the context otherwise requires.

A2.1 Primary Objectives and Regulatory Principles Under the 2002 Act and Common Regulatory Framework

A 2.7 ComReg’s primary objectives in carrying out its statutory functions in the context of electronic communications are to:

- promote competition⁹;
- contribute to the development of the internal market¹⁰;
- promote the interests of users within the Community¹¹;
- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under Section 13 of the 2002 Act¹²; and
- unless otherwise provided for in Regulation 17 of the Framework Regulations, take the utmost account of the desirability of technological

⁹Section 12 (1)(a)(i) of the 2002 Act.

¹⁰Section 12 (1)(a)(ii) of the 2002 Act.

¹¹Section 12(1)(a)(iii) of the 2002 Act.

¹²Section 12(1)(b) of the 2002 Act. Whilst this objective would appear to be a separate and distinct objective in the 2002 Act, it is noted that, for the purposes of ComReg’s activities in relation to ECS and ECN, Article 8 of the Framework Directive identifies “*encouraging efficient use and ensuring the effective management of radio frequencies (and numbering resources)*” as a sub-objective of the broader objective of the promotion of competition. In light of this, the assessment of different regulatory options against this objective is set out in the context of the RIA contained in document 11/60.

neutrality in complying with the requirements of the Specific Regulations¹³ in particular those designed to ensure effective competition¹⁴.

A2.1.1 Promotion of Competition

- A 2.8 Section 12(2)(a) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at the promotion of competition, including:
- ensuring that users, including disabled users, derive maximum benefit in terms of choice, price and quality;
 - ensuring that there is no distortion or restriction of competition in the electronic communications sector; and
 - encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources.
- A 2.9 In so far as the promotion of competition is concerned, Regulation 16(1)(b) of the Framework Regulations also requires ComReg to:
- ensure that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality, and
 - ensure that, in the transmission of content, there is no distortion or restriction of competition in the electronic communications sector.
- A 2.10 Regulation 9(11) of the Authorisation Regulations also provides that ComReg must ensure that radio frequencies are efficiently and effectively used having regard to Section 12(2)(a) of the 2002 Act and Regulations 16(1) and 17(1) of the Framework Regulations. Regulation 9(11) further provides that ComReg must ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies, and, for this purpose, ComReg may take appropriate measures such as mandating the sale or the lease of rights of use for radio frequencies.

¹³ The 'Specific Regulations' comprise collectively the European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No. 333 of 2011), the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011 (S.I. No. 335 of 2011), the European Communities (Electronic Communications Networks and Services) (Access) Regulations 2011 (S.I. No. 334 of 2011), the European Communities (Electronic Communications Networks and Services) (Universal Service and Users' Rights) Regulations 2011 (S.I. 337 of 2011) and the European Communities (Electronic Communications Networks and Services) (Privacy and Electronic Communications) Regulations 2011 (S.I. No. 336 of 2011).

¹⁴ Regulation 16(1)(a) of the Framework Regulations.

A2.1.2 Contributing to the Development of the Internal Market

A 2.11 Section 12(2)(b) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at contributing to the development of the internal market, including:

- removing remaining obstacles to the provision of electronic communications networks, electronic communications services and associated facilities at Community level;
- encouraging the establishment and development of trans-European networks and the interoperability of transnational services and end-to-end connectivity; and
- co-operating with electronic communications national regulatory authorities in other Member States of the Community and with the Commission of the Community in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of Community law in this field.

A 2.12 In so far as contributing to the development of the internal market is concerned, Regulation 16(1)(c) of the Framework Regulations also requires ComReg to co-operate with the Body of European Regulators for Electronic Communications (BEREC) in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of EU law in the field of electronic communications.

A2.1.3 Promotion of Interests of Users

A 2.13 Section 12(2)(c) of the 2002 Act requires ComReg, when exercising its functions in relation to the provision of electronic communications networks and services, to take all reasonable measures which are aimed at the promotion of the interests of users within the Community, including:

- ensuring that all users have access to a universal service;
- ensuring a high level of protection for consumers in their dealings with suppliers, in particular by ensuring the availability of simple and inexpensive dispute resolution procedures carried out by a body that is independent of the parties involved;

- contributing to ensuring a high level of protection of personal data and privacy;
- promoting the provision of clear information, in particular requiring transparency of tariffs and conditions for using publicly available electronic communications services;
- encouraging access to the internet at reasonable cost to users;
- addressing the needs of specific social groups, in particular disabled users; and
- ensuring that the integrity and security of public communications networks are maintained.

A 2.14 In so far as promotion of the interests of users within the EU is concerned, Regulation 16(1)(d) of the Framework Regulations also requires ComReg to:

- address the needs of specific social groups, in particular, elderly users and users with special social needs, and
- promote the ability of end-users to access and distribute information or use applications and services of their choice.

A2.1.4 Regulatory Principles

A 2.15 In pursuit of its objectives under Regulation 16(1) of the Framework Regulations and Section 12 of the 2002 Act, ComReg must apply objective, transparent, non-discriminatory and proportionate regulatory principles by, amongst other things:

- promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods;
- ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services;
- safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure-based competition;
- promoting efficient investment and innovation in new and enhanced infrastructures, including by ensuring that any access obligation takes

appropriate account of the risk incurred by the investing undertakings and by permitting various cooperative arrangements between investors and parties seeking access to diversify the risk of investment, while ensuring that competition in the market and the principle of non-discrimination are preserved;

- taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within the State; and
- imposing ex-ante regulatory obligations only where there is no effective and sustainable competition and relaxing or lifting such obligations as soon as that condition is fulfilled.

A2.1.5 BEREC

A 2.16 Under Regulation 16(1)(3) of the Framework Regulations, ComReg must:

- having regard to its objectives under Section 12 of the 2002 Act and its functions under the Specific Regulations, actively support the goals of BEREC of promoting greater regulatory co-ordination and coherence; and
- take the utmost account of opinions and common positions adopted by BEREC when adopting decisions for the national market.

A2.1.6 Other Obligations Under the 2002 Act

A 2.17 In carrying out its functions, ComReg is required amongst other things, to:

- seek to ensure that any measures taken by it are proportionate having regard to the objectives set out in Section 12 of the 2002 Act;¹⁵
- have regard to international developments with regard to electronic communications networks and electronic communications services, associated facilities, postal services, the radio frequency spectrum and numbering¹⁶; and
- take the utmost account of the desirability that the exercise of its functions aimed at achieving its radio frequency management objectives does not

¹⁵Section 12(3) of the 2002 Act.

¹⁶Section 12(5) of the 2002 Act.

result in discrimination in favour of or against particular types of technology for the provision of ECS.¹⁷

A2.1.7 Policy Directions¹⁸

- A 2.18 Section 12(4) of the 2002 Act provides that, in carrying out its functions, ComReg must have appropriate regard to policy statements, published by or on behalf of the Government or a Minister of the Government and notified to the Commission, in relation to the economic and social development of the State. Section 13(1) of the 2002 Act requires ComReg to comply with any policy direction given to ComReg by the Minister for Communications, Energy and Natural Resources (“the Minister”) as he or she considers appropriate, in the interests of the proper and effective regulation of the electronic communications market, the management of the radio frequency spectrum in the State and the formulation of policy applicable to such proper and effective regulation and management, to be followed by ComReg in the exercise of its functions. Section 10(1)(b) of the 2002 Act also requires ComReg, in managing the radio frequency spectrum, to do so in accordance with a direction of the Minister under Section 13 of the 2002 Act, while Section 12(1)(b) requires ComReg to ensure the efficient management and use of the radio frequency spectrum in accordance with a direction under Section 13.
- A 2.19 The Policy Directions which are most relevant in this regard include the following:

Policy Direction No.3 on Broadband Electronic Communication Networks

- A 2.20 ComReg shall in the exercise of its functions, take into account the national objective regarding broadband rollout, viz, the Government wishes to ensure the widespread availability of open-access, affordable, always-on broadband infrastructure and services for businesses and citizens on a balanced regional basis within three years, on the basis of utilisation of a range of existing and emerging technologies and broadband speeds appropriate to specific categories of service and customers.
- A 2.21 ComReg is conscious that the three year objective described in this policy direction has now expired making this direction less relevant currently.

Policy Direction No.4 on Industry Sustainability

¹⁷Section 12(6) of the 2002 Act .

¹⁸ComReg also notes, and takes due account of, the Spectrum Policy Statement issued by the DCENR in September 2010.

A 2.22 ComReg shall ensure that in making regulatory decisions in relation to the electronic communications market, it takes account of the state of the industry and in particular the industry's position in the business cycle and the impact of such decisions on the sustainability of the business of undertakings affected.

Policy Direction No.5 on Regulation only where Necessary

A 2.23 Where ComReg has discretion as to whether to impose regulatory obligations, it shall, before deciding to impose such regulatory obligations on undertakings, examine whether the objectives of such regulatory obligations would be better achieved by forbearance from imposition of such obligations and reliance instead on market forces.

Policy Direction No.6 on Regulatory Impact Assessment

A 2.24 ComReg, before deciding to impose regulatory obligations on undertakings in the market for electronic communications or for the purposes of the management and use of the radio frequency spectrum or for the purposes of the regulation of the postal sector, shall conduct a Regulatory Impact Assessment in accordance with European and International best practice and otherwise in accordance with measures that may be adopted under the Government's Better Regulation programme.

Policy Direction No.7 on Consistency with other Member States

A 2.25 ComReg shall ensure that, where market circumstances are equivalent, the regulatory obligations imposed on undertakings in the electronic communications market in Ireland should be equivalent to those imposed on undertakings in equivalent positions in other Member States of the European Community.

Policy Direction No.11 on the Management of the Radio Frequency Spectrum

A 2.26 ComReg shall ensure that, in its management of the radio frequency spectrum, it takes account of the interests of all users of the radio frequency spectrum.

General Policy Direction No.1 on Competition (2004)

A 2.27 ComReg shall focus on the promotion of competition as a key objective. Where necessary, ComReg shall implement remedies which counteract or remove barriers to market entry and shall support entry by new players to the market

and entry into new sectors by existing players. ComReg shall have a particular focus on:

- market share of new entrants;
- ensuring that the applicable margin attributable to a product at the wholesale level is sufficient to promote and sustain competition;
- price level to the end user;
- competition in the fixed and mobile markets;
- the potential of alternative technology delivery platforms to support competition.

A2.2 Other Relevant Obligations under the Framework and Authorisation Regulations

A2.2.1 Framework Regulations

A 2.28 Regulation 17 of the Framework Regulations governs the management of radio frequencies for electronic communications services. Regulation 17(1) requires that ComReg, subject to any directions issued by the Minister pursuant to Section 13 of the 2002 Act and having regard to its objectives under Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive, ensure:

- the effective management of radio frequencies for electronic communications services
- that spectrum allocation used for electronic communications services and issuing of general authorisations or individual rights of use for such radio frequencies are based on objective, transparent, non-discriminatory and proportionate criteria, and
- ensure that harmonisation of the use of radio frequency spectrum across the EU is promoted, consistent with the need to ensure its effective and efficient use and in pursuit of benefits for the consumer such as economies of scale and interoperability of services, having regard to all decisions and measures adopted by the European Commission in accordance with Decision No. 676/2002/EC of the European Parliament

and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the EU.

- A 2.29 Regulation 17(2) provides that, unless otherwise provided in Regulation 17(3), ComReg must ensure that all types of technology used for electronic communications services may be used in the radio frequency bands that are declared available for electronic communications services in the Radio Frequency Plan published under section 35 of the 2002 Act in accordance with EU law.
- A 2.30 Regulation 17(3) provides that, notwithstanding Regulation 17(2), ComReg may, through licence conditions or otherwise, provide for proportionate and non-discriminatory restrictions to the types of radio network or wireless access technology used for electronic communications services where this is necessary to—
- avoid harmful interference,
 - protect public health against electromagnetic fields,
 - ensure technical quality of service,
 - ensure maximisation of radio frequency sharing,
 - safeguard the efficient use of spectrum, or
 - ensure the fulfilment of a general interest objective as defined by or on behalf of the Government or a Minister of the Government in accordance with Regulation 17(6).
- A 2.31 Regulation 17(4) requires that, unless otherwise provided in Regulation 17(5), ComReg must ensure that all types of electronic communications services may be provided in the radio frequency bands, declared available for electronic communications services in the Radio Frequency Plan published under section 35 of the Act of 2002 in accordance with EU law.
- A 2.32 Regulation 17(5) provides that, notwithstanding Regulation 17(4), ComReg may provide for proportionate and non-discriminatory restrictions to the types of electronic communications services to be provided, including where necessary, to fulfil a requirement under the International Telecommunication Union Radio Regulations.

- A 2.33 Regulation 17(6) requires that measures that require an electronic communications service to be provided in a specific band available for electronic communications services must be justified in order to ensure the fulfilment of a general interest objective as defined by or on behalf of the Government or a Minister of the Government in conformity with EU law such as, but not limited to—
- safety of life,
 - the promotion of social, regional or territorial cohesion,
 - the avoidance of inefficient use of radio frequencies, or
 - the promotion of cultural and linguistic diversity and media pluralism, for example, by the provision of radio and television broadcasting services.
- A 2.34 Regulation 17(7) provides that ComReg may only prohibit the provision of any other electronic communications service in a specific radio spectrum frequency band where such a prohibition is justified by the need to protect safety of life services. ComReg may, on an exceptional basis, extend such a measure in order to fulfil other general interest objectives as defined by or on behalf of the Government or a Minister of the Government.
- A 2.35 Regulation 17(8) provides that ComReg must, in accordance with Regulation 18, regularly review the necessity of the restrictions referred to in Regulations 17(3) and 17(5) and must make the results of such reviews publicly available.
- A 2.36 Regulation 17(9) provides that Regulations 17(2) to (7) only apply to spectrum allocated to be used for electronic communications services, general authorisations issued and individual rights of use for radio frequencies granted after the 1 July 2011. Spectrum allocations, general authorisations and individual rights of use which already existed on the 1 July 2011 Framework Regulations are subject to Regulation 18.
- A 2.37 Regulation 17(10) provides that ComReg may, having regard to its objectives under Section 12 of the 2002 Act and Regulation 16 and its functions under the Specific Regulations, lay down rules in order to prevent spectrum hoarding, in particular by setting out strict deadlines for the effective exploitation of the rights of use by the holder of rights and by withdrawing the rights of use in cases of non-compliance with the deadlines. Any rules laid down under this Regulation must be applied in a proportionate, non-discriminatory and transparent manner.

A 2.38 Regulation 17(11) requires ComReg to, in the fulfilment of its obligations under that Regulation, respect relevant international agreements, including the ITU Radio Regulations and any public policy considerations brought to its attention by the Minister.

A2.2.2 Authorisation Regulations

Decision to limit rights of use for radio frequencies

A 2.39 Regulation 9(2) of the Authorisation Regulations provides that ComReg may grant individual rights of use for radio frequencies by way of a licence where it considers that one or more of the following criteria are applicable:

- it is necessary to avoid harmful interference,
- it is necessary to ensure technical quality of service,
- it is necessary to safeguard the efficient use of spectrum, or
- it is necessary to fulfil other objectives of general interest as defined by or on behalf of the Government or a Minister of the Government in conformity with EU law.

A 2.40 Regulation 9(10) of the Authorisation Regulations provides that ComReg must not limit the number of rights of use for radio frequencies to be granted except where this is necessary to ensure the efficient use of radio frequencies in accordance with Regulation 11.

A 2.41 Regulation 9(7) also provides that:

- where individual rights of use for radio frequencies are granted for a period of 10 years or more and such rights may not be transferred or leased between undertakings in accordance with Regulation 19 of the Framework Regulations, ComReg must ensure that criteria set out in Regulation 9(2) apply for the duration of the rights of use, in particular upon a justified request from the holder of the right.
- where ComReg determines that the criteria referred to in Regulation 9(2) are no longer applicable to a right of use for radio frequencies, ComReg must, after a reasonable period and having notified the holder of the individual rights of use, change the individual rights of use into a general authorisation or must ensure that the individual rights of use are made

transferable or leasable between undertakings in accordance with Regulation 19 of the Framework Regulations.

Publication of procedures

A 2.42 Regulation 9(4)(a) of the Authorisation Regulations requires that ComReg, having regard to the provisions of Regulation 17 of the Framework Regulations, establish open, objective, transparent, non-discriminatory and proportionate procedures for the granting of rights of use for radio frequencies and cause any such procedures to be made publicly available.

Duration of rights of use for radio frequencies

A 2.43 Regulation 9(6) of the Authorisation Regulations provides that rights of use for radio frequencies must be in force for such period as ComReg considers appropriate having regard to the network or service concerned in view of the objective pursued taking due account of the need to allow for an appropriate period for investment amortisation.

Conditions attached to rights of use for radio frequencies

A 2.44 Regulation 9(5) of the Authorisation Regulations provides that, when granting rights of use for radio frequencies, ComReg must, having regard to the provisions of Regulations 17 and 19 of the Framework Regulations, specify whether such rights may be transferred by the holder of the rights and under what conditions such a transfer may take place.

A 2.45 Regulation 10(1) of the Authorisation Regulations provides that, notwithstanding Section 5 of the 1926 Act, but subject to any regulations under Section 6 of the 1926 Act, ComReg may only attach those conditions listed in Part B of the Schedule to the Authorisation Regulations. Part B lists the following conditions which may be attached to licences:

- Obligation to provide a service or to use a type of technology for which the rights of use for the frequency has been granted including, where appropriate, coverage and quality requirements.
- Effective and efficient use of frequencies in conformity with the Framework Directive and Framework Regulations.
- Technical and operational conditions necessary for the avoidance of harmful interference and for the limitation of exposure of the general public

to electromagnetic fields, where such conditions are different from those included in the general authorisation.

- Maximum duration in conformity with Regulation 9, subject to any changes in the national frequency plan.
- Transfer of rights at the initiative of the rights holder and conditions of such transfer in conformity with the Framework Directive.
- Usage fees in accordance with Regulation 19.
- Any commitments which the undertaking obtaining the usage right has made in the course of a competitive or comparative selection procedure.
- Obligations under relevant international agreements relating to the use of frequencies.
- Obligations specific to an experimental use of radio frequencies.

A 2.46 Regulation 10(2) also requires that any attachment of conditions under Regulation 10(1) to rights of use for radio frequencies must be non-discriminatory, proportionate and transparent and in accordance with Regulation 17 of the Framework Regulations.

Procedures for limiting the number of rights of use to be granted for radio frequencies

A 2.47 Regulation 11(1) of the Authorisation Regulations provides that, where ComReg considers that the number of rights of use to be granted for radio frequencies should be limited it must, without prejudice to Sections 13 and 37 of the 2002 Act:

- give due weight to the need to maximise benefits for users and to facilitate the development of competition, and
- give all interested parties, including users and consumers, the opportunity to express their views in accordance with Regulation 12 of the Framework Regulations.

A 2.48 Regulation 11(2) of the Authorisation Regulations requires that, when granting the limited number of rights of use for radio frequencies it has decided upon, ComReg does so “...on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to

the achievement of the objectives set out in Section 12 of the 2002 Act and Regulations 16 and 17 of the Framework Regulations.”

- A 2.49 Regulation 11(4) provides that where it decides to use competitive or comparative selection procedures, ComReg must, inter alia, ensure that such procedures are fair, reasonable, open and transparent to all interested parties.

Fees for spectrum rights of use/licences

- A 2.50 Regulation 19 of the Authorisation Regulations permits ComReg to impose fees for a licence which reflect the need to ensure the optimal use of the radio frequency spectrum.
- A 2.51 ComReg is required to ensure that any such fees are objectively justified, transparent, non-discriminatory and proportionate in relation to their intended purpose and take into account the objectives of ComReg as set out in Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations.

Amendment of rights and obligations

- A 2.52 Regulation 15 of the Authorisation Regulations permits ComReg to amend rights and conditions concerning licences, provided that any such amendments may only be made in objectively justified cases and in a proportionate manner, following the process set down in Regulation 15(4).

A2.3 Other Relevant Provisions

Wireless Telegraphy Acts

- A 2.53 Under Section 5 of the Wireless Telegraphy Acts, ComReg may, subject to those Acts, and on payment of the prescribed fees (if any), grant to persons licences to keep and have possession of apparatus for wireless telegraphy in any specified place in the State.
- A 2.54 Such licences are to be in such form, continue in force for such period and be subject to such conditions and restrictions (including conditions as to suspension and revocation) as might be prescribed in regard to them by regulations made by ComReg under Section 6.
- A 2.55 Section 5(3) also provides that, where it appears appropriate to ComReg, it may, in the interests of the efficient and orderly use of wireless telegraphy, limit

the number of licences for any particular class or classes of apparatus for wireless telegraphy granted under Section 5.

A 2.56 Section 6 provides that ComReg may make regulations prescribing in relation to all licences granted by it under section 5, or any particular class or classes of such licences, all or any of the matters following that is to say:

- the form of such licences,
- the period during which such licences continue in force,
- the manner in which, the terms on which, and the period or periods for which such licences may be renewed,
- the circumstances in which or the terms under which such licences are granted,
- the circumstances and manner in which such licences may be suspended or revoked by ComReg,
- the terms and conditions to be observed by the holders of such licences and subject to which such licences are deemed to be granted,
- the fees to be paid on the application, grant or renewal of such licences or classes of such licences, subject to such exceptions as ComReg may prescribe, and the time and manner at and in which such fees are to be paid, and
- matters which such licences do not entitle or authorise the holder to do.

A 2.57 Section 6(2) provides that ComReg may make regulations authorising and providing for the granting of licences under section 5 subject to special terms, conditions, and restrictions to persons who satisfy it that they require the licences solely for the purpose of conducting experiments in wireless telegraphy.

GSM Directive (as amended)

A 2.58 In light of the rights of use of spectrum under consideration in this document, ComReg notes that the GSM Directive 87/372/EEC as transposed by S.I. 416 of 1994 and the Amending GSM Directive 2009/114/EC as transposed by S.I. 195 of 2010 are also of relevance.

A 2.59 In particular regulation 3(2) of S.I. 195 of 2010 provides that: “The Commission for Communications Regulation shall examine whether the existing assignment of spectrum in the 900 MHz band to competing mobile operators is likely to distort competition in the mobile markets in the State and, where justified and proportionate, it shall address such distortions in accordance with Regulation 15 of the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2003 (S.I. No. 306 of 2003).”¹⁹

Commission Decision 2009/766/EC on Harmonisation of the 900 MHz and 1800 MHz bands

A 2.60 ComReg must comply with the provisions of the above Commission Decision which is aimed at harmonising the technical conditions for the availability and efficient use of the 900 MHz band, in accordance with Directive 87/372/EEC, and of the 1800 MHz band for terrestrial systems capable of providing electronic communications services. This decision was recently amended by Commission Decision 2011/251/EU.

Commission Decision 2010/267/EU on Harmonisation of 800 MHz band

A 2.61 ComReg must comply with the provisions of the above Commission Decision which is aimed at harmonising the technical conditions for the availability and efficient use of the 800 MHz band for terrestrial systems capable of providing electronic communications services.

Article 4 of Directive 2002/77/EC (Competition Directive)

A 2.62 Article 4 of the Competition Directive provides that:

“Without prejudice to specific criteria and procedures adopted by Member States to grant rights of use of radio frequencies to providers of radio or television broadcast content services with a view to pursuing general interest objectives in conformity with Community law:

- *Member States shall not grant exclusive or special rights of use of radio frequencies for the provision of electronic communications services.*

¹⁹ Now in accordance with Regulation 15 of the 2011 Authorisation Regulations.

- *The assignment of radio frequencies for electronic communication services shall be based on objective, transparent, non-discriminatory and proportionate criteria.”*

Radio Spectrum Policy Programme

A 2.63 On 15 February 2012, the European Parliament adopted the five-year Radio Spectrum Policy Programme (RSPP) which is expected to come into force in due course.

A 2.64 The aim of the RSPP is to establish a multi-annual radio spectrum policy programme for the strategic planning and harmonisation of the use of spectrum in the EU spectrum policy areas such as electronic communications, research, technological development and space, transport, energy and audiovisual policies. The RSPP contains provisions related to the spectrum needs of wireless broadband communications and it is expected that the RSPP will oblige Member States to, amongst other things:

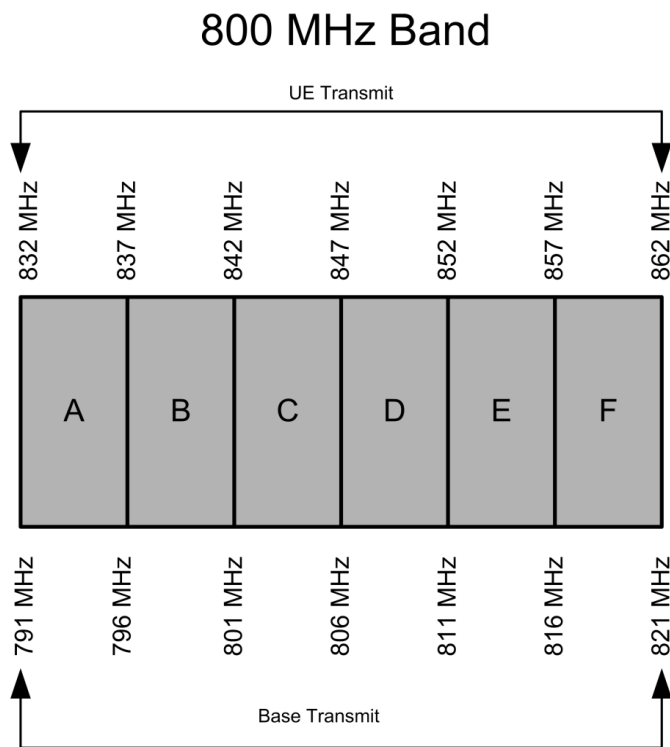
- make the bands covered by Decisions 2008/411/EC (3,4-3,8 GHz), 2008/477/EC (2,5-2,69 GHz) and 2009/766/EC (900/1800 MHz) available under terms and conditions described in those decisions and to carry out the relevant authorisation process by the end of 2012;
- carry out the authorisation process in order to allow the use of the 800 MHz band for electronic communications services by 1 January 2013; and
- in cooperation with the European Commission, promote access to broadband services using the 800MHz band in remote and sparsely populated areas where appropriate.

Annex 3: The Band Plans

- A 3.1 This Annex sets out the Band Plans that apply to the 800 MHz band, the 900 MHz band and the 1800 MHz band.
- A 3.2 Each lot in each of the bands comprises rights of use in respect of one pair of 5 MHz blocks in a frequency division duplex configuration comprising one 5 MHz block for downlink transmissions from base stations to consumer equipment and one 5 MHz block for uplink transmissions from consumer equipment to base stations.

A3.1 800 MHz band

- A 3.3 There are 6 lots in the 800 MHz band, labelled A to F, as depicted in Figure 1.²⁰

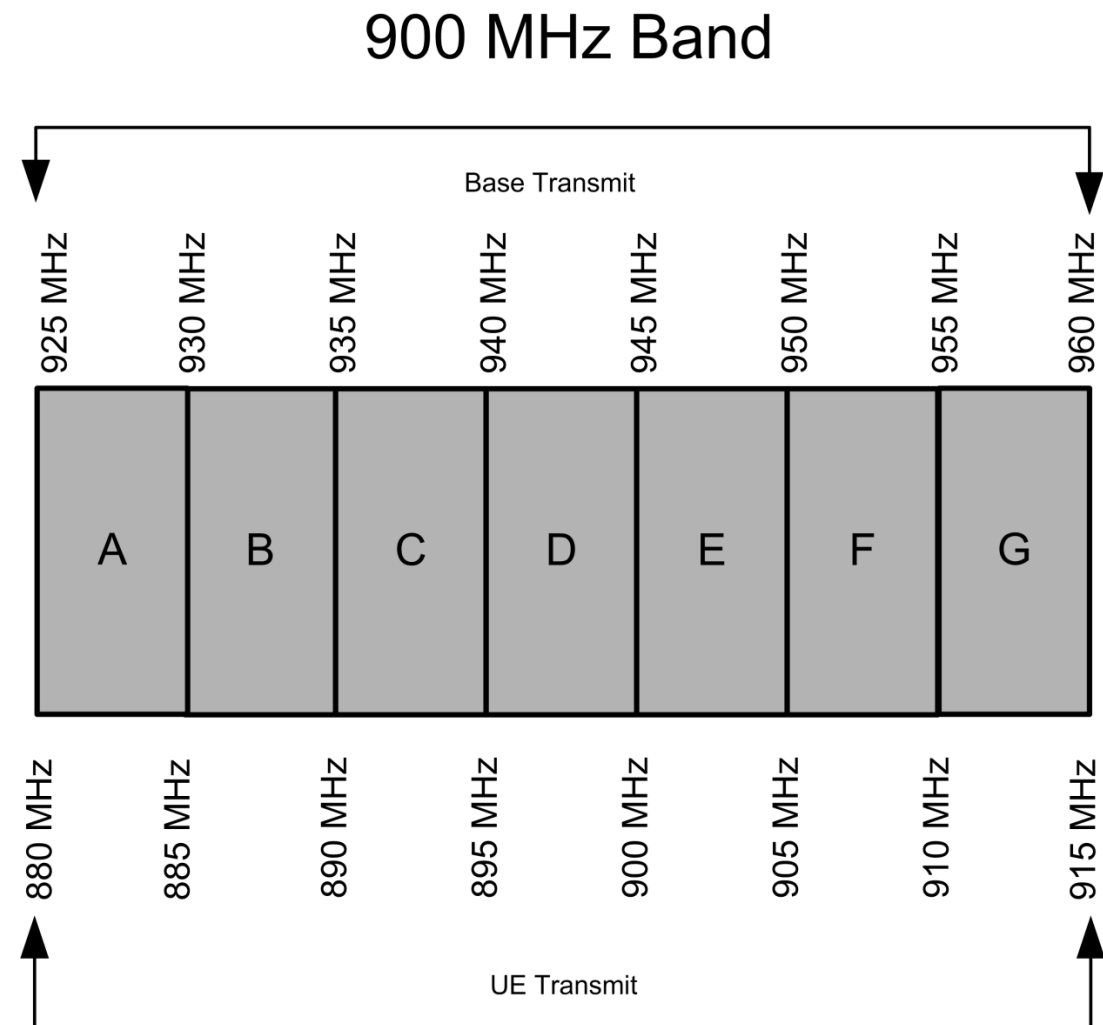


²⁰ This band plan is compatible with the preferred harmonised frequency arrangement set out in the annex to Commission Decision 2010/267/EU.

Figure 1: The 800 MHz band plan

A3.2 900 MHz band

A 3.4 There are 7 lots in the 900 MHz band, labelled A to G, as depicted in Figure 2.²¹



²¹ This band plan is compatible with the arrangements contemplated in ECC report 82 at page 7: http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/rsc/rsc19_public_docs/rscom07_27_cept_study_compatibility_umts.pdf

Figure 2: The 900 MHz band plan

A3.3 1800 MHz Band

A 3.5 There are 15 lots in the 1800 MHz band, labelled A to O, as depicted in Figure 3²².

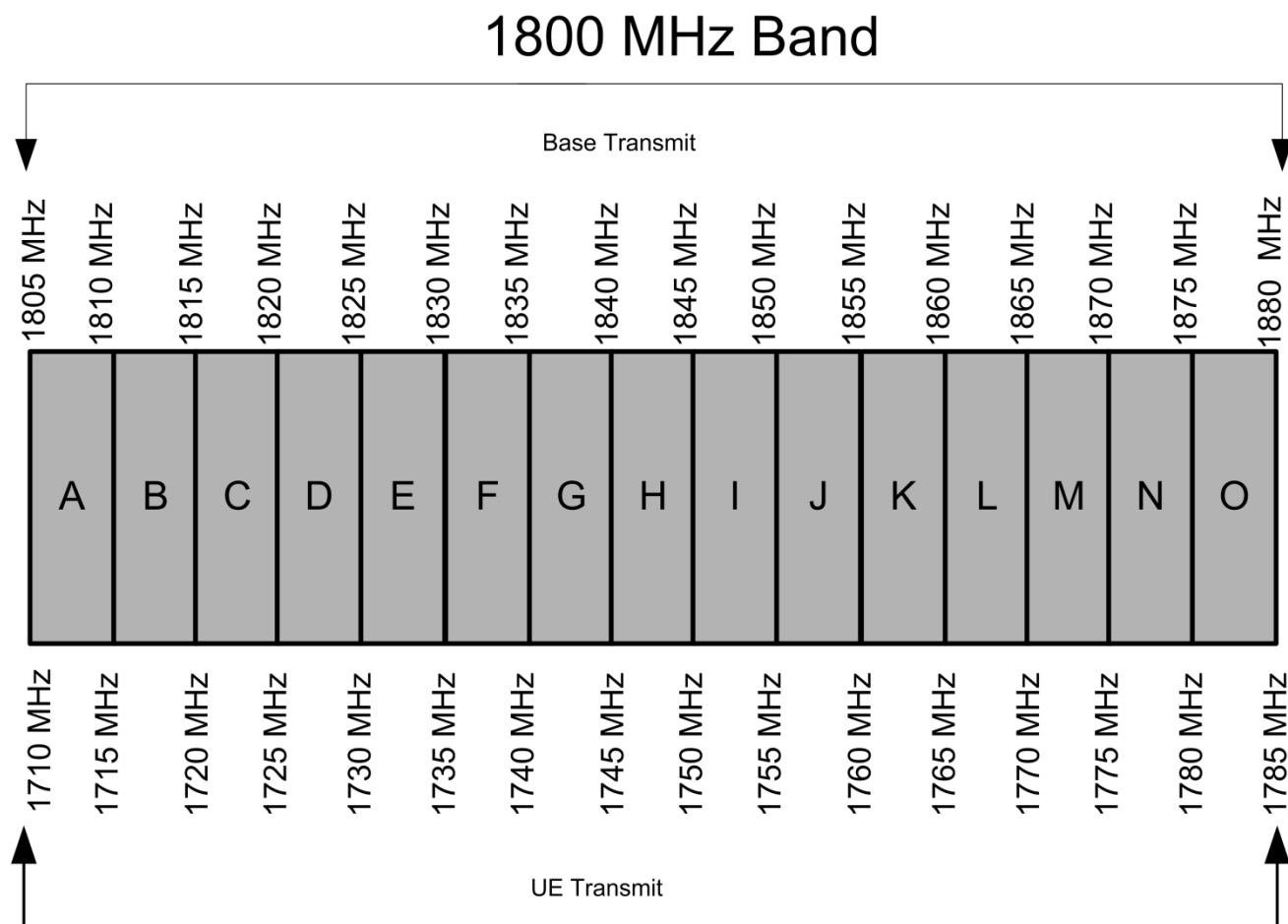


Figure 3: The 1800 MHz band plan

²² This band plan is compatible with the arrangements contemplated in ECC report 82 at page 51: http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/rsc/rsc19_public_docs/rscom07_27_cept_study_compatibility_umts.pdf.

Annex 4: Regulatory Impact Assessment

A4.1 Introduction

- A 4.1 There are two important frameworks which inform the analysis contained in this annex. The first is comprised of ComReg's Regulatory Impact Assessment ("RIA") Guidelines²³ and the second is an assessment of the preferred option against ComReg's other statutory obligations (the statutory provisions most relevant to this award process are set out in Annex 2).
- A 4.2 In Chapter 3 of Document 11/60, ComReg first carried out a draft RIA in order to identify a preferred option in accordance with the RIA framework. In that chapter, ComReg noted that there was a significant degree of overlap between the RIA framework and the above- mentioned assessment of compliance with its statutory obligations. The RIA itself is an appropriate tool for assessing and ensuring compliance of the preferred option with many of those obligations, and importantly, with those core provisions which relate to the efficient use and effective management of Ireland's radio frequency spectrum and the promotion of competition. Notwithstanding this overlap, following the draft RIA and identification of a preferred option in Chapter 3 of Document 11/60, that chapter then set out an assessment of the preferred option against ComReg's statutory obligations.
- A 4.3 Following the above-mentioned assessment, ComReg was satisfied that the preferred option identified was in compliance with its statutory obligations. As was seen in Chapter 3 of this document²⁴ and as will be seen in the RIA below, ComReg has not received any further submissions and is not in possession of any new information tending to suggest that it is appropriate to amend the option preferred in Document 11/60 or to choose an alternative option. As such, ComReg does not consider it necessary to reproduce that assessment again in this document, but, instead, refers readers to Chapter 3 of Document 11/60 and also to its reasoned consideration of the responses received from interested parties to Chapter 3 of Document 11/60, consideration of which is set out in Chapter 3 of this document.
- A 4.4 In the following section, a short explanation is provided of the RIA framework. Applying the RIA framework and following on from the analysis of a broad range

²³ See Document 07/56a - Guidelines on ComReg's approach to Regulatory Impact Assessment - August 2007

²⁴ See Chapter 3 of this document for consideration of submissions received on the draft RIA and on the assessment of the preferred option against ComReg's other statutory obligations.

of issues in Annex 3.1 and 3.2 of Document 11/60a, ComReg then sets out the specific policy issues to be addressed and relevant objectives (i.e. Step 1 of the RIA process set out in ComReg's RIA Guidelines). This leads to the identification of two fundamental policy issues. ComReg then considers these two policy issues separately in accordance with the four remaining steps of the RIA process.

- A 4.5 The following RIA should be read in light of the consideration of relevant responses received to Documents 11/60 and 11/75 set out in Chapter 3 of this document.

A4.2 RIA Framework

- A 4.6 In general terms, a RIA is an analysis of the likely effect of a proposed new regulation or regulatory change, and, indeed, of whether regulation is necessary at all. A RIA should help identify the most effective and least burdensome regulatory option and should seek to establish whether a proposed regulation or regulatory change is likely to achieve the desired objectives, having considered relevant alternatives and the impacts on stakeholders. In conducting a RIA, the aim is to ensure that all proposed measures are appropriate, effective, proportionate and justified.
- A 4.7 ComReg was issued with a Policy Direction on 21 February 2003 by the Minister for Communications, Marine and Natural Resources under Section 13 of the 2002 Act requiring ComReg to conduct a RIA in accordance with best practice. Subsequently, ComReg published its own RIA Guidelines.

Use of RIA in this document

- A 4.8 ComReg's RIA Guidelines set out, amongst other things, the circumstances in which ComReg considers that a RIA might be appropriate. In general, ComReg conducts a RIA in any process that might result in the imposition of a regulatory obligation (or the amendment of an existing regulatory obligation to a significant degree), or which might otherwise significantly impact on any relevant market or on any stakeholders or consumers. This is in line with the Policy Direction of 21 February 2003 on Regulatory Impact Assessment referred to above.
- A 4.9 Given that the outcome of this overall project would significantly impact on the electronic communications sector in Ireland, and in the interests of continuing to ensure openness and transparency, in this current document ComReg has conducted a number of specific RIAs. These have been prepared in accordance with ComReg's RIA Guidelines, and with regard to the RIA Guidelines issued by

the Department of An Taoiseach in June 2009 (“the Department’s RIA Guidelines”) and the above mentioned Policy Direction of 21 February 2003.

- A 4.10 This Annex sets out ComReg’s RIA on two fundamental policy issues: first, what, if any, additional bands should be included with the award of the 900 MHz band and, secondly, what type of assignment process should be used.
- A 4.11 Separately ComReg also conducted RIAs with regard to its proposed licence conditions for coverage and quality of service, the final versions of which are set out in Annex 11.
- A 4.12 ComReg requested that interested parties review the draft RIAs contained in Document 11/60 and to submit any comments or information which they believed ComReg had not considered, and should consider, in finalising its decision on its broader spectrum release proposals. This final RIA has taken account of respondents’ views expressed in response to Document 11/60 and any relevant points raised by respondents to Document 11/75, as addressed in Chapter 3 of this document.

Structure of a RIA

- A 4.13 As set out in ComReg’s RIA Guidelines, there are five steps in a RIA. These are:
- Step 1: Identify the policy issue and identify the objectives;
 - Step 2: Identify and describe the regulatory options;
 - Step 3: Determine the impacts on stakeholders;
 - Step 4: Determine the impacts on competition; and
 - Step 5: Assess the impacts and choose the best option.
- A 4.14 The focus of Step 3 is to assess the impact of the proposed regulatory options available to ComReg on stakeholders. Stakeholders consist of two main groups:
- i. Consumers (i.e. both business and residential end users of spectrum), and
 - ii. Industry stakeholders.

There are a number of different industry stakeholders:

- a. One group of stakeholders is comprised of the companies that are currently active in the mobile electronic communications sector but are not end users. These, in turn, can be differentiated into those with existing rights of use in the 900 MHz and 1800 MHz bands for the purposes of delivering 2G services (i.e. Vodafone, Telefónica and Meteor) and those without any such rights (for example H3GI and mobile virtual network operators (MVNOs) like Tesco and An Post).
- b. In this particular case, another group of stakeholders is comprised of potential new entrants that may be considering entry into the mobile electronic communications sector in the State. This group may include companies that are otherwise engaged in the electronic communications sector in the State, in other Member States or further afield.²⁵

A 4.15 The focus of Step 4 is to assess the impact on competition of the proposed regulatory options available to ComReg. In this particular case, this requires an assessment of competition at two levels – competition ‘for’ the market, that is competition in the award process, and competition ‘in’ the downstream retail market.

A 4.16 Of themselves, the various RIA guidelines and the RIA Policy Direction provide little guidance on how much weight should be given to the positions and views of each stakeholder group (Step 3), or the impact on competition (Step 4). Accordingly, ComReg has been guided by its statutory objectives which it is obliged to seek to achieve when exercising its functions. ComReg’s objectives in managing the radio frequency spectrum, as set out in Annex 2, include:

- the promotion of competition;
- contributing to the development of the internal market; and
- the promotion of the interests of EU citizens.

A 4.17 In this document, ComReg has adopted the following structure in relation to Step 3 and Step 4 – the impact on industry stakeholders is considered first, followed by the impact on competition, followed by the impact on consumers. The order of this assessment has no bearing on their respective importance but

²⁵ As noted in Chapter 3, potential new entrants cannot be required to make submissions or to make themselves known in advance, and may, for good reason, choose not to declare their interest in advance. In this light, ComReg has, in the following analysis, taken a reasonable and sensible approach to considering the likely impact of each option on potential new entrants without being in a position to reference particular submissions, but having regard to its experience and expertise and also having regard to the advice of its consultants.

rather reflects a logical progression. For example, a measure which safeguards and promotes competition should also, in turn, impact positively on consumers. In that regard, the assessment of the impact on consumers draws substantially upon the assessment carried out in respect of the impact on competition.

A4.2.1 RIA: Policy Issues to be Addressed, and Relevant Objectives (Step 1)

Policy Issues

- A 4.18 Directive 87/372/EEC reserved the 900 MHz band exclusively for a public mobile communications service using GSM technology. Since 1987, new technologies have been developed which are capable of providing improved mobile services and which can coexist with GSM in the 900 MHz band in a technologically neutral regulatory context.
- A 4.19 These new technologies, including UMTS, LTE and WiMax, offer significantly enhanced efficiency in the utilisation of spectrum, and enable the provision of high speed mobile broadband access to consumers. It is broadly accepted that the widespread deployment of mobile broadband will have a positive effect on innovation²⁶ and will, in consequence, provide significantly enhanced private and public value relative to that delivered by the continued operation of exclusively GSM networks.²⁷
- A 4.20 Directive 2009/114 (the “GSM Amendment Directive”) was adopted in order to allow new digital technologies to be deployed in the 900 MHz band in coexistence with GSM systems. Among the reasons cited for its adoption, the recitals to the GSM Amendment Directive note that it would: “*contribute to the objectives of the internal market and of the Commission Communication of 1 June 2005 entitled ‘i2010 initiative — A European Information Society for growth and employment’, while maintaining the availability of GSM for users throughout Europe, and to maximise competition by offering users a wide choice of services and technologies.*”,

²⁶ See for instance Darby and Fuhr, “*Innovation and National Broadband Policies*”, The American Consumer Institute, 2 March 2010, at page 26:

“In recent years announcements of several important innovations involving network protocols enabling faster and more diverse information transfers have come in a torrent of alphabetical acronyms like 3G, CDMA, 4G, EV-DO, HSPDA, UMTS, WIMAX, LTE and others Each enables more efficient use of available spectrum and thereby substitutes for more spectrum, while also enabling and accompanying new and innovative equipment and applications.”

²⁷ See estimates of value in relation to the 800 MHz band below.

- A 4.21 The GSM Amendment Directive amends Directive 87/372/EEC and requires Member States to make the 900 MHz spectrum band available for GSM systems and 3G/UMTS systems as well as for other terrestrial systems capable of providing electronic communications services that can co-exist with GSM systems.
- A 4.22 In anticipation of the enactment of this Directive and its transposition into national law²⁸, ComReg embarked on this consultation process with the aim of liberalising rights of use in the 900 MHz band (and possibly the 1800 MHz band) as soon as possible in order to maximise the potential benefits of liberalising this spectrum. ComReg’s spectrum liberalisation consultation process commenced by examining the following two primary policy issues:
- how best to implement the requirements of the GSM Amendment Directive so as to achieve liberalisation of the 900 MHz and 1800 MHz bands; and
 - how best to release spectrum in the 900 MHz band, including how best to address the expiry of existing rights of use in the 900 MHz band.
- A 4.23 In relation to the 1800 MHz band, ComReg initially considered that, due to uncertainty over equipment availability, it would be appropriate to delay liberalisation of this band and not include it with the 900 MHz band in a single award process.²⁹ However, the recent greater availability of equipment for the 1800 MHz band³⁰ has caused ComReg to re-examine its previous proposal to address liberalisation of the 1800 MHz band separately in a subsequent assignment process.³¹ During the course of ComReg’s consultation process, it also became clear that access to the “digital dividend” spectrum in the 800 MHz band (which has very similar propagation properties to the 900 MHz band) would become available for use by terrestrial systems capable of providing ECS several years earlier than expected.³² In light of these important developments, ComReg was faced with the choice of whether or not to combine in one process what would otherwise have been involved in up to three separate assignment processes for the 900 MHz, 800 MHz and 1800 MHz bands.
- A 4.24 In the meantime, and, amongst other things, to facilitate consideration of these issues, the expiry of Vodafone and Telefónica’s existing GSM rights of use in

²⁸ Now transposed in Ireland by the European Communities (Public Pan-European Cellular Digital Land-Based Mobile Communications) Regulations 2010 (S.I. No. 195 of 2010).

²⁹ See Section 9 of Consultation 08/57.

³⁰ See paragraph A 4.38 in this regard.

³¹ See Section 2 of Consultation 10/105.

³² See Information Notice 10/59 and Consultation 10/71.

the 900 MHz band on 15 May 2011 was also addressed through the assignment of interim GSM rights of use until 31 January, 2013, pending the outcome of the envisaged assignment process and release of liberalised spectrum in that band.³³

A 4.25 Following the analysis of a broad range of issues in Annex 3.1 and 3.2 of Document 11/60a, ComReg is of the view that there are two primary policy issues to be considered in relation to the assignment of liberalised rights of use in the 900 MHz band:

- (a) Whether to include the 800 MHz and/or 1800 MHz bands in the 900 MHz spectrum-use-rights assignment process, and**
- (b) In light of the response to the above question, how best to assign rights of use in those band(s).**

A 4.26 ComReg has taken the view that these two important issues, while related, are sequential in nature and can therefore be considered separately. This approach enhances the efficacy of the RIA by increasing transparency within the decision making process and ensuring that full consideration is given to each issue. This approach brings important clarity and objectivity to the key decisions made by ComReg in bringing forward its proposals in relation to this matter.

A 4.27 In relation to the first policy issue, due to matters relevant to digital switch-over and analogue switch-off (or “ASO”) in Ireland becoming clearer, along with several technological developments, it has become evident since the commencement of this consultation process that other spectrum bands should be considered for inclusion in the proposed assignment process with the 900 MHz band, i.e. the 800 MHz and 1800 MHz bands (see Annex 3.1 of Document 11/60a).

A 4.28 In considering the inclusion of these other bands in the award of the 900 MHz spectrum band it is worthwhile noting the differing circumstances surrounding these bands:

- the 800 MHz band would be considered as ‘greenfield’ spectrum by the mobile industry (i.e. after the completion of ASO, the 800 MHz will be unoccupied/unencumbered by existing licensees in the band), and

³³ See Document 11/29.

- the GSM bands would be considered as 'brownfield' spectrum because these bands are, where currently occupied, occupied by existing licensees who are providing GSM services to a large number of customers.

A 4.29 In relation to the second policy issue, a range of possible assignment procedures are available to ComReg in determining how best to assign rights of use in these band(s), including the use of a competitive auction or administrative assignment. These policy issues before ComReg are also reflected in the relevant options set out below.

Objectives

- A 4.30 The focus of this RIA is to assess the impact of the proposed measure(s) on stakeholders, and on competition and consumers. In that way it allows ComReg to identify and implement the most appropriate and effective means to assign spectrum usage rights, while still allowing ComReg to achieve its objectives.
- A 4.31 As noted above, ComReg's immediate objective is to assign liberalised rights of use in the 900 MHz spectrum band and, if appropriate, the 800 MHz spectrum band and/or the 1800 MHz spectrum band as soon as possible, in line with the EC Decision, and in the interests of the economic development of the State and the industry. Where appropriate, additional spectrum bands should also be included in that assignment process. ComReg also aims to design and carry out this assignment process in accordance with its broader statutory objectives (set out in Annex 2), including, but not limited to, the promotion of competition in the electronic communications sector. A further key objective in designing and carrying out this assignment process is to seek to encourage the efficient use and ensure the effective management of the radio frequency spectrum. ComReg's other overarching objectives are to contribute to the development of the internal market and to promote the interests of EU citizens. ComReg also notes that, in achieving its objectives, its ultimate aim is to choose regulatory measures which maximise the benefits for consumers in terms of price, choice and quality.
- A 4.32 Having identified the above policy issues and objectives, the remainder of the RIA is divided between the two stand-alone primary policy issues identified above. Consideration of these policy issues is set out below with a separate assessment of the four remaining steps in the RIA process. They are referred to as the '**Spectrum for Award**' RIA and the '**Assignment Process**' RIA, respectively.

A4.2.2 The ‘Spectrum for Award’ RIA: Regulatory Options (Step 2)

A 4.33 On the basis of its analysis in Annex 3 of Document 11/60, ComReg considers the following to be the spectrum band award options available to achieve the objectives identified earlier:

- Option 1 – Assign rights of use in the 900 MHz band in a stand-alone assignment process. Assign rights of use in the 800 MHz and 1800 MHz bands in a separate later assignment process, or in later processes, which might, or might not, include the award of rights of use in related bands, such as the 2.6 GHz band, when this becomes available³⁴;
- Option 2 – Combine the 900 MHz and the 800 MHz bands into a single assignment process, with or without synchronisation of the timing of the release of these bands.³⁵ Rights of use in the 1800 MHz band might be assigned as part of a separate, later assignment that might, or might not, include the assignment of rights of use in other similar bands; and
- Option 3 – Combine the 900 MHz, 800 MHz and 1800 MHz bands into a single assignment process, with or without the timing of the release of these bands being synchronised.³⁶

A4.2.3 The ‘Spectrum for Award’ RIA: Impact on Stakeholders and Competition (Steps 3 and 4)

A 4.34 The focus of this section of the RIA is to assess the impact of the aforementioned regulatory options on:

- i. industry stakeholders (being existing operators and potential new entrants),
- ii. competition, and
- iii. consumers.

³⁴ The 2.6 GHz band is currently licensed for MMDS services in Ireland. Current licences expire in 2012 and 2014 and, while ComReg has made no decision in relation to potential renewal, Regulation 8 of Statutory Instrument Number 529 of 2003 (S.I. No 529/2003) provides for a licence extension of up to 5 years. See also Annex 3 of Document 11/60a for further discussion on the 2.6 GHz band. In addition, ComReg published a consultation on the future use of the 2.6GHz band (see Document 11/80) and a related consultancy report on technical and economic issues related to the future of the band (see Document 11/80a) in November 2011.

³⁵ In this regard, see Chapter 7 on Advanced Commencement for 900 MHz.

³⁶ In this regard, see Chapter 7 on Advanced Commencement for 900 MHz.

A 4.35 Prior to carrying out the comparative analysis for this RIA, ComReg first provides some useful background information concerning the characteristics of, and developments in, the demand for the spectrum bands under consideration.

Background

A 4.36 Consumer interest and willingness to pay for mobile broadband has increased substantially in recent years. According to survey data, nearly 40% of handsets in the Irish market are smart phones capable of delivering advanced mobile 3G services. Therefore just over 60% of consumers do not, as yet, have equipment that can fully exploit the advantages of advanced mobile 3G services.³⁷

A 4.37 The three spectrum bands under consideration in this RIA are all suitable for the provision of mobile broadband. Equipment availability differs across these bands:

- The 900 MHz band is currently being used in Ireland for GSM services only. UMTS technology equipment is available for this band;
- The 1800 MHz band is also being used for GSM services, with the exception of some prototype LTE-specific dongles.³⁸
- There is currently no mobile equipment of any type (infrastructure or devices) in Ireland that actively operates in the 800 MHz band, however some equipment deployed in Ireland may be capable of operating in this band.

A 4.38 The technological roadmaps of major equipment manufacturers envisage the availability of LTE equipment, including multimode handsets, modules, tablets and dongles, in these bands. Some such equipment is already available.³⁹ LTE is expected to greatly enhance the consumer experience of mobile broadband in terms of download and upload speeds (and thus making available different types of services – for example data-intensive services including video and music streaming, IPTV, video-conferencing etc). Tablets, dongles and

³⁷ *Smart Report* by Amarach (May 2011), available at <http://www.amarach.com/assets/files/The%20Smart%20Future.pdf>. This data is based on an online survey of 844 mobile phone users who were asked *Is your mobile phone a smart phone, i.e. one you can use to surf the internet, download apps etc.*

³⁸ See Section 2.3 of Red-M/Vilicom Report (Document 10/105b).

³⁹ See Global Mobile Suppliers Association (“GSA”), “*Evolution to LTE report*”, 5 January 2012, (http://www.gsacom.com/downloads/pdf/GSA_evolution_to_lte_report_050112.php4), which notes that there are currently 36 devices supporting LTE FDD across the 800 MHz, 1800 MHz and 2.6 GHz bands.

handsets⁴⁰ are now available that enable consumers to access the internet at broadband speeds whilst they are on the move. According to the Global mobile Suppliers Association (“GSA”), there are over 301 operators worldwide investing in LTE and 57 commercial LTE networks have been launched to date.⁴¹

- A 4.39 Timely access to sufficient spectrum in the sub-1 GHz spectrum bands is very important to deliver the benefits likely to be derived from the widespread deployment of high speed mobile broadband. The propagation characteristics of the sub-1 GHz spectrum bands make this spectrum ideal for the provision of wireless ECS, including mobile voice and messaging services and advanced wireless services such as advanced mobile broadband. These spectrum bands are well suited to providing wide-area coverage and in building penetration and, of particular importance in the Irish context, its long distance propagation characteristics are ideal for covering sparsely populated areas. Networks based on sub-1 GHz spectrum bands have substantially lower Capex and Opex relative to networks built using spectrum bands that reside above 1 GHz. For example, in their report (Document 09/14a), Red-M/Vilicom estimated that the overall deployment costs (CapEx) for UMTS 1800 MHz and UMTS 900 MHz were 88.5% and 65.6% respectively of the total cost of a UMTS 2100 MHz network. In terms of OpEx, the largest quantity is consumed in proportion to the number of sites in the network, i.e. the denser the network, the greater the number of prospective truck-rolls needed for maintenance purposes. Also, the electrical power costs increase in direct proportion with network density. A reasonable estimate can therefore be made by indexing the proportion of the costs to the UMTS 2100 MHz network. It is estimated that, in terms of OpEx, UMTS 1800 MHz and 900 MHz would consume 84% and 51% respectively of UMTS 2100 MHz.⁴²
- A 4.40 Bands above 1 GHz are often seen as capacity bands, in the mobile context, though some MNOs have also used this type of spectrum successfully up to now as coverage bands for GSM services when they do not hold spectrum usage rights in sub-1 GHz bands.⁴³

⁴⁰ For instance, Samsung offers LTE handsets which, along with other bands support operation in the 800 MHz and 1800 MHz bands, see: http://www.gsmarena.com/samsung_galaxy_s_ii_hd_lte-4198.php

⁴¹ Global Mobile Suppliers Association (“GSA”), “*Evolution to LTE report*”, 13 March 2012,

⁴² See Vilicom Report (Document 09/14a) UMTS Network Design & Cost Estimation for National UMTS900, UMTS1800 & UMTS2100 Networks

⁴³ For example, the Everything Everywhere joint venture (a merger of T-Mobile UK and Orange UK) forming the biggest network in the UK has no sub-1 GHz spectrum.

- A 4.41 Spectrum, especially spectrum below 1GHz, is a scarce resource. Spectrum below 1 GHz can be used to provide both coverage and capacity but spectrum above 1 GHz is most efficiently used to provide capacity in high demand areas. Accordingly, it is arguably not an efficient use of spectrum to use sub-1GHz spectrum to provide additional capacity in high demand areas where spectrum above 1 GHz spectrum is available for such use.
- A 4.42 Optimal network configuration often involves a mix of both coverage and capacity bands⁴⁴ and ComReg is of the view that operators should be enabled, where possible, to obtain spectrum which allows them to configure an optimal network.
- A 4.43 Given the nature of mobile broadband demand (and its likely evolution) it is expected that individual mobile operators will require significantly more sub-1 GHz spectrum than they did previously to provide the services that consumers will demand in the future. Spectrum in contiguous blocks will continue to have a particular utility to MNOs.
- A 4.44 In this context, the 800 MHz digital dividend spectrum is likely to be the only additional sub-1 GHz spectrum to become available for high speed mobile broadband, on a pan-European basis, in the near future. There are a number of estimates of the economic value that could flow from such adoption with Analysys Mason, DotEcon and Hogan and Hartson estimating that: *“the total value that could be generated by the digital dividend (private value plus public value) is estimated to be between €150 and €700 billion across the EU (discounted over 15 years).”*⁴⁵
- A 4.45 In the medium term, it is likely that undertakings will consider spectrum in the 800 MHz and 900 MHz bands to be close substitutes. However, the substitutability of these bands may be somewhat limited in the short term. This is due to differences in the speed of technological development and deployment, continued legacy GSM operation in the 900 MHz band and the availability of equipment for the two bands, as well as in terms of the amount of bandwidth available.⁴⁶ Accordingly, it is recognised that MNOs which have a significant legacy 2G customer base may only see the 800 MHz and 900 MHz

⁴⁴ Analysys Mason express the view that operators seek a mixture of sub-1GHz spectrum for coverage and capacity and higher frequency (above 1 GHz) spectrum for capacity: Amit Nagpal, *“The digital dividend and its role in bringing next generation mobile broadband services to Ireland”*, 28 April 2010 at slide 3.

⁴⁵ Analysys Mason, DotEcon and Hogan and Hartson, Report for the European Commission, *“Exploiting the digital dividend – a European Approach”*, Final Report, 14 August 2009.

⁴⁶ See RSPG BEREC Report on Competition: Transitional Issues in the Mobile Sector in Europe, paragraph 26, published February 2011.

bands as equally good substitutes after they have acquired sufficient 900 MHz spectrum to continue to serve these legacy customers, or have migrated these customers away from 2G services.

- A 4.46 In light of the above characteristics of, and developments in, the demand for radio frequency spectrum in Ireland, ComReg sets out below a comparative analysis of the three spectrum band award options outlined above, in terms of their impact on stakeholders and competition.
- A 4.47 It is important to note that the following assessment is carried out under the assumption that a reasonable assignment process is identified in the 'Assignment Process' RIA.

Impact on industry stakeholders

- A 4.48 As noted above, industry stakeholders can be split between those operators that are currently active in the mobile electronic communications sector and potential new entrants that may be considering entry into the mobile electronic communications sector in the State.

Option 1 (900MHz only) vs. Option 2 (900 MHz + 800 MHz)

- A 4.49 Given the benefits of sub-1 GHz spectrum in terms of reduced costs and greater efficiency compared to higher frequency spectrum, mobile operators, existing operators and new entrants would generally speaking prefer that there was more sub-1 GHz spectrum available in the auction than would be available with the 900 MHz band alone, all other things being equal.⁴⁷ Consumer demand for high bandwidth data services requires the deployment of advanced networks that require larger quantities of sub-1 GHz spectrum than required to provide GSM services. As noted above, the use of sub 1-GHz spectrum rather than higher frequency spectrum, to provide coverage, allows mobile networks to be more efficient and cost effective, particularly in rural areas, due to enhanced propagation characteristics. Also, it enables network operators to deliver a

⁴⁷ It might however be noted that one strategic advisor to the mobile industry suggests that, for large integrated incumbent MNOs, the: *"best possible scenario is the current status quo, favouring a 'divide and conquer' strategy where the Digital Dividend auction is delayed as much as possible, the current GSM 900 licences are extended, and eventual Digital Dividend licence coverage requirements are either non-existent or technology neutral (since most likely the incumbents are already meeting these coverage requirements with their 3G networks). If push comes to shove, and assuming this is possible without infringing licence obligations, incumbent operators may opt to buy Digital Dividend spectrum but do nothing with it or just meet the minimum coverage requirements, in order to prevent the competition from acquiring this spectrum."* Delta Partners, April 2011 *"The Digital Dividend in Europe: in the Eye of 'The Perfect Storm'"*, <http://www.deltapartnersgroup.com/the-digital-dividend-in-europe-in-the-eye-of-the-perfect-storm>

better service within each network cell on the basis of having additional capacity available at each base station.

- A 4.50 Assigning all the sub-1 GHz blocks that are likely to come available in the coming years in a single process would likely be preferred by most, if not all, industry stakeholders. This preference is evident in the submissions received by ComReg (as set out in Annex 3 of Document 11/60a). ComReg also notes there were no dissenting views expressed on this matter in the submissions received in response to Document 11/60. A combined award of the sub-1 GHz bands would ensure that operators knew their long-term spectrum allocations within these bands; thereby eliminating the risks attaching to sequential processes (see further discussion on sequential processes below).⁴⁸ A combined award would also provide operators with a better chance of obtaining their preferred mix of sub-1 GHz spectrum, by virtue of there being a larger quantity of such spectrum available. The desired mix of spectrum would likely vary from incumbent to new entrant and also within each class of participant. Each participant would know best what its desired mix would be and so would presumably prefer to have the necessary flexibility to determine that mix.
- A 4.51 Some operators may wish to obtain liberalised spectrum usage rights in the 900 MHz band at an earlier date than the date from which the 800 MHz band is expected to become available, and this is, as far as possible, facilitated by the advanced commencement option (see Chapter 7). However, no operator has expressed a preference that the processes be split to achieve this as, presumably, they would then be left with the risks associated with sequential processes as noted above and explained further below. Some operators have instead expressed a preference that the sub-1 GHz bands be assigned in the same process, but that the 900 MHz band, or components thereof, be made available as soon as possible thereafter.⁴⁹ Another operator, Telefónica, in response to Document 11/60 has also suggested that 800 MHz and 900 MHz spectrum be assigned under the same process but that the licence start-date be pushed out at least until January 2014.
- A 4.52 If a competitive assignment process (e.g. an auction) was used to award all of this spectrum (see 'Assignment Process' RIA for further discussion of this matter), as noted by DotEcon previously in both Document 10/71a and Document 11/58, the award or grant of multiple spectrum bands at the same

⁴⁸ As DotEcon has noted in previous reports and in its latest report (Document 12/24), sequential auctions involve uncertainties for participants with regard to expectations of future prices or availability of spectrum and are, therefore, likely to be inefficient.

⁴⁹ As set out elsewhere, both Vodafone and H3GI have expressed these views in their various submissions.

time would allow operators to consider the full mix of possible holdings in different bands and select possible holding options on the basis of price. This would reduce risk for operators and promote efficient allocation. This view has also largely been echoed by respondents to the consultation process, some of which have advocated a holistic approach to identifying spectrum bands for inclusion in the assignment process.

- A 4.53 In contrast, running sequential processes to award spectrum would result in bidders in earlier award processes not knowing what price spectrum usage rights in later processes might be sold for, or whether they would be likely to win any such rights in any later processes. Further, once spectrum usage rights have been won or granted in one process, it would not then be possible to alter this outcome in the course of bidding in a later process. Therefore, sequential processes are unable to explore the full range of options and are highly dependent on bidders' expectations about what might happen in later awards. As a result, and as noted by DotEcon in its latest report (Document 12/24), an efficient allocation is unlikely to occur.⁵⁰ Operators would prefer to determine all at once what their long-term spectrum holding rights in the critical sub-1 GHz bands might be. In the absence of this knowledge, investment commitments would likely be curtailed or withheld. This applies equally to both incumbents and potential new entrants. ComReg also has no reason to believe that an option which reduces the investment risks for MNOs and promotes efficient allocation of spectrum would not also be preferred by MVNOs.
- A 4.54 Having regard to the foregoing, ComReg is of the view that Option 2 would, on balance, be of greater benefit to industry stakeholders as a whole than Option 1. ComReg is not in possession of any information to suggest otherwise.

Option 2 (900 MHz + 800 MHz) vs Option 3 (900 MHz + 800 MHz + 1800 MHz)

- A 4.55 As explained in more detail below, it is evident that incumbent operators may be indifferent as to whether Option 2 or Option 3 is chosen, whilst some may have a preference for Option 2, with others preferring Option 3.
- A 4.56 An incumbent MNO that has existing rights in bands that they currently use for capacity purposes may not require that rights of use in substitutable capacity

⁵⁰ Trading may help to overcome these inefficiencies in the longer term, but trades between competitors for key bands such as these may not occur as often as might be required. DotEcon also noted in its report (Document 10/71a) that where spectrum has been awarded in a sequence of auctions, such as with Swiss WLL licences in 2001, often very different prices are seen for closely similar lots. This is strong evidence of the inefficiency of the outcome, as similar lots should sell for similar prices. Dissimilar prices show that substitution on the basis of price has been largely impossible in a sequential award process.

bands, such as the 1800 MHz band, be awarded/granted in the same assignment process as the 900 MHz band. As such, these operators may be indifferent as to whether bands they perceive as capacity bands are awarded alongside the 900 MHz band or in a subsequent spectrum award process. ComReg notes that Telefónica has previously suggested that the auction of the 1800 MHz band be delayed apparently due to concerns of a potential delay to the proposed issue of interim licences in the 900 MHz band and until clarity could be provided on the availability of the 2.6 GHz band. In relation to the former, the issue of interim licences was addressed in Document 11/29 (Decision 03/11).

- A 4.57 In relation to the latter, ComReg notes and agrees with the Red-M /Vilicom view (Document 11/57) that justifying the timing and structuring of an auction of spectrum-use rights solely on the basis of propagation characteristics of the spectrum being auctioned appears tenuous and ignores other factors that are significant.⁵¹ While we note Telefónica's more recent comments in this regard, as addressed in Chapter 3 of this document, particularly with regard to the non-availability of spectrum in the 2.6 GHz band, ComReg believes that the benefits of awarding both substitutable and complementary spectrum together provides interested parties with a much greater opportunity to secure the mix of spectrum that best suits their needs. Furthermore, as DotEcon notes in its latest report (Document 12/24), postponing the award of available 1800 MHz spectrum until the 2.6GHz band becomes available would be unjustifiable on efficiency grounds. DotEcon also notes that an approach of auctioning sub-1 GHz in an earlier auction and 1800 MHz and 2.6 GHz in a much later auction would have asymmetric effects on different classes of bidder. In particular, incumbent operators would be less disadvantaged by such an approach than potential entrants.
- A 4.58 The problems associated with anticompetitive spectrum hoarding are well-documented by industry experts such as Martin Cave.⁵² This might include denying rivals or new entrants access to spectrum or raising its cost to them. As also noted by Cave, incumbents have incentives to engage in procedural stratagems to delay competition. As noted in the previous section, large incumbent operators may well prefer an option that maintains the status quo and prevents competitors from acquiring spectrum.⁵³ Accordingly, large incumbents may prefer Option 2 to Option 3, as Option 3 increases the

⁵¹ See Section 3.2.2 of Vilicom Report (Document 11/57).

⁵² See Cave, M. (2010) Anti-competitive behaviour in spectrum markets: Analysis and response, Telecommunications Policy, Volume 34, Pages 251-261.

⁵³ Delta Partners, April 2011 "*The Digital Dividend in Europe: in the Eye of 'The Perfect Storm'*", <http://www.deltapartnersgroup.com/the-digital-dividend-in-europe-in-the-eye-of-the-perfect-storm>

likelihood of participation by potential new entrants in the auction and the possibility of new entry in the downstream retail market (as described in more detail below). While incumbent MNOs would of course not make explicit submissions to this effect, it is not unreasonable for ComReg to factor in the possibility that they might see the emergence of new entrants wishing to participate in the assignment process in a negative light, given that such participation might well result in an increase in demand for sub-1 GHz spectrum in the auction. This would, in turn, make it more difficult or more expensive for incumbents to acquire spectrum-use rights, all else being equal. For that reason, an incumbent MNO may prefer that the 1800 MHz spectrum not be included in the assignment process of 900 MHz spectrum, in the belief that this would serve to reduce competition in the auction and increase the likelihood of it acquiring its desired amount of sub-1 GHz spectrum at a lower price. Furthermore, incumbents would have the opportunity to acquire any 1800 MHz rights of use they desired at a later stage. In addition, the exclusion of 1800 MHz spectrum might also be seen by incumbents as reducing the likelihood of new entry (on either a mixed-band or an 1800 MHz-only basis) and any resultant increase in competitive tension in the downstream mobile market and might be preferred by incumbents for that reason also.

A 4.59 On the other hand, it is readily understandable why some incumbents might prefer Option 3 to Option 2. This is because 1800 MHz spectrum, while not ideally substitutable with sub-1 GHz spectrum, is regarded as strategically complementary to sub-1 GHz spectrum. It is generally thought that an optimum and efficient mobile network comprises sub-1 GHz spectrum coupled with supporting spectrum above 1 GHz⁵⁴ (and, in the case of Ireland, 1800 MHz spectrum is the only such spectrum that is clearly available for allocation today). Therefore, an incumbent with a dense network of towers in urban areas may deem additional 1800 MHz, or higher frequency, spectrum as a good substitute, or at least complementary, to sub-1 GHz spectrum. In this regard, incumbents would also benefit from an assignment process that included 1800 MHz spectrum. In addition, including 1800 MHz spectrum would also provide incumbents, at the very least, with the opportunity of early liberalisation of current rights of use in the 1800 MHz band. So while incumbents might not increase their existing rights (apart from increasing from 2 × 14.4 MHz to 2 × 15 MHz) they might value having rights of use on a liberalised basis. Furthermore, incumbents are likely to value the regulatory certainty associated with Option 3 regarding the availability of the 1800 MHz band on a liberalised basis. This may

⁵⁴ See: Vodafone paper: "Vodafone's experience in bringing mobile broadband to the European regions", http://www.vodafone.com/content/dam/vodafone/about/public_policy/speeches/mobile_broadband_mk.pdf, at page 3 for an example of mixed 800 MHz and 2.6 GHz LTE deployment.

to some extent also underlie the support given to Option 3 by the majority of incumbents, despite the aforementioned incentives-in-principle for incumbents to delay competition.

A 4.60 Now, turning to the case of potential new entrants, it is evident, as explained in more detail below, that they would favour Option 3 over Option 2.⁵⁵

A 4.61 Potential new entrants (including operators that are already active in the Irish electronic communications sector but have no existing rights in capacity bands) would likely have a preference for acquiring an optimal mix of coverage and capacity-suitable spectrum and/or enter on the basis of access to coverage-suitable bands only (as has happened elsewhere). An assignment process that included both the 1800 MHz band and the available sub-1 GHz bands would provide new entrants with flexible options and the opportunity to acquire a broader portfolio of spectrum usage rights, thus better enabling them to compete on a level footing with existing operators. Such a broad assignment process would also encourage new entrants to participate in the assignment process itself. In contrast, as noted by DotEcon in its latest report (Document 12/24), splitting up the bands into two auctions for low and high frequencies respectively (with a substantial delay between the two) would create risks for entrants, as it would not be possible to purchase complementary spectrum in a single process through package bids. This could potentially suppress demand for spectrum in the first auction, as there would be no guarantee of being able to obtain complementary spectrum later and also in the second auction, as the spectrum might only be attractive to those who won spectrum in the first auction.

A 4.62 Finally, it is worthwhile considering the benefits and advantages that can reasonably be expected to accrue to operators generally. The award/grant of the available sub-1 GHz spectrum bands together with the 1800 MHz band in a single process would provide an opportunity for all operators to acquire spectrum in the various bands and so acquire a portfolio of spectrum rights that would enable them to optimise their networks. The discussion above made in the context of a joint award of the two sub-1 GHz bands is also equally relevant in considering the inclusion or otherwise of the 1800 MHz band, and is therefore worth repeating here. As noted by DotEcon in its report (Document 10/71a), the

⁵⁵ As noted in Chapter 3 and elsewhere in this annex, potential new entrants cannot be required to make submissions or to make themselves known in advance, and may, for good reason, choose not to declare their interest in advance. Accordingly, ComReg must take a reasonable and sensible approach to considering the likely impact of each option on potential new entrants without being in a position to reference particular submissions, but having regard to its experience and expertise and also having regard to the advice of its consultants.

award of multiple spectrum bands at the same time would provide more spectrum for operators in different bands. This would reduce risks for operators and promote efficient allocation. This view has also largely been echoed by respondents to the consultation process, some of which have advocated a holistic approach to identifying spectrum bands for inclusion in the assignment process. In contrast, staggered or sequential assignment of liberalised spectrum bands would add a layer of inefficiency, as decisions made in an initial award process could only be based on expectations of the possible outcomes of subsequent award processes. In the event that such expectations about subsequent awards were not fulfilled, undertakings could well regret their earlier decisions. This would tend to influence the decision making processes of participants or potential participants in the current assignment process which could lead to regulatory uncertainty and, as noted by DotEcon in its latest report (Document 12/24), an inefficient outcome to the award.

A 4.63 On the basis of its assessment of the matter, ComReg is of the view that Option 3 would likely be preferred over Option 2 by new entrants. ComReg is also of the view that Option 3 reduces the risks for all operators and better promotes efficient allocation of spectrum. In this light, ComReg notes that all but one incumbent, Telefónica, support Option 3. In that regard, while Telefónica has advocated delaying an award of 1800 MHz spectrum until 2.6 GHz availability, ComReg is of the view that its arguments and submissions in this connection are insufficient to justify such delay.

A 4.64 In light of the foregoing, ComReg is of the view that Option 3 would, on balance, be of greater benefit to industry stakeholders as a whole than Option 2.

Impact on competition

A 4.65 Before considering the comparison of the options in terms of their respective impact on competition, it is worthwhile setting out some general points relating to the analysis of the impact on competition.

A 4.66 The inclusion or exclusion of the proposed spectrum bands in the assignment process could impact on competition in the electronic communications sector at two different levels.

A 4.67 First, there is the potential competition within the award process for spectrum-usage rights. This can be referred to as competition 'for' the market. The level of competition 'for' the market can reasonably be assessed by reference to the number of independent undertakings that are willing to participate in the award process. The higher the number of participants, the greater will be the

competition for each spectrum lot (assuming each has sufficient resources and commitment).

- A 4.68 Second, there is competition in the downstream retail market. This can be referred to as competition 'in' the market. The award process used, and the level of competition within that award process, will have a significant impact on the level of competition downstream. At a general level, the more intense the competition in the assignment process (the greater the level of participation), the higher the probability that the spectrum usage rights will be awarded to those operators that value it the most, and who will use the spectrum most efficiently and compete most vigorously in the downstream retail market.
- A 4.69 The inclusion or exclusion of other spectrum bands alongside the 900 MHz band is likely to impact on the number of undertakings willing to participate in the award process. This in turn will impact on competition in the downstream market. Therefore, an option that encourages participation in the award process, and thereby promotes entry, will, in turn, have a more positive impact on competition 'in' the market than an option that deters entry.
- A 4.70 ComReg notes that there is arguably a third or intermediate layer of competition that could be considered in the following RIA analysis. This is the wholesale market for spectrum, in which MNOs compete with one another for MVNO and wholesale national roaming customers. However, ComReg notes that any option which both promotes and safeguards competition 'for' the market will also invariably promote competition in this intermediate market. As such, it is unnecessary to consider this further level of competition independently in this 'Spectrum for Award' RIA or in the following 'Assignment Process' RIA. ComReg notes that this is consistent with the approach taken in previous draft RIAs and that respondents have not raised any issues with this approach.

Option 1 (900 MHz only) vs. Option 2 (900 MHz + 800 MHz)

- A 4.71 It is evident that excluding the 800 MHz spectrum band from the award of the 900 MHz band and adopting a sequential process or sequential processes for the two spectrum bands, i.e. Option 1, would reduce the flexibility available to all operators in terms of obtaining different potential mixes of spectrum available at the same time. As DotEcon notes in its most recent report (Document 12/24), to achieve efficient outcomes where there are demand interrelationships (as there are for the 800 MHz and 900 MHz bands), it is necessary to use a single unified auction, rather than a sequence of separate auctions. In addition, excluding the 800 MHz band from the current award process, thereby reducing the overall quantity of valuable sub-1 GHz spectrum available in the award

process, would reduce the opportunities for new entry into the market and thereby likely reduce participation in the award process. Both competition 'for' the market and, in turn, competition 'in' the market could be negatively impacted.

- A 4.72 On the other hand, Option 2, a combined process involving both 900 MHz and 800 MHz spectrum, would increase the flexibility for operators in terms of different potential mixes of spectrum across the two sub-1 GHz bands as well as increasing the overall quantity of valuable sub-1 GHz spectrum available in the award process. This would increase the opportunities for new entry compared to Option 1, thereby having a more positive impact on competition 'for' the market and, by extension, competition 'in' the market, compared to Option 1.
- A 4.73 Excluding the 800 MHz spectrum band from the award of the 900 MHz band, i.e. Option 1, does not appear to offer any obvious benefits in terms of competition 'for' the market or competition 'in' the market, over Option 2.
- A 4.74 In light of the foregoing, ComReg is of the view that Option 2 would have a more positive impact on competition than Option 1.

Option 2 (900 MHz + 800 MHz) vs. Option 3 (900 MHz + 800 MHz + 1800 MHz)

- A 4.75 The comparison between Option 2 and Option 3 addresses the same issues as the above analysis. Compared to Option 2, Option 3 would further increase the flexibility for operators in terms of different mixes of spectrum across different spectrum bands available at the same time. In particular, Option 3 would increase flexibility by enabling operators to access both low and high frequency spectrum at the same time, and thereby meet both their coverage and capacity requirements while making efficient use of the spectrum. This is likely to increase participation in the award process compared to Option 2.
- A 4.76 As set out above, Option 3, with the inclusion of the 1800MHz band in a joint award of the 800 MHz and 900 MHz spectrum bands, would increase the likelihood of participation by potential new entrants in the award process and, in turn, promote competition in the downstream retail market. Undertakings contemplating entry (or undertakings that view the 1800 MHz band as suitable for coverage and/or capacity) would likely have a preference for an assignment process that included the 1800 MHz band. This is because an entrant with no existing mobile spectrum has two problems:

- First, it needs sufficient spectrum to offer services comparable with incumbent competitors and it may find low frequency spectrum relatively more costly to obtain due to its greater scarcity and high value to incumbents.
- Secondly, it may require a mix of high and low frequency spectrum to be able to provide both wide-area coverage and capacity in urban areas.

A 4.77 Therefore, such an entrant might treat high and low frequency spectrum as complements (i.e. it benefits from a mix) but also substitutes at the margin (i.e. it might make do with more high frequency spectrum even if it ideally would prefer low frequency spectrum). As noted previously and by DotEcon in its latest report, splitting up the bands into two auctions for low and high frequencies respectively (with a substantial delay between the two) would create risks for entrants, as it would not be possible to purchase complementary spectrum in a single process through package bids. This could potentially suppress demand for spectrum in the first auction, as there would be no guarantee of being able to obtain complementary spectrum later and also in the second auction, as the spectrum might only be attractive to those who won spectrum in the first auction. Thus, in terms of the impact on competition 'for' the market, the inclusion of 1800 MHz would make Option 3 even more attractive to new entrants than Option 2. This should increase the likelihood of participation by new entrants in the award process compared with Option 2 and promote competition for spectrum in any assignment process. This, in turn, would enhance competition in downstream retail markets with users deriving maximum benefit in terms of choice, price and quality.

A 4.78 As DotEcon noted in its report (Document 10/71a), maximising opportunities for entrants does not necessarily mean that entry will occur. However, even if entry does not occur, it is still beneficial on competition grounds to make it desirable for entrants to participate.⁵⁶

A 4.79 Furthermore, there would be little prejudice to stakeholders of including the 1800 MHz band in the award of the sub 1 GHz spectrum. If some, or all, of the 1800 MHz spectrum band were not to be successfully awarded in a combined process now, it could still be combined with other spectrum in a subsequent spectrum-use rights assignment process. In that case, it would be clear that no alternative better option would have been passed up.

⁵⁶ For example, were an auction process to be used, even the threat of competition from entrants is likely to undermine gaming behaviour such as tacit collusion and strategic demand reduction and therefore ensure a more competitive award process.

- A 4.80 Excluding the 1800 MHz spectrum band from the joint award of the 800 MHz and 900 MHz bands, i.e. Option 2, does not appear to offer any obvious benefits in terms of competition ‘for’ the market or competition ‘in’ the market over Option 3, as it may deter entry which would otherwise occur were Option 3 pursued and increase the chance that sub-1GHz spectrum would be inefficiently used for capacity purposes.
- A 4.81 In light of the foregoing, ComReg is of the view that Option 3 would have a more positive impact on competition than Option 2.

Impact on consumers

- A 4.82 In terms of consumer preferences, ComReg is of the view that:
- the interests of consumers would be enhanced through the promotion of competition in terms of price, quality and choice of services (including the offering of new and innovative services);
 - consumers would benefit from advanced mobile services being made available sooner rather than later. Consumers might be willing to trade-off earlier delivery of such services against having even more advanced services delivered later if there is a sufficient improvement in quality to be obtained from waiting. This is an important consideration in the context of an award process that could facilitate an early leap to new technologies and services (e.g. LTE). This would be desirable from a consumer’s point of view due to the large increase in download and upload rates⁵⁷ that such a process could bring.⁵⁸

Option 1 (900 MHz only) vs. Option 2 (900 MHz + 800 MHz)

- A 4.83 In light of the above general consumer preferences, ComReg considers that Option 2, a process which combines both sub-1 GHz bands, would be more beneficial for consumers than Option 1 because:

⁵⁷ ComReg notes that upload rates are increasingly promoted by operators when it comes to selling smart phones. Upload rates are particularly relevant in terms of uploading to online social networks which some commentators have suggested are now even more popular than email.

⁵⁸ See for instance: http://stakeholders.ofcom.org.uk/binaries/consultations/wla/annexes/consumer_research.pdf , Ofcom “*Consumer research into use of fixed and mobile internet Research Document*”, 23 March 2010, which indicates that 41 % of residential consumers and 54 % of business consumers considered that mobile broadband would be a realistic alternative to fixed broadband if speed and reliability improved.

- Option 2 would facilitate greater competition ‘for’ the market and therefore, by extension, increase competition in downstream retail markets to the benefit of consumers in terms of price, choice and quality;
- with individual operators being able to access a greater quantity of liberalised sub-1 GHz spectrum in the auction, Option 2 should result in the earlier deployment of advanced services, such as LTE, compared to Option 1. Consumers would receive improved data transfer rates on their mobile devices, which would enable them to more effectively exploit the advantages of smart phones and other such devices, earlier than would be the case under Option 1; and
- with a greater supply of sub-1 GHz spectrum available at one compared to Option 1, Option 2 would put undertakings which are assigned spectrum usage rights in a better position to drive broadband coverage into areas that may not be so well served by other broadband networks as yet.

A 4.84 Furthermore, Option 2 would entail, at worst, only a relatively short delay in obtaining the benefits of liberalisation of the 900 MHz band than would otherwise be the case under Option 1, and ComReg has, in any case, left open the possibility of advanced commencement of 900 MHz spectrum.⁵⁹

A 4.85 Option 1, i.e. excluding the 800 MHz spectrum band from the proposed spectrum assignment process, would have no obvious advantages over Option 2 in terms of consumer welfare.

A 4.86 As such, ComReg is of the view that Option 2 would be more beneficial for consumers than Option 1.

Option 2 (900 MHz + 800 MHz) vs. Option 3 (900 MHz + 800 MHz + 1800 MHz)

A 4.87 It is arguable that Option 3 would deliver additional benefits for consumers, over and above those associated with Option 2. Option 3, a process including the 1800 MHz spectrum band in an assignment process with the 900 MHz and 800 MHz bands, would better enable participants in the assignment process to obtain their optimal portfolio of spectrum usage rights, which should enable them to make more efficient investments in new networks, compared to Option 2. A sequential process for awarding spectrum in these bands would constrain operators in their options and potentially prevent them from making investment decisions until they have full certainty regarding all the substitutable or complementary bands under discussion in this RIA. As noted by DotEcon in its

⁵⁹ See Chapter 7 on Advanced Commencement.

most recent report (Document 12/24), in a sequence of auctions, bidders valuations and demand for spectrum would be based on the expected price and availability of substitutable and complementary spectrum to be awarded in the future. If expectations with regard to future prices or availability transpire to be incorrect, which is a real possibility, then a sequential process would be inefficient. Thus, a sequential assignment process could lead to a delay in the roll out of advanced services, contrary to the interests of consumers. This point applies equally to the inclusion of the 800 MHz band. For this reason, the inclusion of 1800 MHz spectrum in the current process should be more beneficial for consumers in terms of bringing about an efficient outcome and, ultimately, enhanced services.

- A 4.88 Excluding the 1800 MHz spectrum band from the proposed spectrum assignment process has no obvious benefits in terms of consumer welfare. To the extent that liberalised 1800 MHz can be used to alleviate network congestion in urban areas, or to promote new entry, it offers potential benefits to consumers.
- A 4.89 As such, ComReg is of the view that Option 3 would be more beneficial for consumers than Option 2.

A4.2.4 The ‘Spectrum for Award’ RIA: Assessment and the Preferred Option (Step 5)

- A 4.90 The above assessment has considered the impact of the various options from the perspective of industry stakeholders, as well as the impact on competition and consumers.
- A 4.91 It would seem that all stakeholders would prefer, and those that have expressed a preference do prefer, Option 2 over Option 1, such that there should be a joint award of the 800 MHz and 900 MHz bands.
- A 4.92 In relation to the 1800 MHz band, whilst one incumbent operator, Telefónica, would prefer to delay the assignment of rights of use in the 1800 MHz bands until availability of more substitutable 2.6 GHz spectrum, and not award it at the same time as the sub-1 GHz spectrum, ComReg is of the view that the exclusion of the 1800 MHz band would have a negative impact on competition both ‘for’ and ‘in’ the market by potentially deterring new entry (such as those potential entrants seeking to obtain an ideal mix of coverage and capacity spectrum and/or seeking to enter using solely or predominantly above-1 GHz

spectrum⁶⁰). On the other hand, there would be little prejudice to stakeholders of including the 1800 MHz bands in the current assignment process, and its inclusion would lead to greater competition and therefore a better outcome for consumers compared to Option 2.

- A 4.93 Option 3, an award process that encompasses the 900 MHz, 800 MHz and the 1800 MHz bands, appears to be the best means to promote competition for spectrum usage rights (and hence promote new entry) and, in turn, competition in the related downstream retail market. Compared to the other options, it would also better promote efficient investment and drive innovation in new and enhanced mobile networks as assigning rights in the three bands at the same time would enable undertakings to access the mix of spectrum that best suits their needs. The analysis would suggest that Option 3 would be more beneficial for consumers than Option 2 or Option 1.
- A 4.94 For the reasons outlined above, Option 3, involving a combined award process of the 900 MHz, 800 MHz and 1800 MHz bands, is the preferred option identified under the 'Spectrum for Award' RIA.

A4.3 The 'Assignment Process' RIA: Regulatory Options (Step 2)

A4.3.1 Background Information

- A 4.95 As noted at the outset of this chapter, Step 1 of the RIA (Policy Issues and Objectives) is common to both the 'Spectrum for Award' RIA and the 'Assignment Process' RIA.
- A 4.96 Before setting out the specific options under review in the 'Assignment Process' RIA, it is useful to provide some background information regarding the different ways in which spectrum-use rights can be assigned and the various proposals which are associated with these different assignment mechanisms.
- A 4.97 In circumstances like those currently faced by ComReg, two main methods are used to assign rights of use of spectrum:⁶¹

⁶⁰ For example, the Everything Everywhere joint venture (a merger of T-Mobile UK and Orange UK) and new LTE networks have been deployed using 1800 MHz spectrum in countries such as Germany, Lithuania and Poland. See Annex 3 for further details.

⁶¹ Clearly, any method used by ComReg to allocate rights of use of spectrum must be implemented in accordance with ComReg's statutory obligations and must be, *inter alia*, fair, reasonable, open, objective, transparent, proportionate and non-discriminatory.

- (a) **Auction**, whereby, subject to objective, and transparent constraints set ex ante by the regulator, the market determines who gets what spectrum and how much, and
- (b) **Administrative assignment**, whereby the regulator determines who gets what spectrum and how much. Assigning spectrum usage rights using an administrative process can take different forms and can be used to address specific concerns.

A 4.98 Each of the two main methods is discussed in more detail below. As proposed by a number of respondents, and as considered by ComReg below, the assignment of rights of use might also involve a combination of the above two methods.

Auctions

A 4.99 Auctions by their nature involve a competitive process to determine the winner(s) and are used in a variety of different contexts. Spectrum auctions are now much more common than in the past⁶², and have become highly sophisticated in their design and execution.⁶³ They have a number of benefits as a spectrum-usage rights assignment mechanism. By ensuring that those bidders who value the spectrum the most obtain the rights of use of the spectrum, auctions result in an efficient outcome in terms of assignment (i.e. as a result of competition 'for' the market).⁶⁴ This in turn tends to promote competition in the downstream retail market, to the benefit of consumers. Using an auction to assign spectrum-usage rights removes much of the risk of the regulator making incorrect decisions, as a result of not having access to all relevant information, which could have long-standing negative effects on the market.

A 4.100 While administrative assignment processes provide a certain degree of certainty for those recipients of an assignment, auctions avoid the need to determine complex and important questions associated with the use of administrative assessment processes such as ones relating to the following:

- the licence holder(s) - which operators should be awarded spectrum? In making this decision, the regulator could potentially assign spectrum-

⁶² In Annex 11 of Document 11/60 and in previous documents ComReg has provided updates on international developments.

⁶³ There are many different types of competitive auctions (including simultaneous multiple round ascending auctions and combinatorial clock auctions). See section 6 of DotEcon's Report (Document 09/99c).

⁶⁴ See also Section 3 of DotEcon's Report (Document 11/58).

usage rights to the 'wrong' operator, that is a spectrum user which is not an optimum user of the spectrum and/or an operator which is not incentivised to make best use of that spectrum;

- the quantum and price of spectrum assignments - how much spectrum should operators be assigned and in what locations within the bands, the associated fee, and should all operators be assigned an equal amount?

A 4.101 In making these important decisions the regulator must be careful to avoid inadvertently bringing about an inefficient allocation of spectrum and distorting competition to the detriment of end users. This could otherwise also have serious knock-on effects on the welfare of society as a whole. These and other matters are discussed in greater detail below.

ComReg's Proposal

A 4.102 In the course of the consultation process, ComReg has considered a number of different types of competitive auction as candidates for the award of rights of use in respect of the spectrum bands being considered for release, each aimed at achieving the objectives set out in Step 1 above. Of the various auction formats considered, including the previously suggested single round combinatorial auction, ComReg is now proposing that a Combinatorial Clock Auction ("CCA") would be the most appropriate auction format for this particular award (see Annex 6.2 of Document 11/60a). Some of the reasons for this are explored in the following section. A similar type of CCA has been used/is proposed to be used in other countries (see Annex 11 of Document 11/60a). ComReg's auction proposal is set out as Option 1 below.

Administrative Assignment Process

A 4.103 Assigning spectrum-usage rights using an administrative process can take different forms and can be used to address specific concerns. For example, a "beauty contest" can be used if there is a particular objective in mind, whereby the regulator selects the licence holder(s) based on a number of pre-defined criteria (e.g. extent of network roll-out). An administrative process can also take the form of an extension/renewal of an existing licence, or an administrative assignment of spectrum usage rights to particular operators, for a particular period of time. An administrative process can be used for all or part of the spectrum being awarded, or relate to particular locations within a band.

A 4.104 Administrative processes were commonplace in the past to award spectrum-usage rights, but are now less common - particularly in cases where spectrum

is to be released to commercial operators. For example, such an approach may have been used so as to secure wide-area coverage as an overarching goal. However, there is now a general consensus that the use of administrative processes to assign spectrum rights of use is likely to lead to an inefficient outcome compared to a competitive process, and in a number of cases where administrative processes have been used, this has resulted in litigation and associated delays.⁶⁵ In addition, it is acknowledged that incentives to hoard spectrum are pervasive in an administrative spectrum management regime and that there are limited defences against such hoarding.⁶⁶

Proposals made by Respondents

A 4.105 As set out in Annex 3 of Document 11/60a and echoed in the responses received to Document 11/60, a range of proposals have been put forward by respondents at various stages of this consultation process which incorporate administrative processes in various forms. Some of these proposals were made in the context of a 900 MHz-only award, while more recent proposals have been made in the context of a multi-band award.⁶⁷ The main reasons put forward for these respondents' proposals⁶⁸ can be summarised as follows:

- To ensure business continuity and avoid significant consumer disruption; and/or
- To promote new entry or avoid competitive distortion.

Each of these reasons is considered in more detail below.

A 4.106 During the consultation process, a number of respondents called for the administrative assignment of spectrum in the 900 MHz band to the existing GSM operators. The principal reason offered in support of these proposals was that because this spectrum is currently being used to provide GSM services to a

⁶⁵ See for instance *Orange Communications Ltd v Director of Telecommunications and Anor.* [1999] 2 I.L.R.M. 81 where Orange Communications unsuccessfully challenged the ODTR's decision to award Meteor a GSM licence following a beauty contest but as a result Meteor's entry to the market was significantly delayed.

⁶⁶ See Cave, M. (2010) Anti-competitive behaviour in spectrum markets: Analysis and response, Telecommunications Policy, Volume 34, Pages 251-261.

⁶⁷ A number of other proposals were made by respondents which do not fall within these categories. These have been addressed in Annex 3 of document 11/60a and are not considered in the 'Assignment Process' RIA.

⁶⁸ Clearly the proposals may also in some cases have been primarily motivated by commercial interest, such as a desire to retain or acquire as much spectrum as possible for the lowest possible price. While recognising the real possibility of such considerations affecting the submissions made by interested parties, ComReg has nevertheless evaluated all proposals and supporting arguments on their own merits.

large number of customers, using an auction to assign new licences in the band raises the potential for significant consumer disruption (due to uncertainty about the value of business continuity) to occur if an existing operator were to no longer have spectrum usage rights in the band following the conclusion of the auction and the expiry of its current GSM licences. Respondents asserted that using a single round auction would create a risk that an incumbent GSM operator could (due to strategic behaviour or mistaken beliefs underpinning their bidding) fail to win any 900 MHz spectrum, and this could result in large scale consumer disruption to GSM services. For this reason, respondents argued for various amounts of spectrum to be administratively assigned to them (e.g. 2 x 5 MHz each, or 2 x 10 MHz each) for various periods of time (e.g. ranging from licence periods up to 2015 to indefinite licences). Following on from these proposals, there were also various proposals for an administrative assignment of 2 x 5 MHz of 900 MHz spectrum to H3GI, in order to avoid a competitive distortion between the existing GSM mobile operators and H3GI.

A 4.107 Despite obvious incentives for respondents to overstate their concerns regarding business continuity and consumer disruption were an auction to be used to award new liberalised licences in the 900 MHz band, ComReg took on board all respondents' submissions in this regard and, as a result, ComReg's proposed auction format has developed over the course of this consultation process (as set out in Annex 3 and discussed in more detail in Annex 6.2 of Document 11/60a). In particular, ComReg has made a number of key amendments to the proposed auction design to deal with the major concern raised by respondents, i.e. their concern regarding putting a value on business continuity. As noted in Annex 3 of Document 11/60a, in order to address respondents' concerns regarding valuing business continuity, ComReg shifted from its original proposal to use a sealed bid combinatorial auction to a CCA. The CCA, as proposed, would ensure that a bidder could adopt a simple strategy in the supplementary bids round such that their position in the final primary bid round would be protected.⁶⁹ ComReg is of the view that this would provide adequate means to avoid significant consumer disruption on the assumption that incumbent operators would be willing to pay the price determined by the auction for the relevant spectrum. Under ComReg's proposed auction design, a bidder in the auction would know by how much they would need to outbid other bidders in order to guarantee winning spectrum. As DotEcon notes in its latest report (Document 12/24), there are specific rules in the Main Stage auction (specifically the final price cap and the other activity

⁶⁹ See section 3.2 of Annex 8 to Document 11/75 (the draft Information Memorandum) for the most detailed and up to date consideration of this issue.

rules detailed in Document 11/75) that ensure that the outcome of the primary bid rounds cannot be too readily overturned by further bids made in the supplementary bids, enabling bidders to pursue strategies aimed at securing certain minimum amounts of spectrum (provided bidders are willing to compete for those during the primary rounds). In addition, these rules are complemented by the application of a sub-cap of 2×10 MHz of 900 MHz spectrum in the first time slice.

- A 4.108 These important amendments to the auction design appear to have addressed many of the concerns raised by respondents and it has resulted in a number of operators who were originally in favour of an administrative assignment of spectrum to incumbent operators, now supporting ComReg's proposed auction design (e.g. Vodafone and H3GI⁷⁰).
- A 4.109 However, as noted in Annex 3 of Document 11/60a, despite these important changes to the auction design, there are a number of respondents who maintain their opposition to the proposed CCA although they have not put forward any further reasoning as to why incumbent operators should be granted an administrative assignment of spectrum in the 900 MHz band. ComReg would tend to therefore assume that those respondents who continue to argue for administrative assignment of spectrum for incumbent operators are doing so purely in their own commercial interest rather than on the basis of maximising consumer welfare. However in the interests of ensuring that ComReg's proposal is subject to a meaningful impact assessment, ComReg has incorporated proposals that involve administrative assignment of spectrum to incumbent operators into the impact assessment that follows.
- A 4.110 In relation to the second reason-in-principle for using administrative assignment (to promote new entry or avoid competitive distortions) a number of respondents have also expressed support for an auction in which a certain amount of spectrum would be reserved for new entrants to the market or a new band entrant in the case of H3GI's response to Document 11/60. Arguments made in favour of this proposal centred on promoting competition, attracting new entry and benefiting consumers through the prompt delivery of liberalised services. Reserving spectrum for new entrants would be a form of administrative assignment as it would limit the winner(s) of certain spectrum to an operator, or operators, not already active in the market, thereby raising

⁷⁰ Although H3GI has concerns about certain aspects of the proposed auction, as set out in its consultation responses, it supports the use of an auction to award all spectrum in the 800 MHz and 900 MHz bands. However, in its responses to Documents 11/60 and 11/75, H3GI suggests that ComReg should reserve spectrum for a new band entrant in both the 900 MHz and 1800 MHz bands. This is discussed in more detail below.

similar issues to those identified above and in Section 3 of DotEcon's latest report (Document 12/24) and its previous report (Document 11/58). ComReg has considered the possible effects of these proposals in the impact assessment below.

Setting out the options

- A 4.111 These options should be read in light of the considerations and conclusions contained in Annex 3 of Document 11/60a and are set out in the context of a multi band award of the 800, 900 and 1800 MHz spectrum bands, the preferred option of the 'Spectrum for Award' RIA above.
- A 4.112 It is important to bear in mind when considering the various options discussed and analysed below that ComReg's auction proposal is designed in such a way that if demand is insufficient in the auction, the award process reverts to a *de facto* administrative assignment and spectrum lots are sold at reserve prices.⁷¹ While not eliminating the possibility, this mechanism minimises the likelihood of lots going unallocated in the award.

Option 1: Assignment of all available spectrum in the three bands using a fully competitive, Combinatorial Clock Auction

- A 4.113 This option is ComReg's proposal which has been developed over time in light of market developments, expert advice, and also in response to submissions made and concerns raised by respondents over the course of this consultation process. Option 1 would involve a CCA with the following main features:
- Spectrum caps set to ensure that, at a minimum, the current number of competitors in the market is maintained by guaranteeing an outcome of at least four operators (including four operators in the 900 MHz band in the period up until 2015);⁷²
 - With multiple bidding rounds the auction process itself would generate important information for bidders particularly with regard to the value of business continuity;

⁷¹ See, for example, Section 3 of DotEcon's latest report, Document 12/24.

⁷² As DotEcon note in their latest report, the proposed spectrum caps are not intended to be a forceful intervention aimed at picking some particular outcome or fundamentally changing existing market structure and do not predestine a symmetric outcome amongst incumbent operators, unlike alternative proposals made by some respondents. Effective competition does not require symmetric spectrum holdings across each and every band.

- A 'relative cap activity' rule allowing bidders to adopt a simple strategy in the supplementary bids round such that their position in the final primary bid round is protected. This would ensure that any operator which required spectrum to serve existing GSM consumers would have the opportunity to be successful in the auction, while reducing the incentives for bidders to engage in strategic shading of bids, by giving them better information on the value of business continuity;
- Licence conditions relating to minimum levels of coverage and minimum levels of quality of service;
- Spectrum fees whereby the price paid would be determined by the outcome of the auction subject to a minimum price which would be based on a benchmark analysis (as set out in Annex 10) set at a conservative lower bound estimate for spectrum in each band. This would allow bidders to choose amongst spectrum bands on the basis of price information generated during the course of the auction;
- Appropriately limited transparency to bidders in the course of the auction, to reduce the risk of tacit collusion amongst bidders; and
- A two-stage auction process whereby bidders bid for particular quantities of spectrum in the first stage, and particular frequency locations in the second stage.

Option 2: A CCA (with features as set out in Option 1 above) with a restriction on outcomes as a result of an administrative assignment process.

A 4.114 Option 2 is an option reflecting the range of proposals that have been put forward by respondents to this consultation process, as set out in detail in Annex 3 of Document 11/60a. The administrative assignment process under Option 2 could take many forms, e.g. the administrative grant of spectrum to particular operators (such as incumbents) followed by a CCA for the remaining spectrum, or the reservation of spectrum to particular bidders (such as new entrants or new band entrants⁷³) with the remainder of the spectrum being awarded in the 'main' auction and open to all bidders, or even a mixture of these two approaches. While each of the proposals put forward by respondents

⁷³ H3GI has suggested in its response to Document 11/60 that Lot A of the 900 MHz band be reserved in the auction for bidders who, if successful, would be new entrants to that band but not necessarily new entrants to the Irish mobile market. This category of bidders would include H3GI but exclude Vodafone, O2 and Meteor. In addition, in its response to Document 11/75, H3GI suggest that ComReg should also reserve unassigned 1800 MHz in both time slices for a new band entrant.

would involve an auction of some amount of spectrum, there is a key difference between Option 1 and Option 2. Under Option 2, as a result of an administrative assignment process, there would be a restricted number of possible outcomes in the auction, compared to Option 1. The administrative process could thereby be used to favour particular types of operators. In addition, the more expansive the administrative assignment process, the larger the number of possible outcomes that would be precluded as a result.

A 4.115 In this 'Assignment Process' RIA, ComReg assesses Option 2 against Option 1. As noted above, the administrative assignment process under Option 2 could take many forms. However, it is possible to group the proposals put forward by respondents into two main categories aimed at addressing particular objectives, as noted above. Therefore, for illustrative purposes and for the purpose of ensuring that the impact of each key variant of Option 2 is assessed, it is appropriate to consider those two main categories of administrative process identified by respondents. It is not practical to set out fully developed distinct options given the wide range of issues that would have to be considered and as referred to briefly below. For this reason, ComReg will assess Option 2 as a whole, and where relevant and appropriate, specific reference will be made to Option 2A or Option 2B (as set out below).

Option 2A: Reserve spectrum for new entrants to promote competition

A 4.116 One version of Option 2, referred to here as Option 2A, would involve the reservation of a certain amount of sub 1 GHz spectrum specifically for new entrants to the Irish mobile market, or to the 900 MHz and 1800 MHz bands. Only new entrants, or new band entrants as proposed by H3GI, would be permitted to bid and win this reserved spectrum. New entrants would compete against one another for this reserved spectrum but, if only one new entrant participated in the auction, it would automatically win the reserved spectrum.

A 4.117 Within Option 2A, there are a variety of issues which would have to be considered prior to implementation of this option, for example:

- *Definition of new entrant?* Would this mean new entry to the Irish mobile market, or a new entrant to the 900 MHz and 1800 MHz bands;
- *How much spectrum?* The quantity of spectrum reserved for new entrants (e.g. one or more blocks).

- *What type of spectrum?* Spectrum could be reserved for new entrants in the 900 MHz band, the 800 MHz band, the 1800 MHz band or some combination of these bands;
- *How would spectrum fees be set?* The minimum licence fee for the successful new entrant(s) could be set in a number of ways. For example the spectrum reserved for new entrants could be based on the prices determined in the auction for the remaining spectrum, could be subject to the same minimum price as the rest of the spectrum (i.e. based on the same benchmarking approach that would be used under Option 1, set out in Annex 9 of Document 11/60a), or new entrants could be granted a discount on this benchmarked minimum price.

Option 2B: Grant licences to incumbents in advance of the auction to ensure business continuity and minimise the risk of consumer disruption

- A 4.118 Another version of Option 2, referred to here as Option 2B, would involve the administrative assignment of a certain amount of spectrum in the 900 MHz band to incumbent operators, be they current holders of 900 MHz spectrum or not, for a particular period of time followed by the assignment of the remaining spectrum in the 900 MHz band using an auction.
- A 4.119 Within Option 2B, there are a variety of issues which would have to be considered prior to implementation of this option, for example:
- *Who should be awarded an administrative assignment?* Spectrum could be administratively assigned to the 3 GSM operators for GSM use only (on the grounds of ensuring no disruption to GSM services as suggested by a number of respondents), or to the 4 existing MNOs, i.e. including H3GI (on the grounds of ensuring no competitive distortion between the existing MNOs, as put forward by a number of respondents).
 - *How long should the administrative assignment last?* The licence awarded to each incumbent operator could range from a short period of time (e.g. until demand for GSM fell to a specified level), for the full licence duration (to 2030) or even an indefinite licence, as proposed by some respondents.
 - *How much spectrum?* The quantity of administratively assigned spectrum could be linked in some way to the amount of spectrum required for continued GSM use, and reduced over time as demand for GSM declines, or it could be administratively set at 2 × 5 MHz or 2 × 10 MHz per operator.

The quantity of spectrum administratively assigned could differ between operators.

- *How would spectrum fees be set?* Spectrum fees for the administratively assigned spectrum could be set prior to the auction of the remaining spectrum or could be based on the prices determined in the auction for the remaining spectrum. However, neither of these approaches are likely to reflect the correct market price for the administratively assigned spectrum which would be achieved if this spectrum formed part of an overall auction.

A 4.120 It is also possible to consider the impacts of both of these categories of options (Option 2A+2B) together, and again where relevant, specific reference will be made to this combined option in the impact assessment that follows.

A 4.121 On a general note and prior to setting out the next steps of this 'Assignment Process' RIA, it is worth noting that the more intrusive is the impact of an administrative assignment process, the higher the likelihood that the actual optimal allocation of spectrum would not be achieved. As noted by DotEcon in Chapter 3 of its latest report (Document 12/24), and in previous reports, the overriding principle is that a hybrid approach of reservation or partial assignment requires administrative judgments and cannot be as efficient as market testing within a full band auction. Furthermore, a hybrid system would have the challenge of ensuring fair, reasonable and efficient pricing for reserved spectrum. These are important factors in the assessment of the impact of the various options and are considered in greater detail below.

A4.3.2 The 'Assignment Process' RIA: Impact on Stakeholders and Competition (Step 3 and 4)

A 4.122 This section considers the impact of the possible options on:

- Existing operators in the mobile market in Ireland (i.e. the three existing GSM MNOs (Vodafone, Telefónica and Meteor), and H3GI);
- Potential new entrants to this market;
- Competition; and
- Consumers.

A 4.123 As noted in the 'Spectrum for Award' RIA above, consumers, as a stakeholder group, are discussed after the impacts on competition are outlined.

Background Information

- A 4.124 Before considering the potential impact of the options on the particular stakeholder groups and on competition, a number of general comments can be made regarding the options in terms of impacts on stakeholders.
- A 4.125 Option 1 differs from Option 2 in that under Option 1, although bidders may be in different positions entering into the auction in terms of existing spectrum allocations, within the auction all bidders would be treated equally and given equal opportunity to access spectrum for the proposed licence periods. There would be no special conditions attached to any spectrum block and all spectrum blocks within each band would be homogeneous. Each bidder would be treated in exactly the same manner regardless of whether the bidder was an existing MNO in the Irish market or a new entrant.
- A 4.126 Under Option 1, although all bidders would be treated equally (and all spectrum blocks would be packaged equally in the CCA), all bidders would be unlikely to act in the same way in an auction. This is because each bidder would be in a different ex ante situation and this would impact on its bidding strategy. The CCA would allow different bidders to distinguish themselves on the basis of their respective demands for spectrum. This is particularly important as the award of more than one spectrum band in the same process would enable all bidders to substitute between bands in line with their individual preferences.
- A 4.127 Option 2, with the use of an administrative assignment process, would introduce restrictions to the possible outcomes of the CCA with differing implications for different operators as discussed below. Option 2 would restrict the amount of spectrum in the 900 MHz band available for auction as a result of the administrative assignment of spectrum in that band to incumbents and/or introduce a restriction on who could bid for some of the sub-1GHz spectrum by setting aside spectrum for new entrants or new band entrants.
- A 4.128 The preference of an individual operator for either Option 1 or Option 2 would depend on their particular circumstances and whether or not an option might put them at a competitive disadvantage vis-à-vis other operators in the downstream retail market. The impact on existing operators is considered first, followed by the impact on new entrants or new band entrants as proposed by H3GI.

Existing Operators

- A 4.129 On first impressions, given that each of the existing operators would be granted an administrative assignment of 900 MHz spectrum under Option 2B, they are

likely to have a general preference for Option 2B over either Option 1, Option 2A or a combined Option 2A+2B, notwithstanding H3GI's view regarding the reservation of Lot A in the 900 band for a new band entrant. Therefore Option 2B is used as the reference point when comparing the options, from the point of view of existing operators.

- A 4.130 For existing operators, none of the options under consideration would result in an existing operator facing an uncontrollable risk of not winning liberalised spectrum in the 900 MHz band (due to the CCA auction design and their final bid in this auction), unless a very large amount of 900 MHz spectrum were to be reserved for new entrants under Option 2A. Of all of the options, Option 2A would be the least attractive option for incumbents as it would result in a reduction in the amount of spectrum available for incumbents to bid on.
- A 4.131 Option 2B has some unique benefits for existing operators that would not exist under Option 1 or Option 2A. Option 2B would clearly operate to the advantage of incumbents more so than either Option 1 or Option 2A, and to the disadvantage of potential new entrants, as explained below.
- A 4.132 **Less 900 MHz spectrum available for new entrants:** The direct effect of the administrative grant of spectrum to each of the incumbent operators in the 900 MHz band would be a reduction in the amount of 900 MHz spectrum available in the auction for new entrants. Assuming that each of the 3 GSM operators were granted one block of 900 MHz spectrum each this would mean that instead of 7 blocks of 900 MHz spectrum there would only be 4 available, and if one block was granted to each of the four incumbent MNOs, this would leave only 3 blocks available for new entrants to bid on. New entrants would have *ex ante* far fewer options to win spectrum in the 900 MHz band. Notwithstanding their ability to bid for 1800 MHz spectrum instead, such an *ex ante* administrative assignment of 900 MHz spectrum arguably makes it more difficult for new market entrants to obtain sub-1 GHz spectrum, thereby restricting competition 'for' the market.
- A 4.133 **Perception of Regulator favouring incumbents over new entrants:** In addition to this direct effect, a new entrant who participated in the auction under Option 2B would be competing for spectrum against incumbents who each had a guarantee of a minimum spectrum holding in the 900 MHz band, regardless of the outcome of the auction. This guarantee could be either short-term or long-term, depending on the duration of the administratively assigned spectrum.⁷⁴

⁷⁴ In addition, each of the 4 incumbent MNOs would have rights to use 3G spectrum in the 2.1 GHz band up to 2021, regardless of the auction outcome.

Incumbents would only have to bid for additional spectrum. New entrants, on the other hand, would have to participate in the auction without any guarantee of a minimum spectrum holding in the 900 MHz band.

- A 4.134 ComReg notes that the technically optimal allocation of spectrum for LTE deployment appears to be a single block of 2x20 MHz in one band.⁷⁵ Accordingly, while given the amount of sub-1 GHz spectrum available, at most one bidder could obtain such a block in each of the 800 MHz and 900 MHz bands, bidders, who intend to deploy LTE, can reasonably be expected to seek to obtain such a block.⁷⁶
- A 4.135 It could potentially be argued by an incumbent operator, if it was granted an administrative assignment of say one block of 900 MHz, that this may not be enough sub-1 GHz spectrum to ensure that this incumbent would be a successful competitor in the new liberalised world.⁷⁷ Nonetheless, having one guaranteed block of 900 MHz spectrum 'in the bank' before the rest of the spectrum is auctioned would put each of the incumbents at an advantage over new entrants in terms of bidding strategies. This act of administratively granting spectrum to incumbents could also send a signal to potential new entrants that ComReg's preferred outcome was one in which each of the incumbent operators had a guaranteed on-going position in the market, regardless of the consequences on competition/consumers. It could be seen that incumbents were being assigned spectrum purely by virtue of their current operations.
- A 4.136 The combination of these direct and potential indirect effects could therefore make entry less attractive for potential new entrants. The result could be less or no participation by potential new entrants in the auction by virtue of an unnecessarily restrictive award design. This would clearly benefit incumbents by making it easier for each of them to win additional spectrum in the auction.
- A 4.137 Option 2B could significantly benefit incumbents if it ultimately led to complete entry deterrence – few or no new potential entrants participating in the auction. Although the administrative assignment of a total of say four blocks of 900 MHz to the four incumbents could be seen as being relatively small in relation to the 13 blocks of sub 1 GHz spectrum available in the award, nonetheless it could

⁷⁵ See for instance <http://www.slideshare.net/dmcbbv/lte-forum-sweden-april-2010-ventura-lte-discussion>

⁷⁶ In its response to Document 11/60 (at paragraph 2.7), Telefónica asserted that ComReg failed to show that if the existing operators obtained sufficient 900MHz spectrum through administrative assignment, they would wish to secure more. ComReg is of the view that the material set out above is sufficient to demonstrate this.

⁷⁷ Moreover, if incumbents were to be granted an administrative assignment of one block in order to mitigate the risk of consumer disruption, there appears to be an argument that any such grant should be on a GSM only basis.

be enough to deter potential new entrants, given the relative importance of 900 MHz in the short term. Therefore even though the combination of three spectrum bands was considered the preferred option in terms of its impact on competition, the assignment process under Option 2B could nevertheless significantly deter entry to the benefit of existing operators.

A 4.138 In summary, Option 2B is likely to be preferred by incumbents over Option 1 or Option 2A because it would:

- guarantee 900 MHz spectrum for each of the incumbents and therefore their 'place' in the market,
- could have the added bonus for incumbents of reducing competitive pressures in the auction for the remaining spectrum and make it easier for incumbents to acquire more spectrum (particularly if no potential new entrant participates in the auction) compared to a situation where the incumbents had to compete on the merits for all spectrum (and where a new entrant considering participation would not be at an immediate disadvantage). Option 2B could therefore positively impact on the auction outcome in favour of incumbents; and
- Reduce competitive pressure at the retail level.

A 4.139 Turning now to Option 1 and Option 2A, it is clear that these unique advantages to incumbents of Option 2B do not exist.⁷⁸ Under both Option 1 and Option 2A, no incumbent would be given a straight guarantee of 900 MHz spectrum. Each incumbent would have to participate in the auction for the quantity and location of spectrum (new entrants would benefit under Option 2A, as discussed in the next section). Incumbents would not be granted any special treatment purely by virtue of their incumbency in the 900 and 1800 MHz bands.

A 4.140 Looking at Option 2A in particular, there are a number of specific reasons as to why incumbents would have a clear preference for Option 2B over Option 2A:

- Under Option 2A the amount of sub 1 GHz spectrum available for incumbent operators would be reduced. As noted above, 'new entrant reserved spectrum' could be in the 900 MHz band or in the 800 MHz band. Incumbent operators would be particularly opposed to the reservation of spectrum in the 900 MHz band given the preferences expressed by

⁷⁸ Save for H3GI's proposal for the reservation of Lot A in the 900 MHz band for a new band entrant.

incumbent operators for 900 MHz spectrum (linked to continued GSM provision);

- Whilst Option 2B would reduce the likelihood of new entry (thereby benefiting incumbents), Option 2A would increase the likelihood of new entry; and,
- Were spectrum to be reserved for new entrants or new band entrants in the 900 MHz band, Option 2A might impact on the incumbent band operators' ability and incentives to remain in the market, compete and secure investment in future network upgrades.

A 4.141 In the case of a combined Option 2A+2B, existing operators may prefer a combined Option 2A+2B over Option 1 if the new entrant-reserved spectrum was in the 800 MHz band. However, if under Option 2A spectrum was reserved for a new entrant in the 900 MHz band, incumbents are unlikely to find a combined Option 2A+2B attractive, given their strong preferences for spectrum in the 900 MHz band in the first time slice (see Annex 3 of Document 11/60a). Reducing the amount of 900 MHz spectrum available would not be in their interest.

A 4.142 Based on the preceding discussion, it is evident that Option 2B would offer a number of unique advantages for existing operators. However, although there are clear benefits associated with Option 2B for incumbents, when the issue of spectrum fees for the administratively assigned spectrum is factored into the equation, Option 2B may not turn out to be particularly attractive. If an administrative assignment of spectrum were to be made to operators where the price charged to operators was to be determined subsequently by the auction outcome for those blocks that were auctioned, then in effect the incumbent would be making an unlimited bid for that spectrum. ComReg is of the view that such an unlimited bid could create uncertainty and raise certain corporate governance issues for incumbents, the magnitude of which may vary with the financial circumstances of each incumbent.

A 4.143 Moreover, in the proposed CCA, where a formula is provided to enable bidders to place a knock-out bid, incumbents are in a position to obtain an identical result by partaking in the auction and bidding a sufficiently large amount.

A 4.144 Accordingly, ComReg is of the view that the only real advantage that incumbents might obtain from the administrative assignment of spectrum would be any reduction in the price paid for spectrum by the incumbents relative to that which would have been determined in an open and competitive auction.

- A 4.145 As noted above, there are a number of ways in which the price for the administratively assigned spectrum could be determined. If it was to be determined based on the outcome of the auction, a situation could arise whereby an incumbent operator may find that it regrets the spectrum it has been administratively assigned (say for arguments sake this is in the 900 MHz band), and would instead prefer less expensive spectrum in the 800 MHz band etc. It would only be by chance that any fee set on the basis of the outcome of the auction for the remaining blocks would correspond to the firm's valuation of the administratively assigned block.⁷⁹
- A 4.146 In summary, from the perspective of existing operators, Option 2A would be their least preferred option particularly if spectrum was reserved for new entrants or new band entrants in the 900 MHz band. Incumbents are likely to favour Option 2B as it would mean guaranteed 900 MHz spectrum, would reduce the chance of new entry and would possibly increase the chance of successfully bidding for more spectrum. However how the fees are set for the administratively assigned spectrum could be of concern to incumbents and could make this option a less attractive option.
- A 4.147 By extension, ComReg is of the view that MVNOs are likely to favour those options that are advantageous to their long term MNO partners.⁸⁰ To the extent that any MVNO/MNO relationships are short term or are nearing the end of their term, MVNOs may prefer those options that increase competition in the wholesale market for spectrum and which may enable them to negotiate better terms.

Potential New entrants

- A 4.148 The preceding discussion has already outlined how potential new entrants could be impacted by the various options and it is not necessary to repeat these points again here. It is evident from the preceding discussion on existing operators that new entrants would not be left in a favourable position under Option 2B (unless perhaps it was combined with Option 2A). Under Option 2B there would be a reduction in the amount of spectrum available to new entrants placing them at a disadvantage and the knock-on impact for new entrants could be particularly severe. Option 2B would likely place incumbents at a significant

⁷⁹ In its response to Document 11/60, H3GI comments on the pricing of administratively assigned spectrum but does not go into any detail as to how it might be achieved other than to suggest that it can be done by reference to prices paid in the upcoming award and that ComReg should not be afraid to be contentious in determining the price.

⁸⁰ The submissions of Tesco Mobile Ireland Ltd and An Post in response to Consultation 09/99 were largely supportive of their respective MNO partners.

advantage in the auction compared to potential new entrants as set out above. Therefore Option 2B would be the worst option from the perspective of new entrants. Compared to Option 2B, Option 1 and Option 2A would be preferred by new entrants and both of these options are considered below from the perspective of new entrants.

- A 4.149 It is likely that Option 2A, which would involve the reservation of sub 1GHz spectrum specifically for new entrants, would be preferred by new entrants over Option 1 as it appears to offer particular benefits/advantages for new entrants, which would not be the case under Option 1. Option 2A increases the chance for a new entrant(s) to win sub 1 GHz spectrum compared to Option 1 as a new entrant would only face competition for the 'reserved spectrum' from other potential new entrants and not from any of the incumbent operators who would be precluded from bidding on it. Also, if there was only one new entrant it would automatically be the winner of the reserved spectrum.
- A 4.150 Reserving spectrum in the 900 MHz band for a new band entrant rather than a *de novo* market entrant is less likely to be preferred by new entrants as it would likely favour H3GI, a current market incumbent, albeit without 900 MHz spectrum currently. Indeed, new entrants may likely see this approach as being one that consolidates the current market incumbency rather than facilitating new market entry.
- A 4.151 Considering a combined Option 2A+2B, new entrants are unlikely to favour any option which would involve an administrative grant of spectrum to all incumbent operators (i.e. Option 2B). As a new entrant would still potentially have to compete with other new entrants for the 'reserved new entrant' spectrum they would still be at a disadvantage *vis-à-vis* the incumbents each of which would now have guaranteed 900 MHz spectrum going into the auction. Hence, it is unlikely that new entrants would prefer a combined Option 2A+2B over Option 2A on its own (their preferred option).
- A 4.152 However, although Option 2A, absent H3GI's proposal to reserve spectrum in the 900 MHz and 1800 MHz band for a new band entrant, would appear to offer some particular advantages over Option 1, the manner in which the licence fee is determined for the reserved spectrum would influence the preference of new entrants.
- A 4.153 In summary, from the perspective of new entrants, Option 2B would be their least preferred option. New entrants are likely to have an overall preference for Option 2A (absent H3GI's aforementioned proposal for the reservation of

spectrum); however, how fees are set for the reserved spectrum could affect their preferences between Option 2A and Option 1.

Summary of Impacts on Operators (existing and prospective)

- A 4.154 Overall, operator preferences between the options will depend on which outcome serves their interests best – in terms of accessing as much spectrum as possible, at as low a cost as possible or possibly in terms of restricting competition in the market.
- A 4.155 Incumbents are likely to favour the administrative grant of as much spectrum as possible, for as long as possible. This could also act to deter new entry. Therefore on the basis of the above analysis it is clear that incumbents favour Option 2B. This view is supported by incumbent submissions (even H3GI, were it to also benefit). However, it is relevant to note that the extent to which incumbents would ultimately favour Option 2B could depend on how spectrum fees were to be set under that option.
- A 4.156 New entrants are likely to prefer a set aside of as much spectrum as possible for which incumbent operators would be prohibited from bidding. Therefore it would appear that new entrants would favour Option 2A. However again this might depend on how spectrum fees were set under Option 2A for reserved spectrum.
- A 4.157 It is evident from this analysis and the preferences of stakeholders expressed in the consultation process that none of the three options would deliver the preferences of all stakeholders.

Impact on Competition

Background

- A 4.158 Before proceeding to the analysis of competition, it is worth pointing out a number of connections between the various sections in this 'Assignment Process' RIA. The references to new entrants in the section above on stakeholders are highly relevant for the analysis of the impact on competition that follows, which in turn is also intrinsically linked to the impact on consumers (see next section). The option which would deliver the most positive impact on competition would also likely deliver the best outcome for consumers.
- A 4.159 As set out in previous consultations, the three spectrum bands under consideration, in particular the sub 1 GHz bands, are highly important for the mobile market in Ireland given their technical properties and the benefits

associated with liberalising this spectrum. Given the importance of this spectrum, and its finite supply, unnecessary restrictions on the assignment process used to award this spectrum could have a serious negative impact on competition.

A 4.160 The impact on competition is assessed at two levels which are highly interconnected:

- Competition in the auction itself. This is a once-off competitive process and can be referred to as competition ‘for’ the market; and
- Competition in the downstream/retail market between the winning operators. This is an on-going, dynamic process and can be referred to as competition ‘in’ the market. Ensuring competition at the retail level is promoted is the primary goal. Competition in the auction/for the market can therefore be seen as a means to an end. Competition at the retail level between operators for customers is what drives benefits to consumers.

A 4.161 Any form of administrative assignment of spectrum (i.e. Option 2) imposes a restriction on the range of possible outcomes in the auction. The more extensive the restriction, in terms of the possible auction outcomes which it precludes, the more likely it is that the actual optimal allocation is precluded from arising. Restrictions on auction outcomes will impact firstly on competition in the auction itself and ultimately downstream competition and consumers. An efficient outcome in the auction would be best achieved by not imposing unnecessary restrictions on the possible outcomes of the auction and thereby maximising the opportunities for competition in the auction itself – for example, a restriction that there must be a new entrant excludes all potential auction outcomes where no prospective new entrant is a successful bidder.

A 4.162 An efficient and optimal outcome in the auction is where the spectrum ends up with the operators who value it the most and which, in turn, will ensure the efficient use of spectrum. In so doing, an efficient outcome in the auction will deliver the best outcome for competition downstream and ultimately maximize the benefits for consumers. Ensuring that the spectrum is awarded to those operators that value the spectrum the most will ensure that competition in the advanced service market is enhanced. On the other hand, using an administrative assignment mechanism would not guarantee an efficient outcome in terms of spectrum holdings and this would inevitably impact on the outcomes in the downstream retail market over the licence duration. This could occur due to the fact that inefficient entry has been encouraged or an operator that may otherwise have exited the market is preserved through the grant of

spectrum rights in advance. This would both reduce the capacity of other efficient operators to provide services (as the inefficient new entrant is holding spectrum) and may take many years before this is addressed by the market (most probably through the market for corporate control rather than any spectrum trade or lease).

- A 4.163 The award of licences in the 800 MHz, 900 MHz and 1800 MHz bands is critical to setting the initial conditions for the next phase of development in the mobile market in Ireland. With the liberalisation of these key spectrum bands, this is a hugely important stage of development in the market. Mistakes in this phase of market development will likely have enduring consequences for competition on the downstream retail market. Given the large proportion of customers who still have 2G only devices there is significant potential for a considerable take-up of advanced handsets, and lower priced data services.
- A 4.164 Setting the initial conditions correctly at this stage of market development is critical for the long term impacts on the market. In this regard, it is worthwhile looking back at what has happened in many markets for 2G services. The experiences with 2G throughout the EU show that initial conditions are largely determinative of market outcomes. In most cases, those operators that entered the market first have maintained a very strong market position despite later entry and very efficient Mobile Number Portability systems to facilitate customer switching. This is also evident in the Irish market.

Competition in the auction - for the market

- A 4.165 When comparing the options in terms of their impact on competition the first level to assess is the impact on competition in the auction.
- A 4.166 Looking first at Option 1. This involves a CCA of all available spectrum and would produce an efficient auction outcome by design as it would not involve any unnecessary restrictions on outcomes.⁸¹ Excluding outcomes where bidders lose as a result of failed strategic attempts to game the auction, there should be no individual other bidder (or consortium of bidders) that would have been willing to better the bids made by the winning bidders. Therefore Option 1

⁸¹ ComReg is of the view that the proposed spectrum caps are necessary restrictions on the potential auction outcomes as set out in Annex 6.1 of Document 11/60a. These caps would facilitate there being at least four winners of spectrum in the proposed auction and there being at least four winners of 900 MHz spectrum in the first time-slice. It is important to note that this serves both to protect against consumer disruption and promote new entry, without the associated risks of inefficient entry or the sheltering of inefficient incumbents. In that regard, the proposed spectrum caps, while to some extent reducing the range of possible outcomes in the auction, do not have the potentially severe negative effects on competition that administrative assignment can have.

would ensure efficiency through having competition for all spectrum blocks on a purely non-discriminatory basis. Option 1 would go some way towards ensuring that the problems associated with using administrative processes described above would not arise.

A 4.167 Ensuring that all operators compete on the merits and on a level playing field for all liberalised spectrum, and not on the basis of artificial entry incentives, or administrative spectrum assignments, would be the best means by which to ensure an efficient auction outcome where each spectrum block ends up with the operator who values it the most. By not assigning spectrum to certain operators and not limiting who can bid for certain spectrum, this would ensure that the maximum number of bidders would be able to participate in the process and hence all outcomes are possible as opposed to some outcomes being precluded in any process which included an administrative assignment. This would appear to be the best means by which to ensure spectrum is efficiently used and in turn promote competition in the downstream retail market.

A 4.168 On the other hand, Option 2 would distort demand for spectrum that is not subject to the administrative assignment process by restricting the range of possible outcomes in the auction. An efficient auction outcome could not be ensured.

A 4.169 Looking at the different forms of Option 2:

- **Option 2A:** Option 2A entails a CCA for all spectrum but with a restriction on outcomes due to the reservation of spectrum for new entrants or new band entrants only. This might create an artificial divide between the spectrum available to incumbents and the spectrum reserved for new entrants. This could result in inefficient entry by a new entrant if the new entrant was to win the reserved spectrum only because demand for it had been artificially restricted and there would otherwise have been another bidder (i.e. an incumbent) which valued the spectrum more (and was willing to pay more for the spectrum than what the new entrant paid). Also it would restrict potential outcomes for the remaining spectrum to the possible disadvantage of incumbents as it would reduce the amount of spectrum that the incumbent MNOs could bid for. These issues would be further exacerbated if the H3G proposal of reserving Lot A in the 900 MHz band for a new band entrant was adopted.
- **Option 2B:** As set out above, the administrative assignment of 900 MHz spectrum to incumbents would reduce the amount of 900 MHz spectrum awarded in the CCA. This would distort competition for the remaining

spectrum. As explained above, this could well discourage participation by new entrants thus reducing competition in the auction compared to Option 1.

- **Option 2A+2B:** Both Option 2A and Option 2B individually restrict the range of outcomes for the auction (as noted above). Combining these two options together would therefore result in even greater restrictions than either Option when considered on a standalone basis. This holds the greatest potential for an inefficient outcome, e.g. by encouraging inefficient entry or sheltering an inefficient incumbent.

Competition in the market, at the retail level (competition between winners)

A 4.170 The previous section discussed the various options in terms of their impact on competition for the market and their likelihood to deliver an efficient outcome in the auction. Now the impacts on competition in the market, at the retail level, are considered.

A 4.171 As noted above, Option 1 would produce an efficient auction outcome by design as it would not involve any unnecessary restrictions on outcomes. Therefore Option 1 would deliver the best outcome in terms of competition in the market.

- As noted above, Option 2 when compared to Option 1 would distort demand for spectrum and restrict the range of possible outcomes in the auction. An efficient auction outcome could not be assured. If the auction fails to deliver an efficient outcome, this would likely result in a negative impact on downstream competition.
- Option 2 would involve administratively identifying who was to be awarded spectrum. As DotEcon notes in its latest report, administrative judgments cannot be as efficient as market testing within a full band auction. As ComReg cannot be certain which particular operators would be optimum users of the liberalised 900 MHz spectrum, ComReg could make the wrong decision by awarding the spectrum to an operator who does not value it the most and so will not be an optimum user of the spectrum, thereby reducing competition at the retail level than would otherwise be the case under Option 1.

A 4.172 With a lower level of competitive intensity between the new licensees, this would reduce incentives to innovate. In terms of impact on consumers

(discussed below) this is likely to result in a slower roll-out and a more limited range of advanced wireless services.⁸²

- A 4.173 Given the current (and likely future) importance of the mobile service market even small moves away from the optimal spectrum allocation could have potentially very large impacts on welfare over the period up until 2030. Market mechanisms may eventually undo mistakes made, but during that time there would be less competition and less innovation relative to the optimal spectrum rights allocation otherwise occurring under Option 1 and the loss to consumer welfare could be large. Moreover, given the still relatively immature nature of the mobile broadband market, errors could allow operators to obtain a stranglehold on the market that they would not have managed in an optimal spectrum rights allocation.
- A 4.174 Looking at the different forms of Option 2 it is evident that, for different reasons, Option 2A and Option 2B would have a negative impact on downstream competition (and thereby consumers) compared to Option 1.

Option 2A

- A 4.175 A number of respondents have argued that reserving spectrum for new entrants (Option 2A) would be a means by which ComReg would have a positive impact on competition (and thereby consumers). Artificial entry incentives can be used to attract entry that would not otherwise arise. However while attracting new entrants is clearly desirable as a means of promoting competition, promoting competition is not the same as promoting individual competitors. Option 2A would not necessarily promote competition, because:
- Artificial entry incentives could attract inefficient new entry at the expense of potentially more efficient incumbents - entry which would not otherwise be successful were it not for the additional entry incentives put in place. For example, inefficient entry could occur if Option 2A resulted in the entry of a weak new entrant compared to the alternative of a more efficient incumbent had that incumbent been able to access more spectrum (i.e. the spectrum set aside for new entrants).
 - If the set aside of spectrum for new entrants is not large enough to enable a new entrant to be an efficient competitor, and the new entrant fails to win any additional spectrum, then Option 2A would not result in a promotion of

⁸² As noted in ComReg's draft RIA in Consultation 09/99

competition over and above what could be achieved using a CCA (i.e. Option 1) to award all spectrum.

A 4.176 Although artificial entry incentives have been used in other countries this practice tends to be used where there is a very limited amount of spectrum being released to the market, or where incumbent operators have already been granted long-term licences. In the present case, the quantity of spectrum being released is substantial (some 140 MHz of spectrum in total) and so artificial entry incentives are unnecessary in the present case. Under Option 1, where no spectrum would be reserved for incumbent operators, new entrants would be in the same position as incumbents in terms of bidding for spectrum. In that case, spectrum caps are a more appropriate instrument for facilitating competition (see Chapter 4 of this document).

Option 2B

A 4.177 **Reduction in downstream competition as a result of entry deterrence:** As noted above, under Option 2B, assigning 900 MHz spectrum to incumbent operators on the basis of their incumbency, and thereby ex ante reducing the amount of 900 MHz spectrum available for new entrants to bid on, could act as a serious entry deterrent if new entrants perceived the auction design to favour incumbents. Reduced competition in the auction would in turn lead to reduced competitive pressures in the retail market.

A 4.178 **Could help shelter inefficient incumbents:** Option 2B would involve the automatic grant of spectrum to existing operators regardless of how 'fit' a competitor they would be in the new competitive landscape. If an incumbent did not win any more spectrum in the auction and ended up with only one block at 900 MHz which was administratively assigned (and required for continued GSM use) and its existing 2.1GHz spectrum, it may not be an efficient competitor. Option 2B could therefore help shelter an inefficient incumbent. Therefore, administratively assigning 900 MHz spectrum to each of the incumbents could run the risk of delaying the exit of an inefficient incumbent, as well as limiting or prohibiting efficient entry or the reallocation of spectrum to other, efficient, incumbents. An inefficient incumbent with valuable spectrum rights of use would not be in the best interests of competition (and ultimately consumers).

A 4.179 It could be argued that the emergence of spectrum trading (or perhaps the leasing of spectrum) could negate some of these competition concerns associated with Option 2B. However at this point in the development of the market it is difficult to feel confident that this would be the case. For example, a 2011 report by the Electronic Communications Committee within the European

Conference of Postal and Telecommunications Administrations (“CEPT”) reported a total of three trades of what it refers to as international mobile telecommunications (“IMT”) licences within CEPT countries at the date of its preparation.⁸³ This might be because strong operators are unwilling to provide their competitors with the means to compete more effectively or that weaker operators are unwilling to provide stronger competitors with the tools to compete more aggressively and further weaken their position. Indeed, where rivalry is intense, each operator may prefer to hoard than to sell to a rival.⁸⁴ Moreover, the incentives to sell the operator in its entirety might tend to override any incentive to sell or lease any of the critical spectrum assets of the operator to competitors. The report also notes that the risk of distortion of competition by concentration of spectrum increases in the case of bands with a limited number of licences, such as the IMT bands (e.g. GSM, 2.1 GHz, etc). As a result, transactions involving these bands tend to be subject to scrutiny by the relevant authorities. In light of the above, it is difficult to feel confident that spectrum trading would negate the competition concerns associated with Option 2B.

Impact on Consumers

- A 4.180 Before comparing each of the options in terms of the likely impact on consumers, there are a number of general comments that are worth setting out to inform this discussion. As noted above, there is an intrinsic link between the impact on new entrants, the impact on competition and the impact on consumers. The promotion of competition in the downstream retail market is intrinsically linked to ensuring that benefits to consumers are maximised.
- A 4.181 Consumers will prefer the option which has the greatest potential to promote competition as this will maximise long term benefits to consumers in terms of choice, price and quality in the provision of enhanced services and will ensure the earliest deployment of 3G and 4G services in the 800 MHz, 900 MHz and 1800 MHz bands. In terms of when consumers are most likely to experience the benefits of liberalised spectrum, this is intrinsically linked to the promotion of competition. The more competitive the auction is (i.e. the lower the impact of any restrictions that are placed on possible auction outcomes and the lower the likelihood of precluding an efficient outcome), the greater the level of competition that will emerge at the retail level. It is this competitive dynamic which will spur operators to roll out new networks and commence the delivery of

⁸³ ECC Report 169, “*Description of practices relative to trading of Spectrum rights of use*”, http://www.hlspectrumreview.com/uploads/file/ECCREP169_Spectrum_Trading_May2011.pdf

⁸⁴ See Cave, M. (2010) Anti-competitive behaviour in spectrum markets: Analysis and response, Telecommunications Policy, Volume 34, Pages 251-261.

new, innovative services to consumers, using liberalised spectrum, and to continue to invest and innovate over the period to 2030.

A 4.182 In addition, consumers are likely to prefer options which avoid significant disruption to services that they use and avoid significant expenditure, for instance on new handsets. A number of the incumbents claimed that proposals (which fall under Option 2) would ensure that consumers would not face any disruption to GSM services by removing the risk that an incumbent would not win spectrum in an open auction. Under Option 1, the auction design has been amended to ensure there would be no unmanageable risk to business continuity, and therefore consumer disruption, absent a decision by an existing GSM operator to not pay a higher spectrum fee than another bidder to secure the spectrum, as explained previously. Therefore the potential for consumer disruption arising under Option 1 is a much less relevant factor, as each incumbent would have the opportunity to ensure that they retained 900 MHz spectrum, and thereby avoid any risk of their customers being disrupted, simply by bidding enough in the auction.

A 4.183 As noted above, ComReg is of the view that Option 1 would have a more positive impact on downstream retail competition than Option 2. Therefore by extension Option 1 would be better for consumers than Option 2. Competitive auctions, such as Option 1, are the best means to ensure that the welfare of society is maximised where spectrum rights of use are sold. Ensuring that all spectrum is awarded to those operators that value it the most is critical in ensuring that the welfare effects of liberalising the band are maximised. Consumers would therefore be better off with Option 1 which involves a CCA that would ensure that *all* spectrum is awarded to those operators who value it the most. There could be an obvious cost to consumers associated with an administrative assignment process as it would introduce a greater risk that spectrum would be awarded to the ‘wrong’ operator, that is, an operator who would not be an optimum user of the spectrum for a period of time. The larger the amount of spectrum administratively assigned, and the longer the period of the administrative assignment, the greater the costs to consumers associated with that risk. Even small losses to consumer welfare or unrealised potential gains would have a substantial impact on consumer welfare over the period of the new liberalised licences.⁸⁵ Therefore a CCA of all spectrum under Option 1 is the best means by which to determine the winner of each spectrum block by minimising the risk that spectrum is inefficiently assigned and thereby maximising the long term benefits to consumers.

⁸⁵ As noted in ComReg’s draft RIA in Consultation 09/99

A 4.184 Looking at the different forms of Option 2:

- **Option 2A:** Reserving spectrum for new entrants could potentially damage a more efficient incumbent by artificially reducing the amount of spectrum that incumbents could be awarded. Therefore Option 2A would not necessarily increase competition and is therefore not necessarily better for consumers.
- **Option 2B:** Administratively granting liberalised licences to incumbents automatically denies this spectrum to potential new entrants and increases the risk of deterring new market entry. If that occurs, the primary beneficiaries would be the incumbent operators, and not consumers. With a lower level of competitive intensity between the winning bidders than would otherwise be the case, this would also reduce incentives to innovate. In terms of impact on consumers this would likely result in a slower roll-out of advanced wireless services.⁸⁶

A 4.185 In summary, there is a strong correlation between promoting new entry, impacts on competition and consumer welfare. Overall Option 1 is likely to have a more positive impact on competition compared to Option 2. Therefore, by extension, Option 1 would also deliver a better outcome for consumers. ComReg is of the view that using the specifically designed and tailored CCA as set out under Option 1 would maximise the benefits for consumers in terms of services, prices, choice, quality and innovation.

A4.3.2 The ‘Assignment Process’ RIA: Assessment and the Preferred Option (Step 5)

A 4.186 The above assessment has considered the impact of the various options from the perspective of industry stakeholders, as well as the impact on competition and consumers.

A 4.187 In summary, existing operators would tend to prefer Option 2B, whilst new entrants would tend to prefer Option 2A (subject to how spectrum fees were to be set). However based on the analysis above, it is evident that Option 2A and Option 2B would be in the best interests of particular operators but not necessarily in the best interests of competition and consumers. On the other hand, operators would not be disadvantaged by a CCA of all spectrum with certain necessary restrictions (e.g. spectrum caps), as proposed under Option 1, and indeed some respondents have expressed a preference for this.

⁸⁶ As noted in ComReg’s draft RIA in Consultation 09/99

- A 4.188 Option 1 appears to be the best means to promote competition for spectrum usage rights (and hence promote new entry) and, in turn, competition in the related downstream retail market. Compared to Option 2, it would also better promote the goal of efficient investment and drive innovation in new and enhanced mobile networks.
- A 4.189 Option 1 would ensure an efficient auction outcome and therefore ensure that competition in the downstream market is maximised to the benefit of consumers. Such an efficient auction outcome would not however be guaranteed under Option 2.
- A 4.190 For the reasons outlined above, Option 1, involving a CCA of all spectrum in the 800 MHz, 900 MHz and 1800 MHz bands, is the preferred option identified under the 'Assignment Process' RIA.

A4.4 Chosen Option

- A 4.191 The 'Spectrum for Award' RIA concluded with a preference for the joint award of the 800, 900 and 1800 MHz spectrum bands. The 'Assignment Process' RIA concluded with a preference for a CCA of all spectrum subject to a number of key features.
- A 4.192 As noted at the beginning of this annex, following the draft RIA and identification of a preferred option in Chapter 3 of Document 11/60, that chapter then set out an assessment of the preferred option against ComReg's statutory obligations. Following that assessment, ComReg was satisfied that the preferred option identified was in compliance with its statutory obligations. As was seen in Chapter 3 of this document (see Chapter 3 for consideration of submissions received on the draft RIA and on the above mentioned assessment) and as was seen from the above RIA, ComReg has not received any further submissions and is not in possession of any new information, that would suggest it was appropriate to amend its preferred option or to choose an alternative option to that preferred in Document 11/60. As such, ComReg does not consider it necessary to reproduce that assessment again in this document but, instead, refers readers to Chapter 3 of Document 11/60 and to the consideration of responses set out in Chapter 3 of this document.

Annex 5: Spectrum Caps

A5.1 Introduction

- A 5.1 In Documents 11/60 and 11/60a, ComReg noted the views of interested parties provided in response to its previous spectrum cap proposals.
- A 5.2 ComReg also noted DotEcon's consideration and recommendations in relation to spectrum caps (including recommending the introduction of a sub-cap for 900 MHz spectrum in Time Slice 1) as set out in DotEcon's report (Document 11/58).⁸⁷
- A 5.3 Four interested parties provided comments on ComReg's spectrum cap proposals in Document 11/60, being Telefónica, Vodafone, H3GI and eircom Group. The key issues on which these views were provided are as follows:
- the proposed sub-1GHz spectrum cap of 2 × 20 MHz;
 - the proposed overall spectrum cap of 2 × 50 MHz;
 - the proposed 900 MHz spectrum cap of 2 × 10 MHz for Time Slice 1;
 - the suggested introduction of a spectrum floor for sub-1GHz spectrum;
 - ComReg's position on unsold lots at the end of the Award Process;
 - the suggested ability of bidders to combine their individual spectrum cap allowances; and
 - other issues.
- A 5.4 Telefónica, Vodafone and H3GI provided comments on ComReg's proposals in their responses to Document 11/75.
- A 5.5 Each of the separate issues are addressed in turn below.

A5.2 Is there a Requirement for Spectrum Caps?

A5.2.1 Summary of ComReg's Position in Document 11/60

⁸⁷ See section 4 of Document 11/58.

- A 5.6 ComReg stated the primary purpose of auction-based spectrum caps is to avoid extreme outcomes which could harm competition and consumer welfare, whilst at the same time ensuring that the spectrum caps do not, of themselves, determine the final distribution of spectrum rights, which should rather be determined by competition amongst bidders.
- A 5.7 Following consideration of the views of interested parties and DotEcon, ComReg stated that it had received no new information to cause it to change its view that auction-based spectrum caps are reasonably required in present circumstances to, amongst other things, promote and safeguard competition.

A5.2.2 ComReg's Current Position

- A 5.8 On the basis of the reasons identified in Documents 11/60 and 11/60a and noting that the general principle of a spectrum cap was generally supported by interested parties and, further, that no other information before it would lead it to conclude otherwise, ComReg has decided to implement a spectrum cap for the Award Process.

A5.3 Proposed sub-1GHz Spectrum Cap of 2 × 20 MHz

A5.3.1 Summary of ComReg's Position in Document 11/60

- A 5.9 In Document 11/60, ComReg outlined the history of the sub 1 GHz spectrum cap. ComReg first introduced the proposal in Document 10/71 when the 800 MHz spectrum band was first considered for release simultaneously with the 900 MHz spectrum band. In Document 11/60a, ComReg reiterated its analysis from Document 10/71, which recognised that “*highly asymmetric distributions of spectrum could be detrimental to competition downstream*”,⁸⁸ whilst also stating that perfect symmetry of sub 1 GHz spectrum was not necessary to facilitate competition. In Document 10/71, ComReg therefore proposed a 2 × 20 MHz sub 1 GHz spectrum cap, and received diverging views on the appropriateness of this cap from respondents.⁸⁹
- A 5.10 Having taking into account the views of DotEcon⁹⁰ and respondents on this issue⁹¹, in Document 11/60a ComReg maintained its initial view from Document

⁸⁸ Paragraph A 6.127 of Document 11/60a.

⁸⁹ Paragraph A 6.124 of Document 11/60a.

⁹⁰ In ComReg Document 11/58, DotEcon considered that a sub 1 GHz spectrum cap greater than 2 x 20 MHz could lead to extreme outcomes and such outcomes will likely have a damaging effect on competition, whereas a lower spectrum cap “*would likely result in inefficiency of the auction outcome for no obvious gain in terms of the competitiveness of service markets*”

⁹¹ See paragraphs A6.124 to A6.141 of Document 11/60a

10/71 that a sub-1GHz cap 2×20 MHz was the most appropriate sub-1 GHz spectrum cap. Reasons informing ComReg's position included, amongst other things, that:

- a sub-1GHz spectrum cap greater than 2×20 MHz could lead to extreme outcomes likely to have a damaging effect on competition; and
- whereas a lower spectrum cap, by effectively reserving spectrum for a new entrant to the market, would likely result in inefficiency of the auction outcome as there is no obvious gain in terms of the competitiveness of service markets.

A5.3.2 Views of Respondents' to Document 11/60

A 5.11 eircom Group, Vodafone and H3GI provided comments on ComReg's proposal, a summary of which follows:

- eircom Group and Vodafone supported ComReg's proposal, with both considering that it strikes a reasonable balance⁹²;
- H3GI, on the other hand, did not agree with ComReg's proposal for a number of stated reasons, including that in its view:
 - a 2×20 MHz sub-1GHz spectrum cap is too high because:
 1. it is likely to lead to a situation where three operators acquire 2×20 MHz of sub-1GHz spectrum and a fourth operator only 2×5 MHz, which, in its opinion, is an "extreme" outcome/level of asymmetry and would distort competition in the market;
 2. it does not guarantee that at least four operators will obtain the minimum spectrum portfolio (MSP) of 2×10 MHz of contiguous sub-1GHz spectrum which H3GI argues is required by each operator to compete in the market;
 - neither ComReg nor DotEcon have provided sufficient reasoning for their dismissal of H3GI's proposal, nor explained in sufficient detail

⁹² For instance, Vodafone states that the proposal "*strikes a balance between avoiding extremely asymmetrical outcomes in spectrum allocations (that could for example potentially lead to one or more existing licensees losing access to sub-1GHz spectrum entirely with a potentially major adverse impact on competition and consumer welfare) while providing the opportunity for bidders to obtain sufficient spectrum so that the various likely strategies for service provision can be effectively accommodated*". Whereas eircom Group states that "*the proposed cap of 2×20 MHz in the 800MHz and 900MHz frequency bands strikes the correct balance*".

why ComReg's proposed sub-1 GHz spectrum cap of 2×20 MHz will not lead to an extreme outcome/level of asymmetry of spectrum holdings post-auction or otherwise harm competition; and

- ComReg should consider a 2×15 MHz cap relaxed to 2×20 MHz only if supply exceeds demand.

A5.3.3 DotEcon's Analysis and Recommendations

A 5.12 In section 4 of Document 12/24, DotEcon notes that it provided a response to H3GI's similar comments made previously in its response to ComReg document 10/105 regarding a spectrum cap of 2×20 MHz. DotEcon notes that the following points it made in response to H3GI's comments remain valid:

- the proposal does not prevent four bidders from winning sub-1GHz spectrum;
- A bidder *cannot* win 2×5 MHz of sub-1GHz spectrum unless it has explicitly made a package bid including only one block of sub-1GHz spectrum. Packages are never subdivided. Therefore, if a bidder considers that 2×5 MHz alone is unviable, bids should be made only for strictly larger packages (i.e. 2×10 MHz or more);
- with a sub-1GHz cap of 2×20 MHz, the risk of only being awarded 2×5 MHz of sub-1GHz spectrum does not apply only to one operator, but to any bidder who makes bids for packages of spectrum including just 2×5 MHz of sub-1GHz spectrum;
- Given a sub-1GHz cap of 2×20 MHz for each bidder, under the assumption that there will be four competing operators participating in the auction for a total of 2×65 MHz of sub-1GHz spectrum, the situation where one of the operators only acquires 2×5 MHz of spectrum can *only* occur if the incremental value of a second 2×5 MHz block for this operator falls below the incremental value of a fourth 2×5 MHz block for *every one* of the other three competing operators.

A 5.13 DotEcon also laid out the conditions that must all be satisfied in order for one bidder to win only 2×5 MHz of sub 1 GHz spectrum, these conditions being;

- the bidder must actively bid for a package including just 2×5 MHz of sub-1GHz spectrum,

- the bidder must fail to win any package bids including 2 × 10MHz or more of sub-1GHz spectrum,
- If there were three other winners, they would necessarily *all* have to bid for and win 2 × 20MHz of spectrum each. *Every one* of these bidders winning 2 × 20MHz would need to have expressed an incremental valuation for their fourth 2 × 5MHz block (i.e. a value of 2 × 20MHz relative to 2 × 15MHz) that exceeds that of the 2 × 5MHz winner for a second block (i.e. the value of 2 × 10MHz relative to 2 × 5MHz, which may be a large proportion of the total value of 2 × 10MHz),
- if this outcome were the result of bids reflecting valuations for the spectrum (provided these do not include any anticipation of gaining downstream market power) then the result would in fact be consistent with an efficient allocation of spectrum.

A 5.14 DotEcon remains sceptical that, with a sub-1GHz cap of 2 × 20MHz, a bidder is likely to be forced down to 2 × 5MHz of spectrum due to each of its rivals boosting its valuation for a fourth block of sub-1GHz in anticipation of benefits from muted downstream competition, rather than simply because it was more efficient for additional blocks to be assigned to other winners. DotEcon puts forward three main reasons for this (assuming that there will be four bidders):

- the criticisms put forward rely on three bidders each winning 2 × 20 MHz and, if this does not occur, it is not possible for a fourth bidder to be limited to 2 × 5 MHz only. There is inherent fragility in three bidders trying to force a fourth down to 2 × 5 MHz, as if any one of this coalition deviates from the strategy, then the fourth player will obtain more spectrum. Once prices are sufficiently high it becomes increasingly attractive for one of these three bidders to contract demand to less than 2 × 20MHz;
- should any bidder (including H3GI) not see value in holding only 2 × 5 MHz of sub-1 GHz spectrum, DotEcon notes that it should not bid on this outcome in any packages or, alternatively, bid at a low level reflecting its valuation of a single block; and
- it is not clear that long-run downstream competitive intensity would be materially greater with four operators having at least 2 × 10 MHz sub-1GHz relative to three operators with 2 × 20 MHz and one with 2 × 5 MHz (augmented by spectrum in other bands).

- A 5.15 Implicit in H3GI's arguments is the assumption that effective competition requires at least four largely symmetric players and that ComReg should actively intervene to achieve such an outcome. However, DotEcon sees no solid case for active intervention to engineer a largely symmetric four-player outcome in the Irish mobile market. There is also a risk that this would simply create a transient and ultimately unsustainable market structure through an implicit public subsidy generated by the restriction on competition for spectrum that tighter caps (or other measures such as MSPs) would create.
- A 5.16 In relation to H3GI's suggested 2 × 15 MHz sub-1GHz cap (with a relaxation to 2 × 20 MHz if supply is greater than demand), DotEcon considers that this would have some worrying consequences:
- the auction outcome with such a cap would be significantly pre-determined with all four existing operators acquiring 2 × 15 MHz at the reserve price in the event that there was no new entrant. Effectively, competition for spectrum could only come from a new market entrant with this suggested cap;
 - it would effectively leave aside 2 × 5 MHz of sub 1 GHz spectrum for a fifth bidder⁹³ with no justification from a competition perspective, and could result in an inefficient outcome;
 - the fifth bidder could bid for a single block and acquire it at the reserve price. This potentially speculative bidder could then make a significant windfall gain in the future under a future spectrum trading regime if other blocks went for a premium;⁹⁴ and
 - in the absence of a fifth bidder and following the relaxation of the cap to 2 × 20 MHz (as suggested by H3GI under its proposal), the one remaining block would, in any case, be awarded to the bidder with the highest incremental value for an additional sub-1GHz block. In the event of no fifth bidder, the result of the auction resembles a result which could arise if an unconditional cap of 2 × 20 MHz existed.
- A 5.17 DotEcon therefore concludes that H3GI has not made out a valid argument for the reduction of the sub-1GHz cap from 2 × 20MHz to 2 × 15MHz.

⁹³ See DotEcon Report Document 12/24

⁹⁴ ComReg has signalled its position on spectrum trading in paragraphs A 10.46 – 10.52 of Document 11/60a, and more recently in Section 4.2 of the Spectrum Strategy Statement 2011 – 2013, Document 11/89

A5.3.4 ComReg's Consideration of Respondents' and DotEcon's Views

- A 5.18 First, ComReg notes that it did not receive any objections to the principle of a sub-1GHz spectrum cap and, on the basis of the reasons identified in Documents 11/60, 11/60a and Document 11/58 (paragraphs 123 – 132) and noting that no other information before it would lead it to conclude otherwise, ComReg has decided to implement a sub-1GHz spectrum cap in the Award Process.
- A 5.19 In relation to the proposed sub-1GHz cap of 2 × 20 MHz, ComReg notes that, of the three responses received on this proposal, Vodafone and eircom Group supported ComReg's proposal and ComReg notes the reasons provided by them in support of their position.
- A 5.20 ComReg notes H3GI's disagreement with ComReg's proposal and the reasons provided by it in support of its position. ComReg addresses the concerns expressed by H3GI regarding MSP, in the context of H3GI's suggested spectrum floor.
- A 5.21 ComReg also notes DotEcon's assessment of responses received, as set out in section 4 of Document 12/24.
- A 5.22 Having carefully considered the views of interested parties and DotEcon's analysis and recommendations, ComReg's assessment of this issue is as follows:
- in relation to H3GI's suggested 2 × 15 MHz sub-1GHz cap, ComReg finds DotEcon's analysis convincing, including that:
 - it would have the effect of significantly pre-determining the outcome of the Award Process;
 - with an initial sub-1GHz spectrum cap of only 2 × 15MHz, in the case of four competing bidders, this would necessarily result in 2 × 5 MHz being 'set aside', essentially to be left for a fifth entrant, potentially resulting in an inefficient outcome. There is no apparent justification for this on competition grounds;
 - it may encourage speculative demand for a single block to prevent the cap being relaxed and exploit the restriction that this imposes on incumbents; and
 - alternatively, if there is no such demand for a single block, the situation resembles a situation which could arise if a 2 × 20MHz cap

existed (with the additional complexity of a contingent cap not being needed).

- In relation to the concerns expressed regarding the likelihood of a 2 × 20 MHz sub-1GHz cap resulting in a bidder being forced by other bidders to win only 2 × 5 MHz of sub-1GHz spectrum, ComReg would also agree with DotEcon's analysis summarised above, and therefore considers that there is no solid case for active intervention to engineer a largely symmetric four-player outcome in the Irish mobile market.

A 5.23 Having had regard to all relevant material before it and on the basis of the discussion set out above, ComReg has not identified grounds to warrant changing its proposal for a 2 × 20 MHz sub-1GHz spectrum cap for each of Time Slice 1 and Time Slice 2 and has, therefore, decided to implement this proposal in the Award Process.

A5.4 Proposed Overall Spectrum Cap of 2 × 50 MHz

A5.4.1 Summary of ComReg's Position in Document 11/60

A 5.24 Following consideration of views from interested parties and the analysis and recommendations of DotEcon, ComReg considered an overall spectrum cap of 2 × 50 MHz across all three bands to be the most appropriate in the present circumstances because, amongst other things:

- it takes account of the propagation qualities of the sought after sub 1 GHz spectrum; and
- it would enable a bidder to obtain a considerable amount of 1800 MHz spectrum rights so as to enable it to effectively compete with winners of sub-1GHz spectrum, whilst also allowing bidders to acquire an efficient mix of sub-1GHz and 1800 MHz spectrum rights;
- a spectrum cap lower than 2 × 50 MHz would, in the event that there were four winning bidders in the auction, ensure largely symmetric outcomes and would result in significant inefficiency of allocation and potentially spectrum going unsold inefficiently.

A5.4.2 Views of Respondents on Document 11/60

A 5.25 eircom Group, Vodafone and H3GI provided comments on ComReg's proposal, a summary of which follows:

- Vodafone supported the proposal stating that this spectrum cap would avoid the possibility of extreme asymmetries which could adversely impact competition;
- on the other hand, eircom Group and H3GI opposed the proposal, with both preferring a lower spectrum cap of 2 × 40 MHz. In that regard eircom Group stated that:
 - ComReg’s proposal could result in extremely asymmetric outcomes with a detrimental impact on competition and ComReg has not provided any analysis as to how this will be avoided;
 - ComReg cannot reasonably sacrifice long term market competition to expand the breadth of feasible auction outcomes. In particular eircom Group stated that whereas DotEcon has sought to identify the most preferable outcome in terms of the number of outcome permutations in the award process, maximising the number of outcome permutations in the award process to the detriment of ensuring long term competition is not consistent with ComReg's statutory objectives and does not constitute a reasonable basis for ComReg's proposed decision on spectrum caps;
 - it disagreed with DotEcon’s assessment that *"neither of the most asymmetric outcomes that might result from the proposed spectrum caps would be unequivocally harmful to competition."*;
 - the rationale supporting DotEcon’s analysis is flawed, eircom Group provided two examples of possible auction outcomes with an overall cap of 2 × 50 MHz, one possible outcome with four successful bidders⁹⁵ and another possible outcome with five bidders.⁹⁶ In response to DotEcon’s rejection of its concerns, eircom Group stated that, in respect of the first auction outcome example, *"it is not correct to assume that “the other two existing operators would between them be able to win 2x25MHz of sub-1GHz spectrum and 2x15MHz of 1800MHz spectrum” given the potential outcome in respect of Bidder 4"*, and also stated that DotEcon was wrong to

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Outcome 1	Bidder 1	Bidder 2	Bidder 3	Bidder 4
Sub 1GHz	2x20MHz	2x20MHz	2x20MHz	2x5MHz
1800MHz	2x30MHz	2x30MHz	2x15MHz	-

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Outcome 2	Bidder 1	Bidder 2	Bidder 3	Bidder 4	Bidder 5
Sub 1GHz	2x20MHz	2x20MHz	2x20MHz	2x5MHz	-
1800MHz	2x25MHz	-	-	-	2x50MHz

assume that, in respect of both auction outcome examples, the existing 2.1 GHz (technology specific) right of use are substitutable for the proposed 1800 MHz spectrum rights. Whilst the existing 2.1GHz may be made technology neutral in the future, neither the timing nor the terms under which such a variation would be made are known ; and

- H3GI stated that:
 - it disagrees with ComReg’s proposal for reasons presented in the Joint VP/RRA Report dated July 2011;
 - DotEcon does not appear to engage with any of the arguments raised by H3GI in this respect;
 - it questions whether only outcomes that harm competition are “sufficiently extreme”;
 - a 2 × 40 MHz overall cap is required to ensure there are four credible players in the market each with H3GI’s recommended MSP post auction;
 - it does not see value in deploying an 1800 MHz-only network because it believes the provision of indoor quality data services will become essential in the mobile communications market in Ireland over the lifetime of the proposed licence and an 1800 MHz-only licensee would not, in its view, be able to credibly compete with mobile network operators that have rights of use in respect of 2 × 20 MHz of sub-1 GHz spectrum; and
 - ComReg must conduct:
 - a. an assessment of the likely future competition in markets for the provision of mobile electronic communications services after conclusion of the award of the 800, 900 and 1800 MHz bands; and
 - b. an assessment of the prospects of an 1800 MHz-only network. H3GI expressed the view that, in the absence of such assessment and analysis, DotEcon and ComReg are rejecting the alternative overall spectrum cap of 2 × 40 MHz purely on the grounds that it precludes a number of alternative outcomes.

A5.4.3 DotEcon’s Analysis and Recommendations

A 5.26 DotEcon consider the arguments presented by H3GI as being similar to those presented by eircom Group in the two tables above, and DotEcon consider that

its treatment of arguments below applies equally to the comments provided by both H3GI and eircom Group.

A 5.27 In relation to eircom Group and H3GI's criticisms of ComReg's proposal, DotEcon states that:

- in relation to the possible allocations (assignments) as represented by eircom, DotEcon does not consider that these are necessarily plausible or likely outcomes. In particular, it is reasonable to expect that an outcome such as that in eircom Group's table in footnote 96 above would be dominated by an alternative outcome in which synergies between sub-1GHz and 1800MHz are achieved (i.e. Bidder 4 and Bidder 5 are combined) giving a greater total value of winning bids. The outcome in the table in footnote 95 above assumes that one bidder has bid solely for a single block of sub-1GHz spectrum and no 1800MHz spectrum; this outcome cannot arise in any other way, as bids for packages of lots are indivisible, with the package being won in its entirety or not at all.
- in addition, even though neither are likely, they are consistent with the most asymmetric outcomes DotEcon had previously identified (in Document 11/58) where it also considered that in neither case would there necessarily be significant concerns for downstream competition;
- DotEcon considers that a $2 \times 40\text{MHz}$ overall cap would be an unnecessary restriction and an impediment to competition for spectrum. For example, consider the most asymmetric distribution of sub-1GHz spectrum, with three winners of $2 \times 20\text{MHz}$ and one winner of $2 \times 5\text{MHz}$. The winners of $2 \times 20\text{MHz}$ of sub-1GHz spectrum could only acquire $2 \times 20\text{MHz}$ of 1800MHz spectrum, a demand of $2 \times 60\text{MHz}$ in total. Therefore, if the winner of $2 \times 5\text{MHz}$ of sub-1GHz spectrum unilaterally reduced its demand for 1800MHz spectrum to $2 \times 15\text{MHz}$, competition for 1800MHz spectrum would be eliminated entirely and such spectrum obtained at the reserve price;
- it disagrees with eircom Group's contention that the proposal aims to maximise the number of outcome permutations in the award process. DotEcon note that this objective could only be achieved by having no caps at all. DotEcon responds by stating that its aim is to ensure that spectrum caps are not too loose or too tight, which is an important objective to ensure both an efficient auction and an optimal outcome. In that regard, DotEcon notes that, an overall cap of $2 \times 40\text{MHz}$ would limit total demand

from the four incumbents to at most $2 \times 160\text{MHz}$, which does not exceed the available $2 \times 140\text{MHz}$ by much. Therefore, these counterproposals can be expected to limit competition for spectrum within any auction to a significant degree;

- Ofcom's most recent consultation (January 2012) considers the minimum amount of spectrum an operator requires to be an effective competitor, and considers that $2 \times 15\text{ MHz}$ or more of 1800 MHz spectrum should be able to effectively compete against other operators including those with sub 1 GHz spectrum;
- finally, DotEcon points to the general compatibility between the sub- 1GHz spectrum cap and the overall spectrum cap. It believes that, for a given sub- 1GHz spectrum cap, the overall cap should not be set so tightly that competition between winners of sub- 1 GHz spectrum for 1800 MHz spectrum is impeded. Broadly speaking, the higher the sub- 1GHz cap, the higher the overall cap needs to be if perverse outcomes are to be avoided.

A5.4.4 ComReg's Consideration of Respondents' and DotEcon's Views

- A 5.28 In relation to the proposed overall spectrum cap of $2 \times 50\text{ MHz}$, ComReg notes that, of the three responses received on this proposal, Vodafone supported ComReg's proposal and ComReg notes the reasons provided by it in this regard.
- A 5.29 ComReg also notes eircom Group's and H3GI's disagreement with ComReg's proposal and the reasons provided by them in support of their position. ComReg addresses the concerns expressed by H3GI regarding MSP, in the context of H3GI's suggested spectrum floor.
- A 5.30 ComReg also notes DotEcon's assessment of responses received as set out in section 4.3 of Document 12/24.
- A 5.31 Having carefully considered the views of interested parties and DotEcon's analysis and recommendation on its proposal, ComReg assessment of same is as follows:
- in relation to eircom Group and H3GI's concerns regarding the likelihood of a Bidder obtaining only $2 \times 5\text{ MHz}$ of sub- 1GHz spectrum, ComReg refers to its analysis of the same concerns in the context of the $2 \times 20\text{ MHz}$ sub- 1GHz cap proposal above;

- ComReg has also considered DotEcon’s view that eircom Group’s proposal could lead to inefficient auction outcomes by creating an incentive for a bidder to bid for less spectrum than it really wants as a means of paying less for the spectrum which it does win. ComReg’s agrees with DotEcon that in the event that three bidders acquire 2 × 20 MHz sub 1 GHz spectrum and a fourth bidder 2 × 5 MHz, this cap could incentivise a fourth bidder to unilaterally reduce its demand for 1800 MHz spectrum to 2 × 15 MHz in order to remove the competition for spectrum and potentially pay less for what it does win. This could result in an inefficient outcome as the fourth bidder in this instance may not be bidding for what it really wants ;
- ComReg would also disagree with eircom Group’s submission that the proposal aims to maximise the number of outcome permutations in the award process and would reiterate that ComReg’s objectives are to ensure both an efficient auction (such as by providing high levels of bidder flexibility) and an optimal outcome for consumer welfare (such as by providing safeguards against excessively asymmetric outcomes including those where the acquisition of rights of use of spectrum could be motivated by the expectation of muting downstream competition);
- In addition, ComReg concurs with DotEcon’s assessment that an overall spectrum cap of 2 × 40 MHz could have a number of adverse effects, including: significantly limiting competition for spectrum in the Award Process and impeding bidder flexibility without any demonstrable benefit for downstream competition (noting ComReg’s previous assessment of the situation of a bidder with only 2 × 5 MHz of sub-1GHz spectrum rights in the context of the 2 × 20 MHz sub-1GHz cap proposal above).

A 5.32 Having had regard to all relevant material before it and on the basis of the discussion set out above, ComReg has not identified grounds to warrant changing its proposal for a 2 × 50 MHz overall spectrum cap for each of Time Slice 1 and Time Slice 2 and has, therefore, decided to implement this proposal in the Award Process.

A5.5 Proposed 900 MHz Spectrum Cap of 2 × 10 MHz for Time Slice 1

A5.5.1 Summary of ComReg’s Position in Document 11/60

A 5.33 In Document 11/60, ComReg proposed the introduction of a 2 × 10 MHz cap for 900 MHz spectrum rights in Time Slice 1 and this proposal was informed by a number of factors, including that:

- even though the 800 MHz and 900 MHz bands have similar propagation characteristics, the ecosystem for transmission equipment and handsets currently differs considerably. The 900 MHz band was harmonised for 2G services many years ago and has enjoyed the benefits of deployment of mature technologies for quite some time, whereas 800 MHz has only recently been harmonised and hence there is limited equipment available in the band at this time;
- accordingly, in the short term, 800 MHz and 900 MHz spectrum rights may not be sufficiently close substitutes (noting that this should change over time);
- the sub-1 GHz and overall spectrum caps (discussed above) would not, in ComReg's view, necessarily address competition concerns as a result of the 800 MHz and 900 MHz spectrum bands not being close substitutes in the near term; and
- the 800 MHz band is likely to be well established towards the end of Time Slice 1 (2015) and so there should not be a requirement to maintain the 900 MHz cap into Time Slice 2.

A5.5.2 Views of Respondents on Document 11/60

A 5.34 eircom Group, Vodafone, H3GI and Telefónica provided comments on ComReg's proposal in response to Document 11/60, a summary of which follows:

- eircom Group, Vodafone and H3GI supported ComReg's proposal for reasons including:
 - it strikes the correct balance to deal with short term substitutability issues (eircom Group);
 - it recognizes the imperfect substitutability between 800MHz and 900MHz arising from issues including differences in availability of suitable equipment (Vodafone); and
 - in addition, H3GI urged ComReg to extend its proposal into Time Slice 2 because it was not clear to H3GI that equipment utilising 800 MHz spectrum will become more readily available by Time Slice 2.

- On the other hand, Telefónica did not support the proposal for a number of stated reasons including that:
 - it would discriminate in favour of H3GI, by giving H3GI a head-start in launching advanced services because, in Telefónica’s opinion, it is the only existing operator that can launch a UMTS service in the short-term;
 - ComReg is forcing long-term technology selection on operators and the market because this is likely to force existing operators to try to purchase 800 MHz if they wish to roll out advanced services (LTE) in Time Slice 1, thus incurring significant costs in rolling out LTE at 800 MHz, with GSM operators less likely to offer UMTS in the 900 MHz band. It would not be practical or financially feasible to then switch back in Time Slice 2;
 - it would unjustifiably drive up the price for 800 MHz spectrum sub cap by forcing existing operators to bid in the 800 MHz band and increase the price, whilst also potentially preventing at least one operator offering advanced services in the short term;
 - it would conversely decrease the 900 MHz price, forcing three 900 MHz operators out of the band for advanced services and allowing H3GI to acquire long term access to 900 MHz spectrum for less than it would have if the sub-cap was not present;
 - it would prevent an operator from acquiring all of its sub-1GHz spectrum rights in the 900 MHz band;
 - it runs contrary to ComReg’s view (as set out in Section 3.146 of Document 11/60) because it effectively reserves one block of 900 MHz spectrum for a new entrant or leaves it unsold;
 - ComReg has determined that there should be a minimum of four operators in the 900 MHz band without carrying out a market assessment or RIA to justify this position;
 - it is potentially unfair and contrary to ComReg’s obligations and objectives, including the obligations to ensure the efficient use of spectrum, promote competition in new services, not to discriminate as between users of spectrum and act in a technology neutral manner;
 - ComReg and DotEcon have not stated specifically why it now proposes to introduce the new cap, and asserts that the primary driver appears to have been a concern raised by H3GI that 900 MHz spectrum is more in demand than 800 MHz spectrum up until 2015. Further, Telefónica states that ComReg is legally obliged to fully consult industry to assess the wider implications of its proposal.

A 5.35 By way of letter dated 23 January 2012 (published in Document 12/21), H3GI provided further views on ComReg's proposal and disputed a number of Telefónica's submissions regarding the proposal including those to the effect that:

- ComReg has not properly consulted on the issue, by stating that it “*does not agree that ComReg has failed to consult in respect of its 2 x 10 900 MHz first time slice spectrum cap proposal. It has formed part of its consultation regarding its final decision i.e. ComReg Doc No. 11/60 and related documents.*” H3GI also notes elsewhere in its letter that “*ComReg has consulted in respect of the award of the 800, 900 and 1800 MHz bands, including transitional activities, advanced commencement and consumer disruption for over three years*”;⁹⁷
- the cap discriminates in favour of H3GI, by stating that “*H3GI also does not agree that ComReg's spectrum cap proposal discriminates in favour of H3GI in the launch of advanced services. As O2 itself subsequently acknowledges, the proposed spectrum cap benefits H3GI or any new band entrant.*”⁹⁸; and
- incumbents cannot provide advanced services in the short term and they need 2 x 10 MHz to serve existing GSM customer base or that H3GI is in a better position to take advantage of sub 1 GHz spectrum, by stating that “*H3GI does not agree that the incumbent operators cannot provide advanced services in the short term and need 1 x 10 900 MHz to serve their existing GSM customer base. This is supported by proposals from the incumbent operators and has been noted by ComReg. H3GI reiterates that it is not in a better position to take full advantage of liberalised sub-1 GHz spectrum*”.⁹⁹

A5.5.3 DotEcon's Analysis and Recommendations

A 5.36 In relation to Telefónica's criticisms of ComReg's proposal, DotEcon states that:

- first, a number of arguments presented by Telefónica fail to consider that the proposed cap would apply only in Time Slice 1, and that in 2015 there remains the potential for reconfiguration to address any fragmentation issues that may have arisen;

⁹⁷ Pages 5 and 8 of H3GI's letter of 23 January 2012, published in Document 12/21.

⁹⁸ Page 8 & 9 of H3GI's letter of 23 January 2012, published in Document 12/21.

⁹⁹ Page 9 of H3GI's letter of 23 January 2012, published in Document 12/21.

- the inclusion of this proposal is not intended to restrict or pre-prescribe any auction outcome over the duration of the entire licence period up until 2030 and nor does it do so. Rather, DotEcon notes that it takes into account discontinuities of substitution between 800 MHz and 900 MHz spectrum rights in the short term noting, in particular, that all current GSM operators are likely to require 2 × 5 MHz of spectrum in the 900 MHz band to serve current GSM consumers in the near term and it is not feasible for the 900 MHz band to be reconfigured immediately after the auction;
- in addition, it does not see merit in Telefónica’s argument that the proposal would give H3GI an unfair advantage in launching advanced services. In that regard, DotEcon states that the notion that H3GI would be guaranteed to win 2 × 5 MHz of 900 MHz spectrum whilst existing GSM operators are forced to the 800 MHz spectrum band for LTE deployment (and therefore “locked in”) to that technology and spectrum band in Time Slice 2 is unfounded. DotEcon refers to H3GI’s claim that 2 × 5 MHz of 900 MHz spectrum is insufficient for it to provide advanced services in the 900 MHz band and points out that the respective positions taken by H3GI and Telefónica are incompatible and, therefore, cannot both be valid;
- in relation to Telefónica’s view that the proposal would affect prices of spectrum in the different spectrum bands and create fragmentation, DotEcon points out that these are key reasons why the proposal would apply only to Time Slice 1. DotEcon considers that the proposal strikes a balance between allowing bidders to “specialise” in the 800 MHz and/or 900 MHz bands in Time Slice 2, whilst also addressing the short term substitution issues between 800 MHz and 900 MHz spectrum rights in Time Slice 1. In addition, DotEcon notes that defragmentation of spectrum holdings can occur in 2015 in Time Slice 2;
- with a smaller amount of spectrum available in Time Slice 1 compared to Time Slice 2, there is an increased probability of more extreme outcomes in Time Slice 1 compared to Time Slice 2. With a 2 × 20 MHz sub 1 GHz cap, one operator could win 2 × 20 MHz of 900 MHz spectrum in Time Slice 1 leaving only 2 × 15 MHz available for other bidders, which could potentially cause consumer disruption for an incumbent seeking to service existing demand for GSM 900 MHz services. Whilst this may be acceptable to operators in Time Slice 2 when 800 MHz and 900 MHz are substitutable, this outcome is not necessarily so in Time Slice 1.

A 5.37 For the reasons outlined above, and set out in greater detail in Section 4.4 of Document 12/24, DotEcon also dismisses H3GI's proposal to extend the 900 MHz spectrum cap to the second Time Slice.

A5.5.4 ComReg's Consideration of Respondents' and DotEcon's Views

A 5.38 In relation to the proposed 900 MHz spectrum cap of 2×10 MHz for Time Slice 1, ComReg notes that, of the four responses received on this proposal, three respondents - Vodafone, eircom Group and H3GI - supported ComReg's proposal, and ComReg notes the reasons provided by them in support of their position.

A 5.39 ComReg also notes Telefónica's disagreement with ComReg's proposal and the reasons provided by it and H3GI's submission of 23 January regarding Telefónica's stated concerns.

A 5.40 ComReg further notes DotEcon's assessment of responses received as set out in section 4.4 of Document 12/24.

A 5.41 Having carefully considered the views of interested parties and DotEcon's analysis and recommendation on the proposal, ComReg's assessment of same is as follows:

- ComReg does not agree with Telefónica's claim that the proposed cap would discriminate in favour of H3GI because, in particular:
 - H3GI itself has claimed that 2×5 MHz of 900 MHz spectrum is insufficient for it to provide advanced services in the 900 MHz band and points out that the positions taken by H3GI and Telefónica are incompatible and, therefore, cannot both be valid;
 - the wave of recent 800 MHz spectrum auctions may well suggest earlier availability of 800 MHz LTE equipment, negating any early mover advantage for a potential new 900 MHz band entrant such as H3GI;
 - bidders can obtain access to 1800 MHz rights where commercial deployment of LTE services has already taken place in a number of countries;
 - the measure is not specific to H3GI, any new entrant could win spectrum in the band and not just H3GI.
- ComReg notes Telefónica's submission regarding the possibility of fragmentation of spectrum in the different spectrum bands in the short-

term and that the value of spectrum rights may vary between the bands because of, amongst other things, imperfect substitutability between the bands due to different equipment availability. In relation to the former, ComReg notes that bidders will be able to obtain contiguous 900 MHz assignments of over 2 x 10 MHz in Time Slice 2 on (that is, over the substantial proportion of licence duration). In addition, ComReg notes DotEcon's point that this is a reason why the proposed cap would apply to Time Slice 1 only;

- furthermore, insofar as the proposed cap reduces the likelihood of an existing GSM operator not gaining sufficient 900 MHz spectrum rights of use in Time Slice 1 (thereby addressing the imperfect substitutability between 800 MHz and 900 MHz spectrum in the short term), it would reduce the likelihood of a Scenario 2 situation¹⁰⁰ (which is particularly helpful in circumstances where there would not be sufficient time between the completion of the auction and commencement of Time Slice 1 to allow for complete technical remediation). ComReg also notes and agrees with DotEcon's views in this regard;
- at the same time, ComReg does not believe that the cap should also be applied to Time Slice 2 given the short term substitution issues between 800 MHz and 900 MHz spectrum rights;
- in relation to Telefónica's argument that ComReg is "*legally obliged to now fully consult with industry on the proposed cap, working with it to assess its wider implication*", ComReg would respectfully note that Document 11/60 was, in fact a consultation, and ComReg has had cognisance of the views put forward by interested parties on its 900 MHz sub cap proposal, including those of Telefónica in respect of same;
- in addition, ComReg notes and would agree with the reasons provided by eircom Group and Vodafone in support of the proposal, being in particular that it:
 - recognises the imperfect substitutability between 800MHz and 900MHz arising from issues including differences in availability of suitable equipment; and
 - strikes the correct balance to deal with short term substitutability issues.

¹⁰⁰ I.e. an incumbent 900 MHz operator winning only one block of 2 x 5 MHz of 900 MHz spectrum in Time Slice 1.

A 5.42 Having had regard to all relevant material before it and on the basis of the discussion set out above, ComReg has not identified grounds to warrant changing its proposal for a 2 x 10 MHz 900 MHz spectrum cap for Time Slice 1 and has, therefore, decided to implement this proposal in the Award Process.

A5.6 H3GI's Proposal for a sub-1GHz Spectrum Floor

A5.6.1 Summary of ComReg's Position in Document 11/60

A 5.43 In July 2011, H3GI submitted a report from its consultants, Value Partners & Radio Regulatory Associates (VP/RRA), in which a spectrum "floor" of 2 x 10 MHz of 900 MHz and 2 x 10 MHz of 1800 MHz spectrum was proposed. The proposal relies considerably upon Ofcom's proposal in the UK *"to ensure that after the auction, subject to demand, there are at least four holders of a minimum spectrum portfolio that mean they are credibly capable of providing high quality data services in the future"*.¹⁰¹ VP/RRA state that the implementation of the spectrum floor proposal in Ireland would ensure there are at least four holders of a minimum spectrum portfolio that would mean they are credibly capable of providing high quality data services in the future ("Credible Future MNO Competition").

A 5.44 After careful consideration of H3GI's submissions and the VPA/RRA report and DotEcon's analysis and recommendations regarding same, ComReg did not propose to include a spectrum floor in the Award Process. Factors informing ComReg's position in this regard included that:

- the factual situations in the UK and Ireland are materially different. In that regard, ComReg noted and agreed with DotEcon's assessment, including that:
 - the auction rules proposed for the planned multi-band award in Ireland have been set in the context of the conditions in Ireland to ensure that the market structure going forward will be determined not by ComReg but by the competitive rivalry amongst the mobile operators themselves. The proposed spectrum caps provide protections for downstream competition in mobile services; and
 - Ofcom's proposals for use of spectrum floors in addition to spectrum caps to safeguard competition in the UK vary significantly from the spectrum caps proposed in Ireland, and indeed appear to be fit for

¹⁰¹ Paragraph 1.16 of Ofcom Consultation entitled "Consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues", published 22 March 2011 and closed for submissions on 31 May 2011.

purpose in the UK case. However, Ofcom's proposals do not affect our view on the appropriateness of the auction format and rules proposed for a multi-band auction in Ireland;

- the case for ensuring four largely symmetric national network operators in Ireland is ambiguous;
- a spectrum floor of the kind proposed would reduce the potential for an efficient and competitive outcome as it places unnecessary constraints on possible outcomes; and
- in any case, ComReg's proposed spectrum caps would ensure that at least four bidders could win sub-1GHz spectrum rights, whilst also providing safeguards against excessively asymmetric outcomes.

A5.6.2 Views of Respondents on Document 11/60

A 5.45 eircom Group and H3GI provided comments on the spectrum floor proposal put forward by H3GI and its consultants, VP/RRA, a summary of which follows:

- eircom Group disagreed with H3GI's proposal because, in its view, it would unnecessarily increase the complexity of the award process, whereas a reduction in the overall spectrum cap could address the substantive competition concerns;
- on the other hand, H3GI stated that:
 - ComReg is obliged to conduct a detailed competition assessment in Ireland (in particular, a thorough assessment of the likely future competition in markets for the provision of mobile electronic communications services after conclusion of the award of the 800, 900 and 1800 MHz bands);
 - ComReg should ensure the auction results guarantee the existence of four credible players in the mobile communications market with each of these operators acquiring its preferred MSP; and
 - ComReg's proposed spectrum caps will not result in four credible players in the market post-auction.

A 5.46 H3GI provided a number of arguments in relation to each of these points, a summary of which is set out below.

A 5.47 In relation to the issue of a competition assessment, H3GI submits that:

- ComReg and DotEcon rely on differences in market conditions between the UK and Ireland (without elaborating on these) to justify dismissing its proposal; and
- it does not consider there to be material differences between the UK and Ireland and that any differences in respect of 900 MHz spectrum are not such as to warrant a wholly different approach by ComReg. Furthermore, H3GI does not believe that the fact that Ofcom received a Government direction detracts from its view;

A 5.48 In relation to the issue of guaranteeing four credible players with each possessing its preferred MSP, H3GI submits that:

- ComReg and DotEcon do not give clear reasons for dismissing H3GI's view on the requirement for a "four credible player market" and its proposed MSP or provide views on what is considered to be an appropriate number of players in the market and the appropriate spectrum portfolio for each;
- it is vital for operators to have access to a sufficient amount of sub-1GHz spectrum in the future to compete in the market, and that 2 x 5 MHz of sub 1 GHz spectrum is insufficient to compete with an operator with 2 x 20 MHz of sub 1 GHz spectrum; and
- the differences in demography between the UK and Ireland are misleading and do not justify taking up a materially difference approach. H3GI disagrees with DotEcon's assessment of the applicability of Ofcom's assessment to Ireland.

A 5.49 In relation to its spectrum floor proposal, H3GI submits that:

- it accepts that using spectrum floors and caps (as proposed by it) would limit the possible auction outcomes and reduces the potential of the auction to realise a competitive and efficient result. It considers, however, that ComReg has many statutory objectives to balance (e.g. competition and innovation, efficient and effective management of spectrum);
- ComReg's proposed spectrum cap will determine the feasibility of only three network operators which could harm competition. H3GI also states that incorrectly chosen spectrum caps and floors can determine long run market structure to the detriment of competition, and states that ComReg's

existing spectrum cap proposal will determine the market structure going forward to the detriment of competition; and

- H3GI notes that ComReg also refers to an alleged inefficient outcome where the bidders who value the spectrum the most do not access a sufficient amount (whilst remaining under the proposed spectrum cap). H3GI asserts that ComReg would appear to be equating revenue under the proposed auction with efficiency and prioritising this over the medium and long term well-being of the mobile communications market in Ireland. H3GI states that this is not a correct approach and that any loss to Government finances is more than outweighed by benefits to society.

A 5.50 In addition, H3GI submitted that:

- ComReg’s proposed spectrum caps will ensure a significantly asymmetric outcome with substantial amounts of spectrum shared amongst a small number of operators (e.g one operator with 2 × 5 MHz of sub-1GHz spectrum and three operators with 2 × 20 MHz) and such an extremely asymmetric outcome would contradict ComReg’s stated goal of precluding extreme asymmetries; and
- ComReg’s starting point in promoting competition (i.e. to avoid extreme outcomes harmful to competition) is incorrect, and ComReg’s statutory obligation instead requires a positive obligation to promote competition. H3GI implies that ComReg and DotEcon are not clear on what standard it must apply and, in that regard, H3GI states that ComReg must “*as the absolute minimum*” apply EU and national merger control rules which would require ComReg “*to seek to avoid a situation which would result in a substantial lessening of competition / significant impediment of effective competition within the relevant market*”.

A5.6.3 DotEcon’s Analysis and Recommendations

A 5.51 DotEcon notes that the proposals referred to by H3GI regarding ‘minimum portfolio packages’ (‘MPPs’) is still being consulted upon with no certainty that it will be adopted in the UK. DotEcon also note that there is no certainty that at the moment that Ofcom will adopt spectrum floors proposal as opposed to relying on spectrum caps, a point made by Ofcom in its January 2012¹⁰²

¹⁰² Ofcom released its most recent consultation on the 800 MHz and 2.6 GHz spectrum release on 12 January 2012 and is available at the following link, <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/summary/combined-award-2.pdf>

consultation. Ofcom has two current proposals; Group 1 is for a spectrum floor of 2 x 10 MHz sub 1 GHz spectrum or no sub 1 GHz spectrum if 2 x 15 MHz 1800 MHz held. Ofcom's second proposal contains a larger amount number of options (within Group 2) and amount of spectrum and contains either high or low frequency spectrum and others containing a mixture of both¹⁰³. The options presented in Group 2 possess greater aggregate spectrum than the options presented in Group 1. Ofcom will review its proposals in light of responses to consultation which are due in March 2012.

- A 5.52 DotEcon further noted that Ofcom published an addendum¹⁰⁴ to its January 2012 consultation which stated that the portfolios packages would change in the event Everything Everywhere sold its 2 x 15 MHz (that it is required to divest) to a party other than Vodafone or Telefónica in advance of the auction for 800 MHz and 2.6 GHz spectrum.
- A 5.53 DotEcon notes that all the various options within the two Group have the common feature that a sufficient amount of high frequency spectrum is a potential substitute for sub 1 GHz spectrum in providing a sufficient amount of spectrum to permit a national network operator to function effectively. Indeed, DotEcon state that *"the current Ofcom consultation is clear that sub-1 GHz spectrum is not essential to be an effective national operator provided a sufficient quantity of spectrum above 1 GHz is held"*.
- A 5.54 DotEcon also states that any conclusion in the UK should not automatically apply to Ireland. In that regard, DotEcon notes that Ireland has a much smaller population (and dispersion of same) and different geography resulting in different national roll-out in the two markets. Currently, there are not four symmetric players in Ireland and it is not clear what a sustainable long-run market structure might be for Ireland. Indeed, DotEcon notes that other small European countries have not sustained four players in the market¹⁰⁵ and many countries have operators sharing networks for cost savings and efficiencies.
- A 5.55 In addition, DotEcon outlines major differences between the situation in the UK and Ireland, including that:
- Ofcom's proposed spectrum release is for the 800 MHz and 2.6 MHz spectrum bands only (with up to 2 x 15 MHz of 1800 MHz dependant on

¹⁰³ DotEcon reference paragraph 5.74 of Ofcom's consultation paper published 22 March 2011
<http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/summary/combined-award.pdf>

¹⁰⁴ <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/annexes/addendum.pdf>

¹⁰⁵ And refers to Austria and Switzerland in this regard.

divestment by Everything Everywhere), which DotEcon note is not certain to take place before the auction,¹⁰⁶ whereas ComReg's proposed spectrum release involves there being more spectrum available as it is releasing all of the 800 MHz, 900 MHz and 1800 MHz bands (ComReg releasing all 2 x 75 MHz as opposed to Ofcom potentially releasing a portion) simultaneously; and

- there are specific reasons why an interventionist approach is being adopted in the UK. In particular, the UK release does not include 900 MHz spectrum, which, in its totality, is held by Vodafone and Telefónica. Accordingly, there is an existing strong asymmetric distribution of 900 MHz spectrum in the UK that will not be affected by the auction, whereas in Ireland the entire 900 MHz band is being included in the award process (subject to existing GSM 900 MHz rights of use in Time Slice 1), making all of the sub 1 GHz spectrum available simultaneously from Time Slice 2. There is a major difference between the amount of sub 1 GHz spectrum available for award in the UK and in Ireland.

A 5.56 DotEcon notes that even if three bidders acquired 2 x 20 MHz of sub 1 GHz spectrum each, there is still the potential for a fourth bidder to secure enough 1800 MHz spectrum to satisfy Ofcom's "Group 1" MPP, and indeed larger amounts corresponding broadly to Ofcom's high frequency groups, "Group 2" and "Group 3"

A 5.57 For these reasons, DotEcon sees no solid case for active intervention using the auction as an instrument to "engineer" a largely symmetric four-player outcome in the Irish market and it is not clear that the scenario presented by H3GI is necessary for effective downstream competition. Indeed, DotEcon considers that there is also a risk that the spectrum floor proposal would simply create a transient and ultimately unsustainable market structure through an implicit public subsidy generated by the restriction on competition for spectrum that tighter caps (or other measures such as MSPs) would create. DotEcon states that, other than designing an award process which can reasonably be expected to achieve ComReg's objective of promoting competition, ComReg does not need to ensure any particular market structure is created or preserved going forward, save to ensure that there is not an unacceptable risk of a material reduction in downstream competitive intensity.

¹⁰⁶ On 17 February 2012 Ofcom published an addendum to its 12 January 2012 consultation relating to what changes might be made to proposed minimum spectrum portfolios, if before the auction Everything Everywhere (EE) sold the rights to use the 2x15MHz of 1800MHz spectrum that it is required to divest as part of its merger commitments:

<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/annexes/addendum.pdf>

A 5.58 In addition, DotEcon states that it agrees with eircom Group's view that the introduction of a spectrum floor (which no other regulator has implemented to date¹⁰⁷) would considerably increase the complexity of the award process which is already complicated by many idiosyncratic factors.

A5.6.4 Additional H3GI Comments

A 5.59 DotEcon also addresses a number of additional comments presented by H3GI, a summary of which follows:

- in relation to H3GI's view that ComReg is required to conduct an explicit competition analysis, DotEcon expresses the view¹⁰⁸ that ComReg has properly considered competition throughout the award process and notes ComReg's aim of only precluding outcomes that would compromise downstream competition, whilst otherwise providing maximum flexibility to bidders. DotEcon state that therefore "*the protection of downstream competition has an absolute priority, but equally unnecessary restrictions should not be placed on competition for spectrum if these are not required to support effective downstream competition*";
- with regard to H3GI's view that a judgement cannot be avoided regarding the number of players that the market will sustain, ComReg noted (in Document 11/60) that it is not required to ensure a particular number of competitors in the market and considers that the underpinning legislation is principled in nature and not prescriptive. In other words, ComReg need not prescribe a specific number of market operators and to do so would be inappropriate unless a failure of competition in the market or similar circumstances requires ComReg to do so. Rather, leaving to one side the design of an award process that can reasonably be expected to achieve ComReg's objective of promoting competition, the particular issue in this context is to set constraints on the possible outcomes of the auction to prevent, as far as is reasonably possible, a material restriction of competition relative to current market conditions;¹⁰⁹ furthermore, DotEcon notes that effective competition does not require ensuring a certain

¹⁰⁷ ComReg notes that a floor of 2 x 5 MHz was implemented where paired blocks of 2 x 2.5 MHz were offered in Greece, see Annex 13. ComReg notes that this is the minimum size block to realistically provide UMTS or LTE services and accordingly, does not appear to have the same motivation as the spectrum floor proposed by H3GI.

¹⁰⁸ See Document 12/24

¹⁰⁹ In that regard, it is noted that ComReg's spectrum cap proposals would see a minimum of four operators with access to sub-1GHz spectrum rights, compared to the current situation where only three operators have access to such rights (with the fourth operating only enjoying rights of use in the 2.1 GHz band).

number of operators, imposing symmetric auction outcomes or the protection of any particular operator. Rather, in DotEcon's view, the most troublesome scenarios which could adversely affect competition need to be identified, considered and avoided where they would undoubtedly be harmful to competition;

- there are trade-offs when implementing spectrum caps or spectrum floors. For instance, giving operators the ability to acquire more spectrum reduces capacity costs and encourages the deployment of advanced services to the benefit of consumers (provided that other operators are not left with so little spectrum that competition becomes ineffective). Given the obvious difficulties in quantifying such trade-offs, it is reasonable to be guided by the current market structure and ensuring that the award process does not run a significant risk of worsening competitive conditions; and
- finally, DotEcon states that the proposed spectrum caps do not seek to interfere with the market or seek the exit of a market player. Instead, the proposed caps are to ensure competition is not weakened compared to the current market conditions but otherwise not to impose further restrictions. In relation to H3GI's assertion that the spectrum caps do not allow bidders to "*compete on fair and equal terms*", DotEcon notes that all bidders are subject to the same spectrum caps and the same rules, and therefore will compete on equal terms.

A5.6.5 ComReg's Consideration of Respondents' and DotEcon's Views

- A 5.60 Of the two responses received in relation to H3GI's proposal, eircom Group did not support the proposal and ComReg notes the reason provided by same.
- A 5.61 ComReg also notes the additional material provided by H3GI in support of its spectrum floor proposal.
- A 5.62 ComReg further notes DotEcon's assessment of same as set out in section 4 of Document 12/24.
- A 5.63 Having carefully considered the views of interested parties and DotEcon's analysis and recommendations in relation to same, ComReg's assessment of this issue is as follows:

- First, ComReg notes that H3GI's proposal for a lower sub-1GHz cap and its spectrum floor proposal are premised on its view that at least four operators with largely symmetric sub 1 GHz spectrum holdings are required to ensure effective competition in the Irish market. ComReg notes DotEcon's observation that this argument was made without providing any evidence to support this point, other than to refer to Ofcom's recent proposals in the UK. Moreover, there are not currently four symmetric players in Ireland and it is not clear what a sustainable long-run market structure might be for Ireland. Indeed, DotEcon notes that other small European countries have not sustained four players¹¹⁰ in the market and many countries have operators sharing networks for cost savings and efficiencies;
- In relation to the applicability or otherwise of Ofcom's approach to the situation in Ireland, ComReg notes and agrees with DotEcon's views on this issue as summarised above. In addition, ComReg notes that Ofcom's proposals remain subject to consultation and have altered significantly since H3GI's submission was prepared. For example, ComReg notes that Ofcom now appears to be of the view that access to sub-1GHz spectrum is not critical to the credibility of an MNO.¹¹¹
- in addition, ComReg considers that the spectrum floor proposal limits the range of possible auction outcomes and presents a largely pre-determined and potentially inefficient outcome, without adding any tangible value to ComReg's spectrum caps proposal. In that regard, it is significant that H3GI acknowledges that the spectrum floor proposal constrains outcomes and reduces the potential for achieving a competitive and efficient outcome, which ComReg notes runs contrary to one of its objectives for the auction;
- in contrast, ComReg would reiterate its goal of protecting against a reduction of competitive intensity in the market, and not intervening unless it considers it necessary to do so in order to protect competition. As ComReg has previously stated, it is not for ComReg to determine what the most efficient auction outcome should be (noting in this regard that ComReg does not have access to perfect information particularly in relation to the demand for spectrum of potential auction participants).

¹¹⁰ For instance Austria and Switzerland.

¹¹¹ See paragraph 4.104 of Ofcom's January 2102 consultation:
<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/summary/combined-award-2.pdf>.

Rather, ComReg is satisfied that the market will decide the optimum number of operators and the spectrum mix amongst successful operators, whereas ComReg's spectrum cap proposals will operate to preclude extremely asymmetric outcomes which would otherwise have a negative effect on competition and consumer welfare;

- equally, ComReg does not accept that it is not promoting competition through the design of the Award Process, including its spectrum cap proposals. In that regard, ComReg observes that:
 - in the Irish mobile market there are currently four MNOs, only three of which have rights of use in respect of sub-1GHz spectrum.¹¹² Under ComReg's proposal, at least four operators would have access to sub-1GHz rights. In these circumstances, it can reasonably be seen that ComReg is both ensuring that competitive intensity is not diminished as a result of the Award Process (by identifying, considering and avoiding harmful asymmetric outcomes) and promoting competition relative to the present competitive situation;
 - whereas ComReg would prefer that market forces determine the ultimate spectrum allocation between operators, subject of course to the exclusion of harmful asymmetric outcomes, the spectrum floor proposed by H3GI would, in ComReg's opinion, tend to engineer a situation where:
 - a. it is not at all clear that four symmetric operators would be the most ideal outcome for competition (noting also that symmetries between undertakings in an oligopolistic market structure can facilitate tacit collusion); and
 - b. the outcome of the auction, if the proposed spectrum floor was implemented, could be inefficient insofar as it subsidises and protects weaker bidders due to the enforced reduction in demand, with corresponding potential negative consequences on efficient allocation and use of spectrum¹¹³ and on consumer welfare.
- furthermore, ComReg does not agree that its spectrum cap proposals are interfering with the market. In that regard, ComReg would firstly note that its spectrum cap proposals are considerably less interventionist than virtually all of the spectrum assignment proposals put forward by

¹¹² ComReg notes that there are currently roaming agreements in place by virtue of which operators are providing services using 900 MHz spectrum licensed to other operators. ComReg sees no reason why such agreements will not remain part of the competitive landscape after the auction.

¹¹³ ComReg notes and agrees with DotEcon's observations in Document 12/24 that LTE is most efficiently implemented using large block sizes.

respondents to this consultation process, including H3GI's spectrum floor proposal. In addition, in relation to the claim regarding the potential exit of a player, ComReg would observe that:

- first, there are not four symmetric players in Ireland and it is not clear what a sustainable long-run market structure might be for Ireland;
- further, ComReg considers that such matters are for the market to decide and not for a regulator without access to perfect information;
- H3GI's argument does not make clear the extent to which it takes into account a number of factors including that, in the absence of a spectrum floor:
 - a. an operator with “only” 2 × 5 MHz of sub-1GHz spectrum may still acquire significant liberalised 1800 MHz rights;
 - b. existing players would still have 2.1 GHz spectrum rights with which to continue to provide mobile services;
 - c. licensees will be in a position to enter into roaming and network sharing agreements; and
 - d. there may well be releases of other valuable mobile spectrum during the course of the lifetime of Liberalised Licences.
- In relation to H3GI's assertion that the spectrum caps do not allow bidders “*compete on fair and equal terms*”, ComReg notes that all bidders are subject to the same spectrum caps and the same rules, and therefore compete on equal terms.
- ComReg also notes and agrees with DotEcon's observation that it is not clear that the scenario presented by H3GI is necessary for effective downstream competition and that there is also a risk that the spectrum floor proposal would simply create a transient and ultimately unsustainable market structure through an implicit public subsidy generated by the restriction on competition for spectrum that tighter caps (or other measures such as MSPs) would create;
- In addition, ComReg notes and agrees with eircom Group's view that the introduction of a spectrum floor (which no other regulator has implemented to-date¹¹⁴) would considerably increase the complexity of the award process which is already complicated by many idiosyncratic factors;

¹¹⁴ With the exception of a floor of 2 x 5 MHz where paired blocks of 2 x 2.5 MHz were offered in Greece, see Anbex 13. ComReg notes that this is the minimum size block to realistically provide UMTS or LTE services and accordingly, does not appear to have the same motivation as the spectrum floor proposed by H3GI.

- In relation to H3GI's concerns about an operator acquiring only 2 x 5 MHz sub 1 GHz, ComReg would refer to its and DotEcon's assessment of the likelihood of such a scenario occurring in the context of the 2 x 20 MHz sub-1GHz cap above;
- ComReg also rejects H3GI's assertion that it is equating revenue under the proposed auction with efficiency and prioritising this over the medium and long term well-being of the mobile communications market in Ireland. ComReg is of the view that H3GI has taken its statements in this regard out of context. At no point has ComReg attempted to prioritise revenue generation over its statutory functions, objectives and duties and, as H3GI is fully aware, it is commonly accepted that, by ensuring that spectrum goes to those bidders who value it the most, this will ensure its optimum use. Contrary to H3GI's assertion, this will in turn ensure the long term well-being of the mobile communications market in Ireland. ComReg also notes that H3GI has made this comment in the context of advocating the introduction of a spectrum floor. In this regard, ComReg would note that, unlike the proposed spectrum caps, the introduction of a spectrum floor itself runs a clear risk of encouraging inefficient entry or sheltering an inefficient incumbent to the detriment of competition in the mobile communications market and society as a whole.

A 5.64 Having had regard to all relevant material before it and on the basis of the discussion set out above, ComReg has not identified grounds to warrant implementation of the spectrum floor proposal and has, therefore, decided not to implement same.

A5.6.6 Additional H3GI Comments Regarding Competition Assessment

A 5.65 In relation to H3GI's various submissions regarding its view that it is necessary for ComReg to carry out a competition assessment on the likely future competition in the mobile market as a result of the outcome of the auction (citing, by way of example, recent work undertaken by Ofcom), ComReg makes the following observations:

- ComReg has considered, amongst other things, the impact upon competition when designing the various facets of the award process. See, for example, the RIA and assessment of the different options against ComReg's statutory framework;

- a more detailed ‘current competition’ assessment would not be warranted or particularly helpful as the current market has only a limited relevance to the post-auction landscape given ComReg’s proposal for full-band auctions of the 900 MHz and 1800 MHz bands (or “big-bang” scenario);
- a more detailed post-auction competition assessment cannot meaningfully be done, as that would involve looking at a ‘post-big-bang’ scenario, where any number of permutations could crystallise, and where the ‘market’ may also change as a result of the liberalisation of use of spectrum permitted thereafter. Contrast this with the situation in the UK where Vodafone and O2 have, between them, all 900 MHz spectrum rights for an indefinite period which, therefore, provides a known reference point from which to conduct an assessment;
- given the 'big bang' scenario, the impact of various options on competition as discussed in the RIA framework and the chances of various options serving to safeguard and promote competition can be analysed without any more detailed competition assessments than those already prepared and carried out;
- accordingly, ComReg is entitled, without further unnecessary analysis¹¹⁵, to expect that the most positive impact on competition can reasonably be expected to accrue and that its competition-related obligations and objectives can reasonably be expected to be fulfilled, by implementing the particular auction with the particular auction-design features that it is proposing. These, in the most proportionate and non-discriminatory way, seek to achieve the most that can be achieved in such forward-looking circumstances, which is to try to ensure that there will not be any lesser amount of competition in the future, relative to that obtaining currently; and
- to this end, the auction has been designed to provide for the maximum possible potential for participation in the auction and spread of spectrum allocation, by means, inter alia, of the following:
 - an open, transparent, non-discriminatory and competitive process;
 - making available a large amount and range of complementary and substitutable spectrum;

¹¹⁵ Which would, of necessity, delay the societal benefits likely to arise from the deployment of advanced mobile technologies.

- spectrum caps/sub-caps, etc., to avoid extreme asymmetric outcomes, and to provide the potential for new entry; and
- spectrum going to the highest bidders, and therefore, to those who value it most (i.e. those who will make optimum use of it, to the benefit of consumers).

A 5.66 As such, ComReg rejects H3GI's assertion that it is required to carry out a further detailed review of competition in addition to that which it has carried out to date.

A5.7 ComReg's Position on Unsold Lots at the End of the Award Process

A5.7.1 Summary of ComReg's Position in Document 11/60

A 5.67 In Document 11/60, ComReg stated that it would retain its discretion regarding how it would treat unsold spectrum lots depending on the factual circumstances arising from the Award Process. ComReg's position was informed by DotEcon's analysis and recommendations, including that:

- the most appropriate approach will depend on the particulars of the unsold lots (i.e. amount of spectrum unsold and in which bands); and
- a principle should be set out that spectrum lots left unsold at the end of the Award Process would not be otherwise allocated for a period after the Award Process of at least two years. This would be to avoid providing a negative incentive to bidders to "*wait and see*". That is, strategically withholding demand during the Award Process in the hope of being allocated this spectrum on the same terms as those offered in the auction in a follow-up process.

A5.7.2 Views of Respondents on Document 11/60

A 5.68 Vodafone and H3GI provided comments on ComReg's proposal, a summary of which follows:

- Vodafone stated that ComReg's proposal not to assign unsold spectrum for at least two years would provide a disincentive for a 'wait and see' approach from bidders hoping that any unsold spectrum would be offered on more favourable terms in the future; and

- H3GI submitted that ComReg should not leave spectrum unallocated, given its scarcity and importance.

A5.7.3 DotEcon's Analysis and Recommendations

- A 5.69 DotEcon states that if spectrum rights remain unsold at the end of the award process, this is because either there was insufficient demand overall, or there are lots remaining as they do not fit within the optimal winning combination. DotEcon does not see value in attempting to release unsold spectrum immediately after the auction, as the auction would have determined that there is no efficient way to do so. DotEcon agrees with H3GI that the spectrum being released is scarce and important. However, DotEcon does not see harm in deferring award of unsold blocks providing the deferral period is not too long. DotEcon also notes that preparing proposals for a subsequent award of spectrum and consulting on same would in any case limit the speed with which unsold spectrum could be brought to the market.
- A 5.70 DotEcon considers that such an approach reduces the incentives for strategic bidding behaviour where a bidder reduces its demand on the prospect that it may acquire spectrum rights at a later stage on more favourable terms. DotEcon notes the sentiment of Vodafone's argument that any subsequent spectrum releases should not be available on more favourable terms. DotEcon also acknowledges that circumstances can change over time, and that it is not appropriate to bind the terms of future spectrum releases to too great a degree.
- A 5.71 DotEcon therefore recommends that requiring a minimum period before a follow-up sale of unsold spectrum rights is the correct approach to reduce incentives for perverse bidding behaviour whilst providing ComReg with the flexibility to respond to changing circumstances over that period and ensure that appropriate reserve prices are used in any follow-up process given the conditions applying at the time.
- A 5.72 DotEcon do not believe it is necessary to specify an upper bound on how long after the initial auction a follow-up sale should occur. DotEcon state that ComReg will only sell spectrum where there is demand for it, so the timing of any subsequent auction and the terms on which spectrum will be made available will depend on the reason for unsold spectrum and the circumstances prevailing in the market following the passing of the minimum period. Equally where there is clear demand, DotEcon state that ComReg cannot unreasonably withhold spectrum.

A5.7.4 ComReg's Consideration of Respondents' and DotEcon's Views

- A 5.73 ComReg notes Vodafone's and H3GI's respective submissions regarding its position on unsold lots at the end of the Award Process.
- A 5.74 ComReg also notes DotEcon's assessment of responses received as set out in section 5.1 of Document 12/24.
- A 5.75 Having carefully considered the views of interested parties and DotEcon's analysis and recommendations, ComReg assessment of this issue is as follows:
- whilst ComReg agrees with H3GI that spectrum is scarce and important, ComReg also notes DotEcon's view that spectrum lots would remain unsold in the auction if there is insufficient overall demand, or if lots remain as they do not fit within the optimal winning combination. In these circumstances, ComReg would agree with DotEcon's assessment that in either scenario, the auction would have determined that there is no efficient way of releasing such spectrum and, therefore, there would be little harm in deferring release of spectrum, providing it is not deferred for too long a period;
 - accordingly, ComReg considers that there should be little harm in deferring spectrum for not too long a period. and notes that this approach has the benefit of reducing incentives for strategic behaviour by bidders where they do not express their full demand for spectrum in the hope of creating a situation where unsold spectrum might be bought later on better terms;
 - ComReg also agrees with DotEcon's analysis that it is not necessary to specify an upper bound on how long it would wait before holding an auction for any unsold spectrum;
 - in relation to Vodafone's submission that any future release of unsold spectrum should be on no more favourable terms than those for the upcoming auction, ComReg agrees with DotEcon that circumstances can change over time and, as such, it is preferable for ComReg to retain the flexibility to properly respond to changing circumstances over that period and ensure that appropriate reserve prices are used in any follow-up process given the conditions applying at the time.

A 5.76 Having had regard to all relevant material before it, and on the basis of the above, ComReg has not identified grounds to warrant changing its position on lots unsold at the end of the Award Process and has, therefore, decided to adopt this policy for the Award Process, that unsold lots will not be allocated for an appropriate period after the Award Process, of at least one year.

A5.8 The Ability of Bidders to Combine Individually Held Spectrum Cap Allowances

A5.8.1 Summary of ComReg's Position in Document 11/60

A 5.77 In Document 11/60 ComReg proposed that any combined bids in the Award Process should be treated in the same manner as bids from individual bidders and be subject to the same spectrum caps. ComReg's position was informed by the views of interested parties and the analysis and recommendations of DotEcon.^{116,117}

A5.8.2 Views of Respondents on Document 11/60

A 5.78 eircom Group, H3GI and Telefónica provided comments on ComReg's proposal, a summary of which follows:

- eircom Group requested that ComReg should provide clarity on its position with respect to spectrum pooling as, absent this, bidders would find it more difficult to value the spectrum. Whilst recognising that spectrum pooling may give rise to competition law issues, eircom Group did not believe that this, of itself, should preclude the ability to share/pool spectrum within licence conditions. eircom Group also considered that the requirement for competition approval creates unnecessary uncertainty for operators;
- H3GI agreed with ComReg's proposal as set out in ComReg Document 11/60;
- Telefónica, on the other hand, did not support ComReg's proposal and submits that:
 - ComReg's position is wrong and contradictory, as although it allows joint bidding, it rules it out for a significant proportion of likely bidders by not allowing amalgamation of individual spectrum caps;

¹¹⁶ See paragraph 4.43 of Document 11/60 & A6.76 - A6.78 of Document 11/60a.

¹¹⁷ See paragraphs 416 - 419 of Document 11/58.

- ComReg’s proposal is contrary to its obligations and objectives because it would:
 - a. inhibit more efficient use of spectrum by existing operators;
 - b. inhibit the efficiency of network sharing;
 - c. discriminate between operators and new entrants;
 - d. prevent the freeing up of spectrum for new entrants;
 - e. fails to take account of market demand in setting caps; and
 - f. artificially props up demand and prices;
- ComReg is preventing such joint bidding by not allowing for individual bidders to combine spectrum caps to take into account the larger demand inherent with joint bidding by two operators; and
- ComReg has not properly consulted on this matter and should do so immediately.

A5.8.3 Views of Respondents on Document 11/75

- Telefónica O2, Vodafone and H3GI provided comments on ComReg’s proposal in their responses to Document 11/75, a summary of which follows:
- Telefónica submits that ComReg needs to confirm, for example, that (subject to competition law) a Liberalised Licence will allow licensee A to have their apparatus transmit on the spectrum assigned to operator B without a requirement for any kind of prior permission; and
- ComReg's proposed auction structure and spectrum caps is likely to lead to three operators obtaining 2 × 20 MHz of sub-1 GHz spectrum, and one operator obtaining only 2 × 5 MHz of sub-1 GHz spectrum, placing that operator at a much weaker position in terms of its ability to negotiate spectrum trading and/or spectrum sharing arrangements.

A5.8.4 DotEcon’s Analysis and Recommendations

A 5.79 Notwithstanding its suggested modifications to the Assignment Stage as a means of facilitating those wishing to share spectrum to acquire contiguous spectrum, DotEcon notes that any spectrum sharing arrangement would, in general, be subject to *ex post* competition law regardless of any policy prescribed by ComReg, and that any operators wishing to share spectrum are obliged to ensure that competition law is complied with. Therefore, eircom

Group's comment that competition approval might create an obstacle to pooling or sharing spectrum needs to be considered against the fact that, at the very least, the parties to a spectrum sharing arrangement will need to assure themselves that competition law is not being broken.

- A 5.80 DotEcon considers that the additional step proposed of *ex ante* approval is a proportionate measure, given that it could be difficult unwinding spectrum pooling and other transactions such as investment in networks. DotEcon also considers such approval is important to counteract risks of anticompetitive behaviour in a market which has few players and limited entry possibilities.
- A 5.81 DotEcon refers to ComReg's Spectrum Strategy statement (Document 11/89), where ComReg states that when examining any potential collaboration proposal, it will consider issues surrounding competition, efficient spectrum use and effective spectrum management, and whether any potential restriction of competition (or other potential drawback) is outweighed by benefits passed on to end users. DotEcon also notes ComReg's position in Document 11/89 that although it cannot be said to have a firm view, at this moment in time, on the issue of spectrum rights sharing (or pooling), it would look more favourably on agreements that do not overly restrict competition and deliver demonstrable benefits that are shared with final consumers.
- A 5.82 In relation to Telefónica's objection to applying the same spectrum caps to a joint bidding vehicle as those applied to individual bidders, DotEcon consider this to be essential to ensuring that the auction outcome is not anticompetitive. In particular, DotEcon cautions that allowing aggregate spectrum caps for a joint bidding vehicle could allow such a vehicle to win a significant amount of spectrum relative to other bidders which could give a significant advantage in the provision of advanced data services and capacity.
- A 5.83 DotEcon notes that Telefónica's arguments supporting an aggregate spectrum cap for NSA bidders is made on the assumption that it would not affect downstream competition. However, DotEcon points out that such an arrangement could lead to a reduction in the number of independent national networks able to wholesale, and DotEcon cannot assume that an outcome where bidders in a Network Sharing Agreement (NSA) acquire 2 × 40 MHz sub 1 GHz would produce an equivalent outcome for downstream competition to two bidders which acquired 2 × 20 MHz individually. DotEcon also points out that relaxing the caps for a joint bidding vehicle provides strong incentive for parties to form an NSA to reduce competition for spectrum and eliminate competition between the participants.

- A 5.84 DotEcon highlights the difficulty in assessing the effect on downstream competition of an NSA without prior knowledge of the specifics and notes that caps which are appropriate under the assumption that winners act in an uncoordinated manner in downstream markets are inappropriate if they then act as a co-ordinated entity. Under these circumstances one can only adopt a prudential approach that a NSA bidder is treated just like any other bidding entity and each bidding entity – be this a joint bidder or an individual bidder – is subject to the same cap. DotEcon also considers that an increase in spectrum cap for joint bidders could raise concerns regarding discrimination and unfair treatment, as it could allow one participant of a NSA to relax the joint spectrum cap, with the joint bidding vehicle potentially winning access to more spectrum than it would have won as two independent bidding entities.
- A 5.85 DotEcon notes that a simple approach for enabling NSAs is to require that participants of a NSA bid separately in the main stage of the auction (without contravening activity and anti-collusion rules) but to make appropriate modifications to the assignment stage. This approach also permits the participants to express their individual valuations for spectrum which may differ. A NSA could then utilise the introduction of the ‘negotiation stage’ within the Assignment Stage to acquire contiguous spectrum assignments.

A5.8.5 ComReg’s Consideration of Respondents’ and DotEcon’s Views

- A 5.86 In relation to ComReg’s position that any combined bids would be treated the same as any other bid in the competition and therefore subject to equivalent spectrum caps, ComReg notes that, of the three responses received on this proposal, H3GI supported its proposal and ComReg notes the reasons provided by H3GI in support of its position.
- A 5.87 ComReg also notes eircom Group’s and Telefónica’s disagreement with ComReg’s proposal and the reasons provided by them in support of their position.
- A 5.88 ComReg further also notes DotEcon’s assessment of responses received as set out in section 13 of Document 12/24.
- A 5.89 Having carefully considered the views of interested parties and DotEcon’s analysis and recommendation on its proposal, ComReg’s assessment of this issue is as follows:

- ComReg remains of the view that it would not be appropriate to allow joint bidders to combine individual spectrum caps. Factors informing this view, include that:
 - combined spectrum caps for joint bidders would reduce competition for spectrum in the award process and eliminate competition between the participants;
 - combined spectrum caps could provide joint bidders an advantage in the provision of services and capacity and which could have an adverse impact on downstream competition;
 - whilst ComReg notes Telefónica's view that its refusal to relax spectrum caps in the case of joint bidding is discriminatory, ComReg, to the contrary, believes that it would be discriminatory to allow some bidders to benefit from higher caps just because they are bidding through a joint bidding vehicle;
 - in addition, ComReg considers that its modification to the Assignment Stage (see Chapter 4) should adequately address successful joint bidders' desire for adjacent spectrum assignments;
- in relation to Telefónica's view that ComReg has not consulted on this matter or taken into account its network sharing arrangement with Eircom Group, ComReg would, firstly, respectfully note that Document 11/60 was, in fact a consultation, and ComReg has had cognisance of the views put forward by interested parties on its proposal, including those of Telefónica. In addition, ComReg is, of course, aware of eircom Group's and Telefónica's arrangement, but notes that the existence of such an arrangement does not avoid or overcome the concerns identified by ComReg above in relation to allowing joint bidders to combine spectrum caps;
- given the above identified concerns, ComReg also does not accept Telefónica's view that in preventing joint bidders to combine individual spectrum allowances, it is operating contrary to a number of its statutory obligations and objectives. It has, on the contrary, clearly identified a number of concerns with regards to Telefónica's proposal which would run contrary to its statutory objectives;
- in relation to eircom Group's view regarding spectrum sharing, ComReg is not in a position to provide any comfort to a potential sharing arrangement without first obtaining sufficient knowledge of the specifics of said arrangement. To do otherwise would be to inappropriately fetter its discretion and potentially sanction something which may ultimately be

found to be contrary to competition law and/or contrary to its statutory functions, objectives and duties. ComReg would, however, reiterate its position set out in its Spectrum Strategy Statement that it will look more favourably on agreements that do not overly restrict competition and deliver demonstrable benefits that are shared with final consumers.

A 5.90 Having had regard to all relevant material before it and on the basis of the discussion set out above, ComReg has not identified grounds to warrant changing its proposal on the application of spectrum caps to joint bidders and has, therefore, decided to implement this position.

A5.9 Should the Existing Spectrum Holdings Count Towards the Spectrum Cap?

A 5.91 In addition, ComReg considered that a spectrum cap in present circumstances should take account existing spectrum assignments in the 900 MHz and 1800 MHz bands, but not existing 2.1 GHz spectrum holdings as the latter are unlikely to be large enough to greatly affect the long term market structure after the award process.¹¹⁸

A 5.92 On the basis of the reasons identified in Documents 11/60 and 11/60a, that no justified objections were raised and, further, that no other information before it would reasonably lead it to conclude otherwise, ComReg has decided that existing spectrum assignments in the 900 MHz and 1800 MHz bands will count towards the spectrum caps implemented, but not existing 2.1 GHz spectrum holdings (or spectrum holdings in other bands).

A5.10 ComReg's Final Position on Spectrum Caps

A 5.93 Having had regard to all relevant material before it in the context of its statutory functions, objectives and duties, and on the basis of the above, ComReg's final position on spectrum caps is as follows:

- ComReg will apply a 2 × 20 MHz cap to 800 MHz and 900 MHz (i.e sub-1GHz) spectrum rights for each of Time Slice 1 and Time Slice 2;
- ComReg will apply a 2 × 50 MHz spectrum cap to 800 MHz, 900 MHz and 1800 MHz spectrum rights for each of Time Slice 1 and Time Slice 2;

¹¹⁸ See paragraph 4.37 of Document 11/60 and paragraphs A6.86 - A6.91 of Document 11/60a.

- ComReg will apply a 2 × 10 MHz cap to 900 MHz spectrum rights in Time Slice 1;
- ComReg will retain its discretion regarding how it will treat unsold spectrum lots depending on the factual circumstances arising from the Award Process, but unsold lots will not be allocated for an appropriate period after the Award Process of at least one year;
- ComReg will ensure that any combined bids in the Award Process are subject to the same spectrum caps as applicable to individual bidders; and
- ComReg will not implement spectrum floors.

Annex 6: Coverage Measurement Metrics

A6.1 Introduction

- A 6.1 This annex sets out ComReg’s detailed consideration of the comments received in relation to coverage measurement metrics as discussed in section 5.5 of this document and ComReg’s final position regarding coverage measurement metrics that will apply to liberalised licences..
- A 6.2 In Document 11/60, ComReg proposed coverage measurement metrics on a per technology and a per spectrum band basis as set out in Part 4, sub-section 2 of Annex 8.6 of Document 11/60a (i.e. the draft licence schedule).
- A 6.3 In its response to Document 11/60, eircom Group stated that it remained “concerned that there is some ambiguity in the methodology applied for conversion Electric Field Strength per 5MHz and Electric Field Strength per MHz metrics”, and it believed the proposed Electric Field Strength per MHz figures are unrealistically high.
- A 6.4 Specifically, eircom Group requested was of the view that:
- “ComReg has converted¹¹⁹ a value of 48dbµV/m for a 5MHz bandwidth to a 62dbµV/m/MHz figure. ComReg appears to have added $20 \times \log(5)$ to 48 to get a value of 62. eircom Group believes the correct conversion is to subtract $10 \times \log(5)$ to get 41 dbµV/m/MHz.”
 - It noted that “other administrations, for example Finland and Sweden appear to apply a methodology consistent with our own view.¹²⁰ Similarly, this methodology is also recommended within ECC/Rec/(11)04 (in cases of other frequency block sizes $10 \times \log(\text{frequency block size}/5\text{MHz})$ should be added to the field strength values).”
- A 6.5 eircom Group requested ComReg to consider that above and furthermore it added that
- “the proposed licence conditions are constructed on the basis that LTE coverage may be measured using average pilot signal field strength or

¹¹⁹ See ComReg 11/60a, Paragraph A8.116.

¹²⁰ See <http://www.pts.se/upload/Ovrigt/Radio/Koordavtal-Finland-2500-2690MHz.pdf>

measured using Block Error Rate. We have no objection to the proposed Block Error Rate metrics and as such would be comfortable to move forward on the basis of Block Error Rate as the preferred coverage measurement metric.”

A 6.6 In its response to Document 11/75, Vodafone was of the preliminary view that the coverage measurement metrics may constitute a significantly higher standard than that required in order to offer a reasonable and commercially attractive service from both a consumer and supplier perspective. It stated that it *“is undertaking some internal modelling using the proposed metrics and will submit further views on this matter in the near future.”*

A6.2 Additional Information

A 6.7 In considering this matter, ComReg first presents information below on:

- The relationship between Power and Field Strength; and
- International reports and studies.

A6.2.1 The Relationship Between Power and Field Strength

A 6.8 Electrical Power (P) in Watts, is equal to the work done (W) over a period of time (t), which may be expressed in Leibniz notation as;

$$P = \frac{dW}{dt}, \quad \text{Eq. 1}$$

where work is equal to Energy, measured in Joules.

A 6.9 In Electrical Signals, Volts (V) are the unit of electrical energy (W) in Joules, per unit of charge Q , in Coulombs;

$$V = \frac{W(j)}{Q(c)} \quad \text{Eq. 2}$$

A 6.10 Amperes (I) are a measurement of current, which is the charge (Q) flowing, per unit of time (t) in seconds;

$$I = \frac{Q(c)}{t(s)} \quad \text{Eq. 3}$$

A 6.11 Ohms law states that the Voltage (V) is equal to the current (I) flowing through a circuit having impedance Z (Ω),

$$V = IZ \quad \text{Eq. 4}$$

A 6.12 Hence if power $P = \frac{dW}{dt}$, then multiplying Eqs. 1 and 2 gives

$$P = \frac{W}{Q} \times \frac{Q}{t} = VI \text{ and Applying Ohms law;}$$

$$P = \frac{V^2}{Z} \text{ and noting that the Impedance of free space } Z_0 \approx 377\Omega$$

$$\text{Hence } P = \frac{V^2}{Z_0} \quad \text{Eq.5}$$

Signals

A 6.13 The unit of frequency (f) is the Hertz, which is one vibration per unit of time (seconds (s)),

$$f = \frac{1}{t}$$

A 6.14 Fourier's theorem states that any signal $S(t)$ can be expressed as a series of sine waves (spectral components) from zero to infinity;

$$S(t) = \int MSin(t)dt, \text{ assuming } M = 1 \text{ and removing the DC constant i.e. the } t = 0 \text{ limit.}$$

A 6.15 Parseval's theorem states;

$$\int MSin(t)dt == \int MSin(f)df$$

Power Spectral Density (PSD) is the sum¹²¹ of the power of the each spectral component of the signal, over the given frequency range (f_0 to f_1), which may be expressed as;

¹²¹ By integration.

$$PSD\left(\frac{W}{Hz}\right) = \sum_{f_0}^{f_1} P(f) \quad \text{Eq. 6;}$$

and from Eq.5 in

$$PSD = \sum_{f_0}^{f_1} \frac{E^2}{377} \quad \text{Eq. 7}$$

Field Strengths and Power Density

A 6.16 Assuming far field conditions the Power Density P_d carried by a radiated electromagnetic field is given by;

$$P_d = \frac{E^2}{Z_0}, \left(\frac{W}{m^2}\right)^{122}$$

$$\text{And } \frac{W}{m^2} = \frac{\left(E\left(\frac{V}{m}\right)\right)^2}{377}; \text{ and } \frac{W}{m^2} = \frac{V^2 m^2}{377}$$

$$\text{Hence solving for Power, } P = \frac{V^2 m^2}{m^2 377} = \frac{E^2}{377}$$

A 6.17 Electric Field strength received at an antenna;

$$E = V(r).G(i), \text{ where}$$

$V(r)$ is the Voltage received,

$G(i)$ the isotropic gain of the antenna, which is the product of the antenna gain and the antenna factor,¹²³ $G(i) = G(\text{ant}).Af$;

A 6.18 From Eq. 5,

$$\text{The power delivered to the receiver}^{124} = \frac{(V(r).G(\text{ant}).Af)^2}{377} \quad \text{Eq. 8}$$

A 6.19 This may be expressed in dB as

¹²² Chatterton P.A., Houlden M.A., "EMC Electromagnetic Theory to Practical Design", p190, Wiley,1992.

¹²³ Which is itself dependant on frequency.

¹²⁴ Ignoring any impedance matching issues.

$$P(dB) = 10 \log \frac{(V(r).G(ant).Af)^2}{377}$$

$P(dB) = 20 \log V(r) + 20 \log G(ant) + 20 \log Af - Z_0(dB)$; and from Eq. 8 and 7;

A 6.20 Power in a signal (S) of bandwidth $f_1 - f_0$

$$P(s) = \sum_{f_0}^{f_1} 20 \log V(r) + 20 \log G(ant) + 20 \log Af - Z_0(dB)$$

A 6.21 Hence, the power in a signal, is the sum of the electrical field strengths received at an isotropic antenna, between the frequency bounds (f_0 to f_1), which is equivalent to the area under the curve of field strength versus frequency¹²⁵.

A 6.22 Therefore, for a constant power¹²⁶, if the bandwidth is halved, and the centre frequency remains unchanged, then the field strength of the signal will approximately double.¹²⁷

A 6.23 In Document 11/60, ComReg used this relationship to normalise the field strengths to a reference bandwidth of 1 MHz, and this information was presented in text format in the draft Liberalised Use licence (Annex 8.6 of Document 11/60a).

A 6.24 For clarity and for ease of comparison between bandwidths this information will now be presented in tabular format, as set out in Table 2 below, in the Liberalised Use licence.

A6.2.2 Consistency check with other studies and in particular ITU-R Rec.1546

A 6.25 In terms of assessing the proposed field strength metrics for LTE, paragraphs A8.115 to A8.116 of Document 11/60a set out ComReg's then rationale and stated that where possible, ComReg adopted a standards led approach to the proposed measurements metrics.

A 6.26 Since Document 11/60a was published, ComReg has researched this matter further and has compared its proposals against two additional documents^{128 129}

¹²⁵ This method is commonly used in spectrum analysers to measure the power in a given signal.

¹²⁶ This was highlighted in footnote 454 of Document 11/60a

¹²⁷ A useful graphical illustration of a similar concept may be found at http://en.wikipedia.org/wiki/Dirac_delta_function

¹³⁰ on this issue, and has performed a consistency check with ITU-R Recommendation Rec. P.1546-4 (“ITU-R Rec.1546”).

A 6.27 Table 2 below is derived from following the steps contained in Annex 6 of ITU-R Rec.P.1546-4 and using the following basic assumptions;

- Use the 600 MHz, 50% of Locations 1% of time family of curves (figure 11 in ITU-R Rec.1546);
- 37.5m antenna height;
- Base Station Power = 43dBm;
- Antenna Gain = 18dBi;
- Feeder Loss = 3dB;

(Hence EIRP = 43+18-3 = 58dBm \approx 720W, which is 2dB down on the 1kW (60dBm) curve given in ITU-Rec. 1546.

- Distances studied d (km) = 1, 2, 4, 8 and 10,
- Terrain Clearance Angle (TCA) 10° ,
- Urban 20m clutter height considered
- Clutter Factors (CF)dB from Annex 5.10 for $1 < d < 15$; $d = 1,0$; $d = 2,-3$; $d = 4,-1.9$; $d = 8,-0.92$; $d = 10,-0.6$,
- Receive correction not needed as $h_1 < 6.5d$,

¹²⁸ ATDI White Papers; December 2008 ‘Mobile LTE Network design with ICS Telecom’ and January 2009 ‘LTE fixed mobile convergence with ICS Telecom’

¹²⁹ IEEE Communications Magazine February 2009 pp 92-98 on ‘Multisite Field Trial for LTE and Advanced Concepts’.

¹³⁰ Also see http://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2039-2-2010-PDF-E.pdf for relationship between FS and PSD

Distance (d) km	Electric Field Strength (E) dB(µV/m)
1	74
2	61
4	52
8	43
10	39

Table 2. Results from the curves in figure 11 of ITU-R Rec.1546

A 6.28 It should be noted that the figures obtained from ITU-R Rec.1546 would result in an overestimate of the actual field strength at a given distance. However, they form a useful upper bounding check on suitable values of field strength for the 800 MHz band.

A6.3 ComReg’s Final Position

A 6.29 As outlined above, the discussion on the relationship between power and electric field strength¹³¹ supports ComReg’s proposed coverage measurement levels as set out by ComReg in Document 11/60 where a constant power is assumed.¹³²

A 6.30 In addition, ComReg has cross referenced its electric field strength measurement levels against other relevant international studies and recommendations (namely ITU-R Rec.1546, Rep. M2039-2, the ATDI white papers and the IEEE study), and the results of these studies and recommendations also support ComReg’s proposed measurement specifications. Given this, ComReg is of the view that it would be incorrect to adjust the coverage measurement metric specifications set out in Document 11/60 as per eircom Group’s suggestion.

A 6.31 In relation to eircom Group’s reference to ECC Recommendation ECC/REC (11)/04 and the other administrations¹³³, it should be noted that these deal with frequency planning and frequency co-ordination and therefore are not strictly relevant to the discussion in hand. This field strength referred to is the maximum allowable inside another administrations border and minimises the risk of interference into the other administration’s services, and is therefore different to the field strength needed to provide a service. Furthermore, it should

¹³¹ Also see http://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2039-2-2010-PDF-E.pdf for relationship between FS and PSD

¹³² Note footnote 454 of Document 11/60a highlighted that a constant power is assumed.

¹³³ In relation to the Finish and Swedish administrations, their methodology does not relate to the calculation of a normalised (1 MHz) reference signal and took account of the increase in power required to overcome the proportionate increase in noise and decrease in Receiver sensitivity caused by the increase in bandwidth.

be noted that it is based upon the robustness of the OFDM coding and error correction regimes.

- A 6.32 Finally, ComReg notes that Vodafone has not submitted the results of any further internal modelling on this matter and therefore ComReg did not have any information from Vodafone to analyse against its preliminary view that the coverage measurement metrics may constitute a significantly higher standard than that required in order to offer a reasonable and commercially attractive service from both a consumer and supplier perspective.
- A 6.33 Given the above, ComReg is of the view that the coverage measurement metrics as set out in Document 11/60, which are in any event now specified with a measurement bandwidth equal to the nominal channel size in respect of LTE and UMTS signals, are appropriate to include in a Liberalised Use Licence. For clarity, these coverage measurement metrics are set out in tabular format (see Table 3 below) and this table has been included in the Liberalised Use licence as set in Annex 8 of this document.

Terrestrial system and bandwidth	800MHz FS (dB(μV/m))	800MHz Ec/Io or BLER	900MHz FS (dB(μV/m))	900MHz Ec/Io or BLER	1800MHz FS (dB(μV/m))	1800MHz Ec/Io or BLER
GSM (0.2MHz)	45	N/A	46	N/A	54	N/A
UMTS (5MHz)	49	-8	50	-8	57	-8
LTE (5MHz)	47	10 ⁻²	48	10 ⁻²	55	10 ⁻²
LTE (10MHz)	44	10 ⁻²	45	10 ⁻²	52	10 ⁻²
LTE (15MHz)	42.5	10 ⁻²	43.5	10 ⁻²	50.5	10 ⁻²
LTE (20MHz)	41	10 ⁻²	42.5	10 ⁻²	49.5	10 ⁻²

Table 3. The Coverage Measurement Metrics for a Liberalised Use Licence

A 6.34 In terms of eircom Group’s comment regarding the measurement of an “average pilot signal field strength or Block Error Rate”, the concept is that both the FS and the $\frac{E_c}{I_o}$ or BLER parameters will be measured and compared to the coverage measurement metrics specified in the Table 3 above; and

- where both a FS and an $\frac{E_c}{I_o}$ or BLER metric are specified in Table 3 for a particular technology (i.e. UMTS and LTE), an area will be deemed to have coverage where the $\frac{E_c}{I_o}$ or BLER exceeds the levels as set out in Table 3, even if the Field Strength is less than the value shown in the Table.
- where a FS metric is the only metric specified in Table 3 for a particular technology (i.e. GSM), an area will be deemed to have coverage where the Field Strength in Table 3 is met.

A 6.35 As discussed in Document 11/60, ComReg retains the right to adjust the above metrics in line with the amendment procedures as set out in the Authorisation Regulations.

Annex 7: The Draft Regulations

- A 7.1 In line with ComReg’s position as set out in the main body of this document, this Annex sets out ComReg’s current position on the Regulations for the Liberalised Use and Preparatory Licences.
- A 7.2 It should be noted that these draft Regulations are subject to the approval of the Minister for Communications, Energy, and Natural Resources (“CENR”) and will not be sent to the Minister for CENR until ComReg has finalised the Information Memorandum. The text of these draft Regulations may therefore be subject to further change arising from the finalisation and publication of the final Information Memorandum or from the approval process with the Minister for CENR.
- A 7.3 The following outlines the principal changes that have been made to the draft Regulations as set out in Annex 2 of Document 11/75.¹³⁴
- A 7.4 Regulation 2: This Regulation has been amended as follows:
- In line with ComReg’s final position as set out in section 5.8.1 of this document, the “Liberalised Use Licence” and “Preparatory Licence” definitions have been amended, and definitions have been added for “Non-exclusive” and “Non-Interference and Non-Protected Basis”.
 - The “Spectrum Usage Fee” or “SUF” definition has been adjusted in line with ComReg’s position as set out in section 5.8.2 of this document;
 - The “Auction Rules” and “CPI Adjustment” definitions have been amended in line with ComReg’s final position as set out in section 5.9.2 of this document.
 - The “Assignee” and “Assignor” definitions have been amended in line with the Framework Regulations.
 - The “Spectrum Unit” definition has been renamed to “Spectrum Block” to maintain consistency of terms throughout the Regulations.
 - The “other operators”, “connected persons” and “insider” definitions have been deleted as these terms are no longer used in the draft Regulations.

¹³⁴ For the purposes of transparency and ease of reference, where new paragraphs are added to the latest draft of the Regulations, they are labelled A, B, C, etc. In the Regulations that are published, the numbering of the paragraphs will be re-ordered using 1, 2, 3, etc.

A 7.5 Regulation 5: In line with ComReg's final position as set out in section 5.8.2 of this document, Regulations 5 has been amended to remove the annual renewal process of a Liberalised Use Licence.

A 7.6 Regulation 6: This Regulation has been amended as follows:

- Regulation 6(1)(b) has been deleted as this obligation is specified in Part 4 of the Liberalised Use Licence;
- Regulation 6(4) has been amended in line with ComReg's final position as set out in section 5.9.2 of this document;
- Regulation 6(5) has been deleted in line with ComReg's final position as set out in section 5.9.2 of this document;
- In line with ComReg's final position as set out in section 5.8.2 of this document, Regulation 6(A) has been added to the Regulations
- Regulation 6(12) has been amended in line with ComReg's final position as set out in section 5.2 of this document;
- In line with ComReg's final position as set out in section 5.9.2 of this document, Regulation 6(15) and 6(16) have been amended and Regulation 6(B) has been added to the Regulations;
- Regulation 6(17) and 6(18) have been amended;

A 7.7 Regulation 8: This Regulation has been amended as follows:

- Regulation 8(1) has been deleted;
- Regulation 8(2) has been amended to identify that adjustments or refunds of fees may also be applicable;
- Regulation 8(3) has been amended to identify that the Base Price is subject to a reserve price per Spectrum Block, per spectrum band and per Time Slice;
- Regulation 8(4) and 8(5) have been deleted in line with ComReg's final position as set out in section 5.9.2 of this document;
- Table 1 and Regulation 8(8) have been amended to in line with ComReg final position as set out in section 4.8 of this document;

- Regulation 8(9) has been incorporated into Regulation 8(8).
- Regulation 8(10) has been deleted as this information is now set out in Regulation 8(2);
- In line with ComReg's final position as set out in section 5.8.2 of this document Regulation 8(C) has been added to the Regulations;
- Regulation 8(11) and 8(12) has been amended to identify that adjustments or refunds of fees may also be applicable. Regulation 8(12) has also been amended to remove any references to the licence renewal process;
- Regulation 8(D) has been added to the Regulations in line with ComReg's position as set out in paragraph 2.81 of the Draft Information Memorandum;
- Regulation 8 (E) has been added to the Regulations in line with ComReg's final position as set out in section 5.9.2 of this document.

A 7.8 Schedule 1: This has been amended as follows:

- The first page of Schedule 1 has been amended in line with ComReg's final position as set out in section 5.8.2 and section 5.9.2 of this document.
- Part 1 of Schedule 1 presents the commencement and expiry dates on a per spectrum block basis in line with ComReg's final position as set out in section 5.10 of this document.

A 7.9 Schedule 2: This has been amended as follows:

- The first page of Schedule 2 has been amended in line with ComReg's final position as set out in section 5.8.2 and section 5.9.2 of this document.
- Part 2 of Schedule 2 sets out the information in tabular format.

Draft STATUTORY INSTRUMENT

S.I. No. of 2012

**WIRELESS TELEGRAPHY (LIBERALISED USE AND PREPARATORY LICENCES
IN THE 800 MHZ, 900 MHZ AND 1800 MHZ BANDS) REGULATIONS 2012**

(Prn.)
S.I. No. of 2012

WIRELESS TELEGRAPHY (Liberalised Use and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz bands) REGULATIONS 2012

The Commission for Communications Regulation, in exercise of the powers conferred on it by section 6 of the Wireless Telegraphy Act 1926 (as substituted by section 182 of the Broadcasting Act 2009 (No. 18 of 2009)), (No. 45 of 1926), and with the consent of the Minister for Communications, Energy and Natural Resources, as required pursuant to section 37 of the Communications Regulation Act 2002 (No. 20 of 2002) (as adapted by the Communications, Marine and Natural Resources (Alteration of Name of Department and Title of Minister) Order 2007 (S.I. No. 706 of 2007), hereby makes the following regulations:

Citation

These Regulations may be cited as the Wireless Telegraphy (Liberalised Use and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz bands) Regulations, 2012.

Interpretation

2. (1) In these Regulations, unless the context otherwise requires:

“800 MHz Band” means the 791 to 821 MHz band paired with the 832 to 862 MHz band;

“900 MHz Band” means the 880 to 915 MHz band paired with the 925 to 960 MHz band;

“1800 MHz Band” means the 1710 to 1785 MHz band paired with the 1805 to 1880 MHz band;

“Act of 1926” means the Wireless Telegraphy Act 1926 (No. 45 of 1926);

“Act of 1972” means the Wireless Telegraphy Act 1972 (No. 5 of 1972);

“Act of 2002” means the Communications Regulation Act 2002 (No. 20 of 2002);

“Additional Price” has the meaning set out in the Information Memorandum;

“Apparatus” means apparatus for wireless telegraphy as defined in section 2 of the Act of 1926 for terrestrial systems capable of providing Electronic Communications Services in one or more of the 800 MHz, the 900 MHz and the 1800 MHz bands, and, in relation to a Licence, means the particular apparatus for wireless telegraphy to which the Licence relates;

“Assignor” means the party from whom some or all of the rights and obligations under a Licence have been transferred or leased;

“Assignee” means a party to whom some or all of the rights and obligations under a Licence have been transferred or leased;

“Auction” means the competitive award procedure used by the Commission for the purpose of granting rights of use for radio frequencies in the 800 MHz, 900 MHz and 1800 MHz bands, as detailed in the Information Memorandum;

“Auction Rules” means the rules and procedures relating to the Auction as set out in the Information Memorandum;

“Authorisation Regulations” means the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011 (S.I. 335 of 2011);

“Base Price” has the meaning set out in the Information Memorandum;

“Bidder” has the meaning set out in the Information Memorandum;

“Business Day” means a day which is not a Saturday or Sunday or a public holiday (within the meaning of the Organisation of Working Time Act 1997 (No. 20 of 1997));

“Commission” means the Commission for Communications Regulation;

“CPI” means the Consumer Price Index as published from time to time by the Central Statistics Office or its successor;

“CPI Adjustment” means a negative or positive adjustment of the SUF, calculated using the CPI according to the methodology set out the by the Commission in the Information Memorandum;

“Decision of 2009” means the European Commission Decision 2009/766/EC, of 16 October 2009, on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community;

“Decision of 2010” means the European Commission Decision 2010/267/EU of 6 May 2010, on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union;

“EMC Directive” means Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004, on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC;

“Electronic Communications Network” and “Electronic Communications Service” have the meanings assigned to them in the Framework Regulations;

“ETSI” means the European Telecommunications Standards Institute;

“EURIBOR” means the Euro Interbank Offered Rate;

“Framework Regulations” means the European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. 333 of 2011);

“General Authorisation” means an authorisation for an undertaking to provide an electronic communications network or service under and in accordance with Regulation 4 of the Authorisation Regulations;

“Harmful Interference” means interference which endangers the functioning of a Radionavigation Service or other safety services or which otherwise seriously degrades, obstructs or repeatedly interrupts a Radiocommunication Service operating in accordance with a requirement under the International Telecommunication Union Radio Regulations, a regulation of an institution of the European Union or legislation giving effect to an act, or provisions of an act, adopted by an institution of the European Union relating to the provision of an electronic communications service, electronic communications network or an associated facility or the radio frequency spectrum, or regulations made under the Act of 1926;

“Information Memorandum” means the information memorandum which was published on [•] and set out in the Commission’s Document numbered XX/XX for the purposes of outlining in detail the processes and procedures the Commission would follow in running the Auction;

“Liberalised Use Licence” means a Non-exclusive Licence granted under section 5 of the Act of 1926 in accordance with and subject to the matters prescribed in these Regulations to keep and have possession of Apparatus in a specified place in the State;

“Licence” means a Liberalised Use Licence or a Preparatory Licence, as the case may be;

“Licensee” means the holder of a Liberalised Use Licence or a Preparatory Licence, as the case may be;

“Non-exclusive”, in relation to a Licence, means that the Commission is not precluded from authorising the keeping and possession by other persons of other apparatus for wireless telegraphy on a Non-Interference and Non-Protected Basis in one or more of the 800 MHz, the 900 MHz and the 1800 MHz bands;

“Non-Interference and Non-Protected Basis” means a basis on which no harmful interference may be caused to any Radiocommunication Service, and on which no claim may be made for the protection of apparatus operating on this basis against harmful interference originating from Radiocommunication Services;

“Preparatory Licence” means a Non-exclusive Licence granted under section 5 of the Act of 1926 in accordance with and subject to the matters prescribed in these Regulations to keep and have possession of Apparatus in a specified place in the State;

“Radiocommunication Service” means a service as defined in the Radio Regulations of the International Telecommunication Union involving the transmission, emission or reception of radio waves for specific telecommunication purposes;

“Radionavigation Service” means a service involving the determination of the position, velocity and/or other characteristics of an object, or the obtaining of information related to its parameters, by means of the propagation properties of radio waves and used for the purposes of navigation, including obstruction warning;

“Spectrum Block” means a 5 MHz duplex block of spectrum in any of the 800 MHz, 900 MHz or 1800 MHz bands, respectively;

“Spectrum Usage Fee” or “SUF” means the fee payable by a Winning Bidder prior to the grant of its Liberalised Use Licence, in accordance with section 5 of the Act of 1926, or, as appropriate, the fees payable hereunder over the duration of a Liberalised Use Licence in accordance with Regulation 8;

“Time Slice 1” means the time period commencing on 1 February 2013 and ending on 12 July 2015 or on such other date or dates as may be specified by the Commission under Regulation 5 of these Regulations;

“Time Slice 2” means the time period commencing on 13 July 2015 and ending on 12 July 2030, or on such other date or dates as may be specified by the Commission under Regulation 5 of these Regulations;

“Undertaking” has the meaning set out in the Framework Regulations;

“Upfront Fee” means the fee payable by a Winning Bidder prior to the grant of any Licence under section 5 of the Act of 1926 in accordance with and subject to the matters prescribed in regard to such Licence by these Regulations; and

“Winning Bidder” has the meaning set out in the Information Memorandum.

(2) In these Regulations:

(a) a reference to an enactment or regulation shall be construed as a reference to the enactment or regulation as amended or extended by or under any subsequent enactment or regulation;

(b) a reference to a Regulation or a Schedule is to a Regulation of or Schedule to these Regulations, unless it is indicated that a reference to some other enactment is intended;

(c) a reference to a paragraph or subparagraph is to the paragraph or subparagraph of the provision in which the reference occurs unless it is indicated that reference to some other provision is intended; and

(d) a reference to a Directive of the European Parliament and Council shall be the Directive as amended or extended by any subsequent Directive.

(3) A word or expression that is used in these Regulations and that is also used in the Act of 1926 has, unless the context otherwise requires, the same meaning in these Regulations that it has in that Act.

(4) A word or expression that is used in these Regulations and that is also used in the Act of 2002 has, unless the context otherwise requires, the same meaning in these Regulations that it has in that Act.

(5) A word or expression that is used in these Regulations and that is also used in the Framework

Regulations or in the Authorisation Regulations has, unless the context otherwise requires, the same meaning in these Regulations that it has in those Regulations.

(6) The Interpretation Act 2005 (No. 23 of 2005) applies to these Regulations.

Licences to which these Regulations apply

3. (1) These Regulations apply to:

- (a) Liberalised Use Licences, and
- (b) Preparatory Licences

in the form of the respective Licences set out in Schedules 1 and 2 to these Regulations.

Application for the Grant and Form of Licences

4. (1) Application for the grant of any Licence to which these Regulations apply shall be made by a Winning Bidder to the Commission in writing, and in such form as may be determined by the Commission from time to time.

(2) A person who makes an application under paragraph (1) of this Regulation shall furnish to the Commission such information as the Commission may reasonably require for the purposes of these Regulations, and if the person, without reasonable cause, fails to comply with this paragraph, the Commission may refuse to grant the Licence concerned to the person.

(3) The Commission may grant a Liberalised Use Licence or a Preparatory Licence to which these Regulations apply following payment by the applicant of the relevant fees prescribed in Regulation 8 of these Regulations.

(4) A Liberalised Use Licence to which these Regulations apply shall be in the form specified in Schedule 1 to these Regulations with such variation, if any, whether by addition, deletion or alteration as the Commission may determine from time to time or in any particular case.

(5) A Preparatory Licence to which these Regulations apply shall be in the form specified in Schedule 2 to these Regulations with such variation, if any, whether by addition, deletion or alteration as the Commission may determine from time to time or in any particular case.

Duration of Licences

5. (1) (a) The commencement date of a Preparatory Licence to which these Regulations apply shall be set by the Commission and specified in the Preparatory Licence.
 - (b) Unless it has been withdrawn or had its duration amended under Regulation 7(2) and in accordance with the Authorisation Regulations, a Preparatory Licence to which these Regulations apply, shall in any event expire on such date as may be determined by the Commission and as specified in the Preparatory Licence.
- (2) (a) The commencement date of a Liberalised Use Licence to which these Regulations apply shall be specified in the Liberalised Use Licence, and, in respect of:
 - (i) Time Slice 1, shall be 1 February, 2013 or such other date as may be specified by the Commission; and
 - (ii) Time Slice 2, shall be 13 July, 2015 or such other date as may be specified by the Commission.
- (b) A Liberalised Use Licence to which these Regulations apply shall, unless it has been withdrawn or had its duration amended under Regulation 7(2) and in accordance with the Authorisation Regulations, shall in any event expire:
 - (i) in the case of Time Slice 1 on 12 July 2015 or such other date as may be specified by the Commission; and
 - (ii) in the case of Time Slice 2 on 12 July 2030.

Conditions of Licences

6. It shall be a condition of any Licence to which these Regulations apply, that the Licensee shall:
 - (1) ensure that it complies with the conditions contained within the Licence concerned and these Regulations;
 - (2) ensure that any Apparatus in the 800 MHz band complies with the Decision of 2010, and that Apparatus in the 900 MHz band and 1800 MHz band complies with the Decision of 2009;

- (3) ensure that Apparatus installed, maintained, possessed or kept under the Licences is capable of operating on the radio frequency spectrum specified in the Liberalised Use Licence;
- (4) ensure that where the Apparatus is worked or used, as appropriate, it is worked or used on such radio frequency spectrum
 - (a) as is specified in the Liberalised Use Licence; or
 - (b) to which the Licensee has a right of use pursuant to an agreement entered into with a holder of a licence under the Act of 1926 in accordance with procedures specified by the Commission, if any, from time to time ,or both.
- (6) comply with any rules to prevent spectrum hoarding as may be laid down by the Commission under the Framework Regulations;
- (7) ensure that it makes payment of the fees set out in Regulation 8 of these Regulations;
- (A) ensure that in each calendar year in which the Licence concerned is in force, and in any event on or before the anniversary of the Licence Commencement Date of each such year, it submits updated information to the Commission in respect of Part 2 and Part 3 of its Liberalised Use Licence;
- (8) furnish such information and reports as may be requested by the Commission from time to time;
- (9) ensure that the Apparatus or any part thereof, shall be installed, maintained, and where a Liberalised Use Licence is held worked and used, so as not to cause Harmful Interference;
- (10) ensure that the Apparatus or any part thereof, complies with Annex 1 of the EMC Directive;
- (11) comply with any special conditions imposed under section 8 of the Act of 1972 and subject to which these Licences are deemed by subsection (3) of that section to be issued;
- (12) (a) notify the Commission, not less than 6 months prior to the proposed cessation of use of any terrestrial system listed in Schedule 1 to these Regulations to which the Liberalised Use Licence relates and;
 - (b) use reasonable endeavours at all times to ensure that any adverse effects on users of a

- cessation of use of a terrestrial system are minimised;
- (13) upon becoming aware of any event likely to materially affect its ability to comply with these Regulations, or any conditions set out or referred to in any Licence, notify the Commission of that fact in writing within 5 Business Days;
 - (14) comply with all obligations under relevant international agreements relating to the use of Apparatus or the frequencies to which they are assigned;
 - (15) subject to paragraph (B) of this Regulation, only transfer or lease the rights of use attaching to a Liberalised Use Licence in accordance with procedures as may be specified by the Commission from time to time on the transfer or leasing of rights and obligations of a Wireless Telegraphy licence;
 - (16) notify the Commission of its intention to transfer or lease any spectrum rights of use attaching to a Liberalised Use Licence, under paragraph 15 of this Regulation;
 - (B) where the Commission has not yet put in place procedures governing the transfer or lease of spectrum rights of use attaching to Liberalised Use Licences, not, without the consent of the Commission (which shall not be unreasonably withheld), transfer or lease any rights of use attaching to a Liberalised Use Licence;
 - (17) ensure that if the address of the Licensee or its Assignee changes, the Licensee or Assignee shall, as soon as possible, but in any event within 28 days, notify the Commission in writing of the change;
 - (18) ensure that any Assignee enters into a valid binding agreement to comply with all obligations under both these Regulations and the Licences issued pursuant to these Regulations and to provide to the Assignor or Commission, as appropriate, such details as the Commission is entitled to require from a Licensee from time to time.

Enforcement, Amendment, Withdrawal and Suspension

- 7. (1) Enforcement by the Commission of compliance by a Licensee with conditions attached to its Licence shall be in accordance with the Authorisation Regulations.
- (2) The Commission may amend any Licence from time to time in accordance with the

Authorisation Regulations.

- (3) Without prejudice to paragraph (2) of this Regulation, at the request of the Licensee, the Commission may, if it considers it appropriate to do so, amend a Licence by adding to, deleting from, or altering the radio frequency spectrum specified in the Licence, on which the Apparatus may be used. Any such amendment shall be effected by notice in writing from the Commission specifying the amendment and given to the Licensee or sent to the Licensee at the address specified in the Licence or notified to the Commission pursuant to the Licence and these Regulations.
- (4) A Licence may be suspended or withdrawn by the Commission in accordance with the Authorisation Regulations.
- (5) A Licence may be suspended or withdrawn by the Commission if, after the grant of a Licence pursuant to these Regulations, it emerges that the Licensee has breached the Auction Rules.

Licence Fees

8.

- (2) The fee for a Liberalised Use Licence is the sum of the Upfront Fee and the Spectrum Usage Fees over the duration of the Licence less any rebates or adjustments or refunds applicable to the Licensee, as identified in the Information Memorandum.
- (3) The Upfront Fee is determined by the Auction and is the sum of the Base Price and the Additional Price. The Base Price is subject to a reserve price per Spectrum Block, per spectrum band and per Time Slice, as detailed in Table 1.

Table 1: Reserve price¹³⁵ per Spectrum Block per spectrum band and per Time Slice

Spectrum Band	Reserve Price per Spectrum Block in Time Slice 1	Reserve Price per Spectrum Block in Time Slice 2
800 MHz band	€2.55 million	€8.26 million
900 MHz band	€2.55 million	€8.26 million
1800 MHz band	€1.27 million	€4.13 million

- (6) The Additional Price for a Liberalised Use Licence is determined using the pricing methodology set out in the Information Memorandum.
- (7) The Spectrum Usage Fee for a Liberalised Use Licence is the sum of the Spectrum Usage Fees associated with each Spectrum Block in the Liberalised Use Licence as set out in paragraph 8 below.
- (8) The annual Spectrum Usage Fee payable shall be
- (a) the sum of €1.08 million and the CPI Adjustment for each Spectrum Block in the 800 MHz band;
 - (b) the sum of €1.08 million and the CPI Adjustment for each Spectrum Block in the 900 MHz band,
 - (c) the sum of €0.54 million and the CPI Adjustment for each Spectrum Block in the 1800 MHz band; and
 - (d) in the case of a Spectrum Usage Fee, for a period of less than one year, the Spectrum Usage Fee for each Spectrum Block shall be the relevant sum as detailed in sub paragraphs (a) (b) and (c) above , adjusted on a pro rata daily basis for such period.
- (C) Where the commencement date of the Liberalised Use Licence is delayed in Time Slice 1 or in Time Slice 2 due to circumstances as described in section [XXX] of the Information

¹³⁵ The prices will be revised pursuant to an updated benchmarking exercise prior to publication of this Statutory Instrument. [NOTE TO BE REMOVED IN FINAL S.I]

Memorandum, a Licensee shall be entitled to an adjustment of the Licence Fees payable or a refund of Licence Fees already paid, as the case may be, as provided for in section [XXX] of the Information Memorandum.

- (11) The Upfront Fees specified in paragraphs, (3) and (6) of this Regulation less any rebates, adjustments or refunds applicable to the Licensee shall be paid to the Commission on a date specified by the Commission in accordance with the Information Memorandum, by way of banker's draft or such other means and on such other terms, if any, as the Commission may decide. Where the date of payment falls on a day other than a Business Day, payment shall be made on or before the last Business Day before the date on which payment would otherwise have fallen due.
- (12) The Spectrum Usage Fees specified in paragraphs, (7) and (8) of this Regulation, less any rebates, adjustments or refunds applicable to the Licensee, shall be paid to the Commission prior to the grant of a Liberalised Use Licence or prior to the anniversary of the Licence Commencement Date of each respective calendar year within the duration of the Liberalised Use Licence, as the case may be, by way of banker's draft or such other means and on such other terms, if any, as the Commission may decide. Where the date of payment falls on a day other than a Business Day, payment shall be made on or before the last Business Day before the date on which payment would otherwise have fallen due.
- (13) If a Liberalised Use Licence is suspended or withdrawn under Regulation 7(4) or Regulation 7(5), the Licensee shall not be entitled to be repaid any part of the Upfront or Spectrum Usage Fee, paid by the Licensee under this Regulation, but shall still be liable to pay any sums, including interest, that are outstanding.
- (14) If the amount of radio frequency spectrum specified in a Liberalised Use Licence is reduced under Regulation 7(3), the Licensee may be entitled to a refund of Spectrum Usage Fees already paid and a reduction on future Spectrum Usage Fees on a pro-rata basis having regard to the nature of the amendment. The Licensee shall not be entitled to any refund of its Upfront Fee;
- (D) If the duration of a Liberalised Use Licence is reduced at the request of the Licensee, the Licensee may be entitled to a refund of Spectrum Usage Fees already paid on a pro-rata basis having regard to the reduced duration. The Licensee shall not be entitled to any refund of its

Upfront Fee;

(15) The fee for a Preparatory Licence is €100.

(E) Failure by a Licensee to make an SUF payment on or before the date it falls due under paragraph 12 of this Regulation constitute a non-compliance by the Licensee with these Regulations. ComReg, in addition to enforcement actions in accordance with Regulation 7 of these Regulations, may take steps to recover the fees due in accordance with paragraph (16) and (17) of this Regulation.

(16) Where payment of any fee is not made in due time, then the Licensee shall pay to the Commission interest on the fees or part thereof that is outstanding at the appropriate EURIBOR rate, between the date when such fee or part fell due and the date of payment of such fee or part.

(17) An amount payable by a person in respect of a fee under this Regulation may be recovered by the Commission from the person as a simple contract debt in any court of competent jurisdiction.

Licensee to satisfy all Legal Requirements

9. (1) Licences granted pursuant to these Regulations do not grant to the Licensee any right, interest or entitlement other than the right to keep, and have possession of, install, and maintain, and additionally in the case of a Liberalised Use Licence, to work and use, at a specified location or locations in the State, apparatus for wireless telegraphy for terrestrial systems capable of providing Electronic Communications Services.

(2) Nothing in these Regulations shall absolve the Licensee from any requirement in law to obtain such further or other consents, permissions, authorisations or licences as may be necessary for the provision of the services and for the exercise of his or her rights or discharge of his or her obligations under the Licences. The Licensee is responsible for all costs, expenses and other commitments, financial or otherwise, in respect of the Licences and in the provision of terrestrial systems capable of providing Electronic Communications Services, and the Commission shall bear no responsibility whatsoever for such costs, expenses or commitments.

SCHEDULE 1

WIRELESS TELEGRAPHY ACT, 1926

WIRELESS TELEGRAPHY (Liberalised and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz bands) REGULATIONS 2012

Liberalised Use Licence for terrestrial systems capable of providing Electronic Communications Services

Licence under section 5 of the Wireless Telegraphy Act, 1926, to keep and have possession of apparatus for wireless telegraphy for terrestrial systems capable of providing Electronic Communications Services.

The Commission for Communications Regulation, in exercise of the powers conferred on it by section 5 of the Wireless Telegraphy Act, 1926 (No. 45 of 1926) (as substituted by section 182 of the Broadcasting Act 2009 (No. 18 of 2009)), hereby grants to the Licensee specified [insert name of Licensee] of [insert address of Licensee]:

Authorisation to keep and have possession of apparatus for wireless telegraphy for terrestrial systems capable of providing Electronic Communications Services as specified in Part 2 to this Licence, subject to such apparatus being installed, maintained, worked and used in accordance with the terms and conditions and restrictions set out in the Wireless Telegraphy (Liberalised Use Licence and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz band) Regulations, 2012 (S.I. No. [XX] of 2012) (“the Regulations”), including, but not limited to, the following:

- (1) The Licensee shall ensure that it complies with all of the conditions contained within Parts 1 to 4 of this Licence; and
- (2) The Licensee shall ensure that it makes payment of all fees as detailed in the Regulations.

This Licence shall come into effect on DD/MM/YY (the “Licence Commencement Date”) and, subject to revocation, suspension or withdrawal, expires on DD/MM/YY (the “Licence Expiry Date”).

Signed:

For and on behalf of the Commission for Communications Regulation

Official Stamp

Part 1

Commencement and Expiry dates per Spectrum Block

Authorised Band	Name of Spectrum Block	Uplink / Downlink Frequency Assigned to Spectrum Block	Commencement Date per Spectrum Block	Expiry Date per Spectrum Block
<i>800, 900 or 1800MHz as appropriate</i>	<i>Block A, B, C etc.</i>	<i>From XXXX MHz to YYYY MHz including Raster details if appropriate</i>	<i>DD Month 201X</i>	<i>DD Month 20XX</i>

Part 2

The Apparatus to which this Licence applies

Equipment Index Reference	Terrestrial System	Equipment Description	Manufacturer	Model

Part 3

Apparatus Location and Details

(A) 800 MHz band

Location Index	National Grid Reference	Equipment at location ¹³⁶	Maximum EIRP ¹³⁷

(B) 900 MHz band

Location Index	National Grid Reference	Equipment at location ¹³⁸	Maximum EIRP

(C) 1800 MHz band

Location Index	National Grid Reference	Equipment at location ¹³⁹	Maximum EIRP

Part 4

Licence Conditions

(as set out in Annex 8 to this Document)

¹³⁶ This should reference the Equipment Index as specified in part 2 of this schedule.

¹³⁷ EIRP is the Equivalent Isotropically Radiated Power

¹³⁸ This should reference the Equipment Index as specified in part 2 of this schedule.

¹³⁹ This should reference the Equipment Index as specified in part 2 of this schedule.

SCHEDULE 2

WIRELESS TELEGRAPHY ACT, 1926

WIRELESS TELEGRAPHY (Liberalised and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz bands) REGULATIONS 2012

Preparatory Licence for terrestrial systems capable of providing Electronic Communications Services.

Preparatory Licence under section 5 of the Wireless Telegraphy Act, 1926, to keep and have possession of apparatus for wireless telegraphy for terrestrial systems capable of providing Electronic Communications Services.

The Commission for Communications Regulation, in exercise of the powers conferred on it by section 5 (as substituted by section 182 of the Broadcasting Act 2009 (No. 18 of 2009)) of the Wireless Telegraphy Act, 1926 (No. 45 of 1926), hereby grants to the Licensee specified [insert name of Licensee] of [Insert address of Licensee]:

Authorisation to keep and have possession of apparatus for wireless telegraphy for terrestrial systems capable of providing Electronic Communications Services as specified in Part 2 to this Licence, subject to such apparatus being installed and maintained in accordance with the terms and conditions and restrictions set out in the Wireless Telegraphy (Liberalised and Preparatory Licences in the 800 MHz, 900 MHz and 1800 MHz bands) Regulations, 2012 (S.I. No. of 2012) (“the Regulations”), including, but not limited to, the following:

- (1) The Licensee shall ensure that it complies with all of the conditions contained within the Parts of this Licence; and
- (2) The Licensee shall ensure that it makes payment of all fees as detailed in the Regulations.

This Licence shall come into effect on DD/MM/YY (the “Licence Commencement Date”) and, subject to revocation, suspension or withdrawal, expires on DD/MM/YY (the “Licence Expiry Date”).

Signed:

Part 1

Licence Conditions

- (1) The Licensee may keep, have possession of, install and maintain the Apparatus detailed in Part 2 of this Licence.
- (2) The Licensee shall not work or use the Apparatus detailed in Part 2 of this Licence.

Part 2

Statement of Authorised Apparatus

To Include:

Authorised Band	Name of Lot	Uplink / Downlink Frequency Assigned to Lot	Commencement Date of Lot	Expiry Date of Lot	Description of Apparatus
<i>800, 900 or 1800MHz as appropriate</i>	<i>Block A, B, C etc.</i>	<i>From XXXX MHz to YYYY MHz including Raster details if appropriate</i>	<i>DD Month 201X</i>	<i>DD Month 20XX</i>	

EXPLANATORY NOTE

(This note is not part of the Instrument and does not purport to be a legal interpretation.)

These Regulations prescribe matters in relation to licences for apparatus for Wireless Telegraphy for terrestrial systems capable of providing Electronic Communications Services in some or all of the 800 MHz, the 900 MHz and the 1800 MHz bands

Annex 8: Draft Part 4 of Schedule 1 to the Draft Regulations – the Licence Conditions Attached to a Liberalised Use Licence

- A 8.1 In line with ComReg’s final position as set out in the main body of this document, this Annex sets out ComReg’s position on the text of Part 4 of Schedule 1 to the draft Regulations – namely the Licence Conditions to be attached to a Liberalised Use Licence.
- A 8.2 It should be noted that these draft Regulations are subject to the approval of the Minister for Communications, Energy, and Natural Resources (“CENR”) and will not be sent to the Minister for CENR until ComReg has finalised the Information Memorandum. The text of these draft Regulations may therefore be subject to further change arising from the finalisation and publication of the final Information Memorandum or from the approval process with the Minister for CENR.
- A 8.3 The following outlines the principal changes that have been made to these ‘Licence Conditions’ when compared to those set out in Annex 3 of Document 11/75.
- A 8.4 Part 1 of the draft ‘Licence conditions’ as set out in Document 11/75: This Part has been deleted in line with ComReg’s final position as set out in Section 5.10 of this document.
- A 8.5 Section 1 (formerly Part 2 of the Licence Conditions set out in Document 11/75): This section has been amended as follows:
- Sub section 2) and 3). These sections have been amended to align the text with other Parts of the Liberalised Use licence;
 - Sub section 4) Termination of a terrestrial system deployed in the Licensed Frequency Block(s): This sub section has been deleted as this obligation is contained in Regulation 6(12) of the draft Regulations

- Sub section 4) (formerly sub section 5) Provision of Maps and Data: This sub section has been modified in line with ComReg’s final position as set out in section 5.10 of this document.

A 8.6 Section 3 (formerly Part 4 of the Licence Conditions set out in Document 11/75):
This section has been amended as follows:

- Sub section 1) Minimum Coverage and Roll-out Requirement: This sub section has been amended in line with ComReg’s final position as set out in section 5.5 and section 5.10 of this document.
- Sub section 2) Definition of coverage: As discussed in section 5.5 of this document no changes have been made to the coverage level specifications. However Table 5 presents this information in tabular format.
- Sub section 3) Reporting on Compliance: This sub section has been amended in line with ComReg’s final position as set out in section 5.5 of this document.
- Sub section 4) Performance Guarantee: This sub section has been deleted in line with ComReg’s final position as set out in section 5.5 of this document.

A 8.7 Section 4 (formerly Part 5 of the Licence Conditions set out in Document 11/75):
This section has been amended as follows:

- Sub section 1) The Minimum “Availability of the Network” Standard: This sub section has been amended in line with ComReg’s final position as set out in section 5.6 of this document.
- Sub section 2) The Minimum “voice call” standard: This sub-section has been amended in line with ComReg’s final position as set out in section 5.6 and section 5.10 of this document.
- Sub section 3) Compliance Report and Performance Guarantees: This sub-section has been amended in line with ComReg’s final position as set out in section 5.6 of this document.

Part 4 to Schedule 1 of the draft Regulations

Licence Conditions

Section 1 General

1) The Frequency Bands

- The “800 MHz band” means the 791 to 821 MHz band paired with the 832 to 862 MHz band;
- The “900 MHz band” means the 880 to 915 MHz band paired with the 925 to 960 MHz band;
- The “1800 MHz band” means the 1710 to 1785 MHz band paired with the 1805 to 1880 MHz band.

2) The Licensed Spectrum Blocks

“Licensed Spectrum Block(s)” means the Spectrum Blocks set out in Part 1 of the Licence.

3) The Terrestrial Systems and Services

“Terrestrial Systems” means terrestrial systems capable of providing electronic communications services that are in compliance with the technical implementing measures adopted pursuant to Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (“Radio Spectrum Decision”) and in conformity with the standards referred to in Section 1 –4 of this Schedule.

4) Provision of Maps and Data

For the purposes of carrying out coverage (see Section 3) and quality of service (see Section 4) compliance checks, the Licensee shall, on request, provide to the Commission the following:

- (a) Maps showing Coverage as defined in Section 3 of this Schedule;
- (b) An up-to-date list of the locations of the ‘Base Station’¹⁴⁰ transmitters;
- (c) An adequate number of test numbers.

¹⁴⁰ Repeaters are also included as a Base Station for the purposes of this Licence.

Section 2: Technical Conditions

1) The 800 MHz band

1. The Frequency Division Duplex (FDD) method shall be used. Radio transmitters that use the 791 to 821 MHz frequency space shall transmit in a downlink direction (i.e. 'Base Station' transmitters). Radio transmitters that use the 832 to 862 MHz frequency space shall transmit in an uplink direction (i.e. 'Terminals' transmitters).
2. Terrestrial Systems compatible with Decision 2010/267/EU can be deployed in the 800 MHz band.
3. Within a Spectrum Block for which the Licence holder has a Licence, the in-block radiated power from a Base Station transmitter in the downlink direction must not exceed a mean in block power of 59 dBm/5 MHz EIRP.¹⁴¹
4. Outside of a Spectrum Block for which the Licence holder has a Licence, the Licensee shall comply with the out-of-block Block Edge Mask (BEM) as specified in Table 1 to Table 4 below

Table 1: Baseline Requirements – Base Station BEM out-of-block EIRP limits

Frequency Range Of Out-Of-Block Emissions	Maximum Mean Out-Of-Block EIRP	Measurement Bandwidth
832 – 862 MHz (Frequencies used for FDD uplink)	-49.5 dBm	5 MHz

¹⁴¹ EIRP stands for Equivalent Isotropically Radiated Power.

Table 2: Transition Requirements - Base Station BEM out-of-block EIRP limits per antenna over FDD downlink frequencies 791 to 821 MHz

Frequency Range Of Out-Of-Block Emissions	Maximum Mean Out-Of-Block EIRP	Measurement Bandwidth
-10 to -5 MHz from lower block edge	18 dBm	5 MHz
-5 to 0 MHz from lower block edge	22 dBm	5 MHz
0 to +5 MHz from lower block edge	22 dBm	5 MHz
+5 to +10 MHz from lower block edge	18 dBm	5 MHz
Remaining FDD downlink frequencies	11 dBm	1 MHz

Table 3: Transition Requirements – Base Station BEM out-of-block EIRP limits per antenna (for one to four antennas) over frequencies used as guard bands

Frequency Range Of Out-Of-Block Emissions	Maximum Mean Out-Of-Block EIRP	Measurement Bandwidth
Guard band between 790 MHz and 791 MHz	17.4 dBm	1 MHz
Duplex Gap guard band 821 – 832 MHz	15 dBm	1 MHz

Table 4: Baseline requirements - Base Station out-of-block EIRP limits over frequencies below 790 MHz

Frequency Range Of Out-Of-Block Emissions	Conditions On Base Station In-Block EIRP, P dBm/10 MHz	Maximum Mean Out-Of-Block EIRP	Measurement Bandwidth
470 – 790 MHz	$P \geq 59$	0 dBm	8MHz
	$36 \leq P < 59$	(P-59) dBm	8MHz
	$P < 36$	-23 dBm	8MHz

5. The Licensee shall comply with all Memoranda of Understanding (“MoU”) agreed from time to time between the Commission and the national regulatory authority responsible for communications matters in the UK, (“Ofcom”), or its successor, in relation to the 800 MHz band.¹⁴²

2) The 900 MHz and 1800 MHz bands

6. The Frequency Division Duplex (FDD) method shall be used.
7. In the 900 MHz band, radio transmitters that use the 925 to 960 MHz frequency space shall transmit in a downlink direction (i.e. ‘Base Station’ transmitters). Radio transmitters that use the 880 to 915 MHz frequency space shall transmit in an uplink direction (i.e. ‘Terminal’ transmitters).
8. In the 1800 MHz band radio transmitters that use the 1805 to 1880 MHz frequency space shall transmit in a downlink direction (i.e. ‘Base Station’ transmitters). Radio transmitters that use the 1710 to 1785 MHz frequency space shall transmit in an uplink direction (i.e. ‘Terminal’ transmitters).
9. Terrestrial Systems permitted under Decision 2009/766/EC as amended by Decision 2011/251/EU can be deployed in the 900 MHz band and/or the 1800 MHz band.
10. In the absence of bilateral or multilateral agreements between neighbouring Licensees, the Licensee deploying a GSM system¹⁴³ in the 900 MHz and/or 1800 MHz band is required to meet the guard band obligation as set down in Decision 2009/766/EC as amended by Decision 2011/251/EU.
11. The Licensee shall comply with all MoU agreed from time to time between the Commission and the Ofcom, or its successor, in relation to the 900 MHz and 1800 MHz band, including ComReg Documents 11/50c, d, e and f.¹⁴⁴

¹⁴² See the MoU regarding this band, as presented in Annex 14 of this document

¹⁴³ As defined in Decision 2009/766/EC as amended by Decision 2011/251/EU.

¹⁴⁴ <http://www.comreg.ie/fileupload/publications/ComReg1150c.pdf>;
<http://www.comreg.ie/fileupload/publications/ComReg1150d.pdf>;
<http://www.comreg.ie/fileupload/publications/ComReg1150e.pdf>; and
<http://www.comreg.ie/fileupload/publications/ComReg1150f.pdf> .

Section 3: Roll-out and Coverage Requirements

1) Minimum Coverage and Roll-out Requirement

In the case of an existing GSM or 3G licensee, which for the avoidance of doubt excludes MVNOs without GSM or 3G spectrum rights of use, being granted a Liberalised Use Licence?

The Licensee shall ensure the attainment of, and maintain, a coverage level of at least 70% of the population within 3 years of the Licence Commencement Date as set out in the Licence.

In the case of entity that does not have a GSM or 3G licence, which by definition includes MVNOs which do not have GSM or 3G spectrum rights of use, being granted a Liberalised Use Licence.

The Licensee shall ensure the attainment of, and maintain, a coverage level of at least 35% of the population within 3 years and 70% of the population within 7 years of the Licence Commencement Date as set out in the Licence.

2) Definition of Coverage

Where the Licensee has deployed more than one Terrestrial System in the 800 MHz, the 900 MHz and/or the 1800 MHz band, it is the combined coverage of these Terrestrial Systems that counts towards the minimum coverage and roll-out obligation set out in this Licence.

Determining whether the Licensee has coverage shall be calculated as follows:

- For measurement purposes, an average pilot signal will be measured outdoors at a height of 1.5m;
- For propagation prediction systems a pilot signal over 95% of the area during 95% of the time is required;
- The coverage level specification per frequency band, per bandwidth and per Terrestrial System is set out in Table 5 below.
 - Where both a FS and an Ec/Io or BLER metric are specified in Table 5 for a particular Terrestrial System (i.e. UMTS and LTE), an area will be deemed to have coverage where the Ec/Io or BELR exceeds the levels as set out in Table 5, even if the Field Strength is less than the value shown in the Table 5.

- Where a FS metric is the only metric specified in Table 5 for a particular Terrestrial System (i.e. GSM), an area will be deemed to have coverage where the Field Strength in Table 5 below is met.

Table 5: The coverage level specification per frequency band, per bandwidth and per terrestrial system

Terrestrial Systems¹⁴⁵ and bandwidth	800MHz FS (dB(μV/m))	800MHz Ec/Io or BLER	900MHz FS (dB(μV/m))	900MHz Ec/Io or BLER	1800MHz FS (dB(μV/m))	1800MHz Ec/Io or BLER
GSM (0.2MHz)	45	N/A	46	N/A	54	N/A
UMTS (5MHz)	49	-8	50	-8	57	-8
LTE (5MHz)	47	10 ⁻²	48	10 ⁻²	55	10 ⁻²
LTE (10MHz)	44	10 ⁻²	45	10 ⁻²	52	10 ⁻²
LTE (15MHz)	42.5	10 ⁻²	43.5	10 ⁻²	50.5	10 ⁻²
LTE (20MHz)	41	10 ⁻²	42.5	10 ⁻²	49.5	10 ⁻²

Where:

FS = Field Strength;

BLER = Block Error Rate; and

Ec/Io = The ratio of the received energy per chip the interference level.

¹⁴⁵ As defined in EC Decision 2009/766/EC as amended by Decision 2011/251/EU.

Other Terrestrial Systems in the 800 MHz, the 900 MHz or the 1800 MHz bands

Insofar as, over the lifetime of this Licence, WiMAX¹⁴⁶ or other terrestrial systems¹⁴⁷ may also be deployed in one or more of the 800 MHz, the 900 MHz and the 1800 MHz bands, the Commission will set a measurement standard¹⁴⁸ for these when appropriate.

Such measurement standards shall be defined on whatever basis appears appropriate to the Commission having regard to, amongst other things, international standards and recommendations, but for indicative purposes these standards are likely to be based on:

- For measurement purposes – an average pilot signal field strength of “X¹⁴⁹” measured outdoors at a height of 1.5m, or a Carrier to Interference (C/I) ratio of –Y dB¹⁵⁰
- For propagation prediction systems – a pilot signal field strength of “X” over 95% of the area during 95% of the time.

Coverage from terrestrial systems in “other designated frequency bands”

In this paragraph, ‘other designated frequency bands’ means the 2100 MHz band, which is to say, the 1900 to 1980 MHz band and the 2110 to 2170 MHz band.

Where the Licensee has deployed one or more than one terrestrial system in other designated frequency bands on foot of a licence or licences granted under section 5 of the Act of 1926, which provides or provide a seamless service with Terrestrial Systems in one or more than one of the 800 MHz, 900 MHz and 1800 MHz bands, up to 35% of the population coverage (that is to say, one-half) of the 70% of the population coverage obligation set out in Section 3(1) above may be met using coverage provided by the terrestrial systems in these other designated frequency bands.

¹⁴⁶ As defined in EC Decision 2009/766/EC as amended by Decision 2011/251/EU.

¹⁴⁷ “Other terrestrial systems” means an electronic communications network not otherwise listed in this Annex that complies with Decision 2010/267/EU (for the 800 MHz band) or Decision 2009/766/EC as amended by Decision 2011/251/EU (for the 900 MHz band and 1800 MHz band), as applicable.

¹⁴⁸ As with the GSM, UMTS and LTE Terrestrial Systems, coverage will be measured using a device matching the appropriate Users Equipment standard for the system in use.

¹⁴⁹ Corrected for the bandwidth used but based on a harmonised European or International standard which would be confirmed following consultation with stakeholders.

¹⁵⁰ This would be the C/I ratio giving a quasi error free channel, following a standards based approach.

3) Reporting of Compliance

Every twelve months, the Licensee shall measure and submit an annual compliance report to the Commission on coverage.

The measurements required for this compliance report shall be agreed with the Commission in advance and the compliance report shall have sufficient detail and granularity to allow the Commission to verify the Licensee's measurements.

Where the Licensee is claiming to have met the minimum coverage and roll-out obligation set out in Section 3(1) above for the first time, the compliance report shall contain drive test measurements. These drive test measurements are to be carried out at the Licensee's own expense and to a standard as agreed with the Commission.

Upon request by the Commission,¹⁵¹ the Licensee shall carry out drive test measurements and submit these results to the Commission. These drive test measurements are to be carried out at the Licensee's own expense and to a standard as agreed with the Commission.

The Licensee shall submit this compliance report each calendar year within 31 days of the anniversary of the Licence Commencement Date of the Liberalised Use Licence.

In the compliance report the Licensee shall notify the Commission whether it has either (a) met the relevant coverage and roll-out obligation specified in relation to the Licensee in Section 3 (1) above, or (b) failed to meet the said obligation and reasons for same.

Failure by the Licensee to so notify the Commission shall be deemed to comprise non-compliance with both this reporting obligation and the relevant coverage and roll-out obligation.

Section 4: Quality of Service (QoS) Obligations

1) The Minimum "Availability of the Network" Standard

The "availability of the network" shall be measured in terms of "network unavailability" and reported on an annual basis.

¹⁵¹ The Commission does not envisage drive test measurements being required on a frequent basis, but notes that such measurements may be appropriate in circumstances where:

- a Licensee is submitting a compliance report on coverage for the first time;
- the Commission's own verification checks, drive test measurements or other information suggests that there may be discrepancies in the compliance report on coverage or the Licensee may not be meeting its coverage obligation.

"Network unavailability" means the average number of minutes per terminal per six month period for which services on the network are not available due to a network disturbance, failure or scheduled unavailability.

"The network" means any Terrestrial System which uses the Licensed Spectrum Blocks.

The Licensee shall ensure that network unavailability is less than 35 minutes (based on the weighting factors set out in Table 6 below) per six month period.

Table 6: Weighting Factors for Network Unavailability tracking all periods of network unavailability.

Network Unavailability, Weighting Factors (divide duration of each network event by weighting factor)			
	Monday to Friday	Saturday	Sunday
For periods between 07.00 and 24.00	1	2	4
For periods between 00.00 and 07.00	4	8	16

The Licensee shall maintain this network log in a manner that will demonstrate to the satisfaction of the Commission that such a network log is an adequate means of assessing whether the Licensee is complying with its "availability of the network" obligation under this Licence.

The network log, or as may be appropriate part thereof, shall be made available on request to the Commission.

The Licensee shall calculate the network unavailability for any period specified by the Commission from the information recorded in the network log, and shall, upon request and within such time as may be specified by the Commission, provide the Commission with the results of the calculation.

2) The Minimum "Voice Call" Standard

Where the Licensee and/or any third party via contractual or other arrangements with the Licensee, provides a "voice call" service on a Terrestrial System which uses the Licensed Spectrum Blocks, the Licensee shall comply with the minimum "voice call" standard as set out in Table 7 below.

Table 7: The minimum “voice call” standard for each 6 month period for annual reporting

	Average	Worst Case
Maximum Permissible Blocking Rates This refers to the maximum percentage of total call attempts which are unsuccessful during the time consistent busy hour. ¹⁵²	2%	4%
Maximum Permissible Dropped Call Rates This refers to the maximum percentage of total originating calls which are prematurely released by the network within 3 minutes of the call being made.	2%	4%
Transmission quality The Licensee shall ensure that the speech transmission quality is as good as or better than the speech quality associated with the GSM Standard and GSM Technical Specifications of ETSI. The Licensee shall ensure that appropriate echo treatment equipment is used and that it is properly configured.		

“voice calls” does not include Voice over Internet Protocol (“VoIP”) calls

Where a “voice call” service is provided by the Licensee and any third party via contractual or other arrangements with the Licensee, the minimum voice call standard shall be calculated by combining the “voice call” measurements of the Licensee with that of the third party.

3) Reporting on Compliance

Every twelve months, the Licensee shall measure, and submit an annual compliance report to the Commission on (a) the availability of the network QoS standard and (b) the voice call QoS standard.

The measurements required for this compliance report shall be agreed with the Commission in advance and the compliance report shall have sufficient detail and granularity to allow the Commission to verify the Licensee’s measurements.

¹⁵² “Time consistent busy hour” means the period of one-hour starting at the same time each day for which the average traffic of the network concerned is greatest over the days under consideration. The time consistent busy hour shall be determined from an analysis of traffic data obtained from the service and be subject to ComReg’s approval.

The ‘Time consistent busy hour’ is determined from the operator’s voice traffic. It is the one-hour period during which there is the highest level of traffic. The blocked call rates are measured for the same one-hour period during each review period (i.e. 6 months). The one-hour period is determined by the operator and is subject to ComReg’s approval.

Upon request by the Commission ¹⁵³ the Licensee shall carry out drive test measurements and submit these results to the Commission. These drive test measurements are to be carried out at the Licensee's own expense and to a standard as agreed with the Commission.

The Licensee shall submit this compliance report each calendar year within 31 days of the anniversary of the Licence Commencement Date of the Liberalised Use Licence.

In the compliance report the Licensee shall notify the Commission whether the Licensee has either (a) met the relevant QoS obligations as set out in Section 4 (1) and Section 4 (2) above, or (b) failed to meet the said obligation and reasons for same.

Failure by the Licensee to so notify the Commission shall be deemed to comprise non-compliance with both this reporting obligation and the relevant Quality of Service obligations.

¹⁵³ The Commission does not envisage drive test measurements being required on a frequent basis, but notes that such measurements may be appropriate in circumstances where:

- a Licensee is submitting a compliance report on QoS for the first time;
- the Commission's own verification checks, drive test measurements or other information suggests that there may be discrepancies in the compliance report on QoS or the Licensee may not be meeting its QoS obligations.

Annex 9: Co-Existence of the 800 MHz Band and DTT

A 9.1 This Annex sets out ComReg's consideration of measures necessary to facilitate the coexistence of ECS services in the 800 MHz band with the broadcasting service in the band 470-790 MHz. In summary:

- ComReg set out its position in Document 11/60 in relation to concerns raised by parties regarding potential impact on DTT services caused by new 800 MHz licensees. Within this Document, ComReg considered the implementation of 'Case A' BEM from Decision 2010/267/EU in tandem with the exclusion of Channel 60 from DTT deployment significantly minimises the likelihood of interference for DTT consumers. In relation to receiver overload and DTT service degradation from user terminals, ComReg considered both of these issues are issues which if exist, are remedied by the receivers; e.g. overloading at the DTT receiver is primarily a function of the receiver system and therefore DTT community in Ireland should inform consumers on this matter.
- Five respondents to Document 11/60 provided comments on ComReg's position. Of these Arqiva, TG4 and RTE raised some concerns regarding interference risks to DTT users from 800 MHz deployments. Further, RTE in further correspondence also posited that DTT users should be offered more protection, and that the best approach is to have an agreed mechanism and process in place to address issues with antenna systems as and when they arise.
- Further information regarding international studies and licence conditions on the 800 MHz band has taken place since the publication of Document 11/60 in August 2011, and ComReg has duly considered these developments. ComReg notes that most European countries adopted 'Case A' BEM as ComReg proposed in Document 11/60, and ComReg will accordingly apply this BEM. ComReg noted that the maximum in-block EIRP limit for 800 MHz base stations used in other countries vary, yet all lie within the thresholds set out in Decision 2010/267/EU. Taken this information into account alongside respondent's views, ComReg's final position is to set the limit at 59dBm/5MHz.

- RTE raised numerous issues, which ComReg assessed and addressed. In relation to concerns of degradation of DTT services from user terminals, ComReg notes that relevant studies support ComReg's view that this issue is small and transient in nature, and can in any case be resolved by moving the terminal away from the DTT receiver.
- ComReg also considered interference concerns raised by TG4, RTE and Arqiva. ComReg notes that the number of households potentially affected by SINR degradation is a lot lower than suggested by RTE when additional filtering is used. Additionally, ComReg also notes that studies carried out by Sweden, Norway, Denmark and the UK all support ComReg's view that SINR degradation issues tend to be focused on the highest UHF Channel (being Channel 60), and SINR degradation for the remaining UHF channels is likely to be minor. In this regard, ComReg concludes that not using Channel 60 for DTT in Ireland will result in instances of degradation to other UHF channels to be minor in scale. Any such SINR degradation will be addressed by ComReg in line with its statutory obligations.
- RTE raised concerns surrounding potential overload issues for DTT users and who should be responsible for mitigating such issues. ComReg recognises that respondents agree with its view that receiver overload is a function of the receiver system and is best mitigated by using filters within the DTT receiver system. ComReg also recognises that numerous international studies support the view that filters are the most appropriate measure to address receiver overload issues. ComReg also disagrees with RTE's assertion that suitable filters are not currently available, as ComReg has sourced such filters for €19 each.
- ComReg's final position on overload is that it is a matter for consumers to ensure that their television reception system is adequately installed to ensure protection from 800 MHz deployments. In this regard, ComReg urges RTE (and by extension 'Saorview') to inform consumers of these potential issues and information on remedies in an easy to understand manner to avoid receiver overload, which is a function of the consumers receiving equipment.

A9.1 Summary of ComReg's Position in Document 11/60

- A 9.2 Annex 10.4 of Document 11/60a discussed the coexistence of ECS services in the 800 MHz band with services in the band 470-790 MHz.

A 9.3 In Annex 10.4 of 11/60a, ComReg noted that this matter had been raised by two respondents (RTÉ and RTÉNL, and UPC) in their responses to Document 10/71, one or both of these respondents among other things:

- asserted that further studies and consultation with the industry were required in order to ensure that services implemented in the 800 MHz band do not impact on broadcasting services in the adjacent band;
- expressed concern that no reference was made to the ‘additional mitigation techniques’ that could be applied under Decision 2010/267/EU. In this regard RTÉ and RTÉNL noted that additional mitigation techniques were being considered in other jurisdictions (including the UK and Denmark);
- recommended that a separate entity be set-up, independent of 800 MHz licensees, as a point of contact for reports of interference or loss of service, to ensure a prompt resolution for the affected viewers.

A 9.4 Before setting out its assessment of the above issues, ComReg first provided an overview of:

- international studies and licence conditions proposed or implemented in other countries,¹⁵⁴ and
- the Digital Terrestrial Television (‘DTT’) network and 800 MHz context in Ireland.¹⁵⁵

Overview of international studies and licence conditions in other countries

A 9.5 At a European level, ComReg noted that this issue had been studied by the European Conference of Postal and Telecommunications Administrations (‘CEPT’) and noted in particular CEPT Reports 30¹⁵⁶ and 31.¹⁵⁷ ComReg noted that both of these reports were used by the European Commission to form the

¹⁵⁴ See paragraphs A10.67 to A10.98 of Document 11/60a

¹⁵⁵ See paragraphs A10.99 to A10.105 of Document 11/60a

¹⁵⁶ CEPT Report 30: “Report from CEPT to the European Commission in response to the Mandate on The identification of common and minimal (least restrictive) technical conditions for 790 - 862 MHz for the digital dividend in the European Union”,
<http://www.erodocdb.dk/Docs/doc98/official/pdf/CEPTREP030.PDF>

¹⁵⁷ CEPT Report 31 is discussed in Annex 5 of 11/60a. CEPT report 31: “Report from CEPT to the European Commission in response to the Mandate “Frequency (channelling) arrangements for the 790-862 MHz band” (Task 2 of the 2nd Mandate to CEPT on the digital dividend),
<http://www.erodocdb.dk/Docs/doc98/official/pdf/CEPTREP031.PDF>

technical conditions for the 800 MHz sub-band as set out in the Annex to Decision 2010/267/EU.¹⁵⁸

- A 9.6 CEPT Report 30 defined the least restrictive technical conditions for the 800 MHz band in the form of Block Edge Masks ('BEMs') and it also recognised that BEMs do not always provide the required level of protection for broadcasting reception. ComReg noted that Annex 4 to CEPT Report 30 provided a list of potential mitigation techniques which may be used by national administrations to solve or minimise the loss of broadcasting reception on a local/regional/national basis.
- A 9.7 Similar to CEPT Report 30, ComReg noted that while Decision 2010/267/EU obliges member states to apply the BEMs as set out in its Annex, it also recognises that these BEMs "*do not always provide the required level of protection of victim services and additional mitigation techniques would need to be applied in a proportionate manner at national level in order to resolve any remaining cases of interference*".
- A 9.8 From a review of other European countries, ComReg recognised that this issue had already been considered by a number of countries and ComReg provided information on the situation in Denmark, France, Germany, Sweden, Switzerland and The United Kingdom in Annex 10.4 of Document 11/60a. In general, ComReg noted that the 800 MHz licence conditions set or proposed in each of these countries varied depending upon national circumstances and national administrations were at different stages in the development of their respective proposals.

Overview of the DTT network and 800 MHz context in Ireland

- A 9.9 In Annex 10.4 of Document 11/60a, ComReg provided information on the legislative framework and spectrum requirements for DTT in Ireland, and outlined the status of DTT network spectrum planning and the 800 MHz band clearance planning in Ireland.
- A 9.10 ComReg noted that the Broadcasting Act 2009¹⁵⁹ (the '2009 Act') sets out the legislative framework and spectrum requirements for DTT in Ireland, and this legislation provides for ComReg to license up to two national digital multiplexes

¹⁵⁸ Decision 2010/267/EU, "Commission Decision of 6 May 2010 on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union" <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010D0267:EN:NOT>

¹⁵⁹ <http://www.irishstatutebook.ie/2009/en/act/pub/0018/index.html>

to RTÉ and at least four DTT multiplexes to the Broadcasting Authority of Ireland ('BAI'). ComReg noted that two digital multiplex licences had already been issued to RTÉ and stated that it did not expect to issue further multiplex licences prior to Analogue Switch Off ('ASO').

- A 9.11 In relation to spectrum planning (i.e. identifying the necessary spectrum requirements for DTT and clearing the way for the availability of the 800 MHz band for non-broadcasting services at ASO), ComReg noted that this was well underway. It was noted that the first two digital multiplex licences had been issued to RTÉ, and these licences used UHF channels 21 to 59. ComReg stated that it expected that *“any future spectrum requirement for commercial DTT, can be fulfilled using UHF channels 21 to 59 (470 – 782 MHz) only”*.

ComReg's assessment of and proposed coexistence measures

- A 9.12 Paragraphs A10.106 to A10.144 of Document 11/60a set out ComReg's assessment of the measures necessary to facilitate the coexistence of services in the 800 MHz band with services in the 470-790 MHz Broadcasting Band.
- A 9.13 ComReg firstly considered the appropriate BEMs that should be applied to Liberalised Use licences in the 800 MHz band. ComReg noted that Decision 2010/267/EU obliges member states to set a BEM and that most (if not all) European countries had set or proposed the use of the 'Case A' BEMs. In light of this, ComReg proposed that all Liberalised Use licensees in the 800 MHz band would be required to meet the 'Case A' BEMs and this would apply to all frequencies below 790MHz and at all geographic regions in the State.
- A 9.14 ComReg then considered whether it was appropriate to set a maximum mean in-block Equivalent Isotropically Radiated Power ("EIRP") limit for 800 MHz base stations. Given the coexistence issues that may arise due to the introduction of new services in the 800 MHz band, ComReg believed that it was prudent to set such a limit. ComReg noted the maximum in-block EIRP limit as set or proposed in Sweden, Switzerland and the UK, and proposed to set the maximum mean in-block EIRP limit for 800 MHz base stations in Ireland at 59 dBm/5MHz. ComReg noted that the in-block EIRP may be reviewed in the future if required.
- A 9.15 ComReg next considered whether it was appropriate to apply 'additional mitigation measures'. ComReg considered this issue in relation to three distinct loss of broadcasting reception matters, namely;
- (a) SINR ("Signal to Interference plus Noise Ratio") degradation;

- (b) Receiver overloading; and
- (c) Degradation of service from user terminals.

A 9.16 Additionally, ComReg considered whether it would be appropriate to establish a separate entity to deal with ‘interference complaints’.

(a) SINR Degradation

A 9.17 ComReg noted that SINR degradation can occur when a wanted signal is interfered with by an unwanted (or interfering) signal. In considering SINR degradation issues, ComReg noted that it is normally the channels which are closest to the other services that experience SINR degradation issues and given this, ComReg noted that most international studies have focussed on the uppermost UHF channels (i.e. channels 60, 59 and 58).

A 9.18 ComReg noted the studies carried out in the UK (June 2011)¹⁶⁰ and Sweden (Feb 2008),¹⁶¹ and the position in Switzerland.¹⁶² Given these studies, ComReg believed that most (if not all) SINR degradation issues would likely occur in UHF channel 60 and if there are instances of SINR degradation in other channels, then these are likely to be minor. ComReg noted that DTT spectrum planning in Ireland is focused on using channels 21 – 59 only and given this, it believed that it was not necessary to specify ‘additional mitigation measures’ on the 800 MHz Liberalised Use licensee to protect the broadcasting service below 790 MHz in relation to SINR degradation matters.

(b) Receiver Overload

A 9.19 ComReg noted that receiver overloading can occur when the DTT receiver becomes overloaded or desensitised, due to the general presence of a high power radio signal.¹⁶³ ComReg believed that receiver overloading issues are primarily a function of the receiver system (i.e. the aerial, masthead amplifier/amplifier, DTT receiver and/or cabling).

¹⁶⁰ <http://stakeholders.ofcom.org.uk/consultations/coexistence-with-dtt/>

¹⁶¹ <http://www.pts.se/upload/Rapporter/Radio/2009/Report-DVB-T-vs-mobile-network-interference-study-2008-02-05.pdf>

¹⁶² In Switzerland no DTT broadcasting services are planned for Channel 60. Given this the Swiss Regulator (‘OFCOM’) maintains that “few problems with the protection of DTT services are expected in Switzerland” <http://www.bakom.admin.ch/themen/frequenzen/03569/index.html?lang=en>

¹⁶³ This high power radio signal could be in the same frequency band (i.e. a broadcasting signal) or in adjacent frequency bands (e.g. a mobile signal in the 800 MHz band or other communications services signals in the bands below 470 MHz).

- A 9.20 In considering this matter, ComReg noted the results of CEPT Report 30 and Ofcom's (June 2011) technical analysis study¹⁶⁴ in light of these studies, ComReg believed that the most effective and appropriate way of addressing receiver overloading issues is by using appropriate filtering in the DTT receiver system. ComReg believed that it is important that the DTT community in Ireland (i.e. service provider(s), vendors and installers) advise consumers of this potential loss of broadcasting reception matter so that DTT receiver systems installed at consumers' premises would have appropriate filtering fitted where required.
- A 9.21 In light of the above, ComReg did not propose any 'additional mitigation measure' on the 800 MHz Liberalised Use licensee in relation to receiver overload matters.

(c) Degradation of Service from User Terminals

- A 9.22 ComReg noted that degradation of service from user terminals can occur when terminals, such as mobile handsets, are operated in close range of DTT receiving equipment, and this can result in the broadcasting reception being lost or degraded
- A 9.23 In considering this matter, ComReg noted that CEPT Report 31 proposed a reverse Frequency Duplex Direction ("FDD") mode for the 800 MHz band, and the net effect of this is that there is a minimum frequency separation of 42 MHz between the 800 MHz user terminals and services in the Broadcasting band below 790 MHz. In addition, ComReg noted that this issue was discussed in Ofcom's (March 2011) consultation¹⁶⁵ where Ofcom stated it was of the view that 800 MHz user terminal interference into domestic television systems (cable or DTT) is manageable.
- A 9.24 In light of this information, ComReg believed this issue to be minor and transient in nature given that the user can resolve this interference by moving the user terminal away from the DTT receiver and/or improving the quality of the DTT installation (e.g. using appropriately shielded TV cabling and the installation of a filter). ComReg did not propose any 'additional mitigation measure' on the 800 MHz Liberalised Use licensee to address this matter.

Establishing a separate entity to deal with 'interference complaints'

¹⁶⁴ <http://stakeholders.ofcom.org.uk/binaries/consultations/dtt/annexes/Technical-Report.pdf>

¹⁶⁵ *Consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues*
<http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/summary/combined-award.pdf>

- A 9.25 Finally ComReg noted that RTÉ suggested that a separate entity should be established, independent of the future licensees of the 800 MHz band, as a point of contact for reports of interference or loss of service issues.
- A 9.26 In considering this matter, ComReg noted its view (as set out in Annex 10.4 of 11/60a) that any loss of service or interference is likely to affect a small number of consumers and it would therefore not appear to warrant the establishment of a separate entity. Given this, ComReg proposed that:
- *“any loss of service and/or interference issue should first be reported to the relevant service provider who would then determine the potential cause of this interference and/or loss of service issue.*
 - *If it is determined that the issue is attributable to radio interference between services, then the service provider can report this issue to ComReg who has a statutory function to investigate instances of interference across all radio-communications services.”*

A9.2 Views of Respondents

- A 9.27 ComReg received comments from five respondents, RTÉ and RTÉNL (“RTÉ”), TG4, Arqiva, H3GI and eircom Group, on its proposals regarding the co-existence of ECS services in the 800 MHz band with the broadcasting service in the band 470-790 MHz. The views of these respondents are set out below.
- A 9.28 In its response to Document 11/60,¹⁶⁶ RTÉ:
- believed that ComReg’s proposal did not provide an appropriate level of protection to the broadcast service in the adjacent band and is inappropriate in terms of the potential damage it could cause to the emerging DTT platform. RTÉ believed that if this spectrum is released as proposed by ComReg, *“interference can be expected to affect at least 2.5% of Irish SAORVIEW / DTT households by RTÉNL’s estimates (circa 50,000 Irish households)¹⁶⁷ and possibly more”*;

¹⁶⁶ RTÉ and RTÉNL also submitted a response to Document 11/75 where it considered that the proposed 800 MHz licence conditions were unsatisfactory and referred ComReg to its response to Document 11/60.

¹⁶⁷ Footnote 2 of RTÉ’s response to Document 11/60 stated *“2.5% of households is derived by applying Ofcom’s analysis in the UK (2.8% of households including channel 60), taking account of the exclusion of Channel 60 for core broadcasting as proposed in the draft Decision document.”*

- expressed concerns regarding ComReg’s proposed application and approach to the implementation of Decision 2010/267/EU. It believed this to be inappropriate and is in contrast to other countries where 800 MHz spectrum is being released. In addition, it believed that the draft RIA is incomplete as no reference is made to the impact of new services in the 800 MHz band on broadcasting services below 790 MHz; and
- sought clarification on whether or not ComReg is considering that some of the revenues received from the spectrum award be used to cover any costs associated, and to compensate the broadcasters for any costs they incur in implementing interference mitigation.

A 9.29 RTÉ urged ComReg to consider and consult on a number of actions¹⁶⁸ before proceeding to award licences in the 800 MHz band, and it provided a number of specific comments¹⁶⁹ on Document 11/60a.

A 9.30 Among other items in its specific comments, RTÉ:

- stated that it believed that ComReg needs to work with the Programme Making and Special Events (PMSE) and Outside Broadcast (OB) licensees in the 800 MHz band to ensure that adequate alternative spectrum can be allocated to facilitate their migration to below 790MHz;
- welcomed the application of ‘Case A’ BEM in all cases;
- noted that Switzerland’s DTT situation and approach differs with respect to Ireland in a number of ways;¹⁷⁰.

¹⁶⁸ The following actions were listed by RTÉ:

- *“Conduct a detailed study, with direct engagement from the industries concerned, to estimate the potential level of interference in Ireland and the impact of all relevant mitigation methods.*
- *Establish what is an acceptable level of lost coverage for DTT (after mitigation).*
- *Conduct a cost analysis on interference mitigation.*
- *Create a licensing framework that minimises the amount of interference expected for broadcast viewers before it occurs, including pre-emptive action from the licensee likely to cause the interference.*
- *Create a framework to manage viewers who experience interference, ensuring the shortest time possible between a complaint of interference being reported to its being resolved.*
- *Create a framework to fund the cost of resolving interference issues.”*

¹⁶⁹ See section 2 of RTÉ’s response to Document 11/60.

¹⁷⁰ RTÉ noted the following differences: *“Switzerland proposes a lower in-block EIRP than ComReg. A general clause in 800MHz licence to cover interference is proposed in Switzerland. Terrestrial broadcast television has a particularly low penetration in Switzerland at approximately 7% of households, so cases of interference can be expected to be less common and more manageable.”*

- asserted that, after examining the Ofcom results, ComReg is incorrect to that “*most (if not all) SINR degradation issues would likely occur in channel 60*”.
- suggested that “*ComReg should consider base station filtering measure given the number of people living in managed apartment complexes where communal reception systems may be the only option for receiving free to air television.*” RTÉ believed that it is a simple solution for the mobile operator to implement pre-emptively without causing any disruption to the television viewer;¹⁷¹
- noted that “*while the effects of receiver overloading may be considered a function of the receiver it is worth noting that without a high power interfering signal, the overloading would not occur. A more understandable and fairer approach being applied elsewhere is the “polluter pays” principle [cf. Arqiva¹⁷²], where the new licensee is responsible for the mitigation of any problems they are likely to cause*”;
- agreed that the use of filters at the receiver is the most effective solution for the majority of potential overload issues.
- noted, in relation to interference from mobile devices (i.e. uplink interference) into broadcast television reception, that it is important to understand that mitigation by simply moving the interferer away from the television receiver may not always be practical. At some of the distances concerned¹⁷³ the interferer may be in a separate dwelling in a multi-tenant building and completely unaware that they are causing a problem to a neighbour’s reception.
- believed that the potential disruption by mobile interference into the broadcasting service is sufficiently serious to merit that some public entity, independent of ComReg and the licensees, be charged with ensuring interference complaints are quickly remedied. It noted that ComReg’s

¹⁷¹ RTÉ noted Ofcom’s work in its June 2011 consultation on the “*Technical analysis of interference from mobile network base stations in the 800 MHz band to digital terrestrial television*”, and stated that “*according to the Ofcom work additional base station filtering is particularly effective at reducing interference at channel 59, and reduces the interference by up to 99.99%, compared to 97.5% for receiver filtering alone, in a communal receive system scenario.*”

¹⁷² Arqiva response to Ofcom’s consultation:
<http://stakeholders.ofcom.org.uk/binaries/consultations/dtt/responses/arqiva.pdf>

¹⁷³ RTÉ noted that CEPT Report 30 on this matter found that the worst case interference scenario resulted from a separation distance of approx. 22m

proposal is likely to require a number of sequential steps and take several months to resolve a complaint.

A 9.31 Following correspondence between ComReg and the DCENR's Digital Switchover Group ('DSG'),¹⁷⁴ RTÉNL submitted further correspondence¹⁷⁵ to ComReg and stated that it agrees with the vast majority of the technical detail of ComReg's letter of the 21 December 2011. In addition, RTÉNL highlighted the following:

- RTÉNL believes ComReg's letter of the 21 December 2011 takes little account of the practical issues for home aerial installations caused by the policy decision to reduce the broadcast spectrum;
- RTÉNL believes that a policy decision to remove the 800 MHz band from the spectrum used by broadcasting is going to cause problems for "*a small but not insignificant number of homes*". RTÉNL also believe that with effort from the members of the Digital Switch-over Group,¹⁷⁶ including any new 800 MHz band services operator, such effort would make a substantial beneficial contribution to a smooth ASO and launch of any new 800 MHz band service.
- RTÉNL believes that technically the solution is simple:
 - that a suitable filter be installed between the aerial and the amplifier;
or
 - that a new reduced band/narrow band aerial or amplifier be installed.
- As the removal of the 800 MHz band from the spectrum used by broadcasting "*is new to the world of television aerial systems manufacturers and system installers*", RTÉNL believes that at present no suitable amplifiers, aerials, low-band pass, notch or other filter are easily available from any retailers or manufacturers at an affordable price; RTÉNL notes that this area is completely unregulated and it is largely reactive rather than proactive.
- RTÉNL notes that most aerial systems were installed in the last 20 years to the relevant, and still current, technical and policy standards (until 24

¹⁷⁴ See item 20 in ComReg Document 11/102 "ComReg: Letter to DCENR of 21 December 2011 "Overload Problem" (email and letter of 21 December 2011)"

¹⁷⁵ See ComReg 12/21 RTÉNL's email response of 4 January 2012 to ComReg's Letter of 21 December 2011 "Overload Problem".

¹⁷⁶ The DSG is a working group created and chaired by DCENR, which includes DCENR, RTÉ, RTÉNL, the BAI and ComReg to discuss issues related to ASO in Ireland.

October 2012). RTÉNL and SAORVIEW are talking to the various installers and industry groups and all are aware of this current/future issue of co-existence between 800 MHz band services and DTT. RTÉNL believes that as a sufficient volume of homes experience interference problems, suitable filters will appear on the market, hopefully at a cost less than c. €20, plus installation. RTÉNL believes that in the future installations with filters, reduced band aerials, reduced band amplifiers, etc. will become the industry norm. RTÉNL and SAORVIEW are continually talking to TV installers on this issue and state that ComReg “*may be right that the public should be informed as well*”.

- RTÉNL believes that as the vast majority of homes will not be impacted in any way in the foreseeable future, it would be counterproductive to the aims of the DSG to inform every home in the country with an aerial, that their aerials will not meet the relevant standards from October 24 2012. RTÉNL believes that such a message has the potential to damage the migration from analogue television services to DTT in advance of ASO, and/or in advance of a suitable technical solution being available, the message should be carefully crafted, agreed and consistent across the DSG Group.
- RTÉNL believes that instead of informing every home in the country with an aerial, that their aerials will not meet the relevant standards, it would be more practical to have an agreed mechanism and process in place to address any issues with home antenna systems as and when they arise, in conjunction with the roll-out of the new services.
- RTÉNL believes a common message by the various relevant authorities (DCENR, BAI, ComReg) and the broadcasters would help encourage the necessary filters or narrowband aerials or amplifiers onto the shelves at an earlier date. An important part of this is ComReg and/or the DCENR clearly confirming to the industry what the actual broadcast digital dividend is, its implications for antenna systems and its timing. Additionally ComReg clearly confirming that these new adjacent telecommunication services are actually going to materialise and an expected timeframe.
- RTÉNL state that it believes that a technical solution is unlikely to be available in advance of the 800 MHz band services launching, without intervention, and RTÉNL think it is critical that the parties rolling out the new 800 MHz band services are compelled to be involved in the resolution.

- A 9.32 TG4 stated that ComReg's proposals were a source of some concern to it. It suggested that a study on the effects of the spectrum release be carried out and proposed that "*Ireland follow[s] best practice in other EU countries with the licensee being held responsible for mitigating against interference and for dealing directly with complaints from affected viewers*".
- A 9.33 H3GI commented on the maximum EIRP level. It noted that Sweden had set the maximum EIRP levels at 64 dBm and 67 dBm, and in light of Ireland's geography, it believed that this would be a more suitable level.
- A 9.34 eircom Group provided a number of specific comments and stated that:
- it had no objection to the proposed licence obligations setting Case A BEMs and a maximum in-block EIRP limit of 59 dBm/5 Mhz for the 800 MHz band;
 - while it generally supported the thrust of ComReg's conclusions on SINR degradation, it sought clarification on a number of matters:¹⁷⁷
 - It agreed with ComReg's conclusion that the most effective and appropriate means to address receiver overload is the use of appropriate filters in the DTT receiver system. In addition it welcomed ComReg's clarification that the onus rests with the DTT community in Ireland to ensure consumers are suitably advised; and
 - It fully concurred with ComReg that degradation of service from user terminals is minor and transitory in nature and is best managed by users of the equipment directly.
- A 9.35 Arqiva noted concerns associated with the heightened risk of interference to DTT services from the introduction of wireless mobile broadband services based on LTE technology in the 800MHz band. It noted the studies and

¹⁷⁷ Specifically, eircom Group sought clarification on:

- Use of channels 58 and 59: It noted that the current DTT plan shows 8 occurrences of the use of channels 58 and 59;
- Interference investigation: Noting the potential for SINR degradation to occur in channels 58 and 59 and ComReg's statutory obligations regarding investigation of such, it requested clarification as to what liability, if any, may arise in respect of a mobile operator that is compliant with the technical conditions of its licence;
- Cross border SINR degradation: It sought similar clarification in relation to cross-border investigations involving a DTT service in Northern Ireland.
- Long term planning and potential for a second digital dividend: eircom Group proposed that the DTT channel plan should be amended to ensure use of the upper channels be minimised to the maximum extent possible and in particular use of channels 58 and 59, in addition to channel 60 should be avoided.

consultation process undertaken by Ofcom, the UK regulator, and stated that it was keen to work with ComReg to ensure adequate protection arguments are afforded to DTT services to minimise any risk of interference.

A9.3 Updated Information

- A 9.36 Since Document 11/60a was published further information has been made available to ComReg on the international studies and licence conditions proposed or implemented in other countries and the DTT network and 800 MHz context in Ireland. This section sets out this updated information and should be read in conjunction with information set out in Document 11/60a, namely paragraphs A10.67 to A10.105.
- A 9.37 ComReg considers these studies to be relevant and comparable to the situation prevailing in Ireland – at least in so far as concerns the issue at hand. Interested parties should also note that ComReg has not blindly followed the studies in other countries but has considered their application to the specific situation in Ireland.

A9.3.1 Overview of International studies and licence conditions in other countries

- A 9.38 In addition to the information set out in Document 11/60a,¹⁷⁸ this section provides updated information from:
- the European Committee for Electrotechnical Standardization ('CENELEC') / European Telecommunications Standards Institute ('ETSI') joint working group on the digital dividend;
 - Denmark;
 - Norway;
 - Portugal; and
 - The UK.

A9.3.1.1 CENELEC/ETSI Joint Working Group on the Digital Dividend

¹⁷⁸ See paragraphs A10.67 to A10.75 for "Overview of European studies" and paragraphs A10.76 to A10.98 for "overview of studies and licence conditions in other countries",

- A 9.39 In September 2010¹⁷⁹, ‘*The concise report of the CENELEC/ETSI Joint Working Group on the digital dividend*’ was published.¹⁸⁰ This report was prepared by the CENELEC/TC 210/WG 10 (JWG with ETSI).
- A 9.40 This report finds that DTT consumer equipment installed and equipment which will be manufactured over the next few years do not address the new DTT technical operating conditions where the 790 – 862 MHz frequency band is no longer a DTT band. The report suggests that two distinct issues need to be addressed:
- “*New requirements in the relevant standards to ensure the electromagnetic compatibility of future equipment need to be developed as a matter of urgency (within the next 12 months);*”
 - “*Pragmatic mitigation measures need to be developed to deal with anticipated interference cases in existing and near future equipment.*”
- A 9.41 Among the relevant standards indicated as requiring revision, the report noted:
- “*The radiated immunity test level for equipment containing DVB tuners for the frequency range 790 – 862 MHz for the tuned channel is proposed as 1 V/m and for other than the tuned channel in the 790- 862 range 3 V/m is proposed;*”
 - “*The present specifications for receiver parameters for CPE need revision due to the change in the ambient electromagnetic environment;*”
 - “*Standards for coaxial networks need to be revised;*”
- A 9.42 The report also indicates that consumers will need to be informed of the possibility of interference arising as Electronic Communications Service Networks (‘ECNs’) are deployed in the 800 MHz band and on the importance of the use of correct in-home cabling to minimise interference.

A9.3.1.2 Denmark

- A 9.43 In 2011, the Danish Telecommunications Authority (‘NITA’):

¹⁷⁹ Approved by CENELEC on the 12 August 2010 and ETSI on 24 September 2010.

¹⁸⁰ This document is a summary report from the CENELEC/ETSI Joint Working Group on the Digital Dividend based on the analysis which is presented in the Technical Report on the Overview of the Coexistence Issues Stemming from the Current Digital Dividend Decisions.
http://ec.europa.eu/enterprise/sectors/electrical/files/emc/approved-jwg-report-on-ddr1-2_en.pdf

- published a study carried out by DotEcon and Analysys Mason considering the potential interference to DTT from future mobile use of the 790 – 862MHz band (“the 800MHz band”) in Denmark;¹⁸¹ and
- launched a public consultation on a draft framework and information memorandum for an auction of the 800 MHz Band.¹⁸²

Study on the Co-existence of LTE systems in 790-862 MHz with Digital Terrestrial in Denmark

A 9.44 In this study DotEcon and Analysys Mason were asked to: -

- analyse the scope for use of the 800 MHz band;
- assess the risk of interference from the use of the 800 MHz band to DTT services;
- consider whether, and how, any coverage obligations may be imposed on the licences in pursuit of the Danish Government’s overall broadband goal; and
- design a suitable auction.

A 9.45 In relation to the assessment of the risk of interference from the use of the 800 MHz band to DTT services, the report noted that where no mitigation measures are applied between 9,000 and 10,000 households throughout Denmark might be at risk of some kind of interference from mobile use of the 800 MHz band¹⁸³. Two modes of interference were considered; 1) receiver overload and 2) adjacent channel interference (‘ACI’); and the study suggests that:

- Between 2,500 and 3,000 households throughout Denmark might be at risk of interference from receiver overload;
- Between 4,500 and 5,000 households might be at risk of interference from ACI in areas of Denmark receiving DTT services using UHF channel 60, and up to 2,000 households in areas using UHF channel 59.

¹⁸¹ ‘800MHz auction: Co-existence of LTE systems in 790-862 MHz with Digital Terrestrial Television’ August 2011 – By DotEcon and Analysys Mason as commissioned by NITA

¹⁸² Draft Information Memorandum issued by NITA in November 2011

¹⁸³ According to Statistics Denmark (www.statbank.dk), in January 2011 there were 2.58 million households in Denmark.

- A 9.46 Having established that there could be an interference problem from a LTE service in the 800 MHz band to a DTT service, a more detailed analysis to model the effects of a series of realistic LTE network deployments was then conducted. This further analysis took into account that in practice, only a proportion of LTE base stations will transmit at the maximum licensed power level, and the majority will use lower power levels for various practical reasons (e.g. due to planning restrictions, other site restrictions or management of internal interference).
- A 9.47 Following this the feasibility of further reducing the impact of the potential interference from LTE to DTT, through the consideration of various interference mitigation techniques was then assessed.
- A 9.48 In considering the mitigation techniques, it was found that the use of filters at DTT receivers appears to be the most cost effective and practical mitigation technique. The modelling suggested that the use of filtering will substantially eliminate interference from both overload and ACI, leaving a small number of households for which filtering is not suitable. These are most likely to be households viewing DTT services using UHF channel 60 and receiving interference from LTE block FDD1 (i.e. 791 - 796 MHz).
- A 9.49 The report considered other suitable forms of mitigation, which can be applied on a case-by-case basis, including filtering of LTE base stations (which can be used in conjunction with DTT receive filters to further reduce the number of households affected), cross-polarisation between LTE and DTT antennas (i.e. using the opposite of DTT polarisation at LTE sites), and installation of DTT on-channel repeaters. The study noted that the latter might be particularly considered in areas where television viewing households are located at the edge of DTT coverage.
- A 9.50 The report noted that another possible mitigation measure against DTT receiver overload and ACI was to improve the immunity of DTT receivers, by designing them with a higher interference threshold (called overload threshold, or 'Oth') and protection ratio (called 'PR'). A higher Oth and PR limit could be specified within receiver standards for DTT services, to ensure that future receivers are designed with a higher threshold and protection ratio in mind.
- A 9.51 Overall, whilst the initial analysis suggested that interference from LTE to DTT could affect between 9,000 and 10,000 households throughout Denmark, in practice assuming that mobile operators will optimise the power and characteristics of individual base stations within their network, the report noted that the interference problem is substantially reduced. The report noted that the

application of the further mitigation methods could almost eliminate any issues, leaving only a very small number of affected DTT households – possibly of the order of a few hundred in total across Denmark.

- A 9.52 For the remaining few households that would continue to suffer receiver overload or ACI after all appropriate mitigation methods had been considered, the study noted that the only option would be to use an alternative television ('TV') platform such as cable, satellite or IPTV.
- A 9.53 Given that operators are likely to apply reduced power levels in many areas of their network, the report concluded that it is not necessary for NITA to consider any specific licence conditions within the 800 MHz licences other than a maximum EIRP limit.
- A 9.54 In relation to managing interference from the lowermost LTE blocks (FDD1/FDD2, i.e. 791 – 796 MHz/796 – 801 MHz) to DTT services in areas of Denmark using UHF channel 60 (which from the analysis had suggested it could be particularly problematic in terms of potential for ACI), the report suggested that additional requirements could be considered. In this regard, it suggested that it might be necessary to consider a reduced EIRP limit for base stations using blocks FDD1 and FDD2 although it is noted that this limit should be considered carefully in view of its impact upon the ability of mobile operators to provide LTE coverage, particularly in suburban and rural areas.

Public consultation on a draft framework and information memorandum for an auction of the 800 MHz in Denmark

- A 9.55 On 16 November 2011, the NITA together with the Danish Ministry for Business and Growth launched a public consultation on a draft framework and information memorandum for an auction of the 800 MHz Band.¹⁸⁴ Section 2 of the information memorandum sets out the "*licence terms and conditions*" that NITA is proposing to include in the 800 MHz licences.
- A 9.56 The NITA defined two block categories (Block A (791–801 MHz) and Block B (801–821 MHz)) and proposed different technical conditions for these block categories in the geographical areas where UHF channels 60 and 59 are in use by the DTT service.
- A 9.57 For Block category B frequencies, the NITA proposed a maximum in-block EIRP of 59 dBm/5MHz.

¹⁸⁴ Draft Information Memorandum issued by NITA in November 2011

- A 9.58 For Block category A frequencies, the NITA proposed a maximum in-block EIRP per geographically defined areas (pixels) of 20 by 20 metres with EIRP values of either between 30 – 62 dBm/10 MHz or equal to 0 (no base stations using block category A frequencies may be placed in the pixels with an EIRP value of 0). In areas where UHF channels 59 and 60 are not used, the maximum allowed EIRP is 62 dBm/10MHz.
- A 9.59 The NITA explains that the purpose of the restrictions on the in-band EIRP for Block category A frequencies is to ensure that households will be able to use the DTT platform if they have a proper home installation and well performing TV or set-top box, namely:
- A TV-set or set-top box of good quality, e.g. performing within the 10 best performing of current DTT receivers (ECC report 148 of June 2010).
 - A filter in the antenna installation with an equivalent specification to that given for the Braun filter described in the DTT Interference Report for the Danish Telecommunication Authority by Analysys Mason and DotEcon.
 - An antenna installation without components giving rise to separate issues, e.g. antenna amplifiers.
- A 9.60 In addition, the NITA proposed a different BEM for Block category A and Block category B frequencies.
- Table 2.2 to Table 2.5 set out the BEM for the Block category A frequencies and this consisting of four components:
 - Out-of-block requirements for block A (791-801 MHz)
 - Out-of band component in channel 60 areas;
 - Out-of-band component in channel 59 areas;
 - Out-of-band component in areas outside channel 60 and channel 59 areas.
 - Table 2.6 to Table 2.7 set out the BEM for the Block category B frequencies and this consisting of two components:
 - Out-of-block requirements for blocks B1 – B4 (801-821 MHz)
 - Out-of-band component from frequency blocks B1 – B4

A9.3.1.3 Norway

- A 9.61 In April 2011, the Norwegian Ministry of Transport published a public consultation on its proposals to auction the 800 MHz band.¹⁸⁵ In tandem, the Norwegian Post and Telecommunications Authority ('NPT') published a study carried out by Advanced Topographic and Images Limited ('ATDI') on the coexistence of LTE with DTT. This study assessed the potential impact of a Long Term Evolution ('LTE') mobile service operating in the 800 MHz band upon the existing UHF networks using DVB-T that provides a public service in Norway.¹⁸⁶
- A 9.62 The main focus of the assessment was to analyse the potential interference from the adjacent channels in the 800 MHz band and the interference through blocking. The analysis revealed that out of band interference to the existing DVB-T network is predicted to affect anything from 0% to 6.3% of the population. The areas most susceptible are where UHF channel 60 is in use. Instances of interference through blocking were predicted to be relatively small compared to the potential interference from the adjacent channels. The report noted that this is due to the fact that the potentially affected area for blocking is less than 300m around an interfering LTE base station. Therefore the report found that the number of affected people is generally low, but this depends on the population density.
- A 9.63 Options for mitigating interference were assessed in smaller sample areas. The results show that using filters (at the receiver or transmitter end) will help to reduce the interference by 50 % or more. Using vertical polarisation¹⁸⁷ for the LTE network instead of dual slant will reduce the interference dramatically by up to 96 %, due to the fact that in Norway the DVB-T signal is mostly horizontally polarised.
- A 9.64 Several mitigation techniques were investigated in the context of the analysis, however it was reported that no one mitigation technique investigated proved to be 100% effective. The analysis found that each mitigation technique had benefits in terms of cost versus effectiveness. For example, the use of filters at DVB-T receivers demonstrated an improvement of 25% or better. Filtering was also noted as effective against interference through blocking. Another example was the deployment of additional fill-in DVB-T transmission sites small local

¹⁸⁵ <http://www.regjeringen.no/en/dep/sd/dok/hoeringer/hoeringsdok/2011/horing-om-tildeling-av-frekvenser-i-800-.html?id=637994>

¹⁸⁶ 'Interference study for LTE co-existing with DVB-T for NPT' by ATDI - 10 May 2011

¹⁸⁷ According to the 'Interference study for LTE co-existing with DVB-T for NPT' by ATDI - 10 May 2011, the predominant polarisation for DTT is horizontal in Norway. In Ireland, the DTT service uses a mixture of horizontal and vertical polarisations throughout the country.

areas, which improved the DVB-T signal and was noted at possibly reducing interference by 30%.

A9.3.1.4 Portugal

A 9.65 In 2011, Portugal issued licences in the 800 MHz bands. Annex 1 of the “*Auction Regulations*”¹⁸⁸ set out the technical conditions associated with the frequencies, and for the 800 MHz band, it stated that:

- “*The conditions stipulated in Decision 2010/267/EU1 must be complied with, in particular:*
 - *The EIRP power limits for base stations will be set at +56dBm/5MHz, in order to limit the probability of interference with systems operating in adjacent bands and with the Spanish stations;*
 - *Adoption of the out-of block power limits over frequencies below 790 MHz for base stations in accordance with the limits indicated in table 4 of Decision 2010/267/EU2 regarding Case A.”*

A9.3.1.5 United Kingdom

A 9.66 On the 12 January 2012, Ofcom published its ‘Second consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues’, and Annex 15¹⁸⁹ presents Ofcom’s comments on technical issues including the proposed licence conditions for 800 MHz spectrum band regarding the:

- Limits on unwanted emissions below 790 MHz;
- Maximum in-band power limit for 800 MHz.

A 9.67 In relation to limits on unwanted emissions below 790 MHz, Ofcom reported that several stakeholder respondents suggested that Case A limits were insufficient to protect DTT. Ofcom noted that these responses did not include any supporting technical analysis of where any inadequacies lay or quantifying the potential improvements from any alternative limits and it stated that it was not persuaded to deviate from the limits set out in Decision 2010/267/EU.

¹⁸⁸ “*Auction Regulation for the Allocation of Rights of Use of Frequencies in the 450 MHz, 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz Bands.*”
http://www.anacom.pt/streaming/english_version_Auction_Regulation.pdf?contentId=1101807&field=ATTACHED_FILE

¹⁸⁹ http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/annexes/2nd_condoc_Annexes_8-15.pdf

- A 9.68 Ofcom also reported that one respondent stated that Case A limits are too stringent for areas where UHF channels 59 and 60 are not used by DTT, and that Ofcom should consider relaxing this position. Ofcom noted that this suggestion to relax the unwanted emission limits is based on the premise that the DTT plan is not expected to change. Ofcom stated that it considers the potential risks in setting adjacent band conditions on this basis of there being any possibility that the DTT channel usage might need to change.
- A 9.69 In conclusion Ofcom stated that it was minded to apply the Case A limits to all base stations.
- A 9.70 In relation to the maximum in-band power limit for the 800 MHz band, Ofcom reported that several respondents to their June 2011 consultation commented that the proposed in-band power was higher than the value modelled in the DTT coexistence consultation. Ofcom noted that the proposal in its June 2011 consultation for the maximum in-band power limit was 61dBm/5 MHz, while the DTT coexistence modelling assumed that base stations would operate at a level of 59dBm/10 MHz.
- A 9.71 After the closure of the June 2011 consultation period, Ofcom undertook additional modelling to look at coexistence between DTT and base stations operating at 61dBm/5 MHz, which is equivalent to 64dBm/10 MHz. Ofcom reported back on the output of this modelling work and noted that further analysis of the DTT coexistence issues continue to support the proposals put forward in their June 2011 consultation that the maximum in-band power limit should be set at a level of 61dBm/5 MHz.
- A 9.72 On 23 February 2012, Ofcom published its 'second consultation on coexistence of new services in the 800 MHz band with digital terrestrial television'¹⁹⁰ and the results of its further modelling on the 'technical analysis of interference from mobile network base stations in the 800 MHz band to digital terrestrial television'.¹⁹¹
- A 9.73 Ofcom estimated that the total number of households whose DTT reception is affected in the absence of any mitigation measures is approximately 2.3 million across the UK. Ofcom noted that this is a marked increase from the figure of 752,000 households which we had presented in June 2011 report, and stated that this "*can be accounted for by an increase in the assumed number of base*

¹⁹⁰ <http://stakeholders.ofcom.org.uk/binaries/consultations/949731/summary/condoc.pdf>

¹⁹¹ <http://stakeholders.ofcom.org.uk/binaries/consultations/949731/annexes/DTTCo-existence.pdf>

stations (from 8,811 to 11,239 per network), an increase in the assumed base station EIRP (from 59 to 64 dBm/(10 MHz), and updated values of protection ratio.”

A 9.74 In Ofcom’s further modelling, Ofcom stated that *“DTT receiver filters are the most effective method of mitigation.”* In this regard, Ofcom noted that:

- *“the installation of DTT receiver filters (case (b))¹⁹² reduces the estimated total number of affected households to approximately 38,500.”*
- *“the application of network based mitigation (a reduction in base station EIRP to 61 dBm/(10 MHz), and additional base station transmitter filtering) reduces the estimated total number of affected households to approximately 3,300 when used in conjunction with DTT receiver filters (case (d))¹⁹³.”*
- *“When applied in isolation, network based mitigation alone is not an effective mitigation measure, and only reduces the number of affected households to approximately 1.4 million (case (c))¹⁹⁴.”*

A 9.75 Ofcom no longer propose stricter out-of-block emission levels for new licensees in the 800 MHz band and stated that “new licensees may choose to use this approach to reduce the costs they will bear in relation to consumer-based mitigation where it is cost-effective to do so.”

A 9.76 Finally, Ofcom note that the UK Government has now taken policy decisions relating to DTT coexistence:

- *“A single implementation body (referred to as ‘MitCo’) will be set up to manage the delivery of DTT interference mitigation and provide support to DTT consumers. This will be led by the new 800 MHz licensees.*
- *MitCo will be provided with funding of £180m. This money is expected to come and there will be a 50:50 gainshare of any underspend between new licensees and Government when MitCo is closed down.*

¹⁹² Case (b) – Consumer-based mitigation only (DTT receiver filtering), applied to all households;

¹⁹³ Case (d) – Both consumer-based and mobile network-based mitigation (as in cases (b) and (c));

¹⁹⁴ Case (c) – Mobile network-based mitigation only (base station transmitter filtering and reduced radiated power), applied to all base stations;

- *MitCo will provide support to DTT consumers. This will include information and providing DTT receiver filters to households proactively and reactively. Platform changes will also be offered to households where filters do not solve the issue of interference.*
- *A Supervisory Board will be established to monitor MitCo's performance, and to advise Ofcom accordingly.*
- *Additional support will be provided to vulnerable consumers, including installation support; approximately £20m of the £180m fund is intended to cover the cost of this support."*

A 9.77 Ofcom's consultation focuses on the options for implementing the Government's decisions, and its intention is to publish a statement on these issues in the summer of 2012.

A9.3.2 The DTT Network and 800 MHz Context in Ireland

A 9.78 In addition to the information on the DTT network and 800 MHz context in Ireland as set out in paragraphs A10.99 to A10.105 of Document 11/60a, the following provides updated information that has become available since Document 11/60a was published.

A 9.79 On 14 October 2011, the Minister for Communications, Energy and Natural Resources announced that the analogue TV network in Ireland will be turned off on 24 October 2012.¹⁹⁵ On the same day, Digital UK announced that the analogue TV network in Northern Ireland will also turn-off on the 24 October 2012¹⁹⁶; in order to make the transition to digital as straightforward as possible for TV viewers and broadcasters.

A 9.80 Information on the digital switchover process and the digital terrestrial television service 'Saorview' is available via various websites including www.goingdigital.ie¹⁹⁷ and www.saorview.ie.¹⁹⁸

A9.4 ComReg's Final Position

¹⁹⁵ 'Minister Rabbitte announces date for Digital TV Switchover' - Press release DCENR, 14 October 2011

¹⁹⁶ 'Northern Ireland heads for digital era' - Press release DigitalUK, 14 October 2011

¹⁹⁷ This website is owned and operated by the Department of Communications, Energy and Natural Resources.

¹⁹⁸ SAORVIEW is owned and managed by RTÉ. SAORVIEW is the brand name for the two national television multiplexes that RTÉ is obliged or is entitled to provide pursuant to the Broadcasting Act 2009.

A 9.81 This section sets out ComReg's final position on the measures necessary to facilitate the co-existence of services in the 800 MHz band with broadcasting services operating in the 470 – 790 MHz band.

A9.4.1 The use of the 'Case A' BEMs

A 9.82 ComReg notes that two respondents provided comments on ComReg's proposal to apply the 'Case A' BEM's as a licence condition in the 800 MHz band. RTÉ and RTÉNL welcomed ComReg's proposal and eircom Group had no objection to it.

A 9.83 In addition, ComReg notes that the 'Case A' BEM has been applied or proposed as a licence condition in most other European Countries¹⁹⁹. Given this and the supportive views of respondents, ComReg is of the view that its rationale as set out in paragraph A10.108 of Document 11/60a remains valid, namely that:

- Decision 2010/267/EU states that: "*Member States shall apply the baseline requirement in case A in circumstances where digital terrestrial broadcasting channels are in use at the time of deployment of terrestrial systems capable of providing electronic communications services*";
- ComReg has issued licences in respect of the first two DTT multiplexes and there is provision in legislation for a minimum of six DTT multiplexes to be licensed; and
- Case A BEMs are being proposed and/or set as licence conditions in most (if not all) European countries²⁰⁰

A 9.84 ComReg is therefore of the view that it is appropriate to apply the 'Case A' BEMs as a licence condition for all spectrum Blocks in the 800 MHz band.

A9.4.2 A Maximum Mean in-block EIRP Limit for 800 MHz Base Stations

A 9.85 ComReg notes while no respondents disagreed with its proposal to set a maximum mean in-block EIRP limit for 800 MHz base stations, three respondents provided comments on the proposed limit:

¹⁹⁹ The 'Case A' BEM has been applied or proposed as a licence condition in France, Portugal, Sweden, Switzerland and the UK.

²⁰⁰ ComReg notes that the Danish Regulator (NITA) proposed a BEM that varies per 800 MHz frequency block and per geographic area where channel 60 or channel 59 are used.

- RTÉ and RTÉNL proposed that this value be re-evaluated in conjunction with other mitigation measures. Among other items RTÉ and RTÉNL noted that Switzerland had proposed a lower in-block EIRP limit than ComReg;
- H3GI noted that Sweden had set the maximum EIRP at 64 dBm and 67 dBm and believed that this would be a more suitable level given Ireland's geography; and
- eircom Group had no objections to ComReg's 59 dBm/5 MHz proposal.

A 9.86 In considering these views ComReg firstly remains of the view that it is appropriate to set a maximum mean in-block EIRP limit for 800 MHz base stations (noting that Decision 2010/267/EU does not oblige ComReg to do so), given the co-existence issues that may arise due to the introduction of new ECS services in the 800 MHz band. In this regard, ComReg notes that no objections were received to this proposal.

A 9.87 Regarding the appropriate level, ComReg notes that:

- Decision 2010/267/EU states "*unless otherwise justified, such limits would normally lie within the range 56 dBm/5 MHz to 64 dBm/5 MHz*"
- The limits proposed or set in other countries are:
 - Denmark: 62 dBm/10MHz (which is equivalent to 59 dBm/5MHz) in areas where UHF channels 59 and 60 are not used; and either 0 or somewhere between 30–62 dBm/10MHz where UHF channels 59 and 60 are used;
 - Portugal: 56dBm/5MHz;
 - Sweden: 64dBm/5MHz in the direction where the effective antenna height is less than 50m, or 67 dBm/5 MHz EIRP in the direction where the effective antenna height is 50m or above (noting that UHF channel 60 areas have specific conditions related to radiated power and polarisation);
 - Switzerland: 56dBm/5MHz; and
 - The UK: 61dBm/5 MHz.

A 9.88 In light of the above and considered together with the proposed position in paragraphs A10.110 to A10.114 of Document 11/60a, ComReg final position is that the maximum mean in-block EIRP limit should be set at 59 dBm/5 MHz.

ComReg retains the right to review the in-block EIRP limit in the future if required²⁰¹

A9.4.3 ‘Additional Mitigation Measures’

A 9.89 In line with Decision 2010/267/EU, ComReg recognises that it may be appropriate to apply ‘*additional mitigation measures*’ to improve the coexistence of 800 MHz band services with DTT services in the adjacent band. This section sets out ComReg’s consideration of whether there is a need to apply any ‘*additional mitigation measures*’ to address the three loss of broadcasting reception possibilities, namely:

- Degradation of service from handheld user terminals.
- SINR degradation; and
- Receiver Overload.

A9.4.3.1 Degradation of Service from Handheld User Terminals

A 9.90 ComReg notes that two respondents, eircom Group and RTÉ, commented on this issue.

- eircom Group agreed with ComReg’s analysis (as set out in Document 11/60a) that degradation of service from user terminals is minor and transitory and is best managed by users of equipment directly.
- RTÉ stated that it is important to understand that mitigation by simply moving the interferer away from the television receiver may not always be practical. It quoted the work of CEPT Report 30 that found that the worst case interference scenario resulted from a separation distance of approx. 22m, and given this RTÉ pointed out that the interferer may be in a separate dwelling in a multi-tenant building and completely unaware that they are causing a problem to a neighbour’s reception.

A 9.91 In considering the above comments, ComReg firstly notes that RTÉ has cited one section of CEPT Report 30, namely section A3.1.3. ComReg notes that the subsequent section of CEPT Report 30, namely section A3.1.5.4, is also relevant as it considers the mitigation actions that can be used to address this

²⁰¹ ComReg suggests that DTT reception systems being implemented today should ideally be designed to cater for the possibility that in-block EIRP limits for ECS base stations in the 800 MHz band may be set at up to 64 dBm / 5MHz in the future.

issue. In this regard, CEPT Report 30 concludes that any such interference can be successfully addressed by the DTT user by means of additional external filtering in the DTT receiver.

A 9.92 ComReg notes that this issue has also been considered in other international studies and reports,

- CEPT Report 31²⁰² recommended a reverse-direction FDD mode be used for the 800 MHz band. The net effect of this recommendation is that there is a minimum frequency separation of 42 MHz between the 800 MHz user terminals and broadcasting services in the band below 790 MHz. This reverse-direction FDD mode has been adopted by the European Commission in Decision 2010/267/EU and is proposed for the 800 MHz band in Ireland.
- In the UK, Ofcom's March 2011 consultation²⁰³ stated that Ofcom was of the view that 800 MHz user terminal interference into domestic television systems (cable or DTT) is manageable. The Ofcom study, among other points, noted that interference can simply be mitigated against by the user moving away from the DTT receiver. In its February 2012 consultation, Ofcom reaffirms that *"interference arising as a result of mobile handsets should in most cases be relatively easily dealt with by moving the mobile handset away from the affected equipment."* In addition, Ofcom noted that DTT receiver filters will also be effective in mitigating interference from mobile handsets.
- In Denmark, the report²⁰⁴ by DotEcon and Analysys Mason considered papers by European Broadcasters Union (EBU), work conducted in the UK by Cobham Technical Services and presented by Ofcom to the ECC Task Group 4 during 2010.²⁰⁵ The report found that all of the measured interference effects were resolved by the introduction of a low-pass filter in the TV receiving antenna set-up. With regards to mitigating blocking caused by LTE terminals, it is noted that power control within LTE terminals ensures that the devices are usually operating below their

²⁰² www.ero.dk CEPT Report 31 on "Frequency (channelling) arrangements for the 790-862 MHz band"

²⁰³ "Consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues"
<http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/summary/combined-award.pdf>

²⁰⁴ Section 6: Interference from LTE uplink emissions of '800 MHz auction: Co-existence of LTE systems in 790-862 MHz with Digital Terrestrial Television – August 2011' a report for the National IT and Telecom Agency by Analysis Mason and DotEcon.

²⁰⁵ ECC TG4(10)317, UK measurements of LTE into DTT, presented to the 15th meeting of ECC TG4

maximum power level, which provides mitigation in terms of the potential for blocking of DTT portable indoor receivers. The report went on to say that this point was made in a contribution by the GSM Association to CENELEC in 2010,²⁰⁶ which suggested that whilst the maximum power of an LTE terminal is 23dBm, for most of the time the terminal will transmit at significantly less than its maximum output power. Accordingly, the report concluded that it is not considered likely that interference from LTE devices to DTT receivers will cause significant problems in practice.

- A 9.93 ComReg notes that the above studies support ComReg's view that this issue is minor and the problem is transient in nature given that the user can generally resolve this interference by moving the user terminal away from the DTT receiver and/or improving the quality of the DTT installation (e.g. using appropriately shielded TV cabling). Testing has demonstrated that in cases where there is disruption to a DTT service from a mobile handset occurring within a very limited distance from the DTT receiver, usually less than 2.5m²⁰⁷, increasing the physical separation between the two devices is the obvious solution and can be achieved with little effort and disruption.
- A 9.94 In light of the above, and ComReg's considerations in Document 11/60a, ComReg is of the view that degradation of services from user terminals is manageable and does not require the specification of additional mitigation measures to be included in the 800 MHz Liberalised Use licensing regime.

A9.4.3.2 SINR Degradation

- A 9.95 ComReg notes that two respondents provided comments on this matter.
- eircom Group stated that it generally supported the thrust of ComReg's conclusions on SINR degradation, although it sought clarifications on specific aspects of the DTT network planning and ComReg's approach to investigating interference;
 - RTÉ and RTÉNL disagreed with various aspects of ComReg's assessment of SINR degradation and was of the view that the '*additional mitigation measures*' proposed by ComReg were inappropriate. Among other items, RTÉ proposed the use of filters at the 800 MHz base stations.

²⁰⁶ GSM Association: Characteristics of mobile networks expected to be deployed in the 790–862 MHz band, contribution to CENELEC TC 210 WG 10 Meeting #3, 17-18 May 2010.

²⁰⁷ Report 2010-026 – LTE Interference into Domestic Television Systems, compiled by Cobham Technical Services on behalf of Ofcom.

A 9.96 ComReg's consideration of these views is set out in terms of the following matters:

- DTT network planning issues;
- The potential level of interference to DTT viewers;
- A licensing framework that pre-emptively mitigates SINR degradation issues;
- Base station filtering and other mitigation techniques on the 800 MHz licensee;
- ComReg's approach to investigating interference.

DTT network planning issues

A 9.97 In relation to DTT network planning, ComReg notes that:

- RTÉ and RTÉNL stated that ComReg was not correct to conclude that UHF channel 60 will not be required for the provision of six DTT multiplexes in Ireland; and
- eircom Group requested clarifications on the use of UHF channels 58 and 59 in the DTT channel plan (it noted that there were 8 occurrences) and it proposed that the DTT channel plan should be amended to ensure use of the upper channels is minimised to the maximum extent possible and in particular use of UHF channels 58 and 59.

A 9.98 In relation to RTÉ and RTÉNL's comment that ComReg was not correct to conclude that UHF channel 60 will not be required for the provision of six DTT multiplexes in Ireland, ComReg stands over its statement made in Document 11/60a. In this regard, ComReg notes that ComReg, in conjunction with RTÉNL and the BAI, has planned the DTT spectrum requirements for the first six multiplexes on the basis of using UHF channels 21 – 59 only (i.e. using frequencies from 470 – 782 MHz only) and furthermore:

- the licences issued to RTÉ in respect of the first two digital multiplex do not use UHF channel 60;
- the licences in respect of the four commercial DTT multiplex (as provided for under legislation and currently under consideration by the BAI) have

been planned in the 470 – 782 MHz band, and therefore would not use UHF channel 60; and

- ComReg’s bilateral negotiations on DTT planning with the UK are based upon UHF channels 21 to 59 being used for the first six multiplexes.

A 9.99 In relation to eircom’s clarification on the use of UHF channels 58 and 59, ComReg notes these channels are used in 8 locations in the current DTT network plan.²⁰⁸ While ComReg notes eircom Group’s request, it should be noted that ComReg is obliged under the 2009 Act to provide spectrum to licence at least six DTT multiplexes (two to RTÉ and up to four to the BAI). Two multiplex licences have been issued to RTÉ, however there has been no request yet from the BAI under the Broadcasting Act 2009 to issue other licences for the purposes of commercial DTT. Given this obligation and the need for channels to be internationally co-ordinated, ComReg is of the view that it is necessary to use UHF channels 58 and 59 to meet these requirements.

The potential level of interference to DTT viewers

A 9.100 In relation to the potential level of interference to DTT viewers, ComReg notes that RTÉ and RTÉNL believed that ComReg has underestimated the potential level of interference to DTT viewers and stated that if this spectrum is released as proposed by ComReg, “*interference can be expected to affect at least 2.5% of Irish SAORVIEW / DTT households by RTÉNL’s estimates (circa 50,000 Irish households)*²⁰⁹ and possibly more”. In this regard, RTÉ believed that after taking a detailed look at the Ofcom results, it is not correct for ComReg to ascertain that “*most (if not all) SINR degradation issues would likely occur in channel 60*”.

A 9.101 In considering the above, ComReg firstly notes that RTÉ’s view is based upon the estimated number of households in the UK whose DTT service might be affected, as presented in Ofcom’s June 2011 study. From Ofcom’s study, ComReg notes that this information relates to the worst-case scenario and the scenario where no additional mitigation measures (e.g. DTT receiver filters) were applied.

A 9.102 When the results of the Ofcom study are considered where additional mitigation techniques are applied, ComReg notes that, the Ofcom’s studies in the UK

²⁰⁸ The technical parameters for DTT (currently Public Service Broadcast Multiplex 1 and 2) is available on ComReg’s website at:
http://www.comreg.ie/radio_spectrum/technical_parameters.542.1071.html

²⁰⁹ Footnote 2 of RTÉ’s response to Document 11/60 stated “2.5% of households is derived by applying Ofcom’s analysis in the UK (2.8% of households including channel 60), taking account of the exclusion of Channel 60 for core broadcasting as proposed in the draft Decision document.”

suggest that the use of appropriate filtering at the DTT receiver can resolve up to 90–95% of the potential SINR degradation and/or receiver overloading issues in the UK. Using only this mitigation technique, the number of UK TV households susceptible to SINR degradation and/or receiver overloading would reduce from circa 2.7%²¹⁰ to circa 0.17%.²¹¹

A 9.103 When the results of the Ofcom February 2012 study are considered where additional mitigation techniques are applied, ComReg notes that, the Ofcom's studies in the UK suggest that the use of appropriate filtering at the DTT receiver can resolve up to 98% of the potential SINR degradation and/or receiver overloading issues in the UK. Using only this mitigation technique, the number of UK TV households susceptible to SINR degradation and/or receiver overloading would reduce from circa 8.29%²¹² to circa 0.14%²¹³. When other mitigation techniques are considered (e.g. mobile network based mitigation), then the number of households affected would be reduced further.

A 9.104 ComReg has also considered the results from other studies, and notes that these studies support ComReg's view that SINR degradation issues tend to be focused on the uppermost UHF channel (i.e. channel 60), and SINR degradation issues in the remaining UHF channels are likely to be minor.

- In Sweden,²¹⁴ the Swedish regulator (PTS) identified that some SINR degradation issues could occur in areas where UHF channels 58 and 59 are used, but it identified these as being a minor problem compared to areas where UHF channel 60 is used.²¹⁵

²¹⁰ 2.77% was generated by taking the total number of UK TV households, quoted in the June 2011 study as being 27,169,147 and the number of households affected as being 751,889. Figures taken from Section 1.8 of Ofcom technical report, available at,

<http://stakeholders.ofcom.org.uk/binaries/consultations/dtt/annexes/Technical-Report.pdf>

²¹¹ 0.17% was generated by taking the total number of UK TV households, quoted in the June 2011 study as being 27,169,147 and the number of households affected applying appropriate filtering at the DTT receiver as 47,329. Figures taken from Section 1.8 of Ofcom technical report, available at,

<http://stakeholders.ofcom.org.uk/binaries/consultations/dtt/annexes/Technical-Report.pdf>

²¹² 8.29% was generated by taking the total number of UK TV households, quoted in the February 2012 study as being 27,600,000 and the number of households affected as being 2,288,000. Figures taken from Section 5.28 of the Ofcom consultation, available at,

<http://stakeholders.ofcom.org.uk/binaries/consultations/949731/summary/condoc.pdf>

²¹³ 0.14% was generated by taking the total number of UK TV households, quoted in the February 2012 study as being 27,600,000 and the number of households affected applying appropriate filtering at the DTT receiver as 38,500. Figures taken from Section 5.28 of Ofcom consultation, available at,

<http://stakeholders.ofcom.org.uk/binaries/consultations/949731/summary/condoc.pdf>

²¹⁴ "Interference from future mobile network services in frequency band 790 – 862 MHz to digital TV in frequencies below 790 MHz." – published by PTS

²¹⁵ In Document 11/60a, ComReg noted that the protection ratios used for the calculation of interference in this Swedish study would now be considered pessimistic in light of results of ECC report 148

- In Norway, one aspect of the report²¹⁶ investigated the potential for interference from adjacent channels (out of band), focusing on the potential for interference into UHF channels 58, 59 and 60 caused by LTE. The study showed that the potential population affected by out of band interference ranged from two people on UHF channel 58, 116 people on UHF channel 59, and 14,949 people on UHF channel 60.
- In Denmark the report²¹⁷ found that between 4,500 and 5,000 households might be at risk of interference from Adjacent Channel Interference ('ACI') in areas of Denmark receiving DTT services using UHF channel 60, and up to 2,000 households in areas using UHF channel 59. The report also found that the use of DTT receiver filtering substantially eliminates interference, leaving a small number of households for which filtering is not suitable. The report found that these houses were most likely to be in areas where DTT services are being transmitted on UHF channel 60.
- In the UK, Table 17 of Ofcom's February 2012 "*Technical analysis of interference from mobile network base stations in the 800 MHz band to digital terrestrial television*"²¹⁸ presents the result of Ofcom interference modelling analysis highlighting the worst affected DTT channel. These results are presented for Ofcom's mitigation case (a) to (d), and Ofcom note that when DTT receiver filtering is applied to all households, the worst affected DTT channel is UHF channel 60.

A 9.105 Given the above, and ComReg's considerations in Document 11/60a, ComReg maintains its view that instances of SINR degradation are likely to be few and most (if not all) SINR degradation issues would likely occur in UHF channel 60, noting that UHF channel 60 is not used in the current DTT network deployment, nor planned for use in the next four DTT multiplexes. Therefore if there are instances of SINR degradation in the other UHF channels (e.g. 59, 58 etc.), then ComReg is of the view that these are likely to be minor in scale.

A licensing framework that pre-emptively mitigates SINR degradation issues

(June 2010) and therefore the results of this study may overstate the potential issue.

<http://www.ero.docdb.dk/Docs/doc98/official/pdf/ECCREP148.PDF>

²¹⁶ 'Interference study for LTE co-existing with DVB-T for NPT' by ATDI - 10 May 2011

²¹⁷ '800MHz auction: Co-existence of LTE systems in 790-862 MHz with Digital Terrestrial Television' August 2011 – By DotEcon and Analysys Mason as commissioned by NITA

²¹⁸ <http://stakeholders.ofcom.org.uk/binaries/consultations/949731/annexes/DTTCo-existence.pdf>

- A 9.106 In Section 1.6 of RTÉ’s response to Document 11/60, ComReg notes that RTÉ recommends that ComReg “create a licensing framework that minimises the amount of interference expected for broadcast viewers **before it occurs**, including pre-emptive action from the licensee likely to cause the interference.” (emphasis added by RTÉ)
- A 9.107 In considering this view, ComReg notes that this spectrum award process has set out licence conditions and ComReg’s DTT spectrum planning has considered other actions that aim to pre-empt interference to other existing licensed users of the spectrum and their customers.
- In relation to licence conditions on the 800 MHz band, and as discussed earlier, ComReg is of the view that it is appropriate to apply the ‘Case A’ BEMs and set a 59 dBm/5MHz in-block EIRP level as licence conditions in the 800 MHz band; and,
 - Regarding DTT spectrum planning activities, to minimise the effect of SINR degradation further, ComReg has taken on board the results of international studies in its DTT network planning and the first six DTT multiplexes in Ireland²¹⁹ are being planned using UHF channels 21-59 only. When UHF channel 60 is avoided for the provision of a DTT multiplex, this will result in fewer SINR degradation issues being experienced, as in practice this will give a 9 MHz separation between the uppermost DTT channel (i.e. UHF channel 59) and the lower 800 MHz block (i.e. Block A).
- A 9.108 ComReg is therefore of the view that it is taking appropriate pre-emptive actions to minimise the amount of interference from services in the 800 MHz band to the broadcasting service in the lower UHF band.
- A 9.109 Furthermore, ComReg believes that RTÉ and the DTT community should also take appropriate pre-emptive action to prevent the potential for interference to the DTT service as experienced by consumers. As set out in ComReg’s letter²²⁰

²¹⁹ Section 132 of the Broadcasting Act, 2009, sets out ComReg’s obligations in relation to DTT multiplexes:

- Section 132(1) & (2) of the Broadcasting Act 2009 provides for the licensing of two DTT multiplexes to RTÉ.
- Section 132(3) & (4) of the Broadcasting Act 2009 provides for the licensing of DTT multiplexes to the BAI. Section 132(3) of the Broadcasting Act 2009 provides for the licensing of four DTT multiplexes to the BAI, and Section 132(4) of the Broadcasting Act 2009 provides for the licensing of further multiplexes, at the request of the BAI.

²²⁰ See item 20 in ComReg Document 11/102 “ComReg: Letter to DCENR of 21 December 2011 “Overload Problem” (email and letter of 21 December 2011)”

of 21 December 2011 to DCENR, ComReg believes that for DTT consumers to effectively receive a DTT service, it is important that an appropriate DTT receiving system is in place and that it is fit for purpose. Specifically ComReg stated that:

- *“we believe DTT consumers should be advised by RTÉ, in simple-to-understand language, to check that their current aerial systems are likely to function correctly in the presence of ECS signals in the 800 MHz band and, in particular, do not receive signals above 790 MHz and, if they do, to contact a properly qualified installer to remedy any likely problem.”*

A 9.110 In addition, ComReg notes that the Saorview Specification²²¹ is implemented as additions and clarifications to a previous version of the NorDig specification.²²² However both the Saorview specification²²³ and the current version of the NorDig specification²²⁴ require operation across all of the UHF Band V (606 to 862 MHz). ComReg notes that this specification was issued prior to Decision 2010/267/EU and the “*Notification of Change to TV Standards in Ireland*” document²²⁵ on the www.goingdigital.ie website from 10 November 2011. ComReg is of the view that RTÉ, as a member of NorDig, should seek to have the standard specification modified so that it no longer specifies as mandatory for receivers to operate in the portion of the UHF Band V from 790 – 862 MHz.

Base station filtering and other mitigation techniques on the 800 MHz licensee

A 9.111 ComReg notes RTÉ and RTÉNL’s proposal that ComReg considers a base station filtering mechanism as it is a simple solution for the mobile operator to implement pre-emptively without causing any disruption to the television viewer. In this regard, RTÉ and RTÉNL noted that “*according to the Ofcom work²²⁶ additional base station filtering is particularly effective at reducing interference at channel 59, and reduces the interference by up to 99.99%, compared to 97.5% for receiver filtering alone, in a communal receive system scenario.*”

A 9.112 In considering the above, ComReg notes that RTÉ’s comment and Ofcom’s statement (of the June 2011 consultation) is only valid for communal aerial

²²¹ “*Saorview Minimum Receiver Requirements: Digital Terrestrial Television Additions and clarifications to NorDig Unified Requirements 2.2*”, http://www.rtenl.ie/wp-content/uploads/2011/Minimum_Receiver_Requirements_5.pdf

²²² The current NorDig specification is v 2.2.1, http://www.nordig.org/pdf/NorDig-Unified_ver_2.2.1.pdf, the Saorview specification is based on v 2.2.

²²³ Saorview specification document - table 1.

²²⁴ Current version of NorDig specification - table 3.5.

²²⁵ ‘*Notification of Change to TV Standards in Ireland*’ – DCENR, 10 November 2011.

²²⁶ “*Technical analysis of interference from mobile network base stations in the 800 MHz band to digital terrestrial television*”, Ofcom, June 2011.

systems²²⁷ and not other DTT receiver systems. According to the Ofcom June 2011 study, the addition of filtering at the base station transmitter virtually eliminates the impact of interference to households in communal aerial systems as the high-performance DTT receiver (pre-amplifier) filtering assumed in these systems fully exploits the resulting reduction in base station spectral leakage. However, the Ofcom study also notes that the addition of filtering at the base station transmitter is not as effective a mitigation technique for other domestic DTT installations.

A 9.113 When all DTT receiver systems are considered, ComReg notes that the Ofcom June 2011 study suggests that filtering at the DTT receiver is the most effective mitigation technique. In this regard, ComReg notes that Ofcom's study suggested that:

- applying a filter at the DTT receiver had the effect of reducing the potential for interference by 93.71 %, ²²⁸ and
- the effect of a filter at the DTT receiver plus a base station filter increased the effectiveness of the mitigation by 2.22% to 95.93%.

A 9.114 In Ofcom's February 2012 study:

- Ofcom notes that applying network based mitigation at all base stations without any receiver filters would result in 1.41 million remaining affected households (mitigation Case (c)). This form of mitigation is most effective when combined with receiver filtering, which reduces the estimated residual number of households to 3,300 if network-based mitigation is applied to all base stations (mitigation Case (d)), or 17,000 if selective network-based mitigation is used at the base station sites which cause the greatest interference impact (mitigation Case (e)).
- Ofcom state that, as was shown in the previous modelling undertaken by Ofcom for their June 2011 consultation, DTT receiver filters are the most effective method of mitigation.

²²⁷ Section 9.2 of Ofcom's June 2011 study describes a 'communal aerial systems (CASs) as 'installations where multiple dwellings are supplied via a single TV aerial in conjunction with an amplifier.' In addition, Ofcom noted that the launch amplifier within communal aerial systems makes them potentially more susceptible to interference than other systems.

²²⁸ 93.71% was generated as a percentage of the total number of UK TV households potentially affected by interference without mitigating as being 751,889 and the number of households potentially affected by interference with receiver filtering only as being 47,321. Figures taken from Section 1.8 of Ofcom technical report, available at <http://stakeholders.ofcom.org.uk/binaries/consultations/dtt/annexes/Technical-Report.pdf>

- Ofcom state that it no longer proposes stricter out-of-block emission levels for new licensees in the 800 MHz band and stated that *“new licensees may choose to use this approach to reduce the costs they will bear in relation to consumer-based mitigation where it is cost-effective to do so.”*

A 9.115 Aside from the Ofcom study, ComReg also notes the studies in Norway and Denmark, where base station filtering was also considered.

- In Norway, the ATDI study²²⁹ investigated the addition of 3dB, 6dB and 9dB filters at base stations in the 800 MHz band. The study showed that the use of filters at base stations would reduce the out-of-band interference situation²³⁰ and noted that this technique may need to be combined with other options.
- In Denmark, the study by DotEcon and Analysys Mason²³¹ noted that additional filtering at base stations in the 800 MHz band could result in reduced interference into DTT services. However the study also noted that additional filtering may increase the cost of deployment per base station, and require extra space to be available at base station sites. The study further noted that more recent approaches to filter technology aim to reduce their size, weight and power consumption, as well as to achieve a very small insertion loss.

A 9.116 Given the above, and ComReg’s opinion that SINR degradation issues are likely to be minor in scale when UHF channel 60 is not used for DTT, ComReg is of the view that while there are some benefits to applying additional filtering at base stations in the 800 MHz band, these benefits are likely to be small in scale in comparison to the use of filters at DTT receivers, and are likely to be localised to base stations in specific sites or specific areas. ComReg is therefore of the view that it is not appropriate to specify the use of additional filtering at base stations as a licence condition in the 800 MHz band.

A 9.117 In relation to other mitigation measures that could be specified as a licence condition in 800 MHz band, ComReg notes that the studies carried out in the UK, Norway and Denmark consider such measures and in particular each of these studies set out results in relation to polarisation discrimination.

²²⁹ *Interference study for LTE co-existing with DVB-T for NPT* by ATDI - 10 May 2011

²³⁰ Using a 3 dB filter at base stations resulted in about 8,200 people or 55 % of the affected population suffering less interference effects. Using a 6 dB filter would reduce the interference by 80 % or 11,900 people. The usage of a 9 dB filter would improve the interference situation by over 90 % or 13,498 people in the test area.

²³¹ ‘800MHz auction: Co-existence of LTE systems in 790-862 MHz with Digital Terrestrial Television’ August 2011 – By DotEcon and Analysys Mason as commissioned by NITA

- In the UK, the results of Ofcom's²³² modelling suggest that under ideal scenarios the use of orthogonal-to-DTT (as opposed to slant) polarisation at base stations could reduce the number of affected households by a factor of between 3 to 4.²³³ However the Ofcom study also noted that this mitigation measure faced a number of constraints regarding its widespread deployment,²³⁴ and therefore the degree of polarisation discrimination that can be achieved in practice is difficult to predict. In its February 2012 study, Ofcom state that: *"the use of cross polarisation was generally not supported by providers of existing DTT services and potential new licensees. Both its costs and efficacy were questioned, and we expect that it will play little role in mitigating interference, although new licensees will be free to do so if they wish."*
- In Norway, the ATDI study²³⁵ found that using vertical polarisation²³⁶ for the LTE network instead of dual slant will reduce the interference dramatically by up to 96%, due to the fact that in Norway the DVB-T signal is mostly horizontally polarised.
- In Denmark, the study by DotEcon and Analysys Mason²³⁷ concluded that orthogonal-to-DTT polarisation is not a mitigation technique that can be applied throughout networks in Denmark, but can possibly be applied in selected areas only where receiving a DTT service from a horizontally polarised main transmitter. In this regard:

²³² "Technical analysis of interference from mobile network base stations in the 800 MHz band to digital terrestrial television", Ofcom, June 2011.

²³³ The Ofcom study noted that their modelling assumed a polarisation discrimination pattern which attenuates the interferer by 16 dB within the main beam of the TV aerial.

²³⁴ While the study reports that the use of orthogonal-to-DTT polarisation is a technically effective tool for mitigating the impact of interference from base stations in the 800 MHz band to DTT services below 790 MHz, some constraints were noted regarding the widespread deployment of this mitigation measure: -

- base station antennas require a need for more spatial separation and so require more space at the mast head as compared to $\pm 45^\circ$ polarised antennas. Such space may not be available in the smaller base station sites.
- Orthogonal-to-DTT polarisation implies the use of horizontally polarised antennas at base stations. Traditionally, such networks have not used horizontally polarised antennas and these are not widely available commercially.
- The Ofcom study also noted that measurements indicate that the amount of polarisation discrimination achievable in practice is highly dependent on the nature of radio wave propagation and the extent of multipath and scattering in the vicinity of the TV aerial. This means that polarisation may not be equally effective for all households.

²³⁵ 'Interference study for LTE co-existing with DVB-T for NPT' by ATDI - 10 May 2011

²³⁶ According to the 'Interference study for LTE co-existing with DVB-T for NPT' by ATDI - 10 May 2011, the predominant polarisation for DTT is horizontal. In Ireland, the DTT service uses a mixture of horizontal and vertical polarisations throughout the country.

²³⁷ '800MHz auction: Co-existence of LTE systems in 790-862 MHz with Digital Terrestrial Television' August 2011 – By DotEcon and Analysys Mason as commissioned by NITA

- the interference modelling showed that a polarisation discrimination of 16 dB resulted in a 90% reduction of the number of households affected by ACI and blocking; and
- the report noted that the use of orthogonal-to-DTT polarisation as a means of SINR or receiver overload interference mitigation requires base station antennas to be vertically polarised if DTT networks use horizontal polarisation.²³⁸ This, in the opinion of the report, could limit the capabilities of LTE networks, affecting coverage and capacity.

A 9.118 In relation to Ireland, ComReg notes that the DTT service in Ireland uses a mixture of horizontal and vertical polarisations throughout the country. As discussed in the European studies above, such a mixed usage pattern means that orthogonal-to-DTT polarisation is not a mitigation technique that can be applied uniformly throughout Ireland. While ComReg notes that there are benefits to the use of polarisation discrimination, given the above, these benefits are likely to be localised to specific areas. ComReg is therefore of the view that it is not appropriate to specify polarisation discrimination as a licence condition in the 800 MHz band.

A 9.119 While the above sets out ComReg's view that it is not appropriate to specify base station filtering or polarisation discrimination as licence conditions in the 800 MHz band, it should be noted that under the EMC Directive,²³⁹ both the operators of DTT systems and future ECS services in the 800 MHz band have a duty to ensure that the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended and that equipment sold, or installations constructed, by them are appropriately immune to electromagnetic interference. In this regard, ComReg notes that the DTT community and future licensees in the 800 MHz band have an incentive to co-operate with each other to minimise the possibility of interference or electromagnetic disturbances occurring into each other's services.

A 9.120 In this regard, ComReg notes that information regarding the licensed technical parameters of the DTT network in Ireland have been published on ComReg's website²⁴⁰ and details of the Wireless Telegraphy apparatus associated with a

²³⁸ The report also noted that in Denmark most main DTT transmitters are horizontally polarised, however a few main transmitters and most on-channel repeaters (DTT gap fillers) are vertically polarised.

²³⁹ "Directive 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC"

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:390:0024:0037:en:PDF>

²⁴⁰ Licensed technical parameters of broadcasting services in Ireland

http://www.comreg.ie/radio_spectrum/technical_parameters.542.1071.html

800 MHz licensee is to be captured in its licence.²⁴¹ DTT and 800 MHz licensees should take such information into consideration when deploying their networks and considering whether additional mitigation measures (e.g. at a base station level it may be appropriate to use additional filtering or polarisation discrimination) are required.

ComReg's approach to investigating interference

- A 9.121 Noting the potential for SINR degradation to occur in UHF channels 58 and 59 and ComReg's statutory obligations regarding the investigation of such, ComReg notes that eircom Group requested clarification as to what liability, if any, may arise in respect of a mobile operator that is compliant with the technical conditions of its licence.
- A 9.122 In considering this view, ComReg firstly re-iterates its belief that given the mitigation measures as set out in this document and the mitigation measures that can be taken within the DTT receiver system, ComReg is of the view that few (if any) SINR degradation interference issues are likely to arise in respect of UHF channels 58 and 59.²⁴² Furthermore, if such a situation does arise, it is ComReg's view that the scale of any such SINR degradation issue would likely be small, and it would be appropriate for ComReg to address any such issue in line with its statutory obligations.
- A 9.123 In addition, ComReg notes that under the EMC Directive, both DTT systems and future services in the 800 MHz band have a duty to ensure that the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended. As discussed above, ComReg believes that the DTT community and future licensees in the 800 MHz band can co-operate with each other to minimise the possibility of interference or electromagnetic disturbances occurring into each other's services and each licensee should take into consideration the other network's deployment when planning and deploying its own network.
- A 9.124 At this stage it is not possible for ComReg to identify the specific actions that it might take as a result of any such investigation action, but any action taken by ComReg would be in keeping with its statutory obligations which require

²⁴¹ It is ComReg's intention that details of the Liberalised Use Licences in the 800 MHz, 900 MHz and 1800 MHz bands will be published on its website.

²⁴² ComReg notes that no one mitigation technique is exclusively or entirely successful at eliminating all possible co-existence issues which may arise between 800 MHz band service and DTT.

ComReg to act in an objective, proportionate, transparent, non-discriminatory fashion.

A 9.125 Furthermore, it is ComReg's view that RTÉ and the DTT community have a crucial role to play in helping to prevent instances of SINR degradation. As set out in ComReg's letter to DCENR on 21 December 2011, it is ComReg's view that RTÉ and the DTT community should ensure that they advise current and future DTT consumers to ensure their DTT receiver system is appropriate and fit for purpose.

A9.4.3.3 Receiver Overload

A 9.126 In relation to receiver overload, the final loss of broadcasting service matter to be discussed, ComReg notes that eircom Group, RTÉ and TG4 provided comments on this matter. In general all respondents agreed that receiver overload issues are a function of the receiver system and both RTÉ and eircom Group agreed that the use of appropriate filters in the DTT receiver system is an effective measure.

A 9.127 Regarding who should be responsible for mitigating any interference issues, ComReg notes that the respondents had differing views. eircom Group held the view that the onus should be on the DTT community to ensure that consumers are suitable advised, while RTÉ and TG4 were of the view that this should be the responsibility of the 800 MHz licensee. In this regard, RTÉ and RTÉNL stated "*that while receiver overloading may be considered a function of the receiver system, it is worth noting that without a high power interfering signal, the overloading would not occur. In this regard, RTE believes that ComReg should apply a 'polluter pays' principle where the new licensee(s) in the 800 MHz band be made responsible for mitigating against any such problems which may arise*".

A 9.128 In addition, ComReg notes the updated position of RTÉNL as set out in its response of 4 January 2012,²⁴³ which, among other items, highlighted that:

- RTÉNL believes ComReg's letter of the 21 December 2011 takes little account of the practical issues for home aerial installations caused by the policy decision to reduce the broadcast spectrum;

²⁴³ See Document 12/21 RTÉNL's email response of 4 January 2012 to ComReg's Letter of 21 December 2011 "Overload Problem".

- RTÉNL believes that a policy decision to remove the 800 MHz band from the spectrum used by broadcasting is going to cause problems for “a small but not insignificant number of homes”.
- RTÉNL believes that technically the solution is simple:
 - that a suitable filter be installed between the aerial and the amplifier;
or
 - that a new reduced band/narrow band aerial or amplifier be installed.
- As the removal of the 800 MHz band from the spectrum used by broadcasting “*is new to the world of television aerial systems manufacturers and system installers*”, RTÉNL believes that at present no suitable amplifiers, aerials, low-band pass, notch or other filter are easily available from any retailers or manufacturers at an affordable price; RTÉNL notes that this area is completely unregulated and it is largely reactive rather than proactive.
- RTÉNL believes that as the vast majority of homes will not be impacted in any way in the foreseeable future, it would be counterproductive to the aims of the DSG to inform every home in the country with an aerial, that their aerials will not meet the relevant standards from October 24 2012. RTÉNL believes that such a message has the potential to damage the migration from analogue television services to DTT in advance of ASO, and/or in advance of a suitable technical solution being available, the message should be carefully crafted, agreed and consistent across the DSG Group.
- RTÉNL believes a common message by the various relevant authorities (DCENR, BAI, ComReg) and the broadcasters would help encourage the necessary filters or narrowband aerials or amplifiers onto the shelves at an earlier date.
- RTÉNL states that it believes that a technical solution is unlikely to be available in advance of the 800 MHz band services launching, without intervention, and RTÉNL think it is critical that the parties rolling out the new 800 MHz band services are compelled to be involved in the resolution.

A 9.129 ComReg’s consideration of these views is set out in terms of the following matters:

- Receiver overload is a function of the receiver system and the appropriate measure is the use of filters within the receiver system;
- Who should be responsible for mitigating any receiver overload issues?

Receiver overload is a function of the receiver system and the appropriate measure is the use of filters within the receiver system.

A 9.130 In considering the issue of receiver overload, ComReg notes that respondents agreed with its view that receiver overload is a function of the receiver system (i.e. the aerial, masthead amplifier/amplifier, DTT receiver and/or cabling) and the most effective and appropriate mitigation technique is filters within the DTT receiver system.

A 9.131 In addition, ComReg notes that international studies also support the view that filters within DTT receiver systems are the most appropriate measure to address receiver overload issue. These studies include:

- Annex 4 of CEPT Report 30 which provides guidance on the relevant mitigation measures to address overloading and notes that rejection filters and/or low pass filters in the DTT receiver can minimise overloading;
- The June 2011 study published by Ofcom²⁴⁴ which suggests that the use of appropriate filtering at the DTT receiver can resolve up to 90-95% of potential SINR degradation and/or receiver overload issues in the UK. Ofcom's further modelling of February 2012 reaffirmed this view and Ofcom stated *that "DTT receiver filters are the most effective method of mitigation"*;
- In addition, Ofcom's February 2012 study notes that *"using high performance DTT receiver equipment and amplifiers (in terms of resilience to adjacent channel interference) can significantly reduce the number of affected households, and as such, can be considered as a secondary form of mitigation in cases where receiver filtering alone proves ineffective."*
- The report from the CENELEC/ETSI joint working group on the Digital dividend. This report finds that consumer equipment installed and equipment which will be manufactured over the next few years do not address the new technical operating conditions as a consequence of the decision to reallocate the use of the frequency band 790 – 862 MHz; and

²⁴⁴ 'Technical analysis of interference from mobile network base stations in the 800 MHz band to digital terrestrial television' – Ofcom, 10 June 2011

- The study in Denmark.²⁴⁵ This found that the use of filters at DTT receivers appears to be the most cost effective and practical mitigation technique. The modelling suggested that use of filtering will substantially eliminate interference from both overload and adjacent channel interference (ACI), leaving a small number of households for which filtering is not suitable. In addition, this report noted that another mitigation measure against DTT receiver overload and ACI was to improve the immunity of DTT receivers, by designing them with a higher interference threshold and protection ratio.

- A 9.132 Furthermore, ComReg notes the information on the RTÉNL website, in the section entitled 'RTÉNL Saorview FAQs'.²⁴⁶ In this document, RTÉNL advise consumers about their DTT receiver system to ensure that the aerial is suitable to receive in the band 470 – 790 MHz only and protect against 'interference' using a filter.²⁴⁷
- A 9.133 In light of the above, ComReg remains of the view that receiver overloading issues are a function of the receiver system and the most effective and appropriate mitigation technique for receiver overloading is by using appropriate filtering within the DTT receiver system.²⁴⁸ ComReg is also of the view that DTT receiver systems which include masthead amplifiers will require the installation of a filter.²⁴⁹
- A 9.134 In addition, ComReg notes RTÉNL's view that suitable filters are not available on the market and a technical solution is unlikely to be available in advance of the 800 MHz band services launching.

²⁴⁵ '800MHz auction: Co-existence of LTE systems in 790-862 MHz with Digital Terrestrial Television' August 2011 – By DotEcon and Analysys Mason as commissioned by NITA

²⁴⁶ <http://www.rtenl.ie/wp-content/uploads/2012/01/RTÉNL-SAORVIEW-FAQs-Jan-2012-Rev-6.0.pdf> - Rev 6.0 dated January 2012.

²⁴⁷ RTÉNL Saorview FAQs Rev 6.0 dated January 2012 states that "If you are doing work, or having work done on your television aerial, RTÉNL recommend that you ensure that the aerial is restricted, in so far as is possible, to the television broadcast band only (UHF channel 21 to 60). To protect your television services against interference into the future frequencies / channels above and below this should be filtered out."

²⁴⁸ ComReg notes the view held by DCENR, which agrees with ComReg's view: "Filters may be needed in cases where the DTT signals are above channel 51 (due to potential so called image channel "N+9" sensitivity of some receivers) and in cases where channel 58 (770MHz) or 59 (778MHz) are to be used by DTT." As published on its website <http://www.dcenr.gov.ie/Communications/Business+and+Technology/Digital+Dividend/>

²⁴⁹ ComReg notes that this view is held by DCENR: "Installations which use a mast head amplifier for TV reception (irrespective of the frequencies to be received) will most likely need a filter. This is because mast head amplifiers are prone to an "overload" condition if the signal level from either DTT or other sources (on frequencies either above or below the TV signal) is very strong." <http://www.dcenr.gov.ie/Communications/Business+and+Technology/Digital+Dividend/>

A 9.135 ComReg disagrees with this view and has, with minimal effort, been able to identify several suppliers who are making filters specifically to address incompatibilities between DTT and services in the 800 MHz band at prices (in one off quantities) from €19 each²⁵⁰ ComReg is therefore of the view that suitable filters to address the issue are now available at an accessible cost on the Irish market.

Who should be responsible for mitigating any receiver overload issues?

A 9.136 In relation to who should be responsible for mitigating any receiver overload issues, which are by their very nature due to a deficiency in the affected system and in the specific cases referred to in this section are a direct result of an inappropriate amplifier and/or no filtering being employed in the domestic television reception installation, it should be noted that such installations are susceptible to electromagnetic disruption from a wide range of different services and such disruption is not peculiar to the proposed LTE services. As such, in Document 11/60a ComReg stated that it believed that it is the responsibility of the DTT community to advise consumers of this potential broadcast reception issue so that DTT receiver systems installed at consumers' premises would have appropriate filtering fitted where required to ensure that the installation being employed to receive DTT signals meets the requirements set down in relevant EU Directives²⁵¹. All cases of disruption to DTT services not related to overloading of amplifiers or DTT receivers, or lack of appropriate filtering shall be considered external interference and investigated as part of ComReg's statutory obligations. ComReg notes that while eircom Group agreed with ComReg's view, RTÉ was of the view that the 800 MHz licensee should also be responsible.

A 9.137 Since Document 11/60a was published, this issue has been the subject of further comment in the DCENR's DSG and on 21 December 2011, ComReg expressed its views on this issue²⁵² to the DCENR.

A 9.138 In this correspondence and in relation to DTT receivers, ComReg stated that "the coexistence issue between DTT and electronic communications services in the 800 MHz band ... [is not] ... a technical issue for ComReg to address in the

²⁵⁰ ComReg note that such filters are available from two of the largest manufacturers in Europe (Johansson and Triax) which supply much of the equipment for the Irish market.

²⁵¹ Specifically Directive 2004/108/EC, cited as Electromagnetic Compatibility Directive, transposed in Irish law as SI No. 109 of 2007

²⁵² See item 20 in ComReg Document 11/102 "ComReg: Letter to DCENR of 21 December 2011 "Overload Problem" (email and letter of 21 December 2011)"

context of its statutory functions, objectives and duties in relation to the management of the radio frequency spectrum.”

A 9.139 ComReg set out the following reasons for this view:

- *“there are significant issues in relation to the suitability of consumer DTT-receiving systems and, in particular, there is a legacy of consumer television aerial systems which extend reception into the 800 MHz band;*
- *many of these systems will likely result in consumer DTT-receiving systems being susceptible to possible overloading from electronic communications services (“ECS”) operating in the 800 MHz band;*
- *the proposed technical conditions for new services in the 800 MHz band accord with EC Decision 20/267/EU; and*
- *technical conditions on any existing or new services are not targeted to tackle possible issues related to television reception systems which extend reception into the 800 MHz band.”*

A 9.140 Given the above factors, ComReg stated that:

- *it is “imperative that DTT consumers are in a position to ensure that their DTT reception system is installed in such a way so as to not unduly receive radio signals from outside of the television frequency bands at some time in the future (i.e. not suffer from electromagnetic disturbance in the form of radio frequency overload)”²⁵³;*
- *“for consumers to be in a position to avoid receiver overloading, it is, we believe, incumbent upon RTÉ (and by extension, ‘Saorview’) to properly inform DTT consumers and the TV installer community of the issue and how this can be resolved in simple, easy-to-understand terms”;*

A 9.141 Finally, ComReg also stated that

- *“it is the responsibility of consumers to ensure that their television reception system is installed in such a way that it has sufficient levels of protection so as not to receive radio signals from outside of the television frequency bands that may be expected at some point in the future. Indeed Annex 1 of Directive 2004/108/EU (“EMC Directive”) provides that:*

²⁵³ As noted earlier on 24 October 2012, the analogue free-to-air television service will switch-off to accommodate the future use of the 800 MHz band, and the 790-862 MHz band will no longer be used by the broadcasting service.

- *“Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure that it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use”...*
- The Directive also provides that
 - *“A fixed installation shall be installed applying good engineering practices and respecting the information on the intended use of its components, with a view to meeting the protection requirements set out in Point 1.”*
- *ComReg is of the view that the combination of an antenna, any associated amplifiers and filters and a DTT receiver is a fixed installation within the meaning of the EMC Directive and that, in light of EC Decision 20/267/EU it is reasonable to expect that ECS signals will be transmitted in the 800 MHz band throughout Europe.”*

- A 9.142 Subsequent to this letter, ComReg received further correspondence on this issue from RTÉNL.²⁵⁴ In this correspondence, ComReg notes that RTÉNL agrees with the bulk of the technical content of ComReg’s letter to DCENR and is now of the view that a common message by the relevant authorities (ComReg, BAI, DCENR) and the broadcasters would help to address this issue. In this regard, ComReg notes that this issue has been the subject of further discussion with the DSG.
- A 9.143 In addition, ComReg notes that RTÉNL expressed an unwillingness to amend the ‘Saorview’ information campaign to inform consumers of the potential susceptibility of DTT receiving systems to interference from 800 MHz band services. ComReg maintains its view that the ‘Saorview’ information campaign does not currently provide sufficient information on the potential of consumers’ DTT receiving systems to be susceptible to interference from 800 MHz band services, and ComReg urges RTÉ and the DTT community to inform DTT consumers of this issue, in simple-to-understand language.
- A 9.144 Finally in relation to RTÉNL’s view that manufacturers and retailers of television receiver systems operate in an unregulated market, ComReg notes that all manufacturers who place such product on the market within Ireland are obliged to comply with relevant EU Directives (as transposed in Ireland by national

²⁵⁴ See Document ComReg 12/21 RTÉNL’s email response of 4 January 2012 to ComReg’s Letter of 21 December 2011 “Overload Problem”.

legislation) and EU Regulations (by the use of “CE” mark) and retailers can only sell such product on the Irish market if it conforms to European Regulations.²⁵⁵

A 9.145 Given the above, ComReg remains of the view, as set out in its correspondence of 21 December 2011,²⁵⁶ which in summary states that:

- it is the responsibility of consumers to ensure that their television reception system is installed in such a way that it has sufficient levels of protection so as not to receive radio signals from outside of the television frequency bands that may be expected at some point in the future;
- for consumers to be in a position to avoid receiver overloading, it is incumbent upon RTÉ (and by extension, ‘Saorview’) to properly inform DTT consumers and the DTT installer community of the issue and how this can be resolved in simple, easy-to-understand terms.
- DTT consumers should be advised, in simple-to-understand language, to check, or have a suitably qualified person check, that their current DTT receiver systems are likely to function correctly in the presence of ECS signals in the 800 MHz band and, in particular, do not receive signals above 790 MHz and, if they do, to contact a suitably qualified installer to remedy any likely problem.

A9.4.4 Establishing a Separate Entity to Deal with ‘Interference Complaints’

A 9.146 In Document 11/60a, ComReg stated that it did not believe it was necessary to set up a separate entity to deal with ‘interference complaints’ as any loss of service due to interference is likely to be small in scale. ComReg notes that RTÉ and RTÉNL expressed concern regarding the process proposed by ComReg and stated that the process as outlined by ComReg could result in the resolution of a complaint taking several months.

A 9.147 ComReg has carefully considered all additional submissions and has sought out detailed additional information to respond as comprehensively as possible to them. ComReg remains of the view that setting up a separate complaints authority would, based on the anticipated minor scale of the problem, be disproportionate.

²⁵⁵ See the Directive 1999/5/EC (the R&TTE Directive) Directive 2004/108/EC (the EMC Directive).

²⁵⁶ See item 20 in ComReg Document 11/102 “ComReg: Letter to DCENR of 21 December 2011 “Overload Problem” (email and letter of 21 December 2011).

A 9.148 As discussed earlier, it remains the view of ComReg that the scale of any ‘*interference issues*’ between future 800 MHz band services and DTT is likely to be small, and can therefore be addressed by ComReg in accordance with its statutory obligations. Given this, ComReg believes its position, as expressed in Document 11/60a, remains valid and

- any loss of service and/or interference issue should first be reported to the relevant service provider who would then determine the potential cause of this interference and/or loss of service issue.
- If it is determined that the issue is attributable to radio interference between services and not due to a deficiency in the affected system (i.e. cases of radio frequency (RF) overload or instances where there is insufficient immunity to expected sources of electromagnetic disturbance) and that the DTT installation is broadly in-line with good practice, then the service provider can report this issue to ComReg which has a statutory function to investigate such cases across all radio-communications services.

A 9.149 Both the DTT community and future ECS service providers in the 800 MHz band are subject to the provisions of the R&TTE and EMC Directive and ComReg believes that both communities can co-operate to minimise and prevent the possibility of interference or electromagnetic disturbances occurring.

A 9.150 Furthermore, it is also ComReg’s view that RTÉ and the DTT community have a crucial role to play in helping to prevent instances of interference. In this regard, ComReg believes that RTÉ, ‘Saorview’ and the DTT community should advise current and future DTT consumers to ensure their DTT receiver system is appropriate and fit for purpose.

A9.4.5 Other Issues Raised by Respondents

A 9.151 ComReg notes that respondents to ComReg’s documents raised a number of general issues and these are discussed below.

ComReg needs to undertake a study and consult with Industry in Ireland

A 9.152 In their responses to Document 11/60, RTÉ, RTÉNL and TG4 asked ComReg to conduct a detailed study to estimate the potential of interference in Ireland and the impact of all mitigations.

- A 9.153 While ComReg has noted this request, ComReg has also noted the large amount of information available from other studies carried out in Europe. This information has been presented in this document and in Document 11/60a, and includes study results and/or licence condition proposals from CEPT, ETSI/CENELEC, Denmark, France, Germany, Norway, Portugal, Sweden, Switzerland, and the UK.
- A 9.154 Given the large volume of information available from the above studies and the broadly similar circumstances between Ireland and the countries where those studies were carried out, ComReg is of the view outcomes and conclusions from these studies are broadly applicable to Ireland. Accordingly, ComReg is of the view that a further study in Ireland is not required. As discussed throughout this Annex, ComReg has taken into consideration all such studies made available to it in arriving at its position regarding the co-existence of 800 MHz and the DTT service below 790 MHz.

RTÉ's claim that the draft RIA is incomplete

- A 9.155 RTÉ and RTÉNL stated in its response to 11/60 that the draft RIA is incomplete as no reference is made to the impact of the new licensed services on digital broadcasting services in the adjacent band, or to the impact on existing users of the 790 to 862 MHz band not related to ASO.
- A 9.156 While ComReg has noted this comment, ComReg is of the view it is not required to conduct a RIA on this issue. On 6 May 2010, the EC adopted a Decision which harmonises the technical conditions of use in the 800 MHz band, for terrestrial systems capable of providing electronic communications services in the European Union.²⁵⁷ As the harmonisation of the technical conditions of use in the 800 MHz band was a regulatory obligation imposed by the EU, it is not necessary for ComReg to conduct a RIA.
- A 9.157 ComReg's RIA Guidelines²⁵⁸ set out the circumstance in which ComReg considers that a RIA might be appropriate. In general, ComReg conducts a RIA in any process that might result in the imposition of a regulatory obligation (or the amendment of an existing regulatory obligation to a significant degree), or which might otherwise significantly impact on any relevant market or on any stakeholders or consumers. Chapter 3 of this document sets out the use of RIA in this document. In this regard, the RIA contained in Annex 4 deals with two fundamental policy issues: (a) what if any additional bands should be included

²⁵⁷ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010D0267:EN:HTML>

²⁵⁸ See document 07/56a – Guidelines on ComReg's approach to Regulatory Impact Assessment – August 2007.

with the award of the 900 MHz band and; (b) what type of assignment process should be used. ComReg has also conducted RIAs with regard to its proposed licence conditions for coverage and quality of service, as set out in Annex 11.

RTÉ's contention that ComReg's proposed approach to the implementation of European Commission Decision 2010/267/EU is not appropriate or in line with other European states.

- A 9.158 In its response to Document 11/60, RTÉ and RTÉNL expressed the view that ComReg's implementation of the European Commission Decision 2010/267/EU is in contrast to other countries where 800 MHz spectrum is being released. Additionally, RTÉ and TG4, stated that ComReg should follow international best practice.
- A 9.159 ComReg does not believe that this view accords with the reality of the situation. As discussed throughout this Annex, ComReg has taken into consideration all international studies made available to it in arriving at its position regarding the co-existence of 800 MHz and the DTT service below 790 MHz. ComReg's final position, having arranged matters so that UHF channel 60 is unlikely to be used for DTT in Ireland in the foreseeable future, is in line with Decision 2010/267/EU and international best practice in other countries.

RTÉ's contention that some of the revenues received from the spectrum award process should be used to cover costs associated with implementing interference mitigation

- A 9.160 RTÉ and RTÉNL requested clarification whether ComReg is considering that some of the revenues received from the spectrum award process should be used to cover costs associated with implementing interference mitigation.
- A 9.161 ComReg notes RTÉ and RTÉNL request but reminds interested parties that ComReg does not have a mandate to allocate revenues from the award process to cover the costs associated with implementing mitigation actions related to the coexistence of ECS services in the 800 MHz band with the broadcasting service in the band 470-790 MHz band.
- A 9.162 ComReg's detailed consideration of the mitigations actions associated with the coexistence of ECS services in the 800 MHz band and the broadcasting service in the band 470-790 MHz band has been discussed throughout this Annex and among other items, ComReg is of the view that:
- it is the responsibility of consumers to ensure that their television reception system is installed in such a way that it has sufficient levels of protection

so as not to receive radio signals from outside of the television frequency bands that may be expected at some point in the future;

- it is the responsibility of RTÉ and the DTT community to advise consumers of the potential loss of broadcasting reception issue that might arise if DTT receiver systems are receiving signals outside the television frequency bands; and
- if there are instances of SINR degradation, these are likely to be minor in scale and any such SINR degradation would be addressed by ComReg in accordance with its statutory obligations; and
- DTT systems and future services in the 800 MHz band have a duty to ensure that the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended. The DTT community and future licensees in the 800 MHz band can co-operate with each other to minimise the possibility of interference or electromagnetic disturbances occurring into each other's services, and each licensee should take into consideration the other network's deployment when planning and deploying its own network.

Programme Making and Special Events (PMSE) or Outside Broadcast (OB) link usage in the 800 MHz band;

- A 9.163 ComReg notes RTÉ and RTÉNL statement in its response to Document 11/60 that no reference was made to Programme Making and Special Events (PMSE) or Outside Broadcast (OB) links usage of the 790 to 862 MHz band and the provisions that would be required to relocate any such licensees.
- A 9.164 In relation to this issue, ComReg firstly notes that the PMSE issue has been the subject of a separate consultation²⁵⁹ and on 28 September 2011, ComReg published the revised PMSE guidelines, Document 08/08R2, which reflects the changes adopted as a result of the PMSE consultation process.
- A 9.165 Document 08/08R2 addresses RTÉ's comment as it states ComReg's view on PMSE users and states that after ASO,

²⁵⁹ In April 2010, ComReg consulted on future spectrum availability for wireless cameras and wireless microphones, and the response to consultation was published in September 2010. ComReg notes that no representation from RTÉ or RTÉNL was received during the PMSE consultation process.

- UHF channel 38 will be made available for wireless microphone/in-ear monitor operations; and
- all other spectrum assignments above 790 MHz will be migrated to UHF channel 38 and/or any interleaved spectrum that may be available after ASO. ComReg noted that the quantity of interleaved spectrum available after ASO will be determined in future consultations.

A 9.166 In relation to OB links, ComReg is not aware of any such links licensed to RTÉ or RTÉNL in the 800 MHz band. ComReg would remind all parties that it is an offence to keep or operate such equipment without an appropriate licence, unless such equipment is declared a class or description of apparatus for wireless telegraphy to which section 3 of the Wireless Telegraphy Act 1926 (as amended) would not apply.

A9.4.6 Summary of ComReg's Final Position

A 9.167 Having considered the views of respondents and any relevant international studies (as discussed above), this section summarises ComReg's final position regarding the co-existence of services in the 800 MHz band with DTT services below 790 MHz.

A 9.168 In line with Decision 2010/267/EU and given the co-existence issues that may arise due to the introduction of new services in the 800 MHz band, ComReg is of the view that it is appropriate to:

- apply the 'Case A' BEMs as a licence condition for all spectrum blocks in the 800 MHz band; and
- set a maximum mean in-block EIRP limit for all 800 MHz base stations at 59 dBm/5 MHz. ComReg may review the maximum mean in-block EIRP limit in the future, if required.

A 9.169 In addition, ComReg, in conjunction with RTÉNL and the BAI, has planned the Irish DTT spectrum requirements such that the first six DTT multiplexes are planned on the basis of using UHF channels 21 – 59 only (i.e. using frequencies from 470 – 782 MHz only). If a 7th or 8th DTT multiplex is required, then UHF channel 60 may be required in certain areas. As UHF channel 60 has been avoided for the provision of six DTT multiplexes, in practice this will give a 9 MHz separation between the uppermost DTT channel (i.e. UHF channel 59) and the lower 800 MHz block (i.e. Block A). The avoidance of the use of UHF channel 60 in the licensing of the first six DTT multiplexes is a preventative

measure to mitigate against coexistence issues between 800 MHz and DTT services below 790 MHz.

A 9.170 In relation to the possible degradation of DTT services from user terminals operating in the 800 MHz band, ComReg is of the view that this is manageable and does not require the specification of additional mitigation measures to be included in the 800 MHz Liberalised Use licensing regime.

A 9.171 In relation to SINR degradation matters, ComReg is of that view that:

- few (if any) SINR degradation issues are likely to be experienced in Ireland, given the 800 MHz licence conditions above and the DTT spectrum planning in Ireland where UHF channel 60 is not being used or planned for use in the first six DTT multiplexes;
- filters at the DTT receiver are the most appropriate mitigation technique in the first instance to address SINR issues. ComReg also notes from international studies that no one mitigation technique is exclusively or entirely successful at eliminating all possible co-existence issues which may arise between 800 MHz band ECS services and DTT;
- SINR degradation issues may arise in the future, but these are likely to be small in scale; and
- it is appropriate for ComReg to deal with SINR degradation issues in keeping with its statutory obligations.

A 9.172 In relation to receiver overload, ComReg is of the view that:

- receiver overload issues are a function of the receiver systems and are best addressed via the use of appropriate antennas and appropriate filtering at the receiver;
- it is the responsibility of consumers to ensure that their television reception system is installed in such a way that it has sufficient levels of protection so as not to receive radio signals from outside of the television frequency bands that may be expected at some point in the future;
- for consumers to be in a position to avoid receiver overloading, it is incumbent upon RTÉ (and by extension, 'Saorview') to properly inform DTT consumers and the TV installer community of the issue and how this can be resolved in simple, easy-to-understand terms; and

- DTT consumers should be advised by RTÉ (and the DTT community), in simple-to-understand language, to check that their current DTT receiver systems are likely to function correctly in the presence of ECS signals in the 800 MHz band and, in particular, that any such receiver systems do not receive signals above 790 MHz and, if they do, to contact a suitably qualified installer to remedy any likely problem.

A 9.173 While the above sets out ComReg’s view in relation to the loss of broadcast reception matters, it should be noted that under the EMC Directive,²⁶⁰ the operators of both DTT systems and future ECS services in the 800 MHz band have a duty to ensure that the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended and that equipment sold, or installations constructed, by them are appropriately immune to electromagnetic interference. In this regard, ComReg notes that

- the DTT community and future licensees in the 800 MHz band have an incentive to co-operate with each other in order to minimise the possibility of interference or electromagnetic disturbances occurring into each other’s services.
- information regarding the licensed technical parameters of the DTT network in Ireland have been published on ComReg’s website²⁶¹ and details of the Wireless Telegraphy apparatus associated with a 800 MHz licensee is to be captured in its licence.²⁶² DTT and 800 MHz licensees should take such information into consideration when deploying their networks and considering whether additional mitigation measures (e.g. at a base station level it may be appropriate to use reduced power, additional filtering or polarisation discrimination) are required.
- ComReg notes that the Saorview Specification²⁶³ is implemented as additions and clarifications to a previous version of the NorDig

²⁶⁰ “Directive 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC”

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:390:0024:0037:en:PDF>

²⁶¹ Licensed technical parameters of broadcasting services in Ireland

http://www.comreg.ie/radio_spectrum/technical_parameters.542.1071.html

²⁶² It is ComReg’s intention that details of the Liberalised Use Licences in the 800 MHz, 900 MHz and 1800 MHz bands will be published on its website.

²⁶³ “Saorview Minimum Receiver Requirements: Digital Terrestrial Television Additions and clarifications to NorDig Unified Requirements 2.2”,

http://www.rtenl.ie/wp-content/uploads/2011/Minimum_Receiver_Requirements_5.pdf

specification.²⁶⁴ However both the Saorview specification²⁶⁵ and the current version of the NorDig specification²⁶⁶ require operation across all of UHF Band V (606 to 862 MHz). ComReg notes that this specification was issued prior to Decision 2010/267/EU and the “*Notification of Change to TV Standards in Ireland*” document²⁶⁷ on the www.goingdigital.ie website from 10 November 2011. ComReg is of the view that RTÉ, as a member of NorDig, should seek to have the standard specification modified so that it no longer specifies as mandatory for receivers to operate in the portion of the UHF Band V from 790 – 862 MHz.

A 9.174 Finally, it should be noted that ComReg may amend the rights, obligations and procedures relating to wireless telegraphy licences from time to time in accordance with the Authorisation Regulations.

²⁶⁴ The current NorDig specification is v 2.2.1, http://www.nordig.org/pdf/NorDig-Unified_ver_2.2.1.pdf, the Saorview specification is based on v 2.2.

²⁶⁵ Saorview specification document - table 1.

²⁶⁶ Current version of NorDig specification document - table 3.5.

²⁶⁷ ‘*Notification of Change to TV Standards in Ireland*’ – DCENR, 10 November 2011.

Annex 10: Spectrum Fees

A10.1 Background

A 10.1 In Document 11/60,²⁶⁸ ComReg set out its then position in relation to the minimum price and structure of payments as follows:

- There would be a minimum price for liberalised rights of use to 800, 900 and 1800 MHz spectrum;
- A benchmark methodology and application of same by DotEcon would be used to inform ComReg's proposals, including a relativity analysis in relation to the setting of a minimum price for liberalised rights of use to 1800 MHz spectrum;
- Licence fees would be structured to include an upfront spectrum access fee ("SAF") and ongoing spectrum usage fees ("SUFs") and the minimum price would be split on a 50/50 basis between the two types of payments. Further, ComReg proposed that the SUFs should be indexed to inflation based on the consumer price index ("CPI"); and
- The deferred payment proposal, set out in earlier consultations, would be withdrawn.

A 10.2 Further, ComReg proposed the following:²⁶⁹

- For a licence from 2013 to 2015 (time slice 1 circa 2.5 years)
 - The reserve price would be €3.34 million with SUFs of €1.21 million per annum for each 2 x 5 MHz lot of liberalised rights of use to 800 or 900 MHz spectrum;
 - The reserve price would be €1.67 million with SUFs of €0.60 million per annum for each 2 x 5 lot of liberalised rights of use to 1800 MHz spectrum; and
- For a licence from 2015 to 2030 (time slice 2 circa 15 years)

²⁶⁸ At paragraphs 4.192 to 4.206 of Document 11/60.

²⁶⁹ At paragraph 4.205 of Document 11/60.

- The reserve price would be €8.48 million with SUFs of €1.21 million per annum for each 2 × 5 MHz lot of liberalised rights of use to 800 or 900 MHz spectrum;
- The reserve price would be €4.24 million with SUFs of €0.6 million per annum for each 2 × 5 MHz lot of liberalised rights of use to 1800 MHz spectrum;

A 10.3 This annex presents:

- A summary²⁷⁰ of ComReg’s previous proposals in relation to relevant issues;
- A summary of the latest views provided by interested parties in relation to those proposals;
- A summary of relevant views provided by DotEcon, ComReg’s expert economic advisors;²⁷¹
- ComReg’s consideration of certain other relevant materials bearing on the issue; and
- ComReg’s final position, having carefully considered respondents’ and DotEcon’s views as they relate to and address matters raised.

A10.2 Minimum Prices, Benchmark Methodology and Application

A 10.4 In Document 11/60 ComReg considered that a minimum price would be appropriate for the following reasons:

- To deter frivolous bidders without genuine business cases whose participation may prolong the auction process and waste resources;
- To disincentivise and guard against uncompetitive auction outcomes, including those which could arise from anti-competitive collusive behaviour of potential bidders;

²⁷⁰ Where summaries are provided in this annex, whether of previous ComReg proposals, respondents’ submissions or expert reports reference should be made to the original document for the definitive version thereof.

²⁷¹ See DotEcon reports, published as ComReg Document 12/23 and 12/24 alongside this Response to Consultation and Decision, which sets out DotEcon’s detailed consideration of and response to respondents’ views, and its recommendations on the relevant proposals.

- Encouraging efficient use and ensuring effective management of spectrum; and
- To ensure that the administrative cost of the auction process is recovered;

A 10.5 In Section 4.5 of Document 10/71 ComReg determined that the following factors should inform the setting of the minimum price:

- The minimum price should not give rise to or increase incentives for collusive behaviour;
- The minimum price should not be set so high as to choke off demand;
- The minimum price should not be set so low that there is participation by frivolous bidders;
- The minimum price should not reflect any social option value; and
- The administrative costs of running the award process should be recovered from the minimum price set.

A 10.6 Moreover, ComReg's approach to the setting of the minimum prices (using the benchmark exercise and a relativity approach for 1800 MHz spectrum) is informed by its statutory functions, objectives and duties, including its statutory objective to promote competition through ensuring the optimal use of radio frequencies, thereby encouraging the efficient use and ensuring the effective management of radio frequency spectrum.

A 10.7 ComReg remains of the view that to achieve the objective of the promotion of competition it is essential that licences for rights of use to spectrum are assigned to those who value them the most. Accordingly, the benchmark approach is considered to be the approach that best suits the circumstances of the award.

A 10.8 In Annex 9 of Document 11/60a ComReg set out the reasons why a low but non-trivial pricing approach would not be an optimal approach to setting the level of the minimum price.²⁷² For example, ComReg's stated concerns were that it believed that a low but non-trivial pricing approach could maximise the incentives for collusion in any auction where there is limited competition. In addition, ComReg provided an assessment of the potential issues surrounding

²⁷² At paragraph A 9.87 and succeeding paragraphs in Document 11/60a.

interplay between the level of the minimum price and the likelihood of tacit collusion occurring.²⁷³ Following its assessment, it considered that the setting of a minimum price using the benchmark approach would be the most suitable approach in this award.

A10.2.1 Respondents' Views

Overview of Respondent's views

- A 10.9 In the main, respondents to Document 11/60 welcome the reduction in the proposed minimum prices but remain of the view that the proposed minimum prices are too high. The principal reasons they put forward for this view relate to claimed errors or flaws in the approach to the benchmarking exercise (and, by implication, claimed errors in how the relativity analysis for the setting of the 1800 MHz minimum prices is conducted). Concerns expressed include the following:
- The availability (or lack thereof) of suitable data to be applied to the proposed award;
 - Drawing meaningful conclusions from the pricing data, as Ireland has unique macroeconomic characteristics including a larger variation between Gross National Product ("GNP") and Gross Domestic Product ("GDP") per capita statistics than do other jurisdictions whose pricing data is used in the benchmark; and
 - The sensitivity of the modelling to the winners to bidders' ratio ("WtB ratio") gives ComReg and DotEcon a 'free-hand' to adjust the output arbitrarily.
- A 10.10 Accordingly, most respondents suggest that a more conservative approach to setting the level of the minimum price should be taken by ComReg. Vodafone however, maintains its position that a low but non-trivial minimum price should be adopted instead of a benchmarking approach.
- A 10.11 Respondents continue to seek other clarifications including in relation to ComReg's view that the minimum prices are not market values for the spectrum but starting points for the proposed auction. Related to this, respondents assert that ComReg overstates the significance of using the level of the minimum prices to address its concerns regarding the likelihood of collusion or tacit collusion occurring.

²⁷³ At paragraphs A 9.134 to A 9.141 in Document 11/60a.

- A 10.12 In particular, respondents express the view that other means for addressing ComReg's concerns are not weighed appropriately by it and that ComReg's proposals are not a proportionate response to its concerns. For example, respondents express the view that the proposed CCA auction format and threat of expulsion from the auction (or threat of legal actions taken under the Competition Act 2002) would better deal with the concerns that ComReg raises.
- A 10.13 Respondents also generally express the view that at the proposed minimum price levels there would be a risk of spectrum going unsold, which would be contrary to ComReg's objectives for the proposed award.
- A 10.14 Set out below are further details of respondents' specific views and concerns. The analysis of respondents' views which follows, has regard to their original submissions, and only summary views are set out as a means to illustrate specific points and concerns raised by respondents. For the avoidance of doubt ComReg has carefully considered all submissions by all respondents to the consultation process and the omission of a specific point from the discussion in this document does not mean that it has not been considered. Interested parties should refer to respondents' original submissions for further details on the particular concerns raised.

Detailed views of respondents

- A 10.15 Five respondents provide specific views on the minimum prices, benchmark methodology and application. These are eircom Group, H3GI, Telefónica, TiF, and Vodafone.

GNP vs. GDP

- A 10.16 One of the main concerns raised by respondents is that, in their views, ComReg (and DotEcon) have collectively failed to appreciate the 'large' difference between GDP and GNP per capita in Ireland. They claim this requires a more conservative approach to be taken with the benchmarking results (in particular, with respect to the regression benchmark sample).
- A 10.17 In particular, respondents assert that ComReg has not factored the potential impact of the larger difference between Irish GDP and GNP per capita compared with other countries into the price modelling conducted by DotEcon. This leads respondents to claim that the approach is fundamentally undermined and that the results of the benchmarking exercise are not fit for purpose. In short, respondents call for the benchmarking exercise to be recalculated using

GNP per capita rather than GDP per capita as they believe that GNP per capita would give a truer reflection of Irish economic output.

A 10.18 Four respondents provide detailed views on DotEcon's use of GDP per capita in its benchmarking exercise. These are eircom Group, Telefónica, TiF and Vodafone. The following reasons were set out as to why GDP per capita would not be the most appropriate variable to use:

- i. Save for Vodafone, respondents point to commentaries made in annual, quarterly or other reports/bulletins by other national agencies and international organisations that figures for Ireland's GDP per capita and GNP per capita are much less interchangeable and 'do not even approximate closely to each other'. In particular, respondents cite comments by the following organisations:
 - a. the Central Statistics Office ("CSO")²⁷⁴;
 - b. the Organisation of Economic Co-operation and Development ("OECD")²⁷⁵;
 - c. the Central Bank²⁷⁶;
 - d. the Policy Advisory Board for Enterprise, Trade, Science, Technology and Innovation ("Forfás")^{277,278}; and
 - e. in addition, Telefónica notes that ComReg itself has used "*GNP rather than GDP as an indication of overall revenues in the communications markets, for example in document 10/73r*".
- Further, eircom Group states on page 21 of its submission "*that expert economic analysts acknowledge that GDP is not the most appropriate variable to consider*" and notes the CSO statement that "*Luxembourg had a GNP²⁷⁹/GDP ratio of 71.2 compared with 82.9 for Ireland in 2010, while the average for the EU countries was 99.9*". In particular it refers to

²⁷⁴ Eircom Group refers to CSO's report on "*Measuring Ireland's Progress 2010*" which reports that the relationship between GDP and GNI in Ireland is exceptional among EU countries.

²⁷⁵ TiF refers to an Observer article from the OECD which concludes inter alia "*...while Ireland produces a lot of income per habitant, GNI shows that less of it stays in the country than GDP might suggest*".

²⁷⁶ Telefónica refers to the Central Bank quarterly bulletin which forecasts a continuing divergence between GDP and GNP, with the latter having slower growth.

²⁷⁷ Telefónica refers to Annual Competitiveness Reports by Forfás that states GNP is a better measure of Irish living standards than GDP.

²⁷⁸ TiF also refers to the following statement by Forfás "*The GNP measure of economic activity is used to benchmark Irish international performance in R&D as it removes the distortion to output measurement caused by large financial flows through the economy by multi-national firms*"

²⁷⁹ Gross National Income ("GNI") is equivalent to GNP plus EU subsidies less EU taxes (see http://www.cso.ie/en/media/csoie/surveysandmethodologies/surveys/accounts/documents/pdfdocs/methology_2006.pdf).

statements made by the CSO that the choice of GDP or GNP would not be a concern for the vast majority of EU countries given the close relationship highlighted by their respective GNI/GDP ratios. It concludes that GDP is not the correct variable to be used for DotEcon's analysis and that the analysis must be corrected accordingly;

- TiF contends that the following statement at paragraph 160 in Document 11/59 by DotEcon that *"we [DotEcon] opted to use GDP as an independent variable in our regression analysis rather than GNP as it is a better reflection of the domestic income levels within Ireland"* is factually incorrect. In support of its contention, TiF claims that it has been well established and is regularly recognised by Irish Government and international agencies that in the case of Ireland, GNP is *"a much more accurate reflection of the income available to Irish citizens"*. TiF also notes *"that the nominal size of GDP in 2010 was some 18% higher than the GDP [sic], largely due to the substantial profits earned by multinational companies based in Ireland."*
 - ii. Telefónica claims at paragraph 9.7 (i) of its submission that *"GDP is not a useful comparator for the Irish economy because of the large distorting effect of non-national trade"*. Further, it contends that the value of a licence *"is derived almost exclusively from anticipated revenue generated by servicing Irish consumers. The consumption and revenue generated will be determined by the welfare of those consumers, and on the contrary will be minimally influenced by the value of non-national but domestically located production."*
 - iii. Vodafone claims at paragraphs 31 and 32 of its submission that *"GDP is a geographically based measure of the value of output in contrast to GNP which is a resident measure"* and *"the latter [GNP] is clearly superior to the use in terms of reflecting the income actually available to Irish residents."* It claims that the relevant factor in the context of spectrum valuation is the income level of residents as measured by GNP per capita, not the value of national output much of which may be attributable to *"foreign owners of factors of production located in the country"*. In short, Vodafone considers GNP is *"clearly"* a superior reflection of the level of income earned by citizens in a country and better reflects the potential for spending on domestic telecommunication services. It notes the difference between GNP and GDP is approximately 18% and contends that this drives ComReg's minimum prices higher than they should be.

A 10.19 For completeness, interested parties should also note the respondents' views on DotEcon's use of GDP per capita set out previously and which were addressed by ComReg in Document 11/60a at paragraphs A9.31 and A9.36. In particular, various views were considered and responded to, under the following high-level points which are enumerated therein as points (6), (7) and (14)²⁸⁰, and which specifically address views on:

- '*comparing awards between other countries*', which is discussed in detail in Annex 9 of Document 11/60a, and referred to as point (6) in the relevant discussions therein;
- '*accounting for other influential factors (recession and GNP)*', which is referred to as point (7) in Annex 9 of Document 11/60a; and
- '*worsening economic situation*', which is referred to as point (14) in Annex 9 of Document 11/60a.

Modelling issues

A 10.20 Respondents also maintain many of their previously held views on the benchmark approach, modelling exercise and relativity analysis conducted by DotEcon. Namely, they continue to perceive there to be gaps and issues with same, notwithstanding ComReg's extensive draft final analysis and response set out in Document 11/60a at paragraphs A9.92 to A9.97 and DotEcon's analysis in Annex D of Document 11/59 at paragraphs 154 to 172.

A 10.21 For example, views repeated again include those that were considered by ComReg in Document 11/60a under the following high-level points therein:

- '*role of minimum price is not to determine market value*', which is discussed in detail in Annex 9 of Document 11/60a, and referred to as point (11) in the relevant discussions therein;
- '*obtaining a sizeable sample of similar spectrum comparators*' (referred to as point (2) in Annex 9 of Document 11/60a);

²⁸⁰ The points enumerated in Document 11/60a and cited again for completeness here represent some of the 31 numbered points responded to / addressed in Document 11/60a, see paragraphs A9.25 to A9.39, A9.50 to A9.52 and A 9.59 to A 9.63 of Document 11/60a. In addition, numerous other specific points were noted and responded to by ComReg, including 15 numbered points in relation to respondents specific views on ComReg's selection of the level of the minimum price as discussed at paragraphs A9.132 to A9.153 of Document 11/60a.

- ‘*comparing awards between different countries*’ (referred to as point (6) in Annex 9 of Document 11/60a);
- ‘*efficiency of the auction*’ (referred to as point (3) in Annex 9 of Document 11/60a);
- ‘*deterring frivolous bidders*’ (referred to as point (4) in Annex 9 of Document 11/60a); and
- ‘*reflecting on its experience with the 26 GHz auction*’ (referred to as point (5) in Annex 9 of Document 11/60a).

A 10.22 In addition, respondents again sought clarification as regards whether the proposed minimum price was in effect a market price and what implications this might have on ComReg achieving its objectives for the award.²⁸¹

Respondents’ new / additional reasoning

A 10.23 In particular, the following new, and in certain cases additional reasons submitted are set out below. Although these reasons are considered by ComReg to be new and/or additional to previous ones made, there remains some overlap with many of those previously addressed. Accordingly, ComReg provides cross references to Document 11/60a to highlight relevant discussions of respondents’ views therein. This should be helpful in providing additional relevant context. The main new and/or additional points are as follows:

- i. eircom Group notes that “*ComReg’s proposed minimum price appears to be at the lower end of outcomes in respect of European 800 MHz auctions. That said if the minimum price for the Swedish auction had been set at ComReg’s proposed level it is arguable that the Swedish auction could not have proceeded in an efficient manner.*” and submits a graph to illustrate the point being made.²⁸² It contends that the fact that there will always be a number of significant differences between particular national spectrum auctions and the Irish circumstances, is a key reason for the need to apply ‘extreme caution’ when using the results of DotEcon’s analysis to inform a decision in respect of minimum fees to be applied in Ireland;

²⁸¹ ComReg considered these repeated points and does not find reason to alter its position from that set out in Documents 11/60 and 11/60a.

²⁸² See page 17 of the respondent’s submission and Chart 1 on “Recent Sub 1 GHz European Auctions”

- ii. Telefónica claims that ComReg has taken a contradictory position²⁸³ as regards whether the proposed minimum price represents the estimated market value for spectrum. This is illustrated in the text of paragraph 9.18 of the respondents submission where it notes that “*ComReg having stated that its priority is eliminating tacit collusion by setting the price at or near the market value, then go on to claim that it is setting the price safely below the market value*”. In addition at paragraph 9.3 of its submission, Telefónica “*believes this is an impossible task [to set the minimum price close to the sale price] as only the auction itself will determine the value of each lot*” and “*And any attempt to do is prone to significant and substantive error*”; and
- iii. Vodafone claims in paragraph 30 of its submission that it did not see any clear distinction “*between ComReg’s claim that the benchmarked minimum prices are not market prices*” but that they “*are in fact ‘conservative’ market prices or market valuations of spectrum*”. Further it does not consider the minimum prices to be reserve prices set in advance of an auction with the view to eliminating spurious bidders on the basis that a lower price could equally eliminate spurious bidding.

A 10.24 Other new and/or additional reasons for concern submitted in response to Document 11/60 include the following:

- i. eircom Group claims that “*benchmarking analyses are always fraught with difficulties in trying to generate indicators that are comparable with national circumstances.*” Further it claims that time series over which the potential comparators were drawn needs to be addressed together with the specific manner in which adjustments for the circumstances of the Irish economy are made. Vodafone in its response to Document 11/75 makes a related point when stating, in the context of one year licences, that the use of inappropriate comparators is a material error of fact, potentially invalidating the benchmarking process;
- ii. At paragraph 9.23 of its submission, Telefónica contends that “*there are no benchmarks at all for valuing temporal lots*” which it believes needs to be addressed in terms of ensuring that an appropriate minimum price is set across time slices. Telefónica also contends at

²⁸³ In paragraph A 10.92 ii below, other claimed contradictions are set out and addressed.

paragraph 9.12 (ii) that DotEcon should produce “*a graph or table showing the results produced by the model compared with the actual results achieved in the 12 most recent auctions*”;

- iii. Further at paragraph 9.9 (ii) of its submission, Telefónica raises concerns with DotEcon’s argument that the long term nature of the licences mean that the transient shifts in GDP should not have much effect on the value of long-lived assets. It claims that “*This [DotEcon’s argument] ignores the fact that the bulk of the valuation of spectrum is based on their short term value, given the impossibility of predicting the state of the telecommunications market over a longer period*”;
- iv. In addition Telefónica claims at paragraph 9.9 (ii) of its submission, in relation to the current state of the Irish economy that “*demand for telecommunications services has been badly affected by the present downturn*” and does not accept DotEcon’s conclusion in paragraph 37 of Document 11/59 that consumer demand for telecommunication services is more resilient than other services implying that the downturn is not having a serious effect on mobile operators business. It claims expert analysis states that the Irish economy will continue to struggle for several years and domestic demand will continue to contract; and
- v. Concerns raised regarding some of the exclusions and adjustments made by DotEcon in its benchmark samples including the following:
 - a. eircom Group contends that the reasons presented by DotEcon in relation to reducing the importance of the Swedish auction outcome in its analysis calls for ComReg to generally “*apply extreme caution when using the results of DotEcon’s analysis to inform a decision in respect of minimum fees to be applied in Ireland*”. As such, it asserts that “*minimum prices should be set no higher than the lower end of DotEcons’ lower bound estimate (currently €15 m)*”;
 - b. H3GI asserts that DotEcon’s analysis lacked objectivity as it had brought into question the competitiveness of the Swedish and Danish auctions. In particular H3GI states “*H3GI does not agree that these auctions were not competitive and that the prices achieved did not reflect market value*”; and
 - c. In paragraph 9.6 of its submission Telefónica asserts that “[i]n order to be useful, they [benchmarks] must produce a relevant set of data from situations that are directly comparable to that in

Ireland at the current time". Further at paragraph 9.9 (ii) of its submission Telefónica takes issue with DotEcon's statement that the inclusion of recent auctions in the dataset used for the benchmark analysis would be informative on spectrum values in the current economic climate, as in its view the analysis does not include auctions from "*countries undergoing a recession of severity and length of that in Ireland*".

The Winners to Bidders Ratio WtB ratio

A 10.25 One respondent, Telefónica, continues to oppose the manner in which DotEcon uses the WtB ratio in its calculations to produce some of the benchmark data. In particular it provides the following additional reasons:

- i. At paragraphs 9.9 (iv) and 9.16 of its submission, Telefónica expresses the following views:
 - That DotEcon's report on the use of the WtB ratio is unclear and the move from using a ratio of 0.86 to 0.77 in Document 11/59 is a "*significant impact*" on the benchmark range and had DotEcon maintained a ratio of 0.86 "*the minimum price according to table 11 [in DotEcon's report, see Document 11/59] would have been several million euro lower – with the bottom dropping from €15 million to €12 million*";
 - That no analysis is provided as to whether competition in auctions in other jurisdictions "*would translate into greater demand in the Irish market*" and accordingly changing the WtB based on the competitiveness of other auctions should be substantiated by DotEcon and ComReg; and
 - That "*ComReg's stance in altering the WtB ratio (perceived increased competitiveness) contradicts the position it is taking on tacit collusion, where it strongly asserts the risk that the auction will not be competitive*".

Relativity analysis for setting the 1800 MHz minimum price

A 10.26 Two respondents, eircom Group and Telefónica provide specific views on the minimum price for 1800 MHz, and DotEcon's relativity analysis to set same. The following reasons are set out to argue against DotEcon's relativity analysis:

- i. eircom Group claims that the minimum price is "*well in excess of recent outcomes, with the one exception of Italy (Oct 2011)*". It claims that the excessive minimum price appears in part to be related to the proposed methodological approach of making a 50%

adjustment relative to the sub-1 GHz minimum price. It presents two further graphs comparing ComReg's proposals with the outcomes of recent awards to support its view that "*none of the outcomes in respect of higher frequency spectrum conform to ComReg's proposed relativity factor [i.e. conform to 50% of the sub-1 GHz minimum prices]*". In light of its arguments, eircom Group proposes that the relativity factor to be applied should be adjusted to no more than 30%;

- ii. At paragraph 9.25 of its submission, Telefónica claims that the current relative price approach "... *offers no advantage over determining the minimum prices for 1800 MHz independently*" Telefónica also maintains that if there is a scarcity of benchmark pricing data for the 1800 MHz band, this will be even more so the case where data is required for both 800MHz/900MHz and 1800MHz sold together – further reducing the number of reference points. Telefónica views the approach of setting the minimum price for 1800 MHz relative to 800 MHz and 900 MHz as unreliable and most likely produces an erroneous result. For these reasons it believes that the minimum price for 1800 MHz should be set independently; and
- iii. Telefónica also contends that a more detailed analysis than that which has been conducted to date is required. It supports this view at paragraphs 9.26 to 9.28 as follows:
 - a. the relativity analysis has a much more significant impact on the price for 1800 MHz spectrum; and
 - b. DotEcon's claim in Document 11/59 that "*the relativity of sub-1 GHz to 1800 MHz spectrum value has remained fairly constant over time*" (argued by DotEcon to justify the use of pre-2000 auctions) needs to be substantiated by DotEcon, given technology changes and much greater range of spectrum bands now available for use. In particular, the 800 MHz band had not previously been available for use and the greater availability of sub-1 GHz spectrum with its superior propagation characteristics must have an impact on the relative value of 1800 MHz, decreasing its value.

Common Minimum price for 800 MHz and 900 MHz lots

- A 10.27 On the matter as to whether ComReg should set a common minimum price for liberalised 800 and 900 MHz spectrum, two respondents provide views.

- A 10.28 Telefónica claims at paragraph 9.12 (v) of its submission that there is uncertainty in the relative pricing for 800 MHz and 900 MHz and that this is acknowledged in Document 11/59 to be greater as a result of lower perceived substitutability between the bands in the short term. Telefónica also claims that other uncertain factors support a conservative approach to pricing including uncertainty of demand, and of the impact on pricing of auctioning multiple bands simultaneously.
- A 10.29 Vodafone in its response to 11/75 takes the view that a differential between minimum prices for 800 MHz and 900 MHz spectrum should be applied. In particular it refers to the recent Spanish auction results where 900 MHz licences sold for 78% of the auction price of 800 MHz licences as evidence that a different minimum price should be used for 800 MHz and 900 MHz lots in the proposed award.

A10.2.2 Overview of DotEcon's Assessment of Respondents Views and its Recommendations

- A 10.30 DotEcon's views on the above are set out in Document 12/23.
- A 10.31 Having re-run a regression analysis using GNI rather than GDP, DotEcon is of the view that there is no ground to alter its recommended range of €15m to €26m. Having considered the GDP per capita statistics issue, it provides the following main reasons not to alter its recommendations:
- Demand from telecommunications arises from business as well as consumers;
 - Telecommunications is a service provided within the bounds of a country and DotEcon maintains that it is more appropriate to use a measure of domestic economic activity rather than national income; and
 - The impact on predicted licence values from its regression model of using a proxy for GNP (i.e. GNI) instead of GDP does not give grounds for altering its recommendations.
- A 10.32 At Section 3.2 in Document 12/23, DotEcon considers that the price relativity for 1800 MHz should be set between 45% and 60% of the sub-1 GHz minimum price for, inter alia, the following reasons:
- *"If we adopted the same methodology to derive market value estimates of 1800MHz, it would not be on a similar conservative lower bound basis as*

sub-1GHz because 1800MHz spectrum has no clear technical superiority relative to other frequency bands” accordingly DotEcon is of the view that applying such a methodology would generate central estimates for 1800 MHz spectrum and so would not be in line with the proposed conservative lower bound approach adopted for sub-1GHz; and

- This approach and its recommendation is also consistent with that of other NRAs in Europe.

A 10.33 DotEcon maintains that there should be a common minimum price, for blocks of 800 MHz and 900 MHz spectrum, once that price is conservatively set. The reasons for its views are set out in Section 4 of Document 12/23 and include inter alia the following:

- That “...*the similar propagation characteristics of the bands suggest that these bands could be substitutes, perhaps to a lesser degree in the short run but more definitively in the medium to long run where equipment availability in both bands is no longer an issue (paragraph 91)”*;
- That “...*there is insufficient evidence to suggest what the relative market value of 800MHz and 900MHz spectrum might be. Absent such evidence, we propose that a common minimum price be set for 800MHz and 900MHz spectrum. As long as a conservative common minimum price is set for these bands, no demand would be inefficiently choked off and the relative demand for the two bands in the auction will determine their eventual relative value (paragraph 94)”*; and
- That “...*benchmarks derived from our current analysis summarised in Table 10 above, substantiated by natural experiments from recent auction results that used reserve prices within our recommended range provide strong evidence that our estimated conservative value of sub-1 GHz spectrum of €15m - €26m is a suitable range for sub-1GHz spectrum in the upcoming Irish auction (paragraph 98).”*

A10.2.3 ComReg’s Assessment and Response

A 10.34 ComReg does not propose to repeat DotEcon’s assessment of respondents’ views save to the extent that ComReg wishes to highlight key points made by it. As part of the background to this section, ComReg considers DotEcon’s assessment of the relevant issues to be reasonable as it has carefully considered respondents’ views and has provided an updated report which addresses the concerns and points raised.

GNP vs. GDP

A 10.35 As noted above the principal concerns expressed by respondents in relation to the use of GDP per capita statistics are as follows:

- Various commentaries highlight Ireland's GNP / GDP ratio is low compared to EU average;
- Influence of non-national but domestically located production; and
- GDP is a geographically based measure whereas GNP is a resident based measure.

A 10.36 ComReg notes DotEcon's assessment of these concerns in its fifth benchmarking report (Document 12/23) as follows:

- Firstly, DotEcon concludes at paragraph 119 of Document 12/23 that *"...having considered the impact on using GNI rather than GDP, we do not find grounds to alter our recommended range of €15 - €26m"*
- In particular, as part of considering the impact of using GNP instead of GDP as the explanatory variable, DotEcon conducted an alternative version of its regression analysis using GNI as a proxy for GNP. This is described in detail in Annex E of Document 12/23. Table 28 therein sets out the results of this GNI sensitivity analysis, and which DotEcon used to inform the above conclusion.
- Moreover, DotEcon notes that *"...GDP is not used to derive our averages benchmarks. It is only used to define the sample of countries with a certain level of GDP (i.e. GDP per capita lower than €20,000)".* (paragraph 112).
- Further, demand for telecommunications arises from businesses as well as consumers. As such, and as pointed out by DotEcon, *"it is far from clear that national income per head (better measured by GNP) is a stronger influence on demand [for telecommunications services] than domestic economic activity (measured by GDP). DotEcon further notes that "telecommunications is a service provided within the geographical bounds of a country and given the benefits of GDP generally as a more commonly used national output measure, ...it is more appropriate to use a measure of domestic economic activity as an explanatory variable in our main analysis, rather than national income as such"* (paragraph 115).

A 10.37 ComReg's consideration of the GNP v GDP issue is as follows:

- First, ComReg confirms that it concurs with DotEcon's analysis of this issue and its position in this respect, as summarised above at paragraph A 10.36 and set out in Document 12/23.
- Neither ComReg nor DotEcon dispute that the ratio of Ireland's GNI/GDP is low compared to the EU average. Various commentaries highlight this. However, the commentaries selected by respondents were proposed in a different context and do not address the specific issues which arise in relation to the present matter, i.e. whether GDP per capita is the most appropriate explanatory variable to use in benchmarking market value of spectrum across different jurisdictions.
- Instead, it seems that all of the commentaries listed refer to situations where Ireland's 'performance' is being compared to that of other jurisdictions. In ComReg's view, adjusting for the market value of spectrum across different jurisdictions is a wholly different issue than trying to benchmark Irish international performance, which is the aim of the Forfás Annual Competitiveness Report cited by Telefónica and TiF, and the particular OECD Observer article quoted by TiF.
- In addition, in Document 10/73r ComReg compares the performance of the electronic communications sector with other Irish economic output, which necessarily requires using GNP rather than GDP as the comparator. And, in so far as ComReg understands, the other non-specific references made by respondents to the CSO and Central Bank would also relate to comparing performance and not to setting a comparator for correcting for the market value of spectrum.
- In short, none of the examples provided by respondents specifically demonstrate that GDP is an inappropriate comparator to correct for the market value of spectrum.
- ComReg notes that DotEcon has re-run its regression benchmarks using GNI (as a proxy for GDP) and found no reason to alter its recommended minimum price range (see paragraph 119 of the fifth benchmarking report).
- ComReg would like to highlight what DotEcon has stated in paragraph 112 of its latest report, namely that "...GDP is not used to derive our averages benchmarks. It is only used to define the sample of countries with a certain level of GDP (i.e. GDP per capita lower than €20,000)". ComReg

considers that this point is useful in that it demonstrates the limited circumstances when GDP is used.

- ComReg believes that relevant benchmarks are substantiated by “...*natural experiments from recent auctions that used reserve prices within our [DotEcon’s] recommended range*” and which “*provide strong evidence that our [DotEcon’s] estimated conservative value of sub-1GHz spectrum of €15-€26 m is a suitable range for sub-1GHz minimum prices in the upcoming Irish auction*” (paragraph 98); and,
- In light of the above, ComReg does not consider it necessary to amend its approach in this regard.

Modelling issues and Respondents’ new/additional reasoning

- A 10.38 In relation to concerns set out in paragraph A 10.23 (i), (ii) and (iii) above on ‘the need to apply extreme caution when using the results of DotEcon’s analysis’, ‘whether the minimum price represents the estimated market value for spectrum’ and ‘the distinction that the minimum prices are not market prices but conservative market prices or market valuations of spectrum’, ComReg maintains the view that the entire benchmark range produced by DotEcon represents a lower bound conservative estimate of market value and not an attempt at estimating the actual market value of spectrum in Ireland. In particular, ComReg notes DotEcon’s conclusion in its latest report at paragraph 15 that “...*to a larger extent than our previous reports, our estimates in this report should specifically yield conservative lower bound estimates for sub-1 GHz spectrum*”.
- A 10.39 On the basis of the analysis carried out by its expert economic advisors, ComReg believes that any point value within the recommended range is unlikely to represent the market value of spectrum in Ireland but that a point towards the upper end of the range is likely to be closer to that market value. However, only after the auction is completed can the market value be determined. In this regard, ComReg has been mindful of its aim of not choking off demand and accordingly, as set out below, has, adopted a conservative approach and opted for a minimum price well below the top of the range recommended by DotEcon.
- A 10.40 In relation to Vodafone’s assertion that the benchmarked minimum prices are ‘*not reserve prices set in advance of an auction with a view to eliminating spurious bidders and believes that ComReg’s basis or rationale for using them for that purpose is flawed and risks leaving unallocated spectrum*’, ComReg

would point out that deterring spurious bidders is not the sole factor but one of a number of factors, such as reducing incentives for collusion, considered by ComReg in setting an appropriate minimum price. Furthermore, contrary to Vodafone's assertion, setting minimum prices on the basis of a conservative lower bound estimate of market value does indeed achieve the aim of deterring spurious bidders.

- A 10.41 In relation to the concerns raised by eircom Group (and similarly by Vodafone) at paragraph A 10.24 (i) above that '*benchmarking analyses are always fraught with difficulties in trying to generate indicators that are comparable with national circumstances*', ComReg notes that DotEcon has produced five benchmarking reports, each an update on previous versions. In particular, in the fifth benchmarking report issued alongside this Response to Consultation and Decision new updates are made and further corrections to particular benchmark samples are set out. At Section 2.1 of Document 12/23, DotEcon sets out the new auction data relating to recent relevant awards, as well as augmentation of the original auction dataset due to the regular maintenance DotEcon carries out on its Spectrum Awards Database from which the dataset is drawn. This update includes updates to the country level demographic and economic data used in its analysis. At Section 2.2, DotEcon sets out the updates to the treatment of datasets made in its analysis.
- A 10.42 In short, DotEcon considers the above has resulted in the further exclusion of some outliers in its datasets, which it contends should yield "*a more precise estimate of spectrum value for the band specific benchmarks. This is possible with greater amount of more relevant benchmark data now available.*" (paragraph 14).
- A 10.43 As noted above, DotEcon's estimates in its latest report should specifically yield conservative lower bound estimates for sub-1 GHz spectrum to a larger extent than its previous reports.
- A 10.44 Furthermore, ComReg is of the view that other indicators which are comparable across jurisdictions, which ComReg considers have some relevance to determining the relative value of spectrum and for which cross-country data is available, such as monthly minutes of use ("MOU")²⁸⁴ and mobile average revenue per user ("ARPU")²⁸⁵ further validate its view that the benchmark figures constitute a conservative lower bound estimate of the minimum price.

²⁸⁴ MOU is a frequently used metric to determine levels of mobile telephony usage.

²⁸⁵ ARPUs are a function of both the price of mobile services and the level of usage of mobile services.

For example, there has been a 3.5% year on year (to Q3 2011) increase in average minutes of use in Ireland as compared to monthly Western European MOU.²⁸⁶ Notwithstanding the recent decline in ARPU for Irish MNOs, which is generally in line with the trend of recent decline in Western European ARPU, ComReg notes that data collected by Worldwide Cellular Information Service on blended ARPU for the year December 2010 to 2011 shows that average Western European ARPU was €20 per month, as compared to €30 for Ireland. On the basis that ARPUs and MOUs in Ireland are on average higher than most other Western European countries, it is not unreasonable to suggest that spectrum in Ireland may be considered relatively more valuable than certain other countries used in the benchmark by prospective auction bidders. This further indicates that any estimate for the value of spectrum in Ireland derived from the benchmark is conservative.

- A 10.45 Finally, ComReg notes that the conservative approach taken by DotEcon to estimating a minimum price and identifying a recommended range have been further validated by relevant recent auction results.
- A 10.46 At paragraph A 10.24 (ii) above, ComReg noted Telefónica's concern that there are no benchmarks for valuing temporal lots (which, in the present context, we understand to mean time slices) and that this needs to be addressed. In response, ComReg notes that there is no reasoning provided by Telefónica as to how its proposal of a temporal lot benchmark might be implemented.
- A 10.47 Even if ComReg and/or DotEcon could derive from the benchmark database a sample of other jurisdictions employing an identical two-time slice approach (or similar time slice approach), it is not clear how such a sample should be treated in the benchmark exercise in order to yield a result on a lower bound conservative basis, which is the overarching goal of methodology current employed in the benchmarking approach. In the absence of clarification and further reasoning being provided by Telefónica, it is not possible for ComReg to consider this matter further. In any case, ComReg is satisfied that the benchmark approach taken by DotEcon safely yields a conservative lower bound estimate of the market value of spectrum.
- A 10.48 As noted at paragraph A 10.24 (iii) above, in its consideration of the state of the Irish economy Telefónica argues that the bulk of the valuation of spectrum is based on its short term value, given the impossibility of predicting the state of the telecommunications market over a longer period and claims that the Irish

²⁸⁶ Credit Suisse, Equity Research, Wireless Telecommunications Services, European Mobile Sector Review Q3 2011

economy will continue to struggle for several years. As such, Telefónica disagrees with DotEcon's view, set out in Document 11/59, that any shifts in GDP will in part be transient rather than permanent with the transient component not having much effect on the value of long-lived assets.

A 10.49 ComReg does not agree with Telefónica's view in this regard. In response, ComReg notes and agrees with DotEcon's view (in Document 12/23) that: *"...there is no conclusive evidence that consumption of telecommunications services are particularly sensitive to changes in income levels.....as we have mentioned in earlier benchmarking reports, it is important to recognise that radio spectrum licences are long-run assets whose value should be expected to change less than proportionately with changes in contemporaneous GDP. Therefore the transient component of shifts in GDP should not have much effect on the value of long-lived assets. The long-term nature of these licences means that operators will base their valuations on the revenue stream of these licences throughout the term of the licence. We do not expect Irish GDP to be decreasing throughout the 15 year period of the licence and therefore we do not consider that it is appropriate to depress the minimum prices further than what is required to reflect the current state of the Irish economy which we have already taken into account.(paragraph 128)"*

A 10.50 ComReg also notes that:

- There is currently a dramatic year on year growth in data volumes in the Irish mobile market. ComReg has no reason to believe that the growth in mobile data volumes will abate in the foreseeable future. This view of licences would appear to be supported by various other forward looking statements in the industry, which indicate significant potential demand for data services over the long term.²⁸⁷ Accordingly, even with new generations of technology enhancing the efficiency of the use of spectrum, ComReg is of the view that spectrum is almost certain to remain a valuable resource over the timeframe of the proposed licences;
- Telefónica itself argues for licences of indefinite duration and that there should be a minimum notice period before termination of no less than 5 years. This, in ComReg's view, does not support the assertion that the valuation of spectrum is based on its short term value only; and

²⁸⁷ Public availability statements and reports include the Cisco VNI Mobile, 2011, the UMTS Forum, Report 44, Mobile Traffic Forecasts 2010 – 2020 Jan 2011 and the January 2012 update on "4G Mobile Broadband Evolution: 3GPP Release 10 and Beyond.

- DotEcon has in each of its benchmarking reports updated its analyses with results of auctions that have taken place recently, reflecting the current economic climate in Europe and have also used the most up to date demographic and economic data available to it. DotEcon notes that Greece used identical minimum prices (adjusted for Greek population) to those proposed by ComReg in Document 11/60 and awarded all available lots.

- A 10.51 At paragraph A 10.24 (iv) above, ComReg noted Telefónica's disagreement with DotEcon's view that consumer demand for telecommunications services is more resilient than other services, in light of the fact that it claims '*the demand for telecommunications has been badly affected by the present downturn*'. While ComReg acknowledges that demand for electronic communications services has decreased somewhat during the recent economic downturn along with demand for most other services, ComReg believes that this decrease should not be overstated.
- A 10.52 For example, Telefónica notes in its response to Document 11/60 that the mobile sector experienced a 10% revenue reduction between Q2 2009 and Q2 2011. However, ComReg notes that this statement does not give the full picture. Some of this reduction can be attributed to amendments by ComReg during that period to the mobile revenue definitions, in particular the definition of handset sales revenues. Furthermore, ComReg notes that mobile retail revenues had largely recovered from their Q2 2009 level by Q4 2010 until a dramatic drop in mobile retail revenues in Q1 2011, caused in large part by a drop in Telefónica's reported revenues for that period. In any case, ComReg notes that the fall in revenues has slowed down significantly in recent periods such that mobile retail revenues are down only 2.1% since Q3 2010 and comparing Q3 2010 to Q3 2011 data revenues are in fact up by 2.7% with voice and other revenues down by 3.7%.²⁸⁸ However, that is not to say that ComReg has not had cognisance of the state of the industry in coming to its decisions under the Award Process.
- A 10.53 ComReg also notes that even if the auction was to be an uncompetitive auction such that bidders would be required to pay the Minimum Price, the deterioration in the outlook for growth and national income has been reflected in DotEcon's Benchmarking reports, as they have consistently sought to ensure that the most recent GDP levels have been used. Specifically, between the publication of Document 09/99c where 2008 GDP per capita was used and that of Document

²⁸⁸ For a discussion of the issues presented see Document 11/98 on Key Quarterly Data Report for data as of Q3 2011.

12/23 where 2011 GDP per capita is used, GDP per capita dropped by circa 22%. The use of lower GDP levels have reduced the value of the range of market values produced by the regression benchmarks, therefore allowing DotEcon take into account the possible negative effect of the recession on the market value of the spectrum. In its fifth benchmarking report DotEcon includes in its dataset spectrum auction results of recent auctions that would be reflective of the current economic climate. Therefore, the methodology used by ComReg has taken into account the deterioration in the economy over that period and therefore the current state of the electronic communications industry.

- A 10.54 Various forward looking statements in the industry also indicate significant potential demand for data services in the long term such as the Cisco VNI Mobile, 2011, the UMTS Forum, Report 44, Mobile Traffic Forecasts 2010 – 2020 January 2011 and the January 2012 update on 4G Mobile Broadband Evolution: 3GPP Release 10 and Beyond²⁸⁹ which specifically notes “*that global wireless data usage continues to increase at an unprecedented pace*”. These forward looking statements seem to suggest that growth would be expected to continue unabated notwithstanding the present economic context.
- A 10.55 In addition, Document 11/98, ComReg’s Quarterly Key Data Report, Section 4.4 shows that mobile retail revenues for Q3 2011 were €414.5 million, up again by 0.9% but down 2.1% since Q3 2010. Data revenues²⁹⁰ increased for quarter (+2.9%), while voice and other revenues²⁹¹ rose marginally from the previous quarter (+0.2%). Comparing Q3 2010 to Q3 2011, voice and other revenues were down by 3.7% but data revenues were up by 2.7%.²⁹²
- A 10.56 Further, ComReg refers to the points made in paragraph A 10.44 above that the average western blended ARPU for the period December 2010 to 2011 was €20 as compared to the Irish ARPU levels of €30. The above data clearly shows that voice revenues are slightly down but that there is big potential in terms of increasing revenues for data and that Irish ARPU is relatively buoyant when compared to that of other Member States.

²⁸⁹ http://www.4gamerica.org/documents/4G%20Americas_3GPP_Rel-10_Beyond_January%202012%20Update.pdf

²⁹⁰ Messaging revenues (SMS and MMS) and mobile broadband and mobile internet services revenues

²⁹¹ Please note that since Q2 09 the voice and other category revenues includes voice call revenues and net handset sales revenues, connection and rental charges, premium rate SMS and MMS revenues, roaming SMS, MMS and data revenues. Handset sales revenues prior to Q2 09 were reported on a gross revenue basis.

²⁹² Credit Suisse, Equity Research, Wireless Telecommunications Services, European Mobile Sector Review Q4 2010

- A 10.57 As such, ComReg is of the view that there is no new information before it which would suggest that it is appropriate to amend its approach to setting the minimum price.
- A 10.58 In any case, ComReg believes that once the minimum price is not set so high as to choke off demand, bidders can take informed decisions as regards the level of their bids.
- A 10.59 In relation to the concerns summarised at point A 10.24 (v) above on *'reducing the importance of the Swedish auction'*, *'objectivity of DotEcon in light of its comments on competitiveness of Swedish and Danish auctions'* and *'including data from countries undergoing a recession of the severity and length of Ireland'* ComReg's assessment and response is as follows:
- First, ComReg is of the view that the concerns expressed in this regard do not demonstrate that DotEcon's analysis lacks objectivity as, over the course of developing its five benchmarking reports to date, it has always submitted reasoning for particular steps it takes in its benchmarking approach. DotEcon maintains that the Danish auction had characteristics which suggest it was not fully competitive (see also paragraphs 63 to 66 in Document 11/59). For example, it notes that incumbent operators were constrained from bidding in that auction. The respondent argues that this in itself does not mean the auction was not competitive, however, it does not provide any reasoning as to why such a view would hold true when clearly, if incumbent operators could not bid for spectrum, competition in the auction would be reduced.
 - In relation to the Swedish auction, DotEcon provides extensive reasoning as to why the price produced would not be in line with the benchmark (Document 11/59). The respondent raising the concern, however, does not provide any specific analysis of DotEcon's reasoning. ComReg therefore finds DotEcon's views to be more persuasive and credible than those expressed by the respondent.
 - As regards including benchmarks from countries in recession or in similar economic conditions as Ireland, ComReg would first disagree with the assertion that, in order to be useful, benchmarks must produce a relevant set of data from situations that are directly comparable to that in Ireland at the current time. DotEcon has commented previously on the fact that transient shifts in GDP should not have much effect on the value of long-lived assets. In this regard, it is incorrect to suggest that benchmark

pricing should only be based on benchmarks which exactly reflect the current economic climate. If this were so, then benchmarks could probably never be used by regulators given the lack of suitable ‘*direct comparators*’. Instead, DotEcon has had regard to recent auctions across Europe, and notes in its latest report that those regulators set minimum prices that fall within its recommended range of €15 to €26 m (when adjusted for the population of Ireland). In particular, DotEcon sets out and comments on these recent auctions. Arguably, some of these auctions were conducted in countries in a similar economic situation as Ireland.²⁹³

- DotEcon considers the relevance of benchmarks in the frequency bands offered in recent auctions, which have been held in the current economic climate, and notes that “*Given the relevance of these benchmarks, we have considered the auction results carefully ensuring that our recommended minimum price is in line with these benchmarks*” (paragraph 12) which would in ComReg’s view further moderate any concerns in this regard. Following its latest analysis, DotEcon concludes that “*...the benchmarks derived from our current analysis and summarised in Table 10 above, substantiated by natural experiments from recent auction results that used reserve prices within our estimated range provide strong evidence that our estimated conservative value of sub-1GHz spectrum of €15 - €26m is a suitable range for sub-1GHz minimum prices in the upcoming Irish auction*” (paragraph 98).

WtB ratio

- A 10.60 In relation to ‘concerns on the use of WtB ratio’,²⁹⁴ ComReg refers readers to DotEcon’s assessment and response and notes that the WtB is derived from the sample dataset used in the benchmarking analysis rather than being selected by DotEcon. Moreover, DotEcon considers that to use a value for this variable based on a prediction of the auction outcome rather than from the benchmarking dataset would be speculative and it notes that it has “*We have been consistent with our approach to set the winner to bidder ratio for Ireland to the sample average throughout our reports when predicting licence value. The fact that the sample average winner to bidder ratio has decreased from our previous reports purely reflects the increasing competitiveness of auctions within the sample*”(paragraph 136).

Relativity analysis

²⁹³ Recent auctions across Europe considered are Greece, Spain, Italy and Portugal.

²⁹⁴ Set out at paragraph A 10.25.above

- A 10.61 In relation to the concerns expressed in points A 10.26 (i), (ii) and (iii) that *'none of the recent outcomes conform to ComReg's 50% relativity factor'*, *'relative pricing offers no advantage over independent benchmarking'* and *'further evidence to support the claim that the relative spectrum value has remained constant'* ComReg reiterates the reasoning it has set out at paragraph A 9.95 in Annex 9 of Document 11/60a that: *"ComReg notes that a primary aim when setting the price for 1800 MHz is to ensure that the efficiency of the auction process is not compromised. This means that the relative minimum prices between sub-1 GHz and 1800 MHz spectrum should not distort bidders' choice between the different bands. Taking into account the above points, amongst other matters discussed in the revised benchmarking report, and noting that DotEcon recommends that the minimum price for 1800 MHz be set on a reasonably consistent conservative lower bound basis, the exact valuation of sub 1 GHz spectrum and exact valuation of sub-1 GHz relative to 1800 MHz is therefore not crucial. ComReg considers that any uncertainty regarding the precise valuation / parity is reflected in the conservatism in setting the minimum price."*
- A 10.62 Further, ComReg finds DotEcon's assessment and response to the respondent's concerns to be reasonable as it addresses views and considers them against the benchmark methodology which it states *"...has always been to derive a conservative lower bound to market value..."* (paragraph 141).
- A 10.63 In particular DotEcon also notes that *"...if we adopted the same methodology to derive market value estimates of 1800 MHz, it would not be on a similar conservative lower bound basis as a sub-1 GHz because 1800 MHz spectrum has no clear technical superiority relative to other frequency bands. Instead, estimates derived would be central estimates"* (paragraph 64). ComReg considers that a central estimate approach to setting the minimum price for 1800 MHz spectrum is not appropriate given that it considers the lower bound conservative approach should not yield a price that might choke off demand.
- A 10.64 Further ComReg notes DotEcon's observation at paragraph 140 that *"relative prices within the auction should not distort bidders' choice between spectrum"* and as a result the 1800 MHz minimum price should in some way take into account the differences between the likely value of sub-1GHz and 1800 MHz spectrum. As a result of these considerations and concerns DotEcon decided to adopt the approach of determining an appropriate minimum price for 1800MHz spectrum by using auction data to estimate the relative value of 1800MHz to sub-1GHz spectrum which they then applied to the conservative

estimate of sub-1GHz spectrum. This approach allowed it to identify minimum price for 1800MHz spectrum on a similar conservative lower bound basis.

Common minimum price

- A 10.65 At paragraph A 10.28 above, ComReg notes Telefónica's concerns '*on uncertainty in the relative price of 800 MHz and 900 MHz*'. Telefónica argues that this uncertainty supports a conservative approach to pricing.
- A 10.66 In responding to Telefónica's views ComReg considers that DotEcon's views on the matter are particularly relevant. ComReg agrees with DotEcon that "*...we are not implying that the two bands are of identical market value. We acknowledge, particularly in the short run that the two bands could well have differing values as different technologies are deployed within these bands. However, the similar propagation characteristics of the bands suggest that these bands could be substitutes, perhaps to a lesser degree in the short run but more definitively in the medium to long run where equipment availability in both bands is no longer an issue.*" (paragraph 91). ComReg also agrees with DotEcon's conclusion that "*...there is insufficient evidence to suggest what the relative market value of 800MHz and 900MHz spectrum might be*" (paragraph 94) and absent such evidence a common minimum price should be set for 800MHz and 900MHz spectrum. As long as a conservative common minimum price is set for these bands, no demand would be inefficiently choked off and the relative demand for the two bands in the auction will determine their eventual relative value.
- A 10.67 In relation to the concerns raised by Vodafone in its response to Document 11/75 and noted at paragraph A 10.29 above that '*a differential minimum price be applied*' to 800 MHz and 900 MHz spectrum, ComReg notes that the basis for this assertion appears to be the result of a single auction carried out in Spain.
- A 10.68 ComReg also notes and agrees with DotEcon's observations and recommendations in this regard which clearly advocate setting a conservative common minimum price for, *inter alia*, the following reasons:
- "*In the Spanish multi-band auction...it is not surprising that while there was some competition for 800 MHz spectrum that resulted in the 800 MHz licence prices exceeding the common price, only one of two available lots at 900 MHz was won uncontested by Telefonica at the common reserve.*" and "*the lack of competition for 900 MHz spectrum in the Spanish auction, the Spanish auction result does not provide substantial evidence that 800*

MHz and 900 MHz spectrum are of significantly different value.”
(paragraph 92) and,

- *“In the Portuguese auction, Anacom choose to set a lower reserve price for 900MHz spectrum as compared to 800MHz spectrum...As the auction was uncompetitive, the eventual relative price between 800 MHz and 900 MHz spectrum was determined by the relative reserve prices of the two bands rather than their competitive market value.”* (paragraph 93).

A10.3 Structure of Reserve Prices and SUFs

- A 10.69 ComReg discussed this issue at paragraphs 4.180 to 4.183 of Document 11/60. The principal reason for splitting the minimum price between a SAF and annual SUFs is to create sufficient incentive for licensees to make efficient use of spectrum and to hand back part or all of any spectrum holdings which they no longer have any use for.
- A 10.70 ComReg also considered that the SUFs should be indexed to inflation using the CPI published by the CSO.

A10.3.1 Views of Respondents

- A 10.71 Five respondents to Document 11/60 express views on the proposed structure of reserve prices and SUFs. In the main respondents oppose the principle of indexing the SUFs using CPI, with some claiming there are errors in how inflation is treated in the imputation of SUFs.
- A 10.72 eircom Group submits that it found an error in the calculation of reserve prices and SUFs from the minimum prices. It claims that ComReg has erred in its calculations and that, as such, its proposed reserve prices are overstated relative to the proposed minimum price. The following explanation and suggested solutions are provided by eircom Group:
- The claimed error arises due to the manner in which ComReg proposes to calculate the NPVs for the half year elements (Years 2.5, 3 and 17.5) of the proposed time slices. It believes that ComReg’s approach set out in Document 11/60 has the effect of over-inflating the numerators in subsequent calculations but may be easily corrected by ensuring that both the numerator and denominator are derived on a consistent basis.
 - It believes that a very close approximation (ignoring the 19 days in July 2015 beyond expiry of the first time slice) of the correct reserve prices can

be calculated using 6 monthly discount factors. The corrected reserve prices, based on ComReg's proposed minimum fee for sub-1GHz spectrum would therefore be €2.8m for Temporal Lot 1 and €7.8m for Temporal Lot 2.

- It suggests that an alternative approach, using annual discount factors, to ensuring consistent numerators and denominators would be to make a proportionate adjustment to the Year 3 discount factor such that the NPVs of constant cash flow for:
 - Temporal Lot 1 = $Yr1 + Yr2 + (Yr3 \times 45\%)$;
 - Temporal Lot 2 = $Yr3 \times 55\% + (\text{sum } Yr4 \text{ to } Yr 17) + (Yr18 \times 45\%)$;
 - First 15 years = sum of Yr1 to Yr15.

A 10.73 Other assertions were made on how inflation is treated in the derivation of SUFs from benchmarked minimum prices. Two respondents claim ComReg is double counting for inflation by applying CPI for the following reasons:

- eircom Group claims that the Weighted Average Cost of Capital ("WACC") [discount rate] used to calculate annuity for the SUFs already accounts for CPI and thus applying CPI in addition would in effect amount to double counting; and
- Telefónica claims at paragraph 9.31 of its submission that the "*discount rate used to derive the NPV already includes a component to account for inflation*" and so effectively amounts to double counting the indexation of annual usage fees.

A 10.74 In its response to Document 11/75 H3GI believes that it is not appropriate to use the WACC of eircom as an industry standard as it is a highly indebted company and not typical of the existing mobile network operators.

A 10.75 Three respondents, HG3I, Telefónica and Vodafone, oppose any form of indexation of SUFs for the following reasons:

- i. At page 47 of its submission, H3GI claims indexation introduces an unacceptable level of uncertainty into the bidding process;
- ii. Telefónica claims at paragraph 9.12 (vi) of its submission that "*applying average CPI to this price [the proposed minimum price] over the proposed term produces a minimum price of €24 million, which is the higher end of DotEcon's range*"; and

- iii. Vodafone claims at paragraph 37 of its submission that there is no justification for the indexation of SUFs.

A 10.76 Other concerns raised in relation to treatment of inflation include the following:

- i. Telefónica, TiF and Vodafone claim that CPI is not an appropriate index for the following reasons:
 - At paragraph 9.29 of its submission, Telefónica claims that “*there is no correlation between the CPI and mobile communications pricing...let alone spectrum valuation*”. In support of its claim it includes a graph trending CPI and the communications sub-component over a five year period and argues that it illustrates that there is no correlation between the CPI and mobile communications pricing, let alone spectrum valuation;
 - Further at paragraph 9.30 of its submission, Telefónica claims that “*it is widely acknowledged that CPI is not appropriate for use in respect of forms of investment, which spectrum is, because CPI relates to consumer expenditure*”. In support of this claim Telefónica suggests that there is international case law and even legislation (i.e. the Federal Acquisitions Regulations on US government acquisitions) which it asserts recognises that “*the use of an inflation index must only take account of economic factors having a direct and specific relationship to performance of the contract or subject matter in question.*” Telefónica then suggests that “*It is internationally accepted that the index must be constructed to encompass a large sample of relevant items while still bearing a logical relationship to the type of costs being measured. The basis of the index should not be so large and diverse that it is significantly affected by fluctuations not relevant to the costs being measured*”;
 - In its response to Document 11/60, TiF asserts that CPI is a “*very broad measure of inflation in the Irish economy and does not accurately reflect operators revenues as claimed [by ComReg in Document 11/60 and DotEcon in section 14.3 of Document 11/58]*”. TiF goes on to note that, “*a more accurate indicator would be the CPI sub-index on ‘telephone and telefax equipment and services also officially published by the CSO’*”; and
 - At paragraph 37 of its submission, Vodafone claims that there is no justification for the indexation of SUFs but that, “*If ComReg determines that spectrum usage fees indexed to inflation should apply, then the most accurate measure of inflation with respect to the communications industry must be used. This is not CPI, but rather the communications sub-*

component of the overall consumer price index.” It contends that this measure more closely reflects the overall trend in the costs and revenues of the communications industry over the relevant period than the change in the overall CPI.

A 10.77 In addition, at paragraph 38 of its submission Vodafone asserts that “*ComReg does not appear to take account of the impact of spectrum trading, which it now proposes to implement and the effect this has in undermining the rationale to continue to apply spectrum usage fees...The availability of the option to trade some or all of their existing licensed frequencies will effectively lead licensees to internalise the opportunity costs of inefficient spectrum use...*” and “*It is therefore neither objectively justified nor proportionate to impose spectrum usage fees, at least after the first 3 years of the licence, within which time spectrum trading should have been fully implemented*”.

A10.3.2 DotEcon’s Assessment of Views of Respondents and its Recommendations

A 10.78 At section 15.1.3 of its Issues Report (Document 12/24), DotEcon considers the revised methodology provided by eircom Group and concludes that it would be appropriate to adopt aspects of it for the following reasons and based on the following assumptions:

- A different discounting approach is required depending on whether the SUF is to be paid at the start of the period in advance of that period, or at the end of each period;
- SUFs should in fact be paid at the beginning of each period and DotEcon notes that this is ComReg’s standard practice;
- However, for the first time slice, it is necessary to calculate the NPV of a two and a half year licence. DotEcon consider that it is appropriate to apply eircom Group’s proposed correction assuming payments are made at the start of each period; and
- In the third year only half the annualised licence value for the third year is assumed to be paid.

A 10.79 In Section 15 in report on “Issues relating to the award of spectrum in multiple bands in Ireland” (Document 12/24), DotEcon considers the concerns raised by Telefónica of how inflation is treated in the imputation of SUFs from benchmarked minimum prices:

- DotEcon notes that *“it is important to understand the context in which these calculations are being used. In particular, we do not know what discount rate a bidder might apply to future SUFs. Therefore, what is important is that SUFs and reserve prices are not set so high that, in combination, the likely value of spectrum for a serious bidder falls below the reserve price. In this regard, the lower the discount factor used by the bidder, the greater the impact of SUFs in lowering the value of the spectrum to that bidder. Therefore, if being conservative in setting minimum prices, it is reasonable to consider the case of a bidder with relative low cost of capital for the purposes of determining the SUF from benchmarked minimum prices.”* ;
- DotEcon then performs some sensitivity analysis around the discount rate previously used for the SUF calculations. The value used in previous analysis has been a nominal cost of capital for eircom Group at a time when inflation was modest. DotEcon notes that this may understate risks associated specifically with mobile telephony as opposed to fixed telephony, and it needs inflation to be subtracted to give a real discount rate. Given the uncertainties, DotEcon took this as a reasonable estimate of a real discount rate for a bidder. DotEcon then presents some alternative scenarios on the real discount rate and notes that the impact of alternative assumptions is relatively modest. Lower discount rates reduce the SUF, but increase the reserve price for the second time slice; and,
- DotEcon notes that average annual CPI over the period from 2000 to October 2011, gives a figure of about 2.6%. DotEcon recommends that a real cost of capital in the range 7% to 9 % be used for determining SUFs. DotEcon does not consider that, within the range of 7-9% considered, different levels of SUFs will not have any material effect on bidder behaviour or licensee performance. What is important is that bidders have certainty over real values of future SUFs so that these can be reflected in licence valuations (as is being provided with the indexation proposals).

A 10.80 DotEcon considers that the appropriate index for indexing SUFs should be the CPI. The main reasons informing this view are as follows:

- Where possible, ComReg’s approach should remain consistent. Given that ComReg has used CPI to update licence fees in the past and in the recent issue of 900 MHz interim licences to Vodafone and Telefónica, and

in the proposed early liberalisation rebates²⁹⁵, ComReg should remain consistent in its proposed approach;

- This approach would be consistent with ComReg's policy in relation to indexing spectrum licences, which is set out in Document 11/89²⁹⁶;
- The telecoms sub-component of the CPI refers only to price trends in a very limited part of the economy and does not reflect overall price changes in the wider economy; and
- Indexation based on a broad measure of inflation, such as CPI, is likely to be more stable than the use of narrow sub-baskets which are likely to be more volatile.

A10.3.3 ComReg's Assessment and Response

- A 10.81 In relation to the suggested errors in calculating SUFs set out in paragraph A 10.72 above, ComReg notes and agrees with DotEcon's further consideration and recommendation on this issue as set out in Section 15 of its Issues Report and summarised at paragraph A 10.78 above).
- A 10.82 In relation to the concern set out in A 10.73 above that '*there is a double counting of CPI*' ComReg notes and agrees with DotEcon's observations on this matter as set out in Document 12/24 and summarised above at paragraph A 10.79 above.
- A 10.83 In particular, ComReg agrees that using a real discount rate (as by removing inflation from the previously used rate) in the range 7 to 9% for determining SUFs would correct for the issue of 'double counting' as raised by respondents.
- A 10.84 Further, ComReg notes that, within the range of 7 to 9%, different levels of SUFs will not have any material effect on bidder behaviour or licensee performance, and, to correct for the issue of double counting, ComReg intends to select the midpoint of the proposed range and use a real discount rate of 8% for determining SUFs.
- A 10.85 In relation to H3GI's concern that eircom Group's WACC is not typical of the existing mobile network operators, ComReg notes that it is important to understand the context in which the calculations using the discount rate are made. Neither ComReg nor DotEcon know what discount rate a bidder might

²⁹⁵ With which most MNOs agree.

²⁹⁶ Document 11/89 on "Strategy for Managing the Radio Spectrum: 2011-2013," 22 November 2011

apply to future SUFs. What is important is that SUFs and reserve prices are not set so high that, in combination, the likely value of spectrum for a serious bidder falls below the reserve price. In addition, ComReg notes and agrees with the following observation by DotEcon in Document 12/24 at Section 15.1.3 on 'DotEcon commentary on taking account of inflation', "*In this regard, the lower the discount factor used by the bidder, the greater the impact of SUFs in lowering the value of the spectrum to that bidder. Therefore, if being conservative in setting minimum prices, it is reasonable to consider the case of a bidder with a relatively low cost of capital for the purposes of determining the SUF from benchmarked minimum prices.*"

- A 10.86 As noted above, DotEcon has conducted some sensitivity around the discount rate and ComReg has lowered the rate from 10.2 % to 8 % as a result.
- A 10.87 In relation to the concerns expressed by respondents set out in paragraph A 10.74 (i), (ii) and (iii) above '*opposing any form of indexation*', ComReg notes and agrees with DotEcon's assessment and recommendation on this matter as set out by DotEcon, that ComReg should not change its proposed approach.
- A 10.88 In relation to Vodafone's suggestion, noted at paragraph A 10.77 above, that ComReg does not appear to take account of the impact of spectrum trading and that it is neither objectively justified nor proportionate to impose spectrum usage fees, ComReg notes and agrees with DotEcon's views on this matter, in particular that SUFs will still be useful even in the presence of spectrum trading which are set out in Document 12/24 at Section 15.1.3 on 'DotEcon commentary on SUFs in the presence of spectrum trading' as follows:
- "*...spectrum trading exposes a licensee to the opportunity cost of holding spectrum. Therefore, if there is another party with a higher value for that spectrum, holding on to spectrum would be a lost opportunity.*
 - *However, without a spectrum trading regime, the only alternative available to a licensee not using spectrum is to hand it back to ComReg. Recovering a reasonable part of the minimum price through the SUF was justified in part through the need to give incentives to return unused spectrum. This is less relevant with spectrum trading as the opportunity cost of holding spectrum provides an incentive to ensure it is used. Nevertheless, it is still the case that making actual payments for holding a licence is likely to be a more tangible and immediate incentive to giving up unused spectrum than the notional cost associated with failing to transfer to another party who might value it more. This is particularly the case when there may be strategic impediment to the full realisation of spectrum*

trading in the Irish context, as discussed in ComReg documents 11/88 and 11/89. Therefore, there may be still be a case for SUFs to encourage licensees to give up unused spectrum, albeit a lesser case than if spectrum trading were not possible. Spectrum trading reduces the need to use SUFs to encourage optimal use of spectrum; however, it does not eliminate it.

- *Therefore, we do not disagree with the general point made by Vodafone that spectrum trading reduces the role of SUFs in encouraging efficient use of spectrum. However, it does not eliminate its consideration of usefulness in this regard, and SUFs may have other useful effects such as encouraging participation in the award process by effectively back-loading a part of the overall payment for spectrum.”*

- A 10.89 As regards spectrum trading, interested parties should also have regard to Document 11/89 (the recently published “*Strategy for Managing the Radio Spectrum 2011-2013*”), and, in particular, Section 4.2 on ComReg’s position on the secondary trading/transfer of spectrum rights.
- A 10.90 As regards respondents’ concerns set out in A 10.76 above, that ‘*CPI is not an appropriate index*’ ComReg notes and agrees with DotEcon’s assessment and recommendation on this matter as set out by DotEcon and in particular, that ComReg should not change its proposed approach in relation to the use of CPI.
- A 10.91 Telefónica suggests that “*the use of an inflation index must only take account of economic factors having a direct and specific relationship to performance of the contract or subject matter in question.*” ComReg has addressed arguments concerning the suitability of using CPI in the preceding paragraphs. However, in relation to the above argument raised by Telefónica, ComReg notes that the Federal Acquisitions Regulations (“FAR”) regulate economic price adjustment clauses in contracts where supplies are made to US Government entities by contractors and are designed to accommodate inflationary/deflationary changes in the costs of labour and materials.²⁹⁷ In this instance licensees will not be providing services to ComReg, rather ComReg is providing a service to industry and consumers, the activity of controlling and regulating the use of radio frequency spectrum which includes but is not limited to encouraging efficient use and ensuring the effective management of that spectrum. Accordingly, while SUFs also serve functions akin to those performed by administrative incentive pricing (“AIP”) in other jurisdictions, if a direct and specific relationship

²⁹⁷ Bodenheimer, Haile, Economic Price Adjustment Clauses: Pricing Pretzels and Pitfalls, Government Contract Audit Report, Lyman Group. Fall 2002.

were required, in line with practice under FAR, this relationship would be with ComReg's costs rather than licensees' costs.

A10.4 Other Specific Views in Relation to ComReg's Selection of the Level of the Minimum Price

A 10.92 This section of the annex deals specifically with other views in relation to ComReg's selection of the level of the minimum price. The views are grouped into the following broad themes:

- i. Specific views in relation to the interplay between the level of the minimum price and the likelihood of tacit collusion occurring;
- ii. Perceived contradictory views expressed by ComReg or between ComReg and DotEcon in Document 11/60, and claims ComReg is acting contrary to its statutory objectives;
- iii. Claims that ComReg is not addressing all concerns; and
- iv. Claims that operators 'penalised' for potential natural outcomes.

i. Specific views in relation to the interplay between the level of the minimum price and the likelihood of tacit collusion occurring

A 10.93 Respondents repeated many of their views and concerns in relation to the interplay between the level of the minimum price and the likelihood of tacit collusion occurring. Having considered these submissions again, ComReg does not find reason to alter its position from that set out in Documents 11/60 and 11/60a (see paragraph A9.134). In particular, various views were analysed and accordingly responded to under the following points which were discussed in paragraph A9.134 of Document 11/60a as points (1), (2), (3) and (4) and which specifically addressed views on the following:

- '*why the objective of preventing collusion carries greater weight than the objective of not choking off demand*' (referred to as point 1 in Document 11/60a);
- '*the contention that ComReg has not proven and is required to prove that the market is prone to collusion*', (referred to as point 2);
- '*benchmark exercise does not yield price to be set in terms of preventing collusion*' (referred to as point 3); and

- *'spectrum caps and the second price rule should alleviate ComReg's concerns...'*(referred to as point 4).

A 10.94 Three respondents continue to seek clarity on the interplay between the level of the minimum price and likelihood of tacit collusion occurring. This time, two principal assertions are made, firstly that there are other ways for ComReg to address its concerns on collusion and secondly that no evidence is put forward by ComReg to support its claims on the likelihood of collusion or tacit collusion occurring. For completeness and further background, interested parties should review submissions considered previously by ComReg under the points (2) and (4) in paragraph A9.134 of Document 11/60a and ComReg's assessment and response to same in paragraphs A9.135 to A9.141.

A 10.95 Respondents submit new/additional views in relation to the following:

- i. There are other ways to alleviate ComReg's concerns in relation to the likelihood of tacit collusion occurring including the following:
 - H3GI claims that when ComReg refers to tacit collusion "[It does so] *in order to imply that auction at a price below ComReg and DotEcon's perceived value is inappropriate and somehow wrong*". Further it claims that ComReg should acknowledge that "*Actual collusive behaviour is sufficiently dealt with by: (i) the threat of expulsion from the award process; and (ii) prosecution under the Competition Act, 2002 for entering into an agreement or concerted practice contrary to section 4 of that Act*". It also believes that ComReg is "*prioritising short term revenue over competition in the medium and long term*",²⁹⁸
 - At paragraph 9.21 of its submission, Telefónica considers that it is "*incomprehensible*" that even though ComReg has an auction design that is claimed to prevent collusion, it still persists in justifying a high minimum price on the need to reduce the incentive to collude. It also considers that "*ComReg already has the tools to hand to resist the theoretical risk of tacit collusion, such as its choice of auction format, and, if necessary, restrictions on information revelation in the auction*";
 - Further at paragraph 9.20, Telefónica claims that the proposed CCA auction format "*has well understood incentive properties that make tacit collusion impractical*". In support of its position, it refers to published

²⁹⁸ At page 47 of its response to Document 11/60.

statements by DotEcon and Professor Peter Crampton of Maryland University that highlight the benefits of the CCA auction format as regards deterring collusion;

- Vodafone also asserts that the proposed modifications to the spectrum cap in the first time slice materially changes the position in relation to any scope for tacit collusion in the award and does not therefore justify ComReg's current approach; and
- At paragraph 27 of its submission, Vodafone claims that "*The measures which ComReg now proposes, such as limited transparency during the award process, anonymisation of bidder identities etc, are sufficient to effectively address concerns regarding any potential for tacit collusion as may exist.*".
 - ii. In addition, at paragraph 9.15 of its submission, Telefónica claims that there are serious problems "*using T1 900 concerns to justify a 25% price increase across all bands and temporal lots*". It considers that "*it is not proportionate to substantially increase the price of the remaining spectrum across all other bands and temporal lots as a result of concerns predominantly relating to this one category*". It proposes that a more proportionate response is to deal with the issue by deploying measures affecting only the specific spectrum giving concern.

A 10.96 Telefónica asserts that ComReg puts forward no evidence to support its assumptions regarding the likelihood of collusion occurring. For example:

- At paragraph 9.14 (ii) of its submission, Telefónica asserts that "*In the first instance ComReg provides absolutely no evidence, no data to substantiate its assumptions about likelihood of collusion by bidders*". It requests that ComReg's claims be substantiated and at paragraph 9.21 describes ComReg's claims on tacit collusion as "*a theoretical risk*";
- Further, Telefónica contends "*that ComReg is legally required to base such concerns on actual evidence and analysis rather than unsubstantiated assertions*"; and
- At paragraph 9.4 of its submission, Telefónica claims that ComReg has not explained why it believes the proposed CCA in Ireland is more susceptible to collusion by bidders than in any other market.

ComReg's Assessment and Response

- A 10.97 In relation to the concerns expressed by respondents and set out in paragraph A 10.95 (i) above, that '*there are other ways to alleviate ComReg's concerns*', ComReg notes that it has already addressed these concerns previously and does not propose to revisit them here but instead refers readers to its consideration of these issues set out in paragraphs A 9.135 to A 9.141 of Document 11/60a.
- A 10.98 For the avoidance of doubt, and in particular to address the claims made by H3GI summarised in paragraph A 10.95 above, ComReg's assessment and response is as follows:
- ComReg notes that awarding spectrum by an auction ensures that licences are awarded to those bidders with the strongest business cases which usually corresponds to their ability to generate the most economic and social value. It believes that, in light of the substantial reasoning set out by DotEcon in its various reports, any price in the range recommended by DotEcon represents a lower bound conservative estimate;
 - Moreover, as set out below, ComReg proposes to set a minimum price which is significantly below the midpoint of the range proposed by DotEcon. Assuming that ComReg is correct in its view that this price is below the market value of spectrum, setting the minimum price at this level should have no impact on short term revenue (with the effects of collusion excluded); and
 - ComReg does not believe that there is merit in the concern expressed that it is prioritising short term revenue over competition in the medium and long term. First, ComReg notes that the inclusion of SUFs can be expected to reduce short term revenue somewhat in favour of on-going revenue. This does not evidence any intention on behalf of ComReg to maximise short term revenue. ComReg notes that it has no role in maximising revenue; therefore this is not an objective (see also paragraph A 10.119 below) however, ComReg does wish to ensure efficient use of spectrum hence its aim is to award the spectrum to those bidders who value the spectrum the most (i.e. normally those with the strongest business cases for the spectrum).
- A 10.99 In addition, ComReg does not dispute that a CCA auction format offers certain benefits in terms of lowering the risks of collusion, included those noted by Telefónica and supported by its references to published works by Professor

Peter Crampton and DotEcon. However, ComReg notes and agrees with the view expressed by DotEcon that: *“While the auction format and other aspects of the auction as pointed out by Vodafone and Telefónica responses to ComReg document 11/60 should go some way towards minimising the risk of tacit collusion, there is no reason not to set a minimum price that would further discourage strategic behaviour so long as the risk of choking off demand is managed. (paragraph 133 of Document 12/23)”*

A 10.100 As DotEcon has derived its minimum price range with a view to minimising the risk of choking off demand, ComReg is of the view that the minimum price provides a further protection against the possibility of collusion without posing a risk to competition in the auction.

A 10.101 In relation to the concern set out in paragraph A 10.95 (ii) above that *‘to raise the price across all bands by 25% is not proportionate’*, ComReg’s assessment and response is as follows:

- First, ComReg does not ‘raise’ the price on either band, as seems to be suggested by Telefónica. ComReg has used a benchmark methodology to arrive at a lower bound conservative price for the spectrum across all bands. The intention is not to set a market price but to set a floor for a number of reasons including undermining incentives for collusion. ComReg has no reason to believe that the minimum price will actually be the price paid for spectrum in the auction. It considers that all points in the benchmark range would be lower bound conservative estimates and would have a low likelihood of inefficiently choking off demand. In this regard, ComReg notes and agrees with DotEcon’s latest benchmarking report (Document 12/23) which states: *“Our proposed methodology to setting the minimum prices in the upcoming Irish auction has always been to derive a conservative lower bound to market value that would ensure that minimum prices set within this range would have relatively low risk of choking off demand in the auction. The recommended sub-1GHz spectrum is conservative for a number of reasons outlined in Section 1.2. One main reason is that the average value of all mobile frequencies is used in the benchmarking analysis and sub-1GHz spectrum should be worth more than the mobile spectrum on average due to its superior propagation characteristics.”* (paragraph 141)
- Second, Telefónica appears to suggest that the minimum price should apply only to 900 MHz spectrum in the first time slice but makes no attempt at assessing how its suggestion might successfully be

implemented or analysing whether its suggestion could distort demand for spectrum within the auction across bands and time slices. ComReg is of the view that Telefónica's suggestion would have a very high risk of distorting competition within the auction and resulting in an inefficient outcome. ComReg is also of the view that the most proportionate approach to achieving the objective of the promotion of competition is the approach it has proposed to date.

- Third, to the extent that Telefónica's comments on this matter relate to the use of a 900 MHz sub-cap, ComReg notes that this issue is addressed elsewhere in this paper (see Section 4.2 of this document).

A 10.102 In relation to the assertion by Telefónica that ComReg provides no evidence for its tacit collusion argument²⁹⁹, ComReg would note that it has already considered this issue at length previously and does not propose to revisit this matter here but refers readers to its consideration of these issues set out in paragraphs A 9.135 to A 9.141 of Document 11/60a. In any case, ComReg would point out that it would be difficult to determine whether or not collusion has occurred in an auction after the event.³⁰⁰ Accordingly, ComReg is of the view that any paucity of explicit evidence of collusion in past auctions should not militate against the implementation of ex ante measures. In light of the foregoing, ComReg remains of the view that it would be prudent and appropriate to reduce the incentives for collusion during the auction using not only the auction design but also the setting of appropriate minimum prices.

A 10.103 In relation to Telefónica's claim that ComReg has yet to explain why it believes the proposed CCA would be more susceptible to collusion by bidders than in any other market, ComReg would point out that it does not hold this view. While ComReg has not undertaken a systematic review of anti-collusion measures internationally, its focus has been on taking the appropriate steps in the Irish context for minimising the possibility of collusion. Furthermore, it believes that its minimum price proposals are in line with those of other European NRAs in similar recent awards across Europe. These awards have been successful and evidence suggests that demand has not been choked off. This trend seems to be set to continue in upcoming auctions with Ofcom, the UK NRA, stating that it

²⁹⁹ Set out in paragraph A 10.96 above.

³⁰⁰ See, for example, Patrick Bajari and Jungwon Yeo, "Auction Design and Tacit Collusion in FCC Spectrum Auctions" Information Economics and Policy, Elsevier, vol. 21(2), pages 90-100.

is considering setting reserve prices that reflect the market value of spectrum so as to manage strategic incentives of potential bidders.³⁰¹

ii. Perceived contradictory views expressed by ComReg or between ComReg and DotEcon in Document 11/60 and claims ComReg is acting contrary to its statutory objectives

A 10.104 Respondents claim that there were contradictory views expressed by ComReg or between ComReg and DotEcon in Document 11/60.

i. Respondents raise the following concerns:

- a. At page 17 of its submission, eircom Group suggests that *“DotEcon appears to put more reliance on outcomes that exclude new entrant bidders...”*. It asserts that DotEcon is biased in its thinking and that this appears to be at odds with ComReg’s objective of not precluding new entrant participation in the award process;
- b. In its submission at paragraph 9.18, Telefónica suggests that ComReg appears to take a contradictory position on the issue of how it sets the minimum price. It claims that *“...ComReg having stated that its priority is eliminating tacit collusion by setting the price at or near the market value, then go [sic] to claim that it is also setting the price safely below the market value.”*³⁰²
- c. Telefónica further claims at paragraph 9.16 that ComReg takes a contradictory position as regards its stance on the potential competitiveness of the auction and of the likelihood of tacit collusion occurring. For example, it reasons that DotEcon (and ComReg) use a winner to bidder ratio of 0.77 over 0.8 on the basis that the auction will be more competitive than previously anticipated yet, and by contrast, *“the entire tacit collusion argument is based on the assumption that the auction will not be competitive, leaving scope for collusion; and tacit collusion is then justified to increase the minimum price significantly”*. Telefónica makes a very similar argument at paragraph 9.22 of its submission where it states *“It appears ComReg has selected a ratio of 0.77, reflecting an anticipation of a reasonable level of*

³⁰¹ Ofcom, ‘Consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues’, 22 March 2011

³⁰² Telefónica supports its claim by noting that, on the one hand, ComReg states that [at paragraph A9.10 in Document 11/60a] *“setting a higher minimum price, and one particularly that would more closely reflect the real economic value of the spectrum access would reduce the opportunity/ability and incentives of bidders to engage in such behaviour”* but several paragraphs later [at paragraph A9.88 in Document 11/60a] goes on to state that *“the efficiency of the auction will not be impacted once the minimum price is set a reasonable [sic] safe distance below the likely market value of the spectrum”*.

competition in the auction. This seems at odds with the concern that tacit collusion could derive from some kind of common industry assumptions of a 'natural' division of the lots between incumbents."

- ii. Respondents express the view that ComReg's proposals are contrary to its objectives, and that one statement made by it on the objectives of other NRAs should be clarified:
 - a. At paragraph 9.12 (i) of its submission, Telefónica claims that ComReg's decision on the level of the minimum price is "*at odds with ComReg's own statutory objectives, which emphasises the efficiency of spectrum allocation and assignment as the most important goal of any award*". Further, at paragraph 9.5 it claims that arising from the suggested benchmarking errors, and the suggested misinterpretation of its own statutory objectives, ComReg selects too high a minimum price. In so far as ComReg understands this latter point (on misinterpreting its objectives) it notes the following:
 - At paragraph 9.17 of its submission, Telefónica claims that "*ComReg's prioritisation of tacit collusion over other objectives to such a remarkable extent is both contrary to its statutory objectives and stands out amongst other NRAs which have not seen a requirement to elevate the issue to such an extent*";
 - At paragraph 9.12 (iii) in its submission, Telefónica claims that at no point has ComReg considered the relative impact of setting the minimum price too high versus setting it below the anticipated market value which "*Given ComReg's statutory objectives to promote efficient spectrum use, we believe ... the reserve prices should be set at a more conservative level (i.e. no higher than the bottom of the range produced by DotEcon)*".
 - b. Similarly, eircom Group considers that "*There is a very real likelihood that ComReg's proposed 1800 MHz price is excessive and at odds with its stated objectives*". It shows a comparison of the prices achieved in recent awards to support its contention and that the relativity factor should be adjusted to no more than 30% of the price of sub 1 GHz spectrum as a result;
 - c. Two respondents, Telefónica and Vodafone, claim ComReg needs to justify a statement made by it that NRAs in other countries have different objectives when they set low but non-trivial minimum prices. For example, at paragraph 28 Vodafone notes that "*the objectives of all EU NRAs regarding spectrum to be principally and similarly driven by the EU Communications Regulatory Framework*". Similarly Telefónica contends that "*ComReg seeks to justify its divergent approach on the basis that*

other NRAs have different objectives. However as ComReg will be aware, all NRAs should have the same objectives under the relevant EU legislation, so that claiming divergent objectives does not justify ComReg's position".

ComReg's Assessment and Response

- A 10.105 In relation to the concerns set out in paragraph A 10.104 (i) above on perceived contradictions in views expressed by ComReg and between the positions held by DotEcon and ComReg, ComReg's assessment and response is as follows: eircom Group expresses the view that as "[DotEcon] *appears to put more reliance on outcomes that exclude new entrants...*" there is bias in the benchmarking. ComReg notes and agrees with DotEcon's assessment of this issue set out in paragraph 136 of Document 12/23 and in particular its conclusion that its analysis is not biased in favour of auctions that exclude new entrants.
- A 10.106 ComReg also rejects Telefónica's claim that certain statements made by ComReg in Document 11/60 appear to be taking a contradictory position on the issue of whether the proposed minimum price represents the estimated market value for the following reasons:
- First, ComReg would note that it did not propose in Document 11/60 to set the minimum price "*at or near the market value*". These are Telefónica's words.
 - Second, ComReg notes that the two statements quoted by Telefónica are in fact eighty paragraphs apart and so it is important to ensure that the statements are assessed in the correct context. However, ComReg notes that the statement taken from paragraph A 9.10 of Document 11/60a has been taken out of context by Telefónica, as Telefónica ignores the preceding and subsequent text and the overall context of that statement. This statement forms part of an extensive summary of ComReg's original position and how it has evolved, and that summary is clearly intended to be read in its entirety. For example, the bullet point within which the above statement resides is merely a summary of ComReg's views as expressed in section 13.2 of Document 09/99.
 - Third, paragraph 9.10 was intended to compare an approach of setting a higher minimum price to an approach of "*setting a low minimum price*" (which ComReg noted may facilitate and incentivise collusive behaviour amongst participants). ComReg merely noted that a minimum price which

“*more closely*” reflects the real economic value of spectrum than a lower minimum price would reduce the opportunity/ability and incentives of bidders to engage in collusive behaviour. At no point in Document 11/60 has ComReg suggested that the minimum price be set at or near market value.

- Fourth, ComReg makes it clear in the paragraph immediately following the second statement (taken from A 9.88 of Document 11/60a) that the key issue is to set the minimum price at a level which is not so high that it would choke off efficient demand from serious bidders and not so low as to encourage or facilitate tacit collusion. In this regard, ComReg notes that the minimum price has been selected from a conservative lower bound range of the market value of spectrum.
- For the above reasons, ComReg does not consider that the statements quoted by Telefónica at paragraph 9.18 of its submission are contradictory.

A 10.107 In responding to Telefónica’s other concerns that ComReg takes a contradictory stance on the competitiveness of the auction and setting the level of the minimum price,³⁰³ ComReg notes that:

- It cannot predict or determine how competitive the auction might be, rather it is obliged to design and implement a process that will operate effectively and facilitate competition;
- The winners to bidders ratio used in the benchmarking exercise has not been selected as an independent variable driven by assumptions or views of ComReg and/or DotEcon in this regard, rather it is derived from the sample dataset.

A 10.108 Accordingly, ComReg does not see a logical inconsistency between the tacit collusion argument and the change in the WtB ratio. In relation to the concerns expressed by respondents and set out in paragraph A 10.104 (ii) (a) and (c) above that ComReg’s proposals are contrary to its objectives, and that ComReg’s statement on the objectives of other NRAs needs to be clarified, ComReg’s makes the following points:

- ComReg would first note that it is satisfied that the design of the award process complies with its statutory functions, objectives and duties. In this

³⁰³ Set out in paragraph A 10.104 (i) (c).

regard, readers are referred to ComReg's assessment of the preferred option against its statutory objectives as set out in Chapter 3 of Document 11/60.

- In relation to the request that its statement on the objectives of other NRAs be clarified, ComReg agrees with those respondents that all Member States must pursue the same objectives as enumerated in the Framework Directive. However, that does not mean that the approach taken to assigning rights of use for radio frequencies must be, or should be, identical. A variety of market structures and competitive dynamics prevail across Member States and even within Member States over time. Under the regulatory framework, national regulatory authorities enjoy a certain amount of discretion in terms of managing the radio frequency spectrum. In designing auctions, each Member State must react to the prevailing situation in order to ensure that the proposed approach to assigning spectrum best meets its statutory objectives. For this reason, no two auctions will be identical and variations will reflect the particular aims sought to be achieved by each NRA to achieve its statutory objectives.
- Furthermore, ComReg notes that not all auctions included in the benchmarking analysis are from Member States of the EU and so it is incorrect for a respondent to suggest that "*all NRAs should have the same objectives under the relevant EU legislation*".
- Notwithstanding the above view, ComReg notes that use of the term '*objectives*' may have been misleading for some interested parties and the term '*aims*' might have been more appropriate. For example, and referring to paragraph A 9.106 in Document 11/60a, ComReg could have referred to '*differing aims*' of various NRAs as regards payment of SUFs and not '*differing objectives*'. For the avoidance of doubt, at no point has ComReg attempted to suggest that its objectives differ from those set out under the regulatory framework. Whether or not the objectives of other EU NRAs accord with those under the EU regulatory framework is a matter for those NRAs.

A 10.109 At paragraph A 10.104 (i) (a) above ComReg summarises Telefónica's assertion at paragraph 9.17 of its submission that "*ComReg's prioritisation of tacit collusion over other objectives to such a remarkable extent is both contrary to its statutory objectives and stands out amongst other NRAs which have not seen a requirement to elevate the issue to such an extent*".

- A 10.110 In response, ComReg first notes that Telefónica offers no analysis of its own as to how each statutory objective should be weighted. Telefónica appears to focus mainly on the objective of ensuring efficient allocation of spectrum (and thereby presumably the objective of the promotion of competition). However, ComReg notes that this assertion is based on the assumption that the minimum price will choke off demand, yet such an outcome is far from certain and ignores the fact that the minimum price is to be derived from a conservative lower bound estimate of market value. ComReg also notes that Telefónica's argument ignores the fact that reducing incentives for tacit collusion should also, in itself, promote competition.
- A 10.111 Second, ComReg notes that having carried out a full RIA (see Annex 4), various specific RIAs and an assessment against its statutory objectives (see Chapter 3 of Document 11/60), ComReg is satisfied that the design of the award process best meets its statutory objectives in a transparent, non-discriminatory and proportionate manner.
- A 10.112 Finally, ComReg notes and agrees with DotEcon's observations on this matter as set out in its latest benchmarking report and in particular its assessment which states: *"In this respect Telefonica claims that ComReg's emphasis on tacit collusion concerns "stands out amongst other NRAs which have not seen a requirement to elevate the issue to such an extent". However as noted in our previous documents whilst NRAs had in the past set reserve prices at a low but non-trivial level they are moving away from this approach to one that is in line with a conservative estimate of market value. As mentioned above the Greek NRA is an example but there are also others such as the Portuguese NRA which set its 800MHz spectrum reserve price within our proposed range (although it set 900MHz spectrum below our proposed range). Furthermore, the Italian NRA chose reserve prices at the upper end of our range whilst the Spanish chose a common minimum price for sub-1GHz spectrum at the lower end of our range. Therefore our minimum prices have been in line with those of other European NRAs in similar recent awards across Europe. These awards have been successful and evidence suggests that demand has not been choked off. This trend is set to continue in upcoming auctions with Ofcom, the UK NRA, stating, in its consultation on the upcoming UK 800MHz and 2.6GHz auction, that it is considering setting reserve prices that reflect the market value of spectrum so as to manage strategic incentives of potential bidders."* (paragraph 134).
- A 10.113 As such, ComReg disagrees with Telefónica's assertion that ComReg's emphasis on tacit collusion is contrary to its statutory objectives or stands out

amongst other NRAs which have not seen a requirement to elevate the issue to such an extent.

A 10.114 In response to the related concern made by eircom Group set out at paragraph A 10.104 (ii) (b) that there is a very high likelihood that ComReg's proposed 1800 MHz price is at odds with its stated objectives and is excessive, ComReg notes and agrees with DotEcon's analysis of eircom Group's concern set out in paragraphs 140 and 141 of Document 12/23 and in particular its recommendation that the recommended price range of between 45% to 60% for the proposed sub-1GHz minimum price be maintained, in light of new auction data that has become available.

iii. Claims that ComReg is not addressing all concerns

A 10.115 Telefónica claims that all specific concerns raised by it are not dealt with by ComReg. In so far as ComReg understands this claim, and having carefully reviewed Telefónica's submission and previous documents including Document 11/60 (and associated material, such as respondents submissions) it assumes that Telefónica's claim relates to the following specific issues raised concerning spectrum fees:

- i. At paragraph 9.14 (ii) in its submission, "[Telefónica] *reiterates that ComReg must do the work to properly assess levels at which demand could be choked off before it makes such crucial decisions*".
- ii. Related to this point, Telefónica argues that DotEcon and ComReg "*then go on to assert that €20 million will not choke off demand*" but that there remains no evidence to substantiate this assertion.
- iii. At paragraph 9.12 (iii) Telefónica asserts that ComReg has not at any point "*considered the relative impact of setting the minimum price too high verses setting it below the anticipated market value*" and that this should be considered within ComReg's Regulatory Impact Assessment.
- iv. At paragraph 9.4 Telefónica suggests that "*DotEcon should produce a benchmark of minimum prices as another indicator for ComReg, however this does not seem to have been considered*"; and
- v. At paragraph 9.12 (ii) Telefónica suggests that "*ComReg should have DotEcon produce a graph or table showing the results produced by the model compared with the actual results achieved in*

the 12 most recent auctions. This request has not been responded to”;

A 10.116 In addition, Vodafone highlights at paragraph 29 of its submission a further outstanding matter from a previous consultation. Vodafone refers to its submission to Document 09/99 where it stated “*Vodafone does not believe that the factor the minimum price should deliver a fair return to the state is a valid objective in setting the minimum licence price... Vodafone would question the validity of this factor, which could reasonably be regarded as a revenue raising objective (at least up to the undefined ‘fair’ level) and how it can be reconciled with ComReg’s statutory objectives under the EU Framework and the Communications Act 2002. Vodafone does not believe that the DCENR Report of Working Group on Spectrum Policy (2008) is relevant to informing ComReg’s objectives as claimed in the consultation [Document 09/99], particularly as it has no clear relationship to ComReg’s statutory objectives under the EU Regulatory Framework or the Communications Act 2002 and in Vodafone’s view may clearly conflict with these objectives*”

ComReg’s Assessment and Response

A 10.117 In relation to claims that ComReg has not addressed all of the concerns raised by Telefónica ComReg’s response and assessment is as follows:

- Firstly, in relation to the concerns set out in paragraph A 10.115 (i) and (ii) that it should assess levels at which demand could be choked off, ComReg notes Telefónica’s stated position in Document 09/73 as regards assessing demand in an auction. Therein it held the view that “*it is very easy to express interest in obtaining spectrum but that does not necessarily reflect an intention to invest in and use spectrum*”³⁰⁴. Further in ComReg’s past experience of auctions it is very difficult in practice to place any reliance on expressions of interest, a point to which Telefónica agreed with (see Document 09/73). In a similar fashion as regards assessing the level at which demand in an auction might be choked off, ComReg argues that this would be practically difficult. Telefónica provides no support of how such an assessment might be reasonably carried out, or how the claimed practical difficulties in assessing auction demand would not also be present in assessing the level at which demand might be choked off.

³⁰⁴ Page 99 of Document 09/73 “Publication of non-confidential minutes of bi-lateral meetings”

- Secondly, as regards considering the relative impact of setting the minimum price too high versus setting it below market value (see paragraph A 10.115 (iii)), ComReg highlights that it has assessed and considered five reports from its expert economic advisors which provide lower bound conservative estimates for setting the minimum price. In the fifth report, DotEcon concludes that *“to a larger extent than our previous reports, our estimates in this report should specifically yield conservative lower bound estimates for sub-1GHz spectrum”* (paragraph 15) and that *“In other words, the inclusion of recent auction data has largely validated our recommended minimum price”* (paragraph 78). As noted previously in relation to similar arguments made by other incumbent respondents, ComReg notes that Telefónica’s assertion seems to be based on an assumption that interested parties would not value spectrum above the minimum prices. However, it is not clear how Telefónica can draw conclusions on the true valuations held by other interested parties.
- As noted at paragraph A 10.115 (iv) above, Telefónica suggests that DotEcon should produce a benchmark of minimum prices as another indicator. In this regard, ComReg notes the following observations made by DotEcon in its latest report: *“We consider that the merits of using benchmarking to identify a conservative lower bound estimate of licence value are greater than the alternative methods proposed by a number of respondents such as a low but non-trivial minimum price and a benchmark of minimum prices. We considered these two alternative approaches in DotEcon report 11/59 and previous documents.”* (paragraph 132).
- In Annex D of Document 11/59 and paragraphs 480-487 and 471-475 in Part C of Document 09/99c DotEcon set out a discussion of the recent trends away from setting low but non-trivial minimum prices and why setting a low but non trivial or benchmark of minimum prices would not be appropriate in Ireland. As such, ComReg does not propose to consider this matter further.

A 10.118 ComReg disagrees with the suggestion that it should only compare the results of the benchmark with the actual results achieved in the 12 most recent auctions, noted at paragraph A 10.115 (v) above. Given the numerous ways that the data sample could be cut and analysed, the claim is without sufficient reasoning as to why this method would be more appropriate than the current approach. Telefónica asserts that at no point has ComReg considered the relative impact of setting the minimum price too high versus setting it below the anticipated market value and, on this basis, suggests that this should be

considered within ComReg's Regulatory Impact Assessment. ComReg notes that Telefónica's suggestions in this regard ignore the fact that the proposed minimum price will be derived from a conservative lower bound estimate of market value and that DotEcon are satisfied that there are a number of reasons described in its report on benchmarking for believing that the proposed minimum price is conservative and not choke off demand. In light of the above, ComReg rejects claims that the setting of the level of the minimum price is a Regulatory Impact Assessment matter.

A 10.119 In relation to the specific concern raised by Vodafone at paragraph A 10.116 (i) that 'it would not be valid to factor delivering a fair return to the State in the minimum price' ComReg's response is as follows. ComReg notes that this was one of six factors initially listed at page 159 of Document 09/99, where ComReg considered that such factors "*..should inform the determination of the minimum price..*" as follows:

- *the minimum price should not give rise to or increase incentives for collusive behaviour;*
- *the minimum price should deliver a fair return to the State for the use of this finite natural resource and the price of spectrum should reflect its economic value to the user*³⁰⁵;
- *the minimum price should not be set so high as to choke off demand;*
- *the minimum price should not be set so low that there is participation by frivolous bidders;*
- *the minimum price should not reflect any "social option value"; and*
- *the administrative costs of running the award process should be recovered from the minimum price set. "*

A 10.120 ComReg recognises that this factor does not flow from its statutory objectives under the regulatory framework or from a Ministerial Direction.³⁰⁶ Indeed, in

³⁰⁵ Report of Working Group on Spectrum Policy, Department of Communications, Energy and Natural Resources, Sept. 2008, Section 6, bullet point 8; Spectrum pricing should deliver a fair return to the State. The spectrum is a finite natural resource that enables the provision of essential services for both public service and commercial purposes. The price of spectrum to the user should reflect its economic value to that user.

³⁰⁶ This was mentioned by the Minister in the Dail see: <http://debates.oireachtas.ie/dail/2010/07/08/00419.asp> but as no Policy Direction flowed therefrom and so ComReg does not have a mandate to consider it

Document 10/71 (which followed Document 09/99) and Documents 10/105 and 11/60 ComReg omitted this from the list of factors to be considered and, for the avoidance of doubt, did not consider this factor in arriving at its proposals as to an appropriate minimum price. ComReg's Decision on the level of the minimum price does not take this factor into account.

iv. Claims operators 'penalised' for potential natural outcomes

A 10.121 Telefónica claims that ComReg conflates natural outcomes with tacit collusion. At paragraph 9.14 (iii) in its submission, Telefónica reiterates its views (expressed in its submission to Document 10/71) that an outcome which results from low demand is indeed a natural outcome and is "*an entirely legitimate and legal one*". It believes that such an outcome is not collusion, tacit or otherwise but is simply the "*logical consequence of there being more spectrum available than there is demand for it, and represents efficient allocation of spectrum via open auction*". It therefore disagrees with DotEcon's recommendation of setting the minimum price to prevent operators from benefiting from these outcomes and notes that "*ComReg is not entitled, under its statutory objectives and obligations, to seek to penalise or prevent such legitimate outcomes simply because they result in lower prices; as long as they are efficient outcomes its objectives are met.*"

ComReg's Assessment and Response

A 10.122 Telefónica suggests that '*a natural outcome is a legitimate outcome*' and that operators should not be prevented from benefiting from potential low demand scenarios once the outcome is efficient and ComReg's objectives are met.³⁰⁷ ComReg notes that the basis for the argument is Telefónica's belief that it is a 'quite likely' scenario that no new entrant will materialise in the award. However, Telefónica provides no reasons to support this claim and as set out above in the first bullet of paragraph A 10.117 it previously held the view that to assess demand is practically difficult. In addition, ComReg notes that the 'outcomes' with which DotEcon and ComReg are concerned are those where bidders collectively implement bidding strategies to ensure an outcome occurs at a lower price than would occur if such a collective strategy had not been implemented.

A 10.123 ComReg refers to Telefónica's previous statements in relation to the practical difficulties in assessing demand in an auction³⁰⁸, and notes that Telefónica does

³⁰⁷ Set out in paragraph A 10.121 above.

³⁰⁸ See page 99 of Document 09/73

not appear to have provided any reasoning for its position as regards assessing demand in the award process. In addition, ComReg disagrees that there is a 'benefit' to be obtained by lowering the minimum price. ComReg sets the minimum price having regard to what it considers to be a price that encourages an efficient use of spectrum. It has undertaken extensive consultation and analysis on this matter. ComReg's proposed auction can accommodate differing levels of demand. This in no way impairs ComReg's statutory objectives or obligations and therefore ComReg rejects these claims by Telefónica.

A10.5 ComReg's Final Position

A 10.124 ComReg proposes to apply minimum prices in the upcoming auction. This view is informed by the many considerations set out above and in particular, those set out in A 10.5 above.

A10.5.1 Minimum Price and Benchmark Methodology and Application

A 10.125 For the reasons set out above, ComReg decides the following:

- to rely on a benchmarking exercise and relativity analysis in order to calculate a lower bound conservative estimate of the value of spectrum in the 800 MHz, 900 MHz and 1800 MHz bands for the purposes of setting the level of the minimum price for liberalised rights of use in those bands;
- to use a common minimum price for sub-1GHz spectrum;
- to structure minimum prices into an even division between an upfront reserve price and annual SUFs.
- to index SUFs using the Consumer Price Index (CPI).
- to calculate SUFs using a discount rate of 8% as set out in Section 10.3 of the Annex.

A 10.126 The final price, taking account of any additional relevant data, will be set out in ComReg's Information Memorandum.

A10.5.2 Level of the Minimum Price

A 10.127 For the reasons set out above, ComReg decides that the minimum prices will be €20m per 2 × 5 MHz lot of liberalised sub-1GHz spectrum and €10m per 2 × 5 MHz lot of liberalised 1800 MHz spectrum.

A 10.128 These prices break down as follows:

- For a Liberalised Use Licence in Time Slice 1³⁰⁹:
 - the reserve price would be €2.55 million with SUFs of €1.08 million per annum for each 2 × 5 MHz lot of liberalised rights of use in respect of 800 or 900 MHz spectrum; and
 - the reserve price would be €1.27 million with SUFs of €0.54 million per annum for each 2 × 5 MHz lot of liberalised rights of use in respect of 1800 MHz spectrum.
- For a Liberalised Use Licence in Time Slice 2:
 - the reserve price would be €8.26 million with SUFs of €1.08 million per annum for each 2 × 5 MHz lot of liberalised rights of use in respect of 800 or 900 MHz spectrum; and
 - the reserve price would be €4.13 million with SUFs of €0.54 million per annum for each 2 × 5 MHz lot of liberalised rights of use in respect of 1800 MHz spectrum.

A 10.129 As noted above, the final price, taking account of any additional relevant data, will be set out in ComReg's Information Memorandum.

³⁰⁹ Fee calculation based on licence commencing on 01/02/2013 and expiring on 31/07/2015

Annex 11: Final RIA on Coverage and QoS licence conditions

- A 11.1 This annex sets out the regulatory impact assessments (RIAs) on coverage and quality of service obligations.
- A 11.2 As noted in Chapter 3, a RIA is an appropriate tool for assessing and ensuring compliance with many of ComReg's core objectives in relation to the management of Ireland's radio frequency spectrum.
- A 11.3 The focus of a RIA is to identify the impact of the regulatory options under consideration on stakeholders (including existing operators, potential new entrants, and consumers) and on competition and, in so doing, to identify the option that would best achieve ComReg's objectives.
- A 11.4 ComReg's statutory functions and objectives in relation to radio frequency spectrum are set out in Annex 2 of this document. These objectives include:
- The promotion of competition, which includes:
 - ensuring that users derive maximum benefit in terms of choice, price and quality;
 - encouraging efficient use and ensuring effective management of radio frequencies; and
 - ensuring that there is no distortion or restriction of competition in the electronic communications sector.
 - Contributing to the development of the internal market; and
 - Promoting the interests of EU citizens.
- A 11.5 ComReg, in pursuit of these objectives, must apply objective, transparent, non-discriminatory and proportionate regulatory principles as described in Annex 2 of this document. In addition, in determining its preferred option, ComReg must also have regard to relevant Policy Directions.
- A 11.6 The various RIA guidelines provide limited guidance as to how much weight should be given to the positions and views of each stakeholder group. Accordingly, ComReg has been guided by its statutory objectives which it is obliged to seek to achieve when exercising its functions.

A11.1 Structure of a RIA

A 11.7 As set out in ComReg's RIA Guidelines, there are five steps to a RIA. These are:

- Step 1: Identify the policy issue and identify the objectives;
- Step 2: Identify and describe the regulatory options;
- Step 3: Determine the impacts on stakeholders;
- Step 4: Determine the impacts on competition; and
- Step 5: Assess the impacts and choose the best option.

A 11.8 Each of these steps is considered in turn below for each of the RIAs.

A11.2 RIA on Coverage

A11.2.1 Introduction

A 11.9 This section sets out the RIA on coverage which assesses the appropriate minimum level of coverage that should be set as part of a coverage licence condition for new liberalised licences in the 800, 900 and 1800 MHz spectrum bands.

A11.2.2 Policy Issues to be Addressed and Relevant Objectives (Step 1)

Objectives

A 11.10 The focus of this 'Coverage' RIA is to assess the impact of the proposed minimum coverage level on stakeholders, and on competition. In that way it will allow ComReg to identify and impose the most appropriate and least burdensome level, which still allows ComReg to achieve its objectives.

A 11.11 ComReg's overall objectives in relation to this spectrum release process are set out in Annex 2. The most relevant objective in terms of coverage is to ensure that all users derive maximum benefit in terms of price, choice and quality from the spectrum release process.

Policy Issues

A 11.12 Before setting out the policy issues in relation to coverage it is first worth differentiating between:

- the level of coverage specified as a licence condition imposed on an individual operator;
- the actual level of coverage provided by each individual operator via its own network;
- the level of coverage perceived by a customer of an individual operator, which may include coverage obtained as a result of national roaming agreements; and
- the actual level of coverage provided by the market as a whole when the coverage area of all of the operators network is combined.

A 11.13 To date, in Ireland, coverage obligations have been applied in a particular manner. At the individual operator level, a coverage obligation attached as a licence condition sets a minimum level of coverage that an operator must provide over its own network either on a population or a geographic basis (i.e. an operator is not permitted to rely on higher levels of coverage obtained as a result of a roaming agreement with another network operator to fulfill this obligation). This minimum level does not specify a particular 'network map'. Operators are free to choose the geographic area covered by their network, provided the minimum level of coverage is met. Operators are then free to choose to offer higher levels of coverage via their own network or to choose to negotiate a roaming agreement on other networks to provide a higher level of coverage than is required using their own network rollout.

A 11.14 Coverage obligations imposed as a licence condition will not necessarily reflect the actual coverage levels provided by the market as a whole and in fact are highly unlikely to do so for a number of reasons including:

- each individual operator can choose its own network, hence the areas covered by each network may not all overlap; and
- competition between operators will create incentives for operators to offer greater levels of coverage than those specified by their licence conditions as a means of differentiating themselves, and providing a potential additional revenue stream in the form of wholesale roaming charges to other operators.

A 11.15 From the consumer's perspective, the actual level of coverage available to the consumer as a customer of a network operator (including coverage available to the consumer as a result of national roaming agreements) is what is important, not the minimum coverage level set by way of a licence condition.

History of coverage obligations in Ireland

- A 11.16 Maximising the benefit for users in terms of price, choice and quality, is a core ComReg objective. ComReg is of the view that generally consumers of mobile services value the ability to use their mobile devices whenever they want and wherever they are, so long as these services are available at a reasonable price. In other words, consumers value high levels of coverage across the length and breadth of the country.
- A 11.17 However, mobile operators may not provide coverage to the level desired by consumers and past experience has shown that regulatory intervention may be required. There are a number of ways in which coverage levels can be adjusted by means of regulatory intervention, e.g. a licence condition attached to spectrum licence as described above, or direct subsidies to provide coverage in certain designated 'not-spot' areas, as discussed below. Both of these have been used in the past in Ireland.
- A 11.18 When the GSM spectrum bands were awarded regulatory commitments were provided by most licensees as part of the beauty contests used to award the spectrum. This was at the very early stages of the development of the mobile market in Ireland. Widespread mobile coverage was not available at the time the GSM licences were awarded, hence high coverage obligations were very important in terms of ensuring that widespread coverage was provided by the market. In addition, coverage licence conditions may also have been used as a means to ensure that spectrum was put to use and not "hoarded" for strategic reasons. As a result of these steps, GSM coverage is almost ubiquitous with the market providing over 99% population coverage.

Current Situation in Mobile Market

- A 11.19 The current situation in the mobile market is very different to when the GSM and 3G licences were awarded:
- there is now a relatively mature mobile market, with four MNOs with extensive network infrastructure in place, rather than an industry in its early stages;

- ComReg intends to use a fully market-based mechanism to award spectrum usage rights in this case, and not an administrative process (as used for the award of GSM and 3G licences); and
- in awarding Liberalised spectrum rights, ComReg considers that it is not necessary to use a coverage licence condition as a means to ensure the efficient use of spectrum or to avoid the potential for hoarding as there will be other measures in the award process to address these issues (e.g. sufficiently high minimum price incorporating an upfront fee and ongoing annual spectrum usage fees payable over the entire duration of the licence, and spectrum caps, respectively).

A 11.20 Nevertheless, ComReg has a number of concerns relating to coverage, albeit different concerns than those that may have existed previously.³¹⁰

A 11.21 First, one of ComReg's statutory objectives is to promote competition. The award of the three spectrum bands creates a unique opportunity for new entry into the Irish mobile market. In setting a minimum coverage level it is important to realise that a high coverage level could act as a barrier to entry and thereby damage downstream competition. The higher the minimum coverage level the higher the associated network rollout costs for an operator. The four incumbent MNOs have a natural advantage in this regard as they each already have existing infrastructure in place to meet high coverage levels. However, for a new entrant, each additional percentage of population required to be met by a coverage condition, adds to the network roll-out costs. This is a particular issue given the population distribution in Ireland, with one-third of the Irish population living in very rural areas – in very small townlands and one-off houses.³¹¹ Therefore high minimum coverage levels, which could be seen at face value as a pro-consumer tool to ensure ubiquity of coverage, could result in a reduction in downstream competition.

A 11.22 A further disadvantage of high symmetric coverage obligations is that they could result in inefficient network investment in areas of low population density. They could raise the costs across the industry (which would likely be passed onto the end consumer) without any obvious benefit for consumers. Enabling greater

³¹⁰ In his response to Document 11/60, S. Minch expressed concern that ComReg was engaging in a “*dilution of licence conditions in the hope of attracting new entrants*”. In proposing to set licence conditions, ComReg must take into account the prevailing circumstances. Therefore it is not necessarily appropriate to consider how licence conditions for new liberalised licences

³¹¹ See CSO 2006 Census data available at www.cso.ie/census/documents/census2006_Table_7and_12.pdf page 123, ‘Remainder of country’ figure taken as a percentage of ‘State’.

flexibility for legitimate operator co-operation (such as network sharing) would appear to ComReg to be a more efficient means to enable operators to serve sparsely populated areas compared to a requirement for multiple network roll-outs in such areas.

- A 11.23 Both of these factors would suggest that high coverage levels, imposed as symmetric licence conditions across all new licensees, may not be in the best interests of industry stakeholders, competition or consumers.
- A 11.24 On the other hand, in awarding new liberalised licences, ComReg is conscious of the type of urban/rural cross-subsidisation which currently exists in the mobile market. The current MNOs use a system of cross-subsidisation whereby they can use the profits earned from their urban infrastructure to cover the costs of rural infrastructure. As each of the current MNOs is required under its licence conditions to meet a minimum level of coverage, this cross-subsidisation issue is of importance. Setting coverage levels which are very low, or non-existent, could reduce or eliminate this practice amongst operators and thereby negatively impact on competition and consumers.
- A 11.25 It is worth exploring how this could occur. An operator(s) which obtained liberalised spectrum, with a low/no coverage obligation attached, could 'cherry pick' its coverage area and, for example, choose to only roll out a network in what could be described as 'urban areas'. For instance, the 5 large cities (which cover 34% of the population) and their hinterlands, and perhaps a number of large towns nearby by building a 'hub-and-spoke' type network. With a very small geographic footprint, an operator could reduce its roll-out costs, and this could enable such an operator(s) to offer a high-speed, low-cost mobile broadband service, using a negotiated roaming agreement to provide coverage in other areas.
- A 11.26 On face value, this may be seen as a pro-competitive/pro-consumer development. However if an operator(s) which adopted such a hub-and-spoke type model was very successful and ultimately attracted a large tranche of consumers away from the existing operators, this could undermine current rural services. With less revenues generated in urban areas, and in the face of potentially intense competition for 'urban-based consumers, this could force existing operators to roll back on their existing rural infrastructure which they would not otherwise do if this type of operator was not permitted to exist.³¹²
This would reduce the geographic area covered by these operator(s) network(s)

³¹² Assuming that these operators were no longer subject to any coverage requirements associated with their 3G licences, which could also potentially be unattractive for operators, and returned to ComReg.

perhaps leading other operators to do the same and degrading the current near-ubiquitous services.³¹³ To protect consumers against such potential developments, this would require coverage levels to be set for each new licensee at a level which prevented an operator(s) from eliminating the cross-subsidisation business practices currently employed.

A 11.27 Therefore, taking these two policy issues together, it is clear that there are factors which would push up the ideal minimum coverage level set as a licence condition, and factors which would push it down, in the best interest of stakeholders, competition and consumers. Ultimately ComReg is of the view that each licence awarded should have with it a requirement for a minimum level of coverage that would:

- not discourage entry by new players (including from other Member States) and/or entry into the mobile market by existing operators in the Irish market; and/or
- not result in inefficient infrastructure investment from spectrum rights holders,

whilst, at the same time, ensuring that mobile services can be accessed in a very substantial part of the State.

A 11.28 The purpose of this RIA therefore is to consider a range of options in order to determine the level of coverage licence condition that is optimal in light of these conflicting policy issues.

A11.2.3 Regulatory Options (Step 2)

A 11.29 In this RIA, ComReg considers the following five options.

Option 1— Impose no obligation on coverage.

A 11.30 This would mean that each new Licensee would have full flexibility to choose how extensive their network coverage would be regardless of what mix of spectrum it won across the three bands. An operator could choose only to provide services in high density areas or choose to differentiate itself as a provider with an extensive network footprint.

³¹³ In response to Document 11/60, S. Minch noted the potential for such a scenario to emerge. As noted in the Draft RIA, ComReg is fully aware of the importance of protecting consumers against such developments.

A 11.31 This option was considered (and discounted) in the RIA provided in Document 09/99, but is reconsidered again here for the sake of completeness.

Option 2 — Impose a coverage obligation which would require all new licensees to provide a minimum level of area coverage sufficient to serve less than or equal to 50% of the population.

A 11.32 Whilst not having the same degree of flexibility as Option 1, Option 2 would still afford new licensees a high degree of flexibility in choosing their network coverage. Option 2 would involve setting a coverage obligation to provide a level of area coverage sufficient to serve less than or equal to 50% of the population. Under this option an operator would be free to choose how it intended to meet the coverage obligation. A 'network map' would not be specified by ComReg.

A 11.33 The upper end of this range (50%) equates to the population of the 5 main cities (Dublin, Cork, Galway, Limerick and Waterford) plus the 40 largest towns in Ireland (each of which have a population of over 9000 or more), based on CSO census data. Approximately half of these large towns lie within the hinterlands of the 5 main cities. Thus a minimum coverage level of 50% population would enable an operator to deploy a 'hub-and-spoke' type network, as described above.

Option 3 — Impose a coverage obligation which would require all new licensees to provide a minimum level of area coverage sufficient to serve 50%-70% of the population.

A 11.34 This range was proposed by DotEcon as a suitable range for a coverage obligation in Document 09/99c.³¹⁴

A 11.35 This option would afford less flexibility to licensees than Option 2.

A 11.36 The lower end of this range (50%) is as described above. Setting a coverage obligation at this level would mean a new licensee could deploy a hub-and-spoke type network.

A 11.37 Looking now at the mid-point of this range (60%). Based on CSO census data, there are 165 town/townlands with a population of more than 1,500 people and, together with the 5 main cities, this equates to 60.7% of the total population (approximately 2.6 million people). Setting a coverage obligation at this level would mean that a new Licensee would not be able to adopt a purely hub-and-

³¹⁴ See Section 15.1.9 of Dotecon Report (Document 09/99c).

spoke type network and would instead have to cover a much wider geographic area. This would more than likely remove the risk of destabilising the existing urban/rural cross-subsidisation model.

A 11.38 Looking now at the top end of the range (70%), which equates to circa 3 million people, an additional 10% of population (from 60% to 70%) equates to approximately 400,000 people. Based on CSO census data, moving from 60% to 70% would incorporate the 5 big cities and 165 towns with a population of +1,500 people, and in addition, would also incorporate the following:

- approximately 77,000 people who live in townlands with between 1000 — 1,499 people;
- a further 120,000, approximately, who live in townlands with between 500 — 999 people;
- a further 100,000 people, approximately, who live in townlands under 500 people but with at least 50 (inhabited) houses; and
- This leaves a further 100,000 people, approximately, who live in very small townlands/villages/single housing in Ireland that would also be included to bring up the total to 70% population.³¹⁵

A 11.39 Therefore setting a coverage obligation at this level would mean that each licensee would have to extend its network significantly beyond a hub-and-spoke type network. This would remove the risk of destabilising the current equilibrium and consequentially may go further towards ensuring competition outside of urban areas.

A 11.40 One respondent to Document 11/60, eircom Group expressed its preference for Option 3, specifically for a coverage level of 70%, which is at the top end of the range.

Option 4— Impose a coverage obligation which would require all new licensees to provide a minimum level of area coverage sufficient to serve 71%-90% of the population.

³¹⁵ These figures have been amended from those set out in Document 11/60. In his response to Document 11/60, S. Minch noted that paragraphs A8.164 and A1.65 of Document 11/60a appeared to have omitted towns in the population range 1001-1500. In addition, Minch noted that an alternative method to projecting potential coverage on a population basis would be to use electoral divisions rather than towns. S. Minch calculated that 70.06% of the population equates to 938 out of 3,400 electoral divisions.

- A 11.41 The upper bound of the range proposed for Option 4 is 90%. The NBS provides broadband access to 10% of the population which did not previously have access to such services (1028 out of 3440 electoral divisions) and there is a wholesale access obligation on the NBS provider.
- A 11.42 Two respondents to Document 11/60 were in favour of Option 4, namely Vodafone and Mr Minch.
- Vodafone considers that the minimum coverage level should be set at 70% geographic coverage, noting that this would strike a superior balance between the relevant objectives and that the full benefits to end users of the provision of innovative services in these bands would be most effectively achieved if this higher coverage requirement were set; and
 - Mr Minch recommends that the minimum coverage level be set at 92%, or higher, of the national area for voice and text services. In addition, Mr Minch recommends that a minimum coverage level of 92% coverage of the national area for data services, to be met 5 years after the Licence is awarded, subject to an evaluation of the benefits of a mandatory shared rural or national network.

Factors common to Option 1, 2, 3 and 4

- A 11.43 There are a number of associated issues with Options 1, 2, 3, and 4 in terms of the implementation of the symmetric minimum coverage level:
3. Should a symmetric roll-out period for all Licensees be imposed or should there be an asymmetric roll-out period for existing MNOs and new entrants (i.e persons without existing mobile network infrastructure)?
 4. Should licensees be permitted to meet the coverage obligation on new Licences using any spectrum band suitable for mobile services (e.g. 800/900/1800 MHz, 2.1 GHz) in the interests of spectrum efficiency?
 5. Should there be a minimum deployment level set for individual bands to prevent spectrum hoarding/ in the interests of spectrum efficiency?
 6. Should Licensees be permitted to use national roaming on another operator's network to count towards the coverage level or must it be met using a licensee's own network build out?

A 11.44 For the purpose of the RIA, these issues are not of direct relevance in terms of choosing the appropriate level and, consequently, are considered in section 5.5. of the main document.

Option 5 —Auction high coverage and low coverage blocks

A 11.45 ComReg does not propose considering any option involving a symmetric coverage obligation above 90% within the RIA as ComReg is of the view that:

- it would undoubtedly result in inefficient duplication of infrastructure investment;
- it would be unnecessary and disproportionate to require multiple networks to cover areas with extremely low population density;
- consumers would likely have these costs passed onto them; and
- it would have a very strong probability of deterring entry.

A 11.46 For these main reasons, this approach is not considered likely to not meet ComReg's statutory functions, objectives and duties.

A 11.47 Should a coverage obligation beyond 90% be considered, ComReg is of the view that this could only reasonably be implemented if it were applied asymmetrically. i.e. high coverage blocks and low coverage blocks, such that blocks of spectrum within a particular band were heterogeneous, as opposed to homogenous as per Options 1, 2, 3 and 4 above.

A 11.48 This would require consideration of a number of issues:

- How much spectrum should be awarded with a 'high coverage' obligation?
- Would a subsidy be required to incentivise a licensee to obtain a licence with a 'high coverage' obligation? ³¹⁶
- Would the winner(s) of the 'high coverage' spectrum be required to accept a roaming obligation so as to allow other providers to serve areas where it may be uneconomic for more than one operator to deploy base stations and other network equipment?

³¹⁶ The NBS involved a subsidy of €223 million in order to provide broadband coverage for the 10% of the population that did not have access to broadband services. Also in Sweden, UK funding was provided to operators to provide coverage in particular areas.

- What coverage level would be set for the 'high coverage' blocks (e.g. close to 100%) and what level would be set for the 'lower coverage' blocks (e.g. in line with that proposed under Option 1,2,3, 4)?

A11.2.4 Impact on Stakeholders and Competition (Steps 3 and 4)

A 11.49 The focus of this section of the 'Coverage' RIA is to assess the impact of the various regulatory options available to ComReg on:

- industry stakeholders (being existing operators and potential new entrants);
- competition; and
- consumers.

Impact on industry stakeholders

A 11.50 Existing operators and new entrants are clearly in very different circumstances when it comes to meeting a coverage obligation. There is a clear advantage for existing operators with existing networks in place. Therefore the impact of a coverage obligation on new entrants is particularly important in the impact analysis that follows.

A 11.51 Firstly, the case of existing operators is considered. Whilst existing operators may value the flexibility afforded by a very low coverage obligation, meeting a moderate-to-high coverage level is unlikely to have a significant impact on such operators, given that they each have existing networks in place. The value that existing operators would place on flexibility would only kick-in at a much higher level of coverage than for a new entrant. This would suggest that existing operators are likely to be indifferent as to coverage levels that are set at a low-medium level.

A 11.52 However, the higher the coverage level, the greater the chance that this would act as a barrier to entry for a new entrant. This would suggest that existing operators may have a preference for a high minimum coverage level, as a means of limiting competition. Accordingly, existing operators are likely to prefer a minimum coverage level be set towards the upper end of Option 3 range or the lower levels of the Option 4 range.³¹⁷ This would enable existing operators

³¹⁷ ComReg notes that Vodafone in its submissions argued that 70 % geographic coverage would strike a better balance, see paragraphs 42 of Vodafone's response to Document 11/60 as set out in Document 11/102.

to easily meet the obligation using their existing network and would provide such operators with a generous level of flexibility to use operator cooperation/network sharing to provide coverage in very low-density areas while acting as a deterrent to new entry.

- A 11.53 Whilst noting the preference of two respondents for a very high level of coverage,³¹⁸ ComReg remains of the view that a minimum coverage level above 70% is very likely to impact on the entry decision for potential entrants. A small increase in required population coverage at these levels would have a large impact on network rollout costs, given the low population density. The higher the coverage level for individual network build, the more likely this would negatively impact on the willingness of potential new entrants to participate in the auction.
- A 11.54 However, the preference for a high coverage obligation as an entry deterrent would be balanced against existing operators' desire to have high flexibility in providing coverage to very rural areas via network sharing etc. In terms of Option 4, moving upwards along the range (71-90%) would result in an existing operator being forced to rollout /maintain very extensive networks when it could be more efficient to rely upon legitimate co-operation between operators (e.g network sharing) rather than duplicative network roll-outs to areas with very low population density and very low demand. For this reason, existing operators would be unlikely to favour a minimum coverage level at the higher end of Option 4 as it could result in inefficient duplicative infrastructure build and investment by each of the existing operators.³¹⁹
- A 11.55 Any minimum coverage requirement will have an impact on new entrants as it will dictate the minimum cost of their network roll-out. Therefore, new entrants are likely to prefer an option with as low a coverage requirement as possible (i.e. Option 1 would be their preferred option,³²⁰ followed by Option 2, then Option 3, with Option 4 being the worst of the four). With a very low minimum coverage level, a new entrant could choose to roll out their new networks so as to provide coverage in densely populated areas only thus minimising network rollout costs by limiting their network to as small a geographic area as possible (and rely instead on roaming agreements). Under Option 1, for example, if a

³¹⁸ Vodafone and Stephen Minch.

³¹⁹ For instance eircom agreed with ComReg's proposed 70% population coverage proposal.

³²⁰ ComReg notes that it received no comments in relation to Document 11/60 that opposed the principle of imposing a coverage obligation.

potential entrant wanted to enter the Irish market and only provide services in the 5 main cities (which equate to approximately 34% of the population) and the surrounding areas, they would not be prevented from doing so.

- A 11.56 Option 2 would afford a high level of flexibility to new entrants, but not to the same extent as Option 1. In ComReg's view, a new entrant may well consider 50% to be a minimum level at which its network would need to cover in order to be an effective competitor, which is in line with a hub-and spoke, city-based type network. As such, the business plans and investment decisions of a new entrant(s) are likely to account for a coverage level of at least 50% population. If this is the case, a coverage obligation of up to 50% would be unlikely to have any significant impact on a new entrant, as it would not alter the approach that such an entrant would have taken in the absence of this requirement, and accordingly, should not affect the entry decision.
- A 11.57 The likelihood of whether Option 3, with a 50%-70% range, would affect the decision of a potential entrant to enter or not would depend on the type of business strategy the new entrant intended to adopt. The lower end of this range, close to 50%, is unlikely to affect the entry decision. Extending coverage along this range of 50-70% may lead to a point which goes beyond what a new entrant would independently choose to provide. For example, a potential new entrant with a hub-and-spoke, city-based type network in mind would be precluded from doing so if a minimum coverage level was set much above 50%. Even though it could potentially be more cost effective for such an operator to provide coverage in low population density areas via a roaming agreement, this would not be permitted to count towards achieving the minimum coverage obligation.
- A 11.58 The upper end of this range, 70%, would require a licensee to provide coverage in all the townlands in Ireland with at least 50 (inhabited) houses, plus an additional 100,000 people. The business plans and investment decisions of a new entrant(s) may account for a coverage level at this level, but there is no guarantee. For instance UPC, in its response to Document 09/99, expressed the view that a 70% population coverage level would be suitable for a new entrant. In DotEcon's view (Document 12/24), the network roll-out costs associated with the 50-70% range would not act as an entry deterrent for new entrants. However, Imagine in its response to Document 09/99, stated that the minimum coverage level should be set no higher than 50% so as not to deter entry. This indicates that there is at least some uncertainty regarding whether or not the mid-to-upper end of this range could affect new entry. Therefore in

ComReg's view, with Option 3 there is a risk that this could deter certain types of entry/business models.

- A 11.59 Option 4 would impact negatively on and therefore not be favoured by new entrants as the network roll-out costs could be considerable compared to the use of a roaming agreement.

Option 5 would create the potential for winners and losers

- A 11.60 If Option 5 was pursued it would be reasonable to assume that it is far more likely that the winner of the high coverage blocks would be an existing operator rather than a new entrant. Existing operators have networks in place and so the costs for an existing operator to meet the obligation would be much lower than for a new entrant (particularly if, as part of the high coverage obligation, this required the minimum level to be met within a very short period of time, which would make it extremely difficult for a new entrant to achieve).
- A 11.61 The existing operators, particularly those who have already deployed 900 MHz and 1800 MHz networks, may all be keen to be the winner of the high coverage spectrum as it could bring a number of advantages to the operator(s) who won these block(s). If it proved difficult to impose an effective wholesale roaming obligation on this operator, this approach could effectively result in the award of a monopoly position in certain geographic areas.
- A 11.62 Option 5 would not be considered attractive from the perspective of new entrants. Given their obvious disadvantage in terms of winning the high coverage blocks, this would mean that there would be a reduced amount of spectrum effectively available in the award for new entrants thus making entry harder than would otherwise be the case.
- A 11.63 Another relevant factor when considering the impact of Option 5 on industry stakeholders is that under Option 5 all blocks within a band would no longer be homogenous. This could potentially result in increased complexity for bidders in the proposed auction with regard to their bidding strategy, and ComReg notes that some respondents have noted concerns regarding the complexity of the auction in their response to Documents 11/60 and 11/75. All operators may have a preference for less complexity in the auction process.

Impact on Competition

- A 11.64 The level of competition in the downstream retail market is an important factor in terms of determining how extensive the level of coverage provided by the market, beyond the minimum level set as a licence condition. Evidence from the

mobile market to-date has shown that operators have consistently exceeded their coverage obligations. This illustrates how important coverage is as a competitive tool.

- A 11.65 All of the options considered in this RIA are likely to impact on competition in different ways as explained below.
- A 11.66 As noted above, Option 1 and 2 are not likely to deter a new entrant from entering the market, all other things being equal. Under Option 1 a new entrant could choose its own coverage level and consumers would then make choice of supplier based on information from the operators. In a similar manner, Option 2 would also provide a high level of flexibility to new entrants.
- A 11.67 However, Option 1 and Option 2 could distort the current equilibrium as regards urban/rural cross subsidisation. As outlined above, competition may become focused on the densely populated areas and result in a rollback of existing rural infrastructure. The market could stabilise at a level of coverage where there is no incentive for any operator to increase their coverage above this level. However, this level may not necessarily be the level of coverage desired by consumers or result in a competitive market outside of urban areas.
- A 11.68 In relation to Option 3, there is a risk that a minimum coverage level set toward to the mid-to-upper end of the Option 3 range could affect new entry so as negatively impact on competition. In particular, the mid- to upper-end of the range could be beyond what a new entrant would choose to deliver independently and, as such, could act as a disincentive for a potential new entrant whose strategy may be to build their own network to cover the large cities and towns in Ireland but not every small village in the country (as it may be more efficient to have a roaming agreement in place for the very rural areas). A potential new entrant may determine that it would be unable to be an aggressive competitor if it was to be tied to meeting coverage requirements and network-build rather than customer acquisition. Deterring participation in the award and subsequent entry into the Irish mobile market would negatively impact on competition at the retail level. However, on the plus side, Option 3 would be less likely to distort the equilibrium as regards urban/rural cross subsidisation when compared to Option 2 or 1 and consequentially may go further towards ensuring competition outside of urban areas.
- A 11.69 In relation to Options 4 and 5, whilst neither would distort the current equilibrium, as would be the case with Option 1 and 2, and potentially Option 3, they would however raise serious competition concerns as both are very likely to deter entry.

- A 11.70 In relation to Option 4, each operator would be required to have a network that covered at least 71% and up to 90% of the population. This would have a neutral impact on competition between existing players given the current footprint of their networks. However it is likely to deter new entry. As noted above, even the mid-to-upper end of the Option 3 range could raise problems in terms of deterring entry. Therefore in the case of Option 4, the higher the level, the greater the likelihood that this could deter entry as roll out costs become too high, making this highly inefficient for a new entrant who could otherwise negotiate a roaming agreement with one of the other existing network providers. Therefore Option 4 is highly likely to reduce competition 'for' the market (as this concept is described in Chapter 3). A reduction in competition at the auction will in turn likely reduce competition in the downstream market for mobile services.
- A 11.71 In ComReg's view, Option 5 would raise a number of negative implications for competition:
- First, as existing operators are much more likely to win the 'high coverage' blocks, Option 5 would favour existing operators and would reduce the number of blocks available in the auction for new entrants. This could deter entry, therefore reducing competition in the market;
 - Option 5 creates the potential for there to be one operator with almost ubiquitous coverage. If it proved difficult to impose an effective wholesale roaming obligation on this operator, this approach could result in the award of a monopoly position in certain geographic areas;
 - Option 5 could prevent an efficient overall auction outcome as a result of moving away from homogenous lots to heterogeneous lots. By setting aside certain spectrum in the award this is likely to result in greater demand for the remaining blocks within the auction (similar to the effects of Option 2A in the 'Assignment Process' RIA contained in Chapter 3). The high coverage block(s) may inflate the prices of other blocks over and above what they would have been if all blocks were homogenous. There is also a risk that the high coverage spectrum could go unsold if the price is unattractive to bidders compared to price of low coverage blocks.
- A 11.72 Having all blocks homogenous in a licence competition, as is the case under Option 1, 2, 3 or 4 is more likely to result in an efficient outcome than Option 5 since bidder strategies would be less complex and it is more likely that spectrum blocks will be awarded to those who value it the most.

Impact on consumers

- A 11.73 As set out in Step 1 (Policy Issues), generally consumers of mobile services value the ability to use their mobile devices whenever they want and wherever they are, so long as these services are available at a reasonable price. In addition, as competition drives coverage beyond the minimum levels set by a licence condition, it is in the best interest of consumers that competition would not be negatively impacted by the coverage level adopted.
- A 11.74 There are a number of important issues worth restating before considering the impact on consumers of the various options:
- As noted above, minimum levels of coverage set as a licence condition and the actual level of coverage provided by the market are unlikely to be the same; and
 - A very high coverage obligation does not necessarily equate to the best/preferred option for consumers. For example, if a high minimum level was applied symmetrically across all licensees, it could raise costs across the industry and result in inefficient investment which could be passed onto consumers, without any obvious benefits for consumers. To achieve industry-wide, ubiquitous cover that consumers value does not require that all operators build a network that is by itself capable of providing such ubiquity.
- A 11.75 Both Option 4 and Option 5 have a number of features which could prove detrimental to consumers. As noted above, both Option 4 and 5 could deter entry, thereby decreasing competition in the auction and in downstream retail market. Option 4 could also result in inefficient investment/duplication of networks. Imposing a high minimum coverage level would raise costs across the mobile industry with no added benefit for consumers. Option 5, as noted above, would not necessarily lead to an efficient auction outcome as spectrum may not be awarded to the operators who value it the most, and the high coverage spectrum could remain unsold/unassigned. Also, the high coverage advantages to consumers associated with option 5 can be achieved in the State using other schemes such as the Regional Broadband Scheme and the National Broadband Scheme and, arguably, these schemes have less downsides for consumers and competition than option 5.
- A 11.76 From the perspective of consumers, whilst Options 1 and 2 are likely to make entry more attractive compared to the other options, these options could distort the current equilibrium regarding urban/rural cross subsidisation, which could be detrimental to consumers since access to services outside of urban areas may ultimately become reduced. Setting no minimum coverage level or coverage at

a very low minimum level would enable an operator(s) to adopt a hub-and-spoke type network, based around the 5 main cities. If this model proved very successful this could result in more intensive competition in urban areas and lead to rural coverage being scaled back as explained above. There is a risk that geographic areas which have a low population density and/or where there is low/sporadic demand may not be covered and/or base stations could be removed. Although ComReg is of the view that this risk of such destabilising effects occurring may be relatively low³²¹ nonetheless it is a risk that ComReg does not consider appropriate to take as it would not be in the best interests of consumers. The current level of coverage provided by the market is very high and consumers are accustomed to this ubiquity.

- A 11.77 In this regard ComReg also notes that if reductions in overall coverage occurred this would have an impact on access to the emergency services and is of the view that this would have the potential to be of material detriment to consumers.
- A 11.78 Having considered each of the other options, and the various negative implications they could cause for consumers, Option 3 appears to offer a safeguard against the risk of rural coverage being scaled back which may occur under Option 1 and 2, whilst not seriously impacting on the likelihood of new entry, as would be the case under Option 4 or 5. On balance, ComReg considers that a coverage level set within the range encompassed by Option 3 would be in the best interest of consumers.

A11.2.5 Assessment and the Preferred Option (Step 5)

- A 11.79 As set out in the analysis above, existing operators are likely to have a preference for a medium-to-high level of coverage. Such a level would act as a deterrent to new entry, as it would be at a level such that their existing network would already adequately cover, whilst at the same time providing a generous level of flexibility to provide coverage in low population areas through cooperation/network sharing. New entrants are likely to prefer as low a minimum level as possible, as this would provide them with the greatest level of flexibility.
- A 11.80 In terms of the impact on competition, and by extension, the impact on consumers, there were two factors which framed the analysis - on the one

³²¹ Coverage is currently an important factor for consumers, and this is not likely to change; and as these operators already have networks rolled out with the necessary infrastructure in place, the capital investments in these sites are sunk costs, it is reasonable to assume that they will not be shut down, at least in the short term.

hand, an option could deter entry which would clearly be bad for competition and consumers, whilst on the other hand, an option could potentially destabilize the current equilibrium that exists as regards urban/rural cross-subsidisation, negatively impacting on the level of coverage that consumers are accustomed to. Having considered these issues, ComReg considers, on balance, that Option 3 would be the best option on competition grounds, and by extension, in the best interest of consumers, as it is unlikely to have a significant impact on the potential for entry, all other things being equal, and at the same time, would be unlikely to destabilize the current equilibrium. Each of the other options was deemed to have particularly negative impacts on competition, as a result of one or the other of these issues.

- A 11.81 Clearly determining the ideal level at which to set a minimum coverage level involves a number of trade-offs, between new entrants who would prefer a low level, and consumers who would prefer as high a level as possible so long as that was a level which did not deter entry, result in inefficient investment (thus potentially raising prices) or destabilize the current equilibrium regarding urban/rural cross subsidization..
- A 11.82 Having considered each of the options in turn, the analysis in this RIA suggests that a minimum coverage level within the range of Option 3 would best meet ComReg's objectives.
- A 11.83 A minimum coverage level within this range, from 50% to 70% is unlikely to significantly deter entry but there is some risk at the upper end of the range. ComReg is of the view that it is unlikely to result in inefficient infrastructure investment but again there is a some risk at the upper end of the range.
- A 11.84 However, the higher up the range, the more it removes any risk of the current equilibrium level of coverage being distorted via a destabilising effect on the cross-subsidization model which in turn would adversely affect competition in the rural services market and consumers. For this reason, ComReg is of the view that in the best interest of consumers, it is preferable to err on side of caution, given the importance of ubiquitous cover to consumers. Therefore, for this reason, ComReg favours the top end of this range, 70%.
- A 11.85 To reduce the likelihood of the point selected in the range deterring entry, ComReg is of the view that this should be combined with a longer roll-out period for a new entrant. This issue is discussed in more detail in Section 5.

A11.3 RIA on the Imposition of Quality of Service Obligations on Mobile Voice Calls

A11.3.1 Introduction

A 11.86 This section sets out the RIA on Quality of Service (QoS) which assesses the appropriate minimum QoS that should be set as part of a QoS licence condition for new liberalised licences in the 800, 900 and 1800 MHz spectrum bands.

A11.3.2 Policy Issues to be Addressed and Relevant Objectives (Step 1)

Objectives

- A 11.87 The focus of this RIA is to assess the impact of the proposed minimum QoS level on stakeholders, and on competition. In that way it will allow ComReg to identify and impose the most appropriate and least burdensome level, which still allows ComReg to achieve its objectives.
- A 11.88 ComReg's overall objectives in relation to this spectrum release process are set out in Annex 2. The most relevant objective in terms of QoS is to ensure that all users derive maximum benefit in terms of price, choice and quality from the spectrum release process.

Policy issue

- A 11.89 The policy issue to be addressed in this RIA is whether QoS conditions for mobile voice calls should be attached as a licence condition to new licences granted for liberalised 800 MHz, 900 MHz and 1800 MHz spectrum, thereby ensuring that users are offered a minimum QoS for mobile voice calls.

Step 2 - Regulatory options

- A 11.90 The regulatory options being considered are as follows:
- Option 1: Do not impose QoS licence conditions on mobile voice services, provided using liberalised spectrum in the 800 MHz, 900 MHz and 1800 MHz spectrum bands;
 - Option 2: Impose QoS conditions on non-VoIP mobile voice services, provided using liberalised spectrum in the 800 MHz, 900 MHz and 1800 MHz spectrum bands, in line with existing GSM licence standards, with

specific standards relating to: transmission quality; maximum level of dropped calls; and maximum level of blocked calls in a defined period.

- A 11.91 In its response to Document 11/60, Vodafone stated that it supported Option 1 as the vigorous competition that exists in the mobile market would negate the requirement for QoS obligations in relation to voice services. No other alternative options were proposed by respondents.

Step 3 & 4 - Impact on stakeholders and competition

Impact on operators

- A 11.92 An operator can guarantee a quality level for calls made between subscribers on its own network. However, no matter how much an operator invests in its network to provide superior voice call quality, it cannot guarantee call quality when its subscribers make/receive calls to/from a different network. As a voice call to or from a mobile network can originate or terminate on a different network (either fixed or mobile), this makes it very difficult for operators to prove that the quality of voice calls it offers on its network is superior to the quality of voice calls provided by other mobile networks, in the absence of minimum quality standards for calls across all operators.
- A 11.93 As a result of this feature of the market, non-imposition of a minimum standard for mobile voice call could create an incentive for a Licensee (or other third party providers such as an MVNO) to engage in behaviour which resulted in the quality of its voice calls falling below the current standards in the market (e.g. through lack of investment or poor network planning). In addition, other operators with higher quality standards would not be able to isolate the higher quality standards applied to voice calls on their own network from the lower quality standards applied on other networks. Such 'high quality' operators might then have less incentive to maintain this higher QoS and may allow the quality of their voice calls to fall. Such an overall reduction in quality for mobile voice calls could result in lower consumer demand for voice calls, which in turn would negatively impact all providers of voice call services, though no individual provider would have an incentive to unilaterally increase quality back to previous levels.
- A 11.94 The imposition of minimum QoS conditions for voice calls would prevent such a situation from arising, and ensure that all Licensees would be subject to the same minimum standard and, as such, each would be assured that no other licensee could avoid meeting these minimum standards.

- A 11.95 In its response to Document 11/60, Vodafone noted that an MVNO, who did not have spectrum usage rights, should be required to meet the same QoS standards as Licensees. In later responses, H3GI and Vodafone noted that it would be unreasonable for a Licensee to be held responsible for the QoS on a MVNO network. In this regard, Vodafone expressed a clear preference for Option 1.
- A 11.96 As noted in Document 11/60a, ComReg considers that all consumers, including those obtaining a service via an MVNO, are entitled to services that meet a minimum QoS standard. It is not reasonable for some consumers to enjoy a lesser QoS in respect of voice quality and network availability as a result of a commercial agreement between a host MNO and an MVNO.
- A 11.97 Accordingly, if QoS obligations are to be effective in respect of voice services provided by MVNOs, such obligations must be imposed on the holder of rights of use of the spectrum i.e. the licensee.
- A 11.98 ComReg acknowledges that Option 2 may involve compliance costs for Licensees, which would not arise under Option 1. However, investments made by Licensees in voice call QoS on their own networks would not be jeopardised by the possibility of competing operators offering low quality voice call services. Furthermore, ComReg does not consider that the compliance costs involved for Licensees would be disproportionate in terms of the consumer protection objective to be achieved. Licensees are well placed to monitor and ensure the compliance of their own network, and, to the extent that compliance by calls relating to MVNO customers is outside their network control, this can be ensured contractually (as alluded to by Vodafone in its response to 11/60).

Impact on competition

- A 11.99 Neither option is likely to materially impact on the level of competition between Licensees or between Licensees and third party competitors such as MVNOs, provided that all Licensees are subject to similar obligations. Option 1 could, however, result in less competitive intensity in terms of voice call quality than would occur under Option 2, for the reason described above.

Impact on consumers

- A 11.100 Consumers will likely prefer any option which ensures that they receive a minimum quality of service (Option 2) over an option which relies solely on market forces or the goodwill of individual operators (Option 1), as long as the preferred option does not otherwise result in reduced benefits in terms of price,

choice and quality. In this regard, ComReg does not see any downside to Option 2 in terms of consumer welfare.

- A 11.101 As voice calls can originate and terminate on different networks, and due to Mobile Number Portability (whereby a customer does not know which mobile network he/she is calling based solely on the customer's mobile number), a consumer who experiences poor voice call quality cannot determine whether the problem relates to his/her own network or to the network of the person on the other end of the line. Setting minimum QoS standards for voice calls can safeguard the interests of consumers in these circumstances.
- A 11.102 As discussed above, Option 1 could result in consumers receiving lower voice call QoS than that to which they are currently accustomed, by reducing incentives for operators to maintain certain QoS standards.
- A 11.103 For these reasons, consumers would prefer Option 2 as this would ensure that the standards under current GSM licences are maintained for future licences for liberalised spectrum.

Step 5 - Chosen Option

- A 11.104 Having considered the impacts on stakeholders and on competition, ComReg considers Option 2 to be the better option by which to achieve its objectives because, amongst other things:
- it would safeguard the interests of consumers against operators who might not otherwise maintain acceptable levels of voice call QoS. If this were permitted to occur, it could in turn reduce the incentives for other operators to maintain their existing quality levels, which could in turn create incentives for an overall reduction in quality levels across the market to occur;
 - attaching similar QoS standards for voice calls to future licences for liberalised spectrum to those that currently apply to GSM licenses would ensure a minimum QoS standard for mobile voice calls accords with current consumer expectations regarding QoS. These standards have been in place for over 15 years and appear to have served consumers well over this period;
 - ComReg has not received any information to suggest that the proposed QoS licence conditions for voice calls that were proposed in Document 11/60, which are equivalent to those standards which were attached to

GSM licences, would place a disproportionate burden on new licensees;
and

- the presence of high levels of competition in the market, as noted by Vodafone, does not negate the rationale for setting minimum QoS standards for voice calls, given:
 - the inability for individual operators to isolate the higher quality standards applied to voice calls on their own network from the lower quality standards applied on other networks; and
 - that a consumer who experiences poor voice call quality cannot determine whether the problem relates to his/her own network or to the network of the person on the other end of the line

A11.3.2 ComReg’s Final Position

A 11.105 Based on the above RIA, ComReg considers it appropriate to set voice call QoS conditions for all non-VoIP voice calls for all liberalised licences with reference to current GSM QoS standards. This is justified given present day user expectations as to the quality of voice calls and the potential for an overall reduction in quality levels across the market that might otherwise result.

A 11.106 ComReg does not consider it appropriate to set QoS conditions for voice over internet protocol call services and refers to Information Notice 10/91³²²:
“ComReg agrees with Analysys Mason’s view (R14 and R17) [as set out in its Report 10/91a³²³] that monitoring the Next Generation Voice (NGV) market situation is the correct approach at this time, including monitoring customer complaints. This approach could change if BEREC or the European Commission publishes conclusions that intervention should be undertaken in some respect.”

A 11.107 The voice call QoS licence condition and metrics are set out in Table 4 below. These specifications are based on the existing GSM /3G licences.

Condition	Average	Worst Case
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³²² Future Regulatory Framework for Next Generation Voice Services including VoIP, ComReg Information Notice 10/91

³²³ *Review of the regulatory framework for VoIP in Ireland*, Report for ComReg, ComReg Document 10/91a

Condition	Average	Worst Case
Maximum Permissible Blocking Rates This refers to the maximum percentage of total call attempts which are unsuccessful during the time consistent busy hour. ³²⁴	2%	4%
Maximum Permissible Dropped Call Rates This refers to the maximum percentage of total originating calls which are prematurely released by the network within 3 minutes of the call being made.	2%	4%
Transmission quality The Licensee shall ensure that the speech transmission quality is as good or better than the speech quality associated with the GSM Standard and GSM Technical Specifications of ETSI. The Licensee shall ensure that appropriate echo treatment equipment is used and that it is properly configured.		

Table 4. The 'Voice Call'³²⁵ QoS Obligation

A11.3.2 RIA on the Imposition of QoS on Network Availability

Step 1 - Policy issues to be addressed and relevant objectives

Objectives

- A 11.108 The focus of the RIA is to identify the impact of the regulatory options under consideration on stakeholders (including existing operators, potential new entrants, and consumers) and on competition and, in so doing, to identify the option that would best achieve ComReg's objectives.
- A 11.109 ComReg's statutory functions and objectives in relation to radio frequency spectrum are set out in Annex 2 of this document. These objectives include:
- The promotion of competition, which includes:

³²⁴ "Time consistent busy hour" means the period of one-hour starting at the same time each day for which the average traffic of the network concerned is greatest over the days under consideration. The time consistent busy hour shall be determined from an analysis of traffic data obtained from the service and be subject to ComReg's approval. The 'Time consistent busy hour' is determined from the operator's voice traffic. It is the one-hour period during which there is the highest level of traffic. The blocked call rates are measured for the same one-hour period during each review period (i.e. 6 months). The one-hour period is determined by the operator and is subject to ComReg's approval.

³²⁵ "voice calls" does not include Voice over Internet Protocol ("VoIP") calls

- ensuring that users derive maximum benefit in terms of choice, price and quality;
 - encouraging efficient use and ensuring effective management of radio frequencies; and
 - ensuring that there is no distortion or restriction of competition in the electronic communications sector.
- Contributing to the development of the internal market; and
 - Promoting the interests of EU citizens.

A 11.110 ComReg, in pursuit of these objectives, must apply objective, transparent, non-discriminatory and proportionate regulatory principles as described in Annex 2 of this document. In addition, in determining its preferred option, ComReg must also have regard to relevant Policy Directions.

A 11.111 The various RIA guidelines provide limited guidance as to how much weight should be given to the positions and views of each stakeholder group. Accordingly, ComReg has been guided by its statutory objectives which it is obliged to seek to achieve when exercising its functions.

Policy issue

A 11.112 The policy issue to be addressed in this RIA is whether a network availability condition should be imposed on holders of liberalised licences in the 800 MHz, 900 MHz and/or 1800 MHz spectrum bands, in order to ensure that any periods during which a licensee's network is unavailable do not exceed a specified level.

A11.3.3 Regulatory options (Step 2)

A 11.113 The regulatory options being considered are as follows:

- **Option 1:** Do not impose minimum QoS conditions in respect of the availability of the network;
- **Option 2:** Set minimum QoS conditions in respect of the availability of the network, based on current GSM license conditions, such that each licensee shall ensure that service unavailability shall be less than 35 minutes (based on weighting factors) per six month period.

A 11.114 No other alternative options were proposed by respondents.

A11.3.4 Impact on stakeholders and competition (Steps 3 and 4)

Impact on operators

- A 11.115 Option 1 would allow operators full discretion over how often and how long their networks may be unavailable (e.g. for the purposes of systems upgrades etc).
- A 11.116 Option 2 may require operators to incur additional expenditure in their network to ensure compliance with obligations (e.g. back-up systems) over and above the level which they would choose to incur, absent the licence condition. Under Option 1, operators would not incur compliance costs associated with monitoring the performance of their network in line with the requirements set out under Option 2.
- A 11.117 For these reasons, operators may have a preference for the greater flexibility and avoidance of compliance costs associated with Option 1. However, ComReg notes that the only operator to express a view on this particular issue, eircom Group, stated in its response to Document 11/60 that it had no objections to the proposed QoS metrics.

Impact on competition

- A 11.118 Neither option is likely to impact materially on competition as any conditions imposed would apply equally to all licensees. Option 1 could, however, result in less competitive intensity in terms of network availability than would occur under Option 2, for the reason described in the above Voice Call RIA.
- A 11.119 The QoS obligation imposed under Option 2 would apply to licensees which means, in turn, that licensees will need to procure that other third parties using their network assist it in achieving compliance as appropriate.

Impact on consumers

- A 11.120 Network availability is of fundamental importance to mobile consumers. If a mobile network is unavailable, subscribers on that network cannot make or receive mobile calls. Option 2 would ensure that consumers would be protected against an unreasonable level of disruption to services in the form of an inability to make/receive calls. Under Option 2, customers could refer the matter to ComReg if their service provider did not meet its obligations. ComReg would act as a watchdog for consumers by ensuring that the overall duration of network unavailability is within the specified range.

- A 11.121 Under Option 1, operators may, amongst other things, have an incentive to undertake lower levels of investment in their networks in terms of operability than would otherwise be the case, or to impose unreasonable levels of disruption on their customers when undertaking systems upgrades, etc.
- A 11.122 For these reasons, consumers would most likely prefer Option 2 whereby all Licensees are required to ensure that the overall duration of network unavailability does not exceed a specified level, in line with the requirements attached to current GSM licences. This is unlikely to involve much additional costs for consumers since this is already a GSM and 3G standard.

A11.3.5 Chosen Option (Step 5)

- A 11.123 Having considered the impacts on stakeholders and on competition, ComReg considers Option 2 to be the better option by which to achieve its objectives because, amongst other things:
- consumers face serious disruption if the mobile network to which they are subscribed is unavailable. The longer the period of unavailability, the greater the level of disruption. Setting a licence condition relating to network performance would safeguard the interests of consumers against operators who might otherwise have an unacceptably high level of network unavailability;
 - attaching a maximum level over overall network unavailability to future licences for liberalised spectrum would ensure a minimum QoS standard that is in line with current expectations as these standards have been in place for over 15 years and appear to have served consumers well over this period;
 - ComReg has not received any information to suggest that the QoS network availability licence condition that was proposed in Document 11/60, which is equivalent to those standards which were attached to GSM licenses, would place a disproportionate burden on new licensees.

A11.3.6 ComReg's Final Position

- A 11.124 The analysis and conclusions reached in the above RIA have informed ComReg's decision to set a minimum QoS standard in respect of network availability.

A 11.125 The minimum QoS standard in respect of network availability is based on current GSM license conditions whereby a Licensee must:

- keep a log of network availability; and
- ensure that network unavailability is less than 35 minutes per six month period where the calculation of service unavailability is subject to weighting factors that take account of traffic load variations, as set out in Table 5 below.

Service Unavailability, Weighting Factors (divide duration of each network event by weighting factor)			
	Monday to Friday	Saturday	Sunday
For periods between 07.00 and 24.00	1	2	4
For periods between 00.00 and 07.00	4	8	16

Table 5. Weighting factors associated with the 'availability of the network' QoS obligation.

A 11.126 In ComReg's view, such a condition is complementary to the principle of service-neutrality. The proposed condition on network availability would not oblige an operator to provide a particular service nor would it prevent an operator from providing a particular service. Rather, it would be a general QoS condition which is intended to ensure that network availability is maintained at a reasonable level and which would apply to all Licensees irrespective of the service(s) provided.

Annex 12: Consideration of other Issues Raised

A12.1 ComReg's Position is Outdated

- A 12.1 Telefónica stated its belief *“that ComReg’s proposal, which in its structure broadly mirrors that set out originally 2 years ago in Document 09/99 has been overtaken by events and by the passage of time.”*
- A 12.2 In relation to the proposal(s) set out in 09/99, ComReg is of the view that some of these have been overtaken by events and the passage of time. Such events include:
- An announcement concerning the availability of the “digital dividend” (see section 1 of 10/71) which ComReg followed with the proposed addition of the 800 MHz band to the 900 MHz award process, as consulted on in Document 10/71; and
 - Developments in the availability of equipment for the 1800 MHz band (see section 2.2 of 10/105) which addressed ComReg’s previously expressed concerns and which ComReg followed with the proposed addition of the 1800 MHz band to the award process, as consulted on in Document 10/105.
- A 12.3 The passage of time has also required the issuing of two 900 MHz Interim Licences, as initially proposed in Document 10/71 (section 3), consulted upon in detail in Document 11/11 and decided upon in Document 11/29 (D03/11).
- A 12.4 However, ComReg also notes that its proposals have been developed and refined in light of these developments and submissions received from respondents to the various consultation documents. By way of example ComReg has modified its proposals set out in 09/99 by:
- moving from a single band combinatorial single sealed bid auction to a multi-band combinatorial clock auction;
 - refining the early liberalisation option for existing licensees including the methodology for the calculation of a proposed rebate;

- refining the level of the Minimum Price following extensive new data becoming available in recent months;
- introducing preparatory licences to assist spectrum winners in preparing networks in advance of the start date for liberalised licences;
- making provision for dealing with transitional issues addressing arrangements for operators' moves to take up spectrum won in the award process, at the start of the first time-slice, and in the transition between time-slices;
- providing for advanced commencement, potentially allowing earlier use of the spectrum won in the award process, subject to certain conditions; and
- taking into account new provisions contained in a new set of EU rules including, amongst other things, those concerning the transfer or lease of rights of use.

- A 12.5 ComReg is therefore of the view that while the proposal as set out in 11/60 "*broadly mirrors*" that set out in Document 09/99, it has evolved in light of the changing circumstances and responses from operators and is in no way dated or overtaken by the passage of time.
- A 12.6 Telefónica further states that "If ComReg is to comply with its obligations and objectives it must now revise its proposal to reflect the current factual situation and regulatory circumstances".
- A 12.7 ComReg has, throughout this consultation process, acted in accordance with the prevailing legal framework and its statutory functions, duties and objectives.
- A 12.8 In Document 11/60 ComReg noted the considerable evolution of both the market and legislative environment over the course of the last three years and has taken this into account resulting in the expansion of "*the scope of the proposed award process from one originally covering just 35 MHz of paired spectrum at 900 MHz to one that can now include in addition 30 MHz of paired 800 MHz spectrum and a further 75 MHz of paired 1800 MHz spectrum*"³²⁶.
- A 12.9 In addition, and in accordance with its statutory objectives³²⁷ it is ComReg's view that it has, over the course of this consultation process, "*greatly improve[d]*

³²⁶ See paragraph 1.4 of Document 11/60

³²⁷

*the potential of this process to enhance competition, innovation and efficiency, which will be of great benefit to consumers and operators in the mobile industry. It has also taken us away from the concerns initially advanced at the outset of the process about the scope for consumer disruption caused by competing demands on 900 MHz spectrum, and alternatively the need to provide for new entry by reserving spectrum for this purpose*³²⁸.

- A 12.10 ComReg therefore rejects the assertion that, if it is to comply with its obligations and objectives, it must now revise its proposal to reflect the current factual situation and regulatory circumstances. Such an assertion ignores the substantial amendments that have been made to its proposals over the course of this consultation process to reflect the factual situation and regulatory circumstances.

A12.2 Timetable

- A 12.11 Asserting that “*a considerable degree of uncertainty exists in relation to the process and timetable that ComReg will follow in the proposed spectrum assignment*” and that “*the uncertainty regarding the date for an auction hampers operators in their preparation*”, Telefónica called on ComReg to “*produce a detailed timetable showing the steps to be taken up to the grant of licences, together with the planned time for each; for example, Annex 3 of document 07/93*”.
- A 12.12 ComReg notes that Telefónica’s response was made before having sight of Document 11/75 which contains a list of envisaged publications and actions in section 1.3, a detailed indicative timetable in section 3.2. and notes that Telefónica has acknowledged and “*welcomed*” the provision of this timetable in their recent response to Document 11/75 (at paragraph 2.2).

A12.3 Uncertainty of Access to 800 MHz

- A 12.13 Two respondents expressed concern surrounding uncertainty in accessing the 800 MHz spectrum band. H3GI argued that “*In order for the proposed auction to be legally certain, ComReg must address the consequences of delay for the commencement of the proposed licences, including the refund of spectrum fees pro-rata for any delay*”. Telefónica argued that “*in order to be entitled to auction 800 MHz licences with a particular start date, ComReg must have the legal right to do so. It must be able to guarantee the availability of the commodity on the*

³²⁸ See paragraph 1.4 of Document 11/60

promised start date". In commenting on ComReg's advanced commencement proposals Telefónica also noted that "*Allowing 900 MHz licences to start several months earlier does not in any way excuse ComReg of its obligation to provide certainty around the start dates of the 800 MHz spectrum it is proposing to auction*".

A 12.14 ComReg does not agree with Telefónica that it is obliged to provide absolute certainty around the start dates of Liberalised-Use licences. Instead it is ComReg's view that it should provide as much clarity and regulatory predictability as possible in relation to the Award Process, and this document and ComReg's draft and final Information Memoranda aim to provide such clarity and predictability on issues such as the availability of spectrum bands in the multi-band spectrum release process and the terms and conditions associated with Liberalised-Use and Preparatory Licences including their proposed commencement dates. Given the benefits that will flow to consumers and the Irish economy from the deployment of advanced communications services, ComReg is of the view that these should be delivered at the earliest possible date. If ComReg were to wait for ASO to have occurred, before starting the assignment process in respect of 800 MHz spectrum, a substantial delay would be inevitable in the deployment of services in this band. ComReg is of the view that the fallow period that would likely result would not be in accordance with its statutory objectives, in particular, as they relate to the efficient use of spectrum.

A 12.15 Noting that respondents supplied these comments before the publication of Document 11/75, ComReg refers interested parties to:

- section 2.2.2 of Document 11/75 which discussed the potential for delayed commencement of Liberalised-use Licences in Time Slice 1 for Lots in the 800 MHz, 900 MHz and/or 1800 MHz bands; and
- section 2.2.6 of Document 11/75 which sets out ComReg's proposed refund of licence fees in the event that ComReg is unable to make any Lot or Lots in the 800 MHz, 900 MHz and/or 1800 MHz bands to which a Liberalised-use Licence relates, available for use by the commencement date of Time Slice 1.

A12.4 Liberalisation

A 12.16 One respondent (Telefónica) asserted that "ComReg is placing undue emphasis in this Consultation Process on the need to liberalise "as soon as possible" – as

per Commission Decision 2011/251/EU” and “By doing so, ComReg is failing in its obligation to encourage the interoperability of pan-European services and failing to follow the European Commission Decision which envisages that “the current use of GSM in the 900 MHz and 1800MHz bands should remain protected in the whole Community as long as there is a reasonable demand for the service.” – as per the EC Decision on the 900 MHz and 1800 MHz bands.

- A 12.17 ComReg refutes the assertion in that it has placed *undue emphasis* on the need to liberalise as soon as possible. ComReg’s reasoning for liberalising as soon as possible (paragraph 3.18 of 11/60) is in order to maximise the potential use of the relevant radio spectrum for the benefits of operators and consumers, fully in line with ComReg’s statutory obligations as detailed in Annex 1 of 11/60 and clearly in line with the intentions of the GSM Amendment Directive and the yet to be adopted Radio Spectrum Policy Program. This is however without disadvantaging the use of GSM technology by any existing or new licensee.
- A 12.18 ComReg is of the view that recent EC Decisions, which compel Member States to implement the harmonised technical conditions for the availability and efficient use of the 900 MHz and of the 1800 MHz band, as detailed in 2011/251/EC, provide at this time the harmonised conditions for the use of four different technologies – in line with the EC’s general move towards technology neutrality.
- A 12.19 As presented in 11/60 ComReg is proposing to issue new licences for the provision of “liberalised services” and that licensees will be able to provide terrestrial public mobile services using their technology of choice in line with the annex of 2011/251/EU³²⁹. Any operator who chooses to utilise GSM technology under these new licences (or indeed any interim or legacy licences operating at the same time as the liberalised licences), will be protected under the harmonised technical conditions for the availability and efficient use of the 900 MHz and of the 1800 MHz band as detailed in 2011/251/EC.

A12.5 Consumer Participation

- A 12.20 One respondent (Minch) asserts that, due to a lack of input into this process by consumers or consumer interest groups (including ComReg’s Consumer Advisory Panel) that “*ComReg has therefore not sufficiently reflected the*

³²⁹ Due to legacy reasons and as explained in Section 6.6 of 11/60 any existing licensees that hold legacy licences at the same time as liberalised licences have been issued should have the option to liberalise their legacy licences in order to ensure a level playing field and prevent distortions between licensees.

consumer interest or taken sufficient account of the Ireland Offline or Ericsson responses”.

- A 12.21 ComReg notes that throughout this consultation process it has operated in an open and fully transparent manner and that there has been no limitation placed on the submission of responses from any party. The lack of input from consumers or consumer groups, as perceived by this respondent, is outside of ComReg’s control.
- A 12.22 Regarding the assertion that ComReg has not sufficiently reflected consumer interest or taken sufficient account of the views of the two named responses, ComReg refers interested parties to ComReg Document 09/99 in which a number of sections³³⁰ deal directly with the responses received from these two respondents. ComReg also notes that one of the respondents (Ireland Offline) only submitted a response to Document 09/14 (in mid 2009), subsequently rejected ComReg’s offer to attend a bilateral meeting in July 2009 to discuss their response and has not responded subsequently to any of ComReg’s further consultations on this matter.
- A 12.23 However, even without direct input from consumers or consumer groups ComReg has considered the interests of consumers as noted in Annex 2 of this document³³¹. ComReg therefore notes the attention it has given to consumer interests in 11/60 alone, in particular but not limited to:
- Chapter 3 of Document 11/60:
 - para 3.6 on the use of a RIA when there may be an impact on stakeholders or consumers;
 - para 3.27 - maximising the benefits for consumers in terms of price, choice and quality;
 - para 3.31 – the impact of regulatory options on consumers;
 - para 3.73 to 3.80 and 3.11 to 3.170 – the impact of various options on consumers;
 - para 3.89 – the use of auctions and the benefit for consumers;
 - para 3.94 - avoid significant consumer disruption;

³³⁰ Concerning Ireland Offline’s response to 09/14 the following sections of 09/99 deal directly with responses received: 7.12, 7.1.5.2, 7.1.8, 7.1.11, 15.9.1.1 and 15.11.6. Concerning Ericsson’s response to 09/14 the following sections of 09/99 deal directly with responses received: 6.2.2, 7.1.5.2, 7.1.12, 15.5.1, 15.8.1, 15.8.4.4, 15.9, 15.9.1.1, 15.9.6.3, 15.11.3, 15.11.6.

³³¹ In particular see the following paragraphs of Annex 1 of 11/60a: A1.13, A1.15, A1.28, A1.48 and A2.18

- para 3.177 to 3.196 – Compliance of ComReg’s preferred options against its statutory obligations;
- Chapter 5 of Document 11/60:
 - para 5.63 to 5.71- safeguards to ensure that consumers are provided with an acceptable level of coverage and that this coverage would be maintained.
 - Para 5.102 to 5.106 - Performance Guarantees on coverage and roll-out obligations to ensure the provision of services to consumers;
 - Para 5.107 To 5.122 – QoS obligations to ensure adequate service to consumers;
 - Para 5.136 to 5.137 - Access to Emergency Services and Billing;
- Chapter 6 of Document 11/60 – notes the need for transitional issues to, amongst other things, prevent disruption to consumers; and
- Chapter 7 of Document 11/60 – benefits to consumers of advanced commencement of licences.

A 12.24 ComReg has, similarly, had regard to consumer interests in earlier consultation documents in this process.

A 12.25 Regarding the reference to a “*caustic website release*”³³² ComReg notes this information.

A12.6 Weighing of Factors

A 12.26 One respondent suggested that ComReg should construct a quantitative scheme so that the rating of concerns has a “*rational foundation*” [Minch].

A 12.27 While accepting the initial attractiveness of this proposal, ComReg submits that this is not legally possible for ComReg to implement.

A 12.28 At a technical and economic level there are a large number of factors that would flow into any such model. Even reasonable estimates for many such factors could not be obtained without compelling the disclosure of significant amounts of information from the existing network operators. Accordingly, ComReg is of the view that it is not practical to construct such a model at this point.

³³² See footnote 9 on page 10 of Stephen Minch response to 11/60.

- A 12.29 Equally ComReg must act in accordance with the prevailing legal framework and its statutory functions, duties and objectives.
- A 12.30 These functions, duties and objectives are not weighted and ComReg cannot choose precisely how to weight them but must comply with all of its statutory functions and duties and seek to deliver on each of its statutory objectives.

Annex 13: International Update on Regulatory Actions

- A 13.1 This annex sets out specific details of relevant developments relating to the re-farming/liberalisation of the 800 MHz band, 900 MHz and 1800 MHz band activities in other European countries.³³³
- A 13.2 In developing its proposals for the multi-band spectrum release, ComReg has taken cognisance of international developments generally and, in particular, developments in EU countries as they are subject to the same common regulatory framework.

A13.1 Overview

- A 13.3 Recent practice amongst Europe's NRAs has been to release mobile spectrum bands in a combined award process whenever possible.
- A 13.4 In this regard, and as set out in more detail below:
- Portugal has already released spectrum in all of the harmonised mobile spectrum bands (800 MHz, 900 MHz, 1800 MHz, 2.1 GHz & 2.6 GHz bands);
 - the Netherlands and Switzerland propose to release spectrum in all of the harmonised mobile spectrum bands (800 MHz, 900 MHz, 1800 MHz, 2.1 GHz & 2.6 GHz bands) in upcoming auctions;
 - Italy released all of these spectrum bands with the exclusion of the occupied 900 MHz band;
 - Austria proposes to release 800 MHz, 900 MHz and 1800 MHz spectrum in a joint award and Norway is considering the same, in line with ComReg's proposal;
 - France released mobile spectrum it had available in the 800 MHz and 2.6 GHz bands;

³³³ ComReg has compiled some of this annex based on unofficial translations of documents or on translations carried out by or on behalf of ComReg. Whilst every effort has been made to ensure that such translations are accurate in all material respects, ComReg cannot guarantee that the details on international developments set out in this annex are free of errors in translation or interpretation.

- the UK proposes to release these bands together in the near future;
- Spain recently completed an auction which released spectrum concurrently in the 800 MHz, 900 MHz and 2.6 GHz bands; and,
- Greece released 900 MHz and 1800 MHz spectrum concurrently.

A 13.5 A significant percentage of spectrum releases to date and planned in Europe utilise **auctions** to determine successful candidates;

- an auction has been deployed in recent releases of spectrum in the mobile spectrum bands in Belgium, Germany, Greece, Hungary, Italy, Portugal, Spain and Sweden; and
- a number of countries propose to use an auction for upcoming releases of spectrum in the mobile spectrum bands, including Austria, Norway, Denmark, Switzerland, UK, Finland, and the Netherlands.

A 13.6 Of these realised and proposed spectrum releases, the most common format is **Combinatorial Clock Auction (CCA)**;

- Denmark and the UK propose to use CCA, whilst Hungary, Netherlands, Sweden and Switzerland used a CCA,
- Italy and Portugal used a Simultaneous Multi-Round Auction (SMRA), and
- other countries used a comparative selection procedure or “*beauty contest*” (e.g. France), with others assigning spectrum without competition as supply was greater than or equal to demand, in cases due to restrictions on incumbents bidding, e.g. 900 MHz, 1800 MHz and 2.1 GHz in Austria, 900 MHz and 1800 MHz in Denmark and Malta, and some of the 900 MHz spectrum in Spain.

A 13.7 Sweden and Hungary used an **assignment stage** to determine the spectrum assignments once the quantum per band has been determined by auction, whilst Denmark proposes to do the same in its upcoming spectrum release. This assignment stage is in line with ComReg’s proposal.

A 13.8 All recent spectrum releases and proposed future releases in Europe include **spectrum caps** of some form for the competition:

- Denmark, Belgium, Greece and Spain released some spectrum which had conditions associated which limited the number of bidders (incumbents)

based on existing spectrum assignments, therefore did not impose a spectrum cap on these releases;

- Sweden and Portugal had a 2 × 10 MHz cap on its release of 800 MHz spectrum, whereas France had a cap of 2 × 15 MHz cap and Finland proposes to implement a 2 × 20 MHz cap;
- Hungary had a cap of 2 × 7.8 MHz for its release of 900 MHz spectrum, whilst Switzerland proposes a 2 × 20 MHz cap;
- many countries had a sub 1 GHz cap; Italy had and Switzerland proposes to use a 2 × 25 MHz cap; Portugal and Spain had a cap of 2 × 20 MHz, whilst the UK proposes to use a 2 × 27.5 MHz cap,
- Italy had a 2 × 25 MHz cap on its 1800 MHz spectrum, whilst Portugal had 2 × 20 MHz and Switzerland propose 2 × 35 MHz.

A 13.9 Where possible, NRA's have sought to award spectrum contiguously with some countries mandating that assignments are contiguous, e.g. Sweden and Portugal.

A 13.10 The **duration of licences** for spectrum recently released and soon to be released varies, with some countries having shorter licences (e.g. Belgium) or extensions (e.g. Netherlands) to overcome issues such as differing licence expiration and to maintain services to consumers (e.g.):

- 10 – 16 years duration: Greek 900 MHz and 1800 MHz licences;
- 13 – 14 years duration: Swiss 900 MHz licences;
- 15 years duration: Hungarian 900 MHz and 1800 MHz licences
Portuguese 800 MHz, 900 MHz, 1800 MHz and 2.6 GHz licences, Spanish 800 MHz and 900 MHz (one block started early and the licence is of 19 years duration) licences;
- 16 years duration: Swiss 800 MHz licences;
- 17 years duration: Dutch 800 MHz, 900 MHz, 1800 MHz and 2.6 GHz licences;
- 18 years duration: Italian 800 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz licences;

- 20 years duration: French 800 MHz and 2.6 GHz licences;
- 22 years duration: Danish 800 MHz licences;
- 25 years duration: Swedish 1800 MHz licences; and
- indefinite (revocable): UK 800 MHz and 2.6 GHz.

A 13.11 Digital Terrestrial Television has been afforded protection from neighbouring mobile networks in states throughout Europe; Annex 9 details the actions taking by other countries in this regard.

A 13.12 Different administrations have applied different **coverage** conditions to licences:

- no coverage obligation for Danish 900 MHz and 1800 MHz licence (only a new entrant could acquire this licence, NRA considered the blocks too small to merit imposing coverage obligation);
- financial commitment to rollout in Spain and Sweden, e.g. the coverage block in 800 MHz in Sweden requiring SEK 300m to be spent on coverage;
- a requirement to cover a certain amount of land area is proposed for Dutch licences, e.g. 3,080km² to be covered after 5 years;
- 50% population coverage within 5 years of licence commencement for 800 MHz and 900 MHz licences in Switzerland, 25% for 1800 MHz;
- 85% population coverage for 900 MHz and 1800 MHz licence in Belgium within 6 years (with interim milestones);
- 90% population coverage in specific rural areas in Italy for 800 MHz licences within 5 years;
- 90% population coverage of 30Mbps broadband to rural communities with less than 5,000 people by 2020 in Spain;
- 95% population coverage in Finland proposed for 800 MHz release;
- a proposal for 98% indoor population coverage for one 1800 MHz licence in the UK (which includes funding from Government);

- 99.6% population coverage in France for 800 MHz licences (with interim milestones, the NRA encourages network and frequency sharing to achieve this level); and
- between 75% and 99.8% outdoor coverage for 800 MHz licences in Denmark.

A13.2 Detail of European Developments in the 800 MHz, 900 MHz and 1800 MHz bands

A13.2.1 Austria

- A 13.13 The Austrian NRA (RTR) released a consultation on 25 February 2011 on the use of the 800 MHz band and the liberalisation of the 900 MHz and 1800 MHz bands,³³⁴ with the closing date for submissions to consultation set at 25 March 2011. In its consultation, RTR proposed to auction 800 MHz spectrum in late 2011 or early 2012.
- A 13.14 RTR saw benefits in allowing liberalised usage of the 900 MHz band in the near future on the basis that it provides mobile broadband coverage at lower cost, better indoor coverage and increase in capacity. However, the existing fragmented 900 MHz assignments held by three operators do not facilitate the deployment of new technologies as only two operators have access to the required 5 MHz channels. Another issue for RTR is that all existing 900 MHz licences will expire over the period from 2016 – 2018. In order to overcome these obstacles to earliest liberalisation of 900 MHz spectrum and to satisfy its regulatory objectives, RTR proposed to auction liberalised 900 MHz spectrum (with the new assignments of spectrum taking effect when existing licences expire) and reform the 900 MHz band after the 800 MHz band has been assigned.
- A 13.15 In the event that RTR identifies a distortion to competition arising from the 800 MHz and 900 MHz assignments, it proposed to impose certain conditions on a licensee(s) to overcome this issue, namely:
- an obligation on sub 1 GHz licensees with reformed spectrum to provide wholesale services to licensees who have insufficient spectrum sub 1 GHz to provide new technologies; and/or

³³⁴ RTR Consultation on 800 MHz, 900 MHz and 1800 MHz bands - http://www.rtr.at/en/komp/Konsult_DD_Refarming/consultation_dd_refarming_e.pdf

- RTR would only allow re-farming of spectrum in the 900 MHz band if a licensee(s) were willing to relinquish some of its 900 MHz spectrum, which would subsequently be auctioned.

- A 13.16 RTR received 18 responses to its consultation,³³⁵ published a summary of these responses in May 2011³³⁶ and set out its next steps in July 2011³³⁷. RTR proposes to hold a joint auction of 800 MHz, 900 MHz and 1800 MHz spectrum (due to substitutability between the bands and aggregation risk) by mid-2012³³⁸ with special coverage conditions and spectrum caps (details yet to be published). RTR proposes to release spectrum in 2 x 5 MHz blocks, and will try to ensure spectrum is assigned contiguously.
- A 13.17 RTR does not propose symmetry in spectrum assignments, nor extension existing licences as per some respondents' requests. RTR does not intend to allow for liberalisation of existing GSM licences until after the proposed auction, at which time it can assess the situation and the long term frequency assignments. In the event that such liberalisation could distort competition based on such an assessment, RTR is considering options to overcome this, including refraining from liberalising spectrum or imposing suitable conditions e.g. rural access for other operators.
- A 13.18 RTR has yet to publish the specific details of its proposed auction or any proposed licence conditions.

A13.2.2 Belgium

- A 13.19 On 7 February 2011, the Belgian NRA (BIPT) issued a press release³³⁹ outlining its proposed timeline for the release of spectrum in the 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz bands.³⁴⁰ The three existing MNO's in Belgium (Belgacom, Mobistar and KPN) all have existing spectrum assignments in the 900 MHz, 1800 MHz and 2.1 GHz bands. All 900 MHz licences currently expire in 2015, as a result of BIPT extending both Belgacom and Mobistar's 900 MHz licences by 5 years.
- A 13.20 BIPT published a call for candidates on 15 March 2011. On 10 May, BIPT announced³⁴¹ that it had received one satisfactory application for the 3 lots (2 x

³³⁵ http://www.rtr.at/en/komp/Stn_DD_Refarming

³³⁶ http://www.rtr.at/en/komp/Stn_DD_Refarming/Summary_of_comments_and_opinions_dd_refarming.pdf

³³⁷ http://www.rtr.at/en/komp/Erg_DD_Refarming/Results_consultation_DD_Refarming_e.pdf

³³⁸ http://www.cullen-international.com/report/6025/t5116#Table_22

³³⁹ BIPT press release, <http://bipt.be/GetDocument.aspx?forObjectID=3420&lang=en>

³⁴⁰ BIPT Auction rules, <http://www.auction2011.be/images/stories/documents/auctionrules3gen.pdf>

³⁴¹ <http://www.auction2011.be/images/stories/documents/3gkandidatuurENfinal.pdf>

5 MHz blocks) of 2.1 GHz spectrum, for which existing 2.1 GHz licensees could not apply. As there was only one applicant, an auction was not held. The winner of this 2.1 GHz spectrum also had the option of securing 900 MHz and 1800 MHz spectrum (i.e. the 2 × 4.8 MHz of 900 MHz spectrum and 2 × 10 MHz spectrum, available from 2015).

- A 13.21 The 10 year 2.1 GHz licence was issued to the applicant, NV/SA Telenet Tecteo BIDCO, in July 2011,³⁴² with an option to take up spectrum in the 900 MHz and 1800 MHz bands³⁴³ from November 2015. The fixed cost for taking up the option of 900 MHz and 1800 MHz spectrum was €31,507,311, whilst the minimum price for 2.1 GHz spectrum was €71.5m. BIPT had stated that if a new entrant to the mobile market did not present itself and win spectrum, there was a possibility that the spectrum could be auctioned to existing operators
- A 13.22 The coverage requirement for the successful licensee, should it exercise its option in the 900 MHz and 1800 MHz spectrum, is: 30 % After 3 Years, 40 % After 4 Years, 50 % After 5 Years and 85% After 6 Years (best efforts obligation). By the end of year six and after notification of the grant of the rights of use, BIPT may review this 85% target, for various reasons, including public interest.
- A 13.23 In April 2010, BIPT adopted a decision³⁴⁴ on the introduction of UMTS in the 900 MHz band and since then UMTS has been deployed in the 900 MHz band. On the 16 November 2011, BIPT adopted a decision^{345,346} to allow UMTS and LTE in the 900 MHz and 1800 MHz bands. On the same date, BIPT also published a document regarding refarming of existing spectrum assignments³⁴⁷.

A13.2.3 Denmark

- A 13.24 On 23 December 2009, NITA announced its decision on the re-farming of the 900 MHz and 1800 MHz bands. In 2011, the three incumbent operators released a cumulative 2 × 5 MHz of 900 MHz spectrum and 2 × 10 MHz of 1800 MHz spectrum for re-award.

³⁴² http://www.auction2011.be/images/stories/documents/persbericht_toekenning_en.pdf

³⁴³ Note, the announcement from BIPT in footnote 7 stated that the successful operator would take up the 900 MHz and 1800 MHz spectrum, but at that time it had not been officially confirmed.

³⁴⁴ Information on the BIPT decision available here: http://www.cullen-international.com/report/5347/t4030#Table_22

³⁴⁵ <http://www.bipt.be/ShowDoc.aspx?levelID=423&objectID=3626&lang=nl>

³⁴⁶ http://www.cullen-international.com/report/6352/t5833#Table_23

³⁴⁷ <http://www.bipt.be/ShowDoc.aspx?objectID=3625&lang=EN>

- A 13.25 NITA proposed to release this spectrum using an online auction on 20 October 2010 and 25 October 2010 respectively, with a closing date of registration for auction 29 September. For competition reasons, NITA excluded existing 900 MHz and 1800 MHz licensees from participating in the auction. NITA received only one registration for the auction, from Hutchison 3G Denmark, resulting in NITA issuing a licence for the available 900 MHz and 1800 MHz spectrum to Hutchison 3G Denmark on 18 October 2010 at the minimum reserve price.³⁴⁸ The minimum reserve price was 8million DKK (approximately €1.07m) for the 900 MHz spectrum and 4million DKK (approximately €0.535m) for the 1800 MHz spectrum. NITA considered the two assigned frequency blocks too small to carry any coverage or roll out obligations.
- A 13.26 NITA also decided to delay liberalisation of existing 900 MHz and 1800 MHz licences from 1 January 2011 to 1 May 2011 in order to allow the new licensee a reasonable time period to deploy commercial services in the two frequency bands.
- A 13.27 Analogue Switch Off has already taken place in Denmark. On 22 June 2009, NITA allocated the 800 MHz spectrum band for uses other than broadcasting, paving the way for mobile services to be deployed in this band. NITA published a consultation on the 800 MHz spectrum on 17 May 2010 with a response deadline of 24 June 2010.
- A 13.28 NITA published a consultation on its proposed 800 MHz spectrum auction on 16 November 2011³⁴⁹ as well as a Draft Information Memorandum³⁵⁰, which set out that the auction for this spectrum would occur in May 2012 and would be issued on a nationwide and service- and technology-neutral basis. The closing date for submissions was 15 December 2011. The indicative time table also states that the Application Stage will take place in April 2012, with the Grant Stage in June 2012.
- A 13.29 NITA pointed out in its consultation that the lower 10 MHz of the downlink (i.e. 791 – 801 MHz) will have a lower EIRP limit in specific geographical areas in order to minimise interference to DTT users. Other than this stipulation, there are no proposals to minimise disturbance from 800 MHz spectrum licensees to DTT apart from the technical conditions that would be associated with the licences. NITA stated “*Where these restrictions are observed, individual cases*

³⁴⁸ NITA release of 900 MHz and 1800 MHz spectrum, <http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/900-1800-mhz-auction>

³⁴⁹ <http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/800-mhz/filarkiv/800MHz%20consultation%20document.pdf>

³⁵⁰ <http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/800-mhz/filarkiv/IM.pdf>

of problems with DTT reception, including possible interference issues, should not be the responsibility of licensees to resolve.”

- A 13.30 NITA set the coverage requirement to be specific to the specific frequency blocks won. There are three different coverage areas defined by NITA, and within a coverage area (made up of multiple postcodes), a licensee must offer a mobile broadband service with a download rate of at least 10 Mbit/s to 99.8% of households and enterprises (outdoor coverage), 98% of the land area (outdoor coverage excluding forests) and at least 75% of households and enterprises within each postcode. The coverage requirement must be met by the end of 2014 and may be achieved using spectrum in other bands available to a licensee.
- A 13.31 NITA has packaged spectrum into 5 different lots; 2 × 10 MHz at the lower part of the band and 4 lots of 2 × 5 MHz at the top of the band. The winner of the 2 × 10 MHz lot would have to provide the necessary coverage (set out in paragraph A 13.30) to one of the three coverage areas, whereas winners of the remaining 4 lots will have to provide the required coverage to the three separate coverage areas. However only one licensee must provide the necessary coverage in each coverage area.
- A 13.32 Licences will run for 22 years, from 1 January 2013 until 31 December 2034. Licensees have two choices to pay relevant fees; pay all up front, or alternatively pay 20% up front and the remainder spread evenly over the following 8 years. In the event that a winner takes up the second option, it must have a guarantee of funding for the relevant fees for the following 3 years. The cost of the auction must be paid for by successful bidders, pro-rata if spectrum won, with expected cost of DKK 15m (approx. €2m). Annual fees will also be due for the spectrum assigned, with fees for the 2 × 10 MHz lot being approximately DKK 2.26m (approx. €304k) and DKK 1.13 m (approx. €157k) for each 2 × 5 MHz lot.
- A 13.33 NITA proposes to use a CCA (Combinatorial Clock Auction) with primary bid rounds and one supplemental bid round. Interested bidders must provide a deposit of DKK 100m (approx. €13.5m). NITA also propose to utilise an Assignment Round to determine the spectrum assignments for the four 2 × 5 MHz lots (the one 2 × 10 MHz lot will be at the bottom of the band). The reserve price for each lot (whether the 2 × 10 MHz lot or one of the 2 × 5 MHz lots) is DKK 50m (approx €6.73m).
- A 13.34 The proposed spectrum cap is 2 × 20 MHz within the 800 MHz band.

A13.2.4 Finland

- A 13.35 The Finnish Ministry of Transport and Communications announced on the 4 November 2011 that it was proposing to release the 800 MHz spectrum band in an auction by the end of 2013,³⁵¹ with a closing date for comments of 29 November 2011. It is proposed that spectrum is released in 2 x 5 MHz blocks, with a 2 x 20 MHz spectrum cap per bidder. Winning bidders would have three years to deploy their network, with one licensee having a higher population coverage obligation of 95%. The proposal also considers offering PMSE users a once off payment of €5.4m to facilitate relocation to other spectrum bands.
- A 13.36 Spectrum in the 900 MHz and 1800 MHz bands has been available for UMTS usage since 2007, whilst LTE can also be used in the 900 MHz band. There is extensive deployment of UMTS in the 900 MHz band in Finland.³⁵²

A13.2.5 France

- A 13.37 The French NRA (ARCEP) announced in April 2011 its intention to hold an auction for 800 MHz and 2.6 GHz spectrum by the end of 2011.³⁵³ On 13 May 2011, ARCEP published its Draft Decision and announced its plans to release a call for applications for spectrum³⁵⁴ in the 800 MHz and 2.6 GHz band, once its Draft Decision received government approval. On 15 June 2011, ARCEP made a call for applications for 2.6 GHz and 800 MHz spectrum, with respective closing dates of 15 September 2011 and 16 December 2011.
- A 13.38 Spectrum for the 2.6 GHz band was awarded in September 2011 with four successful bidders winning either 2 x 15 MHz or 2 x 20 MHz of 2.6 GHz spectrum³⁵⁵. The 20 year national licences were issued via a beauty contest, with the amount due from each successful bidder dependant on commitments made.
- A 13.39 Analogue Switch Off was scheduled to take place by 30 November 2011 which would permit the release of the 800 MHz band for other purposes. Four lots of 800 MHz spectrum were subsequently offered in the competition, amid concerns from three of the four existing mobile operators that the remaining mobile operator could flex its financial strength and acquire two of the four lots,

³⁵¹ <http://www.lvm.fi/web/fi/tiedote/-/view/1276464>

³⁵² http://www.cullen-international.com/report/6352/t5833#Table_23

³⁵³ <http://www.rethink-wireless.com/2011/04/08/french-cellcos-demand-spectrum-limits-orange.htm>

³⁵⁴ [http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1\[uid\]=1382&tx_gsactualite_pi1\[backID\]=1&cHash=5774070235](http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1382&tx_gsactualite_pi1[backID]=1&cHash=5774070235)

³⁵⁵ [http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1\[uid\]=1436&tx_gsactualite_pi1\[backID\]=1&cHash=13e708e6da](http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1436&tx_gsactualite_pi1[backID]=1&cHash=13e708e6da)

thereby resulting in one operator obtaining no 800 MHz spectrum.

Subsequently, the French government announced a spectrum cap of 2 × 15 MHz for 800 MHz spectrum for any given operator.³⁵⁶

- A 13.40 The 800 MHz competition for 20 year licences took place in December 2011. ARCEP announced on 15 December 2011 that it had received 4 applications for the 800 MHz spectrum.³⁵⁷ There were four different lots, two lots of 2 × 10 MHz at the top and bottom of the band, and two 2 × 5 MHz lots in the middle of the band. Coverage targets for the 800 MHz band required each successful licensee to cover 99.6% of the population of mainland France (40% in 5 years and 90% in 10 years). Also, sparsely populated areas have an accelerated rollout timetable encouraging operators to engage in network and frequency-sharing arrangements facilitating the achievement of this coverage level. Reserve prices varied for the 800 MHz blocks, two of the 2 × 5 MHz has a reserve price of €300m, whilst one of the 2 × 10 MHz blocks has a reserve of €400m (due to its adjacency to broadcast licensees), whilst the other 2 × 10 MHz block has a reserve of €800m.
- A 13.41 ARCEP announced the results of the beauty competition on 22 December 2011^{358, 359}. Three of the four applicants won 2 × 10 MHz each, whilst Free Mobile was unsuccessful in acquiring any 800 MHz spectrum. In excess of €2.69bn was raised in the 800 MHz auction, with Bouygues Telecom winning the lowest 2 × 10 MHz at a cost of €683m, SFR winning the middle 2 × 10 MHz for €1.065bn and Orange France winning the 2 × 10 MHz at the top of the band for €891m. ARCEP announced that it issued the 800 MHz licences on 17 January 2012³⁶⁰.
- A 13.42 As Free Mobile was unsuccessful in acquiring 800 MHz spectrum, it can apply to roam on SFR's network once its own 2.6 GHz network reaches 25% population coverage, as SFR was the only bidder to win 2 lots.

³⁵⁶ http://www.fiercewireless.com/europe/story/france-imposes-caps-lte-spectrum-auction/2011-05-04?utm_medium=nl&utm_source=internal

³⁵⁷ [http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1\[uid\]=1463&tx_gsactualite_pi1\[backID\]=1&cHash=377b4c6bf9](http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1463&tx_gsactualite_pi1[backID]=1&cHash=377b4c6bf9)

³⁵⁸ [http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1\[uid\]=1470&tx_gsactualite_pi1\[backID\]=1&cHash=80abfa005c](http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1470&tx_gsactualite_pi1[backID]=1&cHash=80abfa005c)

³⁵⁹ http://www.cullen-international.com/report/6385/c87454#_Bouygues_Telecom,_Orange

³⁶⁰ [http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1\[uid\]=1478&tx_gsactualite_pi1\[backID\]=1&cHash=ffab4d3723](http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1478&tx_gsactualite_pi1[backID]=1&cHash=ffab4d3723)

- A 13.43 Licensees of 900 MHz and 1800 MHz spectrum have been permitted to use this spectrum for UMTS since 2008, with Orange and SFR currently using 900 MHz spectrum for UMTS.³⁶¹

A13.2.6 Germany

- A 13.44 In October 2009, BNetzA announced that upon request it would liberalise individual 900 MHz and 1800 MHz licences and that liberalisation would take place after BNetzA completed a review of the German mobile market, scheduled to begin within three months of conclusion of its “big bang” auction for the 800 MHz, 1.8 GHz, 2.1 GHz and 2.6 GHz bands. The review would analyse any potential market distortions that may arise from asymmetric holdings of spectrum in the bands below 1 GHz as a result of the “big bang” auction. Due to the highly complex issues involved, the NRA decided to publish a public consultation on key questions. The “impulse paper” was published on 11 August 2010.³⁶²
- A 13.45 Germany’s “big bang” spectrum auction ended on 20 May 2010 after 27 days of bidding, raising a total of €4.4bn. The bulk of fees arose from its auction of the 800 MHz band, accounting for over 81% of the total fees, even though the 800 MHz band only accounted for one sixth of the spectrum on offer.³⁶³ In this auction, BNetzA controlled the bidding rights by imposing a spectrum cap, which limited the spectrum that a single operator could hold below 1 GHz to a maximum of 2 × 20 MHz. Notwithstanding, all spectrum blocks were awarded. The licences are technology and service neutral and will expire in 2025.
- A 13.46 In relation to the 800 MHz band, Telefonica O2, T-Mobile and Vodafone each succeeded in winning 2 × 10 MHz while the remaining existing mobile network operator E-Plus did not acquire any spectrum in the 800 MHz band.³⁶⁴ BNetzA announced on 28 December 2011 that the three 800 MHz operators had successfully achieved the required broadband coverage in rural areas³⁶⁵ (a condition on licences before they could deploy in urban areas), and were then free to deploy 800 MHz services wherever they wished in Germany.

³⁶¹ http://www.cullen-international.com/report/6352/t5833#Table_23

³⁶²

http://www.bundesnetzagentur.de/cae/servlet/contentblob/159006/publicationFile/8292/ImpulspapierFreqVertUntersuchg_pdf.pdf

³⁶³ <http://www.cullen-international.com/report/3619>

³⁶⁴ <http://www2.bundesnetzagentur.de/frequenzversteigerung2010/index.html>

³⁶⁵

http://www.bundesnetzagentur.de/cln_1911/SharedDocs/Pressemitteilungen/EN/2011/111228BroadbandExpansionSchleswigHolstein.html?nn=214432

- A 13.47 Existing 900 MHz and 1800 MHz licences can be made technology neutral upon request. Up to now, E Plus is the only operator to do so in the 900 MHz band, offering UMTS services at 25 sites³⁶⁶. Some 1800 MHz spectrum (that was auctioned in 2010) is technology and service neutral, with some deployment of LTE in this band.
- A 13.48 BNetzA does not intend to alter the pre-existing assignments of 900 MHz and 1800 MHz spectrum (licences in respect of which were issued in 1999) in advance of licence expiry, which will take place in 2016. BNetzA are seeking to test demand for spectrum with operators given until 16 January 2012 to outline spectrum requirements, and BNetzA hopes to release spectrum by 2013.³⁶⁷

A13.2.7 Greece

- A 13.49 The Greek NRA (EETT) released a public consultation on the liberalisation and assignment of the 900 MHz and 1800 MHz spectrum bands in January 2011.³⁶⁸ On 26 July 2011, EETT published an Information Memorandum outlining its proposals for spectrum in the 900 MHz and 1800 MHz bands^{369, 370}.
- A 13.50 In this document, EETT sets out its proposal to issue all of the 900 MHz spectrum and 20 MHz of 1800 MHz spectrum in this competition, on a technology and service neutral basis, in line with the EU Directive. Spectrum in the 900 MHz band was packaged in 2 × 2.5 MHz blocks, whereas 1800 MHz spectrum was released in 2 × 5 MHz blocks. Due to existing licences there were different availability dates for some blocks of 900 MHz spectrum: 2 × 2.5 MHz of spectrum would become available in 2012, with 2 × 5 MHz available in 2016 and a further 2 × 5 MHz available in 2017. All licences to be issued will co-terminate in September 2027, and EETT proposed different minimum prices per 2 × 2.5 MHz block of 900 MHz spectrum:
- €23.3m per 2 × 2.5 MHz block issued in September 2012;
 - €17.1m per 2 × 2.5 MHz block issued in 2016; and
 - €15.5m per 2 × 2.5 MHz block issued in 2017.

³⁶⁶ http://www.cullen-international.com/report/6352/t5833#Table_23

³⁶⁷

http://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/PressSection/PressReleases/2011/111122DemandGSMFrequencies.pdf?__blob=publicationFile

³⁶⁸ http://www.eett.gr/opencms/opencms/admin_EN/Consultations/cons_0006.html

³⁶⁹ http://www.cullen-international.com/referencedocument/auction_synopsis

³⁷⁰ http://www.eett.gr/opencms/opencms/admin_EN/News/news_0126.html

- A 13.51 Each of the available blocks of 2 × 5 MHz of 1800 MHz spectrum has a minimum price of €20.5m and will be issued for 15 years immediately after the competition.
- A 13.52 The 900 MHz spectrum was reserved in the first instance for the incumbent 900 MHz operators, with any unallocated 900 MHz spectrum becoming available in parallel with the 1800 MHz band. If an incumbent did not accept the spectrum reserved for it in the 900 MHz band, no future renewal request would be accepted by the EETT. At a minimum, 70% of the auction fees had to be paid within 20 days of EETT announcing the winners.
- A 13.53 The spectrum cap on 900 MHz spectrum was dependant on the number of bidders; 2 × 12.5 MHz if there were four bidders, otherwise a 2 × 15 MHz cap. The 1800 MHz spectrum cap was 2 × 35 MHz. A spectrum floor of 2 × 5 MHz in the 900 MHz band would have been applied if there were four or more bidders.
- A 13.54 EETT announced the completion of the auction on 14 November 2011³⁷¹. The three mobile operators in Greece acquired all of the available 900 MHz and 1800 MHz spectrum for a total price of €380.5m.
- A 13.55 All 900 MHz and 1800 MHz licences were made technology neutral in November 2011 upon completion of the auction.

A13.2.8 Hong Kong

- A 13.56 The Hong Kong NRA (Ofca) held an auction for spectrum in the 850 MHz and 900 MHz bands. On 15 April 2011, Ofca announced³⁷² Hutchison Telephone Company Limited proved the successful bidder for a 2 × 5 MHz block in the 900 MHz band at a price of HK\$1.1bn (approx. €107.4m), and SmarTone Mobile Communications Limited as the successful bidder of a 2 × 5 MHz block in the 850 MHz band costing HK\$875m (approx. €85.4m). There were a total of 6 operators bidding for the two available blocks of spectrum.
- A 13.57 Licences were issued on a technology and service neutral basis for a period of 15 years, with an associated coverage requirement of at least 50% within 5 years of licence issue.³⁷³

A13.2.9 Hungary

³⁷¹ http://www.eett.gr/opencms/opencms/admin_EN/News/news_0128.html

³⁷² http://www.ofca.gov.hk/en/industry/850/success_bidding.pdf

³⁷³ <https://www.policytracker.com/headlines/hk-operators-win-new-spectrum-just-in-time-to-beat-data-crunch>

- A 13.58 The Hungarian NRA (NMHH) announced that it intended to hold an auction for 2 × 10.8 MHz of spectrum in 2011³⁷⁴. NMHH would release 2 × 10.8 MHz of 900 MHz spectrum in three lots, with one 2 × 5 MHz block and 5.8 MHz of additional spectrum split into smaller allocations. The winner of the 5 MHz block would have the option of acquiring up to 3 × 5 MHz of 1800 MHz spectrum and 3 × 5 MHz of 2.1 GHz spectrum.³⁷⁵ There is a cap of 2 × 7.8 MHz spectrum in the competition, with applications due by 20 October 2011. Licences would have duration of 15 years and would be tradeable. NMHH ran a two stage auction for spectrum (other than the 2 × 5 MHz block), the first stage to determine amount of spectrum won and the second stage determining the location of the assignment within the given spectrum band. The minimum price for the 2 × 5 MHz block of 900 MHz spectrum was HUF4bn (approximately €14.5m).
- A 13.59 NMHH announced on 2 January 2012 that four bidders were approved for entry to the auction,³⁷⁶ whilst two parties were unsuccessful in meeting the pre-requisite criteria for entry to the auction. The auction amongst the four qualified bidders began on 5 January 2012, with the outcome of the auction expected shortly afterwards.³⁷⁷ A new entrant, Magyar Posta Zrt. was the successful bidder for the 5 MHz block of 900 MHz spectrum, and also took up the option of buying the 1800 MHz and 2100 MHz spectrum associated with the 900 MHz block at a cost of HUF 10bn (approx. €34.6m).³⁷⁸ The remaining 2 × 5.8 MHz of 900 MHz spectrum was won between the three incumbent operators.³⁷⁹

A13.2.10 Italy

- A 13.60 On 24 March 2011, the Italian Regulator (Agcom) published draft regulation for public consultation in relation to an auction for; 800 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz spectrum³⁸⁰ on a technology neutral basis. The auction was scheduled to take place in autumn 2011, with the draft decision stating it will be an SMRA auction. Licences issued in this auction will expire in December 2029.
- A 13.61 The amount of spectrum in the auction was:
- all six 2 × 5 MHz blocks of spectrum in the 800 MHz band;

³⁷⁴ <http://www.nmhh.hu/dokumentum.php?cid=27724&letolt>

³⁷⁵ <http://www.nmhh.hu/dokumentum.php?cid=27726&letolt>

³⁷⁶ <http://www.nmhh.hu/index.php?id=hir&cid=16469>

³⁷⁷ <http://www.nmhh.hu/index.php?id=hir&cid=16489>

³⁷⁸ <http://www.bloomberg.com/news/2012-01-31/hungary-state-companies-win-mobile-bid-as-orban-widens-influence.html>

³⁷⁹ <http://www.ihs.com/products/global-insight/industry-economic-report.aspx?id=1065932247>

³⁸⁰ http://www.cullen-international.com/report/5511/c67854#_AGCOM_draft_decision

- three 2 × 5 MHz blocks of spectrum in the 1800 MHz band;
- one block of 1 × 15 MHz in the 2.1 GHz extension band; and
- 14 blocks of 2 × 5 MHz and two blocks of 1 × 25 MHz of 2.6 GHz spectrum.

A 13.62 The Draft Decision stipulated a spectrum cap of:

- 2 × 25 MHz between the 800 MHz and 900 MHz spectrum bands (which would permit each of the existing 900 MHz operators to acquire up to 2 × 15 MHz each);
- 2 × 25 MHz of 1800 MHz spectrum; and
- 55 MHz (between TDD and FDD) of 2.6 GHz spectrum

A 13.63 Agcom set out specific coverage conditions which varied by band. For the 800 MHz band:

- For each region, the ministry identified communities that have a limited broadband coverage, divided into three groups:
 - A: < 1,000 inhabitants;
 - B: 1,000-2,000 inhabitants; and
 - C: > 2,000 inhabitants.
- Licensees would commence roll out in small communities (A) before continuing to roll out in larger ones (B and C). The coverage obligation would be contingent on the amount of spectrum acquired. 50% of the obligation must be fulfilled within three years, and 100% within five years. A community is considered covered when at least 90% of its population have access to broadband with at least 2 Mbps nominal download speed. The commercial launch (retail or wholesale) of the broadband service must take place within three years, with new entrants permitted one additional year to reach the same objectives.

A 13.64 For the 1800 MHz, 2.1 GHz and 2.6 GHz bands:

- 30% coverage of the population within two years, 50% within four years with coverage to be distributed over all Italian regions. Commercial launch (retail or wholesale) within two years, with new entrants permitted one additional year to reach the same objectives.

- Existing mobile operators that acquired 800 MHz spectrum were required to offer national roaming to new entrants in this band on their 800 and 900 MHz networks for a period of 2 and a half years nationwide, and 6 years limited to areas not covered by the new entrant. Before having the right to national roaming, the new entrant must cover at least 10% of the population with its own network.

- A 13.65 Agcom published its decision in June 2011. The Ministry of Economic Development published the auction rules on 28 June 2011.³⁸¹ In July 2011, The Ministry accepted the applications of the four Italian mobile network operators (MNOs) to participate in the auction of 800 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz spectrum³⁸². A fifth operator was conditionally accepted, without further detail provided on the reasoning. Initial bids for the auction were due by 29 August 2011 with the auction concluding in September 2011. The only participants in the auction were the four incumbent mobile operators.
- A 13.66 The auction for 800 MHz spectrum concluded after 17 days on 22 September 2011, with three of the four bidders successful acquiring 2 × 10 MHz each³⁸³, at a combined cost of €2.96bn. The one 2 × 5 MHz block adjacent to broadcasting was the only block without coverage conditions as the winner of this block had to consider interference to broadcasting. Licences are expected to begin at the end of 2012 when ASO occurs in Italy.
- A 13.67 The auction for 1800 MHz, 2.1 GHz and 2.6 GHz ended on 29 September 2011. There were no bidders for the 15 MHz unpaired spectrum in the 2.1 GHz band, whilst licences in respect of the three blocks of 1800 MHz spectrum sold for €477m and the entire 170 MHz of spectrum in the 2.6 GHz band was sold to four operators for €506m.
- A 13.68 There are no annual fees associated with the licences issued in this auction. Licences of 900 MHz and 1800 MHz spectrum will be permitted to use UMTS and other more advanced technologies on request,

A13.2.11 Malta

³⁸¹

http://www.sviluppoeconomico.gov.it/index.php?option=com_content&view=article&idmenu=804&idarea2=0§ionid=1&viewType=5&andor=AND&andorcat=AND&idarea3=0&partebassaType=4&MvediT=1&id=0&showMenu=1&showCat=1&idarea1=0&idareaCalendario1=0&idarea4=0&idarticolo2=0&idarticolo3=0&showArchiveNewsBotton=1&partebassaType=4

³⁸² <http://www.cullen-international.com/report/5993/c76575#> Five operators admitted

³⁸³ <http://www.cullen-international.com/report/6043/c78361#> xTelecom Italia, Vodafone

- A 13.69 In February 2009, the Malta Communications Authority (MCA) published a consultation outlining future licensing proposals and assignment mechanisms for the 900 and 1800 MHz bands.³⁸⁴ The consultation phase was followed by a round of bilateral meetings to clarify respondent's views and on 16 July 2010 the MCA published its analysis of stakeholders' comments together with its final decision.³⁸⁵ The decision addresses numerous issues, including interim measures to deal with differences in the existing licence expiry dates (2010 and 2011).
- A 13.70 The licences of incumbent operators were extended to ensure continuity of GSM services until the new licences come into effect.³⁸⁶ A provision was present in 900 MHz licences which empowered the Authority to add or amend any of the licence terms and conditions by written correspondence with licensee. Currently the existing licences in the 900 MHz and 1800 MHz bands have different termination dates. In order to ensure a smooth migration, the July 2010 Decision provided that the existing GSM licences would be extended by a few months pending the completion of the re-assignment process of 900 MHz and 1800 MHz spectrum. These extensions were intended to be issued once off and non-renewable. The licences retained the terms and conditions of the initial licence and granted no additional rights to the existing licence holders.
- A 13.71 The MCA published a call for applications from prospective licensees on 27 October 2010³⁸⁷, and there were three expressions of interest submitted by the closing date of 14 January 2011.³⁸⁸ The MCA announced in May 2011³⁸⁹ that it had concluded the process for spectrum assignment. Three interested parties made applications for the spectrum and passed the qualification stage, meaning that demand exceeded supply. In line with its call for applications document, the MCA held meetings with the three interested parties and made proposals for the assignment of spectrum, with this proposal accepted by all three parties. UMTS is now allowed in these bands.

A13.2.12 Netherlands

- A 13.72 In January 2010, the Ministry of Economic Affairs announced that existing licences in the 1800 MHz and the E-GSM band would not be renewed when they expire in 2013. The remaining licences in the 900 MHz band (currently held

³⁸⁴ <http://www.mca.org.mt/filesystem/pushdocmgmtfile.asp?id=695&source=1&pin=>

³⁸⁵ <http://www.mca.org.mt/filesystem/pushdocmgmtfile.asp?id=895&source=1&pin=>

³⁸⁶ <http://www.mca.org.mt/filesystem/pushdocmgmtfile.asp?id=1435&source=4&pin=>

³⁸⁷ <http://www.mca.org.mt/newsroom/openarticle.asp?id=923>

³⁸⁸ <http://www.mca.org.mt/newsroom/openarticle.asp?id=944>

³⁸⁹ <http://www.mca.org.mt/newsroom/openarticle.asp?id=965>

by KPN and Vodafone), which were renewed in 2008, would also expire on the same date.³⁹⁰ All spectrum rights in the 900 MHz and 1800 MHz bands would be awarded through an open auction, to be held one year in advance of expiry.

- A 13.73 In relation to the 1800 MHz band, the Ministry rejected arguments for further extension on the grounds of possible consumer disruption,³⁹¹ *inter alia* noting that:
- operators can acquire alternative spectrum holdings;
 - operators can migrate customers to 2100 MHz networks; and
 - customers can change service provider while retaining their existing phone numbers.
- A 13.74 It was also announced that current holders of spectrum in the 900 MHz and 1800 MHz bands can apply for a ministerial decree to liberalise these licences for their remaining term, but only after several other ministerial decrees and decisions have been amended.
- A 13.75 In relation to the 800 MHz band, the Government proposes to clear this band by 2012. On 28 July 2010, the Ministry for Economic Affairs informed Parliament that its preference was for the 800 MHz band to be allocated for mobile services.³⁹² A strategic note on mobile communications was published in December 2010.³⁹³
- A 13.76 In February 2011, the Ministry of Economic Affairs published Draft rules for the proposed auction of spectrum in the 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz bands³⁹⁴ to take place later in 2011. Spectrum in the 800 MHz band would be auctioned with €35m reserve per 2 × 5 MHz lot, with 2 × 10 MHz of the 800 MHz band reserved for new entrants (i.e. operators without access to 900 MHz, 1800 MHz or 2100 MHz spectrum). Reserve price for each of the seven available 2 × 5 MHz block in the 900 MHz band would be €29m, with a reserve of €4.16m per each of the available 1800 MHz blocks, and a reserve of €0.57m for each of the ten available 1 × 5 MHz of 2.6 GHz spectrum.

³⁹⁰ http://www.cullen-international.com/report/3796/t3373#Table_25

³⁹¹ Translated from: <http://www.rijksoverheid.nl/documenten-en-publicaties/notas/2010/02/02/besluit-gsm-1800-vergunningen.html>

³⁹² Translated from: <http://www.rijksoverheid.nl/onderwerpen/frequentiebeleid/documenten-en-publicaties/kamerstukken/2010/07/28/brief-stand-van-zaken-digitaal-dividend-en-het-800-mhz-spectrum.html>

³⁹³ <http://www.rijksoverheid.nl/bestanden/documenten-en-publicaties/rapporten/2011/02/11/quick-scan-spectrum-awards-in-the-netherlands/2010-12-06-min-el-i-quick-scan-spectrum-awards-final-stc.pdf>

³⁹⁴ <http://www.telecompaper.com/news/dutch-govt-publishes-draft-rules-for-spectrum-auction>

- A 13.77 Coverage conditions associated with the 800 MHz spectrum required licensees to cover 308 km² after two years, 3,080 km² after five years. The 900 MHz band must be rolled out over 256.7 km² within two years and 2567 km² after five years. For the 1.8 GHz, coverage has to reach 36.7 km² in two years and 367 km² in five; for 2.1 GHz, the requirement is 27.5 km² to 275 km². The requirement for 2.6 GHz is 20 km² and 200 km² after two years and five years respectively.
- A 13.78 Opta announced in January 2012 that it will hold the auction in October 2012, with expressions of interest to participate in the auction due by mid-April.³⁹⁵ In addition to the Draft Rules of February 2011, Opta decided to reserve 2 × 5 MHz of 900 MHz spectrum as well as 2 × 10 MHz of 800 MHz spectrum for new entrant(s). Opta also stated that existing 900 MHz and 1800 MHz licences due to expire in February 2013 will not be extended. 900 MHz and 1800 MHz licences will be made technology neutral upon request.³⁹⁶
- A 13.79 The auction in the Netherlands will use a Combinatorial Clock Auction with modified second price rule.

A13.2.13 Norway

- A 13.80 In 2005, licences were renewed following a consultation in which only the two 900 MHz incumbent licensees expressed demand. The regulator (NPT) has since redistributed spectrum holdings in the band to allow an additional operator access to a block of 2 × 5 MHz.
- A 13.81 The existing 900 MHz licences were made technology neutral in July 2010 when all refarming had been completed. 1800 MHz spectrum can still only be used for GSM, but will be allowed to be used for other technologies upon request.⁴⁰⁰ A temporary renewal of 1800 MHz spectrum licences which were due to expire in 2010 was granted until March 2012.
- A 13.82 The existing 900 MHz licences are due to expire in 2013 and 2017 and there is no legislative provision to renew these licences. NPT consulted on the mechanism for the future award of spectrum in the band and proposed to release the three 2 × 5 MHz blocks due to expire in 2013 in an auction.
- A 13.83 In early 2010 the Ministry received an application to assign 20 MHz of spectrum in the 1800 MHz band. Interested parties were given an opportunity to submit

³⁹⁵ <http://www.telegeography.com/products/commsupdate/articles/2012/01/09/opta-to-hold-frequency-auction-in-october/>

³⁹⁶ http://www.cullen-international.com/report/6352/t5833#Table_23

applications for this spectrum by 19 February. On 16 April the Ministry announced³⁹⁷ that the combined demand expressed during this period exceeded the amount of spectrum available and that consequently an auction based award would be held in early 2011. The auction has not taken place to date nor have specific details of the auction been defined.

- A 13.84 In relation to the 800 MHz band, the authorities decided to reserve the 790-862 MHz band for mobile telecommunication and mobile broadband. The auction was due to take place in 2011, but has been delayed due to coordination issues with Russia, and will now likely take place in Q2 2012. A consultation was released in December 2011, regarding interference issues with DTT in neighbouring bands. The closing date for submissions was 29 January 2012. It is proposed that any 800 MHz licences will have a duration of 15 years.

A13.2.14 Portugal

- A 13.85 On 31 March 2010 the NRA (ANACOM) launched a public consultation on a draft decision,³⁹⁸ which would combine each operator's existing rights of use issued in the 900 MHz, 1800 MHz and 2100 MHz bands into a single licence. The consultation closed on 6 May 2010. On 8 July 2010, the NRA adopted its decision.³⁹⁹
- A 13.86 The 900 MHz and 1800 MHz licences of the three existing mobile operators expire in 2021 and 2022, whilst the three operators 2.1 GHz licences expire in 2016. Existing 900 MHz and 1800 MHz licences were liberalised prior to the auction of additional liberalised spectrum took place.⁴⁰⁰
- A 13.87 In relation to the release of spectrum, ANACOM published Draft Auction Regulations on 17 March 2011,⁴⁰¹ with a closing date of 2 May 2011 for receipt of comments on the Draft Regulations.⁴⁰² The Draft Regulations were in relation to the simultaneous release of spectrum in the 450 MHz, 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz bands.

³⁹⁷ <http://www.regjeringen.no/nb/dep/sd/aktuelt/nyheter/2010/Ledige-frekvensressurser-i-1800-MHz-bandet-vil-bli-tildelt-ved-en-auksjon.html?id=600883>

³⁹⁸ <http://www.anacom.pt/render.jsp?contentId=1019850>

³⁹⁹ <http://www.anacom.pt/render.jsp?contentId=1037520>

⁴⁰⁰ http://www.cullen-international.com/report/6352/t5833#Table_23

⁴⁰¹ <http://www.anacom.pt/render.jsp?contentId=1077096>

⁴⁰²

http://www.anacom.pt/streaming/Draft_Auction%20Regulation_17mar2011.pdf?contentId=1078193&field=ATTACHED_FILE

- A 13.88 The final Auction Regulations were published on 17 October 2011^{403, 404}.
- A 13.89 ANACOM released the following spectrum in lots, with each lot being 2 × 5 MHz, and each licence being 15 years in duration:
- 6 lots of 800 MHz spectrum, with a spectrum cap of 2 × 10 MHz per operator, reserve price of €45m per lot;
 - 2 lots of 900 MHz spectrum, with a spectrum cap of 2 × 5 MHz for existing 900 MHz licensees, or 2 × 10 MHz for new entrants, with reserve of €30m per lot;
 - a deferred sub 1 GHz spectrum cap of 2 × 20 MHz between existing holdings and holdings won in the auction, with excess spectrum handed back from 30 June 2015;
 - 9 lots of 2 × 5 MHz and 3 lots of 2 × 4 MHz of 1800 MHz spectrum, with a spectrum cap of 2 × 20 MHz inclusive of existing 1800 MHz holdings, and a reserve of €4m and €3m per lot respectively;
 - 2 TDD lots (i.e. unpaired) of 2.1 GHz spectrum, with a reserve of €2m per lot; and
 - 14 lots of paired (2 × 5 MHz) 2.6 GHz spectrum with a spectrum cap of 2 × 25 MHz, and 2 TDD lots (unpaired, 25 MHz each) with a spectrum cap of 2 × 20 MHz for paired spectrum, with a reserve of €3m per lot.
- A 13.90 The auction format used was SMRA. A deposit of €15m was required from each bidder competing for access rights in the 800 MHz, 900 MHz and 1800 MHz spectrum bands, which resulted in each applicant having the maximum eligibility points of 15 (€1m per eligibility point). Any operator holding 2 × 10 MHz of sub 1 GHz spectrum post auction was obliged to provide network access to other operators. When the auction was completed and the amount of spectrum won by each operator determined. ANACOM ranked winning bidders based on a combination of highest average price paid per spectrum band and number of spectrum bands an operator successfully bid in. The highest rank bidder had first choice over spectrum assignments, with the proviso that all assignments must be contiguous. Successful bidders for spectrum in the auction are charged

403

http://www.anacom.pt/streaming/english_version_Auction_Regulation.pdf?contentId=1101807&field=ATTACHED_FILE

404 <http://www.anacom.pt/render.jsp?categoryId=344689>

spectrum usage fees by ANACOM in line with its overarching on-going fees structure, and varies based on different characteristics of the network.⁴⁰⁵

A 13.91 The qualification stage began on 20 October 2011 and concluded on 17 November when all four eligible bidders were notified.^{406,407} ANACOM announced the result of the auction on 30 November 2011,⁴⁰⁸ with the three incumbent operators winning 29 of the available 39 lots at a total cost of €372m and the remaining 10 lots going unsold. The assignment round took place on 2 December 2011,⁴⁰⁹ with Vodafone having first preference on assignment within each band it won spectrum, whilst TMN and Optimus had paid the same amount of money for spectrum and assignment preference had to be determined by random selection using an electronic platform, with TMN randomly selected to have second choice for assignment and Optimus third choice.

A 13.92 Each bidder won

- 2 x 10 MHz of 800 MHz spectrum at the reserve price of €45m per lot;
- 2 x 14 MHz of 1800 MHz spectrum at the cumulative reserve price of €11m; and
- 2 x 20 MHz of 2.6 GHz spectrum at the reserve price of €12m.

A 13.93 Additionally, Vodafone won 2 x 5 MHz (the maximum it could acquire) of 900 MHz spectrum at the reserve price of €30m, and 25 MHz TDD 2.6 GHz spectrum at the reserve price of €3m.

A13.2.15 Singapore

A 13.94 The Singapore Regulator (IDA) issued a Draft Decision on the release of 1800 MHz spectrum on 24 January 2011.⁴¹⁰ The IDA decided to allow both the 900 MHz and 1800 MHz bands be utilised by 2G and 3G technologies, as well as LTE and other technologies which satisfied IDA's licence conditions on mobile networks (e.g. coverage, Quality of Service). The IDA pointed to the benefits of

⁴⁰⁵ Spectrum Usage Fees, <http://www.anacom.pt/render.jsp?contentId=978283&languageId=1>

⁴⁰⁶ <http://www.anacom.pt/render.jsp?categoryId=344690>

⁴⁰⁷ <http://www.anacom.pt/render.jsp?categoryId=344698>

⁴⁰⁸ <http://www.anacom.pt/render.jsp?categoryId=344704>

⁴⁰⁹ <http://www.anacom.pt/render.jsp?categoryId=344707>

⁴¹⁰

http://www.ida.gov.sg/doc/Policies%20and%20Regulation/Policies_and_Regulation_Level2/20100329151251/4G_Interim_Position.pdf

re-farming the 1800 MHz spectrum band, and cited the rollout of Mobyland's LTE network in Poland as evidence of the developments of usage of technologies in the 1800 MHz band.

A 13.95 The IDA also published a decision on the release of one 2 × 5 MHz 1800 MHz spectrum block,⁴¹¹ which is only available for existing licensees to acquire as, in its view, this amount of spectrum would not satisfy the spectrum requirements of a new entrant. The licence will be 6 years in duration, which will co-terminate with 900 MHz and 1800 MHz licences. The IDA intends to leave one 2 × 5 MHz block of 1800 MHz spectrum unused to facilitate test and trialling of equipment in the spectrum band.

A13.2.16 Spain

A 13.96 In January 2010 the Ministry of Industry published a draft law⁴¹² proposing to liberalise the 900 and 1800 MHz licences following a review of existing spectrum holdings by Royal decree. In February 2010, a Royal Decree ordered that the band 790-862 MHz band be made available for mobile broadband. The NRA decided without stakeholder input to release 800 MHz spectrum on a paired basis.

A 13.97 In June 2010, the Ministry published a consultation on its proposals for re-farming the 800 MHz 900 MHz, 1800 MHz and 2.6 GHz bands⁴¹³.

A 13.98 In July 2010, the Spanish Competition Authority (CNC) raised some concerns regarding the Ministry's proposals,⁴¹⁴ noting:

- the potential competitive advantage that the winner of a 900 MHz licence commencing in 2011 may have over those acquiring licences that cannot be used before 2015;
- the application of a 2 × 20 MHz cap to spectrum below 1 GHz implies that three operators could obtain 92% of the entire spectrum available, leaving only 2 × 5 MHz for a fourth operator; and
- the extension of existing 900 MHz licences to 2030, in return for the early release of spectrum, may limit competition.

⁴¹¹

http://www.ida.gov.sg/doc/Policies%20and%20Regulation/Policies_and_Regulation_Level2/20080522114233/ExpMemo1800MHzAuction2011.pdf

⁴¹² <http://www.mityc.es/telecomunicaciones/es-ES/Paginas/index.aspx>

⁴¹³ http://www.cullen-international.com/report/3796/t3371#Table_27

⁴¹⁴ <http://www.cncompetencia.es/Inicio/Informes/Informes/tabid/166/Default.aspx>

- A 13.99 Three incumbent operators had their 900 MHz and 1800 MHz licences altered in accordance with EC Decision 2011/267/EU, in return for each operator relinquishing certain amounts of spectrum and meeting certain coverage conditions whilst also allowing other operators access to their networks.^{415, 416}
- A 13.100 In early 2011, the Spanish Government announced that it would assign spectrum in the 800 MHz, 900 MHz, 1800 MHz and 2.6 GHz bands in auctions and beauty contests scheduled for Q2 2011.⁴¹⁷
- A 13.101 In relation to the 900 MHz band, an auction was held in May 2011 for one block of 2 × 5 MHz, released by existing 900 MHz licensees with assignment of spectrum in 2011 and expiry in 2030. Orange won the rights to the 900 MHz spectrum,⁴¹⁸ with a €126m licence fee and a minimum investment commitment of €433m over the next 3 years to extend services to communities with fewer than 5,000 inhabitants.⁴¹⁹ Telefonica and Vodafone were not permitted to compete for this 2 × 5 MHz block. Any operator holding 2 × 10 MHz of 900 MHz spectrum must offer wholesale 3G services. In the same competition, Yoigo won rights to three 2 × 5 MHz 1800 MHz spectrum blocks with a licence fee of €42m and a commitment to invest a minimum of €300m in providing coverage within three years. These licences expire in 2030.
- A 13.102 Two more blocks of 2 × 5 MHz were auctioned in Q2 2011, although not assigned until 2015,⁴²⁰ following the expiry of a Telefónica licence and the release of a further 1 MHz of spectrum by Vodafone. Telefónica and Vodafone were committed to compete for this spectrum, providing the overarching spectrum cap of 2 × 20 MHz for sub 1-GHz spectrum (800 MHz and 900 MHz) was not breached. The reserve price for this spectrum was €169m per paired 2 × 5 MHz block.
- A 13.103 In relation to 800 MHz, the 6 blocks of 2 × 5 MHz in the 800 MHz band were auctioned contemporaneously in Q2 2011, with a licence duration of 15 years. The 800 MHz spectrum had a reserve price of €170m per 2 × 5 MHz block. Successful bidders for 800 MHz spectrum had also to commit to deliver speeds of at least 30 Mb/s to 90% of people living in communities with less than 5,000 people by 2020.

⁴¹⁵ <http://www.cullen-international.com/report/5615/c69922>

⁴¹⁶ <http://www.cullen-international.com/report/6043/c78385>

⁴¹⁷ http://www.cullen-international.com/report/5469/c67423#_Upcoming_spectrum_award

⁴¹⁸ http://www.fiercewireless.com/europe/story/orange-yoigo-only-bidders-first-round-spains-lte-auction/2011-05-25?utm_medium=nl&utm_source=internal

⁴¹⁹ <https://www.policytracker.com/headlines/spanish-government-outlines-spectrum-auction-plans>

⁴²⁰ http://www.cullen-international.com/report/3796/t3352#Table_26

- A 13.104 To compensate operators for the release of 900 MHz spectrum, the expiry dates for their remaining assignments in the band were extended to 2030. 900 MHz licensees were granted permission to deploy other technologies, subject to certain coverage requirements, and Telefónica and Vodafone are also subject to wholesale obligations until May 2015 to provide national roaming to operators not licensed in the 900 MHz band. Further, these operators were required to invest in deployment of services in rural areas.⁴²¹ Operators may have to pay for the difference between the value of this extension and the market value of spectrum returned⁴²².
- A 13.105 The Ministry announced in August 2011 that the spectrum award process in July 2011 of 800 MHz, 900 MHz and 2.6 GHz spectrum successfully raised over €1.6bn⁴²³.
- A 13.106 The Government proposed that upon request, 1800 MHz licensees could also be permitted to use spectrum for alternative technologies⁴²⁴ in return for the release of a block of 2 x 5 MHz or for a once-off fee. The three returned 2 x 5 MHz blocks would be assigned in 2011 on foot of a beauty contest in the Q2 2011 competition, with a minimum investment commitment of €20m per 2 x 5 MHz block. Existing 1800 MHz licensees were not permitted to participate for the 1800 MHz spectrum in the beauty contest. Yoigo was successful in acquiring all the available 1800 MHz spectrum in the April 2011 beauty contest.⁴²⁵
- A 13.107 2.6 GHz spectrum (previously unoccupied in Spain) was also released via auction. Five 2 x 10 MHz blocks, four 2 x 5 MHz blocks and five 1 x 10 MHz blocks would be released, with a reserve price of €5m per block for national licences, and fees scaled down pro-rata for regional licences and licence expiry in 2030.
- A 13.108 All of the 800 MHz spectrum and 2 x 5 MHz of 900 MHz spectrum was won by three incumbent operators in the auction in July 2011,⁴²⁶ along with some 2.6

⁴²¹ Telefónica Móviles must invest €80m in upgrading its existing 900 MHz GSM network to 3G/4G systems in all cities with less than 1,000 inhabitants or, alternatively, provide new coverage for 500,000 inhabitants in such cities (around 1% of population) by December 31, 2013, Vodafone must invest €160m in upgrading its existing 900 MHz GSM network to 3G/4G systems in all cities with less than 1,000 inhabitants or, alternatively, provide new coverage for 1m inhabitants in such cities by December 31, 2013.

⁴²² http://www.cullen-international.com/report/5520/t4352#Table_22

⁴²³ <http://www.mityc.es/en-US/GabinetePrensa/NotasPrensa/2011/Paginas/npfinaizacionsubasta010811.aspx>

⁴²⁴ http://www.cullen-international.com/report/3796/t3352#Table_26

⁴²⁵ <http://www.cullen-international.com/report/5927/c73879>

⁴²⁶ <http://www.cullen-international.com/report/6043/c78385>

GHz spectrum. The 800 MHz spectrum will become available at as of yet undefined time, sometime before 1 January 2015.

- A 13.109 Not all spectrum was sold at the July auction, so another auction took place in November 2011 for the remaining 2 × 5 MHz of spectrum (available from 2015) and the 2.6 GHz spectrum. This auction raised €185m. The sub-1 GHz spectrum cap for the July 2011 auction had to be raised to 2 × 25 MHz in order to sell the last 900 MHz lot.

A13.2.17 Sweden

- A 13.110 In 2009, following a joint proposal by five MNOs for renewal of 900 MHz licences, the Swedish Post and Telecom Agency (PTS) decided to redistribute existing spectrum assignments,⁴²⁷ renew licences and permit the introduction of new systems into the band. As part of the decision, PTS assigned additional spectrum to Hi3G who did not previously have any 900 MHz spectrum in the band. Existing operators intending to deploy new systems in the 900 MHz band were required to meet their existing coverage conditions until the end of 2015 with the potential for further extension of this period.
- A 13.111 Later in 2009 the PTS decision was investigated by the Swedish Competition Authority on foot of a complaint lodged with the EC. The Authority reached the preliminary conclusion that the joint proposal presented by five MNOs to the PTS constituted an agreement restricting competition that is prohibited under Article 81 of the EC Treaty.⁴²⁸ In June 2010, the Competition Authority concluded its investigation into the 2009 PTS decision, noting that the regulation of spectrum as a resource limited the potential for the inter-operator agreement to restrict competition in the market, and the Competition Authority closed its investigation as it determined the PTS decisions was not in contravention of competition rules.⁴²⁹
- A 13.112 A legal challenge against the 2009 PTS decision was rejected and the decision became final on 23 February 2011. The 900 MHz licensees were permitted to utilise the spectrum on a technology neutral basis from 24 May 2011, with the band currently permitted for GSM use only.⁴³⁰

⁴²⁷ <http://www.pts.se/en-gb/News/Press-releases/2009/PTS-issues-decision-concerning-space-in-the-900-MHz-band-which-will-ensure-continued-high-coverage-for-mobile-telephony-in-Sweden/>

⁴²⁸ Now article 101 of the TFEU

⁴²⁹ <http://www.kkv.se/upload/Filer/Konkurrens/2010/Beslut/08-0688.pdf>

⁴³⁰ <http://www.telecompaper.com/news/sweden-opens-up-900mhz-band>

- A 13.113 PTS announced on 13 December 2010⁴³¹ that it would release 800 MHz spectrum via an auction in early 2011. PTS stated it would release 2 × 30 MHz of 800 MHz spectrum in blocks of 2 × 5 MHz, with a spectrum cap of 2 × 10 MHz per operator, and licence expire of December 2035. One of the 2 × 5 MHz blocks had specific coverage conditions associated with it,⁴³² PTS also stated that the onus was on successful bidders to operate and deploy systems which did not cause interference with broadcast transmissions.
- A 13.114 The auction concluded on 4 March 2011, and three bidders were successful in winning rights to 2 × 10 MHz of 800 MHz spectrum^{433,434}. The auction raised over SEK 2bn (approx €220m). Net4Mobility won the block with coverage obligations, with a final bid of SEK 349m, of which SEK 49m was recovered by PTS in the form of auction fees, and the remaining SEK 300m is committed by Net4Mobility to provide PTS required coverage. From 2013, any of the committed coverage expenses not yet invested is liable to CPI, with a CPI base of 2010.
- A 13.115 Each of the 800 MHz blocks had a SEK 200k fee associated with it. There is an annual fee of SEK 570k (approximately €63k) per 2 × 5 MHz for spectrum usage, and an additional supervision charge of SEK 17.1k (approximately €1.9k) per block. These annual fees are in the existing regulations and are liable to change over the period of the licence.
- A 13.116 PTS extended the four existing 1800 MHz licences in February 2011, with three operators reducing their existing 1800 MHz assignment to 2 × 10 MHz in order to receive an extension of 15 years (January 2013 until December 2027), while another licensee increased its assignment to 2 × 5 MHz under the same conditions.
- A 13.117 On 1 June 2011, PTS announced⁴³⁵ that it was inviting interested parties to register their interest in participating in an auction for the returned 1800 MHz spectrum (from existing licensees) by 2 September 2011, with a planned start date of 11 October 2011 for the auction. PTS would release the returned 2 × 35 MHz of 1800 MHz spectrum in this auction, which both incumbents of the band and new entrants could participate in. Licences in the 1800 MHz band would commence on 1 January 2013 and last for 25 years, with no spectrum cap

⁴³¹ <http://www.pts.se/en-gb/News/Press-releases/2010/PTSs-invitation-to-auction-of-the-800-MHz-band/>

⁴³² Section 2.9 of <http://www.pts.se/upload/Beslut/Radio/2010/10-10534-open-invitation-800-mhz-auction-dec10.pdf>

⁴³³ <http://www.pts.se/en-gb/News/Press-releases/2011/Press-release/>

⁴³⁴ <http://www.pts.se/upload/Beslut/Radio/2011/10-10534-desicion-assignment-800mhz.pdf>

⁴³⁵ <http://www.pts.se/en-gb/News/Press-releases/2011/PTS-invites-interested-parties-to-the-spectrum-auction-for-the-1800-MHz-band/>

imposed for users of this band. The auction would entail two stages; the auction stage to determine the amount of spectrum a licensee has access to, and an assignment stage to determine where in the band each licensee will be assigned its spectrum. PTS will leave one 2 × 5 MHz block unlicensed and permitted to be used by anyone without the requirement for a licence.

- A 13.118 The clock auction (with subsequent assignment round) concluded on 17 October 2011⁴³⁶. Two incumbent operators were successful in acquiring the 1800 MHz spectrum, Telisonera acquired 2 × 25 MHz of 1800 MHz spectrum at a cost of SEK 920m (approx. €100m) while Net4Mobility acquired 2 × 10 MHz at a cost of SEK 430m (approx. €43m).
- A 13.119 All 800 MHz licences are technology neutral, whilst 900 MHz and 1800 MHz licences permit UMTS and GSM, and 900 MHz licences also allow for LTE usage.⁴³⁷

A13.2.18 Switzerland

- A 13.120 Existing GSM licences were extended in 2009 in order to harmonise their expiry dates⁴³⁸. The decision to extend these licences also included measures which came into effect early in 2010 allowing the regulator to redistribute spectrum in the bands. The redistribution of spectrum was completed in March 2010 and each operator then had access to at least 2 × 5 MHz of spectrum in the 900 MHz band.
- A 13.121 The current GSM and UMTS licences will expire in 2013 and 2016 respectively and the regulator was planning a 2011 “big-bang” auction⁴³⁹ of 550 MHz of spectrum in the 800 MHz, 900 MHz, 1.8 GHz, 2.1 GHz and 2.6 GHz bands.
- A 13.122 A consultation was published in June 2009 and in November 2009 the NRA published its report on the comments received. The report noted that the renewal of existing licences may lead to asymmetries in frequency holdings and inefficiencies in the market.
- A 13.123 On 26 November 2010, the NRA announced its intention to hold a combinatorial clock auction (CCA) for all the 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz spectrum on a technology neutral basis in the first half of 2011⁴⁴⁰.

⁴³⁶ <http://www.pts.se/en-gb/News/Press-releases/2011/Auktionen-avslutad---budsumma-ca-1-35-miljarder/>

⁴³⁷ http://www.cullen-international.com/report/6352/t5813#Table_21

⁴³⁸ <http://www.comcom.admin.ch/aktuell/00429/00457/00560/index.html?lang=en&msg-id=27081>

⁴³⁹ <http://www.bakom.admin.ch/dokumentation/medieninformationen/00471/index.html?lang=en&msg-id=30007>

⁴⁴⁰ <http://www.bakom.admin.ch/dokumentation/medieninformationen/00471/index.html?lang=en&msg-id=36440>

Interested parties initially had until 18 March 2011 to submit to the NRA the amount of spectrum each of them is seeking in each particular band, the appropriate bank guarantee relating to the reserve price of the spectrum desired⁴⁴¹, along with proof it satisfies statutory licensing requirements and the specific obligations of the invitation to tender. The NRA later extended the period for submission of interest in auction.⁴⁴²

A 13.124 The NRA received voluminous correspondence from interested parties after it had published its invitation to tender in November 2010. Accordingly, the NRA announced that the auction would take place in Q1 2012, and maintained its position⁴⁴³ that releasing the available spectrum in the different bands simultaneously in one auction is a better option than releasing the different bands in sequential awards processes, but did revise rules regarding certain issues, e.g. spectrum cap and bank guarantee. Existing licensees now have until the end of 2014 (end of 2015 in Basle and Geneva) to complete all transitions in the 900 MHz and 1800 MHz bands.

A 13.125 The NRA announced that it made some alterations to its proposals based on inputs from respondents⁴⁴⁴. Interested parties had until 30 September 2011 to submit a candidature dossier to the NRA, in which they must specify the maximum amount of spectrum they wish to purchase in each bands. Each interested party had to submit a bank guarantee amounting to 50% of the minimum bid for the requested spectrum and show that it can comply with the legal licensing requirements and the specific obligations of the tender. Swiss spectrum management rules state that the auction price for auctioned frequencies must be paid in a single installment immediately after licences are awarded⁴⁴⁵. If a candidate meets the requirements, it would be authorised to participate in the auction. The Auction Rules were published in November 2011.⁴⁴⁶

A 13.126 The NRA specified spectrum caps, and later revised the caps^{447,448}, the revised caps being as follows:

441

http://www.bakom.admin.ch/themen/frequenzen/03569/index.html?lang=en&download=NHZLpZeg7t.lnp6I0NTU042I2Z6ln1ad1Izn4Z2qZpnO2Yug2Z6gpJCDen99fWym162epYbg2c_JjKbNoKSn6A--

442 http://www.bakom.admin.ch/themen/frequenzen/03569/index.html?lang=en#sprungmarke3_8

443 <http://www.bakom.admin.ch/dokumentation/medieninformationen/00471/index.html?lang=en&msg-id=39412>

444 <http://www.news.admin.ch/message/index.html?lang=en&msg-id=40253>

445 <https://www.policytracker.com/headlines/swiss-spectrum-auction-put-back-to-2012>

446

http://www.ofcom.admin.ch/themen/frequenzen/03569/index.html?lang=en&download=NHZLpZeg7t.lnp6I0NTU042I2Z6ln1ad1Izn4Z2qZpnO2Yug2Z6gpJCDeoR7f2ym162epYbg2c_JjKbNoKSn6A--

447 <http://www.news.admin.ch/NSBSubscriber/message/attachments/23212.pdf>

- 2 × 135 MHz of the total available FDD spectrum (duplex frequencies)⁴⁴⁹:
- 2 × 25 MHz between 800 MHz and 900 MHz bands;
- 2 × 20 MHz for the 900 MHz band;
- 2 × 35 MHz for the 1800 MHz band; and
- 2 × 30 MHz for the 2.1 GHz band.

A 13.127 The reserve price for the 800 MHz and 900 MHz 2 × 5 MHz blocks are the same, and set at CHF 21.3m (approximately €17.6m). 1800 MHz 2 × 5 MHz block reserve price is CHF 7.1m and 2 × 10 MHz is CHF 16.6m (approximately €5.87m and €13.72m) and CHF 8.3m (approximately €6.85m) per 2 × 5 MHz block of 2.1 GHz and 2.6 GHz spectrum.

A 13.128 The availability date of spectrum won by bidders in the auction varies; some spectrum is currently fallow and will be immediately assigned after the auction, whereas spectrum currently assigned is available for assignment at different dates⁴⁵⁰, and all licences will co-terminate on 31 December 2028. Assignment dates for the spectrum is as follows:⁴⁵¹

- 800 MHz: All the 800 MHz band (six 2 × 5 MHz blocks) will be assigned in January 2013;
- 900 MHz: The 900 MHz band (seven 2 × 5 MHz blocks) will be assigned in January 2015 and January 2016;
- 1800 MHz:
 - 2 × 10 MHz block of 1800 MHz will be assigned immediately (only 2 × 8.6 MHz is usable until January 2014);
 - the remainder (thirteen 2 × 5 MHz blocks) of 1800 MHz band assigned in January 2015 and January 2016;
- 2.1 GHz:

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http://www.ofcom.admin.ch/themen/frequenzen/03569/index.html?lang=en&download=NHZLpZeg7t,lnp6I0NTU042I2Z6ln1ad1IZn4Z2qZpnO2YUq2Z6gpJCDen99fGym162epYbg2c_JjKbNoKSn6A--

449 Note, there is also 35 MHz of unpaired spectrum in the 2.1 GHz band and 45 MHz of unpaired 2.6 GHz spectrum available in this competition.

450

http://www.bakom.admin.ch/themen/frequenzen/03569/index.html?lang=en&download=NHZLpZeg7t,lnp6I0NTU042I2Z6ln1ad1IZn4Z2qZpnO2YUq2Z6gpJCDen99fGym162epYbg2c_JjKbNoKSn6A--

451 http://www.cullen-international.com/report/6352/t5834#Table_22

- three blocks of FDD (2 × 5 MHz), and two blocks of TDD (1 × 5 MHz and 1 × 15 MHz) will be assigned immediately;
- nine blocks of FDD (2 × 5 MHz) and three blocks of TDD (1 × 5 MHz) will be assigned in January 2017; and
- 2.6 GHz: All of the 2.6 GHz band (fourteen FDD 2 × 5 MHz blocks and three TDD 1 × 15 MHz blocks) will be assigned immediately.

A 13.129 Licensees who have the right to use frequencies below 1 GHz are obliged to ensure coverage of 50% of the population of Switzerland with mobile radio services via their own infrastructure by 31 December 2018 (800 MHz) and 31 December 2020 (900 MHz), licensees for 1800 MHz have until 31 December 2020 to achieve 25% coverage, whereas licensees of 2.1 GHz spectrum have to achieve 25% coverage by 31 December 2021.

A 13.130 An Assignment Round will take place after the auction to determine spectrum assignments for winning bidders. In all cases, spectrum will be assigned contiguously.

A 13.131 The NRA has stated that it will have an auction if there are enough candidates to merit one, and that it would not announce eligible bidders and other information until after the auction is complete.⁴⁵²

A 13.132 The Swiss auction began on 6 February 2012, and concluded on 22 February⁴⁵³. Three of the existing operators won all of the paired spectrum in the 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz bands, whilst the unpaired 2.6 GHz was also bought and the unpaired 2.1 GHz spectrum unsold⁴⁵⁴. One other interested party did not satisfy the admission criteria and was therefore not allowed to participate in the auction.

A 13.133 The auction generated over CHF 996m (approx. €826m).

A13.2.19 The United Kingdom

A 13.134 Licences for spectrum in the 900 MHz and 1800 MHz bands were varied to allow for usage of the spectrum for UMTS as well as GSM⁴⁵⁵ (and in time, other technologies deemed compatible by EC), on foot of a government direction,

⁴⁵² <http://www.ofcom.admin.ch/themen/frequenzen/03569/index.html?lang=en>

⁴⁵³ For more information on the Swiss Auction, please see of DotEcon's Benchmarking Report, Document 12/23

⁴⁵⁴ <http://www.news.admin.ch/NSBSubscriber/message/attachments/26008.pdf>

⁴⁵⁵ <http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800mhz-wireless-telegraphy/statement/Statement.pdf>

which was made on 20 December 2010 and brought into force on 30 December 2010. This decision also required the UK Regulator (Ofcom) to “*assess likely future competition in markets for the provision of mobile electronic communication services after the conclusion of the award of 800 MHz and 2.6 GHz bands*”.

A 13.135 Under the Wireless Telegraphy Act Order 2010, Ofcom was required to:⁴⁵⁶

- conduct a competition assessment of the mobile market, taking account of the possible impact of an auction;
- make regulations for an auction of spectrum in the 800 MHz and 2.6 GHz bands as soon as possible after the competition assessment has been performed; and
- revise the licence fees paid by holders of 900 MHz and 1800 MHz spectrum to take account of the sums bid in the auction.

A 13.136 Ofcom released a consultation⁴⁵⁷ on 22 March 2011 on the release of 800 MHz and 2.6 GHz spectrum, with a closing date for submissions of 31 May 2011. The auction was expected to take place in the first half of 2012. Ofcom discussed the possibility of implementing spectrum floor and spectrum cap for sub 1 GHz spectrum to ensure a minimum of four credible players in the market. Annual spectrum fees for the 900 MHz and 1800 MHz bands would be revised to reflect full market value, and would incorporate information from the upcoming 800 MHz and 2.6 GHz auction. Analogue Switch Off is due to take place by the end of 2012⁴⁵⁸.

A 13.137 Ofcom had suggested a range of reserve prices for the spectrum it intends to release, with 800 MHz reserve price in the range of £30m to £200m (approx. €35.85m - €239m) per 2 × 5 MHz block, and £10m to £40m (approx. €11.95m - €47.8m) per 2 × 10 MHz of 2.6 GHz spectrum. Ofcom proposed to release spectrum in a combinatorial clock auction (CCA) with second price rule. Licences would be issued for an indefinite term, but with an initial 20 year period where revocation could occur in certain circumstances.

A 13.138 Ofcom proposed to make one 2 × 5 MHz block of 800 MHz spectrum available to achieve high nationwide broadband coverage. A requirement of a successful applicant for this block would, by 2017, be providing an electronic

⁴⁵⁶ <http://www.cullen-international.com/report/5511/c67862#> Ofcom consults on

⁴⁵⁷ <http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/summary/combined-award.pdf>

⁴⁵⁸ http://www.cullen-international.com/report/5520/t4361#Table_23

communications network that is capable of providing mobile telecommunications services with a sustained downlink speed of not less than 2Mbps, with a 90% probability of indoor reception and to an area within which at least 95% of the UK population lives.

A 13.139 Ofcom proposed a spectrum cap for the competition, taking into consideration spectrum already licensed to operators. The spectrum cap was:

- 2 × 27.5 MHz for spectrum under 1GHz for all bidders, including existing spectrum holdings of the bidder (the “Sub-1GHz Cap”); and
- 2 × 105 MHz for spectrum in the 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz (paired) and 2.6 GHz (paired and unpaired) bands for all bidders, including existing spectrum holdings of the bidder (the “Overall Cap”).

A 13.140 If one or more lots were not awarded as part of the award process, Ofcom retain the discretion to award the remaining lots through a separate award process.

A 13.141 On 2 June 2011, Ofcom published a consultation⁴⁵⁹ on the technical considerations for the release of the 800 MHz and 2.6 GHz spectrum. This consultation focused on proposals for dealing with sharing and interference mitigation of the 800 MHz band (primarily with DTT) and the 2.6 GHz (primarily with radar) with other services, and to allow LTE and WiMAX be deployed in the 900 MHz and 1800 MHz bands. Ofcom proposed specific Block Edge Masks and maximum transmit power for both the 800 MHz and 2.6 GHz bands, and also made proposals on low power usage for some blocks and licensees coordination for users in the 2.6 GHz band.

A 13.142 On 7 October 2011, Ofcom stated that it would hold a further consultation on the spectrum release, and it expected to publish its decision in the summer of 2012 with the auction now taking place around Q4 2012⁴⁶⁰.

A 13.143 The UK Culture, Media and Sport Parliamentary Committee published a document on 3 November 2011⁴⁶¹. This committee labelled Ofcom’s current 800 MHz coverage condition for one block of spectrum of 95% of the population “*unambitious*”, and recommended that “*Ofcom imposes a coverage obligation of 98% on one or more of the 800 MHz licences being auctioned*”.

⁴⁵⁹ <http://stakeholders.ofcom.org.uk/binaries/consultations/tlc/summary/condoc.pdf>

⁴⁶⁰ http://stakeholders.ofcom.org.uk/consultations/combined-award/update?utm_source=updates&utm_medium=email&utm_campaign=combined-award-update

⁴⁶¹ <http://www.publications.parliament.uk/pa/cm201012/cmselect/cmcomeds/1258/1258.pdf>

- A 13.144 This Committee agreed with Ofcom's proposal not to reallocate existing 900 MHz spectrum or increase licences fees⁴⁶². The Committee also queried whether Everything Everywhere should solely benefit from the sale of its divested 1800 MHz spectrum, or whether some of the profit should be put towards network development.
- A 13.145 Ofcom consulted again on the release of spectrum in the 800 MHz and 2.6 GHz spectrum bands in January 2012.⁴⁶³ Ofcom reiterated its view after carrying out a competition assessment that four credible operators are required post auction with a minimum spectrum portfolio to foster competition. Ofcom maintained its spectrum cap proposal from the March 2011 consultation, and reserved spectrum for a fourth national wholesaler⁴⁶⁴. However, Ofcom's preferred spectrum floor option has been modified. The current consultation document puts forward three possible groups of spectrum floors (of increasing size) with Ofcom currently indicating that it prefers group 2. Ofcom's preferred group (group 2) would provide that an operator winning any one of the following combinations of lots would have achieved the spectrum floor:
- 2 x 15 MHz of 800 MHz
 - 2 x 10 MHz of 800 MHz & 2 x 10 MHz of 2.6 GHz
 - 2 x 10 MHz of 800 MHz & 2 x 15 MHz of 1800 MHz
 - 2 x 15 MHz of 1800 MHz & 2 x 10 MHz of 2.6 GHz
- A 13.146 We note that, in contrast with its March 2011 consultation, none of the groups of spectrum floors under consideration require that an operator obtain sub-1 GHz spectrum with Ofcom stating: "*In March we identified the ability to provide service deep indoors as important to the credibility of a national wholesaler and that some sub-1GHz spectrum would be likely to be needed to offer such services. We now consider that it is less certain that the locations that can only be realistically served with a macrocell network using sub-1GHz spectrum (and cannot be served using other technologies such as Wi-Fi and femtocells) are likely to be sufficiently important in the overall market that not having a capability to serve them would be likely to bring into question the credibility of the national wholesaler*".

⁴⁶² http://www.cullen-international.com/report/6276/c84059#_Parliamentary_committee_calls

⁴⁶³ <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/summary/combined-award-2.pdf>

⁴⁶⁴ http://www.cullen-international.com/report/6385/c87469#_Ofcom_revises_proposals

- A 13.147 Ofcom also proposes to apply a coverage condition to be achieved by the end of 2017 on at least one of the 800 MHz licences and is considering two options; one option is for 98% indoor population coverage, whilst the other option is for the licensee to achieve broadband coverage comparable to existing 2G coverage and any additional coverage achievable with the proposed £150m government (mobile infrastructure programme) fund for this licensee. The 800 MHz band is proposed to be released in 5 lots; four 2 × 5 MHz lots, and one 2 × 10 MHz lot which is the licence which will contain the coverage obligation.
- A 13.148 Ofcom also proposes to revise the fees of current 900 MHz and 1800 MHz licences, using a new methodology which incorporates realised auction fees.
- A 13.149 The latest consultation will close on 22 March 2012, and Ofcom expects to publish its Decision, Auction Regulations and Information Memorandum in the summer of 2012 with the auction beginning in Q4 2012⁴⁶⁵.
- A 13.150 On 17 February 2012, Ofcom published an addendum to its 12 January 2012 consultation relating to what changes might be made to proposed minimum spectrum portfolios if, before the auction, Everything Everywhere (EE) sold the rights to use the 2x15MHz of 1800MHz spectrum that it is required to divest as part of its merger commitments.⁴⁶⁶
- A 13.151 Everything Everywhere has expressed concern⁴⁶⁷ with Ofcom's modified spectrum cap floor proposal in its January 2012 consultation in that Ofcom's new proposals do not guarantee Everything Everywhere 800 MHz spectrum, as the previous March 2011 proposal had done.

A13.3 Miscellaneous Developments

- A 13.152 Credit Suisse stated in its report of 28 November 2011⁴⁶⁸ that the Polish operator Mobyland launched LTE services in the 1800 MHz band, and expected download speeds to reach up to 153 Mbps.
- A 13.153 In December 2011, Hi3G in Sweden announced^{469,470} the going live of "*the world's first commercial FDD/TDD dual-mode LTE network*". Also in Sweden, Telisonera have plans to develop its LTE network further.⁴⁷¹

⁴⁶⁵ <http://stakeholders.ofcom.org.uk/consultations/award-800mhz-2.6ghz/summary>

⁴⁶⁶ <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/annexes/addendum.pdf>.

⁴⁶⁷ Credit Suisse European Telecoms Daily – 13 January 2012

⁴⁶⁸ Credit Suisse Report of 28 November 2011 – Telecommunications Services- Dutch Mobile and LTE opportunities.

- A 13.154 Telstra in Australia is expected to launch LTE smartphones by the end of January 2012.⁴⁷² Telestra has deployed LTE in the 1800 MHz band, and recently outlined the benefits of LTE⁴⁷³. Optus intends to turn on its LTE network in April 2012, whilst Vodafone has carried out trials of LTE but as of yet has not formalised its plans.
- A 13.155 In January 2012, CNET stated⁴⁷⁴ that Verizon in the US intends to have LTE support for practically all of its smart phones going forward. This article also stated that Verizon activated 2.2 million LTE devices in Q4 2011, the most in a quarter since it launched in December 2010.
- A 13.156 In its LTE report of 5 January 2012⁴⁷⁵, GSA reported that there were 49 commercial LTE networks in 29 countries at that time and forecasted 119 LTE networks in 53 countries by the end of 2012. GSA also outlined the pace of international developments regarding LTE in the 1800 MHz band. GSA also report commercial launch of LTE services in the 1800 MHz bands in Singapore, Finland and Hong Kong.
- A 13.157 BT and Everything Everywhere are carrying out an LTE trial in the UK using 10 MHz of 800 MHz spectrum⁴⁷⁶. Virgin Media in the UK also carried out an LTE test in December 2011.⁴⁷⁷
- A 13.158 In December 2011, Tarriff Consultancy (TCL) stated⁴⁷⁸ its view that “global LTE mobile broadband pricing will decline by as much as 60 percent during the five-year period between 2012 and 2016”. TCL also stated “*As of the end of 2011 about 60 percent of commercial LTE services have been launched so far in Europe*” and “*forecasts more than 250 million users of LTE mobile broadband services, and average pricing per subscriber will decrease to around \$26 per month*”.

⁴⁶⁹ http://www.fiercebroadbandwireless.com/story/swedens-hi3g-announces-first-fddtd-lte-network/2011-12-19?utm_medium=nl&utm_source=internal

⁴⁷⁰ <http://www.rethink-wireless.com/2011/12/15/hi3g-rolls-dual-mode-lte-sweden.htm>

⁴⁷¹ <http://www.globaltelecomsbusiness.com/Article/2909941/TeliaSonera-plans-LTE-expansion-in-Sweden.html>

⁴⁷² <http://www.smh.com.au/digital-life/mobiles/first-4g-smartphone-coming-to-australia-this-month-sources-20120111-1pub3.html>

⁴⁷³ http://www.gsacom.com/downloads/pdf/Telstra_4G_261011.php4

⁴⁷⁴ http://www.fiercewireless.com/ceslive/story/verizon-commits-lte-all-future-smartphones/2012-01-12?utm_medium=nl&utm_source=internal

⁴⁷⁵ http://www.gsacom.com/downloads/pdf/GSA_evolution_to_lte_report_050112.php4

⁴⁷⁶ <http://www.mobilenewscwp.co.uk/2012/01/everything-everywhere-and-bt-wholesale-extend-4g-trial/>

⁴⁷⁷ <http://www.v3.co.uk/v3-uk/news/2140685/virgin-media-testing-4g-spectrum-ahead-auction-bid>

⁴⁷⁸ http://www.fiercebroadbandwireless.com/story/report-global-lte-pricing-fall-60-five-years/2011-12-19?utm_medium=nl&utm_source=internal

A 13.159 Vodafone Germany's LTE subscriber base reached over 100,000 by February 2012⁴⁷⁹, and it will launch its first LTE smartphone in Germany in the near future.

A 13.160 GSA reported an update on LTE networks in February 2012.⁴⁸⁰

- 226 firm LTE network commitments in 76 countries;
- 59 additional pre-commitment operator trials in 17 additional countries;
- 49 commercially launched LTE networks in 29 countries;
- 14 operators have commercially launched LTE service in 1800 MHz spectrum (LTE1800);
- GSA forecasts at least 119 LTE networks will be in commercial service in 53 countries by end 2012; and
- LTE-Advanced is accepted as an ITU IMT-Advanced (4G) technology; several operator trials underway.

A 13.161 GSA also reported on the device ecosystem for LTE:

- 269 LTE user devices launched by 57 manufacturers; 36% higher than identified on October 28, 2011;
- 48 LTE smartphones, 6x increase over 6 months; number of LTE-enabled tablets more than doubled over 6 months;
- 50 LTE1800 user devices announced supporting LTE network deployments in 1800MHz spectrum; and
- 44 LTE TDD devices confirmed;

A 13.162 GSA also published a document on 9 February 2012 outlining the widespread developments of UMTS in the 900 MHz band.⁴⁸¹

⁴⁷⁹ http://www.fiercewireless.com/europe/story/vodafone-germany-launch-htc-velocity-first-german-lte-smartphone/2012-02-10?utm_medium=nl&utm_source=internal

⁴⁸⁰ http://www.gsacom.com/downloads/pdf/mobile_broadband_fact_sheet_070212.php4

⁴⁸¹ http://www.gsacom.com/downloads/pdf/UMTS900_information_paper_090212.php4

Annex 14: Agreed MoU with the UK on the 800 MHz band

- A 14.1 This Annex contains an agreed memorandum of understanding (MoU) between the national regulatory authorities of the Republic of Ireland (ComReg) and the United Kingdom (Ofcom) on the use of the 800 MHz spectrum bands in border areas between these two countries.
- A 14.2 This MoU is based on ECC Recommendation ECC/REC/(11)04 on frequency planning and frequency co-ordination for terrestrial systems for mobile/fixed communication networks (MFCN) capable of providing electronic communications services in the frequency band 790-862 MHz⁴⁸².

⁴⁸² Recommendation adopted by the Working Group Frequency Management of the ECC on 26 May 2011.



**MEMORANDUM OF UNDERSTANDING ON
FREQUENCY COORDINATION BETWEEN
THE REPUBLIC OF IRELAND
AND
THE UNITED KINGDOM
IN THE FREQUENCY BAND
790 – 862 MHz**

1. INTRODUCTION

- 1.1. This Memorandum of Understanding (MoU) describes the procedures for the coordination of radio services, other than broadcasting, between the Republic of Ireland (RoI) and the United Kingdom (UK) in the frequency band 790 – 862 MHz.
- 1.2. In order to facilitate the deployment of systems operating in neighbouring countries, it is necessary to establish, by agreement, regulatory and technical procedures for frequency co-ordination. Moreover, this agreement is designed to reduce the administrative procedures in the frequency bands in the countries concerned.
- 1.3. In the UK, the frequency band 790 – 862 MHz is expected to be awarded on a service and technology neutral basis, in accordance with decisions to be made by Ofcom, following a consultation process.
- 1.4. In the RoI, it is intended that the 790 – 862 MHz band will become available as part of the Digital Dividend post analogue TV switch off (“ASO”) in Ireland. In Ireland and the UK, use of the 790 – 862 MHz band will be in conformance with the European harmonised technical conditions of use as set out in European Commission Decision 2010/267/EU⁴⁸³.
- 1.5. The preferred harmonised CEPT channelling arrangement for the 790 – 862 MHz band is as follows:

790-791	791-796	796-801	801-806	806-811	811-816	816-821	821 – 832	832-837	837-842	842-847	847-852	852-857	857-862
Guard band	Downlink						Duplex gap	Uplink					
1MHz	30 MHz (6 blocks of 5 MHz)						11 MHz	30 MHz (6 blocks of 5 MHz)					

- 1.6. Ofcom is the Administration of the United Kingdom responsible for all relations with the RoI concerning this MoU.
- 1.7. The Commission for Communications Regulation (ComReg) is the Administration of the RoI responsible for all relations with the UK concerning this MoU.
- 1.8. Accordingly, the Administrations of the UK and the RoI have agreed the co-ordination procedures in this MoU.
- 1.9. This MoU applies in the territories of The Republic of Ireland and the United Kingdom.
- 1.10. The co-ordination procedure is based on the principle of equitable access to the spectrum resource.

⁴⁸³ Commission Decision of 6 May 2010 (2010/267/EU), on harmonised technical conditions of use in the 790 -862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010D0267:EN:HTML>

- 1.11. Coordination of FDD services in the 790 – 862 MHz band is based on the protection requirements for non preferential frequency blocks given in Annex 1 of ECC Recommendation (11)04⁴⁸⁴.

2. COMMITMENT OF THE ADMINISTRATIONS

- 2.1. The Administrations of the RoI and the UK are committed to ensuring that the radio communication stations operating in the band 790-862 MHz, respect the limits given at paragraph 3, unless the stations are specifically exempt from the coordination procedure in accordance with paragraph 4.

3. CRITERIA FOR COORDINATION

- 3.1. Suitable coordination arrangements, outlined in paragraphs 3.2 and 3.3, are derived from Annex 1 of ECC Recommendation (11)04.
- 3.2. Within the frequency band 791-832 MHz, stations of FDD Systems may be operated, established or modified in a country, without co-ordination with the neighbour country, provided that the predicted field strength produced by a cell (all transmitters within the sector) does not exceed the threshold of **55 dB μ V/m in a bandwidth of 5 MHz at a height of 3 m above ground level at the coast or border line of the neighbouring country**, and **29 dB μ V/m in a bandwidth of 5 MHz at a height of 3m above ground at a distance of 9 km** inside the neighbouring country.

In the case that LTE is deployed on both sides of the border, the field strength levels may be increased to **59 dB μ V/m in a bandwidth of 5 MHz**, and **41 dB μ V/m in a bandwidth of 5 MHz at 6 km**

- 3.3. Within the frequency bands 791- 821 MHz and 832 – 862 MHz, stations of TDD Systems may be operated, established or modified in a country, without co-ordination with the neighbour country, provided that the predicted mean field strength produced by a cell (all transmitters within the sector) does not exceed the threshold of **15 dB μ V/m in a bandwidth of 5 MHz at 10% time, 50% of locations at a height of 3 m above ground level at the coast or border line of the neighbouring country**.
- 3.4. Base stations, for which the predicted field strength exceeds the values given in 3.2 or 3.3, must be co-ordinated in accordance with paragraph 7, except where stations are listed in paragraph 6 or an arrangement exists between operators as described in paragraph 4.
- 3.5. To establish the predicted field strength produced by a station, the methodology set out at paragraph 5 shall be employed.
- 3.6. In the case of time division duplex technology the interference power shall be the power, during the active part of the signal, in the stated bandwidth.
- 3.7. Systems operating in border areas are required to co-ordinate physical-layer cell identities in accordance with Annex 5 of ECC Recommendation (11)04.

⁴⁸⁴ ECC Recommendation (11)04: Frequency planning and frequency coordination for terrestrial systems for mobile/fixed communication networks (MCFN) capable of providing electronic communications services in the frequency band 790-862 MHz.

4. ARRANGEMENTS BETWEEN OPERATORS

- 4.1. An Agreement between the administrations of the Republic of Ireland and the United Kingdom, which enables planning arrangements between mobile operators, subject to agreement of the Administrations, was brought into force on 01 May 2005⁴⁸⁵. The administrations of the Republic of Ireland and the United Kingdom agree to extend the applicability of this Agreement to all operators of systems in the frequency bands 791 - 832 MHz.
- 4.2. To facilitate reasonable and timely development of their systems, licensees are encouraged to develop arrangements in accordance with the Agreement of 01 May 2005.
- 4.3. Operators may only negotiate Arrangements concerning the common part of those frequency bands for which they have been licensed by the National Administration. The provisions in the Arrangements shall not result in an impairment of the authorised use of radio frequencies by third parties not involved in the Arrangements.
- 4.4. In order to facilitate Arrangements between operators, each Administration will provide names and point of contact information for the relevant licensees, subject to the agreement of the licensees.

5. PREDICTION OF PROPAGATION

The field prediction method shall be according to the latest version of Recommendation ITU-R P. 1546⁴⁸⁶, With parameters:

- 10% of the time
- 50% of locations
- Height of the receiver antenna 3m

Taking account of:

- Terrain profile (effective height) for the base station in all main directions
- Type of terrain (e.g. land, sea, mixed path)
- Effective radiated field strength
- Antenna tilt and azimuth

Including model components:

- Mixed land/sea paths

⁴⁸⁵ Agreement between the administrations of the Republic of Ireland and the United Kingdom concerning the approval of planning arrangements between mobile radio communications network operators.

⁴⁸⁶ Recommendation ITU-R P.1546, Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 3 000 MHz

- Receiving/mobile antenna height
- Terrain clearance angle

And standard values: $\Delta N = 40$ (N0m-N1000m)

6. CO-ORDINATED STATIONS

The stations listed below have been agreed by both Administrations to be coordinated. Any subsequent change in the parameters given in the table shall void any acceptance of co-ordination for the corresponding station or stations.

Name	Individual Channel bandwidth	Modulation	Centre Frequency	Lat	Long	East	North	Ground H AMSL (m)	H AGL (m)	EIRP dBm	Antenna Manufacturer reference	Pol .	3dB BW Degs	Az Degs E of N.

7. CO-ORDINATION PROCEDURE

- 7.1. Exchanges of information for co-ordination/notification purposes shall be in the format set out in Annex 2A of the HCM agreement (revised at Vilnius 2005)⁴⁸⁷.
- 7.2. A co-ordination request must be sent by the licensee through the Administration responsible for its authorisation.
- 7.3. The co-ordination procedure shall follow the one described in the HCM Agreement.
- 7.4. In the event of interference between authorised users of the band 790-862 MHz in the RoI and the UK, the affected users shall exchange information between themselves with a view to resolving the interference by mutual agreement. A report of the interference and the details of the information exchanged shall be sent to both Administrations who can, if requested, advise on resolution.. The Administrations of the RoI and the UK agree to facilitate the exchange of information between authorised users of the band.

⁴⁸⁷ Agreement between the Administrations of ... on the Coordination of frequencies between 29.7 MHz and 39.5 GHz for fixed service and land mobile service (HCM Agreement) Vilnius, 2005
http://hcm.bundesnetzagentur.de/http/englisch/verwaltung/index_europakarte.htm

8. REVIEW OF MoU

- 8.1. The co-ordination threshold and prediction methods defined in this MoU may be reviewed in the light of experience of operation of networks in both countries and future prediction developments.
- 8.2. This MoU may be updated following the adoption of any international decisions, directives or recommendations relevant to the band 790 - 862 MHz, or the results of awards of licences to use the frequency band 790 - 862 MHz.

9. TERMINATION OF THE MEMORANDUM OF UNDERSTANDING

Either Administration may withdraw from this Memorandum of Understanding subject to 6 months' notice.

10. DATE OF ENTRY INTO FORCE

This Memorandum of understanding shall enter into force on 01 March 2012

For the administration of the REPUBLIC OF IRELAND

[... ✂ ... Signature deleted]

Signed at Dublin on 28 February 2012

For the administration of the UNITED KINGDOM

[... ✂ ... Signature deleted]

Signed at London on 29 February 2012.