Commission for
Communications Regulation

Consultation Paper

Licensing Digital Terrestrial Television

Digital Terrestrial Television (DTT) Multiplex Licence Conditions

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All responses to this consultation should be clearly marked:- "Reference: Submission re ComReg YY/NN" as indicated above, and sent by post, facsimile, e-mail or on-line at www.comreg.ie (current consultations), to arrive on or before 5.00PM, 12th of October 2007, to:

Ms. Sinead Devey
Commission for Communications Regulation
Irish Life Centre
Abbey Street
Freepost
Dublin 1
Ireland

Ph: +353-1-8049600 Fax: +353-1-804 9680
Email: marketframeworkconsult@comreg.ie
Please note ComReg will publish all respondents submissions with the Response to this Consultation, subject to the provisions of ComReg's guidelines on the treatment of confidential information – ComReg 05/24

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1 Foreword by the Chairperson

The application of digital technology to free-to-air television broadcasting will result in many benefits for the consumer including more TV services, interactivity and an overall enhanced television viewing experience.

Digital Terrestrial Television (DTT), the replacement for the current free-to-air analogue system, therefore represents a major step forward for terrestrial TV transmissions in Ireland. It will also represent a significant further manifestation of technological convergence in broadcasting, media and telecommunications.

Ensuring the full potential of DTT in this market will not only need the regulatory and technical framework that ComReg is currently consulting on here but also will require that appropriate agencies develop public awareness and understanding of the benefits it can bring.

ComReg is conscious that in order to facilitate the establishment of DTT in Ireland, the framework within which ComReg intends to licence and regulate DTT multiplex licences needs to be developed.

The relevant policy goals of ComReg include:-

- ensuring efficient spectrum use by terrestrial broadcasting spectrum users;
- enhancing competition between digital TV platforms whether cable/MMDS, satellite or terrestrial; and,
- minimising disruption to consumers as a result of changes in transmission technologies and spectrum use.

At the end of March 2007, there were over 775,500 digital TV subscribers in the total market of circa 1.45million TV households in Ireland[1]. The fact that Irish consumers are increasingly giving up forms of analogue TV reception for digital alternatives is evidence of the importance of the DTT platform in Ireland.

The proposals outlined in this consultation document regarding the DTT multiplex licence conditions are intended to inform potential licensees and bidders for BCI multiplex contracts of the proposed regulatory environment and to stimulate responses from all interested parties in order to ensure that an appropriate regulatory regime will be developed.

I would encourage interested parties to participate in this consultation process so as to best inform the decisions made by ComReg in relation to the licensing of digital terrestrial television.

Mike Byrne,
Chairperson.

[1] Irish Communications Market: Quarterly Key Data – June 2007, ComReg 07/34

2 Executive Summary

The purpose of this document is to consult on the proposed licence conditions for the DTT multiplex licences to be issued to Radio Telifis Éireann (RTÉ) and the Broadcasting Commission of Ireland (BCI), by ComReg, under the Wireless and Telegraphy Act, 1926, and the Broadcasting (Amendment) Act, 2007.

The scope of the consultation is focused on the regulatory regime within which ComReg intends to licence and regulate these DTT multiplexes, taking cognisance of the requirements imposed by the relevant legislation and the conditions that should enable DTT to be launched efficiently and effectively. The process involves consulting on a range of technical and non-technical licence conditions considered relevant by ComReg in this context.

ComReg's preliminary views on the DTT multiplex licence conditions are set out in Section 4 of this document. ComReg expects that the first DTT multiplex licences will be issued in 2007 / 2008. Comreg's preliminary views include specific proposals in relation to the following licence conditions:-

- Licence duration of between 10 and 12 years;
- Initial annual licence fees of €114,000 per multiplex, indexed to inflation using the consumer price index on annual basis;
- rollout obligations in the case of licences issued to the BCI, will be aligned to those resulting from the BCI competition for multiplex contracts;
- sanctions for non-compliance with licence conditions, which may include:-
    - licence termination, suspension, term reduction, reduction of geographical coverage area and re-allocation of spectrum thus recovered and licence revocation;

  and,

- technical conditions attached to DTT multiplex licences as specified in section 4.7 of this document relating to:-
    - DTT multiplex characteristics; and,
    - transmission characteristics for the transmission networks carrying the DTT multiplexes.

3 Introduction

3.1 Legislative background on digital broadcasting

The Broadcasting (Amendment) Act 2007 was enacted earlier this year and commenced on 15 May, 2007. This Act sets out the legislative framework for future licensing of digital broadcasting services and provides a mechanism for the switch-off of analogue broadcasting services in Ireland.

The enactment of the legislation requires that an appropriate licensing regime is developed and implemented by ComReg. This will provide for the availability of television, and other associated digital services and features carried by DTT multiplexes. The licensing regime, within which ComReg intends to licence and regulate DTT, is the focus of this Consultation Paper.

The Broadcasting (Amendment) Act 2007 provides for the licensing of national DTT multiplexes by ComReg to RTÉ and the BCI. These national digital multiplex licences will be issued by ComReg under the Wireless Telegraphy Acts 1926 to 1988, section 16 (3)(a) of the Broadcasting Act 1960 and the Broadcasting (Amendment) Act 2007, and, will facilitate the introduction of DTT and the enhancement of competition in the delivery of digital television to the Irish consumer.

3.1.1 Fixed, portable and mobile TV reception

ComReg's proposed DTT multiplex licence conditions set out in this consultation paper support fixed and portable reception of DTT multiplexes.

It is ComReg's intention to carry out a separate consultation regarding the licensing of a multiplex for mobile television. Mobile reception of DTT multiplexes may support mobile TV services and applications targeted at small handheld, or similar, mobile devices. It intends to licence these services as provided for in section 5 (5) of the 2007 Act. Accordingly, an appropriate set of licence and technical conditions to specifically support mobile reception of DTT multiplexes will be developed before mobile TV is licensed by this office.

3.1.2 Key points in the legislation

The Broadcasting (Amendment) Act 2007 obliges RTÉ to establish, maintain and operate a national digital television multiplex which shall in due course ensure the availability by free-to-air digital means the RTÉ One and RTÉ Two television services, to an extent similar to that such as is currently available by free-to-air analogue means.

BCI has a duty to endeavour to arrange, as a matter of priority, for the establishment, maintenance and operation of three national television multiplexes which shall, in so far as is reasonably practicable be capable of being transmitted by digital terrestrial means to the whole community in the State.

ComReg has an obligation to issue licences to RTÉ in respect of two multiplexes and to the BCI in respect of four. The immediate priority, however, is for ComReg to issue one national multiplex licence to RTÉ and three to the BCI. Spectrum for the issues of licences over and above the immediate priority is, subject to demand, not likely to be available until the period of simulcasting of existing analogue services concludes with analogue switch off.

3.1.3 Other regulatory implications associated with DTT multiplex licences

The multiplex licensee, or, in the case where the benefits of a licence have been passed on to a third party, the third party, shall, be required to notify and register with ComReg as a provider of an Electronic Communications Network (ECN) and abide by the conditions set out in the Authorisation Regulations (S.I. No. 306 of 2003). While an undertaking may have previously notified ComReg, it is nevertheless required to update its registration to reflect the provision of DTT services.

ComReg Document 03/81 entitled "*General Authorisation - Conditions for the provision of Electronic Communications Networks and Services*", available for download from the ComReg website, sets out the obligations under the General Authorisation for a provider of an electronic communications network or service. A holder of a multiplex licence or a party to whom the benefits of a licence have been passed on will be subject to the conditions of a General Authorisation. ComReg Document 03/83 entitled "*Guidelines related to General Authorisations*" also provides further relevant material associated with these regulations.

It should be noted that this consultation relates to the conditions of a digital multiplex licence and does not deal with the requirements of a General Authorisation.

3.2 Digital TV and DTT platform

Digital TV services may be delivered using a variety of platforms such as:-

- digital cable;
- digital mulitpoint microwave distribution systems (MMDS);
- digital satellite; and,
- digital terrestrial television (DTT).

The DTT platform has an important role, in conjunction with other platforms, in ensuring that Irish consumers will have a choice of digital broadcasting solutions available to them before analogue terrestrial broadcasting is switched off. It is therefore necessary and expected that DTT will be available to an extent similar to that currently available by free-to-air analogue means.

The potential for digital programming material carried by the DTT multiplexes to have a greater geographical and population reach than cable/MMDS coverage, is a key feature of the DTT platform.

ComReg's role at this time is to ensure that the licensing framework for the DTT multiplexes, and the transmitter networks needed to carry them throughout Ireland, can be introduced efficiently and effectively.

3.3 ComReg's immediate task

The immediate task for ComReg arising from the Broadcasting (Amendment) Act 2007 is to issue four national DTT multiplexes licences, one to RTÉ and three to the BCI.

To achieve this task, ComReg is actively progressing three key elements of the DTT multiplex licence, namely:-

1. identification of the spectrum available for the transmitter networks that will be used to carry the DTT multiplexes;

2. international co-ordination with the UK of the frequencies and relevant transmission parameters of the transmitter networks that will be used to carry the multiplexes; and,

3. confirmation of the licence conditions, including all technical requirements, which will be imposed to ensure the effective regulation of DTT in Ireland.

This paper sets out to consult on item 3, namely the main licence conditions that ComReg proposes to impose.

Meanwhile, spectrum identification work, carried out in conjunction with spectrum planning engineers from RTÉ and the BCI is at an advanced stage, with internal co-ordination underway for the first tier of transmitter stations. Part of the technical characteristics of the spectrum to be used to carry the DTT multiplexes is published as an appendix to this Consultation Paper in order to inform potential respondents and help them understand the background to the proposed licence conditions, see Appendix A.

4 Consultation Issue: DTT Multiplex Licence Conditions

The following seven licence conditions set out the framework within which ComReg intends to license and regulate DTT Multiplexes in Ireland:-

1. Licence duration;
2. Licence fees;
3. Rollout obligations;
4. Sanctions for non-compliance with licence terms;
5. Provision of information;
6. Other relevant conditions; and,
7. Technical conditions.

4.1 Licence duration

ComReg recognises the considerable capital expenditure required to put a transmitter network in place to carry DTT multiplexes. It considers that the duration of the licence should reflect this and therefore should be sufficient to enable operators to make a return on their investment.

The licence period for nationwide DTT multiplex licences will be set so as to provide a balance between the following factors:-

- the need for infrastructural investment;
- the need for return on that investment;
- the need to achieve rollout; and,
- the need for continuity of service for the consumer.

ComReg considers that a licence term of between 10 and 12 years should allow for the achievement of the required balance. ComReg sees merit in having the multiplex licence and the BCI contract of similar durations.

Q. 1. Do you consider that the length of the licence period is appropriate? If not, how long do you consider the licence period should be for? Please give reasons for your proposal?

Q. 2. Do you consider that factors other than those included above should be taken into account in deciding the licence duration? If so, indicate what are they and give the reasons for your proposal?

4.2 Wireless telegraphy licence fees

Wireless telegraphy licence fees for the nationwide DTT multiplex licences will be set so as to provide a balance between the following factors:-

- the need for the State to get a fair rent for the use of radio spectrum, which is a valuable national resource;
- the need to promote technical efficiency and encourage the rollout of infrastructure in the area specified in the licence;
- the need to defray the costs of regulation of spectrum users;
- the need to offset the opportunity cost of spectrum from other commercial uses while respecting the social value of free-to-air broadcasting to Irish citizens; and,
- the need to encourage fair competition between competing platforms for the benefit of Irish consumers.

ComReg intends to base its Wireless Telegraphy Licence Fee for the DTT multiplexes on the fee for radio spectrum licensed for MMDS, which was set in 2003 at €1905 per MHz [2]. This approach is based on the fact that MMDS uses spectrum to carry multiplexes of programme content and both MMDS and DTT will be competing platforms in the provision of digital multi-channel TV. ComReg intends to adjust this figure by a yearly rate of 4.5%, as a proxy for price increases in the intervening period. ComReg considers that this basis should allow for the achievement of the required balance.

ComReg expects that the first digital multiplex licenses will be issued in 2007/2008 and based on the factors set out above it intends to set the initial charge per MHz, for the transmission networks carrying the DTT Multiplexes, at €2375 per MHz.

There are circa 48 UHF channels available for use as part of the transmission networks carrying the DTT Multiplexes and eight national DTT multiplexes have been provided for from the available set of UHF channels. Accordingly, the initial annual cost in 2008 would be €114,000 per multiplex licence [3].

4.2.1 Review clause and Index linked

ComReg believes that this Wireless Telegraphy Licence Fee is best applied by taking a short term outlook in order that changes in the above factors can be reviewed at specific intervals throughout the period of the licence.

ComReg, therefore, intends to review the licence fee on a yearly basis. It intends to index-link the licence fee using the consumer price index (CPI) as a proxy for the

[2] Statutory Instrument No. 529 of 2003, Wireless Telegraphy (Microwave Multipoint Distribution System) Regulations 2003.

[3] €114,000 is arrived at as follows: a bandwidth of 8MHz per channel × proportionate number of channels in the multiplex, i.e. 6 channels, × MMDS spectrum usage rate, adjusted to €2375 per MHz based on a 4.5% yearly increase since 2003.

rate of inflation. The review will be carried out annually, on the anniversary of the grant of the licence.

4.2.2 Forward payment of fees

Fees are to be paid to ComReg on the date of the award of the licence and annually on the anniversary of the grant of the licence. If a licence is suspended or revoked, the licensee shall not be entitled to be repaid any part of the fee paid but shall be liable to pay any sums subsequently outstanding.

4.2.3 Recovery of fees

A fee may be recovered by ComReg as a simple contract debt in any court of competent jurisdiction.

Q. 3. Do you consider the proposed licence fee to be reasonable? If not, indicate an alternative fee and give the reasons for your proposal?

Q. 4. Do you consider that other factors, in addition to the range identified, should be taken in to account in deciding the licence fees? If so, indicate what they are and give the reasons for your proposal?

Q. 5. Do you agree with the principle of reviewing and indexing the licence fee using CPI as a proxy for inflation? What alternative methods could be used in reviewing the licence fee?

4.3 Rollout obligations

In the interests of effective radio spectrum use in Ireland, most spectrum licences issued by ComReg require the licensee to meet rollout targets. This standard provision is normally set down as a condition of licence [4].

RTÉ is obliged, by the Broadcasting (Amendment) Act 2007, to ensure the availability by free-to-air digital means the RTÉ One and RTÉ Two television services, to an extent similar to that such as is currently available by free-to-air analogue means, in due course [5]. ComReg does not therefore see a necessity in setting rollout obligations for RTÉ.

[4] The Wireless Telegraphy Act 1926 sets down conditions that can be imposed as licence conditions.

[5] Section 3 (2) Broadcasting (Amendment) Act 2007

The legislative obligation and the immediate task for the BCI however, in respect of arranging for the establishment, maintenance and operation of three national multiplexes requires that in so far as is "*reasonably practicable*" [6], BCI multiplexes are to be capable of being transmitted by digital terrestrial means to the whole community in the State.

ComReg believes that as many people as possible should have the option to avail of DTT services. It sees merit, from a spectrum usage perspective, in having services transmitted from at least the twelve main transmitter stations set out in Appendix A at analogue switch off, which it understands is likely to be 2012 though the actual date will be set following a review by the Minister as provided for in Section 11 of the Broadcasting (Amendment) Act 2007. This would give population coverage of approximately 91% [7].

ComReg recognises however that operators applying for multiplex contracts from the BCI will have to make commercial decisions which will include the proposed extent of their "national" networks. It will be a matter for the BCI to achieve the best practicable network coverage as part of its contract award process in respect of the independent DTT multiplexes. ComReg, as the national spectrum management agency, intends to reflect as a licence condition, in each of the licences issued to the BCI, the rollout agreed by the BCI with the contractor to whom the rights and obligations of the multiplex licence is being passed on in order to ensure that licensed spectrum is used efficiently.

ComReg considers that there may be further merit in seeking voluntary penalties, as part of the BCI multiplex contract competition, for failure to meet agreed roll out requirements as outlined in Section 4.4.1. Notwithstanding any such voluntary penalties, ComReg intends to include in the licence to be issued to the BCI sanctions for failure to meet roll out targets set down in the licence as outlined in Section 4.4 below.

[6] Section 4 (4) Broadcasting (Amendment) Act 2007

[7] For comparison, the percentage population coverage from the 12 main sites using analogue transmission technologies would be slightly less, circa 90%, given that the required field strength to protect analogue coverage is more than that required to protect digital coverage from interference, assuming the same transmission powers and technical characteristics.

Q. 6. Do you agree with the concept of rollout obligations in relation to effective frequency spectrum use? If not, indicate an alternative concept and give the reasons for your proposal?

Q. 7. Do you consider it is appropriate in the case of licences issued to the BCI, for ComReg to set roll out obligations aligned to those resulting from the BCI competition for multiplex contracts?

4.4 Sanctions for non-compliance with licence terms

In issuing the national DTT multiplex licences ComReg needs to be satisfied that licensees will comply with the licence terms. In the event of non-compliance, ComReg will apply the sanctions it will have set out in the licence.

ComReg considers that the licensee will be responsible for ensuring compliance with the licence terms. In the case of operators, who benefit from multiplex licences issued to the BCI, ComReg will expect that compliance with the licence requirements, such as rollout obligations or technical conditions, will be passed on as contractual obligations by the BCI.

In the event of the failure by a licensee, or by a party contracted to a licensee, to observe the conditions of the licence, ComReg reserves the right to terminate, suspend, reduce the geographical area of the licence and re-use spectrum thus released and / or reduce the term of the national DTT multiplex licence.

4.4.1 Voluntary sanctions

ComReg may consider alternative sanctions or the use of voluntary sanctions and would welcome suggestions in relation to suitable alternatives.

Q. 8. Do you see merit in seeking voluntary sanctions for non compliance with licence conditions for example, failure to meet roll out obligations set down in the licence? If yes, please indicate what sort of voluntary penalties might be appropriate and give reasons for your answer?

4.5 Provision of information

It is a standard provision in most spectrum licences issued by ComReg that the licensee is obliged to provide whatever information[8] is required by ComReg in order for it to assess the licensee's compliance with regulatory requirements.

ComReg is minded to include a similar provision in the DTT multiplex licences issued to RTÉ and the BCI.

Where the benefits of a licence have been passed on to a third party, it will be a matter for the licensee to make appropriate arrangements to acquire the information required by ComReg.

4.6 Other relevant conditions

ComReg is also minded to include other provisions some of which feature in most spectrum licences issued by ComReg including the following:-

4.6.1 Telecoms Data Cap

ComReg believes that the provision of data services and internet on a DTT multiplex should be secondary to the provision of programming services both television and radio. It recognises, however, that there may be residual capacity in a multiplex which may be used for non-broadcast related purposes and has no objection to the use of such residual capacity for the provision of such services.

In order to reinforce the primacy of broadcast services in a DTT multiplex, ComReg intends to impose a "telecoms data" cap as a licence requirement for each multiplex.

The telecoms data cap to be imposed is 20 percent of the capacity of each multiplex at any one time, subject to a cumulative maximum of 15 percent in any 24hour period.

There are other delivery media which are more suited to the provision of telecoms data for example, DSL, cable or FWA.

[8] An example of information that may be required might include relevant information regarding the technical performance of the transmitter stations that are used to carry the multiplexes.

Q. 9. Do you agree that the concept of a "telecoms data" cap reflects the primacy of programming services, both television and radio, in DTT multiplexes?

Q. 10. Do you agree with the structure of the data cap as proposed? If not, what structure would be appropriate and give the reasons for your proposal?

4.6.2 Other authorisations and responsibilities

The licensee will be required to obtain all other authorisations necessary, and/or fulfil other obligations in respect of the services which it plans to provide. These matters will be covered by the ComReg licensing process and the onus will be on the licensee to obtain all such approvals, consents, licences, permissions, and authorisations required in connection with the provision of the service

4.6.3 Variation of licence

At any time, ComReg may amend, or vary, the terms of the licence, following such public consultation as is deemed appropriate by ComReg, provided that the licensee is given reasonable opportunity to make representations regarding the proposed amendment or variation and that ComReg has considered those representations.

4.6.4 Non-ionising radiation

It is a standard provision in most spectrum licences issued by ComReg that the licensee shall ensure that non-ionising radio emissions from each radio installation operated under its licence are within the limits specified by the guidelines published by the International Commission for Non-Ionising Radiation Protection (ICNIRP) and any radiation emission standards adopted and published from time to time by ICNIRP or its successors or any emission standards specified by national and EC Law.

Q. 11. Do you consider that any other relevant conditions should apply? If so, please specify and give the reasons for your proposal?

4.7 Draft Technical Conditions – DTT Multiplex Licence

4.7.1 Definitions and Glossary of terms

4.7.1.1 Carrier to Noise ratio

The difference in decibels between the carrier level at a given point in the system and the noise level at that point (measured within a bandwidth appropriate to the television or radio system in use).

4.7.1.2 ComReg

Commission for Communications Regulation.

4.7.1.3 Conditional Access Service Provider

A provider of conditional access services or operator of conditional access systems.

4.7.1.4 Digital Multiplex

A signal (which in its baseband form is a DVB transport stream, but is a signal with a bandwidth of 8 MHz in UHF and 7 MHz in VHF Band III, when modulated) containing more than one programme service, with associated and other data.

4.7.1.5 Digital Multiplex Provider

Provider of the above service.

4.7.1.6 Digital Terrestrial Television System

A Digital Terrestrial Television System (DTT) is a system used for the transmission of a modulated data stream containing Digital Multiplexes in the broadcasting bands III, IV and V intended for direct reception by the general public.

4.7.1.7 Effective Antenna Height (Eff. Ht.)

The height in metres above the average level of the ground between distances of 3 and 15 Km from the transmitter. This is calculated for each of 36 evenly spaced radials (10 degree separation) starting from true North [9].

Note: This takes into account both the height of the site (a.s.l) and the height of the mast (a.g.l).

[9] This can be calculated by ComReg using the national grid reference for the transmitting station, consisting of one letter and six digits, provided the site height above sea level and the antenna height above ground level are supplied.

4.7.1.8 Effective Radiated Power (e.r.p.) (in a given direction)

The product of the power supplied to the antenna and its gain in a given direction relative to a half-wave dipole. This is usually expressed in decibels relative to one watt (dBW).

4.7.1.9 EPG

Electronic Programme Guide is the means by which a user can navigate around the supplied services.

4.7.1.10 Encryption

A means of encoding a Programme Service, such that it is only available to subscribers who are authorised to avail of such a service.

4.7.1.11 European Standards Body

A body such as ETSI, the IEC or CENELEC, which sets standards for equipment or services.

4.7.1.12 Omnidirectional Antenna.

An antenna having a horizontal radiation pattern with variations of 2 dB, or less, over 360 degrees.

4.7.1.13 Programme Redistribution Operator

The operator of a system for the retransmission or relay of programme service multiplexes on a point-to-multipoint basis over-the-air or by cable.

4.7.1.14 Programme Service Multiplex

A signal containing more than one Programme Service with associated and other data.

4.7.1.15 Programme Service Multiplex Provider

Provider of the programme service multiplex.

4.7.1.16 Programme Service Provider

A compiler of programme content into a programme service.

4.7.1.17 Set Top Box

A device, which can receive and demodulate fully a scrambled Programme Service, which when a normal television is connected to it enables a subscriber to view such a service.

4.7.1.18 Station

One or more transmitters or receivers, or a combination of transmitters and receivers, including the associated equipment necessary, at one location implementing a digital terrestrial television system.

4.7.1.19 Transcontrol

The means where, upon payment of any relevant charges, a Programme Redistribution Operator may access Programme Services and retransmit them using their own Technical Services.

4.7.1.20 Transport Stream

A data stream corresponding to the relevant ETSI (DVB) standards carrying MPEG encoded video and associated or other data.

4.7.2 Purpose

This section of the document specifies draft multiplex and transmission characteristics attached to a DTT multiplex licence.

4.7.3 Summary Information

These conditions detail the characteristics of the equipment that need to be considered for the purposes of the provision of a satisfactory service to the subscriber and safety. They do not include detailed equipment specifications.

These conditions also detail those characteristics relevant for ensuring compatibility with other authorised users of the radio frequency spectrum.

The parameters specified in this document are mainly based on those given in IEC, ETSI and CENELEC documents: ISO/IEC 13818-1, 2, 3, ISO/IEC 14496, EN 300 468, TR 101 211, TR 101 289, EN 301 192, EN 50221 and EN 300 472.

For issues not referred to by this document, the licensee shall comply with standards set out in any relevant ETSI, IEC or CENELEC standard relating to DVB (Digital Video Broadcasting).

ComReg does not require evidence of type approval of equipment. Instead a procedure of system audits will apply.

The conditions specified in this document may be revised and/or added to from time to time.

Nothing contained in these conditions shall absolve the licensee from any requirement in law to obtain whatever additional consents, permissions, authorisations, or licences, necessary for the exercise of entitlements under the licence.

4.7.4 System Transparency

Television:
Unless specifically excluded by the licence, the Digital Multiplex shall be implemented in such a manner that it is capable of relaying all components within a Programme Service intended for general reception[10], [11].

Note: - This would include the EPG, TeleText and additional sound channels associated with the vision material. (see Section, 4.7.5.4)

4.7.5 DTT Multiplex Characteristics

4.7.5.1 System Engineering:-

4.7.5.1.1 General

The mechanical and electrical construction of the installation shall be in accordance with best practice.

The practice of good system engineering is a necessary requirement to ensure the provision of a high quality service and the minimising of the potential for interference to, or from, radiocommunication services operating in accordance with the Irish Table of Frequency Allocations.

4.7.5.2 Equipment Construction:-

4.7.5.2.1 General

All controls, meters, indicators and terminals shall be clearly labelled. Details of the main and any auxiliary power supply from which the equipment is intended to operate shall be clearly indicated.

4.7.5.2.2 Controls

Controls which, when wrongly adjusted, change the system parameters, increase the risk of interference or cause improper functioning of the transmitter and other appropriate equipment, shall be immediately accessible to qualified personnel only.

4.7.5.2.3 Manufacturer's Identification.

The equipment shall be labelled with the manufacturer's trademark, type designation and serial number.

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[10] While not intended for reception by the general public, the broadcast organisations may include Test signals in the Transport Stream. The system must be transparent to these signals, so as to facilitate performance measurements.

[11] While the Multiplexing System shall be designed to relay all the components within a television signal, the actual components relayed shall take account of the copyright arrangements between the licensee and the service provider.

4.7.5.3 Installation Certification and Maintenance:-

4.7.5.3.1 Access and Personnel

The licensee shall, on a request made by an authorised officer of ComReg, facilitate that officer in the inspection [12] of any part of the Digital Multiplex System installation.

Only authorised personnel shall have access to the Digital Multiplex System for the purpose of adjustment and/or maintenance of that equipment.

The licensee shall ensure that all authorised personnel are adequately trained for the functions they are to undertake.

4.7.5.3.2 Examination and Testing

When the installation of equipment is complete, the licensee shall examine the station and indicate to the Digital Terrestrial Television Operator whether the installation is ready to commence operation in accordance with these conditions. Permission for on-air testing prior to the examination and commencement of regular service can be obtained. On commencement of operation, the licensee shall inform ComReg of the date of commencement and provide certification indicating that the station is operating in accordance with the specified conditions and characteristics.

4.7.5.3.3 Maintenance

The Digital Multiplex installation shall be so maintained as to always comply with these conditions. The licensee shall ensure that a suitably qualified person has the necessary technical training, knowledge and practical experience so as to be able to certify that the installation and maintenance of the installation complies with these conditions. The licensee shall examine the installation annually to ensure compliance and shall keep a log indicating the dates and results of these examinations.

A copy of any maintenance programme and the log shall be made available to an authorised officer of ComReg on request.

4.7.5.3.4 Weather Protection.

All apparatus and cables exposed to weather, corrosive atmosphere, or other adverse conditions shall be so constructed, or protected, as may be necessary to prevent danger, or interference, arising from such exposure.

[12] Inspection shall include the undertaking of measurements.

4.7.5.4 System Standards:-

4.7.5.4.1 Frequency Spacing and Bands of Operation

Nominal radio-frequency channel bandwidth occupied by a modulated Digital Multiplex for UHF:- Band IV and V	8MHz
Nominal radio-frequency channel bandwidth occupied by a modulated Digital Multiplex for VHF:- Band III	7MHz

4.7.5.4.2 Encoding Standards

MPEG 2

System	ISO/IEC 13818-1
Video *	MPEG 2 Main Profile, Main Level, ISO/IEC 13818-2
Audio	MPEG 2 layer I and II, ISO/IEC 13818-3
Data (Additional services for general reception)	EN 301 192
Data (Additional services for closed user groups)	EN 301 192
Technical Services (CA Message sections)	TR 101 289

**Note: Higher levels and profiles may be used for the provision of HDTV.*

MPEG 4

System	ISO/IEC 14496-1
Video *	ISO/IEC 14496-10, MPEG4 Advanced Simple Profile, Level 5.0 or Main Profile, Level 4.0
Audio	ISO/IEC 14496-3, AAC
Data (Additional services for general reception)	EN 301 192
Data (Additional services for closed user groups)	EN 301 192
Technical Services (CA Message sections)	TR 101 289

4.7.5.4.3 Other Video and Audio Parameters

SD Video Frame rate	25 or 50Hz
SD Aspect Ratio	4:3 or 16:9
SD Resolution	720 x 576
Audio Sampling Frequency	48kHz
Emphasis	None
HD Video Frame rate	25 or 50Hz
HD Aspect Ratio	4:3, 14.9or 16:9
HD Resolution	1920 x 1080 (1080i)
Audio Sampling Frequency	48kHz
Emphasis	None

4.7.5.4.4 Minimum Programme Bit rates

MPEG 2

Encoded Video	4.5Mbps[13]
Encoded Audio, Stereo Channel	256kbps[14]
Encoded Audio, Mono Channel	96kbps

If the original Programme Service has an Encoded Video bit rate of less than 4.5Mbps, then that Programme service must be relayed at the supplied rate.

MPEG 4

Encoded Video	2.2Mbps
Encoded Audio, Stereo Channel	128kbps
Encoded Audio, Mono Channel	64kbps

If the original Programme Service has an Encoded Video bit rate of less than 2.2Mbps, then that Programme service must be relayed at the supplied rate.

In both cases the Encoded Video bit rate may be reduced:-

1 if the operator can objectively show that their system can provide a Video signal with the equivalent resolution, as an ITU-R grade 4 PAL I signal; and/or

2 if the programme falls into one of the following categories for exemption.
- a) Archival footage (Black and white).
- b) Footage originated on a non-broadcast format.

[13] Mega bits per second

[14] kilo bits per second

c) News bulletins.
d) Parliamentary broadcasts.
e) Educational Programmes

No other programme categories may be broadcast at a lower bit rate.

ComReg reserves the right to monitor and assess the licensee's picture quality and any abuse of the exemption above will lead to its withdrawal.

4.7.5.5 Programme Specific Information:-

All Transport Streams shall provide the tables and descriptors of Programme Specific Information (PSI) as required by the ISO/IEC standard 13818-1, EN 300 468 and TR 101 211. All items should be used in the manner specified in 101 TR 211.

Each Transport Stream shall carry the following PSI tables: NIT, PAT, and PMT. Where a Conditional Access system is used, the Transport Stream shall carry a CAT.

The PIDs of all Transport Stream packets in the Transport Stream shall be one of the PIDs defined by ISO/IEC 13818-1 or EN 300 468 or be described in the CAT, PAT or PMT[15].

4.7.5.6 Service Information:-

SI tables and descriptors shall be provided in all Transport Streams, as required by EN 300 468 and TR 101 211, in particular the following:-

- **NIT** This must be carried by each transport stream and must describe all the Transport Streams from a specified point of emission regardless of whether they are part of the same network.

- **SDT** This must be carried by each transport stream and must describe all the Transport Streams from a specified point of emission, regardless of whether they are part of the same network. The service descriptors shall carry real and unique service names.

- **EIT** [16] Both the Present EIT and the following one, must be carried by all Transport Streams from a specified point of emission. Each EIT shall carry a short event name with a real name of up to 32 characters. Event

[15] Ghost PIDs may be used for test purposes.

[16] If the Licensee is providing schedule information in a proprietary form, such as an EPG on a Transport Stream, then the aforesaid Transport Stream shall carry the EIT schedule information for that Programme Service or Services for a period of at least 24 hours in advance.

transitions shall be accurate, matching the actual transmission on the Programme Service to within 1 second.

Advertising breaks may not be regarded as events. Only programme material as defined in ETSI EN 300 468 may be regarded as events. The running status codes must be implemented as in the specification EN 300 468 and according to the guidelines laid down in TR 101 211.

Event Pause must be implemented during advertising breaks.

- **TOT** All Transport Streams shall carry TOTs with a time offset descriptor for at least Ireland, the country code is specified in ISO 3166. The values of current time offset and next time offset shall reflect the legal requirement in Ireland at the time of broadcast.

- **TDT** All Transport Streams shall carry this table and this shall be transmitted every 30 seconds.

- **ST** All Transport Streams shall carry this table.

4.7.5.7 Service Information Codes:-

As defined in TR 101 162.

4.7.5.8 Software Updates and Encryption:-

Changes to software and/or services, should be implemented 'over the air' with the data in the form dictated by EN 301 192.

Encryption data may be included in the Digital Multiplex to enable only authorised subscribers to view certain programmes.

4.7.5.9Additional Broadcasting Services:-

4.7.5.9.1 Permitted Additional Broadcasting Services

The transmission of a subtitling EPG or teletext service is permitted. Any data carried which is an integral part of the programme shall conform to the methods described in EN 301 192 and observe the guidelines referenced in TR101 202 and TR 101 211The subtitling system used must conform to EN 300 743 or any future European standard describing the implementation of such services. 'Over the air' software updates to set top boxes conforming to TS 102 006 are also permitted.

4.7.5.9.2 Additional Broadcasting Services Requiring Approval from ComReg

Prior approval must be obtained from ComReg for any additional services, other than those indicated in Section 4.7.5.9.1, which are included within a Digital Multiplex.

4.7.5.10 System Performance:-

4.7.5.10.1 Impairment Quality

The performance limits set out in this section apply in the presence of all signals for which the Digital Multiplex System was designed. There are three main forms of visible interference in a digital television signal. These are exhibited by artefacts; such as an absence of picture, freezing of frames and blocking (where the picture turns into course blocks).The signal should be free from all such interference, and be present for 99.99% of the time, as scheduled. All reasonable efforts should be made to ensure that any signal or signals under the control of the Digital Multiplex Provider are sufficiently reliable to enable the successful demodulation and decoding of Programme Services by authorised subscribers.

4.7.5.11 Information to be submitted to ComReg:-

4.7.5.11.1 Update of System Information

The licensee shall, upon request from ComReg, submit in a format specified by ComReg: -

- details of Programme Services, including Programme Service Provider, position and ID in the Digital Multiplex.
- the percentage of capacity available on the Digital Multiplex for Core and/or Secondary services.
- all relevant information as requested by ComReg.

The licensee shall notify ComReg immediately any change occurs.

4.7.5.12 Conditions for the Operation of Conditional Access Systems:-

4.7.5.12.1 Definition of a Conditional Access System/Service

A system or service or any part thereof controlling access to digital television services, so that only authorised subscribers receive such services. This includes *Encryption Services*, that is to say, any encryption of signals for digital television services; and the conveyance by such a system of encryption information.

4.7.5.12.2 Subscriber Authorisation Services

That is to say:-

a) the means to actuate or control remotely or otherwise decoders or any other such device; or

b) the initial transmission of messages connected with the aforesaid.

4.7.5.12.3 Subscriber Management Services

That is to say:-

a) the preparation and/or supply to subscribers of essential components; or

b) the preparation from subscribers orders of instruction for authorisation signals, for transmission to decoders; or

c) both.

4.7.5.12.4 Technical Services:-

Technical Services, such as

a) 4.7.5.12.1,2 and 3 above; or

b) any part thereof which is of a technical nature, which prevents the digitally transmitted services of the Programme Service provider, or the Programme Service Multiplex provider, being accessed by subscribers.

4.7.5.13 Condition 1, Standards:-

1. Licensees in the State, intending to use the above Conditional Access Systems as defined or part thereof, must use either of the systems referred to in a) or b) below.

    a) Multicrypt technology, as specified in CENELEC standards EN50221 and R 206001.
    b) Simulcrypt technology, as specified in ETSI standards TS 101 197-1, 101 197-2.

2. Licensees must ensure that any Set Top Box offered for sale, lease, rent or otherwise made available by them is fully labelled to indicate the equipment functionality and that user manuals clearly document any limitations of the equipment.

4.7.5.14 Condition 2, Service Obligations for Conditional Access Service Providers:-

1. Any Technical Services, in respect of the licensee's Conditional Access System, offered by the licensee to a programme service provider or a programme service multiplex provider shall be offered on a fair, reasonable and non-discriminatory basis.

2. If any Technical Service is provided under Paragraph 1 the licensee shall co-operate with the programme service provider or programme service multiplex provider and do whatever is required, within reason, to ensure the interconnection and or interoperability of the relevant system and all associated apparatus for provision and maintenance of Technical Services.

3. The licensee shall not cause the programme service provider or programme service multiplex provider to incur costs or incremental expenditure in interfacing with the licensee's apparatus or systems greater than the initial charge for the Technical Service or disproportionate to the benefit to be gained from the use of the Technical Services.

4.7.5.15 Condition 3, Cost Effective Transcontrol:-

1. Where;

   the licensee provides to a programme service provider or programme service multiplex provider any Technical Service in relation to the provision of digital video services; and the programme service provider's or programme service multiplex provider's digital video services are provided to a programme redistribution operator for the purpose of redistribution;

   The licensee shall co-operate with and assist the programme redistribution operator, providing all information and assistance necessary to facilitate cost effective transcontrol, whereby the programme redistribution operator can transcontrol and redistribute the digital video service using its own Technical Services.

2. Where;

   the licensee does not provide any Technical Services but contracts a conditional access service provider to provide Technical Service in relation to the provision of digital video services, which digital video services are then provided to a programme redistribution operator for the purpose of redistribution:

   The programme service multiplex provider or programme redistribution operator shall make all reasonable efforts to ensure that the Conditional

Access Service provider co-operates and assists the programme redistribution operator, providing all information and assistance necessary to facilitate cost-effective transcontrol, whereby:-

The programme redistribution operator can transcontrol and redistribute the digital video service using its own Technical Services.

4.7.5.16 Condition 4, Prohibition on Linked Sales:-

1. The licensee shall not attach any condition on the provision of Technical Services where such condition requires the purchase of:-

   a) another service from the licensee, except where the service is essential for the operation of the Technical Service requested; or

   b) any apparatus or system, unless the requested Technical Service cannot be provide without such apparatus or system.

2. The licensee may offer bulk discounts on more favourable terms and conditions in respect of a quantity of Technical Services and apparatus it supplies; however, such discount charges (or favourable terms and conditions) should not be more favourable than would have been available for the provision a single Technical Service or apparatus alone.

4.7.6 DTT Transmission characteristics

4.7.6.1 System Engineering:-

4.7.6.1.1 Weather Protection.

All apparatus and cables exposed to weather, corrosive atmosphere, or other adverse conditions shall be so constructed, or protected, as may be necessary to prevent danger, or interference, arising from such exposure.

4.7.6.2 System Standards:-

4.7.6.2.1 Transmission Standard

The Transmission Standard used shall be the DVB-T standard as specified in EN 300 744.

4.7.6.3 Summary List of Parameters:-

4.7.6.3.1 Frequency Spacing and Bands of Operation

Nominal radio-frequency channel bandwidth occupied by a modulated Digital Multiplex for UHF:- Band IV and V	8MHz
Nominal radio-frequency channel bandwidth occupied by a modulated Digital Multiplex for VHF:- Band III	7MHz

4.7.6.3.2 Modulation

Modulation (COFDM)	X7F
Number of carriers	6817
Carrier Modulation	16QAM or 64QAM
Guard Interval (Single Frequency Network)* (Multi Frequency Network or SFN where the inter-station distance is less than 8.5km)	1/8 to 1/32

**Note: Where a station that is a member of an SFN loses synchronisation, then the output of that station should be reduced by 6dB, or the station should cease transmission, to avoid interference with the remaining synchronised stations.*

4.7.6.3.3 Emission Designation

UHF Band IV and V (470 to 862MHz)	8M00X7FXF
VHF Band III (174 – 230MHz)	7M00X7FXF

4.7.6.3.4 Software Updates

Changes to software, and/or services, should be implemented ‘over the air’ with the data in the form dictated by EN 301 192 or TS 102 006.

Encryption data may be included in the Digital Multiplex to enable only authorised subscribers to view certain programmes.

4.7.6.4 Additional Broadcasting Services:-

4.7.6.4.1 Permitted Additional Broadcasting Services

The transmission of a subtitling EPG or teletext service is permitted. Any data carried which is an integral part of the programme shall conform to the methods described in EN 301 192 and observe the guidelines referenced in TR101 202 and TR 101 211The subtitling system used must conform to EN 300 743 or any future European standard describing the implementation of such services. 'Over the air' software updates to set top boxes conforming to TS 102 006 are also permitted.

4.7.6.4.2 Additional Broadcasting Services Requiring Approval from ComReg

Prior approval must be obtained from ComReg for any additional services, other than those indicated in Section 4.7.6.4.1, included within a Digital Multiplex.

4.7.6.5 System Performance:-

4.7.6.5.1 Impairment Quality

The performance limits set out in this section apply in the presence of all signals for which the Digital Terrestrial Television System was designed.

There are three main forms of visible interference in a digital television signal. These are exhibited by artefacts; such as an absence of picture, freezing of frames and blocking (where the picture turns into course blocks).

The signal should be free from all such interference for 99% of the time at 99% of locations served.

4.7.6.5.2 Frequency Stability

The equipment shall be designed to operate on the assigned frequency in the frequency Bands III, IV and V only.

The frequency tolerance shall be

Fs = Bw/100N

Fs	Frequency Stability
Bw	Bandwidth (8 MHz or 7 MHz)
N	No of carriers

Or

- ± 250 Hz, for transmitters for which the licence characteristics do not require the use of offset and are part of a Multi Frequency Network.

- ± 1 Hz, for transmitters for which the licence characteristics require the use of offset or are part of a single frequency network

The transmitter frequency adjustment control shall be accessible to qualified personnel only.

4.7.6.5.3 Power

As the total effective radiated power is the sum of the transmitter output power (in dBW) and the gain of the antenna (in dB), the output power of transmitter shall be adjustable so that the value of the effective radiated power permitted for each station is not exceeded.

If the equipment is designed to operate with different levels of power, the rated output power for each power level must be declared by the manufacturer.

4.7.6.5.4 Maximum Permitted Levels of Spurious Emissions

The maximum permitted level of spurious emission for a transmitting station shall be:-

- at least 40 dB below the transmitter e.r.p. and shall not in any case:-
  exceed -46 dBW for a transmitter e.r.p. less than, or equal to, 14dBW.

- at least 60dB below the transmitter e.r.p. and shall not in any case:-
  exceed -17 dBW for transmitter e.r.p. above 14 dBW.

4.7.6.6 Overview of National Band Plan:-

4.7.6.6.1 Frequency Channels and Standard Groups

The frequency bands for broadcasting are bands III, IV and V.

Due to the phased development of the Digital Terrestrial Television System, a station may initially have coverage in excess of the planned service area. With the introduction of additional stations, it is to be expected that this extended service area will be reduced.

4.7.6.6.2 Assignment List

A list of the Assignments, which constitute the national plan, will be maintained by ComReg.

4.7.6.6.3 Planning Parameters

The planning parameters used by ComReg correspond to those set out in the Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Region 1 and 3, in the frequency bands 174 – 230 MHz and 470 – 862 MHz, Geneva 2006 (GE06). This was a conference convened by the ITU. A summary of these parameters is given below.

Table 1.0

Parameter	Description	Value used
Propagation using terrain data	Wanted Signal: Unwanted Signal, Domestic: Unwanted Signal, DVB-T and RBL[17]:	50% location, 50% time 50% location, 5% time 50% location, 1% time
Quality of service	Continuous Interference: Tropospheric Interference:	Grade 4 [18] Grade 3 [19]
Polarisation Discrimination	Domestic: RBL:	15 dB 20 dB

Table 2.0

Parameter	Description	Value used
Maximum Receive antenna directivity	Domestic: RBL:	16 dB 20 dB

Analogue television (for information)

Table 3.0

Parameter	Description	Value used
Analogue Protection Ratios	Co-channel, continuous	52 dB, no offset
		40 dB, 3/12 line offset
	Co-channel, tropospheric	45 dB, no offset
		30 dB, 3/12 line offset
	Lower Adjacent Channel	-9 dB, tropospheric
	Upper Adjacent Channel	-12 dB, tropospheric
	Image channel	-10 dB, tropospheric
	Local oscillator channel	-10 dB, tropospheric
Analogue Protection Ratios, with precision offset	Continuous, no offset	36 dB
	Tropospheric, no offset	32 dB
	Continuous, 3/12 line offset	27 dB
	Tropospheric, 3/12 line offset	22 dB

Table 4.0

Parameter	Description	Value used
Analogue, PAL I interfered with by DVB-T 8 MHz.	Co-channel, continuous	40 dB
	Co-channel, tropospheric	34 dB
Analogue vision signal interfered with by a DVB-T 8 MHz channel.	Lower adjacent, continuous	-5 dB
	Lower adjacent, Tropospheric	-9 dB
	Upper adjacent, continuous	-5 dB
	Upper adjacent, tropospheric	-8 dB

[17] Radio Broadcasting Link

[18] Grade 4: Perceptible, but not annoying

[19] Grade 3: Slightly annoying

Table 5.0

Parameter	Description	Value used
Analogue, PAL I interfered with by DVB-T 7 MHz.	Co-channel, continuous	41 dB
	Co-channel, tropospheric	35 dB
Analogue vision signal interfered with by a DVB-T 7 MHz channel.	Lower adjacent, continuous	-5 dB
	Lower adjacent, tropospheric	-9 dB
	Upper adjacent, continuous	-5 dB
	Upper adjacent, tropospheric	-8 dB

Digital Video Broadcasting – Terrestrial (DVB-T)

Table 6.0

Parameter	Description	Value used
Protection rations for co-channel DVB-T interfered with by DVB-T, for fixed reception.	16-QAM 1/2	11.00 dB
	16-QAM 2/3	14.00 dB
	16-QAM 3/4	15.00 dB
	16-QAM 5/6	16.90 dB
	16-QAM 7/8	17.50 dB
	64-QAM 1/2	17.00 dB
	64-QAM 2/3	20.00 dB
	64-QAM 3/4	21.00 dB
	64-QAM 5/6	23.30 dB
	64-QAM 7/8	24.30 dB

Table 7.0

Parameter	Description	Value used
Protection rations for co-channel DVB-T interfered with by DVB-T, for portable indoor reception.	16-QAM 1/2	13.00 dB
	16-QAM 2/3	16.00 dB
	16-QAM 3/4	18.00 dB
	16-QAM 5/6	19.40 dB
	16-QAM 7/8	20.10 dB
	64-QAM 1/2	19.00 dB
	64-QAM 2/3	23.00 dB
	64-QAM 3/4	25.00 dB
	64-QAM 5/6	25.80 dB
	64-QAM 7/8	26.90 dB

Table 8.0

Parameter	Description	Value used
Protection ratios for DVB-T interfered with by DVB-T.	Lower adjacent	-30 dB
	Upper adjacent	-30 dB

Table 9.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T,	16-QAM 1/2	-8.0 dB	-8.0 dB
	16-QAM 2/3	-3.0 dB	0.0 dB
	16-QAM 3/4	0.0 dB	2.5 dB
	16-QAM 5/6	9.0 dB	10.3 dB

fixed reception, interfered with by co-channel analogue television.	16-QAM 7/8	16.0 dB	17.40 dB
	64-QAM 1/2	-3.0 dB	0.0 dB
	64-QAM 2/3	3.0 dB	4.5 dB
	64-QAM 3/4	9.00 dB	12.0 dB
	64-QAM 5/6	15.0 dB	16.30 dB
	64-QAM 7/8	20.0 dB	21.4 dB

Table 10.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, portable indoor reception, interfered with by co-channel analogue television.	16-QAM 1/2	- 8.0 dB	-8.0 dB
	16-QAM 2/3	- 3.0 dB	3.0 dB
	16-QAM 3/4	0.0 dB	5.0 dB
	16-QAM 5/6	9.0 dB	12.8 dB
	16-QAM 7/8	16.0 dB	20.0 dB
	64-QAM 1/2	- 3.0 dB	3.0 dB
	64-QAM 2/3	3.0 dB	6.0 dB
	64-QAM 3/4	9.00 dB	15.0 dB
	64-QAM 5/6	15.0 dB	18.8 dB
	64-QAM 7/8	20.0 dB	24.0 dB

Table 11.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, fixed reception and portable indoor reception, interfered with by lower adjacent (N – 1) analogue television.	16-QAM 1/2	- 43.0 dB	- 43.0 dB
	16-QAM 2/3	- 42.0 dB	- 42.0 dB
	16-QAM 3/4	- 38.0 dB	- 38.0 dB
	16-QAM 5/6	- 39.4 dB	- 39.4 dB
	16-QAM 7/8	- 38.9 dB	- 38.9 dB
	64-QAM 1/2	- 40.0 dB	- 40.0 dB
	64-QAM 2/3	- 35.0 dB	- 35.0 dB
	64-QAM 3/4	- 32.0 dB	- 32.0 dB
	64-QAM 5/6	- 32.0 dB	- 32.0 dB
	64-QAM 7/8	- 31.1 dB	- 31.1 dB

Table 12.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, fixed reception and portable indoor reception, interfered with by upper adjacent (N + 1) analogue television.	16-QAM 1/2	- 45.4 dB	- 45.4 dB
	16-QAM 2/3	- 43.0 dB	- 43.0 dB
	16-QAM 3/4	- 41.5 dB	- 41.5 dB
	16-QAM 5/6	- 40.4 dB	- 40.4 dB
	16-QAM 7/8	- 39.9 dB	- 39.9 dB
	64-QAM 1/2	- 40.2 dB	- 40.2 dB
	64-QAM 2/3	- 38.0 dB	- 38.0 dB
	64-QAM 3/4	- 36.4 dB	- 36.4 dB
	64-QAM 5/6	- 35.0 dB	- 35.0 dB
	64-QAM 7/8	- 34.1 dB	- 34.1 dB

Table 13.0

Parameter	Description	Gauss	Value used

Protection ratios for DVB-T (7 MHz), fixed reception, interfered with by overlapping 8 MHz analogue television.	16-QAM 1/2	- 5.8 dB	- 4.8 dB
	16-QAM 2/3	- 3.4 dB	- 2.3 dB
	16-QAM 3/4	- 1.9 dB	- 0.7 dB
	16-QAM 5/6	- 0.8 dB	0.5 dB
	16-QAM 7/8	- 0.3 dB	1.1 dB
	64-QAM 1/2	- 0.2 dB	0.8 dB
	64-QAM 2/3	2 dB	3.1 dB
	64-QAM 3/4	3.6 dB	4.8 dB
	64-QAM 5/6	5.0 dB	6.3 dB
	64-QAM 7/8	5.9 dB	7.3 dB

Table 14.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T (7 MHz), portable indoor reception, interfered with by overlapping 8 MHz analogue television.	16-QAM 1/2	- 5.8 dB	- 2.6 dB
	16-QAM 2/3	- 3.4 dB	0.0 dB
	16-QAM 3/4	- 1.9 dB	1.7 dB
	16-QAM 5/6	- 0.8 dB	3.0 dB
	16-QAM 7/8	- 0.3 dB	3.7 dB
	64-QAM 1/2	- 0.2 dB	3.0 dB
	64-QAM 2/3	2 dB	5.4 dB
	64-QAM 3/4	3.6 dB	7.2 dB
	64-QAM 5/6	5.0 dB	8.8 dB
	64-QAM 7/8	5.9 dB	9.9 dB

Table 15.0

Parameter	Description	Value used
Protection ratios for DVB-T, fixed reception, interfered with by co-channel T-DAB.	16-QAM 1/2	16.00 dB
	16-QAM 2/3	19.10 dB
	16-QAM 3/4	21.20 dB
	16-QAM 5/6	21.90 dB
	16-QAM 7/8	22.50 dB
	64-QAM 1/2	21.00 dB
	64-QAM 2/3	25.10 dB
	64-QAM 3/4	27.20 dB
	64-QAM 5/6	28.30 dB
	64-QAM 7/8	32.40 dB

Table 16.0

Parameter	Description	Value used
Protection ratios for DVB-T, portable reception, interfered with by co-channel T-DAB.	16-QAM 1/2	18.20 dB
	16-QAM 2/3	21.40 dB
	16-QAM 3/4	23.60 dB
	16-QAM 5/6	24.40 dB
	16-QAM 7/8	25.10 dB
	64-QAM 1/2	23.20 dB
	64-QAM 2/3	27.40 dB
	64-QAM 3/4	29.60 dB
	64-QAM 5/6	30.80 dB

	64-QAM 7/8	35.00 dB

4.7.6.6.4 Minimum Field Strength

The minimum field strengths used in planning are:-

DVB-T, Band III (174 – 230 MHz)

Table 17.0

Parameter	Description	Value used
Minimum median field-strength values (dB(µV/m)) for fixed reception at reference frequency 200 MHz.	16-QAM 1/2	40.60
	16-QAM 2/3	43.10
	16-QAM 3/4	44.70
	16-QAM 5/6	45.90
	16-QAM 7/8	46.50
	64-QAM 1/2	46.20
	64-QAM 2/3	48.50
	64-QAM 3/4	50.20
	64-QAM 5/6	51.70
	64-QAM 7/8	52.70

Table 18.0

Parameter	Description	Value used
Minimum median field-strength values (dB(µV/m)) for portable indoor reception at reference frequency 200 MHz.	16-QAM 1/2	71.80
	16-QAM 2/3	74.40
	16-QAM 3/4	76.10
	16-QAM 5/6	77.40
	16-QAM 7/8	78.10
	64-QAM 1/2	77.40
	64-QAM 2/3	79.80
	64-QAM 3/4	81.60
	64-QAM 5/6	83.20
	64-QAM 7/8	84.30

DVB-T, Band IV/V (470 - 862 MHz)

Table 19.0

Parameter	Description	Value used
Minimum median field-strength values (dB(µV/m)) for fixed reception at reference frequency 500 MHz.	16-QAM 1/2	44.60
	16-QAM 2/3	47.10
	16-QAM 3/4	48.70
	16-QAM 5/6	49.90
	16-QAM 7/8	50.50
	64-QAM 1/2	50.20
	64-QAM 2/3	52.50
	64-QAM 3/4	54.20

	64-QAM 5/6	55.70
	64-QAM 7/8	56.70

Table 20.0

Parameter	Description	Value used
Minimum median field-strength values (dB(µV/m)) for portable indoor reception at reference frequency 500 MHz.	16-QAM 1/2	81.80
	16-QAM 2/3	84.40
	16-QAM 3/4	86.10
	16-QAM 5/6	87.40
	16-QAM 7/8	88.10
	64-QAM 1/2	87.40
	64-QAM 2/3	89.80
	64-QAM 3/4	91.60
	64-QAM 5/6	93.20
	64-QAM 7/8	94.30

The minimum median field-strengths given in the above tables 17 – 20 (above) are for reference frequencies, *fr*, 200 MHz (Band III) and 500 MHz (Band IV/V). For other frequencies, the following interpolation rule shall be used:-

$$E_{med\ (f)} = E_{med\ (fr)} + Corr$$

where:

$E_{med\ (fr)}$ The minimum median field strength at the reference frequency in dBµV/m,
$E_{med\ (f)}$ The minimum median field strength at the actual frequency in dBµV/m,

Fixed reception:-

Corr $Corr = 20 \log_{10} (f/fr)$, *f* is the actual frequency, *fr* is the reference frequency.

Portable reception:-
Corr $Corr = 30 \log_{10} (f/fr)$, *f* is the actual frequency, *fr* is the reference frequency.

The above values are for 10 metres above ground level for fixed reception.
Protection cannot be sought for locations with a field-strength below the values mentioned above.

4.7.6.7 Station Certification and Maintenance:-

4.7.6.7.1 Examination and Testing

Adequate and accurately calibrated test equipment shall be made available for non-radiative measurements of transmitter power, modulation characteristics and spurious emissions whilst the station is undergoing initial alignment and regular maintenance.

Permission for installation and commissioning transmissions prior to the examination and commencement of regular service can be obtained. On

commencement of operation, the licensee shall inform ComReg of the date of commencement and provide certification indicating that the station is operating in accordance with the specified conditions and characteristics.

4.7.6.7.2 Maintenance

The transmission installation shall be so maintained as to always comply with these conditions. The licensee shall ensure that a suitably qualified person has the necessary technical training, knowledge and practical experience so as to be able to certify that the installation and maintenance of the station complies with these conditions. The licensee shall examine a station annually to ensure compliance and shall keep a log indicating the dates, and results, of these examinations.

A copy of any maintenance programme and the log shall be made available to an authorised officer of ComReg on request.

4.7.6.8 Additional and Modified Assignments:-

4.7.6.8.1 Requisite information

The licensee shall provide ComReg with all the necessary details in support of an application for an additional assignment, or a modification of an existing assignment.

4.7.6.8.2 Examination

The licensee shall examine any proposal for an additional, or modified, assignment with regard to other persons having assignments in the same frequency segment.

4.7.6.8.3 Field Strength Measurements

It may be necessary to supply field strength measurements in support of an application or an interference complaint.

4.7.6.8.4 International Agreements

ComReg is bound by the provisions of the Radio Regulations and the Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Region 1 and 3, in the frequency bands 174 – 230 MHz and 470 – 862 MHz, Geneva 2006 (GE-06) in relation to aspects of UHF and VHF Band III broadcast television services. These agreements require ComReg to undertake certain co-ordination and registration procedures when considering additions / modifications of the assignment plan.

A minimum of three months is allowed for co-ordination. However, co-ordination of additional or modified assignments cannot be guaranteed. The licensee shall allow adequate time in planning, and provide ComReg with the relevant information, to ensure compliance with these agreements.

4.7.6.9 Information to be submitted to ComReg:-

4.7.6.9.1 Update of System Information

The licensee shall, upon request from ComReg, submit:

- An up to date frequency plan indicating the Digital Multiplex on any given frequency channel. The licensee shall notify ComReg immediately any change occurs.
- An updated network diagram/map of their system, clearly indicating the most up to date geographical area of operation of their Digital Terrestrial Television System.

5 Submitting Comments

All comments are welcome, however it would make the task of analysing responses easier if comments were referenced to the relevant question numbers from this document.

The consultation period will run from 31 August 2007 to 12 October 2007 during which time the Commission welcomes written comments on any of the issues raised in this paper.

Having analysed and considered the comments received, ComReg will review the DTT multiplex licence conditions and publish a report in November on the consultation which will, inter alia summarise the responses to the consultation.

In order to promote further openness and transparency ComReg will publish all respondent's submissions to this consultation, subject to the provisions of ComReg's guidelines on the treatment of confidential information – ComReg 05/24. We would request that electronic submissions be submitted in an-unprotected format so that they can be appended into the ComReg submissions document for publishing electronically.

Please note
ComReg appreciates that many of the issues raised in this paper may require respondents to provide confidential information if their comments are to be meaningful.

As it is ComReg's policy to make all responses available on its web-site and for inspection generally, respondents to consultations are requested to clearly identify confidential material and place confidential material in a separate annex to their response

Such Information will be treated subject to the provisions of ComReg's guidelines on the treatment of confidential information – ComReg 05/24

Appendix A – List of Transmission sites

The following, List A and List B, are sites where suitable DVB-T frequency assignments have been identified. International co-ordination is currently in process for List A and List B sites, final technical details are not known at the time of this publication. The frequency assignments listed come from Ireland's GE06 frequency plan. Multiplexes (MUX) 1 to 4 are indicated.

LIST A - Main Transmitters	**MUX 1 - 4**			
Cairn Hill	41	44	47	51
Clermont Carn	53	57	60	63
Holywell Hill	25	30	32	35
Dungarvan	55	59	62	65
Kippure	54	58	61	64
Maghera	55	48	67	65
Mt Leinster	39	42	45	49
Mullaghanish	21	24	25	28
Spur Hill	45	49	66	68
Three Rock	54	58	61	64
Truskmore	52	56	53	57
Woodcock Hill	41	44	47	51

LIST B	**MUX 1 - 4**			
Achill	41	44	47	51
Aranmore	41	44	47	51
Casla	41	44	47	51
Castlebar	22	25	28	32
Castletownbere	55	59	62	65
Clifden	23	26	29	33
Clonmel	55	59	62	65
Crosshaven	45	49	66	68
Drogheda	21	24	27	31
Kilduff	53	57	60	63
Fanad	55	59	62	65
Falcarragh	22	25	28	32
Greystones	52	56	66	68
Iorras	22	25	28	32
Kilkeeveragh	41	44	47	51
Knockmoyle	52	56	66	68
Letterkenny	53	57	60	63
Suir Valley	52	56	66	68

The following are sites currently in use by analogue television transmission operators and may be considered suitable for use as part of a DVB-T network. Suitable frequency assignments can be found, if a DVB-T multiplex operator so requires.

Abbeyfeale	Monaghan	Carrickmourne	Glencar Co Leitrim	Macroom
Arklow	Moville	Clonakilty	Glenties	Monasootagh
Ballybofey	Mt Gabriel HP	Clonmany	Headfort	Mossy Glen

Bantry
Blarney
Casla
Clonmel
Cornamona
Dooncarton
Falcarragh
Ferrypoint
Glencolmkille
Gorey
Greystones
Knockanore
Lehinch
Malin
Mitchelstown
Mt Gabriel VP
Wexford
Wicklow
Ashford
Ashleam
Ballingeary
Ballintrillick
Ballydavid
Ballymacarbry
Ballynakilly
Bandon
Bealanabrack
Broadford
Cahir
Carlingford
Crossbarry
Dingle
Drimoleague
Dromanassig
Dunmanway
Dunmore East
Dunquin
Ennistymon
Failmore
Fermoy
Finvarra
Glanmire
Gleann Na Ngealt
Glenbeigh
Glencar Co Kerry
Inchigeelagh
Iniscleire
Inistioge
Kells Co Kerry
Kilgarvan
Kilkee
Killaloe
Killeagh
Kilmacomma
Kilmacthomas
Kinsale
Laragh
Lauragh
Listowel
Maam
Mt Eagle
Mulrany
Nire Valley
Rosscarbery
Tomriland
West Port
Youghal A

Appendix B – Consultation Questions

List of Questions