An Coimisiún um
Rialáil Cumarsáide
Commission for
Communications Regulation

Review of the Fixed Radio Links Licensing Regime

Response to Consultation and Draft Decision including Draft Regulations

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An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation
1 Lárcheantar na nDugaí, Sráid na nGildeanna, BÁC 1, Éire, D01 E4X0.
One Dockland Central, Guild Street, Dublin 1, Ireland, D01 E4X0.
Teil | Tel +353 1 804 9600 Suíomh | Web www.comreg.ie

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Content

Section Page

Annex

Section Page

Table of Figures

Section Page

Table of Tables

Section Page

Chapter 1

1 Executive Summary

1.1 Introduction

1.1 In its Radio Spectrum Management Strategy Statement for the 2019 to 2021 period, ComReg outlined its intention to conduct a review of the Fixed Links Bands and the associated licensing approach. In conducting its review, ComReg considered it important to firstly establish the existing and potential use cases for Fixed Links in Ireland before providing its views on an appropriate licensing framework that would provide for those use cases.

1.2 To inform its considerations, ComReg and its expert advisors DotEcon/Axon conducted a detailed and comprehensive stakeholder engagement process with over 90 licensees, vendors, and equipment suppliers. This engagement revealed that any new licensing framework should provide for five existing use cases[1] and two potential use cases[2]. It also provided important background information regarding recent trends in demand for the various use cases identified. ComReg also published two consultation documents (ComReg Documents 20/109[3] and 21/134[4]) enabling interested parties to submit their views on ComReg's proposals for a new Fixed Radio Link licensing regime.

1.3 This Response to Consultation and draft Decision including draft Regulations ("draft Decision") builds on this important work by permitting ComReg to set out its draft Decision on the proposed new Fixed Link licensing framework and potential improvements that would better ensure the efficient use of the radio spectrum.

1.2 Importance of Fixed Radio Links

1.4 A Fixed Radio Link, also known as a "Fixed Link" or a "microwave link", is a wireless connection for the transmission of information between two or more fixed locations. Fixed Links are used extensively for Point-to-Point telecoms, as well as for Point-to Multipoint telecoms to convey voice and data signals. Fixed links can provide an alternative or a complement to copper cables or fibre and are used for a variety of applications, including backhaul for mobile network base stations; distributing TV

[1] Narrowband telemetry and control applications, broadcast distribution, backhaul from mobile cell sites, fixed wireless access, links within core networks

[2] Advanced FWA & specialist low latency links

[3] ComReg Document 20/109, "*Review of the Fixed Radio Links Licensing Regime*", published 9th November 2020, available at https://www.comreg.ie/

[4] ComReg Document 21/134, "*Review of the Fixed Radio Links Licensing Regime*", published 17th December 2021, available at https://www.comreg.ie/

signals from studios to broadcast transmitter sites; providing direct voice or data connections to end users and connecting nodes within private or corporate communication networks.

1.5 There are currently twenty radio spectrum bands ranging from 1.3 GHz to 80 GHz allocated for Fixed Links in Ireland. The Fixed Links Bands are far from homogenous though, as demonstrated by the varying propagation characteristics of each of these bands, which when taken in the round provide for a diverse set of use cases. This highlights the need for a licensing framework that can accommodate such multiplicity, and which encourages licensees to use spectrum that fits their actual requirements, rather than utilising spectrum that could be better used (or in fact needed) by others.

1.3 Existing Fixed Link Framework

1.6 The existing Fixed Link licensing framework was established in 2009 and has delivered a wide variety of use cases including narrowband telemetry and control, broadcast distribution, backhaul from mobile cell sites, fixed wireless access ("FWA"), and links within core networks, to the benefit of competition and consumers. However, while the current framework has worked well, it was established at a time when the number of Fixed Links was far fewer, and the bandwidth requirements of those links was decidedly less. Since 2009, the number of Fixed Links in use has more than tripled, while the variety of use cases has also increased and with them, a far greater appetite for larger bandwidth. More use cases will undoubtedly emerge in the coming years.

1.7 With that in mind, ComReg is mindful that the existing Fixed Link Licensing Framework, if left unaddressed, might lead to further congestion, reducing spectrum availability and harming the efficient delivery of services in the future.

1.8 Overall, the current Fixed Link Licensing Framework appears unsustainable in the face of an ever-increasing demand for bandwidth. While most frequency bands are currently uncongested, demand for Fixed Links is growing and there is a strong likelihood of greater scarcity arising in the future. For this reason, ComReg considers it appropriate to make changes to the Fixed Links Licensing framework including the licensing fees. This is to promote the more efficient use of all Fixed Links, but also to best safeguard the availability of spectrum for a wide array of uses going forward.

1.9 It should be noted that ComReg envisages that the draft Regulations will be made by ComReg pursuant to section 6 of the Wireless Telegraphy Act 1926, as amended, with the consent of the Minister, further to section 37 of the Communications Regulation Act 2002, and taking into account the current EU Telecoms Framework (namely e.g., S.I. No. 335 of 2011, the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011). ComReg is mindful that the Communications Regulation Bill 2022 is progressing

through the Oireachtas at the moment, and S.I. No. 444 of 2022 (the European Union (Electronic Communications Code) Regulations 2022), which transposes relevant provisions of the European Electronic Communications Code[5], has not yet been commenced.

1.4 Proposed Fixed Link Framework

1.4.1 New Licence Fee Framework

1.10 ComReg is proposing to use a formula-based approach to set Fixed Link fees. This would update the Fixed Link fee framework to ensure it is future-proofed and robust enough to meet present and future changes in demand (i.e., for bandwidth, and across different bands). ComReg's proposal would achieve this in three principal ways:

- First, it would require licensees to pay fees that increase with the Fixed Links bandwidth. This represents a significant enhancement on the current approach, where there is no additional cost for bandwidth above 40 MHz. This should encourage licensees to carefully evaluate any perceived need for additional bandwidth;
- Second, the proposal better reflects the value differences between lower and higher Fixed Link frequencies by establishing a frequency gradient within the range suggested by opportunity cost estimates for the highest band and the lowest band. This should increase the incentive for operators to install equipment in the higher frequency bands instead of lower frequencies in cases where it is feasible to do so; and
- Third, it increases the differential between congested and uncongested bands so that licensees would have a real incentive to use other, cheaper, Fixed Link Bands or even alternative technologies, thereby leaving the spectrum available for higher value users.

1.11 The proposed approach achieves these improvements while keeping overall fee levels broadly neutral[6]. Of course, these changes vary across the licensees. Consequently, in aggregate for each licensee, fees would be composed of a range of increases and decreases depending on how licensees currently deploy existing rights of use. However, any overall increase in fees is relatively modest and it may even be possible for licensees to reduce fees by re-dimensioning their networks over an appropriate period. Finally, any changes on foot of this draft Decision process

[5] Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code.
[6] The average fee for a Fixed Link and average fees paid stakeholder both declines. For further information please see Section 4.3.

would be introduced over a three-year period following the making of any final Decision.

1.4.2 New Regulations for Fixed Links

1.12 ComReg is proposing to replace the existing Regulations (S.I. 370 of 2009) for Fixed Links with a new set of Regulations. The new Regulations for Fixed Links will include:

- licences to which the regulations apply;
- the limitations of the licence;
- application for licences and form of licences;
- the duration and renewal of licences;
- the conditions of licences;
- enforcement, amendment, revocation and suspension;
- licence fees;
- the congested Fixed Links bands; and
- transitional arrangements regarding the implementation of a new fee structure.

1.4.3 New Guidelines for Fixed Links

1.13 ComReg proposes to replace ComReg Document 09/89R2 with a new set of guidelines. The guidelines will provide information to stakeholders on the licensing requirements for individual Fixed Link licences which will include but not limited to:

- An up-to-date band plan for each of the Fixed Links bands including the new channel spacings;
- The minimum technical requirements for deploying Fixed Links;
- An up-to-date high/low database;
- Information on the licensing fees framework;
- Information on the application process and eLicensing functions including the frequency band usage checker; and
- Information about the congestion zones and bands.

1.5 Draft Decision and Draft Regulations

1.14 ComReg has set out its draft Decision in Chapter 6 of this document and proposed its draft Regulations in Annex 4 of this document.

1.6 Next Steps

1.15 Following this, ComReg envisages that a response to this draft Decision together with its final Decision including Regulations would be issued by Q2 in 2023.

Chapter 2

2 Introduction

2.1 Background and Purpose

2.1 The Commission for Communications Regulation ("ComReg") is the statutory body responsible for the regulation of the electronic communications telecommunications, radio communications and broadcasting networks), postal and premium rate sectors in Ireland and in accordance with European ("EU") and Irish law. ComReg also manages Ireland's radio frequency spectrum ("radio spectrum" or "spectrum") and the national numbering resource. Under the Communications Regulation Act 2002, as amended, and the European Electronic Communications Code, ComReg has a range of functions and objectives in relation to the provision of electronic communications networks ("ECN"), electronic communications services ("ECS") and post, which includes ensuring the efficient and effective use of the national radio spectrum resource.

2.2 As noted in ComReg's Electronic Communications Strategy Statement 2021 to 2023[7], radio spectrum, as a medium over which data can be transmitted, is an essential input in the supply of wireless/radio-based ECN / ECS for a diverse range of uses and end-users. It is a valuable national resource as it underpins nearly all communications services in the State. These communication services include mobile telephony, wireless broadband, radio and television broadcasting and radio communications used by commercial business and by air and maritime transport. Many services rely on wireless connectivity as part of the backbone linking mobile base stations, providing feeds to broadcast transmitters and telemetry links that allow the monitoring of disperse infrastructure, for example water reservoir levels and remote power transformers.

2.3 The demand for radio spectrum continues to grow, driven by society's ever-increasing requirements in terms of access to data intensive services while on the move. In this context it is ComReg's goal[8] that the management of spectrum facilitates competition, enhances connectivity, and promotes efficient investment.

2.4 A key service for telecommunication infrastructure development is the fixed service which is a radio communication service between specified fixed geographic points. Some examples of fixed service applications are fixed links, transport networks

[7] ComReg Document 21/70, "*Electronic Communications Strategy Statement 2021 to 2023*", published 30 June 2021, available at https://www.comreg.ie/

[8] ComReg's Competition & Investment strategic intention – Goal 1.6: The management of spectrum and numbers facilitates competition, enhances connectivity and promotes efficient investment

(trunking, multi- hop, etc.), mobile backhaul networks, fixed wireless access ("FWA")[9] and temporary networks (electronic news gathering and disaster relief).

2.5 On 9 November 2020, ComReg issued a preliminary consultation on its review of the Fixed Links Bands licensing regime (ComReg Document 20/109[10]).

2.6 The preliminary consultation examined in particular:

- the existing and potential use cases (i.e., those with the potential to evolve and/or emerge over the foreseeable future) for the current Fixed Link Bands[11], and potential use cases for future frequency bands ("Candidate Bands") in Ireland;
- recent trends in demand for all use cases identified nationally and internationally, and forecast the likely demand for each use case over the foreseeable future in Ireland; and
- the need for any of the Fixed Link Bands and/or Candidate Bands to be made available for, or reallocated from, some or all of the use cases identified.

2.7 ComReg also published an interim report (ComReg Document 20/109A[12]) prepared by ComReg's economic and technical experts, DotEcon Limited ("DotEcon") and Axon Consulting ("Axon")[13], on the current situation regarding the Fixed Links environment in Ireland and how this may develop in the future. Document 20/109A was informed by, amongst other things:

- Interviews, as conducted by DotEcon and ComReg, with several stakeholders including existing users and equipment manufacturers (the "Stakeholder Interviews");
- responses received to a voluntary request for information ("RFI") issued in March 2020 to current Fixed Link licensees; and

[9] Fixed Wireless Access means a radiocommunication services between a base station and fixed subscriber terminals locations.
[10] ComReg Document 20/109, "*Review of the Fixed Radio Links Licensing Regime*", published 9 November 2020, available at https://www.comreg.ie/
Hereinafter referred to as "Document 20/109"
[11] There are currently twenty radio spectrum bands ranging from 1.3 GHz to 80 GHz which are allocated for Fixed Links in Ireland
[12] ComReg Document 20/109A, "*Consultant's Report - Fixed Links Bands Review*", published 9 November 2020, available at https://www.comreg.ie/.
Hereinafter referred to as "Document 20/109A"
[13] Hereinafter referred to as "DotEcon"

- responses received to an additional RFI sent by ComReg issued in March 2020 to members of the Independent Regulators Group[14].

2.8 In Document 20/109, ComReg provided an overview to Fixed Links and the associated licensing frameworks along with information on the demand and trends in Fixed Link licensing. ComReg has not repeated this here. Readers are referred to Document 20/109 and Document 20/109A in this regard.

2.9 In December 2021, ComReg issued a further consultation on the review of the Fixed Links Bands licensing regime (ComReg Document 21/134[15]) and accompanying Consultants Report (ComReg Document 21/134A[16]) which set out proposals and preliminary views regarding:

- a new fee schedule for Fixed Links that facilitates the greatest number of use cases to promote greater use of the spectrum;
- a draft Regulatory Impact Assessment (RIA) of the revised Fixed Link licensing framework;
- frequency bands suitable for the revised Fixed Link licensing framework; and
- technical requirements for the deployment Fixed Links in the bands identified.

2.2 Respondents to Consultation 21/134 and 21/134A

2.10 In response to Documents 21/134 and Document 21/134A, 10 responses were submitted by the following interested parties:

1. Eircom Limited and Meteor Mobile Communication Limited (trading as 'eir' and 'open eir') ("eir");
2. Enet Telecommunications Networks Limited ("Enet");
3. ESB Networks DAC ("ESBN");
4. JFK Communications Ltd ("JFK");

[14] The Independent Regulators Group ("IRG") a group of European National Telecommunications Regulatory Authorities (NRAs) that functions as a forum for exchange of best practices and discussions on regulatory challenges in communications between NRAs

[15] ComReg Document 21/134, "*Review of the Fixed Radio Links Licensing Regime*", published 17 December 2021, available at https://www.comreg.ie/
Hereinafter referred to as "Document 21/134"

[16] ComReg Document 21/134A, "*DotEcon Report Fixed Links Bands Review – conclusions and recommendations",* published 17 December 2021, available at https://www.comreg.ie/
Hereinafter referred to as "Document 21/134A"

5. Orion Digital Services Limited ("Orion");
6. Raft Technologies Limited ("Raft");
7. Three Ireland (Hutchison) Limited ("Three");
8. Virgin Media Ireland Ltd ("Virgin");
9. Vodafone Ireland Ltd ("Vodafone"); and
10. Wireless Connect Ltd ("Wireless Connect").

2.11 ComReg would like to thank the interested parties for their submissions and has published the non-confidential versions of the submissions in ComReg Document 22/93B.

2.12 Having carefully considered the submissions, the points made therein and other relevant information, this document, among other things, sets out ComReg's assessment of, and views in relation to, the matters raised by respondents.

2.3 Structure of this Document

2.13 This Document is structures as follows:

- **Chapter 3:** sets out the responses received to Document 21/134 and Document 21/134A. This includes ComReg's assessment of the responses.
- **Chapter 4:** sets out ComReg's view in relation to the Regulatory Impact Assessment.
- **Chapter 5:** sets out ComReg's draft Decision regarding its proposals.
- **Chapter 6:** sets out information on submitting comments in response to this consultation and outlines the next steps.
- **Annex 1:** sets out relevant methodologies for setting fees for Fixed Links.
- **Annex 2:** sets out the parameter values for option 2.
- **Annex 3:** provides information on ComReg's Legal Framework and Statutory Objectives.
- **Annex 4:** sets out the draft Regulations to facilitate the Proposed Framework for the Fixed Links Bands licensing regime.
- **Annex 5:** provides the number of licences issued each year since 2010 for each of the Fixed Link Bands.

- **Annex 6:** provides information about the Frequency Bands & technical conditions.
- **Annex 7:** provides updated information on award status in Europe, harmonisation decisions and spectrum availability for the 1.4 GHz and 26 GHz band.

Chapter 3

3 Response to submissions received to Document 21/134 and 21/134A

3.1 Introduction

3.1 This chapter sets out ComReg's consideration of respondents' views and is structured as follows:

1. Assessment on the submissions to the draft RIA;
2. Assessment of other matters discussed in Document 21/134 and 21/134A; and
3. Other matters raised by the respondents.

3.2 Respondents are generally supportive of ComReg's preferred option preliminary views and proposals as set out in Document 21/134 and Document 21/134A, with disagreement centred on certain matters.

3.2 Assessment on the submissions to the draft RIA

3.3 ComReg assesses the responses to consultation under the following headings:

- Congestion area;
- Opportunity Cost Pricing;
- Administrative Cost Pricing;
- Incentive formula and proposed fees;
- Fee Indexing;
- Phase-in period; and
- Review period.

3.2.2 Congestion Area

Summary views of ComReg in Document 21/134

3.4 ComReg proposed to adopt the Grid Methodology [17] (proposed by DotEcon) as a tool to support the monitoring of congestion by estimating spectrum availability by reference to the density of spectrum use within a band-specific area and thereby identifying areas of potential congestion.

3.5 Using the Grid Methodology, ComReg identified concerns over congestion in the Congestion Zone (central Dublin city) in the 13 GHz, 15 GHz, 18 GHz and 23 GHz bands. ComReg therefore proposed to adopt the Congestion Zone as defined by National Grid 3122 and 3123 (Ordnance Survey of Ireland ("OSI")) with regard to the 13 GHz, 15 GHz, 18 GHz and 23 GHz bands. The results of the Grid Methodology, along with demand trends apparent from the licensing data and views of some stakeholders, supported the view that there is still congestion in that area in the relevant bands. ComReg therefore proposed to continue applying congestion measures in the corresponding area/bands. This Congestion Zone is the area in which applications for new 13 GHz and 15 GHz links have been closed since 2014, and a congestion charge applies to 18 GHz and 23 GHz links (the Grid Methodology uses smaller squares than those found in the OSI National Grid).

3.6 ComReg proposed to monitor congestion periodically and adjust as necessary in light of changes in demand.

3.7 ComReg also sought the views of interest parties on the following.

> Q.11. ComReg welcomes the views of interested parties regarding ComReg's proposal to:
>
> a) identify the geographic area, as defined by National Grid 3122 and 3123, as a congested area, and the 13 GHz, 15 GHz, 18 GHz and 23 GHz bands within that geographic area, as being subject to a congestion surcharge as part of a future licensing framework; and
>
> b) use the Grid Method to monitor congestion.

[17] The grid method involves splitting Ireland into small grid squares (1 km x 1 km), and for each band in each square checking the proportion of channels of a given bandwidth (generally the modal bandwidth across links in the band) that are in use anywhere in the square (by links either passing through the square, or with one or both ends in the square).

View of respondents to Document 21/134

3.8 Virgin broadly agrees with the use of the proposed Grid Methodology to monitor congestion.

3.9 eir and Three express concerns that the proposed Grid Methodology may overestimate congestion. eir proposes the use of a more granular geographic unit to define congestion such as Dublin's post code areas or Central Statistics Office ("CSO") work-place zones.

3.10 JFK and Three suggest defining congestion on the basis of rejected applications for Fixed Links within a given area and band.

3.11 Three requests further information on the "quantitative evidence" underpinning the Grid Methodology, and the potential introduction of additional congestion zones. It also seeks clarity on whether the Grid Methodology considers how transmitters and potential interfered receivers may not have direct line of site between them (if not, then the approach could be overly conservative).

3.12 Three also states that ComReg should consider the removal of the congestion area altogether, as it contends that congestion in the 13 GHz, 15 GHz, 18 GHz and 23 GHz bands will be relieved by the rollout of fibre and the use of 80 GHz bands.

Views of DotEcon

3.13 In response to concerns regarding the Grid Methodology, DotEcon reiterates that the Grid Methodology is neither proposed to be an automatic means of defining congested areas, nor intended to be the main or sole justification for making changes to congestion measures, as detailed further investigation from ComReg would always be needed. Rather, the Grid Methodology could act as a useful indicator and an additional tool that ComReg could utilise in addition to other information, including the assessment of rejected applications.

3.14 DotEcon clarifies that the methodology does not take into account the specifics of individual links or clusters of links (e.g., we do not check whether transmitters and receivers have a direct line of site), as doing so would be complex and unnecessary for the intended purpose.

3.15 DotEcon disagrees that the Grid Methodology increases uncertainty regarding congested areas and bands, noting that the potential for introducing or removing congestion measures over time was always a feature of the fixed links regime. On the contrary, ComReg could release information that helps operators to form their own expectations on the risk of future congestion in certain areas/bands (e.g., Publish the results of the Grid Methodology or early notification to operators of any areas/bands that where congestion appears to be increasing to levels where further

investigation and potential measures might be required).

3.16 DotEcon refers Three to its explanation of the Grid Methodology contained in Annex C of Document 21/134A. In summary, a grid is placed over Ireland and in each square of that grid, for each band, we ask how many new links of a given channel width could be installed in that location, measured as a proportion of the number of links of that size that could be accommodated if the band was currently empty. Using this approach, DotEcon observed that while there are pockets of low availability outside of the congested area, there is no strong evidence to suggest that the congestion area needs to be extended.

3.17 DotEcon agrees with Three that monitoring rejected applications is one of the methods ComReg could use in addition to the Grid Methodology for assessing where congestion might be a problem. However, it notes that rejected applications could fall for reasons unrelated to the level of congestion and therefore neither method should be relied upon exclusively.

ComReg's Assessment

3.18 ComReg notes the agreement of Virgin on the use of the proposed Grid Methodology to monitor congestion.

3.19 In relation to Three's request for further information regarding the quantitative evidence supporting the Grid Methodology, ComReg refers Three to the following:

- Section 4.4 of 21/134A, which outlines how DotEcon arrived at its recommendation for the proposed congestion area based on its analysis of scarcity;
- Annex C of 21/134A, which sets out the method used for measuring the availability of spectrum for new links, and the results of DotEcon's application of this method; and
- Section 2.2 of 22/93A (the "DotEcon Report") which provides further explanation of the methodology employed to measure scarcity.

3.20 ComReg also notes that it will provide early indication of whether any particular bands are becoming congested through its Fixed Links annual report.

3.21 ComReg agrees with DotEcon's proposal that the Grid Methodology (which estimates spectrum availability using the number of unused channels in a grid square) should be used as a screening tool for congestion and not applied in a mechanistic fashion. Therefore, ComReg would only update congested areas following a thorough examination of the candidate area and band, all relevant material at its disposal, and consultation with the relevant stakeholders. ComReg

agrees with the views of DotEcon that:

> "*The grid methodology can therefore be used to provide evidence of where congestion might be an issue but needs to be taken into account alongside a less formulaic assessment of other factors e.g. large numbers of applications being rejected (as with 13 GHz and 15 GHz), identification of popular routes, feedback from stakeholders.*"

3.22 In relation to Three's queries regarding the potential for new congested areas or the removal of existing congested areas, ComReg notes that the extent of future congested areas will ultimately be determined by the future trends in Fixed Link demand and technology. While ComReg sees no basis, at present, for further congested areas or the removal of existing congested areas, this would be determined by future Fixed Link reviews. ComReg agrees with the view of DotEcon that this does not materially increase uncertainty, as ComReg will regularly provide updated information on developments in deployments and congestion. Any change to congestion areas would be made following consultation as part of ComReg's proposed five-year review.

3.23 In relation to the proposals of JFK and Three to define congestion using refused applications, ComReg agrees with DotEcon that the usefulness of rejected applications as a measure or screen for congestion will be reduced as a result of the recently introduced information policies[18] which improve operators' ability to identify available channels (e.g., Frequency Band Usage Checker). ComReg notes that DotEcon cited this as a factor motivating its recommendation for a measure of congestion based on spectrum availability:

> "*…ComReg's recently introduced Frequency Band Usage Checker tool is also a helpful measure to allow applicants to assess relative scarcity in different bands. This should also reduce the number of applications rejected for interference management reasons, but also means that information about rejections is not so informative about scarcity. Therefore, we propose an alternative format for reporting the number of unused channels across a geographical grid (described in Annex C), which gives a good indication of spectrum availability.*"

3.24 That said, ComReg will use information on rejected applications (and the Grid Methodology) to inform its future decision making around congestion. As noted previously, ComReg does not propose to use one source of information in isolation to determine congestion (e.g., rejected applications or the Grid Methodology). The Grid Methodology is useful as an ongoing monitoring and screening tool to alert

[18] ComReg intends on introducing further measures, where possible, to reduce the time wasted by operators making applications for Fixed Links which are ultimately unsuccessful. This could further reduce the value of rejected applications as a measure of scarcity within a band and/or area in the future.

ComReg to potential congestion issues. However, it is not sufficient on its own to determine if any new congestion measures need to be introduced or if existing congestion measures could be removed. Any decision around congestion areas will be made having regard to information available at the time, including rejected applications, trends in usage (which were assessed by ComReg and DotEcon in Document 20/109) and consultation with stakeholders.

3.25 Regarding the views of JFK and Three that the congestion area is overly broad and eir's proposal to define smaller congested zones, ComReg acknowledges that the proposed congested area may include sub-areas or sites in which alternative Fixed Links are not blocked. However, ComReg does not consider smaller and more numerous congested areas appropriate for the following reasons:

- Overly small congestion zones may ultimately only shift Fixed Links from congested to 'almost congested' sites nearby, and merely shift congestion from one site to another;
- Smaller congested areas would likely result in a greater number of congested areas and 'almost congested' areas. This could potentially require more frequent updating of the congested area as areas move in and out of congestion - this ultimately reduces certainty for licensees about whether a particular area is subject to congestion fees for a discernible period (i.e., the period under review); and
- A greater number of smaller congestion areas potentially changing frequently would likely reduce the impact of the congestion charge through lowering awareness and certainty regarding where it applies.

3.26 ComReg also agrees with DotEcon that the use of either Dublin postcodes or CSO workplace-zones to define congestion (as suggested by eir) does not represent an improvement on existing proposals as:

- CSO workplace-zones[19] are small[20] such that that many of the issues listed by above (i.e., smaller congestion areas) would apply and could negate the benefits relative to the proposed congested area.

[19] Central Statistics Office Website, available at: https://www.cso.ie/

[20] There are 626 Congestion workplace-zones in Dublin City.

- Dublin postcodes vary significantly in their (often irregular) shape and size[21], with a number of postcodes containing areas with high and low congestion. Therefore, Dublin postcodes appear unlikely to better target congested Fixed Links than the proposed congested area and subsequent monitoring.

3.2.3 Opportunity cost pricing

Summary views of ComReg in Document 21/134

3.27 ComReg assessed a variety of different fee methodologies that could be used to calculate Fixed Link fees in Annex 2 of Document 21/134. ComReg's preferred option (Option 2) proposes the use of USPP as an AIP[22] proxy, as recommended by DotEcon. This sets fees that are reflective of opportunity cost, using a formula that approximates the structure of opportunity costs of Fixed Links through a small number of parameters, as outlined in the draft RIA of Document 21/134.

View of respondents to Document 21/134

3.28 Three agrees that opportunity cost-based fees can promote efficiency in congested areas. However, Three contends that a uniform congestion charge will result in license fees for Fixed Links above or below opportunity cost in certain cases because opportunity cost is not uniform and varies between Fixed Links.

3.29 Three argues that ComReg must ensure that the proposed new regime does not increase costs unnecessarily in areas where fees are not required to ensure efficiency. Three opines that ComReg should set fees based on the administrative costs of Fixed Links in the 18 GHz Band and that existing Fixed Links do not prevent the use of other links in the same area (i.e., congestion). Three posits that there is no evidence that the 18 GHz Band is congested or that there is any significant risk of future congestion, with the majority of Fixed Links in the 18 GHz band being located in uncongested areas.

Views of DotEcon

3.30 DotEcon notes that there is a distribution of opportunity costs for congested Fixed Links, individually and across operators, and notes that this is consistent with its view that some operators will choose to switch bands and other bands will pay the congestion charge. Indeed, DotEcon's proposal is reliant upon there being no "*sharp cut-off … level*" at which congestion charges result in all operators exiting the band. DotEcon submits that other stakeholders' positive responses contradict Three's

[21] Dublin postal codes were the 24 zones used by postal service operators to sort and distribute mail in Dublin. These were incorporated into a new national postcode system, known as Eircode, which was implemented in 2015.

[22] Universal System Performance Pricing ("USPP") as a proxy for Administrative Incentive Pricing ("AIP").

claim that the proposed congestion charges are unnecessary and will prevent Fixed Link deployment in the 13-23 GHz bands.

3.31 DotEcon notes that Three might be a relatively inflexible user, especially in the short run, but there is no evidence that all users are unable to efficiently spread out across bands in response to price signals, particularly as wider channels are opened in other bands. The purpose of the proposed charging structure is to incentivise flexible operators to use cheaper bands, so that the more valuable bands are available for users who are reliant on them. However, the inflexible users must then be expected to pay something representing the cost of keeping other users out of the band (i.e., the opportunity cost).

3.32 DotEcon notes that fees should increase with the amount of spectrum in use, to reflect the opportunity costs that arise from other operators potentially being denied that spectrum, and this structure should also be in place where congestion has not yet arisen, so that fees include some measure of long run opportunity costs to incentivise efficient network planning.

ComReg's Assessment

3.33 This topic is assessed under two headings:

- First, ComReg responds to queries about the need for opportunity cost pricing for uncongested links; and
- Second, ComReg responds to queries about how opportunity cost pricing is implemented (i.e., uniform congestion charges cannot be effective, because opportunity costs vary from link to link).

Need for opportunity cost pricing

3.34 In relation to Three's view that fees for Fixed Links in the 18 GHz band should be set based on administrative costs, ComReg notes that it set out its views on why administrative cost pricing was not appropriate as a basis for setting fees 5.39 – 5.65 of the draft RIA. In summary:

- It fails to account for potential scarcity in the future and that there could be an opportunity cost to a new licence even if there is no current scarcity in that band, as given long equipment lifetimes, the new fixed link may to be in place for many years and scarcity may emerge over that lifetime.

- Under an administrative cost approach, and due to low fees, at the very least a review of the level of congestion in the 18 GHz band (and others) would likely be required, and possibly a new licensing framework (if e.g., annually renewable licences cease to be appropriate) after a short period to account for changes in demand for the Fixed Links – this would significantly reduce the certainty for licensees.

- The existing fee schedule provides ComReg with reliable information about the level at which fees would not choke off efficient demand and fees do not need to be set excessively low (increasing congestion possibilities) to avoid such risks.

- Under administrative cost pricing ComReg would be prevented from implementing a frequency gradient, potentially resulting in hoarding, producing scarcity in higher/lower frequencies in new areas.

3.35 ComReg notes that Three has not engaged with the points raised in the draft RIA. The incentives required to prevent congestion emerging in areas and bands require fees that exceed administrative costs. Such incentives target long-term efficiency, as the anticipation of future congestion charges alone is not likely to remedy this. Such incentives can influence operators' choice of band, in particular those with greater flexibility (i.e., less reliant on certain bands), and this should free up space for operators that are less flexible (i.e., more reliant on certain bands).

3.36 ComReg also makes the following points in response to Three's submission.

I. ComReg agrees with DotEcon that it is necessary to ensure that the fees are future proofed and that new forms of inefficiency do not arise from future use or the absence of appropriate incentives to use links more efficiently. There is no guarantee that Fixed Links that do not currently restrict alternative Fixed Links at present would not do so in the future. Therefore, the proposed fee model aims to incentivise long-run efficiency by targeting both actual and potential congestion, which requires that fees incentivise efficient use of spectrum to manage demand outside of the presently congested areas, as set out in paragraphs 5.141-5.154 of Document 21/134.

II. ComReg notes that the increase in fees for certain licensees in certain bands, (e.g.,18 GHz) is primarily the result of the high bandwidth of Fixed Links in those bands regardless of whether the band is designated as congested or not (see figure 4 in ComReg 21/134A). Such increases arise because licensees were effectively charged zero for incremental spectrum above 40 MHz under the old fee regime. There are clear efficiency justifications for fees to increase in line with bandwidth used - as described in the draft RIA.

III. In relation to the 18 GHz Band, ComReg notes that the number of Fixed Links are increasing, especially for Fixed Links with a bandwidth of 112 MHz (see paragraph A 6.14 below for further information). This increases the risk of future congestion absent a fee structure which provides better incentives for efficient use.

IV. Three's proposal would entail a departure from the status quo and reduce the fee for a Fixed Link in the 18 GHz Band with a bandwidth of 110 MHz from €1,125 to €100. This might suit Three's own short term interests but such a significant reduction in fees would elevate the risk of potential congestion in this future because fees are set too low, stimulating demand for additional bandwidth.

Queries about the implementation of opportunity cost pricing

3.37 Separately, ComReg notes that Three's concern that a uniform congestion charge will not reflect the opportunity cost of individual Fixed Links in different areas and considers it to be imprudent for the following reasons.

3.38 **First**, as noted by DotEcon, the efficiency enhancing effects of the congestion charge require a distribution of opportunity costs across all Fixed Links. The congestion fee for some links will be above opportunity cost and for others, below it. However, having non-uniform fees would result in a large discrepancy in fees across areas and bands[23]. A congestion charge set too high that more accurately reflects these opportunity costs in certain areas would likely result in disorder and mass cancelation of Fixed Links. Under current proposals some will choose other bands while others pay the congestion charge - this approach is more likely to encourage licensees to spread out across bands.

3.39 **Second**, while more granular estimation of opportunity cost is generally more desirable, ComReg notes that there are practical limits to the ability of any pricing model to accurately estimate the true opportunity cost of an individual Fixed Link. Such factors include, but are not limited to, the:

- Large number of Fixed Links to be assessed;
- Limited data available for assessment;
- Resources required for any approach requiring a more manual assessment; and

[23] For lower frequency bands, the opportunity costs estimates are typically well above the fees charged by ComReg (where very expensive intermediate stations would have to be installed if users moved to a higher band).

- Risk of overlooking future and/or potential congestion from an overly narrow assessment.

3.40 It is simply not possible to accurately estimate the opportunity costs associated with each individual link. The opportunity cost estimates proposed by DotEcon are only reflective of the actual opportunity costs imposed by users where there is congestion. The level of opportunity costs cannot be used directly to set fees, as it requires assumptions about congestion, which is difficult to measure due to the complex nature of interference between links.

3.41 **Third**, the use of a uniform congestion charge and zone, provides greater cost certainty for operators, facilitating network planning relative to an individual assessment, as an individual assessment would:

- require operators to apply before knowing whether a congestion charge would apply to a given Fixed Link or not;[24]
- result in a discrepancy in pricing between otherwise identical Fixed Links, if applied only to those individual Fixed Links deemed to tip an area/path/site into congestion; or
- result in unpredictable pricing, if applied all Fixed Links located on the affected area/path/site.

3.42 Considering these issues and DotEcon's analysis indicating that congestion limited to Fixed Links in four bands in a small geographic area, ComReg believes that a uniform congestion charge based on a Fixed Links location and band represents the most appropriate of the approaches to targeting congestion through fees[25] which are feasible[26].

3.2.4 Administrative cost pricing

Summary views of ComReg in Document 21/134

3.43 Option 2 also proposes setting a price floor (based on administrative costs) below which fees would not fall below. ComReg proposed to set an administrative cost of €100 per link, as recommended by DotEcon[27] based on its estimate of the average

[24] As ComReg would not know the points of origin and destination in advance.
[25] Relatedly, ComReg assesses responses in relation to the definition of the congested area in paragraphs 3.2.2 above.
[26] Indeed, ComReg is unaware of any NRA that assesses the opportunity cost of individual Fixed Links, which perhaps reflects the practical issues and the concerns regarding uncertainty. More generally, ComReg notes that fees to tackle congested in services besides radio spectrum, such as roads, typically rely on "uniform congestion prices", despite the varying opportunity cost
[27] A detailed explanation of how the administrative cost of a Fixed Link Is calculated is set out in paragraphs A 3.32 – A 3.36 of ComReg Document 21/134.

total administrative cost of a Fixed Link.

View of respondents to Document 21/134

3.44 Three submits that the administrative cost fee should be set at the estimated administrative cost per link of €67 and not be rounded up to €100.

Views of DotEcon

3.45 DotEcon considers Three's concerns regarding rounding the administrative cost floor to €100 to be misguided as the:

- rounding merely accounts for uncertainty around administrative costs and fluctuations in demand;
- the impact on the fees paid by operators is negligible; and
- fees act as a floor only in the lightly used 1.3 GHz, 1.4 GHz and 42 GHz Bands.

ComReg Assessment

3.46 ComReg agrees with DotEcon that setting the price equal to the nearest €100 is appropriate. DotEcon's estimate relies upon some simplifying assumptions and therefore subject to a margin of error, and therefore likely underestimates the true administrative price.

3.47 Furthermore, as noted by DotEcon, it only applies to a modest number of Fixed Links and will have a negligible (<1%) impact on stakeholders' fees.

3.2.5 Incentive formula and proposed fees

3.48 Under Option 2 of the draft RIA, ComReg proposed the following formula to set fees.

$$\text{Fee} = \max\left[x \times r_i \times c_{is} \times b(i,\ h),\ \ A\right]$$

Let F_i be the frequency midpoint of band *I*, and number the bands from 1 to N, in ascending order of frequency.

$$r_i = 1 + (R - 1)\,\frac{F_i - F_N}{F_1 - F_N}$$

Let $\widehat{h_i}$ be the typical bandwidth of band i. Then

$$b(i,h) = \begin{cases} h & \text{if } h \geq \widehat{h_\iota} \\ \widehat{h_\iota} + m(h - \widehat{h_\iota}) & \text{if } h < \widehat{h_\iota} \end{cases}$$

3.49 ComReg proposed the following parameters[28]:

- to set the base price $x = 1.3$, to ensure that the proposed approach should restructure the fees rather than concern itself with the overall fee levels, in line with DotEcon's recommendations.
- fees should increase proportionately to bandwidth to provide the appropriate incentives for efficient use of spectrum, in line with DotEcon's recommendations.
- to set the congestion intensity at $c = 3$ for congested fixed links, to strengthen the incentive to make efficient use of the spectrum for Fixed Links in congested bands and areas, relative to the current fee congestion intensity of $c = 1.2$, in line with DotEcon's recommendations.
- to increase the existing frequency gradient for fees from 'top to bottom' ratio, to 1:30 relative to the current (except for the 80 GHz band, which will be set at $r_i = 0.25$), to strengthen the incentive to move up the frequency bands, in line with DotEcon's recommendations.
- to apply a 'small link gradient' to disincentivise the use of atypically small channels, set at $m = 0.5$, in line with DotEcon's recommendations.

3.50 The level of the base price per MHz, x, determines the general level of fees, and to some extent follows from the band schedule that has been set. In Document 21/134, ComReg set the formula parameters in a way that restructures the fees rather than leading to a fundamental change in the fee levels. On this basis, x was set such that the standard fees for the most used bandwidths in the most commonly used bands (11 – 23 GHz), remain similar to those under the current regime.

3.51 ComReg proposed a 'typical bandwidth', for each band which reflects the most common channel size used or likely to be used within that band and also proposed a 'small link gradient that applies to links with a channel size smaller than the typical bandwidth for the band. The values for the typical bandwidths for each band were set out in Table 3 in ComReg 21/134.

3.52 DotEcon recommended that the fee of P-MP systems be charged equal to the sum of the individual links for systems of 8 or less links, with any additional links beyond

[28] ComReg refers interested readers to Table 7 in Annex 3 of ComReg Document 21/134, which provides a full description of each the variables.

8 being charged at 25% of the links individual fee.

3.53 DotEcon recommended that the High usage charges be retained but apply where the licensee holds 50% or more of the available channels within a band on a certain path.

3.54 To understand the impact of the fees, ComReg conducted detailed financial analysis. ComReg also provided licensees with a calibrated model to allow licensees to estimate the potential impacts and sought the views of interest parties on same.

Q.1. ComReg asks respondents to clarify whether submissions to question 6 of ComReg Document 20/109 are either address by the Regulatory Impact Assessment in ComReg Document 21/134 and accompanying DotEcon Report 21/134.

View of respondents to Document 21/134

3.55 eir broadly supports the proposed fee regime and notes that the resulting fees are consistent with the objective of promoting efficiency.

3.56 ESB and Virgin both state that issues raised in its previous submissions have been adequately addressed.

3.57 The remainder of responses are categorised separately under the following headings:

Bandwidth

3.58 Three and JFK raised concerns with the extent of the fee increases for large bandwidth links in rural areas. Three contends that the proposals have failed to take into account how fixed links are likely to be used in the near future, and based on this opinion, argues that the proposed changes will be ineffective (e.g., it sees 112 MHz links as essential for 5G mobile backhaul).

Congestion Charge

3.59 Three contends that the proposed congestion charge is likely to be ineffective and to be disproportionately costly. Three submits that because of the proposed increase in the congestion charge, operators will not deploy Fixed Links in 13 GHz and 15 GHz Bands. More generally, Three contends that increased fees will amount to a barrier to the deployment of new Fixed Links.

3.60 Both ESB and Virgin support the congestion charge and the re-opening of the 13 GHz and 15 GHz bands. ESB states that persistent congestion should ideally be tackled through releasing further spectrum bands, wherever possible.

Rural Fees

3.61 Whilst acknowledging beneficial aspects of ComReg's preferred option, JFK submits that the current pricing structure for 18 GHz and 23 GHz channels in rural areas should be retained until congestion becomes a problem. Otherwise, JFK considers that fee increases under Option 2 will have a negative effect on delivery of services to rural areas.

Migration

3.62 Enet contends that ComReg's financial impacts analysis, excludes migration and notes that the analysis should include migration costs so that fee changes are revenue neutral as opposed to "*broadly revenue neutral*", which Enet considers to be more in line with Article 3 and Article 45 of the EECC.

3.63 Enet states that it has identified a number of Fixed Links[29] which would experience "*substantial*" fee increases, which are subject to contracts that Enet believe would become unprofitable were Enet to migrate such Fixed Links to alternative bands. Enet contends that several Fixed Links would become unprofitable, even without migration.

3.64 Enet and Three both contend that fee changes could increase uncertainty in network deployment and investment. Three claims that, once deployed, a fixed link cannot be switched to a lower cost or less congested band without loss of investment. Therefore, Three claims that fee increases could result in "stranded assets" that provide little or no return on investment, as operators deployed fixed links under the expectation of an asset life of 7-8 years.

Point-to-Multipoint and high-usage charge

3.65 No respondent provided views on the proposed changes to the high-usage charge and the fees for point-to-multipoint licences.

Views of DotEcon

Bandwidth

3.66 DotEcon notes that its initial proposal in Document 21/134A for calculating effective bandwidth works well if there is a clear 'typical channel' size. However, in many bands, there are three channel widths that each make up a significant proportion of new applications. Given this, DotEcon suggests that ComReg introduces a second measure of bandwidth – *the largest bandwidth in common use*. This is the largest bandwidth that is expected to be used by a significant proportion of new links in the band in the near future (this measure is forward looking). In summary, DotEcon

[29] Based on the information provided by Enet provides, ComReg can estimate that this affects approximately [✂ ✂] Fixed Links.

proposes the following approach.

3.67 For *the largest bandwidth in common use* in the band, $\hat{h}_i$, (and any larger bandwidths if these are available) effective bandwidth is set equal to link bandwidth. To set the effective bandwidth for smaller bandwidths, DotEcon proposes the following formula that is defined by a relationship between effective bandwidth for successive channel sizes (where the next largest channel size up is double the size):

$$b(i,h) = (1-m)h + m\, b(i,2h)$$

3.68 The formula above can be successively applied to set the effective bandwidth for smaller bandwidths. This provides an incentive for uses of smaller channels to consider their effect in precluding larger channels.

3.69 DotEcon also advises that if ComReg adopts this revised definition of effective bandwidth, it should also review the level of the parameter m. This parameter controls how quickly per MHz charges decline as the channel size increases the purpose of charging smaller links more per MHz is to provide incentives for operators of these smaller links to position themselves efficiently (e.g., by grouping together with other smaller operators or using bands where larger channels are not in common use). DotEcon suggests that m=0.25 is a reasonable value to reflect the opportunity cost of smaller links.

3.70 DotEcon proposes that bands that are likely to be close substitutes should be treated in a similar way when determining the largest bandwidth in common use. Therefore, DotEcon suggests that in all bands from 15 GHz to 42 GHz in which 110/112 MHz channels are or soon will be available, 110/112 MHz channels are taken as the largest in common use.

Recalibration

3.71 DotEcon recommends that ComReg recalibrates the fees based on more recent Fixed Links licencing data. Doing so would lead to a reduction in the level of the proposed fees, with x=1.2 now being the value that best keeps fees for calibration links at a similar level.

3.72 DotEcon notes that this change arises because the new usage data effectively leads to a reweighting of fees across the bands because the number of 55 MHz links in the 18 GHz band has increased. From the draft Decision onwards, ComReg should then avoid further recalibrating, to maximise certainty for operators regarding the new fees to be introduced.

Fee increases

3.73 DotEcon agrees with some of Three's specific points on the fee formula, in particular that it should take into account the likely demand for 110/112 MHz channels in the near future. It considers that the combination of the revised definition of effective bandwidth, recalibration of the overall level of fees and phasing in of the new fees is sufficient to address Three's legitimate concerns relating to fee increases.

3.74 DotEcon notes that some of Three's other concerns regarding the Fixed Links in 18 GHz are based on misunderstanding of the proposals, noting that fee increases in the 18 GHz band are the result of charging by bandwidth and that the impact of the rounding of administrative fees is negligible.

3.75 In relation to Three's concern that new fees could amount to a barrier to network deployment, DotEcon notes that fees for Fixed Links account for only a small share of the costs of mobile network deployment and that no other mobile network operator has suggested that the fees would obstruct network rollout.

3.76 In relation to JFK's concern regarding the increase in fees in the 18 GHz band in rural areas (which it claims it relies upon due to scarcity of channels in 11 GHz -15 GHz), DotEcon notes that this was not a finding of its assessment of scarcity and in the absence of evidence of scarcity in 11 GHz - 15 GHz in rural areas, does not recommend applying congestion charges to those bands outside of the Congestion Zone (which would be the obvious means of freeing up scarce 11 GHz - 15 GHz spectrum). Nor does DotEcon propose changing fees for 18 GHz in rural areas[30], noting that fee increases in this band largely arise because of JFK's requirement for bandwidth.

Increase supply of spectrum

3.77 DotEcon notes that ESBN's suggestion to increase the supply of spectrum available as a remedy to future congestion ignores that ComReg cannot simply release spectrum without departing from CEPT decisions. This might also foreclose potential alternative uses and may be of limited benefit where the band lacks either equipment or appropriate propagation characteristics (e.g., opening high-frequency bands to alleviate mid-band congestion).

Cost of migration

3.78 In relation to Enet's concerns regarding the cost of migration, DotEcon notes that it does not anticipate widespread migration, as the proposed fees are well below explicit opportunity cost pricing estimates. Therefore, DotEcon considers that total migration costs will be low.

3.79 DotEcon notes that concerns regarding competition between FWA operators using

[30] DotEcon considers this issue further in relation to the Phase-in period.

Fixed Links and NBP are beyond the scope of this review and should not impact pricing of Fixed Links.

ComReg's Assessment

3.80 ComReg notes eir's broad agreement with the proposed fees and the agreement of ESBN and Virgin with the proposed congestion charge and re-opening of 13 GHz and 15 GHz.

Bandwidth

3.81 As set out above, ComReg disagrees with Three's argument regarding whether the fees are justified by opportunity costs. ComReg also notes that there are some factors regarding the 18 GHz Band (and potentially other bands in the future) that require further consideration, in particular, whether the existing approach is sufficiently forward looking that it can account for the likely requirement for higher bandwidth use in the future.

3.82 ComReg's use of effective bandwidth is based on the most common bandwidth used in a band at a point in time (i.e., the modal bandwidth). Such an approach is effective where the frequency of this bandwidth use in a band is significantly greater than any other bandwidths used in that band. It should be noted that the modal bandwidth can exist under a variety of different scenarios. For example, and for illustration only, the modal bandwidth in a band could be 56 MHz where 90% of links are 56 MHz, 5% are 28 MHz and 5% are 112 MHz. Alternatively, the modal bandwidth could be 56 MHz where 40% of links are 56 MHz, 30% are 28 MHz and 30% are 112 MHz.

3.83 In both scenarios, the modal bandwidth is 56 MHz - however in the second scenario there is reasonably common use across different bandwidths (three different bandwidths). In such scenarios the use of an effective bandwidth is less useful and requires judgment on what might be the most frequent bandwidth over the review period rather than at a point in time. This is particularly the case where there are at least three different bandwidths in reasonable common use.

3.84 ComReg notes that since the publication of Document 21/134 in November 2021, the number of Fixed Links in these bands has increased, with growth concentrated in Fixed Links with the highest bandwidths, as shown in Table 1 below.

Band (GHz)	**Modal bandwidth (MHz)**	**Live links (% with channel width)**			**Links issued in last year (% with channel width)**		
		Half typical	Typical	Double typical	*Half typical*	Typical	Double typical

13	56	42.4	44		45.7	47.7	
15	56	30.2	56.5		34.1	60.5	
18	55	32.1	46.8	21.1	28.1	35.6	36.4
23	56	37.7	40.1	8.3	35.9	39.9	18.4
80	500	28	56.9	14.4	24.1	45.1	29.3

Table 1: Fixed Links in 13 GHz - 23 GHz bands, by bandwidth

3.85 Given the growth in 110 MHz Bandwidths in the 18 GHz Band, it is possible that these higher bandwidths (i.e., 110 MHz / 112 MHz) may become the modal bandwidth at some point during the review period which means that such links may become relatively expensive compared to 56 MHz links. This raises the question of whether ComReg should set the typical bandwidth for the 18 GHz Band at 112 MHz instead of the current modal bandwidth of 56 MHz.

3.86 However, even if it was correct to pre-emptively increase the typical bandwidth to 110 MHz, this has the undesirable effect of making 56 MHz fees more expensive at 18 GHz than in neighbouring bands, which could potentially break the chain of substitutes across bands. Over time, similar issues could arise in other bands.

3.87 With that in mind, ComReg notes DotEcon's proposed new definition of effective bandwidth, which links the prices of adjacent bandwidths. With this more general definition of effective bandwidth, each time the bandwidth of a link is doubled, the per MHz charges decline (at least up to bandwidths in common use). This continues to ensure that licensees are charged for additional bandwidth but has the advantage that it links the prices of adjacent bandwidths (e.g., 56 MHz and 112 MHz) and this method could be applied across all bands such that the chain of substitution across bands is maintained. Note that this has the effect of reducing the per MHz charge for higher bandwidths (e.g., in the 18 GHz Band), addressing the matter raised by both Three and JFK in their respective responses.

3.88 This alternative method takes a forward-looking view when considering how to charge by bandwidth. By including a reference to the largest bandwidth in common use, the formula is more future proofed as it is not relying solely on modal bandwidth, which concerns bandwidth at a point in time. This revised approach to charging by bandwidth continues to apply a reference to opportunity cost, but it is better able to deal with changes to channel sizes going forward.

3.89 Therefore, ComReg proposes to include this revised definition of effective bandwidth.

Recalibration

3.90 ComReg agrees with DotEcon that $x = 1.2$ is the value that best keeps fees for modal bandwidth links in the most commonly used bands (11 – 23 GHz) outside of the Congestion Zone at a similar level to those under the current fee schedule.

3.91 ComReg also agrees that further recalibrating should be avoided to maximise certainty for operators regarding the new fees to be introduced.

Congestion charge

3.92 In relation to Three's contention that the congestion charge is disproportionate, ComReg notes that the congestion charge appears the most proportionate means of tackling the inefficiencies of congestion relative to available alternatives, noting that previous attempts including closing affected bands are unsatisfactory as, amongst other things, it restricts access to spectrum to incumbent users and use cases to the detriment of potentially more valuable new users or use cases.

3.93 ComReg is cognisant of the potential for an improved information policy to partially alleviate congestion by providing operators with greater visibility of vacant channels. However, while this may usefully minimise application inefficiencies for applicants and ComReg (when conducting interference analysis) an information policy of itself cannot incentivise users to use uncongested bands where possible. An appropriate congestion charge provides better incentives for licensees to consider the range of substitutable fixed links bands available (as opposed to, for example, reusing an existing band for legacy reasons).

3.94 In relation to Three's concern that the congestion charge would prevent operators deploying Fixed Links in the 13 GHz and 15 GHz bands, ComReg notes that this assertion ultimately depends on other operators' response to the proposed fee structure, not Three's. This concern therefore appears unfounded as other operators appear not to share this view, noting the support of ESB and Virgin for instance. The number of Fixed Links has been the same in the 13 GHz and has increased in the 15 GHz band in recent years, as shown in figure 15, demonstrating increasing demand.

3.95 In relation to Three's contention that the congestion charge will be ineffective, ComReg notes that there is uncertainty regarding the level of premium that would best balance supply and demand for Fixed Links in the congested area and bands. There was some justification for ComReg using C=6 – however, it considered that C =3 was more appropriate noting that it would monitor whether changes were required for the next review period. What is certainly clear, as noted by DotEcon, is that the existing congestion charge of C=1.2 has been ineffective, being too low to affect operators' choice of bands for Fixed Links. In light of that a larger premium is warranted, noting the arguments in favour of including a congestion charge to combat

acute congestion.

Rural services and fees

3.96 ComReg disagrees with JFK's view that rural services will be negatively impacted if existing fees for Fixed Links in the 18 GHz and 23 GHz bands are not retained, noting that Option 2 would result in lower fees for most Fixed Links outside of the congested zone (e.g., Dublin city). As noted by ComReg in paragraph 5.214 of Document 21/134:

> "*Further, Option 2 has the additional benefit of supporting the development of rural ECS services and networks, noting that the decline in fees is greater in uncongested Fixed Links, which occur primarily in non-urban areas (e.g., outside of Dublin and the main cities).*"

3.97 ComReg's updated Financial Analysis has confirmed that the impact of the proposed fee regimes would be roughly revenue neutral in rural areas, with a similar number of fees for existing Fixed Links increasing as decreasing, as shown in Table 2 below. This is unsurprising as the congested charge affects only Fixed Links in Dublin city and the other Fixed Links which see the greatest increase in fees, in 18 GHz and 23 GHz[31], account for only a minority of Fixed Links in uncongested areas (i.e., primarily outside urban areas).

Change in Fees	Uncongested area	Congested area
Decreases	**61%**	**0%**
Increases	**39%**	**100%**
No change	**0%**	**0%**
Total links	**10,611**	**322**

Table 2: Percentage of fees increasing/decreasing in congested and uncongested areas

3.98 The increase in fees in the 18 GHz, and 23 GHz bands arises because of the setting fees that increase with bandwidth, as at present operators do not pay an incremental fee for spectrum above 40 MHz. Therefore, JFK's concern regarding rural services is best understood as relating to the bandwidth charge[32], as does Three's broad concern that increased fees will amount to a barrier to deployment of new Fixed Links

[31] This was noted by ComReg in paragraph 5.214 of ComReg Document 21/134 "*The change in fees that would be paid among these licensees is driven largely by their links which exceed 40 MHz bandwidth particularly in the 18 GHz and to a lesser degree 23 GHz bands*."

[32] ComReg notes that while a number of respondents concerns are related to price increases as a result of ComReg's proposal to charge by bandwidth, no submission to has directly disputed this.

as bandwidth would drive fee increases in many such cases.

3.99 ComReg considers that charging fees in line with increasing bandwidth is entirely appropriate given its obligations with regard to the efficient use of the radio spectrum and will thus incentivise efficient use. This will minimise the risk of avoidable inefficient assignment and congestion, to 'future-proof' the fees in light of increased and increasing demand for bandwidth. The proposed fees are based on 'effective bandwidth', such that charges are linear in bandwidth for links using the largest commonly used channel sizes or larger, with smaller links subject to a surcharge (because it risks fragmenting the band, thereby denying access to larger channels).

3.100 ComReg notes that the revised effective bandwidth definition continues to charge for additional bandwidth, it (and recalibration) has the effect of reducing fees for wide channels compared to its previous proposals. Furthermore, ComReg's proposal to extend the 'phase in' period (see Section 3.2.7 below) also mitigates the impact on stakeholders whose fees may increase. Finally, as noted in the RIA, it may be possible for stakeholders to reduce fees by re-dimensioning their network by migrating into bands where fees are lower.

Increased supply of spectrum

3.101 While supportive of ESB's general view that supply should be made available where possible and justifiable, ComReg agrees with DotEcon that increasing the supply of spectrum for Fixed Links to alleviate present congestion is not practical given band availability. However, ComReg will monitor the demand for Fixed Links to assess the appropriateness of making further spectrum (e.g., in the D-band[33] and/or W-Band[34]) available in light of market and technical trends and developments.

Migration costs

3.102 In relation to Enet's contention that migration costs should be included in the financial analysis and that the fee regime should be revenue neutral on operators, ComReg makes the following clarification:

[33] D-Band: 130 – 174 GHz
[34] W-Band: 92 – 114 GHz

- ComReg agrees with Enet that the fees should be, "*largely revenue neutral in terms of the overall impact on operators (and by extension consumers)*". ComReg notes that the proposed fees meet this criterion in aggregate, as shown in the updated Financial Analysis in the RIA[35]. However, re-weighting revenues towards Fixed Links with higher opportunity costs, while holding overall revenues constant, will necessarily result in some operators paying greater total fees, as operators vary in their exposure to Fixed Links which increase or decrease in price. It is simply not possible to introduce an incentive approach without providing incentives for licensees to choose other bands whose fees may be lower. If all licensees' fees simply stayed the same there would be no incentive to switch bands and no value in undertaking this work.

- ComReg has not overlooked migration cost, which the basis for DotEcon's calculation of opportunity costs (on which the fees are based[36]). The model provides a proxy for opportunity costs using estimates of the cost of switching between bands, in the hypothetical event of a set of bands being closed, informed by interviews with and data provided by existing Fixed Link licensees. Therefore, the cost of migration is captured by the Financial Analysis (in the RIA) within the relative differences between bands driven by differences in migration cost for Fixed Links in those bands. It is therefore not appropriate to "net out" migration costs.

3.103 Furthermore, ComReg notes that Enet's estimate for total migration costs appears to overestimate true migration costs[37] as:

- ComReg notes that for many operators the revised phase-in period (See Section 3.2.7 below) should resolve much of the issues associated with any increased fees.

- The proposed fees have decreased relative to those outlined in 21/134, as a result of a number of unrelated revisions to the proposed fee model parameters[38].

3.104 In relation to Enet's claim that some existing contracts would become unprofitable under the proposed fees once migration costs are factored in, ComReg notes that

[35] This was also the case for the draft RIA, as outlined in ComReg Document 21/134.

[36] Such switching costs include the cost of an additional repeater and of switching to dual polarisation but excludes the cost of equipment having found that the difference in cost between bands is negligible. ComReg refers interested readers to Annex B of ComReg Document 21/134a and Section 4.2.2 of the ComReg Document 20/109a for further details

[37] ComReg notes that Enet's estimate for the per link cost of migration, [✂ ✂], aligns with findings of ComReg and DotEcon.

[38] Enet itself [✂]

the financial impact on those whose fees increase the most is modest given changes to effective bandwidth and the overall level of fees discussed above. Further, not all licensees are resellers and not all the Fixed Links of licensees that resell Fixed Links are subject to contracts. Enet itself acknowledges that several such Fixed Links would remain commercially viable without migration.

3.105 In relation to Three's view that migration would result in a loss of investment due to stranded assets, ComReg notes that the phase in period should ameliorate this concern and operators have been provided with advance notice of the potential fee changes, noting that any delay in the implementation of the fees could result in a delay in the benefits from the improved efficiency of the proposed fees. ComReg considers the revised Phase-in proposals and existing timelines as outlined below are appropriate.

Point-to-Multipoint and high-usage charge

3.106 ComReg proposes to adopt the proposed changes to the high-usage charge and the fees for Point-to-Multipoint licences, noting the absence of views provided by respondents on these changes.

3.2.6 Fee Indexing

Summary views of ComReg in Document 21/134

3.107 ComReg noted in document 21/134 that existing fees are currently not indexed to inflation and that therefore a potential option would be the indexing existing fees to CPI.

View of respondents to Document 21/134

3.108 No respondent provided their views on indexing of fees.

Views of DotEcon

3.109 DotEcon notes that ComReg's policy of indexing its spectrum fees for inflation does not apply to the existing Fixed Links fees, because they predate the indexing policy, but the new Fixed Links fees should be indexed. However, it recommends that indexing would not begin in advance of the commencement of the phase in process. In practice, this means that fees would fall in real terms prior to the end of the implementation period (i.e., the initial level of the new fees will continue to be set to keep fees for common links at a similar level to the nominal level of fees set in 2009).

3.110 As a point of clarification, DotEcon does not think it is appropriate to mix two licence fee structures, only one of which is indexed, therefore it recommends that once the phase in process begins, ComReg indexes both the new fees and the old fees.

ComReg's Assessment

3.111 ComReg has a long-standing policy of indexing its spectrum fees for inflation (measured using CPI)[39] and the new Fixed Links fees will be indexed to CPI. As discussed above, there is a question as to when such indexing would begin (i.e., Year 1 – Year 5). Existing fees are currently not indexed to inflation because they predate the existing policy. Therefore, to be consistent with allowing existing charges to remain the same for Year 1, ComReg is of the view that it is appropriate to begin indexing from Year 2 only. ComReg also agrees with DotEcon's recommendation that once the phase in process begins, ComReg indexes both the new fees and the old fees.

3.2.7 Phase-in period

Summary views of ComReg in Document 21/134

3.112 ComReg proposed to gradually phase in the fees applicable under Option 2 over a three-year period, with the following weightings in each year:

- Year 1: 1/3 weight to the new prices and 2/3 to old prices;
- Year 2: 2/3 weight to the new prices and 1/3 to old prices; and
- Year 3: new prices in full effect.

View of respondents to Document 21/134

3.113 Three contends that a 3-year phase-in period is unreasonable, that new fees should apply only to licenses issued after the date of the Decision and that ComReg should amend the timeline of the phase-in as follows:

- Years 1 to 3 (inclusive): no change to existing fee.
- Years 4 and 5**:** a simple 50% application of all price changes.
- Year 6: new pricing applies in full.

3.114 Enet argues that the proposed 3-year phase-in process does not provide sufficient notice for migration of Fixed Links, with many contracts potentially becoming unviable within this time frame. Enet proposes what it describes as a dual glide-path approach to phase-in, whereby fees for Fixed Links which increase in price are phased in over a longer period of 5 years, while fees for Fixed Links which decrease in price are

[39] See section 7.6 of ComReg Document 15/131, "Draft Radio Spectrum Management Strategy 2016 to 2018", published 14 December 2015, available at www.comreg.ie

phased-in over the planned 3-year period.

3.115 JFK argues for a 7-year period for phase in for the 18 GHz and 23 GHz bands in rural areas, given the asset lifetime and that the investment that was made based on the current Fixed Links licensing regime and its expected continuation of the fees.

Views of DotEcon

3.116 DotEcon notes that ComReg must periodically review fees to ensure efficient use in light of changes in technology and demand. DotEcon notes that changes to the fees could also have been reasonably anticipated by operators given ComReg's commitment to review the fixed links licensing regime as part of its 2019-2021 Radio Spectrum Strategy Management Statement (RSMSS), which was published almost four years ago in December 2018.

3.117 DotEcon acknowledges there is a trade-off between providing sufficient notice of the details of the new fees to operators and watering down the efficiency benefits of the new fees through delaying changes. DotEcon considers the proposed three-year phase in period appropriately balances these conflicting benefits. However, in recognition of some of the issues raised by respondents, DotEcon notes that the proposed glidepath could be delayed by a year such that fees would remain the same in year one with the glide path applying from year 2 onwards. New fees would then fully apply from year 4 instead of year 3.

ComReg's Assessment

3.118 ComReg agrees with DotEcon that it must review fees periodically to ensure that encourage efficient use. ComReg also agrees with DotEcon that ComReg can reduce uncertainty regarding potential changes to fee structures by providing operators with timely information. In this regard, ComReg intends on monitoring trends in Fixed Links.

3.119 ComReg agrees that there is a trade-off between providing sufficient notice of new fees to operators and watering down the efficiency benefits of the new fees through delaying changes. In that regard, ComReg notes that the alternative glidepaths proposed by respondents would, if adopted, unduly delay the impact of the full fees.

- Three's suggested alternative glide-path would result in a less smooth phase in of new fees (50% increase in one period increase of 50% vs. 33%), which undermines the stated aim of the phase-in to achieve smoother transition to the new fees. The new fees would not be introduced until year 6

- Enet's suggested dual glide path for Fixed Links (i.e., longer glide path for links with increasing fees) would distort the relative prices of Fixed Links and therefore undermine the incentives in the proposed fee model, potentially leading to inefficient investment (e.g., under incentivising operators to economise on scarce spectrum).
- JFK's suggestion to adopt a slower phase-in for the 18 GHz and 23 GHz bands, would similarly distort the relative prices of Fixed Links across bands, potentially leading to inefficient investment (e.g., under incentivising operators to economise on spectrum in 18 GHz and 23 GHz)[40].

3.120 However, an extended phase in period would provide licensees with more time to migrate to new bands in line with particular investment cycles and/or spread the impact of any fee increases over a longer period. ComReg is therefore minded to provide an additional year to help licensees adjust to the new framework and better plan migration and investment cycles accordingly. There should still be good incentive benefits with this slower phasing, given that new links will usually be expected to last a long time (15 years or more).

3.121 Therefore, ComReg proposes that the glide path would begin one year after the final decision such that new fees would be:

- Year 1: Existing Charges;
- Year 2: 1/3 weight to the new prices and 2/3 to old prices;
- Year 3: 2/3 weight to the new prices and 1/3 to old prices; and
- Year 4: New prices in full effect.

3.122 ComReg notes that the glidepath after year 1 allows the new prices to be even more transparent to existing licensees, which should be helpful in demonstrating the trajectory for prices and encourage more efficient choices for new links even prior to the phasing completing.

3.2.8 Review period

Summary views of ComReg in Document 21/134

3.123 ComReg noted that its preferred option (Option2) would be subject to a 3 – 5 Year review where the various parameters to the formula could be reviewed. ComReg noted that it was minded to hold the initial review 3 years following the full implementation of this Option. ComReg sought views from stakeholders on an

[40] More broadly, ComReg notes that JFK's concern here relates to the impact on rural fees which ComReg has already considered in Section 3.2.5.

appropriate timeframe for such a review.

Q.12. ComReg seeks views from stakeholders on when the proposed new framework should be reviewed (within a 3-to-5-year period from any Decision)?

View of respondents to Document 21/134

3.124 Eight respondents (eir, ESBN, JFK, Orion, Three, Virgin, Vodafone and Wireless Connect) provided views on the proposed framework review.

3.125 Virgin and Vodafone considers a three-year review to be appropriate. Virgin states that this will allow for an assessment to be carried out to discern if it will have the desired effect of promoting efficacies in the use of fixed link spectrum and if there has been any negative impact on congestion zones or the creation of unnecessary zones.

3.126 eir submits that the initial review should take place 6 years after implementing the decision i.e., allowing 3 years for the transition to the new fee regime to complete and then allow the regime to operate in full for 3 years so that sufficient time has passed to allow a proper assessment of its impact.

3.127 ESBN contends that ComReg should carry out major reviews of the framework every 5 years, as fixed links plans and deployments are costly, and decisions made on a long-term basis. Therefore, greater regulatory certainty suits the investment made by Fixed Links users. ESBN contends that ComReg should also carry out any necessary interim reviews should there be significant change in the fixed link environment that requires it.

Views of DotEcon

3.128 DotEcon notes that an initial three-year review cycle is likely to be appropriate, to ensure ComReg can react to any changes, if necessary, in a timely manner.

3.129 DotEcon notes that the impact of the new fees cannot be known for certain in advance and it is important that ComReg has the opportunity and ability to adjust parameters in the fee formula if it observes that there is a need and justification for doing so. In that sense, it is important to not leave too long a gap before the first review and between reviews, at least during the initial stages of the new regime, so that ComReg can react appropriately.

ComReg's Assessment

3.130 Having considered the views of DotEcon and respondents, ComReg remains of the view that a review should be conducted 3 years after the full Phase-in of the proposed fees. ComReg notes that a review period of 5 to 6 years (as suggested by ESBN and

eir) is likely to be too long such that any issues that could arise would remain in place over an extended period potentially compromising the efficient use of the spectrum. ComReg agrees with DotEcon that it is important not to unduly delay its initial review.

3.3 Summary of other matters discussed in Document 21/134 and 21/134A

3.131 The responses received are generally supportive of the preliminary views as set out in Document 21/134 and Document 21/134A.

3.132 The following matters were identified in ComReg 21/134 and 21/134A:

- Opening new channel spacings for various Fixed Links bands;
- Adjusting the minimum transmit power for each of the frequency bands currently listed in Annex 1 of ComReg Document 09/89R2[41] ("Document 09/89R2");
- Including Automatic Transmit Power Control ("ATPC") in future versions of the guidelines;
- Retaining the minimum path lengths for each of the frequency listed in Annex 1 of Document 09/89R2;
- Adjusting the minimum transmission capacity for each of the frequency bands listed in Annex 1 of Document 09/89R2;
- Adjusting the minimum antenna requirements for each of the frequency bands listed in Annex 1 of Document 09/89R2;
- Adjusting the mandatory equipment class values listed in Annex 1 of Document 09/89R2;
- Reviewing the radius values of the high/low search database, and in particular DotEcon's suggestion to reduce or remove the requirement for the 80 GHz band;
- Allowing the use of Multi-Band Aggregation and potential minimum link length requirements and link availability targets; and
- The future use of the 1.4 GHz and 26 GHz band.

[41] ComReg Document 09/89R2, "*Guidelines to Applicants for Radio Links Licences*", published 06 July 2017, see https://www.comreg.ie/

3.3.2 Opening new channel spacing for various Fixed Links bands

Summary of ComReg preliminary view in Document 21/134

3.133 ComReg agrees with DotEcon's recommendations to make wider channel spacings available where they have been set out in relevant the European Conference of Postal and Telecommunications Administrations ("CEPT") and International Telecommunication Union ("ITU") Recommendations, and where there is an option that permits channel merging. ComReg has provided the proposed channel arrangements in Annex 1 of ComReg 21/134.

Q.2. ComReg welcomes the views of respondents on its proposed channel spacings for the frequency bands listed in Annex 1 of ComReg Document 21/134. Please provide evidence and reasoning for your views.

Views of respondents to Document 21/134

3.134 Five respondents commented on the channel arrangements in the Fixed Links consultation.

3.135 Virgin, Three, eir and Vodafone agree with ComReg's proposals to make available the new channel spacings as identified in Annex 1 of ComReg 21/134. Virgin states that the demand for greater data throughputs on Fixed Links is increasing and opening new channel spacings will make more efficient use of the spectrum available to Fixed Links. Three states that this will help mobile operators meet the increased traffic demands.

3.136 ESBN does not agree with ComReg's proposal as, in its view, this would increase pressure on spectrum bands which are already severely congested. ESBN recognises the drive for higher bandwidth in higher frequency bands to support backhaul for the likes of mobile networks. However, ESBN's key requirement is for long haul, highly available solutions rather than large bandwidth. For large distances, ESBN contends that fibre is much more suitable to deliver large throughputs, therefore alleviating the requirement for larger channel sizes in the lower frequency bands. Consequently, ESBN would prefer if ComReg maintained the channel spacing as it stands in respect of frequency bands up to and including 11 GHz, whilst allowing larger channel sizes for frequency bands above 11 GHz.

ComReg's Assessment

3.137 ComReg notes the support of Virgin, Three, eir and Vodafone regarding its proposal to make available larger channel spacings for Fixed Links as outlined in Annex 1 of Document 21/134.

3.138 ComReg does not agree with ESBN that the proposal would increase pressure on

spectrum bands which are already severely congested. ComReg notes that there is no congestion in the 6 GHz, 7 GHz, 8 GHz and 11 GHz frequency bands where ComReg has proposed to open new channel spacings. ComReg observes that, except for the 11 GHz band, there has been no increase in demand for those bands since 2010.[42]

3.139 ComReg further observes that the opening of larger bandwidth channels in the 6 GHz, 7 GHz, 8 GHz and 11 GHz frequency bands would be unlikely to increase demand for Fixed Link licences. Currently, when an ECN/ECS provider requires larger bandwidth to meet the throughput demands on their network, they apply for two adjacent channels within a frequency band to meet the demand. Therefore, one of the main effects of opening of larger bandwidth channels will be ECN/ECS providers consolidating two fixed licences into one licence, for example in the 11 GHz band a provider may convert two Fixed Link licences with 40 MHz bandwidth each into a single Fixed Link licence with 80 MHz bandwidth, which is also administratively more efficient.

3.140 ComReg notes and agrees with DotEcon's view that it does not believe that opening wider channels increases the risk of congestion, e.g., because absent wider channels, operators could still demand access to more bandwidth by licensing adjacent channels. DotEcon further states that if anything, opening wider channels in a range of bands (alongside an updated pricing formula) may alleviate congestion if operators view this as increasing the range of bands that are suitable for their needs (and therefore spread out more efficiently across bands) or enables better organisation of assignments within bands.

3.141 Regarding ESBNs view that fibre would be a more suitable method for delivering larger throughputs over longs distance, ComReg notes that the use of fibre may not always be possible due to geographic constraints and that a Fixed Link may be the only option in some cases to provide services over a large distance. Therefore, the opening of new larger bandwidth channels would enable ECN/ECS providers to service end-users in areas where fibre is not available. ComReg also notes DotEcon's view that fibre might not be available over all routes where operators wish to use long range, high-capacity links and therefore does not provide justification for restricting access to wide channels.

3.142 Finally, ComReg observes that the opening of larger channel bandwidths outlined in Annex 1 of Document 21/134 are in line with relevant (Electronic Communications Committee ("ECC") and/or ITU recommendations.

3.143 Therefore, having carefully considered the views of respondents, ComReg is of the view that to meet the current and future requirements of ECN/ECS providers and

[42] See annexes 1 and 3 of ComReg Document 20/109, and annex 6 of this document.

end-users it is appropriate and necessary to open the Bandwidths as set out in Annex 1 of Document 21/134.

3.3.3 The maximum transmit power and ATPC for Fixed Links

Summary of ComReg preliminary view in Document 21/134

3.144 To minimise the risk of interference and facilitate greater frequency reuse, ComReg requires Fixed Links licensees to use the minimum power necessary for the link to operate to the specified radio availability criteria. DotEcon observes that ComReg's current approach is well grounded in relevant Recommendations published by the ITU[43] and the European Telecommunications Standards Institute ("ETSI")[44]. DotEcon recommends that ComReg maintains the requirement for operators to use the minimum power necessary for the link to operate to the specified radio availability criteria.

3.145 ComReg notes that Automatic Transmit Power Control ("ATPC") is a feature of Fixed Links that adjusts transmitter output power based on the varying signal level at the receiver. ATPC automatically increases the transmit power during "fade" conditions such as heavy rainfall. When the "fade" conditions end, the ATPC system reduces the transmit power again. This reduces the stress on the microwave power amplifiers, which reduces power consumption, heat generation and increases equipment lifetime. ComReg proposes that its guidelines on Fixed Links be amended to include the requirement that ATPC is used on licensed Fixed Links.

Q.3. ComReg seeks views of interested parties regarding the adjustment (if any) to minimum transmit power for each of the frequency bands currently listed in Annex 1 of ComReg Document 09/989R2. Please provide evidence and reasoning for your views.

Q.4. ComReg seeks the views of interested parties regarding the inclusion of ATPC in future version of the guidelines.

Views of respondents to Document 21/134

3.146 Five respondents commented on the minimum transmit power and six respondents commented on the inclusion of ATPC in future version of the guidelines.

(a) Minimum Transmit Power

3.147 Virgin and Three agree with DotEcon's recommendation that ComReg maintain the requirement for operators to use the minimum power necessary for the link to operate to the specified radio availability criteria and to only consider setting up specific power

[43] ITU Fixed and Mobile Services Division, available at https://www.itu.int/
[44] ETSI Fixed Radio Links, available at https://www.etsi.org/

limits. eir and Vodafone are not proposing any adjustments to the minimum transmit power as outlined in Annex 1 of ComReg Document 09/89R2. ESBN agrees with ComReg that the minimum transmit power should be used to achieve the required availability. This provides for greater spectrum efficiency and assists for more usage out of the limited resource, particularly in more congested spectrum bands.

(b) ATPC

3.148 Enet welcomes ComReg's proposal regarding ATPC, and requests that ComReg provide guidance on an effective date for this decision. Virgin and Vodafone agree that ATPC should be included in future guidelines as it is a feature of their Fixed Links. ESBN states that ATPC should be promoted and included in future versions of the guidelines. ESBN further opines that ATPC allows for greater use of limited spectrum resources, enhancing efficiency. In the absence of ATPC, Fixed Links may be planned and designed to inefficiently use higher transmit power to always achieve required availability, which results in greater pressure on spectrum bands and reduces the number of links that can be licensed.

3.149 Three is of the view that the inclusion of ATPC in future guidelines is not warranted. The current approach of setting maximum permissible Equivalent Isotropic Radiated Power ("EIRP[45]") values means that operators are, in Three's view, protected from third party interference as the interference calculations are conducted under the assumption that links are operating at EIRP values defined on the licence. Hence, in Three's view, the use of ATPC does not facilitate any efficiencies in spectrum management given that channel assignments will still be based on links operating at their maximum permissible EIRP. Three also opines that ATPC may not be an available feature on some older legacy hardware and so a blanket requirement for ATPC may not be achievable.

ComReg's Assessment

(a) Minimum Transmit Power

3.150 ComReg notes that no proposals were made in respect of the minimum transmit power. At this stage ComReg will not amend the minimum transmit power values as stated in Annex 1 of the guidelines.

(b) ATPC

3.151 ComReg notes that the advantages derived from the implementation of ATPC are set out in Document 21/134 and as such are not restated here.

3.152 In relation to Three's comments regarding ATPC, ComReg would like to clarify that

[45] The EIRP is the product of the power supplied to the antenna and the maximum antenna gain relative to an isotropic antenna

it is not ComReg's intention to make ATPC a mandatory requirement for Fixed Links already deployed and therefore legacy equipment which does not support ATPC will not be affected.

3.153 ComReg welcomes the comments made by Enet, Virgin and ESBN regarding the benefits of ATPC and their support for its inclusion in the next version of the Fixed Links guidelines. As ComReg intends to allow the use of ATPC to ensure spectrum efficiency, rather than make it a mandatory requirement, licensees are strongly encouraged to enable ATPC on any relevant equipment at their earliest convenience prior to the future publication of any revised guidelines.

3.154 ComReg intends to permit the use of ATPC and include this in future versions of the guidelines.

3.3.4 Minimum path length

Summary of ComReg preliminary view in Document 21/134

3.155 ComReg has implemented a link length policy for Fixed Links which stipulates the minimum path length appropriate to a particular frequency band that Fixed Links are licensed in the most appropriate frequency bands thereby maximising the efficient use of spectrum. The transmission of radio waves in the 3 – 10 GHz frequency range can cover long distances (>20 km), however, path lengths become increasingly shorter as the frequency increases due to attenuation. Fixed Links in the 10 – 20 GHz frequency range have path lengths of circa 10 – 20 km, and in bands above 20 GHz the path length is 10 km or less.

3.156 Of the eight countries (UK, Switzerland, France, Czech Republic, Portugal, Hungary, Slovakia and Lithuania) benchmarked in DotEcon's report:

- five do not set any explicit obligations with regards to the minimum path link length. One, however, applies a surcharge if the length of a Fixed Link is below a given threshold;
- one defines minimum path link length values for all the Fixed Links Bands; and
- two have set minimum path length requirements for a subset of low to mid bands.

3.157 DotEcon observes however that the path length policy set by ComReg is aligned with those put in place by three National Regulatory Authorities[46] ("NRA's"). DotEcon sees no reason to amend ComReg's minimum path link lengths approach, noting

[46] Switzerland, Slovakia and Lithuania.

that this may not necessarily apply if Multi-Band Aggregation technology were to be used. ComReg did not propose to make any changes to the existing minimum path length requirements.

Q.5. ComReg seeks views of interested parties regarding retaining the minimum path lengths for each of the frequency bands listed in Annex 1 of ComReg Document 09/89R2. Please provide evidence and reasoning for your views where you submit that alternative minimum path lengths should be used for certain frequency bands.

Views of respondents to Document 21/134

3.158 Five respondents commented on retaining the minimum path length for each of the frequency bands listed in Annex 1 of Document 09/89R2.

3.159 Virgin, Three and Vodafone all agree that there is no requirement to amend the minimum path lengths. eir has no strong views currently.

3.160 ESBN agrees with the principle of minimum path lengths, however, believes these should be guidelines as opposed to strict criteria with adjustments to the length for each band in Annex 1 of ComReg Document 09/89R2. In its view, having a guideline of minimum suggested path length per band ensures that there is an even distribution of Fixed Links across bands and not letting market dynamics dictate bands requested. ESBN contends that a minimum path length guideline ensures that applicants make Fixed Link requests based on the most appropriate spectrum band.

3.161 ESBN believes that ComReg should make the path lengths a guideline only to allow for extenuating circumstances where a link lower than the guideline should be permitted. ESBN further suggests that ComReg reduce the guideline minimum path lengths by 20% to better facilitate the requirements for Fixed Links, whilst preserving the even distribution of Fixed Links across appropriate spectrum bands.

ComReg's Assessment

3.162 ComReg notes the responses received in support of retaining the minimum path length policy.

3.163 ComReg notes that ESBN did not provide any evidence to support its proposal to reduce the path lengths by 20%. ComReg further notes that while it does apply a minimum path length to individual frequency bands, it does make exceptions on a case-by-case basis. In such circumstances the maximum EIRP of the Fixed Link is reduced to meet the availability requirements and to limit the potential for harmful interference to future Fixed Links.

3.164 ComReg observes that DotEcon is of the view that the minimum path lengths set by

ComReg are well aligned with policies in other European countries, and supported, at least in principle, by all respondents. Therefore, DotEcon does not agree with ESBN that the minimum path lengths should be reduced by 20% and does not think it likely that an operator would find itself in a position where it was unable to use any Fixed Links band because of some combination of the minimum path lengths in one band and propagation characteristics of higher frequency ones.

3.165 ComReg is of the view that stipulating the minimum link lengths for the different frequency bands ensures that operators deploy Fixed Links in the frequency bands most appropriate to their needs, thereby maximising the efficient use of radio frequency spectrum. ComReg intends to maintain the current minimum path length requirements but is open to reviewing the policy as part of any future review where there is supporting evidence that path lengths could be reduced.

3.3.5 Minimum transmission capacity

Summary of ComReg preliminary view in Document 21/134

3.166 ComReg sets a minimum transmission capacity for each Fixed Link Band, which in some cases increases with channel width within a band. This is intended to promote efficient use of the wider channels available in higher frequency bands, thereby supporting higher capacity services than can otherwise be achieved via the available bandwidth in the lower bands.

3.167 DotEcon notes that there is no obvious trend when considering the practices adopted by other European NRAs. DotEcon further notes that when assessing those NRAs that have set specific minimum thresholds, these all fall below the minimum requirements set by ComReg. Considering the above, and absent any clear trends to the contrary, DotEcon recommends that the minimum transmission capacity values currently set out in the guidelines should remain unchanged.

3.168 Having carefully considered DotEcon's recommendation regarding the minimum transmission capacity for each band, ComReg did not propose to undertake any changes to its current guidelines.

Q.6. ComReg seeks views of interested parties regarding the adjustment (if any) to the minimum transmission capacity for each of the frequency bands listed in Annex 1 of ComReg Document 09/89R2. Please provide evidence and reasoning for your views.

Views of respondents to Document 21/134

3.169 Five respondents commented on adjusting transmission capacity for each of the frequency bands listed in Annex 1 of Document 09/89R2.

3.170 Virgin agrees with DotEcon's report and ComReg's considerations finding the current minimum throughputs adequate as they encourage the efficient use of the Fixed Link bands. Three agrees that there is no justification to amend the existing minimum transmission capacity for each of the frequency bands listed. Vodafone is not proposing any changes to the guidelines and ESBN has no comment to make on this. However, ESBN also state that in practice this is not an issue as bandwidth requirements have increased over the years so the vast majority (if not all) of fixed links are deployed in excess of the minimum transmission capacity. Whilst this requirement served a purpose in the past to ensure spectrum was used efficiently, it no longer serves this purpose.

3.171 eir state that licences should be based on frequency and carrier bandwidth. The capacity should be determined by the licensee based on link design requirements.

ComReg's Assessment

3.172 ComReg notes that four respondents are in favour of keeping the minimum transmission capacity policy.

3.173 In relation to eir's comment, ComReg observes that the purpose of the minimum transmission capacity is intended to promote the efficient use of the wider channels available in higher frequency bands. The minimum requirements are reflective of the minimum throughput capabilities of the relevant frequency bands and bandwidths. However, there are no restrictions on licensees using higher throughput on all Fixed Links to meet their particular capacity requirements.

3.174 ComReg agrees with ESBN's observation that the vast majority of Fixed Links are deployed in excess of the minimum transmission capacity. However, ComReg disagrees with ESBN regarding the suggested removal of the minimum transmission capacity requirement. ComReg considers that this requirement ensures that operators deploy apparatus in the bands that most appropriately meet their needs and thereby maximises the efficient use of the radio spectrum.

3.175 ComReg will maintain the existing minimum transmission capacity policy but is open to reviewing the minimum link transmission policy in future reviews.

3.3.6 Minimum antenna requirements

Summary of ComReg preliminary view in Document 21/134

3.176 ComReg sets a minimum antenna class for each band, which helps to maximise spectrum re-use possibilities while supporting efficient use of the radio spectrum. ETSI defines antenna classes by reference to their suitability for different interference environments.

3.177 The radiation pattern envelope ("RPE") that represents how the maximum gain (dBi) of the antenna varies depending on the azimuth angle to the main beam axis, is classified by the ETSI according to the classes below.

- Class 1: antennas required for use in networks where there is a low interference potential (e.g., low-density deployment areas);
- Class 2: antennas required for use in networks where there is a high interference potential (e.g., high-density deployment areas);
- Class 3: antennas required for use in networks where there is a very high interference potential; and
- Class 4: antennas required for use in networks where there is an extremely high interference potential.

3.178 DotEcon notes that it is a reasonably common practice to set minimum antenna requirements for the different Fixed Links Bands. Furthermore, the minimum requirements set by ComReg are aligned with those applied by other European NRAs. DotEcon also notes that given the demography and the high density of antennas in urban areas of Ireland, a Class 3 type antenna seems appropriate for Ireland. Considering the above, DotEcon is of the view that no changes to the guidelines with respect to minimum antenna requirements is required. Having carefully considered DotEcon's recommendation regarding the minimum antenna class for each band, ComReg did not propose to make any changes to such.

Q.7. ComReg seeks views of interested parties regarding the adjustment (if any) to the minimum antenna requirements for each of the frequency bands listed in Annex 1 of ComReg Document 09/89R2. Please provide evidence and reasoning for your views.

Views of respondents to Document 21/134

3.179 Five respondents commented on adjusting the minimum antenna requirements for each of the frequency bands listed in Annex 1 of Document 09/89R2.

3.180 Virgin agrees with the minimum antenna requirement as it maintains the standards across the industry at a good base, discouraging the use of lower quality antennas which could have the potential to cause issues for other operators. Three agrees that there is no requirement to amend the existing minimum antenna requirements for each of the frequency bands listed. ESBN agrees that ComReg should ensure that suitable minimum antenna standards are in place across frequency bands to promote efficient use of spectrum and enable a higher number of links be licensed in each band. eir has no strong views currently, while Vodafone is not proposing any changes to the guidelines.

ComReg's Assessment

3.181 ComReg notes the support of respondents to retain the minimum antenna requirements and that no changes were proposed.

3.182 Consequently, ComReg will maintain the existing minimum antenna requirements in the next guidelines update.

3.3.7 Mandatory equipment class

Summary of ComReg preliminary view in Document 21/134

3.183 ComReg defines mandatory equipment classes based on ETSI standards which, alongside the antenna and transmission capacity requirements, ensures that the equipment used for Fixed Links remains compatible with continuing efficient use of the radio spectrum.

3.184 It is a reasonably common practice to refer to the ETSI norm "EN 302 217"[47] , and/or any of its derivative documents, to set the standards for equipment class for the various Fixed Links Bands. DotEcon therefore recommends maintaining the current standards in respect of equipment class. Having carefully considered DotEcon's recommendation regarding the minimum antenna class for each band, ComReg did not propose to make any changes to such.

Q.8. ComReg seeks views of interested parties regarding the adjustments (if any) to the mandatory equipment class values listed in Annex 1 of ComReg Document 09/89R2. Please provide evidence and reasoning for your views.

Views of respondents to Document 21/134

3.185 Five respondents commented on the mandatory equipment class values for each of the frequency bands listed in Annex 1 of Document 09/89R2.

3.186 Virgin supports the mandatory equipment class values and do not seek any adjustments here.

3.187 Three agrees that there is no requirement to amend the existing mandatory equipment class values.

3.188 ESBN agrees that ComReg should ensure that suitable mandatory equipment class are in place across frequency bands to promote efficient use of spectrum and enable a higher number of links be licensed in each band. eir has no strong views currently,

[47] Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas: ETSI EN 302 217

while Vodafone is not proposing any changes to the guidelines.

ComReg's Assessment

3.189 ComReg notes that respondents are in favour of retaining mandatory equipment class values in future versions of the guidelines and that no changes are proposed.

3.190 ComReg notes and agrees with DotEcon's recommendation regarding the minimum antenna class for each band. Consequently, ComReg will maintain the antenna class values in future versions of the guidelines.

3.3.8 High/low frequency designations at Fixed Link sites

Summary of ComReg preliminary view in Document 21/134

3.191 All Fixed Links deployed in most allocated frequency bands operate using Frequency Division Duplex ("FDD") technology.[48] Using FDD on Fixed Links requires one side of the Fixed Link to transmit using one frequency of the duplex pair. ComReg requires that Fixed Links using the same frequencies within a given radius ("high/low search radius") of each other either all transmit on a 'high' frequency or all transmit on a 'low' frequency. This is to avoid harmful interference between Fixed Links and ensures receivers are not subject to interference from transmitters at the same location.

3.192 DotEcon states that given the very narrow beamwidth of Fixed Links in the 80 GHz band, interference between Fixed Link sites operating in the 80 GHz band seems very unlikely to occur. ComReg is considering adjusting the high/low search radius in the guidelines for the 80 GHz band by either reducing it to 50m or even removing it entirely.

Q.9. ComReg seeks views of interested parties regarding the radius values of the high/low search database, and in particular DotEcon's suggestion to reduce or remove the requirement for the 80 GHz band. Please provide evidence and reasoning for your views.

Views of respondents to Document 21/134

3.193 Five respondents commented on the high/low frequency designations at Fixed Link sites.

3.194 Virgin and Three are both of the view that the high/low search radius for 80 GHz should be removed. Three observes that there are already conflicting high/low designations in the 80 GHz band on certain sites and there is no evidence to suggest that these conflicts have, to date, caused any performance issues at those sites.

[48] The 80 GHz band uses frequency division duplex (FDD) and time division duplex (TDD).

3.195 Vodafone does not propose any changes to the current high/low designations while eir states that consideration should be given to the search radius for all frequency bands.

3.196 ESBN contends that the high/low designations are necessary to protect links from potential interference. ESBN further opines that ComReg should ensure the smallest practical distance is used for each band whilst providing necessary protection and this should be evaluated on a regular basis. ESBN does not use the 80 GHz band so has no strong opinion on removing the requirement for this band.

ComReg's Assessment

3.197 ComReg notes the submissions by Virgin and Three regarding the removal of the high/low search radius for the 80 GHz frequency band.

3.198 ComReg observes that in the 80 GHz frequency band the radio waves have narrow beamwidths and propagate over short distances (≤7 km), thereby reducing the potential for harmful interference between Fixed Links in this band. ComReg observes that the small antenna dish size and general distribution of 80 GHz Fixed Links in urban areas would also contribute to mitigating high/low interference between Fixed Links. ComReg notes that there are several 80 GHz high/low conflicts at certain locations but there is no evidence of harmful interference arising as a consequence. Considering the submissions received and ComReg's observations, ComReg intends to remove the search radius for the 80 GHz band.

3.199 ComReg does not intend on making any changes to the high/low requirements for other frequency bands.

3.200 ComReg will continue to monitor and assess the high/low requirements for all frequency bands.

3.3.9 Multi-Band Aggregation

Summary of ComReg preliminary view in Document 21/134

3.201 In Document 21/134, ComReg noted that licensees may have a requirement to use techniques such as Multi-Band Aggregation ("MBA")[49], which combines multiple frequency bands over the same radio link to increase the capacity of a link. An example of MBA is using the 15 GHz band with 80 GHz band on the same Fixed Link over 6-8 km. Under the guidelines, the minimum path length for the 15 GHz band would not allow for the use of MCA on a link shorter than 9 km. Therefore, ComReg is of the view that there may be merit in allowing shorter path lengths for Fixed Links

[49] Also referred to as Band and Carrier Aggregation ("BCA")

that use techniques such as MCA to increase capacity.

3.202 ComReg observed that both ETSI and CEPT have published reports regarding the Multi-Band Aggregation technique, and that DotEcon noted that there are no barriers in the guidelines that would prohibit the use of this technology. However, there are two matters worthy of attention if considering the introduction of MBA:

- Link Availability; and
- Minimum link length.

Q.10. ComReg seeks the views of interested parties regarding allowing the use of Multi-Band Aggregation and potential minimum link length requirements and minimum link availability targets. Please provide evidence and reasoning for your views.

Views of respondents to Document 21/134

3.203 Five respondents (eir, Enet, ESBN, Three, and Virgin) provided views regarding Multi-Band Aggregation.

3.204 eir states that it has no strong views on this at the present time.

3.205 Enet is of the view that the current licensing structure for MBA makes potential uses of this technology prohibitive as it would like to consolidate multiple backhaul links into a single link in certain areas.

3.206 Enet believes that the economics are very challenging, when dual license costs, tower costs, and vendor license costs are factored in. Enet would like ComReg to consider innovative ways to be more supportive in helping operators develop solutions utilising MBA.

3.207 ESBN requests ComReg to clarify if the proposal would require two separate licences and two separate payments.

3.208 Three agrees with DotEcon's recommendation that an appropriate alternative approach might be to impose the availability requirement only on the lower band, while the higher band availability could be planned from an interference perspective. The very nature of MBA dictates that the higher frequency band link will typically fail to meet ComReg availability requirements given that it is designed to provide additional capacity on a best effort basis. Three agrees with all ComReg's conclusions in Section 4.46 of the consultation document.

3.209 Virgin states that it is currently reviewing multi-band aggregation technology as it is of the view that multi-band aggregation promotes the efficient and holistic use of backhaul spectrum. Virgin states it would welcome ComReg accommodating the use

of Multi-Band Aggregation.

ComReg's Assessment

3.210 ComReg observes that Enet has not, in support of its submission, provided any comparison of the tower rental and vendor license costs of Fixed Links employing MBA and those which do not. Notwithstanding, ComReg notes that while MBA is achieved by using a single antenna (rather than two individual antennas), two separate frequency bands are still required. ComReg further notes that use of a single antenna would take up less space on a tower compared with two individual antennas thereby potentially saving on tower rental costs.[50]

3.211 ComReg disagrees that the current (and proposed) Fixed Links regime makes the use of MBA prohibitive. Because two frequency bands are being utilised, ComReg is of the view that fees for both bands are required - firstly to promote the more efficient use of all Fixed Links, but also to best safeguard the availability of spectrum going forward. Fees are used to provide for the optimal use of the spectrum, and this requires that fees are charged on all relevant spectrum used to deliver a particular service.

3.212 In response to ESBN's request for clarification, ComReg notes that the introduction of MBA would require separate Fixed Link licences and fees as two separate frequency bands would be employed in the use of MBA.

3.213 ComReg notes Three's support of DotEcon's recommendation that an appropriate alternative approach might be to impose the availability requirement only on the lower band, while the higher band availability could be planned from an interference perspective. ComReg also agrees with DotEcon's recommendation and proposes to only apply the availability requirement on the lower band where MBA is used.

3.214 ComReg notes the views of the respondents and is minded to allow the use of MBA on licensed Fixed Links.

3.215 Regarding the link length for Fixed Links using MBA, ComReg notes that the general combination of frequency bands used for MBA are in the range 15 - 23 GHz (used to cover distances up to 7 - 10 km) with the 70/80 GHz Band.[51] ComReg further notes that the current minimum link lengths, as specified in its ComReg Document 09/98R2, for the 15 GHz, 18 GHz, and 23 GHz bands are 9 km, 0 km and 0 km respectively. Respondents did not submit any views or evidence regarding the minimum length of links using MBA. Therefore, ComReg does not proposed to make

[50] For example, ComReg notes that in its brochure for its multi-band booster products, Ericsson notes that by using multi-band antenna there could be a saving on tower rental costs. https://www.ericsson.com/49c940/assets/global/eridoc/405873/31-28701-FGB101004UEN.pdf

[51] ECC Report 320, "*Guidelines on Band and Carrier Aggregation in fixed point-to-point systems*", approved 2 October 2020, available at ECO Documentation (cept.org)

any changes to the minimum link lengths for Fixed Links using MBA but will continue to monitor any discussions on the matter by the CEPT or ITU.

3.216 Regarding the licensing of frequency bands, ComReg notes that Fixed Links using MBA will require the use of two separate frequency bands, and ComReg will be required to undertake separate interference analyses to ensure there is no potential harmful interference. It is currently not possible to undertake an interference analysis of a single Fixed Link using two separate frequency bands, therefore separate licences would need to be issued for each band to ensure a proper analysis is done for any future applications.

3.3.10 The future use of the 1.4 GHz band

3.217 Following the completion of the Multi Band Spectrum Award ("MBSA2"), ComReg will consider whether to award some or all of the 1.4 GHz Band[52] to facilitate the introduction of Wireless Broadband ("WBB") and/or Mobile/Fixed Communications Network ("MFCN") in the band.

3.218 While ComReg's consideration will be set out at that time, ComReg currently observes (see Annex 7) that:

- the 1.4 GHz Band is harmonised at an EC level for WB ECS[53];
- Article 2 of this EC Decision obliges EU Member States (MS) to designate and make available some or all of the 1.4 GHz Band for WBB ECS with recital 15 of EU 2018/661 (see below) providing guidance on how the measures in that EC Decision should be applied;

(Recital 15)

"The measures provided in this Decision should be applied by Member States with the ***ultimate objective to ensure take-up of the full 1 427-1 517 MHz frequency band*** *or, in the absence of national demand, a portion thereof, for downlink-only wireless broadband electronic communications services in order to contribute, as much as possible, to the fulfilment of the RSPP spectrum target."* (emphasis added)

[52] The 1.4 GHz Band (1427 – 1517 MHz) consists of the 1.4 GHz Centre Band (1427-1452 MHz) and the 1.4 GHz Extension Bands (1427-1452 MHz and 1492 – 1517 MHz).
[53] The 1.4 GHz Band is harmonised in Commission Implementing Decision 2015/750 as amended by Commission Implementing Decision EU 2018/661 of 26 April 2018.

- a significant number of EU Member States (MS) and other European Countries have already awarded some or all of this band for WBB[54];
- a device ecosystem has developed for the 1.4 GHz Centre Band and is developing for the 1.4 GHz Extension Bands[55]; and
- a number of WBB ECS networks are already deployed[56].

3.219 In relation to the future use of the 1.4 GHz band, existing licensees and interested parties should take the above information into account when planning any future fixed link deployments in this band.

3.3.11 The future use of the 26 GHz band

3.220 As part of the MBSA2, the future use of the 26 GHz Band was considered in ComReg's consultation document 18/60[57]. For the reasons detailed in ComReg documents 19/59R and 19/124, ComReg decided that the 26 GHz band should not be included in the proposed award and all respondents agreed with ComReg's proposal.

3.221 ComReg has since published an Information Notice[58] and consultant's report[59] on the appropriate licensing framework or frameworks and the options for assigning spectrum in the 26 GHz band for MFCN/ECS.

3.222 ComReg noted in Document 21/136 that it will continue to monitor developments in the 26 GHz band and following the completion of MBSA2 and subject to demand (e.g., reasoned submissions to responses to consultations, use of any test and trial licences issued, etc.), consult on making one or more portions of the 26 GHz band available, noting that any consultation process may also consider other harmonised spectrum bands available for award.

3.223 Updated information (award status in Europe, harmonisation and spectrum availability) on the 26 GHz Band is set out in Annex 7 of this document.

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[54] 10 European countries have awarded the band (the 1.4 GHz Centre Band in 10 of these countries and more recently 6 of these countries have awarded the whole 1.4 GHz Band) with 6 European countries planning awards in the near future. Source Cullen international – see further Annex 7.

[55] 644 devices are available in the 1.4 GHz Centre Band and 11 devices are available in the extension bands which include Samsung Galaxy S22 series of smartphones. Source GSA GAMBOD

[56] 12 networks are deployed in the 1.4 GHz Centre Band and 5 Networks that also include the 1.4 GHz Extension Bands. Source GSA GAMBOD

[57] ComReg Document 18/60, "*Proposed Multi Band Spectrum Award - Preliminary consultation on which spectrum bands to award",* published 29 June 2018, available at https://www.comreg.ie/

[58] ComReg Document 21/07, "*Information Notice - 26 GHz Band 5G Study",* published 26 January 2021, available https://www.comreg.ie/

[59] ComReg Document 21/07a, "*26 GHz Band 5G Study*", published 26 January 2021, available at https://www.comreg.ie/

3.4 Other matters raised

3.224 The following additional matters were raised by respondents.

3.4.2 Block Licensing in the 80 GHz band

3.225 Enet welcomes ComReg's decision that it is not appropriate to issue block licenses within the 80 GHz band, and also agrees that any such licensing would be severely disruptive to existing 80 GHz operators in the Dublin area. To provide some stability in the market, Enet would like to see a declaration from ComReg that such a consultation on additional block licensing will not occur again for a defined period, i.e., 5 years.

ComReg's Assessment

3.226 ComReg notes Enet's submission, however ComReg cannot issue a declaration as requested by Enet. ComReg observes that to declare it will not consult on a matter for any period would unnecessarily restrict ComReg from carrying out its statutory function for efficiently managing the radio spectrum and may restrict competition. ComReg notes that the purpose of public consultation is to provide information to the public on the topic being consulted on and to give interested parties an opportunity to make representations. ComReg will continue to efficiently manage the radio spectrum in line with its statutory objectives. Where ComReg is minded to make changes to any licensing regime to ensure the efficient use of the radio spectrum, it will do so in line with ComReg consultation procedures as set in ComReg Document 11/34.[60]

3.4.3 Publication of Fixed Links Data

3.227 Enet notes ComReg's proposal to publish additional licensing data, however Enet questions the rationale for doing so and is concerned that the public publishing of additional data may provide commercially sensitive data to other operators. Enet submits that the current information published is sufficient to allow operators to manage their services and rejects the argument that facilitating outsourced third parties access to operators' information is a rational and legitimate reason for continued development and pushing of this initiative.

ComReg's Assessment

3.228 ComReg is of the view that one of the keys to the effective spectrum management and the co-existence of shared services across frequency bands is the publication of

[60] ComReg Document 11/34a, "Information Notice on ComReg Consultation Procedures", published 6 May 2011, available at https://www.comreg.ie/

technical information regarding existing licences.

3.229 In this regard ComReg notes that Recital 57 of the European Electronic Communications Code ("EECC") provides that:

> *Information gathered by national regulatory and other competent authorities should be publicly available, except in so far as it is confidential in accordance with national rules on public access to information and subject to Union and national rules on commercial confidentiality.*

3.230 Also, Regulations 98(15) and (16) of the S.I. No. 444 of 2022[61] provides that:

> *(15) "The Regulator and other competent authorities shall, subject to the protection of the confidentiality of any information which they consider to be confidential and the protection of personal data, publish from time to time such information as would, in the opinion of the Regulator or the other competent authority, contribute to an open and competitive market".*
>
> *(16) "The Regulator and other competent authorities shall publish the terms of public access to information as referred to in paragraph (15), including the procedures for obtaining such access.*"

3.231 In addition, Recital 57 of the European Electronic Communications Code ("EECC") provides that: "*Information gathered by national regulatory and other competent authorities should be publicly available, except in so far as it is confidential in accordance with national rules on public access to information and subject to Union and national rules on commercial confidentiality.*"

3.232 ComReg also notes that EC Decision 2007/344/EC[62] requires EU Member States to provide, on the ECO Frequency Information System information ("EFIS")[63], information on Rights of Use which are tradable in accordance with Article 9.3 of Directive 2002/21/EC or which are granted through competitive or comparative selection procedures pursuant to Directive 2002/20/EC. In that regard, ComReg has published on the EFIS website information[64] on the following licence types – MFCN licences, third-party business radio licences, fixed wireless access licences, fixed link, fixed link block licences, and smart grid licences.

3.233 In addition, ComReg notes that the ECC has undertaken multiple feasibility studies to facilitate shared usage across all frequency bands by, for example, the Fixed

[61] S.I. No. 444 of 2022 European Union (Electronic Communications Code) Regulations 2022 (which has not yet been commenced).
[62] Commission Decision of 16 May 2007 on harmonised availability of information regarding spectrum use within the Community. https://docdb.cept.org/download/191
[63] ECO Frequency Information System (cept.org)
[64] ECO Frequency Information System – Rights of Use

Service and the Fixed Satellite Service. In several Decision documents, the ECC has decided that CEPT member states should publish licence information to facilitate future deployments and the co-sharing of bands.[65]

3.234 ComReg observes that in both its Radio Spectrum Management Strategy Statement for 2022 – 2024 ComReg Document 21/90[66],and in its consultation on the Review of the Satellite Earth Station licensing regime ComReg Document 22/56[67], ComReg stated its intention to publish Fixed Links licence information on Siteviewer[68]. ComReg notes that respondents to both consultations[69,70] agreed that this proposal would promote transparency, facilitate efficient network planning, coordination, coexistence, and deployment for service providers.

3.235 ComReg further observes that in their submissions to Document 20/109, eir and Siklu agreed with ComReg's proposal to make information on live Fixed Link licences publicly available.[71]

3.236 Finally ComReg considers that the publication of non-confidential licence information would not only assist ComReg in meeting its objectives of promoting competition between undertakings and ensuring the efficient use of spectrum, but it would also be in line with ComReg's 'Open by Default' approach to data, ensuring that data collected as part of its regulatory duties should be considered for publication as Open Data in line with Ireland's Open Data Strategy 2017 – 2022[72] for the benefit of all interested parties. ComReg currently provides useful information on deployments to interested parties on mobile base stations on the Siteviewer database and also Fixed Links through the eLicensing[73] platform.

3.237 As part of the Mobile Phone and Broadband Taskforce's Work Programme for 2022, ComReg has committed to making Fixed Links information publicly available and in a downloadable format via the Siteviewer resource, to provide greater overall transparency to relevant stakeholders regarding services deployed in certain

[65] Examples of this can be found in ERC Decision (00)07, ERC Decision (00)02, and ECC Decision (21)01
[66] ComReg Document 21/90, "*Proposed Strategy for Managing the Radio Spectrum 2022 to 2024*", published 10 September 2021, available at https://www.comreg.ie/
[67] ComReg Document 22/56, "*Review of the Satellite Earth Station Licensing Regime Response to Consultation and Further Consultation*", published 4 July 2022, available at https://www.comreg.ie/
[68] ComReg's SiteViewer
[69] ComReg Document 21/136a, "*Strategy for Managing the Radio Spectrum 2022 to 2024: Response to consultation on ComReg's draft Radio Spectrum Management Strategy Statement for 2022 to 2024*", published 17 December 2021, available at https://www.comreg.ie/
[70] ComReg document 22/56s, "*Review of the Satellite Earth Station Licensing Scheme Non-Confidential Submissions to Documents 21/135 and 21/135a*", published 4 July 2022, available at https://www.comreg.ie/
[71] ComReg Document 21/134, "*Review of the Fixed Radio Links Licensing Regime*", published 17th December 2021, available at https://www.comreg.ie/
[72] Goal 5.1 of ComReg's Electronic Communications Strategy Statement for 2021 to 2023
[73] eLicensing available at https://elicensing.comreg.ie/

areas.[74]

3.238 ComReg therefore intends to undertake a separate short consultation on its proposal to publish radio licence information on its Siteviewer database. This would provide all interested parties an opportunity to submit any views they may have on ComReg's proposal to publish radio licence information on its Siteviewer database.

3.4.4 Time Constrained Submission

3.239 Orion and Wireless Connect note ComReg is using its standardised consultation to Section 2.3 of ComReg's Consultation Procedures (ComReg Document 11/34). Orion and Wireless Connect are disappointed that ComReg chose not to make an exception at this time given the number of concurrent consultations from ComReg, the EU Commission, and the Department of the Environment, Climate and Communications ("DECC"). Orion and Wireless connect would invite ComReg and indeed the DECC to consider the Department of Public Expenditure and Reform ("DPER") Guidelines on running a consultation and to consider updating their procedure to accommodate Small-to-Medium Size Enterprise ("SME") operators.

ComReg's Assessment

3.240 ComReg notes the submission by Orion and Wireless Connect, however ComReg's Consultation Procedures are not the subject of this consultation. The Consultation principles & Guidance Document, published by the DPER, states, amongst other things, that a consultation process would ordinarily be expected to vary from 2 to 12 weeks, however the length of a consultation should be decided on a case-by-case basis; there is no set formula for establishing the right length.

3.241 ComReg determined that a six-week consultation period[75] to be appropriate for the matters discussed in Document 21/134. Finally, ComReg notes that it has no authority regarding the timing and publication of consultations by other bodies.

3.4.5 Opening the 3 – 30 MHz range for Fixed Services

3.242 Raft submits that under the Radio Frequency Plan for Ireland (ComReg Document 20/58[76], as amended) there are several bands in the 3 MHz – 30 MHz range that are allocated to the Fixed Service. Raft further submits that ComReg is permitted to grant rights of use and issue licences pursuant to its statutory powers and functions.

3.243 Raft notes that it intends to construct and operate both a transmit and receive sites

[74] See action 8 of the Mobile Phone and Broadband Taskforce's Work Programme for 2022.

[75] For consultation 21/134, ComReg provided an additional two weeks over the four outlined in ComReg's Consultation Procedures as it spanned the Christmas Period.

[76] ComReg Document 20/58R, "*Radio Frequency Plan for Ireland",* published 20 December 2021, available at https://www.comreg.ie/

near the east coast of Ireland in the outskirts of Dublin. These sites would take part in a global network of links and primarily be used to establish data transport between Ireland as an EU hub and destinations in the United States of America and the Asia-Pacific region.

3.244 Raft intends to seek rights of use for several frequencies in the range of 3 MHz – 30 MHz, with a frequency band of at least 48 KHz, which is required for effective transmission of data traffic.

ComReg's Assessment

3.245 ComReg observes that the propagation characteristics of the 3 MHz – 30 MHz frequency range make it suitable for long-distance (>3,000 km) communications between two or more sites connected by low latency Fixed Links. Traditionally, this type of long-distance communication has been used by fixed services such as time signal radio services, Government embassies, Militaries, and disaster relief operations to provide emergency radiocommunications when the telecommunications infrastructure has been disrupted or destroyed. In addition, the 3 MHz – 30 MHz frequency range is becoming increasingly popular for ultra-low latency wireless global networks to facilitate, for example, high speed trading.[77]

3.246 Transmissions in the 3 MHz – 30 MHz frequency range reflect off the ionosphere allowing them to reach great distances. However, the reflection changes based on the time of day as well as the solar cycle[78]. During the cycle the amount of sun activity changes, and the propagation is better when the sun is more active. In addition, different frequencies within the 3 MHz – 30 MHz frequency range propagate better at different times of the day.[79]

3.247 The 3 MHz – 30 MHz frequency range is used intensively worldwide, usually by several users together, and national and international coordination is required to prevent harmful interference between licensed users. In this context, the ITU's Radio Regulations (RR) sets conditions for the use of fixed services in the 3 MHz – 30 MHz frequency range. ComReg notes that the ITU has a notification process[80] for terrestrial services to ensure that any frequency assignment that may cause or receive interference to or from stations of other administrations are recorded in the Master International Frequency Register.[81] This enables NRAs to consider the

[77] ARRL, "*Experiments Look to Leverage Low-Latency HF to Shave Microseconds off Trade Times*", available at http://www.arrl.org/

[78] The solar cycle is an 11-year cycle.

[79] Recommendation ITU-R P.533-14, "*Method for the prediction of the performance of HF circuits",* available at - https://www.itu.int/

[80] ITU Guidance for Notification for terrestrial services, available at https://www.itu.in

[81] The Master International Frequency Register (MIFR) or the Master Register contains frequency assignments together with their particulars as notified to the ITU in accordance with Article 11 of the Radio Regulations (RR), available at https://www.itu.int

impact of notified assignments and provide comment on the assignment where harmful interference may be an issue for an existing fixed service station.

3.248 ComReg further notes that generally in Europe the authorisation of fixed services below 30 MHz is done under a separate licensing regime to that for microwave Fixed Links which provide services in frequency ranges >3 GHz. For example, in Portugal and in Germany, the Autoridade Nacional de Comunicações[82] and Bundesnetzagentur[83] respectively have implemented licensing regimes specifically for fixed services below 30 MHz [84] [85]. ComReg also observes that several other European NRAs, such as Ofcom,[86] may not have any authorisation regime in place to allow the deployment of fixed services in frequency ranges below 30 MHz.

3.249 There is currently no licensing regime in Ireland for the use of the 3 MHz – 30 MHz frequency range by fixed services, therefore ComReg cannot issue rights of use for the 3 MHz – 30 MHz frequency range at this time.

3.250 ComReg is of the view that it is not appropriate to open the 3 MHz – 30 MHz frequency range for fixed services as part of this consultation for the following reasons:

(a) The use cases which may require authorisation to use frequencies in the 3 MHz – 30 MHz range are international services due to the propagation characteristics of the frequency range. Therefore, ComReg would need to consider and consult on an appropriate licensing framework;

(b) As part of those considerations and due to the specific use cases, ComReg would need to seek independent expert advice to assist in identifying potential use cases, developing and proposing appropriate technical conditions;

(c) ComReg would also need to develop a new licence application process for considering any applications, as its current application process for Fixed Links in the microwave frequency bands may not be suitable for assessing applications for frequencies in the 3 MHz – 30 MHz range. For example, ComReg notes the following statement by Bundesnetzagentur in its document[87] titled *Verwaltungsvorschrift für die Zuteilung von Frequenzen*

[82] ANACOM - Autoridade Nacional de Comunicações
[83] Bundesnetzagentur
[84] Anacom Fixed stations (bands less than 30 MHz)
[85] Bundesnetzagentur Fixed radio service < 30 MHz
[86] Ofcom
[87] Verwaltungsvorschrift Fester Funkdienst.doc (bundesnetzagentur.de)

des Festen Funkdienstes sowie des Normalfrequenz- und Zeitzeichenfunkdienstes unter 30 MHz[88]:

> "*As a rule, extensive compatibility tests are required as part of the application processing. Experience has shown that the international coordination of frequency use and notification to the ITU that may be required will take 8 months.*" [translated to English from German][89]

(d) ComReg would also need to consider what, if any, fees should apply to fixed services in the 3 MHz – 30 MHz range and determine the most appropriate approach to setting any fees. Regulation 19 of the Authorisation Regulations permits ComReg to impose fees for rights of use that reflect the need to ensure the optimal use of the radio frequency spectrum[90]. In addition, 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; and

(e) Finally, ComReg notes that the ECC has not published any harmonising decisions on the use of 3 MHz – 30 MHz range for fixed services. ComReg set out in its Radio Spectrum Management Strategy Consultation (Document 21/90) that its approach to granting spectrum rights of use for ECN/ECS is informed by several factors, including any relevant EC and ECC harmonisations Decisions.

3.251 Therefore, ComReg does not propose to open the 3 MHz – 30 MHz frequency range as part of this consultation process. Instead, ComReg intends to consider the matter as a separate work item to assess the potential demand for a new licensing framework. The timing of any such work item would be subject to the completion of ComReg's current work items as identified in its current work plan for the 2022 - 2024 period[91] and ComReg's resourcing capacity. ComReg may consider the work item as part of its future consultation on its work plan for the 2025 – 2027 period. ComReg intends to begin the consultation on its future work plan in Q1 2024.

3.252 ComReg notes that Test and Trial licensing Ireland[92] enables researchers and

[88] Translated as "Administrative regulation for the allocation of frequencies of the fixed radio service and the standard frequency and time signal radio service below 30 MHz"

[89] Original: "Der vollständige Antrag ist so früh wie möglich vor der beabsichtigten Nutzung zu stellen. In der Regel sind im Rahmen der Antragsbearbeitung umfangreiche Verträglichkeitsprüfungen erforderlich. Für die ggf. erforderliche internationale Koordinierung der Frequenznutzung und Notifizierung bei der ITU ist erfahrungsgemäß mit einem Zeitbedarf von 8 Monaten zu rechnen."

[90] See too the equivalent provision in Regulation 24 of S.I. No. 444 of 2022 (not yet commenced).

[91] ComReg Document 21/136, "*Radio Spectrum Management Strategy Statement 2022 to 2024*", published 17 December 2021, available at https://www.comreg.ie/

[92] ComReg's Test and Trial website available at https://www.testandtrial.ie/

developers to test or trial wireless technologies at a low cost in a wide variety of frequency bands in Ireland. However, any applications for Test and/or Trial licences need to properly assess to prevent harmful interference to existing services nationally and internationally.

Chapter 4

4 RIA

4.1 Introduction

4.1 In November 2020, ComReg published a consultation[93] and associated DotEcon Report[94] containing its preliminary views on potential adjustments to the existing Fixed Links licensing framework. In relation to fees, ComReg observed that spectrum fees would continue to form a part of ensuring the optimal use of the Fixed Link frequencies. Further, ComReg noted there are a variety of methodologies that can be used to calculate applicable fees for Fixed Link Bands, and it would set out its views in relation to same in the next phase of this review.

4.2 In December 2021, ComReg published a further consultation[95] and associated DotEcon Report[96] that set out its views in relation to methodologies that can be used to calculate applicable fees for Fixed Link Bands and the fees resulting from the proposed fee model. In its draft RIA (Document 21/134) ComReg considered the impacts of the proposed fees on the relevant stakeholders and determined that its preferred option was to adopt the proposed new fee regime.

4.3 In that regard, this chapter sets out ComReg's updated Regulatory Impact Assessment ("RIA") on the procedure for setting spectrum fees for the Fixed Links Bands and provides ComReg's preferred option having regard to the impact on stakeholders, competition, and consumers. It concludes with an assessment of the Preferred Option against ComReg's statutory remit, including relevant functions, objectives, duties and principles (as outlined in Annex 3).

4.4 ComReg conducted this draft RIA having regard to the following:

- the first DotEcon Report (Document 20/109A);
- the second DotEcon Report (Document 21/134A);
- the third DotEcon Report (Document 22/93A);

[93] ComReg Document 20/109, "Review of the Fixed Radio Links Licensing Regime", published 9 November 2020, available at https://www.comreg.ie/

[94] ComReg Document 20/109A, "*Consultant's Report - Fixed Links Bands Review*", published 9 November 2020, available at https://www.comreg.ie/

[95] ComReg Document 21/134, "*Review of the Fixed Radio Links Licensing Regime*", published 17 December 2021, available at https://www.comreg.ie/

[96] ComReg Document 21/134A, "*DotEcon Report Fixed Links Bands Review – conclusions and recommendations",* published 17 December 2021, available at https://www.comreg.ie/

- the supporting Annexes (Annex 1 & Annex 2); and
- the views of respondents to Document 21/134[97], Document 20/109[98] and the stakeholder interview and information gathering conducted in 2020.[99]

4.2 RIA Framework

4.5 A RIA is an analysis of the likely effect of proposed new regulation or regulatory change and, indeed, of whether regulation is necessary at all. The RIA should help identify regulatory options and establish whether the proposed regulation is likely to have the desired impact, having considered relevant alternatives and the impacts on stakeholders. The RIA is a structured approach to the development of policy and analyses the impact of regulatory options. In conducting a RIA, the aim is to ensure that all proposed measures are appropriate, effective, proportionate and justified.

4.6 A RIA should be carried out as early as possible in the assessment of regulatory options, where appropriate and feasible. The consideration of the regulatory impact facilitates the discussion of options, and a RIA should therefore be integrated into the overall preliminary analysis. This is the approach which ComReg follows in this draft Decision and this RIA should be read in conjunction with the overall Consultations. This RIA will be finalised in the final Decision arising from this draft Decision, having considered responses to this draft Decision.

4.7 In conducting the RIA, ComReg has regard to the RIA Guidelines[100], while recognising that regulation by way of issuing decisions, for example imposing obligations or specifying requirements in addition to promulgating secondary legislation, may be different to regulation exclusively by way of enacting primary or secondary legislation.

4.8 To ensure that a RIA is proportionate and does not become overly burdensome, a common-sense approach is taken towards a RIA. As decisions are likely to vary in terms of their impact, if after initial investigation, a decision appears to have relatively low impact ComReg may carry out a lighter RIA in respect of that decision.

4.2.2 Structure for the RIA

4.9 In assessing the available regulatory options, ComReg's approach to the RIA is

[97] ComReg Document 22/93B, "*Non-Confidential Submissions to Document 21/134 and 21/134A*", published 17 December 2021, available at www.comreg.ie

[98] ComReg Document 21/134s, "*Non-Confidential Submissions to Document 20/109 and 20/109A*", published 17 December 2021, available at www.comreg.ie

[99] See Annex B – ComReg Document 20/109A

[100] ComReg Document 07/56a, "*Guidelines on ComReg's Approach to Regulatory Impact Assessment*", published 10 August 2007, available at www.comreg.ie

based on the following five steps:

- **Step 1**: describe the policy issue and identify the objectives;
- **Step 2**: identify and describe the regulatory options;
- **Step 3**: determine the likely impacts on stakeholders;
- **Step 4**: determine the likely impacts on competition; and
- **Step 5**: assess the likely impacts and choose the best option.

4.10 In the following sections, ComReg identifies the specific policy issues to be addressed and relevant objectives. (i.e., Step 1 of the RIA process). Before moving on to Step 1 of the RIA, ComReg first makes some relevant observations below on the stakeholders involved and on ComReg's approach to Steps 3 and 4.

4.2.3 Identification of stakeholders and approach to Steps 3 and 4

4.11 Step 3 assesses the likely impact of the proposed regulatory measures on stakeholders. Hence a necessary precursor is to identify such stakeholders.

4.12 In this RIA, stakeholders fall into two main groups:

I. Consumers (Impact on consumers is considered separately below); and

II. Industry stakeholders.

4.13 The industry stakeholders comprise the providers and users of Fixed Links for the relevant use cases, which include:

- Narrowband telemetry and control applications (Network Utility Operators e.g., in the Electricity, Gas and Water sectors);
- Broadcast distribution (Broadcasters);
- Backhaul from mobile cell sites (MNOs);
- Fixed wireless access (FWA operators, Local Government and Emergency services);
- Advanced FWA services in urban areas (FWA operators); and
- Specialist low latency links (e.g., for financial trading).

4.14 Step 4 assesses the impact on competition of the various regulatory options available to ComReg. In that regard, ComReg notes that it has various statutory functions, objectives and duties which are relevant to the issue of competition.

4.15 Of themselves, the RIA Guidelines and the RIA Ministerial Policy Direction provide[101] 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 statutory objectives in managing the radio frequency spectrum, as outlined in Annex 3, include:

- to promote competition[102];
- contribute to the development of the internal market[103];
- promote the interests of users within the Community[104];
- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under Section 12 of the 2002 Act[105];
- Regulation 16(2)(a) which requires ComReg to promote efficient investment and innovation in new and enhanced networks[106];
- Regulation 19 of the Authorisation Regulations[107] permits ComReg to impose fees for rights of use, which reflect the need to ensure the optimal use of the radio frequency spectrum; and
- Regulation 17(3)[108] 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,

[101] Ministerial Direction dated 21st February 2003
[102] Section 12 (1)(a)(i) of the 2002 Act.
[103] Section 12 (1)(a)(ii) of the 2002 Act.
[104] Section 12(1)(a)(iii) of the 2002 Act.
[105] Section 12(1)(b) of the 2002 Act.
[106] S.I. No. 333/2011 - European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011.
[107] European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011 (S.I. No. 335 of 2011).
[108] See S.I. No. 333 of 2011

- 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)[109].

4.16 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. This order does not reflect any assessment of the relative importance of these issues but rather reflects a logical progression. A measure which safeguards and promotes competition should, in general, 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.

4.2.4 Step 1: Identify the policy issues & the objectives

Policy Issues

4.17 The spectrum available for Fixed Links is a finite resource with many different services and users, and the radio spectrum management of these resources involves the careful consideration of a broad range of factors (e.g., administrative, regulatory, social, economic, and technical) with a view to ensuring that radio spectrum is optimally and efficiently used.

4.18 This may also involve balancing a range of competing factors, including:

- appropriately meeting the requirements of all radio services, including commercial and public uses, such as public safety, national security, and health care; and
- promoting competition including ensuring that users derive maximum benefit in terms of price, choice, and quality, contributing to the development of the internal market, and promoting the interests of users within the Community.

4.19 ComReg also notes that, in achieving its objectives, it seeks to choose regulatory measures which maximise the benefits for consumers in terms of price, choice and quality. Effective spectrum management also requires flexibility and responsiveness to adapt to changes in, among other things, technologies, demand from spectrum users and end-users, market developments and public policy. In that regard, ComReg identifies two broad regulatory tools that are relevant in allowing it to

[109] See S.I. No. 333 of 2011

effectively manage to radio spectrum being made available for Fixed Links:

- Information Policy; and
- Spectrum Fees.

A. Information Policy

4.20 In Document 21/134, ComReg observed that while spectrum fees will continue to form a part of ensuring the optimal use of the Fixed Link frequencies, an appropriate information policy should also form a key part of any licensing. Indeed, ComReg is of the view that the information policy in respect of the Fixed Links is likely to be central to ensuring that licensees make optimal decisions, particularly when installing or renewing links. ComReg's information policy should be viewed as complementary to the incentives provided by spectrum fees. That is, spectrum fees are likely to be less effective if licensees lack predictable information about a range of issues including emerging scarcity in particular bands at certain locations and whether a given channel is in use within a radius of a proposed site before submitting an application.

4.21 Achieving efficient use of the available spectrum bands depends on good information being available to users about emerging demand, allowing assessment of where congestion is likely to arise. Such information would allow operators to make informed and better network planning decisions, where possible avoiding clashes by moving towards bands less in demand. For example, depending on the rules used for the assignment of frequencies, this may allow a more efficient assignment of frequencies in cases where there are potential interference problems between neighbouring users of different technologies. Such information would also improve the efficiency of the application process.

4.22 ComReg already provides useful information to licensees through the frequency band checker and its Fixed Links annual report. DotEcon recommends steps to further enhance:

- the Frequency Band Usage Checker should help users to understand the current state of availability/congestion, and thereby speed up the application process by reducing the number of applications that cannot be accepted; and
- ComReg should consider refining the information it publishes regularly (e.g., data on rejected applications, or results of the proposed Grid Methodology for assessing spectrum availability), to improve the support to users with forming expectations on where congestion may emerge in the future.

B. Spectrum Fees

4.23 Regulation 19 of the Authorisation Regulations permits ComReg to impose fees for rights of use that reflect the need to ensure the optimal use of the radio frequency spectrum. In addition, ComReg is required to ensure that any such fees are objectively justified, transparent, non-discriminatory, and proportionate in relation to their intended purpose, and consider the objectives of ComReg as set out in Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations.

4.24 In that regard, the effective management of radio spectrum requires more than a purely technical consideration of spectrum efficiency; functional and economic considerations must also be considered, including the extent to which the utilisation of spectrum meets a user's specific needs and the social and economic value that can be derived from it. This is particularly relevant in the current case where there is a variety of different users, providing different services using different technologies based on existing licence conditions (including spectrum fees).

4.25 While there are various methods of determining the level of a licence fee some approaches (or a combination of same) are likely to be more suitable than others. ComReg does not envisage one approach being suitable to account for all of the various bands and associated uses, given that there are potentially quite different considerations for each band.

4.26 ComReg's efficiency[110] objectives are typically supported using a market mechanism for assignment, such as a well-designed auction with prices set based on opportunity cost, which can help to[111]:

- establish the efficient assignment of spectrum amongst bidders, given bidders' willingness to pay (which can be expected to represent the economic value they are able to generate); and
- establish the opportunity costs of the assignment, setting suitable spectrum usage fees at a level that represents market value (and could be considered fair) and encourages the winning bidder(s) to utilise the spectrum more efficiently.

4.27 However, where rights of use across many bands are being made available for relatively short periods (e.g., annually renewable) an auction would clearly be impractical. In such cases, ComReg must use a different methodology for

[110] Section 12 (1) (b) of the 2002 Act.

[111] Use of a market mechanism also removes the burden on ComReg to make complex judgements (based on incomplete information) in relation to assigning the spectrum and the suitable level of fees, as it can better elicit relevant information about the value (and efficient assignment) of the spectrum that is likely not available to ComReg.

establishing the fees to be charged that are in line with its objectives[112].

4.28 In that regard, the main policy issue to consider in this RIA is, in the context of its statutory objectives, how best to establish a licensing framework for the Fixed Links regime, including an appropriate fee schedule.

4.29 As set in Document 20/109, ComReg will be guided by the following factors:

- Where excess demand exists or may exist in the future, an opportunity cost methodology (or proxy for same) may be appropriate in line with previous approaches; and
- An opportunity cost approach may not be suitable where spectrum is more freely available. In such cases, fees should incentivise potential users to assess its actual need for spectrum and select the most appropriate spectrum band from a range of alternatives.

4.30 ComReg notes that no respondent disagreed with such factors in response to Document 20/109 or Document 21/134.

Objectives

4.31 ComReg aims to design and carry out its review of the Fixed Links licensing regime in accordance with its broader statutory objectives (as outlined in Annex 3) including the promotion of competition in the electronic communications sector.

4.32 A key objective is that spectrum fees must reflect the need to ensure the optimal use of the radio spectrum and must also be objectively justified, transparent, non-discriminatory, and proportionate.

4.33 In addition, the focus of this RIA is to assess the impact of the proposed measure(s) (see regulatory options below) on stakeholders, competition, and consumers. ComReg can then identify and implement the most appropriate and effective means by which to set spectrum fees for the Fixed Links Bands, while achieving its relevant statutory objectives under section 12 of the 2002 Act of promoting competition by, among other things:

- Encouraging efficient use and ensuring effective management of radio frequencies;
- Ensuring that users derive maximum benefit in terms of choice, price and quality;

[112] Noting that the effectiveness of particular methodologies is constrained by the scope and quality of available data.

- 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 interest of EU citizens.

4.34 ComReg notes that, in achieving its objectives, it seeks to choose regulatory measures which maximise the benefits for consumers in terms of price, choice and quality.

4.2.5 Step 2: Identify and describe the regulatory options

4.35 The existing Fixed Link licensing framework has been in place since 2009 and has supported a wide variety of use cases to the benefit of competition and consumers. ComReg will evaluate the existing Fixed Link regime as an option, given its utility to date, and also to fully understand the impact of any change from an alternative option. Therefore, ComReg notes that **Option 1 is to maintain the status quo** and extend the use of the existing Fixed Links licensing framework in the long run.

4.36 In relation to other options, ComReg observes that there is a variety of methodologies that could be used to calculate applicable fees for Fixed Link Bands. ComReg does not envisage one approach being suitable to account for all of the various bands and associated uses, given that there are potentially quite different considerations for each band. In that regard, and to identify potential options, ComReg assessed a variety of different methodologies in Annex 2 of Document 21/134.

4.37 In relation to the approach recommended by DotEcon (USPP as an AIP[113] proxy), this option sets fees that are reflective of opportunity cost which should encourage licensees to utilise the spectrum more efficiently, including incentivising the return of unused or underused spectrum. It seeks to achieve this in a practical and sensible way given the difficulties of estimating opportunity cost across a variety of different bands. As advised by DotEcon, this approach sets fees using a formula that seeks to proxy opportunity costs through a small number of parameters. The focus is largely on short run opportunity cost, where a surcharge applies for bands and areas where there is current congestion. However, the formula is designed to also reflect some of the structure of long-run opportunity cost, recognising that demand is increasing and that, even where there is no scarcity at present, there may be benefit in providing incentives for operators to organise themselves efficiently within the bands to avoid future congestion where possible.

4.38 Therefore, ComReg is of the view that the approach recommended by DotEcon (USPP as an AIP proxy) is a valid regulatory option. This approach is considered as

[113] Universal System Performance Pricing (“USPP”) as a proxy for Administrative Incentive Pricing.

Option 2 for the remainder of this RIA. Option 2 is summarised below but set out in more detail in Annex 2 and Section A.2 of the DotEcon Report.[114]Interested Parties should review Chapter 3 (Response to draft RIA) because it contains details of a revision to the definition of the effective bandwidth provided in Document 21/134.

4.39 In Annex 2 of Document 21/134, ComReg also observed that it may be appropriate to consider administrative cost recovery as a regulatory option. As most Fixed Link Bands are uncongested, ComReg notes that a potential approach would be to assign rights of use on an administrative cost[115] basis for bands in areas that are not subject to congestion and apply an appropriate congestion charge for congested bands/areas[116].

4.40 Prior to setting out its view on whether an administrative cost recovery methodology is a valid regulatory option, ComReg provides the following background information that informs that assessment:

I. First, ComReg assesses whether Fixed Links are subject to potential scarcity.

II. Second, ComReg assesses the potential for significant migration from licence exempt bands into the Fixed Links Bands under an administrative cost recovery option.

III. Third, ComReg assesses the potential for increased spectrum hoarding incentives in the Fixed Link Bands under an administrative cost recovery option

I. Fixed Links already subject to potential scarcity

4.41 Currently, congestion is relatively rare, primarily being an issue in the 13 GHz – 23 GHz bands in Dublin and between the city centre and a number of key sites to the south (e.g., Three Rock). Less than 1% of existing links fall into the congested bands in the congestion area as currently defined. However, congestion issues may well arise elsewhere in the future. As noted by DotEcon "*…this is not to say that congestion issues will not arise elsewhere in the future, in particular with ever increasing bandwidth requirements and the potential for fixed links to support fibre networks in rural areas*."[117]

[114] All remaining options assessed in Annex 2 are clearly inferior to Option 2, therefore the inclusion in this RIA would serve little purpose.
[115] ComReg notes that the €100 per link referred to in the DotEcon Report and this consultation is based on administrative costs incurred under the current regime and would in any event be higher if an administrative charge was charged to all uncongested links due to the likely significant increased compliance costs imposed on ComReg as a result.
[116] Noting that any such congestion fees would likely be greater than those presently in effect.
[117] See page 81 of ComReg Document 20/109A.

4.42 Nevertheless, ComReg has previously suspended the acceptance of new Fixed Link Applications, in the 13 GHz and 15 GHz frequency bands in Dublin's city centre and the south of the city due to congestion. During the stakeholder interviews concerns were raised by some Existing Licensees in relation to this.

- A number of licensees complained about congestion in specific bands in Dublin city centre and south; and
- A number of licensees expressed concern regarding future congestion in higher bands in Dublin.

4.43 Where congestion arises, efficiency requires that spectrum rights of use are assigned to those users that value them the most. If spectrum is licensed at below opportunity cost, then there may be some other party that would have been prepared to pay more for the right of use but is being inefficiently denied access.

4.44 More generally, an effectively functioning fees framework should ensure that licensees are incentivised to use assigned rights of use as efficiently as possible, avoiding excessive spectrum use where alternatives are available that would cost the licensee less than the foregone value that excluded users could realise from that spectrum. Promoting efficient spectrum use ensures that the best use is made of a scarce resource and minimises the risk that access to spectrum becomes restricted due to inefficient or unnecessary congestion. With that in mind, it is important to assess the potential for congestion arising in the future and to put in place proportionate measures (e.g., reflecting long-run opportunity costs) to address this prospect.

4.45 There is strong evidence that bandwidth requirements for Fixed Links are growing. Further, the availability of alternative technologies (e.g., fibre) will not arrest the general upward trend.[118] With that in mind, the following factors may have some relevance:

- Stakeholders have already noted that their demand for bandwidth is increasing, and raised the point that operators are restricted in the bandwidth they can access by means of the widest channel widths available in certain bands[119];
- Demand for links is increasing more generally, but especially for Fixed Links with higher bandwidths. This in turn could lead to congestion issues arising elsewhere. ComReg notes that:

[118] See page vi and Annex B.3 of ComReg Document 20/109A.

[119] The licensing data is consistent with this view, with operators using the second polarisation to double capacity over a given link, especially when wide channels are unavailable (e.g., we note that increased use of dual polarisation links started earliest in the 11 GHz band, where the largest channels are only 40 MHz)

- demand for links is increasing in the uncongested zone;
- bandwidth requirements are increasing, and there is potential for Fixed Links use cases to expand into previously unserved rural areas; and [120]
- average link lengths are expected to decrease (e.g., as fibre presence expands, short microwave hops will be required to connect sites to a fibre node) so demand for higher frequencies (e.g., 80 GHz) will likely increase. [121]

- Increasing bandwidth requirements is required to meet the need for faster speeds [122];
- An increase in capacity requirements and use of dual polarisation where wider channels are not available [123];
- Increased demand for higher frequency bands where channel spacing is typically higher; and
- 5G backhaul will contribute significantly to increased demand in the coming years. [124]

4.46 Further, the potential for increased congestion is not proportionate across bands but often depends on network deployment across different use cases. For example:

- In bands up to 8 GHz, and although there does not appear to be any significant spectrum scarcity[125] currently, some stakeholders opined that they have sporadically found it difficult to find an available link in certain bands;
- There seems to be accord regarding a growing demand for links in the 18 GHz and 23 GHz bands. This is in part due to the roll-out of multi-band technology solutions that allow for pairing these bands with higher frequency spectrum (e.g., in the 80 GHz band) to achieve high-capacity links over mid-range distances. Given the current use of these bands there is a risk of further congestion going forward[126];

[120] See page 90 of ComReg Document 20/109A
[121] See page 111 of ComReg Document 20/109A
[122] See page 109 of ComReg Document 20/109A
[123] See page 109 of ComReg Document 20/109A
[124] See page 112 of ComReg Document 20/109A
[125] See page 109 of ComReg Document 20/109A
[126] See page 110 of ComReg Document 20/109A

- Even in the uncongested/rural areas, demand is concentrated in certain areas or origin/destination paths due to the availability of suitable sites (e.g., those with favourable topography) and the concentration of population in certain areas, which creates the potential for pockets of congestion to emerge outside of urban areas[127].
- Several stakeholders raised concerns that the E-band (80 GHz) might to become congested, particularly in urban areas. Others contend that there is sufficient spectrum available in the band to allay any imminent congestion concerns, further noting that the W-band is a potential alternative in the future if the 80 GHz band was to become congested[128]; and
- Increased bandwidth usage is primarily driven by the MNOs and FWA operators. The trends for these user groups are qualitatively similar, and in both cases, there are rapid increases in bandwidth used, facilitated now by increased use of the 80 GHz band.

4.47 Therefore, ComReg is of the view that the established trend of increasing bandwidth requirements, given the prevailing business cases, increases the risk of potential scarcity in the future.

II. Migration from licence exempt

4.48 The Fixed Link licence exempt bands are currently composed of the 2.4 GHz, 5 GHz, 17 GHz, 24 GHz and 60 GHz Bands. The main use of licence exempt spectrum is in the 5 GHz, 17 GHz and 24 GHz bands which collectively have approximately 800 MHz bandwidth available.

Band	Bandwidth
2.4 GHz	83.5 MHz
5 GHz	355 MHz
17 GHz	200 MHz
24 GHz	250 MHz
60 GHz	14 GHz

Table 3: Licence Exempt Bands

[127] Supporting this view, a respondent in its submission to 21/134 highlighted instances of congestion in certain bands in rural areas.
[128] See page 11 of ComReg Document 20/109A

4.49 Respondents to ComReg's RFI[129] noted that FWA links were the most common use case in the Fixed Links licence exempt bands, though there were also some fixed network links, corporate users, and telemetry applications. Most licence exempt links operate outside of the five main cities[130] and in some cases outside regional towns. ComReg is aware that there are at least 20,000 FWA customers[131] availing of services provided via licence exempt spectrum in the 2.4 GHz and 5.8 GHz Bands and several thousand licence exempt fixed links.

4.50 Under this option, there is a risk that some or all operators that would ordinarily rely on use of licence exempt spectrum to satisfy existing and future requirements, would instead seek spectrum rights of use in the licensed bands, given the potential attractiveness of access to protection from other users and services at low cost. In effect, licence exempt users would be provided with the benefits of licensed spectrum rights of use which could in turn create unintended incentives to migrate to the Fixed Link Bands.[132]

4.51 The precise impact of such a development is somewhat uncertain, in particular as the threat of a future congestion surcharge being applied if demand increases sharply should mitigate such a possibility. However, ComReg is of the view that reducing the difference between the costs of licensed and licence exempt spectrum to such an extent would unavoidably come with some risk of inefficient migration into the licensed bands, resulting in an unnecessary congestion.

4.52 This view is also informed by the RFI responses where it was shown that the operators who use licence exempt spectrum are those parties most sensitive to price. DotEcon notes that:

"*operators' use of the licence exempt bands and their expressed opinion that licence fees limit use of the main fixed links bands suggests that the demand for other bands could increase significantly if licence fees were lower*."[133]

4.53 It is difficult to predict what frequencies licence exempt users would likely prefer in the event of migration given the disparate characteristics of individual users. RFI responses suggest that if operators who rely on licence exempt spectrum had to move out of the 5 GHz band, they would consider the 80 GHz band where link lengths

[129] See Section 2.7 of ComReg Document 20/109A

[130] Certain licensees operate link(s) in the urban Dublin area (operating between Dublin and Three Rock Mountain).

[131] ComReg notes that this number of subscribers is likely conservative as it concerns residential users and licence exempt spectrum is also used to deliver FWA for businesses and schools. Further, ComReg note the views of respondents in Section 3.2.2 that the number of subscribers are under reported.

[132] ComReg also notes that the availability of more advanced equipment in the future will allow licensees to utilise greater bandwidth as existing legacy equipment is limited by the bandwidth it can operate at.

[133] See page 34 of ComReg Document 20/109A

permit, or into neighbouring bands where they could achieve higher throughput.[134] However, they could also move into bands with similar propagation – noting that less spectrum is generally available in these band compared with higher frequencies.

4.54 Therefore, ComReg is of the view that there would be an increased risk of inefficient and unpredictable migration from the licence exempt bands[135] that would primarily concern the provision of fixed wireless in rural areas.

III. Increased incentives for spectrum hoarding

4.55 Spectrum hoarding can be defined as acquiring or retaining frequencies with a zero or low expectation of efficient use. Spectrum hoarding can come in different forms[136]:

- Anti-competitive hoarding involves the accumulation of rights of use for strategic reasons to prevent potential competitors acquiring sufficient rights of use to compete downstream[137]. (See Section 5.7 below);
- Inefficient hoarding occurs where licensees obtain more spectrum than necessary because the cost of holding it is low; and
- Speculative hoarding is undertaken with the purpose of reselling for a higher value in the future (though this is primarily an issue for long-lived licences).

4.56 Under the proposed option, licensees would have a stronger incentive to hoard spectrum inefficiently or anti-competitively[138] than is currently the case due to the lower costs. The potential for ComReg to introduce a congestion charge might help to address this but there could still be scope for inefficient or anti-competitive hoarding up to the point at which congestion charging appears to be a real threat

[134] See page 34 of ComReg Document 20/109A

[135] ComReg notes that because equipment is typically tuneable within a given band, or sub-band, but not across different bands, such a process would not occur at once and would instead occur over a period of time. However, as noted from the stakeholder engagement (See Annex B5 of Document 20/109A) - the asset life of the equipment is not a key driver of when equipment is replaced (i.e., replacement of links is driven by end user demand); therefore, some migration may happen sooner. Further, any new links whether from existing license exempt users or new entrants would likely be located in the Fixed Link Bands when license exempt spectrum would have been used if the Fixed Link Bands were subject to more appropriate pricing.

[136] In all cases, hoarding restricts the supply of scarce spectrum resources to the rest of the market for its intended use. This results in the underutilisation of spectrum, to the detriment of other operators, competition and ultimately of consumers.

[137] ComReg also observes that the notion of anticompetitive spectrum hoarding can be better understood by reference to recital 122 of the EECC which provides: “In order to avoid the creation of barriers to market entry, namely through anti-competitive hoarding, enforcement of conditions attached to radio spectrum rights by Member States should be effective…” and Recital 133, which provides: “National competent authorities should, however, always ensure the effective and efficient use of radio spectrum and avoid distortion of competition through anti-competitive hoarding”.

[138] Speculative hoarding is unlikely to be relevant and is not considered further in this consultation because fixed links rights of use are annually renewable and cannot be traded in secondary markets.

(e.g., in between ComReg's regular reviews).

4.57 Given the relevant background information discussed under I, II and III above, ComReg is of the view that Fixed Links are already subject to potential scarcity in the future and an administrative cost recovery option would likely lead to increased usage and more widespread congestion in the future than is currently the case.

4.58 ComReg now considers whether an administrative approach described above is a valid regulatory option.

ComReg assessment of administrative approach

4.59 Based on the information before it, ComReg remains of the view that administrative cost recovery is not a valid regulatory option in the context of ComReg's statutory framework and is unlikely to be objectively justified and proportionate (compared to the current framework) as required by Regulation 15 of the Authorisation Regulations. Factors informing this view are as follows.

4.60 **First**, the proposed option would not accord with the objective of promoting competition because, among other things:

- Such an approach would fail to support the efficient management and use of the radio spectrum as required under Section 12 of the Act because:
    - it fails to take account of the different characteristics (e.g., propagation and capacity) of each of the Fixed Links Bands. For example, DotEcon does not recommend this type of administrative approach, "*as some differential should be maintained between higher and lower frequency bands to avoid lower frequencies being filled by users who could easily use higher frequencies, precluding lower bands to users who need their propagation advantages*".[139]
    - It fails to account for potential scarcity in the future and that there could be an opportunity cost to a new licence even if there is no current scarcity in that band, as given long equipment lifetimes, the new fixed link may to be in place for many years and scarcity may emerge over that lifetime.
    - There are no incentives to choose bandwidth that is in line with actual requirements, and it would likely increase the incentives for inefficient hoarding of spectrum because the cost of holding additional spectrum would be low.
    - It would potentially lead to increased congestion and even the

[139] See page 34 of ComReg Document 21/134A.

creation of new congestion areas across the state due to an increase in number of links and associated bandwidth resulting from risk of migration from the licence exempt bands and hoarding, as described above.

- Licence exempt spectrum which is currently used in the delivery of services by operators (that are effective in managing interference) could become unnecessarily underused and the future use of these bands would need to be considered.

- There would be an increased risk of distortion or restriction of competition to the detriment of users because licensees would have stronger incentives for anti-competitive and inefficient hoarding[140] as the cost of holding those rights of use diminishes significantly under the proposals.

4.61 **Second**, creating the conditions for promoting efficient investment and innovation in new and enhanced infrastructures involves ComReg exercising its regulatory functions in an appropriate and predictable fashion, thus providing regulatory certainty. As noted by DotEcon, "*it is important that fees for Fixed Links are predictable, if ComReg is to encourage efficient investment. Otherwise, it could create a hold up problem, where investment is avoided because of highly uncertain and potentially large future fees (which operators cannot easily avoid by moving to other bands or alternative technologies such as fibre once equipment is installed)*."[141]

4.62 Under an administrative cost approach, a new licensing framework would likely be required after a short period to account for changes in demand for the Fixed Links Bands as described above. For example:

- ComReg may need to consider whether permitting licensees to renew rights of use annually in the context of increasing levels of congestion is appropriate[142], which may require a future reassignment and a transition process; and

[140] For example, ERG-RSPG report on the management of radio spectrum in order to avoid anticompetitive hoarding notes that:
"*Under an administrative spectrum management regime, where spectrum usage rights are distributed according to a first-come-first-served principle and the administrative charges are low, the incentives to hoard could be expected to be rather high*."
[141] See page 47 of ComReg Document 21/134A.
[142] Such issues create concerns around asymmetric access to the spectrum and spectrum hoarding.

- In the absence of fees being effective in reducing incentives for spectrum hoarding, and pursuant to Regulation 17(10) of the Framework Regulations 2011, ComReg may need to consider introducing rules in relation to spectrum hoarding and include specific rollout conditions for all Fixed Link licensees which likely would be reported to ComReg on an annual basis and prior to any decision to renew rights of use. Such rollout conditions could impose significant costs on licensees but may nonetheless be required in the absence of an effectively function fees framework.

4.63 Considering the above, licensees would have no certainty on whether such a licensing framework and associated fees would be retained over a sufficiently long period. Any investment undertaken under this proposed option would likely become inefficient in the event of a new framework being introduced.

4.64 **Third**, as set out under Option 1 below, there is no evidence that existing fees have choked off efficient demand. On the contrary, the Fixed Links regime has largely flourished, and users have benefitted from the general availability of spectrum rights of use that has supported the delivery of services across a range of use cases. The existing fee schedule provides ComReg with reliable information about the level at which fees would not choke off efficient demand and illustrates that fees do not need to be set excessively low (increasing hoarding possibilities) to avoid such risks.

4.65 **Fourth**, ComReg notes that such an approach would notably undermine ComReg's spectrum management function by reducing its ability to manage the risks created by an inefficient framework. For example, under administrative cost pricing ComReg would be prevented from implementing a frequency gradient, potentially resulting in hoarding and leading to scarcity in lower frequencies in new areas. An effectively functioning fees framework should ensure that licensees are incentivised to use assigned rights of use as efficiently as possible. This avoids excessive spectrum demand where alternatives are available, and which would cost licensees less than the foregone value that excluded users could realise from that spectrum.

4.66 Further, ComReg received no responses on these four matters listed above, while addressing more general comments on administrative cost recovery in Chapter 3.

4.67 Accordingly, considering the above and based on the information currently before it, ComReg is of the view that an administrative cost recovery should not be included as an option in the RIA.

4.68 Considering the above and taking into consideration information provided in submissions in response to Document 20/109, Document 20/109A, ComReg considers that the following two regulatory options are available to it.

Option 1 – Make available for assignment all rights of use to the Fixed Link Bands on the same basis as the schedule of Fixed Link licence fees taken from Part 2 of

the 2009 Regulations.

4.69 Under Option 1 the existing fee schedule would continue to apply. In assessing this option, ComReg also considers small changes that could be made to the existing regime (e.g., CPI existing fees).[143]

4.70 **Option 2 –** Make available all rights of use to the Fixed Link Bands using a USPP (as an AIP proxy) approach that sets fees for all bands using a formula. The approach would be introduced gradually over a three-year period[144] and include the following elements:

- a base price per MHz;
- a schedule of band specific values that determine the relative value difference between upper and lower frequencies;
- an 'effective bandwidth'[145], for each band which exceeds link bandwidth where the channel size is less than the largest commonly used channel size within that band;
- a congestion charge; and
- an administrative cost floor below which prices cannot fall.

4.71 This latter option would be subject to a 3 – 5 year review. ComReg would be minded to hold the initial review 3 years following the full implementation of Option 2 (i.e., circa 2030 if a final Decision is made by ComReg in 2023).

4.72 A more detailed account of Option 2 and its associated variables is set out in Annex 2, and Section 4 of Document 21/134A. ComReg also notes that an Assessment Tool is also available for existing Fixed Link licensees to assess the extent to which fees would change in response to this option (See Chapter 6).

4.2.6 Steps 3 and 4: Impact on industry stakeholders, competition, and consumers

Identification of stakeholders

[143] Existing fees are currently not indexed to inflation – therefore a potential option would be the indexing existing fees to CPI. However, such a change can be assessed under Option 1 and avoids the need for unnecessary repetition on the impacts of a particular option.

[144] With 3-year phasing:
- Existing fees retained for year 1
- 1/3 weight to new prices and 2/3 to old prices in year 2;
- 2/3 weight to new prices and 1/3 to old prices in year 3; and
- new prices from year 4.

[145] See Annex 2 and Chapter 3 for discussion on revised definition of effective bandwidth.

4.73 Step 3 assesses the likely impact of the proposed regulatory measures on stakeholders. Hence a necessary precursor is to identify such stakeholders who, in this RIA, fall into two main groups:

I. industry stakeholders as described above; and

II. competition and consumers.

4.74 ComReg sets out below a comparative analysis of each of the three options regarding pricing outlined above, in terms of their impact on stakeholders, competition and consumers.

4.75 For the purposes of the assessment below, stakeholders are categorised broadly into existing Fixed Links licensees ("Existing Licensees") and future and potential holders of Fixed Links.[146]

4.76 ComReg considers this to be the more useful than to examine each user case given that outcomes are more dependent on the attributes of the licensee and their requirements rather than the use case itself.

Impact on industry stakeholders

4.77 This section provides information on the impacts on industry stakeholders (as outlined above) arising from the regulatory options above.

4.78 ComReg notes that there are two broad categories of impacts relevant in this section:

- **First**, the impact of the regulatory option on spectrum fees paid by Existing Licensees or would be paid by future licensees (i.e., "Financial Impacts"); and
- **Second,** the impacts arising from how rights of use are assigned in each of the regulatory options (i.e., "Assignment Impacts").

4.79 In relation to the Financial Impacts, ComReg notes that any changes to the existing fees have the potential to affect stakeholders in different ways such that some stakeholders may pay more, or less, compared to fees currently paid for similar spectrum rights of use.

4.80 Relatedly[147], and regarding Assignment Impacts, the preferred option should better

[146] This may include entrants based in the State, in other Member States or further afield that providing innovative new services such as the Potential Use Cases, international providers of services in existing use cases wishing to operate in the State or even existing users that wish to enter into the provision of services in other Existing Use Cases.

[147] ComReg notes that fee's impacts refer to a static analysis where licensees are assigned the same rights of use. However, it possible, even likely, that licensees will consider alternative bands or amounts of spectrum across different areas in response to ComReg's proposed changes.

incentivise the efficient assignment of spectrum rights of use such that an appropriate charging structure should create incentives for the installation of new links in the future).

4.81 ComReg assesses Financial Impacts and the Assignment Impacts on stakeholders in turn below.[148]

4.3 Financial Impacts

4.82 To assess the financial impact of Option 2 on Existing Licensees, ComReg has conducted a comparative analysis of the fees paid by those Licensees compared to Option 1. The assessment that follows is necessarily static (i.e., it is based on existing Fixed Link deployment[149]) and is conducted to highlight possible impacts, noting that final fees paid by Existing Licensees would depend on choices made by those licensees in determining how to dimension their networks in the future.

4.83 This is a conservative approach to estimating the impact of Option 2 on Existing Licensees because it assumes that operators would continue to use existing rights of use in the same way which, while contrary to the aim of this review, nonetheless provides a useful comparator[150].

4.84 ComReg notes that equipment is generally only tuneable across a small range of frequencies and some rationalisation could occur over the short run – however any significant reorganisation would likely coincide with normal equipment replacement. That said, there is likely to be greater flexibility for certain operators. For example, the stakeholder interviews and RFI observed that the asset life of the equipment is not a key driver of when it is replaced (i.e., replacement of links is driven by end user demand). [151]

4.85 Under Option 2, the total fees paid by Existing Licensees would be broadly neutral, decreasing by approximately €1.35 million annually compared to Option 1[152].

4.86 While the impact on stakeholders overall is broadly positive, with the fees paid by licensees decreasing by 13.2% on average, licensees would experience a decrease in fees while others would experience an increase. The impact on an individual licencees aggregate fees for fixed links depends on how those licensees currently

[148] These assessments are not provided in any particular order and the issues they address can overlap.
[149] This assessment is based on licensing data as of 1 July 2022.
[150] For example, Existing Licensees may rationalise or change their use of Fixed Links under Option 2. This could arise due to licensees substituting between bands in response to changes in the relative prices, or from rationalising on other rateable factors such as bandwidth in response to higher price.
[151] See Annex B5 of ComReg Document 20/109A
[152] ComReg notes that the fees outlined in this consultation are lower than those in 21/134. This is the result of the revision of certain parameters of the Fixed Link fee model, which has incidentally decreased the total fees payable by operators under Option 2 relative to Option 1.

deploy existing rights of uses (i.e., bands, bandwidth, location). It is not possible to outline each of these impacts individually, given the prevailing confidentiality concerns. However, ComReg would note that any increase or decrease is modest (either in % or absolute terms), and licensees can assess those impacts using the Assessment Tool provided as part of this draft Decision.

4.87 It is notable that the variation in fees is not contingent on the stakeholder group (e.g., MNOs / FWA Operators); indeed, one finds that there are variations within stakeholder groups. Rather, the differentiating factor is how licensees have chosen to dimension their networks and the Fixed Link Bands on which they have relied. An assessment of the financial impact according to particular stakeholder groups is therefore unlikely to be informative.

4.88 With that in mind, the remainder of this section assesses the financial impact on fees in two parts:

- The first part assesses how fees vary (increase or decrease) across both options. ("Fee Variations"); and
- The second part provides an assessment of why fees vary across both options and the key factors driving same. ("Key Factors Driving Fee Variations").

4.89 Stakeholders should carefully consider the reasons why fees may increase or decrease as this should help to inform any future considerations it might have in dimensioning their network and help mitigate any increases in fees in particular bands or areas.

Fee Variations

4.90 As noted above, Option 2 is broadly neutral, because it reflects a re-weighting based on the individual characteristics of each Fixed Link. This necessarily implies different impacts to stakeholders given the heterogenous nature of Fixed Links and how licensees have deployed their networks.

4.91 As noted by DotEcon, "*some licences will see increases, but others decrease in fees. For many classes of user, these changes will largely net out. Therefore, the proposed pricing formula is largely a restructuring of fees, rather than a general shift in level. In any case, we propose that changes are phased in over three years*". [153]

4.92 Under Option 2, 76% of existing Licensees would pay lower fees[154] and any aggregate reduction in a licensee's Fixed Link fees would arise because of a

[153] See page xi of ComReg Document 21/134A

[154] Assuming there was no change in the current use of fixed links i.e., this is a static comparison.

reduction in uncongested fees[155].

4.93 Under Option 2 uncongested Fixed Links would become less expensive, with the median[156] fee decreasing from €1,125 under Option 1 to €784 under Option 2. Under Option 1 fees for uncongested links are capped at €1,500 per Fixed Link. However, fees per uncongested link tend to be higher compared to Option 2 because more fees are distributed closer to the cap. Under Option 1, there are many uncongested links, heavily weighted in the €1,100 to €1,200 range.

4.94 Under Option 2, fees are not capped, but instead are strictly increasing with the bandwidth used (for a given band and congested status). However, based on existing Fixed Links, there is a more even spread of fees across all price ranges (particularly those below €1,000). For example, under Option 2 there are approximately 6,400 Fixed Links with fees less than or equal to €1,000 per link and 4,200 Fixed Links with fees above €1,000 per link.

4.95 Figure 1 illustrates the distribution of fee variations under Option 2 compared to Option 1. Notably, the fees for approximately 7,400 uncongested links (70%) would reduce, with most reductions in the €0 - €600 range.

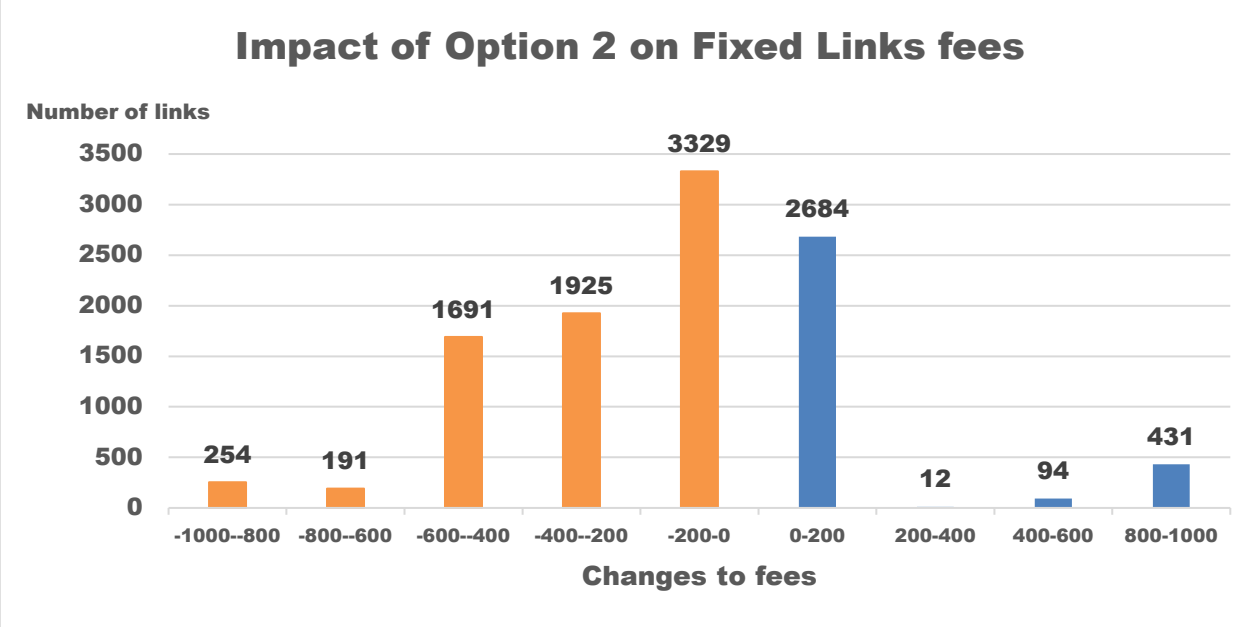

Figure 1: Uncongested fee increases and reductions under Option 2

[155] All congested fees increase (see congestion charges below).
[156] In statistics and probability theory, the median is the value separating the higher half from the lower half of a data sample, a population, or a probability distribution. For a data set, it may be thought of as "the middle" value. The median value may be appropriate than an average when comparing distributions as it is less sensitive to outliers.

4.96 On the other hand, around 3,200 uncongested links would experience an increase, around 83% of which are in the €0 - €200 range. As noted below ('Charging for increasing bandwidth') the reason for certain uncongested links increasing compared to Option 1 primarily relates to the bandwidth used for those links (i.e., under Option 1 fees increase slowly with bandwidth used and not at all after 40 MHz). See section 4.6 (Spectrum management and efficiency) below for a further discussion.

Band	No. of Licences	Average Change (%)
1.3/1.4	28	-90%
1.3/1.5	43	-90%
2.0/2.3	15	-59%
L6	81	-21%
U6	91	4%
L7	7	-51%
U7	179	-28%
L8	168	-25%
U8	3	-83%
11	1,139	-8%
13	963	-18%
15	1,179	-21%
18	2,035	20%
23	1,189	-13%
26	61	-53%
28	394	-40%
38	1,025	-75%
42	33	-25%
80	2,300	4%

Table 4: Average change in fees per band

4.97 Under Option 2, 16 of the 19 existing bands would experience a reduction in Fixed Link fees on average[157] as shown in Table 4.

4.98 Licensees whose overall fees would reduce under Option 2 (76% of licensees) would likely prefer that Option over Option 1. Such stakeholders would benefit from reduced fees if existing rights of use were retained. Further, such stakeholders may also decide to reconsider how its Fixed Links are deployed such that the required connectivity can be delivered more cost effectively by moving out of congested bands/ migrating to higher frequency bands etc.)

4.99 Existing Licensees whose fees would decline are likely to have two main concerns:

[157] This is the average of all changes across fixed links fees in their respective bands, under Option 2.

- Under Option 2, Fixed Links would no longer be capped at €1,500 resulting in some higher fees for Fixed Links that Existing Licensees may require in the future [158]; and
- To the extent such licensees required rights of use (or additional rights of use) in congested areas in the future, they would face higher fees for same.

4.100 However, such concerns (were they to arise) are clearly manageable given the incentives provided by Option 2 and licensees can calculate the most cost-effective approach to deploying such links.

Key Factors Driving Fee Variations

4.101 Under Option 2, there are three key factors informing any variation in fees, and in particular fee increases relative to Option 1:

1. Bands assigned;
2. Bandwidth assigned (specifically above 40 MHz); and
3. Congestion charges.

1. Bands Assigned

4.102 As set out in Table 2 above, the average fee for a Fixed Link would increase in three bands under Option 2 relative to Option 1:

- the upper 6 GHz - 4% increase;
- 18 GHz - 20% increase; and
- 80 GHz - 4% increase.

4.103 The most impacted Existing Licensees are those who would experience an increase in fees of greater than or equal to 10% (of existing fees) and/or an increase of greater than €10,000 under Option 2. The change in overall fees that would be paid among these licensees is driven largely by their current links which exceed 40 MHz bandwidth[159] particularly in the 18 GHz[160] and to a lesser degree 23 GHz bands where 110 / 112 MHz links are more common. In that regard, ComReg notes that the key driver of overall fee increases for Existing Licensees under Option 2 is that the

[158] Under Option 2, fees for uncongested fixed links would have a greater variance, with a significant number of fixed links becoming more expensive (fatter tails to the right of the distribution).
[159] Under the existing fee schedule an otherwise identical Fixed Link of 40 MHz or 120 MHz would have the same fee - the additional 80 MHz was in effect free. Under the proposed fee model this Fixed Link would now be more expensive, with the fee rising linear to the bandwidth.
[160] ComReg notes that the increase in fees in the 18 GHz Band is driven by changes in how additional bandwidth is charged.

incremental charge for additional bandwidth above 40 MHz is no longer set at zero.

4.104 As shown in Table 4, the magnitude of the change in average fees also varies significantly across bands, therefore the extent to which an existing licensees' fees increase or decrease depends in part on the bands in which it currently operates. Given that the various bands form a chain of substitutes there is much scope for Existing Licensees to switch many Fixed Links out of bands with higher fees into bands with lower fees.

2. Bandwidth assigned

4.105 ComReg estimates that under Option 2, that fees on bandwidth above 40 MHz (c. 6,000 Fixed Links) would account for approximately 33% of total fees.[161] This is roughly commensurate with its share of total bandwidth, noting that under Option 1 the additional bandwidth above 40 MHz does not account for any share of fees paid. This clearly raises the need for measures to address the lack of charging for additional bandwidth considering the ever-increasing demand for bandwidth.

4.106 Table 5 shows the fee under Option 1 and Option 2 for an uncongested Fixed Link in the most common bandwidth within each band. In short, fees reduce for the most commonly used bandwidths in most bands.

Fees for select uncongested Fixed Links, by band

Bands	Bandwidth	Option 1	Option 2
1.3/1.4	0.5	€1,200	€100
1.3/1.5	1	€1,100	€100
2.0/2.3	14	€1,200	€495
L6	29.65	€1,200	€947
U6	40	€1,200	€1257
L7	14	€1,100	€434
U7	28	€1,000	€861
L8	29.65	€1,000	€901
U8	7	€1,100	€210
11	40	€1,200	€1,105
13	56	€1,500	€1,461
15	112	€1,500	€2,280
18	110	€1,125	€1,943
23	112	€1,125	€1,650
26	28	€900	€421
28	112	€1,125	€1,177
38	112	€825	€412
42	112	€150	€112
80	1000	€150	€250

[161] To estimate this ComReg examined the fees for existing Fixed Links under the new fee model, with and without bandwidths capped at 40 MHz.

Table 5: Average change in fees for largest, commonly used bandwidths

4.107 Fees increases for highest commonly used bandwidths under Option 2 are concentrated in the middle frequency bands where licensees regularly require additional bandwidth above 40 MHz, after which point no marginal cost applied under existing fee schedule. Under Option 2, above 40 MHz fees would increase in line with the bandwidth used.

3. Congestion charges

4.108 The number of links (and associated licensees) which would require a congestion charge is relatively small (c. 322 Fixed Links held by 26 licensees) and this congestion premium would account for just 6% of total fees[162], noting that under the existing fee regime congestion charge accounts for <1% of total fees

4.109 Under Option 2, congested Fixed Links would become more expensive, with the median fee increasing from €1,080 to €1,967. There is also a greater spread of fees above €1,700. The left-hand side of figure 2 provides some rationale for the ineffectiveness of the existing congestion charges, with those charges under Option 1 weighted too heavily in the €900 - €1,100 range.

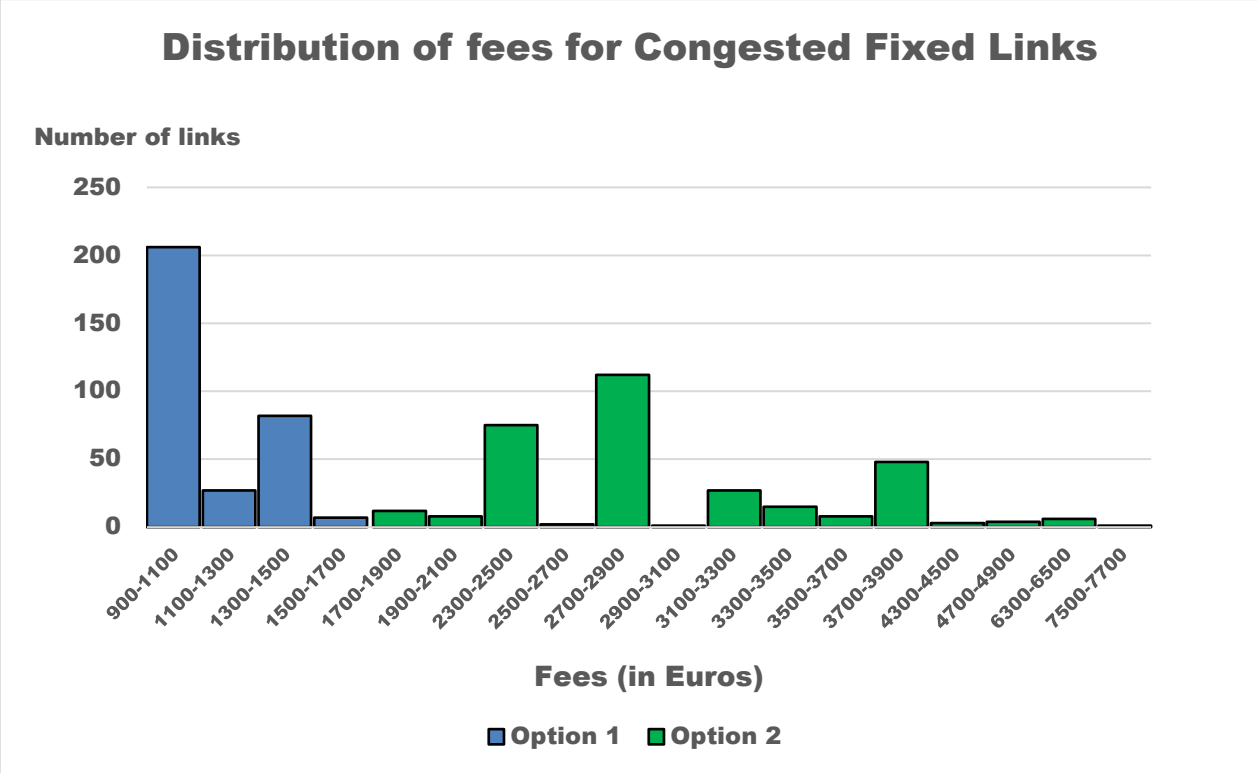

Figure 2: Distribution of fees for Congested Fixed Links

[162] To estimate this, ComReg examined the fees for existing Fixed Links under the new fee model, with and without congestion charges.

4.110 Therefore, while stakeholders that would experience an increase in fees are likely to prefer Option 1 over Option 2, such stakeholders may also welcome the flexibility provided by Option 2 noting that most links are uncongested and fees for such links are typically lower, as shown above.

Conclusion on stakeholder Impact

4.111 The impact of Option 1 is neutral on all stakeholders because this is the status quo option.

4.112 The extent to which Existing Licensees may prefer either Option 1 or Option 2 depends on several factors including the level of fees and the extent to which such licensees would prefer additional flexibility:

- 69% of licensees would pay lower fees and would **likely prefer Option 2** because of these reductions. Further, such licensees may be able to reduce their fees further by re-dimensioning their network by migrating into bands and bandwidth where fees are lower; and
- 31% of licensees would pay higher fees and would thus **likely prefer Option 1.** However, because increases are relatively modest and such licensees **may prefer Option 2** because it may be possible to reduce fees over time by migrating into bands where fees are lower. In particular:
    - Fees for uncongested links primarily increase where bandwidth requirements are above common bandwidths of 28 MHz or higher.
    - The combination of bandwidth above 40 MHz in the bands between 17 GHz and 37 GHz is where fees under Option 2 are highest compared to Option 1.
    - This increase is driven primarily by links in the 18 GHz band, that exceed 40 MHz in bandwidth.

4.113 New licensees are **likely to prefer Option 2** because fees decrease for most links and new licensees can dimension their networks from the outset in line with the incentives provided by that option. New licensees will benefit from the fact that the primary focus of Option 2 is on the incentive potential an appropriate charging structure creates for the installation of new links.[163] Such licensees will be able to choose the most cost- effective combination of bands and bandwidth that best meet its link length and bandwidth requirements.

4.114 Under Option 1, new licensees would be faced with greater uncertainty about whether that framework would persist in the long run and may delay investment

[163] See page 31 of ComReg Document 21/134

decisions and ultimately entry. This is mostly because it lacks the flexibility given by Option 2 for ComReg to vary parameters in response to changes in demand and technology developments for Fixed Links without making wholesale changes to the framework.

4.4 Assignment Impacts

4.115 Assignment Impacts refer to the nature and quantum of spectrum rights of use to be assigned to licensees. The choice of preferred option can impact an operator's ability to obtain the rights of use necessary to satisfy efficient demand and deliver one or more use cases. ComReg assesses the Assignment Impacts under the following headings:

(a) Efficiency and congestion;

(b) Simplicity; and

(c) Stable and predictable fees.

4.116 ComReg notes that there is overlap between some of the items discussed in this section and other areas of the draft Decision. To avoid repetition, ComReg, where appropriate, will refer readers to the relevant sections.

I. Efficiency and Congestion

4.117 As outlined in 'Charging for increasing bandwidth' below, ComReg is of the preliminary view that increased bandwidth requirements increase the risk of potential scarcity in the future. This creates Assignment Impacts for stakeholders to the extent that future users may be unable to access sufficient spectrum because fees failed to promote more efficient use. This could arise through ComReg not having an appropriate charging structure that creates incentives for licensees to consider their requirements at the point of installation of new links.

4.118 ComReg does not repeat the assessment here but under 'Spectrum management and efficiency' that follows, ComReg outlines its preliminary view that Option 2 best promotes spectrum efficiency considerations and would be more likely to reduce congestion scenarios in the future. Therefore, Option 2 is more likely to reduce assignment risks associated with spectrum availability in the future.

4.119 Further, because Option 2 is more likely to prevent congestion issues arising, it is significantly more likely that spectrum will be available when a new licensee requires it. Alternatively, under Option 1 a new licensee may have to choose a sub-optimal combination of bands and bandwidth because of congestions in certain bands and areas that would not exist under a more efficient option.

II. Simplicity

4.120 DotEcon advises that simplicity for users is important to ensure that users and potential users do not face undue burdens in the assignment process.[164] In particular, new users should not be discouraged from applying for rights of use. The preferred option should reduce the extent to which a potential licensee is assigned rights of use which were made based either on poor information or a lack of understanding of the assignment process.

4.121 Option 1 seems most unlikely to create confusion for Existing Licensees; indeed ComReg has received no information from stakeholders that would suggest a difficulty with the current framework. Similarly, potential or new licensees are likely to find Option 1 relatively straightforward as the schedule of fees is clearly laid out and only requires a licensee to select its band(s) and bandwidth from the schedule.

4.122 Under Option 2, there is some risk that a new licensing framework could create Assignment Impacts that would not arise under Option 1. ComReg considers this unlikely because the practical implementation of the formula is very straight-forward, and licensees are generally very well versed given the nature of Fixed Links. Licensees simply must know their requirements or range of requirements for a specific link and the associated fee would be calculated automatically on that basis.

4.123 Therefore, while Option 1 is likely to be simpler for licensees in the short run, any additional complexity created by a new approach under Option 2 is likely to be marginal and transient. Consequently, there are unlikely to be any Assignment Impacts arising from simplicity/practicality under either Option.

III. Stable and predictable fees

4.124 As set out at “Efficient Investment’ under Option 2, the use of a formula-based approach helps to ensure the pricing regime is future-proofed and robust to changes in demand (i.e., for bandwidth, and across different bands) and developments in congestion (which may increase or decrease in different bands and/or locations). Importantly however, Option 1 would likely require changes in the future arising from matters such as increased bandwidth requirements outlined earlier in this document, and consequently fees under this Option are inevitably likely to change in the not-too-distant future (see “Spectrum management and efficiency” below)

4.125 Therefore, Option 2 is more likely to result in stable and predictable fees.

4.126 Overall, ComReg is of the preliminary view that Option 2 would result in more positive Assignment Impacts.

[164] ComReg does not have a specific simplicity objective, except to the extent that excessive complexity would compromise its ability to provide for an efficient assignment.

4.5 Impact on competition

4.127 As outlined above, (see Policy Issues and Objectives) there are different elements to competition that are relevant in determining the impact of any of the preferred options. There is a natural overlap between the aims of the fee methodology and an assessment of ComReg's compliance with some of its statutory obligations, particularly that of promoting competition, in accordance with Section 12 of the 2002 Act of by. These include:

(a) Encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources[165] ("Efficiency and Spectrum Management - Section 4.6");

(b) Ensuring that there is no restriction or distortion of competition in the electronic communications sector[166] ("Distortions to competition" – Section 4.7);

(c) Promoting efficient investment and innovation in new and enhanced infrastructures[167] ("Efficient Investment and Innovation" – Section 4.8); and

(d) Safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure-based competition[168] ("Infrastructure based competition" – Section 4.9). [169]

4.128 The remainder of ComReg's 'Impact on Competition' assessment, arising from each of the regulatory options, is assessed under the headings provided in (a) to (d) in the preceding paragraph. In doing so, ComReg notes that it previously set out its assessment of the impact of the Options on each of the stakeholders earlier. This assessment is not repeated here and instead ComReg refers to the relevant aspects of same in completing its assessment.

4.6 Spectrum management and efficiency

4.129 ComReg's spectrum management role requires that operators with spectrum assignments in the relevant bands are incentivised to efficiently use those spectrum assignments. ComReg agrees with DotEcon that the primary focus is on the incentive potential an appropriate charging structure creates for the use of links. [170]

[165] Section 12(2)(a) of the 2002 Act.
[166] Section 12(2)(a) of the 2002 Act.
[167] Regulation 16(2) of the Framework Regulations.
[168] Regulation 16(2) of the Framework Regulations.
[169] Impact on consumers assessed separately below.
[170] ComReg Document 20/109A, "*Consultant's Report - Fixed Links Bands Review*", published 9 November 2020, available at https://www.comreg.ie/

4.130 With that in mind, ComReg assesses the efficiency of each Option under the following headings, in common with the discussion in the DotEcon Report (Document 21/134A):

I. Fees should best reflect the fact that a unit of spectrum (MHz) in the lower frequency bands has a higher value than in the higher frequency bands because of increased propagation and more limited supply. ("Frequency gradient").

II. Licensees should be subject to fees for additional bandwidth ("Charging for increasing bandwidth").

III. Spectrum should be made available in way that reduces the extent to which a frequency band(s) is fragmented into blocks that are unusable by others ("Fragmentation Risk").

IV. Where scarcity occurs, fees should best reflect the opportunity cost of the spectrum ("Congestion Charges").

4.131 Before, assessing each efficiency consideration below, readers are reminded that under Option 1:

- The 'Band Category' refers to the category of bands (e.g.,17 GHz to 37 GHz) that a link is required for and for which a particular fee applies; and
- The 'Bandwidth Category' refers to the category of bandwidth (e.g., 20 MHz to 40 MHz) that is required for a link and for which a particular fee applies.

1. Frequency Gradient

4.132 All things being equal, licensees would typically prefer to locate links in lower frequency bands where propagation of links is greatest. As noted in the first DotEcon Report:

> "*Operators, in response to the RFIs and through the stakeholder interviews, emphasised that link length policy is the most important factor in the selection of a band, and beyond that they simply select an appropriate size channel".* [171]

4.133 While licensees typically have a range of bands that can be used to deliver a specific use case[172], it is likely that bands with longer links, that fall within that range, will be chosen once appropriate channel spacing is available. Accordingly, absent sufficient

[171] See page 54 of ComReg Document 20/109A

[172] As set out in ComReg Document 20/109A, "most use cases have a degree of flexibility and are able to use a range of bands around some range of feasible alternative bands which varies from use case to use case". See Table 1: Key bands for each use case

incentives, licensees are, unsurprisingly, more likely to pick lower frequency bands when higher frequency bands would have been sufficient to accommodate their needs, even though there is less bandwidth typically available in those bands. This, in turn, makes them more prone to congestion.

4.134 DotEcon notes that there is a good case for maintaining a differential between lower and upper bands as this avoids the problem that lower frequency bands become occupied with users who could have used alternative higher bands as they did not actually require the superior propagation offered by lower bands. [173]

Option 1

4.135 ComReg notes that existing fees under Option 1 are based on a Frequency Gradient such that the ratio between lowest frequency bands (1.3 GHz – 15 GHz) and highest frequency bands (42 GHz – 80 GHz) for a given bandwidth is 10 to 1. For example, in the lowest frequency band category (1.3 GHz – 15 GHz) the fee for 0.25 MHz to 3.5 MHz is €1,000 compared to €100 in the 42 GHz – 80 GHz bands. This 1:10 ratio holds for all bandwidth categories.

4.136 To determine whether the existing frequency gradient sufficiently reflects the value difference between the upper and lower frequency bands, DotEcon estimated the difference in opportunity cost between upper and lower frequencies (if there was scarcity).[174] The ratio between the highest opportunity cost and lowest opportunity cost for links of a given size, and given level of congestion, is informative of the relative prices at which operators may prefer one band over another.

4.137 This modelling[175] shows that value differences is significantly greater than the 10:1 ratio that is used under Option 1. DotEcon advises that while there is uncertainty around these opportunity cost estimates, the current charging scheme does not seem to provide a strong enough incentive to avoid the lower bands if they were acutely congested. The cost modelling suggests that the ratio of opportunity cost in congested areas between lower and upper bands is in the order of **1:15 to 1:54** depending on the bandwidth used and the location of the links considered. [176]

4.138 Therefore, ComReg is of the view that while a frequency gradient is present under Option 1, this 1:10 level is unlikely to reflect the likely value differences between the bands. Consequently, it is not able to provide a strong enough incentive to discourage the use of the lower bands when higher frequency bands are also fit for

[173] See page 30 of ComReg Document 21/134A.
[174] DotEcon also advise that even without acute congestion, there is a still good case for maintaining a differential between lower and upper bands. This avoids the problem that lower frequency bands become occupied with users who could have easily moved to alternative higher bands when initially installing links, not needing the superior propagation of lower bands.
[175] See Annex 2
[176] See Table 9, 10 and 11 of ComReg Document 21/134A.

purpose. This deficiency could therefore lead to inefficiencies in the assignment of spectrum rights of use in the future.

Option 2

4.139 DotEcon considers that it is beneficial to try to reflect at least some of the likely structure of long run opportunity costs within fees. Option 2 achieves this by establishing some reasonable differential in per MHz fees across different bands reflecting the intrinsically more limited supply of low frequency spectrum and to provide an incentive for users with flexibility to leave lower bands available for those who require them.[177]

4.140 Under Option 2, the ratio between the highest opportunity cost and lowest opportunity cost for a given link and level of congestion is used to determine the relative ratio between bands. This is likely to be informative of the relative prices at which flexible operators may prefer one band over another. As noted, this is likely to be in the range of **1:15 to 1:54,** depending on factors such as the bandwidth used, and the location of the links considered. Within this range, ComReg considers that a ratio of 1:30 would seem appropriate (See Annex 2).

4.141 Furthermore, and as set out in Table 6 below, ComReg notes that Option 2 provides a 1:30 ratio between the highest and lowest frequency bands, providing a more accurate reflection of the relative value differences between all 20 Fixed Links Bands (i.e., each band is assigned its own ratio). This contrasts with Option 1 which retains the 1:10 ratio only for the highest and lowest categories of bands rather than between each of the bands under Option 2. There is little incentive for an operator (who is able to do so) to choose the higher frequency band within a category of bands (e.g., 17 – 37 GHz) since the price is the same regardless of the band used.

4.142 Of course, the higher ratio under Option 2 does not mean that fees are three times higher compared to Option 1 (i.e., 1:10 v 1:30) as this refers only to the ratio between the lower and upper frequencies. For a given band, the minimum price per MHz for that band[178] is simply the base price multiplied by the band ratio. Note that the 1:30 ration applies to the per MHz price for modal bandwidth links, and therefore, following the revision to the definition of effective bandwidth, the band ratio for the 42 GHz band is now less than one. The base price for the two lowest frequency bands (1.3 GHz and 1.4 GHz) is determined by treating them as the same frequency band (See Annex 2).

Frequency Bands (GHz)	Option 2	Option 1

[177] See page 28 of ComReg Document 21/134A.
[178] Adjustments to account for the bandwidth used and whether a congestion charge should be applied is made subsequent to this.

1.3	30.00	10
1.4	30.00	
2	29.49	
L6	26.62	
U6	26.19	
L7	25.83	
U7	25.62	
L8	25.31	
U8	25.03	
11	23.02	
13	21.74	
15	16.97	
18	14.72	7.5
23	12.27	
26	12.54	
28	8.76	
38	3.07	5.5
42	0.83	1.00
80	0.21	1.00

Table 6: Band ratio (Option 1 v Option 2)

Conclusion of frequency gradient

4.143 ComReg is of the view that Option 2 is likely to better reflect the relative differences in value between each of the bands and provide better incentives for operators to choose appropriate bands, that is lower frequency bands would be chosen only when the particular characteristics of that band are required (e.g., the additional propagation and/or available equipment in lower bands).[179]

2. Charging for increasing bandwidth

4.144 An effectively functioning fees framework should ensure that licensees are incentivised to use assigned rights of use as efficiently as possible (i.e., the least amount of spectrum necessary to deliver a service at certain levels) and not rely on additional rights of use when a service could be delivered using less. If the cost of holding additional spectrum rights of use is either too low or even non-existent, the incentives to use those rights of use efficiently are reduced. This could even lead to inefficient spectrum hoarding.

4.145 Indeed, ComReg notes the views of Vodafone in relation to the 80 GHz Band that

[179] DotEcon notes that such approach would allow for long run opportunity costs to be built into a limited extent, reflected by a variance in per MHz fees across the fixed links bands and charging in proportion to bandwidth

opines:

- the current pricing framework has led to a situation whereby a licensee could be retaining licences but not using them, as they are the cheapest licence per Mbps capacity available today; and
- a licensee can hold licenses, with very large bandwidths for very little cost per year and not deploy, resulting in apparent congestion of the band in certain areas.

4.146 Any preferred option should discourage spectrum hoarding by reducing its incentives. This is a particular concern arising from Option 1 and is discussed below.

Option 1

4.147 Under Option 1, fees for each bandwidth category above the lowest bandwidth category increase slowly in steps[180] up to 40 MHz, and not at all after that. DotEcon notes that because fees increase slower than proportionately with bandwidth used and not at all above 40 MHz bandwidth, the current charging structure fails to reflect emerging demand for higher bandwidths. [181] ComReg notes the following issues with the assignment of additional bandwidth under Option 1.

4.148 **First**, where bandwidth is available there are poor incentives for licensees to choose bandwidth categories that best reflect their actual requirements. The increase in prices as a licensee moves to a higher bandwidth category is very modest (and zero after 40 MHz) and unlikely to deter licensees from acquiring additional bandwidth when a lower amount would suffice. If scarcity becomes more of an issue in the future, the prevailing fees framework needs to favour more efficient operators that are able to deliver services with lower amounts of spectrum.

4.149 **Second**, within bandwidth categories, fees are entirely unaffected by additional bandwidth. For example, the fee for a 3.5 MHz link is the same as a 20 MHz link and only increases when moving into the 20 – 40 MHz bandwidth category which is really only pertinent for the higher bandwidth categories which involve greater amounts of bandwidth. Fees are entirely unaffected beyond 40 MHz which effectively means the incremental charge for links above 40 MHz is zero. This is likely to become increasingly relevant in the future for several reasons, including:

- increased bandwidth requirements generally means that there is going to be an increased requirement for higher bandwidth lengths (e.g., the majority of links are already above 40 MHz and invulnerable to the current fees structure); and

[180] Steps of 10% from the lowest bandwidth category up to 40 MHz.
[181] See page 31 of ComReg Document 21/134A

- take up of more advanced equipment in the future will provide operators with increased flexibility to increase bandwidth (i.e., provide a higher bandwidth ceiling than existing legacy equipment. [182][183]

4.150 **Third**, the bandwidth categories themselves do not reflect the need for additional bandwidth, with two of the four bandwidth categories accounting for just 5% of all links (see Table 7 below). It is likely that over time more and more links will require bandwidth above 40 MHz given the clear evidence of growth in demand for larger contiguous bandwidth (i.e., demand shifting away from the smaller channels used historically and an increase in used of the wider channels e.g., 56 MHz and even moving up to 112 MHz).

Bandwidth category	% Links
0.25 – 3.5 MHz link fee	1%
3.5 – 20 MHz link	5%
20 - 40 MHz link	43%
40 – 2000 MHz link	51%

Table 7: Links in each bandwidth category under Option 1

4.151 Much of the difficulty with Option 1 arises because the fees for the lowest bandwidth categories are too high to be increased proportionately as bandwidth increases. An increase in fees in proportion to bandwidth required using the lowest bandwidth category as a base would likely to choke off efficient demand. For example, if fees increased proportionately in the 1.3 – 15 GHz band category the price for the 20 – 40 MHz bandwidth category would be over €11,000 instead of €1,200. Such an approach may have been appropriate in the past when lower bandwidth categories were more popular, and a higher fee was necessary to encourage efficient use of that spectrum. However, with emerging demand for higher bandwidths, Option 1 could create inefficiencies going forward and more suitable incentives may be required to ensure the efficient use of the spectrum across all bandwidth requirements (whether large or small) and prevent inefficient spectrum hoarding.

Option 2

4.152 Option 2 moves away from the bandwidth category approach and instead charges fees that increase with channel size. However, additional spectrum is less expensive

[182] See Ceragon Products available at https://www.ceragon.com/

[183] To some extent the lower bandwidth capabilities in legacy equipment has limited the extent to which operators have been able to obtain additional spectrum at zero incremental rate. (i.e., if existing equipment was able to operate at a higher bandwidth such licensees might already have done so and would likely do so in the future once that limitation has been removed.)

up to the highest commonly used channel, after which the fees increase linearly with bandwidth used. That is, there is a declining marginal cost of spectrum for larger channel sizes and lower per MHz price for larger channels.

4.153 DotEcon notes that where there is significant congestion, efficient pricing requires licensees to pay in proportion to bandwidth used because the assignment of additional spectrum precludes some other potential users (with the opportunity cost defined by the highest value amongst these potential alternative users). If there are many excluded alternative users (reflecting a high level of scarcity), the effect of diminishing returns will be weak, as there will be some other next highest value excluded user with closely similar value as the highest value excluded user. [184]

4.154 Separately, even where there is no current issue of acute scarcity, (e.g., uncongested links) DotEcon advises that charging by bandwidth would seem to be appropriate, to ensure operators do not acquire licences for larger channels than they need and minimise the risk of avoidable congestion arising in the future. This is likely to be particularly relevant for cases where congestion is not currently an issue, but demand is increasing and inefficiently assigned spectrum might become an issue.

4.155 ComReg agrees with DotEcon and is of the preliminary view that this approach is more efficient in the assignment of bandwidth than Option 1 because:

I. it is more reflective of current circumstances where demand for increased bandwidth is emerging, particularly in the higher frequency bands. For example, all bands from 11 GHz and above (except 26 GHz[185]) have significant usage of channels of 40 MHz or more;

II. fees increase with bandwidth used;

- thereby ensuring that for congested links additional rights of use are more likely to be assigned to those who value that spectrum the most; and
- for uncongested links it minimises the risk of inefficient assignment and the risk of avoidable congestion arising in the future.

III. there are no situations where fees are entirely unaffected for increasing bandwidth requirements and licensees will have to carefully consider any need for additional bandwidth;

IV. this approach strikes a balance between discouraging hoarding (e.g., fees proportionate to bandwidth above commonly used bandwidths) while

[184] See page 31-32 of ComReg Document 21/134A
[185] The widest channels available in the 26 GHz band are 28 MHz

encouraging use among commonly used bandwidths (e.g., declining marginal price for commonly used channels);

V. the starting point for determining the appropriate fee is based on actual usage (rather than the fee for the lowest bandwidth category under Option 1); and

VI. lower bandwidth links can still be efficiently provided for (e.g., 1 MHz is the most common bandwidth for the 1.3/1.5 GHz band.) [186]

4.156 Notice that this is not an argument for fees being higher but rather that fees should be assigned based on the largest most commonly used bandwidth within the band (which by definition most licensees would fall under) and increase in proportion for bandwidths higher than that.

Conclusion on charging for increasing bandwidth

4.157 Based on the assessment above, ComReg is of the preliminary view that Option 2 is likely to better reflect emerging demand for higher bandwidths and encourage licensees to choose bandwidth levels that best reflect their requirements.

3. Fragmentation risk

4.158 There is always a risk that a band(s) can become fragmented to some extent given that users tend to have different bandwidth requirements (larger or smaller) depending on their use case. Fragmentation arises because of the assignment of smaller channels where larger channels are required or will be required in the future (i.e., gaps between smaller channels preclude allocation of large channels).

4.159 Fragmentation would not be an issue if users all want the same channel size and spectrum is offered in that channel size. In such circumstances, gaps would be useable by all parties. However, there is a risk of a band(s) becoming fragmented, if a licensees smaller bandwidth requirement (e.g., 28 MHz) is spaced in such a way that users who require a larger bandwidth (e.g., 56 MHz) might not be facilitated even if there is enough spectrum available overall. As noted by DotEcon:

> "*This could occur if the channel widths demanded by operators increase and, while there is sufficient unused spectrum available to accommodate a new larger channel, the organisation in of the existing links in the band preclude the new higher capacity link from being installed".* [187]

4.160 This creates a risk of inefficiency if currently unused spectrum is fragmented and

[186] Indeed, fees for what would fall under the lowest bandwidth category under Option 1 (e.g., 1 MHz link) would be significantly lower under Option 2.
[187] See page 145 of ComReg Document 20/109A

cannot be utilised to its full potential by larger bandwidth users who have a requirement for same.[188] This has not been a substantial issue to date, but the general trend towards larger bandwidths increases the risk of fragmentation becoming more prevalent in the future in areas where a significant number of smaller channels remain in use.

4.161 DotEcon observe that fragmentation becomes more of an issue in the larger channel widths. With 28 MHz channels there is some impact of fragmentation in some areas, but no issue in the majority of the country. The number of "problem areas" increases in the options for assigning 56 MHz channels; the presence of 112 MHz channels appears to have a fragmentation impact in a large proportion of the country.

4.162 While a certain amount of fragmentation is inevitable given the differing bandwidth requirements of users and consequently the matters cannot be fully resolved by either Option, the assessment below evaluates the extent to which either option would mitigate future fragmentation, particularly with the larger uncongested bands in mind.

Option 1

4.163 Under Option 1, the fee structure means that licensees are generally incentivised to choose larger channel sizes over small ones. (i.e., smaller channel sizes are significantly more expensive than larger ones on a per MHz basis). This would appear to suggest that the assignment of smaller channels (which are the source of fragmentation) are less likely to arise under Option 1.

4.164 However, the definition of a smaller channel is not an absolute. Rather, it varies according to band and is ultimately relative to the size of the so-called larger channels in that band. Under Option 1, there is no reference point with which to determine whether a particular channel size is large or small. In practice, smaller channels are simply those channels that are smaller than the common channel size within a band.

4.165 The use of bandwidth categories under Option 1 results in one fee covering a range of different channel sizes. This range is notably significant above 40 MHz, increasing the possibilities for more licensees to have bandwidth smaller than the common bandwidth (i.e., while there will be a common bandwidth there is a greater risk of more licensees having bandwidth below that.) Alternatively, under Option 2, a fee would apply solely to the common bandwidth and smaller channels would be charged a premium on same.

[188] There is an internal efficiency trade-off between encouraging efficiency and while this is in some ways supportive of efficient spectrum use (operators with limited bandwidth requirements do not need to acquire larger channels that are then partially unused), it does create potential fragmentation issues where the unallocated frequencies are not in sufficiently large contiguous blocks to allow access to greater bandwidths (even if there is enough free spectrum overall to do so)

Option 2

4.166 Under Option 2, while users of a smaller channel would pay less than users of a larger channel, fees increase proportionately for bandwidths below the largest commonly used channel size, because the effect of a user licensing a smaller channel may be to preclude a marginal user of larger bandwidth (e.g., if the price for 56 MHz typical bandwidth was €1,000 the price for a 28 MHz channel would be €625). As noted by DotEcon:

- the pricing structure proposed would also help by creating incentives for users to use larger channels rather than multiple small channels with the same total bandwidth, increasing the potential for spectrum in use to be kept contiguous and better organised in the formal channel plan. [189]
- would give an incentive for smaller channel users to come together and share a wider channel, which is desirable as it avoids these smaller users scattering across the band, leaving unusable gaps. [190]

Conclusion on fragmentation

4.167 Based on the assessment above, ComReg is of the preliminary view that while the risk is low across both options[191], Option 2 provides better protection against excessive fragmentation of bands which would unnecessarily preclude the issuing of wider channels in the future.

4. Congestion charges

4.168 In relation to Congestion Charges, where there is congestion (i.e., as already occurring in the 13 – 23 GHz bands) rights of use should be assigned to the users who value it most.

4.169 The impact of congestion charge on efficiency under both options is assessed under the following headings which form separate parts of the congestion charge:

- The level of the congestion charge; and
- High usage charges.

Option 1

Level of congestion charge

[189] See page 15-16 of ComReg Document 21/134A

[190] See page 32 of ComReg Document 21/134A

[191] Further, long-term technology changes will assist in reducing any fragmentation that exist. DotEcon advise that the use of XPIC configurations and carrier aggregation equipment to combine non-adjacent channels would alleviate the problem, particularly in the longer term as equipment is naturally swapped out. However, the timeframe for these changes is unclear and the fee structure can assist in the interim.

4.170 Under Option 1, a congestion charge of 20% of the corresponding uncongested fee applies in areas determined to be congested. For example, in the 1.3 GHz – 15 GHz band category, the fee for 0.25 to 3.5 MHz bandwidth category is €1,000 compared to €1,200 in congested areas (i.e., the congestion charge is quite modest, adding only 20% of the corresponding uncongested fee).

4.171 DotEcon notes that setting fees based on opportunity cost[192] supports an efficient assignment of spectrum as the 'excluded users'[193] under the efficient allocation would have incentives to use other (cheaper) Fixed Link Bands or alternative technologies such as fibre, leaving the spectrum available for the higher value users.[194]Such an approach is consistent with ComReg's view that efficient spectrum assignment[195] generally requires rights of use to be assigned to those users who value it the most and can make the best economic use of it.

4.172 In that regard, DotEcon approximates that the short-run opportunity cost for the congested 13 GHz, 15 GHz and 18 GHz bands for a 56 MHz bandwidth is over €10k per annum. This is estimated based on users that may need to migrate up to higher bands and may need additional intermediate stations. DotEcon notes that a key concern is that if lower frequency bands (with better propagation) become congested, this could force some users up to higher frequency bands, requiring additional intermediate stations (or possibly a shift to fibre in some cases). [196]

4.173 With that in mind, DotEcon notes that the current congestion surcharge of 20% is very likely too low. It is clear that the current congestion prices are significantly below the modelled short-run opportunity costs because the maximum congested fee under Option 1 is €1,800 compared to a modelled opportunity cost of €10,000.

4.174 However, DotEcon also notes that "*the surcharges do not necessarily need to be at such a high level to promote efficient use of the spectrum, as at least some users are likely to be able to shift bands more easily and so would do so in response to more modest fee differentials between bands, but these certainly still need to be large enough to at least compensate for possible equipment cost differences and somewhat less robust connections at higher frequencies."* [197]

4.175 Notwithstanding, ComReg agrees with DotEcon that existing congestion fees under

[192] The opportunity cost is the value that is forgone by assigning spectrum to the user rather than making that spectrum available to other users. (i.e., the opportunity cost is set by the valuation of the excluded user).
[193] Where a band becomes congested (i.e., with Existing Licensees) there are a group of excluded licensees and fees charged to existing users should be reflective of opportunity cost (set by the valuation of the marginal excluded user) in order to encourage efficient use.
[194] See page 27 of ComReg Document 21/134A
[195] Subject to measures that reduce the risk of restrictions or distortions to competition.
[196] The methodology for estimating opportunity cost and the result of the model is described in greater detail in Annex B of ComReg Document 21/134A.
[197] See page 29 of ComReg Document 21/134A

Option 1 are likely too low and therefore unable to encourage more efficient use of the radio spectrum. In particular:

- Under Option 1 congestion charges are significantly below the actual short-run opportunity costs associated with acute congestion and more relevantly not large enough to at least compensate for possible equipment cost differences and / or less favoured propagation at higher frequencies;
- Any impact that may exist reduces significantly as licensees move to higher frequencies which could become congested in the future. For example, in the 42 – 80 GHz band category the impact of the congestion charge is an inconsequential €20 - €50 depending on the bandwidth category; and
- The congestion charge has no impact above 40 MHz (i.e., in the same way fees above 40 MHz bandwidth are entirely unaffected by additional bandwidth) such that any bandwidth above 40 MHz is only €50 - €500 more expensive, depending on the bandwidth category.

4.176 Therefore, while the 20% congestion charge provides notional incentives to avoid the band in the congested areas, the impact (if any) is likely to be quite small.

High usage charges

4.177 Under Option 1 (and at present), ComReg applies a congestion charge for links in the 18 GHz and 23 GHz bands where at least one end of the link is within the congested area. A high usage charge applies when a licensee has five or more links over the same path.

4.178 The high usage charges worked well in encouraging users to avoid having many links in the same path. For example, there was a relatively high number of high usage links when this approach was first introduced (e.g., 102 in 2010). However, licensees appear to have migrated usage over time to avoid these charges and there have been no high usage charges applied since April 2019 (having fallen to 10 or less links per year for each of the previous 4 years).

4.179 However, with increased bandwidth usage in the future, it is possible that high usage charges may become less effective in preventing localised congestion. As noted by DotEcon, a high usage approach needs to avoid creating perverse incentives by making the total fees that a licensee would pay significantly different dependent on whether it licenses a given bandwidth as a single channel or as multiple channels across different links.[198] This problem is present under Option 1 because fees do not increase beyond a 40 MHz bandwidth and being assigned additional bandwidth can be achieved across one link (avoiding the need for multiple links when the high usage

[198] See page 35 of ComReg Document 21/134A.

charge might apply).

4.180 It also leads to situations where licensees with the same spectrum endowment in a band over a given path could be treated differently depending on the Fixed Links they are assigned (i.e., a licensee that is assigned multiple links could be subject to a high usage charge but an alternative licensee with fewer individual links, but the same overall bandwidth would avoid the high usage charge).

4.181 Therefore, Option 2 is likely to better reflect the emerging demand for higher bandwidths and better encourage licensees to choose bandwidth levels that best reflect their requirements.

Option 2

Level of congestion charge

4.182 As noted above, DotEcon estimates that the short-run opportunity cost for the congested 13 GHz, 15 GHz and 18 GHz bands for a 56 MHz channel is over €10k per annum.[199] To implement congestion charging to best reflect opportunity costs of that scale would require setting the congestion charge value at 6 rather than 1.2 under Option 1. Under Option 2, ComReg intends to take a conservative approach and set the congestion charge at 3. (See Annex 2).

4.183 Congestion fees need to be large enough to incentivise potential licensees to at least consider whether it would be more efficient and cost effective to be assigned alternative rights of use in other bands. Further, DotEcon[200] observes that congestion charges set at a sufficiently high-level puts users of uncongested links on notice that they may face surcharges in the future if congestion arises.

4.184 Under Option 2, it is possible that a congestion charge of 3 (See Annex 2) may be set too low, however, it is likely to be more effective at encouraging efficient use than Option 1 and ComReg can change the charge in the future in response to any developments in how licensees use Fixed Links in the future.

High usage charges

4.185 Under Option 2, fees are increasing with the bandwidth used[201] reducing any difference between using more channels or larger channels if this leads to the same overall bandwidth in use. With that in mind, a high usage path surcharge only applies if more than half of the total spectrum across the group of bands is used. (i.e., the surcharge would apply to half the total spectrum across a range of bands regardless

[199] The approach to setting opportunity cost is described in Annex B of the DotEcon Report (ComReg Document 21/134A).
[200] See page 56 of ComReg Document 21/134A
[201] This is subject to surcharges for small channels – represented as “m” in the formula under Option 2.

of number of channels used).

4.186 This is likely to be more effective in preventing localised hoarding than Option 1 (which was primarily aimed encouraging use of fibre[202]) although both effects are possible in each case.

Conclusion on congestion charges

4.187 Based on the assessment above, ComReg is of the preliminary view that Option 2 better reflects the short-run opportunity cost of spectrum rights of use in congested bands and better ensures that rights of use to those bands are held by those who value the spectrum the most.

4.7 Distortions to competition

4.188 Potential distortions or restrictions to competition in the assignment of Fixed Links rights of use could arise in two main ways.

I. Anti-competitive hoarding.

II. Fee's choking off efficient access.

4.189 The remainder of this section assesses each option under I and II in order determine whether the Options would potentially create restrictions or distortions to competition.

I. Anticompetitive hoarding

4.190 As described in paragraph 5.53 above, anticompetitive hoarding involves the accumulation of rights of use for strategic reasons to prevent potential competitors acquiring sufficient rights of use to compete downstream. [203]

4.191 Below, ComReg assesses anti-competitive hoarding[204] under Option 1 and Option 2.

Option 1

4.192 Option 1 has delivered a variety of important use cases, including narrowband telemetry and control, broadcast distribution, backhaul from mobile cell sites, fixed

[202] ComReg Document 09/89R2 "*Guidelines to Applicants for Radio Links Licences",* published 06 July 2017, available at www.comreg.ie

[203] ComReg also observes that the notion of anticompetitive spectrum hoarding can be better understood by reference to recital 122 of the EECC which provides: "In order to avoid the creation of barriers to market entry, namely through anti-competitive hoarding, enforcement of conditions attached to radio spectrum rights by Member States should be effective…" and Recital 133, which provides: "National competent authorities should, however, always ensure the effective and efficient use of radio spectrum and avoid distortion of competition through anti-competitive hoarding".

[204] Inefficient hoarding is assessed under 'Spectrum Management and Efficiency' above.

wireless access, and links within core networks.[205]These have been delivered since at least 2009 and ComReg is unaware of any anti-competitive hoarding having occurred in that time. This is to be expected given that there is high availability of links, with <1% of links considered congested and all of those located in specific geographic locations in Dublin.[206] Further, no high usage charges have been levied since April 2019, supporting the view that there is unlikely to have been any issue of localised hoarding.

4.193 Relatedly, there is unlikely to have been any issues around asymmetric access to spectrum[207] arising from any incumbency advantages Existing Licensees may have. While these links are typically renewed annually by licensees (having been originally assigned on a first-come first served basis), congestion is highly restricted and the assignment of links in such areas is unlikely to have constrained or distorted competition given the availability of alternative frequencies to other licensees.

4.194 However, ComReg notes that such a situation may not always be the case and there is the potential that restrictions or distortions to competition may arise in the future. We note that bandwidth requirements for Fixed Links are increasing, and the increasing availability of more advanced equipment will allow licensees to utilise greater bandwidth links. This would exacerbate the existing pricing inefficiency (i.e., fees do not increase in proportion to bandwidth used) and could lead to asymmetric access concerns.

4.195 The extent to which such scenarios would restrict or distort competition depends on the levels of congestion, the importance of the frequencies and the availability of alternatives. For any given use case, there is typically a range of frequency bands that can be used. As noted by DotEcon, a consequence of there being a chain of substitutes is that even if one band is scarce, it may be possible – at least in the long-run once equipment is renewed – for users to employ different bands such that spectrum can be freed up. [208] There is no frequency band that holds special relevance in the provision of a particular use case(s) because there are typically a range of bands available for any particular use case. [209]

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[205] See Section 2.1 of ComReg Document 20/109A, for further discussion on these use cases.

[206] Congestion mainly arises in a number of key high sites with good visibility to the city centre (e.g., Three Rock).

[207] Anti-competitive hoarding can arise from asymmetric access to spectrum and particularly by incumbents or Existing Licensees. Such issues could arise in the provision of fixed links. For example, if a frequency band(s) important in the delivery of a particular downstream service(s) became congested and sufficiently substitutable frequencies were not available. Asymmetric access can arise because Existing Licensees may have incumbency advantages from being able to renew such frequencies and could be protected from new entry.

[208] See Section 4.2.1 of ComReg Document 20/109A

[209] As noted by DotEcon "*Whilst there will be a "sweet-spot" in terms of optimising the trade-off between capacity and propagation for any given use case, in practice there is typically a wide range of feasible frequencies and particular use cases are not limited to single bands*." See p52, Document 20/109a.

4.196 However, depending on level of congestion there could potentially be incentives for anti-competitive hoarding for some use cases (e.g., Advanced FWA) over others (e.g., mobile backhaul)[210] particularly in the longer run as demand for bandwidth grows and potential use cases emerge. FWA is already an established service in Ireland and is one of the primary use cases for Fixed Links, both for connecting end users and for backhaul into the core network.

4.197 Further, as noted by DotEcon[211], advanced FWA[212] has already emerged, allowing operators to offer fixed wireless broadband services at much higher speeds. These typically use dense networks of links at higher frequencies and are aimed at competing directly with fixed networks in urban areas. This provides valuable competition to existing fixed and mobile broadband services and the use of spectrum for this purpose should clearly not be precluded because of any incentives for incumbents to hoard spectrum rights of use.

4.198 While FWA services are typically spread across several bands (depending on their specific speed and length requirements), advanced FWA has the narrowest range of frequencies of all the use cases identified by DotEcon which are likely to be suitable (i.e., a short chain of substitutes).[213] These are the bands that offer the large bandwidths required to run high-capacity links but can still operate over distances that are long enough to be economical and not suffer from propagation issues. (e.g., 37 – 39.5 GHz[214]). In that regard, because it is the use case that would likely compete with existing FWA, fixed and/or mobile operators and because it operates across the narrowest range of frequencies, such operators may be tempted to hoard spectrum inefficiently in these bands in the future.

4.199 Overall, ComReg is of the view that the fee schedule under Option 1 is unlikely to result in anti-competitive hoarding, particularly in the short run. However, and while the risk is generally low, anti-competitive hoarding scenarios cannot be ruled out in the longer run as more advanced use cases become available.

Option 2

4.200 Under Option 2, the cost of holding additional bandwidth increases in proportion to

[210] Hoarding in relation to backhaul is unlikely as other higher frequency bands may become available (e.g., W-Band and D-Band) along with other technologies that are available to MNOs, such as integrated access backhaul (IAB) that would not require such high frequencies. See p9, Document 20/109A.

[211] See page 48 of ComReg Document 20/109A

[212] Advanced FWA can use new technologies (such as dynamic beamforming) that can support much higher capacities using mmWave bands, creating the potential to use Point-to-Multipoint and/or mesh systems to provide high-speed broadband in urban areas. See Document 20/109A (Section 4.1). See also Section 3.2.2 and Vodafone and Siklus view on relevance of advanced FWA.

[213] See Figure 1 of ComReg Document 20/109A

[214] For example, a US ISP Starry is currently using a combination of light-licensed shared spectrum in the 37 – 39 GHz band and its recently acquired exclusively licensed spectrum in the 24 GHz band. See page 48 of ComReg Document 20/109A

the bandwidth used and consequently, any anticompetitive hoarding strategies would be significantly more costly. More generally, Option 2 is less likely to result in unnecessary congestion and inefficient use which create the conditions for asymmetric access and hoarding.

4.201 Further, congestion charges set at a sufficiently high-level puts users of uncongested links on notice that they may face higher fees in the future if congestion arises. This has a disciplining effect because hoarding is premised on rights of use becoming congested, precluding competitors or new entrants from using those rights of use. However, if such a situation arose congestion charges would apply, significantly increasing the costs of holding hoarded spectrum compared to Option 1.

4.202 Finally, as noted above, the high usage charges provided an additional protection against localised hoarding by imposing an additional charge if a user occupied more than half of the available spectrum in the band.

4.203 Therefore, the risk of anticompetitive hoarding under Option 2 is highly unlikely.

Conclusion on anti-competitive hoarding

4.204 ComReg is of the view that while the risks of anticompetitive hoarding are low under Option 1, Option 2 is more future-proofed as it provides additional protections that would better encourage the development of new and competing use cases.

II. Fees choking demand

4.205 Distortions or restrictions to competition could arise due to the level of fees choking off efficient demand for spectrum rights of use. (i.e., spectrum would have been used to provide services, if the fees were set lower). Fees have a role in encouraging efficient use and preventing unnecessary congestion in various spectrum bands, however, such fees should not be set at a level that would choke off any particular use. Prices that are set too high could lead to scarce spectrum being unused, or under-used (e.g., with an operator choosing not to deploy sites at the expense of diminished coverage or service quality).

Option 1

4.206 ComReg is not aware of any particular use case that has been restricted or choked off due to the existing level of the fees. Indeed, the detailed stakeholder engagement conducted in 2020 did not uncover any use cases that were restricted through the existing fee levels or structure.

4.207 Further, in response to Document 20/109, only Virgin raised any issue regarding the level of current fees:

> "*the annual fees especially on the frequencies 38 GHz and below on higher bandwidths can impact or impede the use of these frequencies. This issue*

becomes more apparent when operators are dealing with cross border links and are therefore in a position to compare to the equivalent Ofcom pricing model."

4.208 It is not clear from this response what aspect of existing charging is impeding the use of these frequencies in the view of Virgin. Further, the eight fixed wireless operators[215] have not raised any particular issues instead noting that:

"*A new hopefully Improved fee schedule for Fixed Links that facilitates the greatest number of use cases, in order to ultimately promote greater use of the spectrum that are identified in this consultation and the responses".*

4.209 Separately, in response to Document 20/109, eir noted that in its experience the current fee structure seems to work well.

4.210 Finally, ComReg agrees with DotEcon's view that "*The current pricing regime has worked reasonably well to date and does not appear to have set fees at an excessive level that is inefficiently choking off demand*". [216]

4.211 Therefore, ComReg is of the preliminary view that fees are unlikely to choke off demand under Option 1.

Option 2

4.212 As set out on the impact on stakeholders earlier, and while impact on stakeholders overall that would arise from the adoption of Option 2, there would inevitably be some adjustment in fees paid by individual licensees. Licensees who experience a fee decrease (estimated at 51%) are unlikely to be choked off from delivering efficient demand since existing services are already being delivered at a higher level under Option 1.

4.213 Further, Option 2 has the additional benefit of supporting the development of rural ECS services and networks, noting that the decline in fees is greater in uncongested Fixed Links, which occur primarily in non-urban areas (e.g., outside of Dublin and the main cities). Fixed Links in such areas support the provision of ECS to rural consumers and businesses as rural ECS network are particularly reliant upon Fixed Links given the topographical and economic challenges in using alternatives in rural areas (e.g., fibre).

4.214 ComReg notes however that fees for several Fixed Links will increase, most notably in the case of:

[215] Airwave, BBNet, Digitalforge, Whizzy, Kerry Broadband, Lightnet, Orion, Regional Telecom and Wireless Connect

[216] See page 38 of ComReg Document 21/134A

- Fixed Links in the congested areas (Dublin city centre and south); and
- Fixed Links with high bandwidths (>100 MHz) in 15 GHz, 18 GHz, 23 GHz and 80 GHz.

4.215 In relation to licensees whose fees may be higher, it is possible that those higher fees might affect demand. However, while this risk is arguably greater under Option 2, ComReg notes that any fee increases would be relatively modest in either % increase or in terms of absolute increases.[217] Further, any of the greater increases would be borne by the larger licensees who hold the greatest number of links in any event.

4.216 Fee increases are a result of the incentives under Option 2 that are necessary to promote the efficient use of spectrum, specifically the *Bandwidth charge* and the *Congestion charge* which would increase the weighting on larger bandwidths and congested links respectively. ComReg has already explained in detail why such incentives are necessary if it is to achieve an efficient assignment of Fixed Links (see "Assignment Impacts").

4.217 Further, ComReg notes that in instances where an operator faces an increase in fees, it could take actions to limit its exposure to that price increase over time. For example, an operator could, where distance and capacity permit:

- switch its Fixed Links to a less expensive band (e.g., a higher band);
- in Dublin, switch its Fixed Links to an uncongested band (e.g., a higher or lower in band; and
- economise on its bandwidth or rationalise its Fixed Links.

4.218 ComReg notes that use cases with the least potential for switching, and therefore at a greater risk of having demand choked off, are those which rely on the peripheral bands where propagation is specifically required such as 1.4 GHz (e.g., radio broadcasters). ComReg notes however that the average fee in individual Fixed Link in these bands decreased, and therefore the viability of the use cases with the narrowest range of potential bands are not negatively impacted. ComReg notes that fees for links in the 1.3/1.4 GHz bands would decrease from €1,000 to €100 per link.

4.219 Therefore, ComReg is of the view that the fee level under Option 2 is unlikely to choke off efficient demand.

Conclusion on fees choking off demand

[217] For example, some smaller licensees have a large % increase which corresponds to a small absolute increase and vice versa (i.e., an increase of from €500 to €1,000 is a 100% increase but just €500 in absolute terms).

4.220 The fee levels under Option 1 and Option 2 are unlikely to choke off efficient demand in the future.

4.8 Efficient investment and innovation

Option 1

4.221 Creating the conditions for promoting efficient investment and innovation in new and enhanced infrastructure investment involves ComReg exercising its regulatory functions in an appropriate and predictable fashion, thus providing regulatory certainty. As noted by DotEcon, "*it is important that fees for fixed links are predictable, if ComReg is to encourage efficient investment. Otherwise, it could create a hold up problem, where investment is avoided because of highly uncertain and potentially large future fees (which operators cannot easily avoid by moving to other bands or alternative technologies such as fibre once equipment is installed).*" [218]

4.222 Any option should provide certainty that the regulatory framework, which often underpins investment decisions, will not change unnecessarily and require operators to make subsequent and additional investments and/or changes to their network. Promoting competition and encouraging efficient investment, in ComReg's view, means allowing for a cost-effective deployment of Fixed Links and preventing inefficient duplication of investment caused by predictable changes to the regulatory regime.

4.223 As noted by DotEcon "*Fixed links licences are annual, but the equipment used for fixed links has a long asset life, often over ten years. Therefore, it is important that fees for fixed links are predictable, if ComReg is to encourage efficient investment. Otherwise, it could create a hold up problem, where investment is avoided because of highly uncertain and potentially large future fees (which operators cannot easily avoid by moving to other bands or alternative technologies such as fibre once equipment is installed).*" [219]

4.224 With that in mind, it is important that any option considers the likely long run development of the market to avoid future changes to the regulatory framework that could have been foreseen or give rise to additional cost.

4.225 Under Option 1, it is likely that investment in networks used to deliver services up to now could be considered efficient given the benefits to consumers and competition. However, it is unlikely that this Option can persist in the long run for the reasons set out above. In particular, the increased requirement for additional bandwidth is not compatible with an Option that provides no incentives for efficient use beyond 40

[218] See page 36 of ComReg Document 21/134A
[219] See page 36 of ComReg Document 21/134A

MHz, that is it is unlikely to be fit for purpose.

4.226 Therefore, ComReg would be unable to provide regulatory certainty that Option 1 would persist in the long run.

Option 2

4.227 Option 2 has been designed to accommodate all existing and potential use cases that are likely to require Fixed Links. Investments in new use cases (e.g., advanced FWA) are more likely to arise under Option 2 which promotes innovation in new and enhanced infrastructure.

4.228 Option 2 seems sufficiently future-proofed given that it also takes account of changes in demand conditions (e.g., increased requirement for bandwidth) that are likely to arise in the medium to long-term so that changes in demand conditions in the future should not require significant regulatory intervention. As noted by DotEcon:

> "*Use of a formula-based approach also helps to ensure the pricing regime is future-proof and robust to changes in demand (i.e., for bandwidth, and across different bands) and developments in congestion (which may increase or decrease in different bands and/or locations).*" [220]

4.229 Further, it provides flexibly to adjust the formula in a straightforward fashion to the extent that issues arise (e.g., if one of the variables is set too low) without requiring large scale structural changes (i.e., an entirely new framework). As noted by DotEcon:

- "*ComReg should be free to adjust the fees in response to changes in fixed links demand, but it should be clear on its reasons for doing so, any major changes it does make should be phased in and operators should be given sufficient notice of any changes ComReg is considering*." [221]
- "*setting the fees using a formula provides a limited and transparent set of ways in which ComReg can changes the fees – this should help users form reasonably accurate expectations on the fees they will pay over the lifetime of a link they are about to install*." [222]

4.230 It is also proposed that Option 2 would be introduced over a three-year period thereby providing users with sufficient time to consider how to dimension their network and to plan future investments accordingly.

4.231 Finally, Option 2 is less likely to create unnecessary congestion zones that would

[220] See page 32-33 of ComReg Document 21/134A
[221] See page 36 of ComReg Document 21/134A
[222] See page 36 of ComReg Document 21/134A

compromise efficient investments made on the basis of sufficient spectrum rights of use being available in certain locations.

4.232 Therefore, ComReg is of the preliminary view than Option 2 better promotes efficient investment incentives.

4.9 Infrastructure based competition

4.233 Infrastructure based competition is competition among operators that physically own networks. This could be a fixed operator competing with a mobile operator or two operators which have similar networks competing against each other. As a general point, the Fixed Links regime provided under either Option would enhance the possibilities for infrastructure-based competition because it would allow operators to deploy services using Fixed Links when alternative infrastructures are available (e.g., fixed/fibre).

4.234 Fixed Links continue to enhance infrastructure across the state.

- Fixed Links are provided in urban areas (five cities) to interconnect dense networks of small cells which typically only requires short links, but at high bandwidth[223]. Fixed Links are typically used in many cases where operators may be unable to secure permission to install fibre to each of these sites and/or it would likely be prohibitively expensive. Fixed Links are also used in urban areas for customers requiring higher bandwidth connections, typically provided as dedicated Point-to-Point links.
- Fixed Links are used in rural areas or hard to reach locations. A key role for such links is for FWA to provide bandwidth connectivity to isolated customers and businesses in areas where fibre deployment is not economically viable. In less densely populated rural areas, there can be a lack of infrastructure-based competition due to the cost of fixed rollout.

4.235 As noted above, the risk of congestion arises in both rural and urban areas. The promotion of infrastructure-based competition in these areas relies on spectrum rights of use in the Fixed Links bands being available to the greatest extent possible at the various locations. This competition is endangered by unnecessary congestion in certain locations where some bands may not have the available capacity to meet the link length and bandwidth requirements. [224]

[223] Where there are a large number of cells within a small area (for example attached to street furniture or contained in shop hoardings), it may be either cost prohibitive or simply infeasible to run fibre to each site. Therefore, there is likely to be significant and growing demand for short wireless links to connect small cells.
[224] For example, there is a risk that the demand for certain use cases (e.g., advanced FWA technologies) would not be served or might be underserved by Option 1 because of the greater risk of congestion arising

4.236 ComReg notes that Option 2 provides incentives for operators to dimension their network over time and choose the most cost-effective combination of bands and bandwidth when delivering services. ComReg considers therefore Option 2 has the potential to improve infrastructure-based competition by encouraging operators to fully consider how their Fixed Links are deployed and thereby how they could deliver connectivity more efficiently than rivals.

4.237 Given the benefits to efficiency as described above, the prospects for the extension of infrastructure-based competition may be greater under Option 2.

4.10 Impact on consumers

4.238 ComReg observes that the notion of what may benefit consumers can be viewed in terms of ensuring that spectrum rights are used to (a) provide the services that are most highly valued by consumers (e.g. services which consumers would purchase, either directly or indirectly, and lead to the greatest consumer benefits (e.g. overall sales)) and (b) in a manner which would be valued by end-consumers (e.g. high quality/service levels at the lowest cost), over the lifetime of the rights of use.

4.239 Further, it can be generally assumed that what is good for competition, and what promotes investment in infrastructure, is, good for consumers. This is because increased competition between operators brings benefits to their customers in terms of price, choice and quality of services. In that regard, options that are good for competition are likely to be good for consumers. For example, consumers are likely to prefer those options which maintain or improve services and while at the same time not deterring entry or efficient investment. With that in mind, ComReg reminds the reader that Option 2 is preferred in terms of the likely impact on competition.

4.240 ComReg is also satisfied that Option 2 would not choke off[225] efficient demand for the delivery of services.[226]

4.241 In relation to congested links, Option 2 should ensure that Fixed Links rights of use are assigned to those bidders who most value those rights of use and who are therefore best placed to maximise consumer welfare (by using their assigned

from this Option. Similarly, wireless backhaul could be employed as an alternative to fixed or fibre connections (e.g., backhaul, broadcast distribution, links within core networks) and where appropriate links are not available, the cost of fibre deployment would be high increasing the overall cost of providing connectivity.

[225] Demand for a Fixed Link or Use Case is inefficiently choked off where a fee results in a Fixed Link (or Use Case) being uneconomic, where a lower price could both be economically viable for users and cover the necessary opportunity cost of the spectrum. The economic viability of a given use case will depend on both the spectrum licence fee and the value of the Fixed Links for that use case (e.g., the ability to generate profits).

[226] See paragraph 4.62 above.

spectrum efficiently)[227]. This is a result of setting fees for congested rights of use by reference to both an estimate of the short-run opportunity cost of spectrum (e.g., congestion) and of the licence itself (e.g., bandwidth).

4.242 Existing Licensees would have the opportunity to retain their existing rights of use or migrate, making those rights of use available for new licensees (potentially new entry) who are willing to pay a price reflective of the short-run opportunity cost. ComReg additionally notes such criteria (i.e., assigning rights of use to those users that value scarce spectrum the most) should also result in the greatest benefits to downstream competition and consumers.

4.243 Alternatively, under Option 1, some Existing Licensees could hold rights of use in congested areas at a price significantly below its short-run opportunity cost which could preclude access to other users who would be willing to pay more. Excluded users with limited flexibility may not have good alternatives leading to certain areas and consumers being underserved or not at all.

4.244 In relation to uncongested links, consumers are also likely to benefit more from Option 2, because there would be an overall reduction in Fixed Link fees in uncongested areas. As previously noted, for licensees that use the most common bandwidth, uncongested fees per link will be lower under Option 2 which should benefit end-consumers. Further, and as noted above, increased infrastructure-based competition arising from the overall incentives provided under Option 2 should benefit consumers by improving operator competitiveness and the services they provide, which includes mobile, fixed and FWA networks.

4.245 In relation to existing and potential use cases, ComReg notes consumers are likely to prefer Option 2 because it (unlike Option 1) is forward looking and has been designed to accommodate all existing and potential use cases that are likely to require Fixed Links. This provides for a range of outcomes and differentiated services which increases the choice for consumers while also allowing for mobile operators to complement their existing spectrum holdings or fixed connections, while improving existing and future services to consumers.

4.246 ComReg notes that the use cases that are delivered over Fixed Links can be categorised into (i) those that are provided directly to consumers and businesses in downstream markets and (ii) those that are used as inputs to provide downstream.

Downstream services

4.247 In relation to (i), ComReg notes that FWA and advanced FWA are the only two use cases that are provided directly to consumers and business in downstream markets.

[227] If downstream competition is effective, the objective of achieving greatest social benefit can be achieved by assigning rights of use to whoever values the rights the most.

In that regard, ComReg is of the preliminary view that consumers would prefer Option 2 for the following reasons:

- Overall growth in bandwidth is driven in part by demand from FWA operators[228], and the more efficient use of spectrum by all licensees ensures that more spectrum is available for the delivery of end services (from consumers who increasingly require more bandwidth);
- FWA is the primary use case in rural areas and Option 2 better supports the development of rural ECS networks, noting that the decline in fees is greater in uncongested Fixed Links, which occur primarily in non-urban areas
- Investments in new use cases (e.g., advanced FWA) are more likely to arise under Option 2 because it promotes innovation and efficient investment; and
- Option 2 is less likely to restrict the development of advanced FWA by reducing the likelihood of congestion[229] and the incentives for spectrum hoarding in bands suited for the delivery of this service.

4.248 Alternatively, under Option 1, certain areas may be underserved or not at all in the future due to emerging congestion.

Inputs to downstream services

4.249 In relation to the remaining use cases (e.g., backhaul etc), it is useful to briefly set out why the efficient assignment of Fixed Links across a range of bands which are not directly used for downstream services is an important issue for consumers, as it will affect the choice, price, and quality of the electronic communications service that ultimately are made available to consumers.

4.250 Providers of wireless mobile services use a combination of inputs to provide those services. This includes radio frequency spectrum which is used to transmit signals between base stations and end users' devices and to operate key network infrastructure such as base stations and transmission towers. The backhaul element of a mobile network is essential to the provision of wireless mobile services as it routes voice and data traffic from base stations to the core network. Providers of wireless mobile services must have access to sufficient backhaul, in terms of sufficient capacity and speed, to avoid communications bottlenecks and a reduced quality of service for their consumers.

4.251 The need for improved backhaul infrastructure - in terms of higher capacity and faster speeds – has increased and will probably continue to increase in parallel with the

[228] See page 126 of ComReg Document 20/109A.
[229] Through the incentive mechanisms identified in Impact on Competition above (i.e., frequency gradient, bandwidth charges and congestion charges etc).

roll-out of more advanced services (e.g., advanced FWA etc) and ever-increasing consumer demand for data intensive mobile services such as mobile video streaming. ComReg observes that a 'feedback loop' exists in that increased consumer demand leads to better services, which further increases consumer demand, which leads to even better services, which further increases consumer demand, and so on. All of this puts pressure on backhaul infrastructure. Even if operators were to use more fibre backhaul in the future, alongside wireless backhaul, microwave links would still be essential for backhaul to the core network, especially in rural areas. Therefore, the way new Fixed Links are assigned for backhaul could have significant impacts on consumers and on downstream communications markets.

4.252 In that regard, Option 2 would likely be preferred by consumers because, as noted previously, it best ensures that spectrum rights of use are available for the delivery of these services. In particular, the incentives provided by Option 2 are less likely to result in congestion in the future such that rights of use are more likely to be available in provision of same. This improves an operator's ability to use Fixed Links and deliver services where and when they need it. Option 2 would incentivise operators not to occupy and retain Fixed Links unnecessarily (e.g., Fixed Links in Dublin) and more generally to economise on their use of Fixed Links spectrum (e.g., bandwidth charge).

4.11 Preferred option

4.253 This RIA considers a number of regulatory measures available to ComReg within the context of the analytical framework set out in ComReg's RIA Guidelines (i.e., impact on industry stakeholders, impact on competition and impact on consumers). This section complements that analysis and provides an assessment of the extent to which any regulatory measure would, if implemented, be likely to achieve one or more of ComReg's statutory objectives in the exercise of its related statutory function or functions.

4.254 Considering the above, ComReg remains of the view that Option 2, is the preferred option in terms of the impact on stakeholders, competition and consumers.

4.255 This assessment has considered the impact of the various options from the perspective of industry stakeholders, as well as the impact on competition and consumers, and should aid stakeholders' understanding of the relative merits of the alternative pricing methodologies and models.

4.256 The following section assesses the Overall Preferred Option against ComReg's other relevant functions, objectives and duties.

4.12 Assessment of the Preferred option against ComReg's other relevant statutory objective

4.257 This RIA identifies and considers the options potentially available to ComReg, within the context of the RIA analytical framework as set out in ComReg's RIA Guidelines (impact on industry stakeholders, the impact on competition and the impact on consumers). This RIA also analyses the extent to which those various options would facilitate ComReg to meet its statutory remit in managing the radio spectrum. This includes analysing the extent to which the various options would promote competition and ensure that there is no distortion or restriction of competition in the electronic communications sector, whilst also encouraging efficient investment in infrastructure, promoting innovation, and ensuring the efficient use and effective management of the Fixed Links Bands.

4.258 In this section, ComReg assesses the Overall Preferred Option in the context of other statutory provisions relevant to the management of Ireland's radio frequency spectrum (which are summarised in Annex 1 of this document). It is not proposed to exhaustively reproduce those statutory provisions here. However, set out below is a summary of all statutory provisions which ComReg considers to be particularly relevant to the management and use of the radio frequency spectrum with an assessment (to the extent not already dealt with as part of the draft RIAs) of whether, and to what extent, the Overall Preferred Option accords with those provisions. In carrying out this assessment, ComReg has highlighted below some of the relative merits / drawbacks which would arise if it was to select some of the alternative options assessed under the draft RIA above.

4.259 For the purposes of this section, the statutory provisions which ComReg considers to be particularly relevant to the management of the radio frequency spectrum in the State are grouped as follows:

- general provisions on competition;
- contributing to the development of the internal market;
- to promote the interest of users within the Community;
- efficient use and effective management of spectrum;
- regulatory principles;
- relevant Policy Directions and Policy Statements; and
- general guiding principles (in terms of spectrum management, setting of fees and licence conditions).

- Objective justification;
- Transparency;
- Non-discrimination; and
- Proportionality.

4.12.2 General Provisions on Competition

4.260 There is a natural overlap between the aims of the draft RIA and an assessment of ComReg's compliance with some of its statutory obligations and, in particular, one of its statutory objectives under section 12 of the 2002 Act of promoting competition by, among other things:

- ensuring that 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 effective management of radio frequencies.

4.261 In so far as the promotion of competition is concerned, Regulation 16(1)(b) of the Framework Regulations further requires ComReg to ensure that:

- ensuring that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality; and
- ensuring that, in the transmission of content, there is no distortion or restriction of competition in the electronic communications sector. [230]

4.262 Certain other provisions also relate to ComReg promoting and protecting competition in the electronic communications sector including:

- Regulation 16(2) of the Framework Regulations which requires ComReg inter alia to apply objective, transparent, non-discriminatory and proportionate regulatory principles by safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure-based competition;

[230] The final two statutory obligations were introduced by Regulation 16 of the Framework Regulations.

- Regulation 9(11) of the Authorisation Regulations which requires ComReg to ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies; and
- General Policy Direction No. 1 on Competition (26 March 2004) which requires ComReg to focus on the promotion of competition as a key objective, including removing barriers to market entry and supporting new entry (both by new players and entry to new sectors by existing players).

4.263 Based on the assessment provided in the RIA above, ComReg's view is that the Preferred Option in the draft RIA would best safeguard and promote competition to the benefit of consumers.

4.12.3 Contributing to the development of the Internal Market

4.264 In achieving the objective of contributing to the development of the Internal Market, another of ComReg's statutory objectives under section 12 of the 2002 Act, ComReg considers that the following factors are of particular relevance in the context of setting fees for Fixed Links:

- the extent to which the Overall Preferred Option would encourage the establishment and development of trans-European networks and the interoperability of pan-European services, by facilitating, or not distorting or restricting, entry to the Irish market by electronic communication services providers based or operating in other Member States; and
- to ensure the development of consistent regulatory practice and the consistent application of EU law, the extent to which ComReg has had due regard to the views of the European Commission, BEREC and other Member States in relevant matters, in selecting an option and considering any regulatory action required by ComReg in respect of such an option.

Encouraging the establishment and development of trans-European networks and the interoperability of pan-European Services

4.265 ComReg notes the overlap between this objective and the objective of promoting competition in the provision of ECN/ECS. Encouraging the establishment and development of trans-European networks requires that operators from other Member States seeking to develop such networks are given a fair and reasonable opportunity to obtain spectrum rights of use required for such networks and, particularly, access to critical spectrum rights of use. Accordingly, options which would restrict or distort competition or otherwise unfairly discriminate against potential entrants (such as through pricing models which do not incentivise efficient use or encourage low value incumbent not to vacate) would not, in ComReg's view, satisfy the requirements of this objective.

4.266 In this regard, ComReg refers to the 'draft RIA and its preliminary finding that the Overall Preferred Option is likely to be preferred by future and potential Fixed Link licensees, which may be new entrants. This is because the Overall Preferred Option would best encourage the efficient use of Fixed Links and reduce the incentives for Existing Licensees to engage in spectrum hoarding strategies. Further, this option reduces the likelihood of asymmetric access scenarios arising which may benefit Existing Licensees simply by virtue of their incumbency. Such an approach would also be in line with service- and technology-neutrality requirements by not preferring existing services and technologies by virtue of incumbency.

Promoting the development of consistent regulatory practice and the consistent application of EU law

4.267 In relation to this aspect of contributing to the development of the internal market, ComReg continues to cooperate with other National Regulatory Authorities ("NRAs"), including closely monitoring developments in other Member States to ensure the development of consistent regulatory practice and consistent implementation of the relevant EC harmonisation measures and relevant aspects of the Common Regulatory Framework.

4.268 For instance, ComReg has had clear regard to international developments in the context of:

- ComReg considered international trends in the use of Fixed Links in paragraph 75 of Document 20/109 and informed its consideration in developing its preferred Option;
- ComReg issued a Request for Information and received 22 responses from members of the Independent Regulators Group ("IRG")[231] provided a response to the IRG RFI which ComReg issues in order to gather, among other things, the most up to date information on trends in the use of Fixed Links;
- ComReg and DotEcon held stakeholder meetings with international equipment manufacturers and vendors to inform its Preferred Option; and
- DotEcon had clear regard to fee methodologies[232] used in other countries in forming its recommendations giving an overview European price references[233] and common practices[234].

[231] The Independent Regulators Group ("IRG") a group of European National Telecommunications Regulatory Authorities (NRAs) that functions as a forum for exchange of best practices and discussions on regulatory challenges in communications between NRAs
[232] See Annex A of ComReg Document 21/134A
[233] See Table 5 of ComReg Document 21/134A
[234] See Table 6 of ComReg Document 21/134A

4.12.4 Promote the interest of users within the community

4.269 The impact of the Overall Preferred Option and other options on users and stakeholders from a more general perspective and in the context of ComReg's objective to promote competition has been considered in the context of the above RIA and it is not proposed to consider this matter further here.

4.270 ComReg also observes that most measures set out in Section 12(2 (i) to (iv) of the 2002 Act, aimed at achieving this statutory objective, are more relevant to consumer protection, rather than to the management of the radio frequency spectrum.

4.12.5 Efficient use and effective management of spectrum

4.271 Under section 10(1) of the 2002 Act, it is one of ComReg's functions to manage the radio frequency spectrum in accordance with a Policy Direction under section 13 of the 2002 Act. Policy Direction No. 11 of 21 February 2003 requires ComReg to ensure that, in managing spectrum, it takes account of the interests of all users of the radio frequency spectrum (including both commercial and non-commercial users) (see discussion on this policy direction below). Importantly, in pursuing its objective to promote competition under section 12(2)(a), ComReg must also take all reasonable measures to encourage efficient use and ensure effective management of radio frequencies. Section 12(3) of the 2002 Act also requires that in carrying out its functions, ComReg shall seek to ensure that measures taken by it are proportionate having regard to the objectives set out in section 12.

4.272 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.

4.273 In relation to Policy Direction No. 11, the draft RIA set out above considers the interests of all users of the radio frequency spectrum (and assesses the extent to which such interests are consistent with ComReg's own statutory obligations), both commercial and non-commercial. ComReg is of the view that the Overall Preferred Option is one that would safeguard and promote those interests.

4.274 In addition, the preferred Option best facilitates efficient new entry and encourages an efficient use of spectrum by those successful in acquiring spectrum. This is because the formula-based approach under Option 2 would achieve the following:

- In relation to uncongested links, it best provides that licensees are incentivised to use assigned rights of use as efficiently as possible (i.e., the least amount of spectrum necessary to deliver a service at certain levels) and not rely on additional rights of use when a service could be delivered using less; and
- In relation to congested links, it best ensures that spectrum rights would be awarded to those users who value them the most and because of the incentives provided under this option, those users are also the most likely to use the spectrum efficiently.

4.275 In particular, ComReg refers to Section 5.6 ‘Spectrum management and efficiency above'.

4.276 ComReg is of the preliminary view that the Overall Preferred Option complies with the obligations contained in the above statutory provisions. ComReg is also of the preliminary view that Option 1 would fail to satisfy the above provisions to the same extent, if at all considering the increased requirement for bandwidth in the future.

4.12.6 Regulatory Principles

4.277 Under Regulation 16(2) of the Framework Regulations, ComReg must, in pursuit of its objectives under Regulation 16(1) and section 12 of the 2002 Act, 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; and
- promoting efficient investment and innovation in ECS networks and infrastructure.

Regulatory Predictability

4.278 ComReg notes that it places importance generally on promoting regulatory predictability and as illustrated below, has complied with this principle in carrying out the current process.

4.279 In the present context, ComReg considers the following objectives to be of particular importance to achieving the aims of this regulatory principle:

- promoting regulatory predictability in relation to availability of spectrum rights to other users of spectrum by applying an open, transparent, and non-discriminatory approach to accessing spectrum for Fixed Links; and

- promoting regulatory predictability in relation to ensuring that the process used to determine fees is predictable and not subject to significant change such that it would compromise efficient investments.

4.280 In relation to the first objective, ComReg's approach for congested links is consistent to its general treatment of a scarce resource such that rights of use should be assigned to those who value it the most. Further, in relation uncongested links, ComReg assigns rights of use in a way that encourages efficient use in line with its competition objectives.

4.281 In relation to the second objective, ComReg refers to its assessment under efficient investment below and its view that the conditions for promoting efficient investment and innovation in new and enhanced infrastructures investment involves ComReg taking its regulatory functions in an appropriate and predictable fashion as provided under Option 2.

4.282 Considering the above, ComReg is of the view that the Overall Preferred Option complies with the regulatory principle of promoting regulatory predictability.

4.12.7 Efficient Investment and Innovation in New and Enhanced Infrastructures

4.283 ComReg considers that the Overall Preferred Option is consistent with the aims of this regulatory principle for the reasons set out in Section 4.8. Further, ComReg notes that it:

- provides for a range of outcomes and differentiated services noting that this option has been designed with existing and potential use cases in mind and consulted in detail on same in Document 20/109 and associated documents. This potentially increases the choice for consumers while also allowing for mobile operators to complement their existing spectrum holdings or fixed connections, while improving existing and future services to consumers;
- supports entry and/or participation by new use cases or new entrants by removing any incumbency advantages Existing Licensees may have from holding certain rights of use;
- is the one likely to best promote competition in the assignment of Fixed Links; and
- produces an efficient outcome by assigning congested links to uses who would attach the highest value to it and, because of these financial incentives, thereby generate the greatest benefits to society from the use of the spectrum.

4.12.8 Relevant Policy Directions and Policy Statements

4.284 ComReg has taken due account of the Spectrum Policy Statement issued by the then DCENR in September 2010 and its Consultation on Spectrum Policy Priorities issued in July 2014. ComReg notes that the core policy objectives, principles and priorities set out therein are broadly in line with those set out in the 2002 Act and in the European Electronic Communications Code (which has repealed the Common Regulatory Framework) and, in turn, with those followed by ComReg in identifying the Overall Preferred Option.

4.285 Section 12(4) of the 2002 Act requires ComReg, in carrying out its functions, to have regard to policy statements, published by or on behalf of the Government or a Minister of the Government and notified to it, in relation to the economic and social development of the State. Section 13 of the 2002 Act requires ComReg to comply with any policy direction given to ComReg by the Minister as he or she considers appropriate to be followed by ComReg in the exercise of its functions.

4.286 ComReg considers below those Policy Directions which are most relevant in this regard (and which have not been considered elsewhere in this chapter).

Policy Direction No.3 of 21 February 2003 on Broadband Electronic Communication Networks

4.287 This Policy Direction provides that:

> "*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.*"

4.288 The purpose of this Policy Direction was to ensure that the regulatory framework for electronic communications plays its part in contributing to the achievement of the then Government's objectives regarding the rollout of broadband networks.

4.289 ComReg is cognisant of the fact that the three-year objective described in this policy direction has now long expired. In any case, ComReg is of the view that the Preferred Option is aligned with the objectives of the current Programme for Government. For example, it would promote the introduction of advanced FWA services and fixed wireless more generally in relevant bands and it complements other schemes such as the National Broadband Plan aimed at improving broadband infrastructure and services for businesses and citizens across the State.

Policy Direction No. 4 of 21 February 2003 on Industry Sustainability

4.290 This Policy Direction provides that:

> "*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".*

4.291 The purpose of this policy direction is to ensure that any regulatory decisions take due account of the potential impact on the sustainability of industry players, in light of the business cycle at the time such decisions are taken.

4.292 ComReg observes that this policy direction concerns the sustainability of the industry as a whole rather than the position of individual players. In that regard, ComReg notes that total fees are broadly stable under Option 2 and may reduce depending on how licensees decide to deploy their networks in the future.

4.293 Notwithstanding, in its RIA above, ComReg has considered the impact of its Preferred Option in the context of all industry stakeholders, including different types of industry stakeholders, and refers the financial impact on these stakeholders in the Impact on Stakeholders section above. This shows that while Option 2 may result in some modest increases for certain stakeholders, this is highly unlikely to threaten industry sustainability. ComReg also refers to its considerations in the context of the principle of proportionality above.

Policy Direction No. 11 of 21 February 2003 on the Management of the Radio Frequency Spectrum

4.294 This Policy Direction provides that:

> "*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".*

4.295 The purpose of this policy direction is to ensure that ComReg achieves an appropriate balance between the interests of various users of the radio frequency spectrum the respective interests of commercial and non-commercial user.

4.296 In carrying out the draft RIA, ComReg has considered the Preferred Option in light of the interests of various categories of industry stakeholders and consumers.

4.297 ComReg is of the view, therefore, that it has complied with this requirement in carrying out the RIA and that the Preferred Option is the one that best serves the interests of all users of the radio frequency spectrum and strikes an appropriate balance where those interests may conflict.

4.12.9 General guiding principles (in terms of spectrum management, licence conditions and setting of licence fees)

4.298 ComReg notes that it is required to comply with the guiding principles of objectivity, transparency, non-discrimination and proportionality in carrying out its functions under the 2002 Act and under the European Electronic Communications Code (which has repealed the Common Regulatory Framework). In relation to the current process, ComReg considers that these principles are most relevant in terms of its functions concerning spectrum use and management, attaching conditions to rights of use and the setting of licence fees.

4.299 In relation to spectrum management and use, ComReg notes that:

- Regulation 11(2) of the Authorisation Regulations requires that ComReg grants rights of use for radio frequencies based on selection criteria which are objective, transparent, non-discriminatory, and proportionate; and
- the regulatory principle set out in Regulation 16(2) of the Framework Regulations requires ComReg in pursuing its objectives to apply objective, transparent, non-discriminatory, and proportionate regulatory principles by, amongst other things, ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services.

4.300 ComReg notes that the above guiding principles are Irish and EU law principles that ComReg abides by generally in carrying out its day-to-day regulatory functions.

4.301 ComReg is of the view, having regard to the applicable legislation and legal principles, its draft RIAs and other analyses, its expert advice and reports, and the material to which it has had regard, that the Overall Preferred Option is objectively justified, transparent, proportionate, and non-discriminatory. In particular, the preferred option:

- is objectively justified given the detailed assessment provided in this RIA, including that it would be unlikely to distort or restrict competition and it better encourages the efficient use of the radio spectrum;
- would not give rise to discrimination in the treatment of undertakings because:
    - any change in fees arising from Option 2 arise because the situation of some licensees is materially different from the other.
- Means that whether fees increase or decrease does not depend on the stakeholder but rather on the bandwidth and bands operators locate their rights of use;

- is transparent because, among other things:
    - the detailed methodology is set out in Annex B and the DotEcon Report;
    - ComReg provides an assessment of the impact on stakeholders (including financial impact) in the RIA above; and
    - ComReg will provide each licensee with an Assessment Tool to estimate impacts at a licensee level.
- is proportionate because, among other things:
    - the preferred option would accord with ComReg's statutory objectives and regulatory principles as described above;
    - there does not appear to be less onerous means by which these objectives and principles could be achieved; and
    - the preferred option is being implemented over a 3-year period which allows licensees more time to plan and make the necessary changes to their use of Fixed Links and relevant networks, allowing greater flexibility in adjusting to the changes. ComReg considers that this will allow the operators to make better planned and more informed decisions and resulting improve efficiency of assignment.

Conclusion

4.302 In light of the above, ComReg is satisfied that the Preferred Option complies with those statutory functions, objectives and duties relevant to its management of the radio frequency spectrum.

Chapter 5

5 Draft Decision

This chapter sets out ComReg's draft decision document based on the views expressed by ComReg in the preceding chapters and their supporting annexes.

Decision

1. DEFINITIONS AND INTERPRETATION

1. In this Decision, save where the context otherwise admits or requires:

"Authorisation Regulations" means the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations, 2011 (S.I. No. 335 of 2011);

"Communications Regulation Act 2002" means the Communications Regulation Act, 2002, (No. 20 of 2002), as amended;

"ComReg" means the Commission for Communications Regulation, established under section 6 of the Communications Regulation Act 2002;

"**Congestion Area**" means the geographic area wherein a congestion charge applies to a Point-to-Point Radio Link or Point to Multi-Point Radio Link operating on a Congested Frequency Band;

"**Congestion Band**" or "**Congested Frequency Band**" means the frequency band, or bands, which have been identified as being congested within a specific geographic area;

"Electronic Communications Network" and **"Electronic Communications Service"** have the meanings assigned to them in the Framework Regulations;

"Framework Regulations" means the European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011, (S.I. No. 333 of 2011);

"**Fixed Links"** are Point-to-Point and/or Point-to-Multipoint wireless systems that connect two or more fixed geographic locations for Wireless Telegraphy;

"Minister" means the Minister of Communications, Climate Action and Environment;

"**Licence**" means a licence granted in accordance with section 5 of the Act of 1926 in accordance with and subject to the matters prescribed in these Regulations to

keep, have possession of, install, maintain, work and use Apparatus in a specified place in the State granted to the licensee

"**Duration of Licence**" means the duration of time from the commencement date that the Licensee is licensed to use a Fixed Link licence set out in draft form in Schedule 1 to the Radio Links Regulation;

"**Licence Fee**" means the fee associated for Fixed Links are set out in draft form in Schedule 2 to the Radio Links Regulations;

"**Renewal of Licence**" means a licence may be renewed from time to time by the Commission set out in the Radio Links Regulations;

"Point-to-Multipoint ("P-MP") means a radio communication service by links between a single station located at a specified fixed point and a number of stations located at specified fixed points;

"Point-to-Point ("PP")" means a radio communication service by a link between two stations located at specified fixed point**;**

"**Temporary Licence**" means a licence that is only valid for a limited time;

"Undertaking" has the same meaning set out in the Framework Regulations; and

"Wireless Telegraphy Act 1926" means the Wireless Telegraphy Act, 1926 (No. 45 of 1926), as amended.

2. DECISION-MAKING CONSIDERATIONS

2. In arriving at its decisions in this document, ComReg has had regard to:

   I. the contents of, and the materials and reasoning referred to in, as well as the materials provided by respondents in connection with, the below-listed ComReg documents (insofar as they are relevant to the present Draft Decision):

      a. ComReg Documents 20/109 and 21/134;

      b. ComReg Document 22/93 [document to which this draft Decision including draft Regulations is attached]; and

      c. the consultants' reports commissioned, and the advice obtained by ComReg, in relation to the subject-matter of the documents and materials listed above (insofar as they are relevant to the present decision) and, in particular, ComReg documents 20/109A, 21/134A and 22/93A;

   II. the powers, functions, objectives and duties of ComReg, including, without limitation those under and by virtue of:

a. the Communications Regulation Act 2002, and, in particular, sections 10, 12 and 13 thereof;

b. the Framework Regulations, and, in particular, Regulations 13, 16 and 17 thereof;

c. the Authorisation Regulations, and, in particular, Regulations 9, 10, 11, 12, 15, 16, 17, 18(1)(c) and 19 thereof;

d. Sections 5 and 6 of the Wireless Telegraphy Act, 1926; and

e. the applicable Policy Directions made by the Minister under section 13 of the Communications Regulation Act 2002.

III. and, noting that it has given all interested parties the opportunity to express their views and make their submissions in accordance with Regulation 11 of the Authorisation Regulations and Regulation 12 of the Framework Regulations.

3. DECISIONS

3. Having had regard to the above considerations, ComReg has decided:

I. subject to obtaining the consent of the Minister to the making by it of the Radio Link Licence Regulations, to make those regulations under section 6 of the Wireless Telegraphy Act 1926, prescribing relevant matters in relation to Fixed Links, including prescribing the form of the Licences concerned, their duration, fees, and the conditions and restrictions subject to which they are granted.

II. to grant Fixed Links Licences, under section 5 of the Wireless Telegraphy Act 1926 to relevant applicants subject to the conditions and restrictions (including conditions as to suspension and withdrawal), prescribed in the Fixed Links Regulations as currently set out in Annex 4 of Document 22/93 [this document]

Frequency Bands and bandwidths for Fixed Links

III. make available the frequency bands and bandwidths as set out in Table 10 of Annex 5.

Technical Requirements for deploying Fixed Links

IV. set minimum technical requirements for the use of each frequency band as set out in Table 11 of Annex 5.

<u>High/Low Database</u>

V. to remove the search radius requirement for the 80 GHz band.

VI. to retain the high/low search radius for all other frequency bands as set out in Table 12 of Annex 5).

Multi-Band Aggregation (MBA)

VII. to apply the availability requirement for the relevant lower frequency band for Fixed Links employing MBA.

Congestion Area

VIII. to make the 13 GHz and 15 GHz bands available for licensing in the Congestion Area.

IX. to designate the 13 GHz, 15 GHz, 18 GHz and 23 GHz band as Congestion Bands (see Table 13 of Annex 5).

X. to designate the Grid 3122 and 3123 as the Congestion Area (see Table 13 of Annex 5).

Duration and Renewal of Licence

XI. that a Licence shall, unless it has been revoked, withdrawn or surrendered, remain in force from the date of grant for a period of one year unless renewed.

XII. that a Temporary Licence shall, unless it has been revoked, withdrawn or surrendered, remain in force from the date of grant until the expiry date as specified in the licence, which shall not be greater than a eleven (11) month period, and shall not be renewed.

Licence Fees

XIII. that the Licence Fee shall be calculated in accordance with the Tables as set out in the Radio Link Licence Regulations.

XIV. the Licence Fee for any period of less than one year shall be calculated on a pro rata daily basis for such period.

XV. that if a Licence is surrendered by the Licensee, the Licensee may be entitled to a refund of the relevant Licence Fee of the fee paid by the Licensee.

XVI. that if a Licence is suspended or withdrawn due to a finding by ComReg of non-compliance with any relevant licence conditions, the Licensee shall not be entitled to be repaid any part of the Licence Fee paid by the Licensee, but shall still be liable to pay any sums, including interest, that are outstanding.

XVII. that if the amount of radio frequency spectrum specified in a Fixed Link Licence is reduced, the Licensee may be entitled to a refund of the relevant Licence Fee already paid in the relevant year on a pro rata monthly basis having regard to the nature of the amendment.

4. STATUTORY POWERS NOT AFFECTED

4. Nothing in this document shall operate to limit ComReg in the exercise of its discretions or powers, or the performance of its functions or duties, or the attainment of objectives under any laws applicable to ComReg from time to time.

Chapter 6

6 Assessment Tool, Submitting Comments and Next Steps

6.1 Assessment Tool

6.1 As noted earlier, an Assessment Tool will be made available for existing Fixed Link licensees on request. Requests should be made as soon as possible following the publication of this document noting that the Assessment Tool itself will be made available for 5 working days commencing 16 November.

6.2 Requests must be submitted in written form (email) to the following recipient, clearly marked – "**Assessment Tool for ComReg 22/93**":

Email: marketframeworkconsult@comreg.ie

6.2 Submitting Comments

6.3 All input and comments are welcome. It would make the task of analysing responses easier if comments were referenced to the relevant section / paragraph number in each chapter and annex in this document or the relevant accompanying consultant's report.

6.4 Please also set out your reasoning and all supporting information for any views expressed.

6.5 The consultation period will run until 17:00 on Friday 9 December 2022 during which time ComReg welcomes written comments on any issues raised in this paper.

6.6 Submissions must be provided in written form (e-mail) to marketframeworkconsult@comreg.ie, clearly marked – "**Submissions to ComReg Document 22/93"**.

6.7 Electronic submissions should be submitted in an unprotected format so that they may be readily included in the ComReg submissions document for electronic publication.

6.8 ComReg appreciates that respondents may wish to provide confidential information if their comments are to be meaningful. To promote openness and transparency, ComReg will publish all respondents' submissions to this notice, as well as all substantive correspondence on matters relating to this document, subject to the provisions of ComReg's guidelines on the treatment of confidential information

(Document 05/24[235]).

6.9 In this regard, respondents should submit views in accordance with the instructions set out below. When submitting a response to this notification that contains confidential information, respondents must choose one of the following options:

1. Preferably, submit both a non-confidential version and a confidential version of the response. The confidential version must have all confidential information clearly marked and highlighted in accordance with the instruction set out below and include the reasons as to why they consider any particular material to be confidential. The separate non-confidential version must have actually redacted all items that were marked and highlighted in the confidential version.

OR

2. Submit only a confidential version including the reasons as to why they consider any particular material to be confidential and ComReg will perform the required redaction to create a non-confidential version for publication. With this option, respondents must ensure that confidential information has been marked and highlighted in accordance with the instructions set out below. Where confidential information has not been marked as per our instructions below, then ComReg will not create the nonconfidential redacted version and the respondent will have to provide the redacted non-confidential version in accordance with option A above.

6.10 For ComReg to perform the redactions under Option B above, respondents must mark and highlight all confidential information in their submission as follows:

(a) Confidential information contained within a paragraph must be highlighted with a chosen particular colour,

(b) Square brackets must be included around the confidential text (one at the start and one at the end of the relevant highlighted confidential information),

(c) A Scissors symbol (Symbol code: Wingdings 2:38) must be included after the first square bracket.

For example, “Redtelecom has a market share of [✂ 25% ✂].”

6.3 Next Steps

6.11 Following receipt and consideration of submissions in response to this draft Decision, and other relevant material, ComReg intends to publish a response to this draft

[235] ComReg Document 05/24, “*Guidelines on the treatment of confidential information*”, published 22 March 2005, available at www.comreg.ie

Decision together with its final Decision including Regulations.

Annex 1: Relevant methodologies for setting fees for Fixed Links

A 1.1 This Annex identifies the methodologies that could be used to estimate fees for Fixed Links in the absence of a market mechanism. These methodologies may form one or more regulatory options in the RIA.

- Description of potential methodologies for setting fees for Fixed Links; and
- Assessment of potential methodologies and suitability for consideration in the RIA.

Methodologies for setting fees for Fixed Links

A 1.2 In Annex 1 of Document 21/134A, DotEcon provides an assessment of the various methodologies available to ComReg for setting fees for fixed links administratively (i.e., outside of a market mechanism). DotEcon assessed four general methodologies[236]:

(i) Universal system performance pricing ("USPP");

(ii) Administrative Incentive Pricing ("AIP");

(iii) Benchmarking; and

(iv) Administrative cost recovery.

A 1.3 ComReg provides a brief description of each methodology before assessing the appropriateness of each Option for inclusion in the RIA.

I. USPP

[236] DotEcon also briefly assessed other methodologies for setting spectrum fees that are not broadly used internationally, as they are not easily adapted to different circumstances. These are all inferior to the methodologies above and were not assessed further

A 1.4 The USPP approach implements a price for spectrum based on a set of relevant usage factors that are selected in advance, such as bandwidth, the number of channels or links used, degree of congestion, geographical location etc. Therefore, the term 'USPP' refers to a broad approach to spectrum pricing, with a specific implementation involving choice of a pricing formula and factors to act as inputs into that formula. Those choices will reflect both the policymaker's objectives and the need for a workable pricing formula based on objectively verifiable data forming inputs to that formula.

A 1.5 A typical application of USPP would identify various factors related to the interference, or 'pollution area', imposed on others by a given licence, and to set spectrum fees by applying rating factors. In effect, this penalises a licensee in relation to the spectrum that it denies other users. Such rating factors encourage efficient use through incentivising operators to establish links in a more spectral efficient manner and penalises spectrum hoarding. This should be thought of as accounting for the opportunity cost of the specific licence (i.e., the foregone spectrum uses as a result of the individual characteristics of a licence.

Example

USPP fee = (Bandwidth factor x Use factor x Frequency factor).

II. **Administrative Incentive Pricing or "AIP"**

A 1.6 AIP attempts to set prices equal to opportunity cost, such that only the highest value users have an incentive to take up licences in the band and an efficient outcome is achieved. A fee is based on an estimate of the opportunity cost of the spectrum, typically the value per MHz. This should be thought of as accounting for the opportunity cost of the spectrum (i.e., the foregone use of this spectrum.) The fee is set administratively to incentivise efficient use, rather than being determined by a process such as an auction, which would reveal opportunity cost through a competitive process.

Example

Fee = Reference Fee × Bandwidth factor × Frequency band factor × Path length factor × Availability factor

A 1.7 An AIP fee formula usually contains multiple criteria such as bandwidth, number of channels or links used, degree of congestion, geographical location etc that seek to account for the specific characteristic of the licence being awarded. Therefore, in practice, there may be some overlap between USPP, in that it implements a formula-based pricing rule based on various factors. However, with AIP, it is necessary to consider not just how a licence is used by the licensee, but also factors related to the value that excluded users might have for that spectrum (for example, the availability factor in formula in the box above might indicate congestion for a particular licence type).

III. USPP as an AIP proxy

A 1.8 DotEcon advises that, if the factors with a USPP formula are the key determinants of opportunity cost and with an appropriate formula, then USPP could (in principle) be used as a proxy for opportunity cost. However, the term USPP is typically used to describe formula-based pricing rules more widely, whether or not they are intended to act as a proxy for opportunity cost.

A 1.9 Due to the difficulties in estimating opportunity cost (in particular, the lack of information that the administrator is likely to have about the value of excluded potential users for spectrum), AIP may in practice be implemented through a simplified formula that only includes the most significant drivers of opportunity cost. Therefore, any practical AIP scheme will involve a degree of averaging of opportunity costs across different users, rather than each user paying an opportunity cost individualised to its own specific circumstances.

A 1.10 Therefore, a formula-based implementation of AIP could be very similar in structure to USPP. For this reason, we use the term “USPP as an AIP proxy” below to describe a situation in which a formula-based pricing approach is used, but the factors within the formula and its parameters are chosen to proxy opportunity cost (at least in terms of its broad features).

IV. Administrative cost-recovery

A 1.11 Cost based fees can take the form of simple charges that are set at a level sufficient to recover the costs of spectrum management. This is one of the simplest methodologies available and may be appropriate when there is no threat of spectrum scarcity.

A 1.12 A typical formula for such an approach would be to calculate fees based on the estimated cost of the licensing regime divided by the number of licences.

Example

Spectrum Fee = Spectrum Management Costs / Amount of total Spectrum Assigned to the User

V. Benchmarking

A 1.13 Benchmarking estimates the value of spectrum based on the prices paid by licensees in other countries for access to equivalent spectrum.

A 1.14 Regulators may also carry out benchmarking by drawing inferences from market prices for substitutable bands, in the same or similar jurisdictions. Where fees are set by benchmarks derived from (competitive) auction results, this implicitly uses opportunity cost pricing. Regulators could also benchmark the fees set administratively in other jurisdictions.

A 1.15 ComReg's award of the 2 GHz band to Mobile Satellite Services ("MSS") in 2017 (the "SSA") [237], used benchmarking to set fees administratively.

Assessment of methodologies for setting fees for Fixed Links

A 1.16 DotEcon assessed these methodologies against four criteria which are broadly aligned with ComReg's statutory objectives;

(i) promoting competition and **efficient** use of the radio spectrum, including ensuring that the most valuable users should be prioritised where spectrum is scarce.

(ii) **simplicity for users**, to ensure that users and potential users do not face undue burdens. In particular, new users are not discouraged from applying (which reinforces a dynamic efficiency objective).

(iii) charges should be **predictable**, so that users do not face future price shocks.

(iv) **practicality** of implementation for ComReg. It is of little value if a methodology provides theoretically optimal fees but requires inputs which are impossible to measure or otherwise unavailable to ComReg.

A 1.17 A summary of DotEcon assessment across each of the four criteria is provide in Table 8.

[237] Mobile Satellite Services with Complementary Ground Component Authorisation Regime, 17/19.

	AIP	USPP as an AIP proxy	Benchmarking	Administrative cost
Efficiency	Potentially good but may be difficult to measure opportunity costs with accuracy due to lack of information.	Potentially good if opportunity costs are reasonably approximated by the pricing formula.	Likely very poor in this case, due to highly varied basis of setting fixed link charges used by other NRAs and different scarcity environment in other countries.	Very poor, as unlikely to reflect opportunity cost and encourage more efficient use.
Simplicity	May be complex if many drivers of opportunity cost included.	Reasonable and significantly simpler than full AIP, as only key drivers of opportunity cost.	Simple	Simple
Predictability	Moderate – opportunity cost estimates may be unstable over time.	Good, provided that the price formula anticipates future requirements.	Moderate-low.	Moderate-high.
Practicality	Challenging due to difficulty of measuring opportunity cost, so in practice likely to fall back to some proxy approach anyway.	Reasonable.	Reasonable, though question of which benchmarks to use where there is significant variation across NRAs.	Good.

Table 8: Links in each bandwidth category under Option 1

A 1.18 DotEcon suggests that a proxy for opportunity cost prices based on a formula that sets fees for all bands (i.e., what we describe above as USPP as an AIP proxy) could be an appropriate way to set fees for Fixed Links. This is more likely to support efficient use of the spectrum than simpler methods but remains more predictable and practical than using modelled opportunity cost estimates directly as fees.

A 1.19 ComReg agrees with the assessment provided by DotEcon and sets out its view in relation to each of the methodologies below.

A 1.20 **In relation to benchmarking,** comparable market values could be used to estimate fees for the Fixed Link Bands and reduce the burden of directly calculating the opportunity costs of spectrum. However, such an approach requires benchmarks that are sufficiently reflective of opportunity costs in the Fixed Link Bands. With that in mind, ComReg notes that:

- spectrum rights of use for fixed links are rarely awarded by auction and only a small number of auction benchmarks are therefore available [238];
- such auctions are made on a very infrequent basis (10 -15 years); and
- such auctions cover only a small number of the 20 Fixed Links Bands.

A 1.21 Similarly, benchmarking against fees set administratively in other jurisdictions is also inappropriate. These fees are typically not reflective of opportunity costs (as they are not based on the outcome of a competitive process) and do not provide any particularly meaningful basis for setting fees in Ireland.

A 1.22 Further, any fees framework needs to account for the various use cases identified in this draft Decision. Fees in other jurisdictions were set historically (decades ago in some instances) and therefore could not account for the use cases that were consulted on in Document 20/109, Document 21/134 and discussed further in this draft Decision.

A 1.23 For these reasons, ComReg could not rely on benchmarking to set fees for each of the Fixed Links Bands[239]. Therefore, there is no benefit in including benchmarking for consideration in the draft RIA.

[238] For example, ComReg's 2017 26 GHz award and Norway 2020 Multiband award (0 GHz, 13 GHz, 18 GHz, 23 GHz, 28 GHz, 32 GHz and 38 GHz).
[239] ComReg notes that DotEcon/Axon has considered the small number of potential comparable in for the small number of instances available (e.g., ComReg's 26 GHz award).

A 1.24 **In relation to AIP**, ComReg notes that such an approach is theoretically appealing because it directly sets prices based on estimates of the opportunity cost, which should promote efficient use. However, and as noted by DotEcon, it is difficult to implement in practice. In particular, even under some simplifying assumptions (i.e. that marginal excluded users are existing fixed links licensees, and looking only at a scenario where there is acute scarcity of spectrum) the determination of the opportunity cost of the spectrum requires ComReg to calculate the discounted cash-flow of potential users with and without access to the spectrum under assessment. ComReg notes several difficulties with such an approach.

- First, there could be a substantial difference in the use case of licensees and associated cashflow estimates. (i.e., there is likely to be a high degree of usage asymmetry between licensees). There are a variety of services for which Fixed Link Bands might be used, all of which have different commercial and revenue structures. This makes it very difficult to adequately reflect the opportunity cost arising from its use. Readers will be aware that this phenomenon is particularly acute in Fixed Links where there are a wide variety of different users and up to seven different use cases, as identified in Document 20/109;

- Second, there is a large amount of uncertainty surrounding the results of the modelling process. If the model has insufficient data or makes incorrect technical or commercial assumptions about licensees, this could result in errors that misrepresents the value of spectrum across all of the fixed link bands. It is unrealistic to suggest that ComReg can accurately determine opportunity cost for each band/region combination without relying on assumptions, but the robustness of those assumptions seem unlikely to be adequate; and

- Third, due to the reasonable confidential and commercially sensitive nature of much of the required information, it would be difficult to achieve transparency in implementing this approach.

A 1.25 For these reasons[240] ComReg could not rely on AIP to estimate fees for each of the Fixed Links Bands[241]. Therefore, there is no benefit in considering whether AIP is a valid regulatory option in the draft RIA.

[240] There is also a risk that fees would be set too low where the opportunity cost is low or zero. Such scenarios are problematic where potential scarcity is an issue because such fees do not provide licensees with incentives to use spectrum efficiently and promote greater availability of spectrum in the future.
[241] ComReg notes that DotEcon/Axon has considered the small number of potential comparable in for the small number of instances available (e.g., ComReg's 26 GHz award).

A 1.26 **In relation to administrative cost**, ComReg agrees with DotEcon that such an approach is straightforward and simple to implement. However, ComReg also agrees that it does not reflect opportunity cost in any way and would provide poor incentives for efficient use more generally. Notwithstanding, where there is no risk of spectrum scarcity over a sufficiently long period, there may be a sufficient basis for it to be used to set fees for spectrum rights of use.

A 1.27 Therefore, ComReg is of the preliminary view that there is merit considering whether an administrative cost recovery option is a valid regulatory option in the draft RIA. [242]

A 1.28 The **USPP (as an AIP proxy)** proposed by DotEcon[243] recognises that any attempt to estimate opportunity cost accurately for 20 Fixed Link Bands is subject to significant data and assumption limitations. This approach identifies important drivers of opportunity cost (e.g., channel size, frequency band) and includes these as part of a formula for setting fees. While this would not be as accurate as a fully modelled approach (assuming data was even available), it constitutes a more realistic approach to providing a coherent schedule of fees for the Fixed Link Bands.

A 1.29 This formula-based pricing should effectively encourage more efficient use of the spectrum as long as the fees (and parameters informing same) are set at a level that does not choke off efficient demand. Indeed, such fees may be above the administrative cost if there is information available regarding the willingness of licensees to pay for spectrum rights of use in the delivery of services. This is particularly helpful in guarding against the risk of setting fees too low which could encourage spectrum hoarding and ultimately impede the availability of spectrum for more efficient users in the future.

A 1.30 The formula-based approach used in this methodology also has the advantage that it may be possible to retain the formula but to update specific parameters within it if future circumstances change. Therefore, it provides a reasonable compromise with providing predictability and clarity for licenses, but still provide flexibility for ComReg to modify fees if circumstances change.

[242] This assessment is provided in Step 2 of the RIA framework. 'Identify and describe the regulatory options'
[243] See ComReg Document 21/134A

A 1.31 In particular, the formula can be extended to include areas that are congested and reflect estimates of opportunity cost under different scarcity conditions. As noted by DotEcon, "*Although opportunity cost modelling is still necessary, the assumptions become less critical (e.g. ComReg can calculate opportunity costs under the assumption that there is scarcity, and use this as one of a number of inputs to the fees, rather than relying on detailed congestion estimates, which are complex given the interference analysis required).*"[244] These are estimated by comparing the costs incurred by fixed links operators to those they would incur in a counterfactual scenario in which some fixed links bands were switched off.

A 1.32 Therefore, ComReg is of the view that there may be benefit in considering whether the **USPP (as an AIP proxy) methodology** proposed by DotEcon is a valid regulatory option in the draft RIA.

[244] See ComReg Document 21/134A

Annex 2: Parameter values in Option 2

A 2.1 This Annex provides a formal description of the formula used to calculate fees under Option 2. Further, it outlines the values for each parameter under that option and explains the motivation for each value. The remainder of this Annex is laid out as follows:

- Section A 2.1 provides a formal description of the formula used under Option 2; and
- Section A 2.2 provides the justification for the proposed parameter values in the formula.

A2.1 Formal description of the formula

A 2.2 The fee for a link of bandwidth h in band i, and area s is given by the following formula:

$$\text{Fee} = \max\left[x \times r_i \times c_{is} \times b(i,h), \quad A\right]$$

A 2.3 Table 9 below provides a description of each of each of the variables and how each variable is mathematically represented.

Variable	Description and proposed values
The base price: $\boldsymbol{x}$	A base price per MHz, x; **ComReg propose setting x = €1.20** (i.e., €1.20 per MHz)
The frequency gradient is determined by $\boldsymbol{r_i}$,	r_i, is a schedule of band specific values that determine the relative minimum prices per MHz across bands; The level of the schedule parameter for each band (i.e., the value of each r_i) is defined by ComReg and is not a formal part of the proposed formula. ComReg proposes initially setting the values of r_i (for bands other than 80 GHz) such that the ratio of per MHz charges for modal bandwidth links reflects the approximate ratio of estimated opportunity costs for the highest frequencies and the lowest frequencies. Specifically, with the bands numbered from 1 to N in ascending order of frequency, for band i: $\hat{r}_i = 1 + (R-1)\,\frac{F_i - F_N}{F_1 - F_N}$ $r_i = \hat{r}_i \frac{\bar{h}_i}{b(i,\bar{h}_i)}$

	where *F*i is the frequency midpoint of band i, and R represents the ratio of estimated opportunity costs for the highest band and the lowest band. $\bar{h}_i$ is the modal bandwidth in band i and $b(i, \bar{h}_i)$ is the effective bandwidth of a modal bandwidth link in band i (discussed below) **ComReg proposes setting the 'top to bottom' ratio: R = 30.** **For 80 GHz, ComReg proposes setting $\mathbf{r_i} = 0.2$** instead of using the formula, given the greater availability of of spectrum in the band.
An 'effective bandwidth': $\widehat{h_i}$	For each band, a 'effective bandwidth', generally reflecting the largest bandwidth in common use within that band, $\widehat{h_i}$; Let $\widehat{h_i}$ be the largest commonly used bandwidth of band i. For links at or above this channel size, the effective bandwidth is equal to bandwidth. For links below this channel size, the fees are set assuming as if the link had a 25% chance of forgoing a larger link, that is the effective bandwidth for a link with channel size h in band i is given by: $$b(i,h) = \begin{cases} h & \text{if } h \geq \widehat{h_i} \\ (1-m)h + m\, b(i,2h) & \text{if } h < \widehat{h_i} \end{cases}$$ The values for the effective bandwidths for each band are set out in Table 3. **ComReg proposes setting $m = 0.25$**
The congestion intensity: c	The levels that the congestion intensity, c, can take. **ComReg proposes setting $c = 3$ for congested fixed links.**
An administrative cost floor: A	An administrative cost floor, A, to ensure the recovery of the administrative cost of a Fixed Link licence. **ComReg proposes to set a price floor of €100 per fixed link.**

Table 9: The values for the proposed model parameters under Option 2

A2.2 Parameter values

A 2.4 DotEcon has suggested a range of valuations for each parameter which it considers should provide the correct level of incentive to licensees to mitigate the risks it has identified and best provide for the efficient use of the radio spectrum.

A 2.5 The values chosen by ComReg are those used as the basis for the assessment of Option 2 in the R.I.A and in the DotEcon assessment of the impact of fees (see Section 4.3.8 of the DotEcon Report).

A 2.6 ComReg discusses the parameters for each component of the formula in order below:

- Top to Bottom Radio;

- Base price;
- Congestion;
- Administrative costs; and
- Bandwidth.

Top to bottom Ratio

A 2.7 DotEcon makes two recommendations[245] in respect of the top to bottom ratio.

- First, that r_i is based on a ratio of at least R = 30 (i.e., ratio of 1:30) across bands from 1.3/1.4 GHz up to 42 GHz, noting there are grounds for setting an even steeper gradient, up to around R = 40; and
- Second, that $r_i = 0.2$ for the 80 GHz Band in the initial set of band schedule parameters, rather than basing this on the ratio of opportunity costs.

A 2.8 In relation to the first recommendation[246], ComReg is of the preliminary view that the frequency gradient should be strengthened relative to the current fee schedule to encourage use of the higher bandwidths in order to preserve spectrum for Fixed Links in lower bands. ComReg provides its detailed views on the frequency gradient in Section 5.6.1 including its view that the existing gradient level (1:10) is unlikely to be at a level that sufficiently reflects value differences between the bands, given that the cost modelling[247] suggests that a more appropriate ratio is the range of 1:15 to 1:54.

A 2.9 Given same, DotEcon advises[248] that:

- 1:15 is unreasonably low (because it is based on high bandwidth links that are unavailable below 11 GHz); and
- all ratios likely underestimate the difference in opportunity cost across the full range of bands, because the bands were grouped for the opportunity cost calculations. [249]

[245] See p44-46 of ComReg Document 21/134A
[246] See p45 of ComReg Document 21/134A
[247] See Table 9, 10 and 11 of ComReg Document 21/134A.
[248] See p45 of ComReg Document 21/134A
[249] These are ratios of average opportunity cost in the 1.3 – 8 GHz band to average opportunity cost in the 23 – 38 GHz bands).

A 2.10 ComReg agrees with DotEcon that a ratio set too low and closer to R = 15 is unlikely to provide a strong enough incentive to avoid the lower bands when higher frequency bands would be sufficient. That said, there is little to be gained in setting the gradient too high and closer to R = 54 because that is only representative of a very specific bandwidth usage (20 – 40 MHz) and only in urban areas.

A 2.11 Alternatively, a ratio in the R = 30/40 range is likely more reflective of the estimated opportunity costs across different bands given the bandwidth requirements users will have in both urban and rural areas (i.e opportunity costs differ across bands, but also between rural/urban in a given band). R = 30/40 provides the best fit across those characteristics).

A 2.12 In its latest report, DotEcon recommends that the 1:30 ratio should apply to per MHz charges for the most common channel widths (modal bandwidth links). To implement this, it is necessary to scale down the ri values listed in 21/134 by the ratio of the modal bandwidth and the effective bandwidth of a modal bandwidth link (in bands where the modal bandwidth is strictly less than the largest bandwidth in common use).

A 2.13 ComReg proposes to set $R = 30$[250] [251] at the lower end of the DotEcon recommendation (for bands up to 42 GHz), in line with DotEcon's updated methodology (using modal bandwidth links), noting that should this level of gradient prove ineffective in encouraging operators to organise themselves efficiently within the bands, ComReg could address the matter by adjusting the band schedule parameters in the future.

A 2.14 In relation to the second recommendation, in its latest report DotEcon suggests[252] setting $r_i = 0.2$ for the 80 MHz Band instead of using the formula. The opportunity cost modelling suggests that opportunity cost for the 80 GHz band is higher than for bands in the 23 – 42 GHz range because the large bandwidths used mean that it is not possible to switch into alternative (lower frequency) bands, and opportunity costs are driven by the need to use dual polarisation. DotEcon advises that the 80 GHz fees need to be matched to (uncongested) 42 GHz fees to avoid inefficient migration between the two bands. In that regard, applying a 1:4 ratio for the 80 GHz band relative to the 42 GHz band would roughly reflect both relative channel sizes and relative supply in the bands, thereby leaving fees for 80 GHz broadly unchanged.

[250] ComReg considers that this incentive does not disadvantage users with preferred bandwidths relative to the status quo, given that in fact that average fees for Fixed Links across all bands besides U6, 13, 18, 32 and 80 GHz are decreasing.

[251] Specifically, the r^i formula with R=30 for bands from 42GHz or below, and ri=0.2 for 80 GHz.

[252] In 21/134a, DotEcon advised the setting $r_i = 0.25$ and has revised this figure and the R recommendation, as a result of the recently updated analysis using more recent data as described in Annex A of the DotEcon Report.

A 2.15 Setting the position of the 80 GHz band in the set of round schedule parameters on the basis of relative opportunity cost would result in a higher r_i for 80 GHz compared to 42 GHz Band which would not be reflective of the level of substitutability between these bands. This would create potential distortions with licensees potentially applying for 42 GHz spectrum when they would have preferred spectrum in the 80 GHz band. This would run counter to ComReg's view that the frequency gradient should encourage use of the higher bandwidths to preserve spectrum for Fixed Links needing the propagation of the lower bands.

A 2.16 Therefore, ComReg agrees that setting $\mathrm{r_i} = 0.21$ is a practical approach to ensuring the 80 GHz Band and other substitutable bands are used more efficiently in the future.

A 2.17 The $\mathrm{r_i}$ for each band and the associated calculations are set out in tab 'Details of Bands' in the Assessment Tool.

The Base Price

A 2.18 DotEcon recommends that ComReg set the formula parameters in a way that restructures the fees rather than leading to a fundamental change in the fee levels. DotEcon advises that a reasonable approach might be to set x such that the standard fees for largest commonly used bandwidths in the most commonly used bands, 11 – 23 GHz, remains similar to those under the current regime. With that in mind, in its latest report DotEcon recommends[253] setting $x = 1.2$ which would keep the general level of charges for uncongested links at typical bandwidth broadly similar for the 11 - 23 GHz bands (given $R = 30$).

A 2.19 ComReg agrees with DotEcon that the proposed approach should restructure the fees (i.e., according to frequency gradient, bandwidth requirements, congestion etc) rather than concern itself with the overall fee levels[254]. Note that this view is informed by the clear evidence that existing fees levels have not appeared to have choked off efficient demand. Obviously, if ComReg was approaching this issue absent this information, it may initially set a different base price and review at a later time. However, the existing fees paid by licensees provide highly relevant information about the extent to which the rollout of services are impacted by a particular fee level.[255] In this case, the existing fee levels are highly unlikely to choke off efficient demand.

[253] In 21/134A, DotEcon advised the setting x=1.3 and has revised its recommendation, as a result of the recently updated analysis.
[254] ComReg does not have a revenue raising objective. Consequently, revenue generating issues are not relevant in determining an appropriate fees framework. The overall fees collected would be a by-product of an efficient fees framework.
[255] This reduces concerns that ComReg might normally have about fees being set too high.

A 2.20 Setting $x = 1.2$ would result in a decline in overall fee levels on a static basis (i.e., if licensees make no changes to their existing deployment overall fees would not change). However, this approach would also provide incentives for Existing Licensees to deploy these links more efficiently over a period of time and reduce the fees paid by individual licensees. Reducing the base price would likely reduce the incentives for Existing Licensees to deploy links more efficiently because the savings from such a deployment would be reduced. Existing Licensees are more likely to choose a more efficient deployment where the savings from doing so are higher.

A 2.21 Separately, the fees for any new links, whether with existing or new licensees, would be those that are most cost effective from the outset. The extent to which overall fees would change in the future would be irrelevant and would simply be a by-product of the decisions made by licensees in the deployment of Fixed Links.

A 2.22 Therefore, ComReg agrees that $x = 1.2$ is an appropriate base price.

Congestion

A 2.23 DotEcon estimate that the current opportunity cost for the congested 13, 15 and 18 GHz bands for a 56 MHz bandwidth is over €10k per annum. To implement congestion charging to reflect opportunity costs of that scale would require setting $c \approx 6$ for congested cases, rather than the current $c = 1.2$. DotEcon recommends that a first step might be to set c in the region of 2 - 4 for congested bands/areas[256]. An initial sharp increase above 4 is unnecessary because, among other things, the relative scarcity in particular bands may in any case be reduced by the proposed pricing formula.

A 2.24 ComReg is of the preliminary view that a value at the lower end of the 2 – 6 range is appropriate. ComReg proposes to set $c = 3$ in Dublin for congested bands only and $c = 1$ in all other cases. ComReg notes that as $c = 3$ is at the lower end of the 2 – 6 range, there is scope for c to be readjusted following future analysis in the future review. This may arise due to further or persistent congestion in the congested bands and areas of emerging congestion in bands or areas not currently designated as congested.

A 2.25 This represents a larger difference between the fees for Fixed Links in congested bands/areas and uncongested areas/bands compare with the current fee structure[257]. ComReg considers the increase in fees for congested Fixed Links to be appropriate given that congestion charges do not appear to have had the desired impact by failing to reduce congestion to date in the congested bands.

[256] See ComReg Document 21/134A

[257] As DotEcon note, the existing regime has an implicit congestion factor of 1.2 in Dublin for congested bands.

Effective Bandwidths

A 2.26 In 21/134A, DotEcon advised the adoption of a "Typical Bandwidth", using the modal bandwidth for Fixed Links within a given band. DotEcon has revised its recommendation to setting fee to target fragmentation using the highest bandwidth in common use bandwidth, as a result of the potential impact of this approach on smaller Fixed Links in bands with multiple bandwidths in common use which could result in fees disincentivising fairy common bandwidths and their use cases.

A 2.27 As noted by DotEcon in some bands, the largest bandwidth in common use is also the modal bandwidth, but this is not always so. In the 18 GHz band, the modal bandwidth is still 56 MHz, but there is use being made of 112 MHz as well. DotEcon advise the use of effective bandwidths that set as the largest bandwidth in common use for each Fixed Link Band as of November 2022.

A 2.28 ComReg agrees that choosing the highest bandwidth in common use bandwidth is an appropriate approach for setting the effective bandwidth for each Fixed Link Bands. ComReg notes the issues identified by DotEcon would have been exacerbated by future trends, considering the strong trend towards wider channels (e.g., 110/112 MHz).

A 2.29 The effective bandwidth for each band and the associated calculations are set out in tab 'Details of Bands' in the Assessment Tool, which is available on request.

A 2.30 In relation to the small link gradient m, ComReg is of the preliminary view that setting $m = 0.25,$ is appropriate.

Administrative Cost Floor

A 2.31 DotEcon considers that €100 is a reasonable level at which to set the administrative cost floor[258], based on the analysis of administrative costs by Axon.

A 2.32 This is estimated by DotEcon/Axon as follows:

A 2.33 First, ComReg's costs fall into three categories:

- one-off (e.g., equipment used to assess interference complaints);
- recurring (e.g., support and maintenance fees for the interference modelling software); and
- staff costs (e.g., salaries).

[258] See Section 4.3.5 of ComReg Document 21/134A

A 2.34 Second, for each item in these categories, the annual expenses are multiplied by the estimated proportion of the expense attributable to Fixed Links, and sum these to give an estimate of ComReg's total annual fixed links administrative cost. This comes to approximately EUR 835,000 per year. Dividing this by the total number of links in operation (as of 2021) gives an average cost estimate of €67 per link, which DotEcon recommends rounding up to €100 per link.

A 2.35 ComReg considers this approach to be appropriate noting that it is based on data confidentially provided by ComReg on its administrative costs for spectrum licencing[259]. ComReg considers the proposed weighting of the "*administrative price floor*" ($A = €100$) to be appropriate noting that this estimate only serves as a floor on fees and only becomes the actual fee for a relatively small number of links (all of which face a decrease in fees relative to the existing charges).

[259] For further information on the calculation of administrative cost for Fixed Links licences, see Annex B of ComReg Document 21/134A

Annex 3: Relevant Legal Framework and Statutory Objectives Decision Instrument

A 3.1 The Communications Regulation Act 2002 (as amended by the Communications Regulation (Amendment) Act 2007) (the "2002 Act"), the European Electronic Communications Code (which has repealed the EU Common Regulatory Framework, namely the Framework and Authorisation Directives);[260] the corresponding Framework and Authorisation Regulations[261](which must be read in light of the EECC), and the Wireless Telegraphy Acts 1926 to 2009[262] set out, amongst other things, ComReg's functions and objectives that are relevant to the management of the radio frequency spectrum in Ireland and to this Response to Consultation and draft Decision document including draft Regulations.

A 3.2 Apart from licensing and making regulations in relation to licences, ComReg's functions include the management of Ireland's radio frequency spectrum in 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 relevant provisions of the European Electronic Communications Code. 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.

[260] 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").

[261] 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.

[262] The Wireless Telegraphy Acts 1926 to 1988 and Sections 181 (1) to (7) and (9) and Section 182 of the Broadcasting Act 2009

A 3.3 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 functions, objectives powers, and duties of ComReg that appear most relevant to the matters at hand and generally excludes those not considered relevant (for example, in relation to postal services, premium rate services or market analysis). For the avoidance of doubt, however, the inclusion of particular material in this annex does not necessarily mean that ComReg considers same to be of specific relevance to the matters at hand. All references in this annex to enactments are to the enactment as amended at the date hereof, unless the context otherwise requires. All references in this annex to enactments are to the enactment as amended at the date hereof, unless the context otherwise requires.

New European Electronic Communications Code

A 3.4 On 20 December 2018, Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code ("EECC") entered into force.

A 3.5 **It is important to note that further to Article 125 ("Repeal") of the EECC, with effect from 21 December 2020, the EECC replaced the EU Common Regulatory Framework adopted in 2002 (and amended in 2009) under which ComReg has regulated electronic communications since 2003[263].**

A 3.6 With some limited exceptions (see Article 124 of the EECC), Member States had until 21 December 2020 to transpose the EECC into national law[264]. The DECC is responsible for the transposition of the EECC[265] and ComReg has assisted the DECC in that regard as appropriate.

A 3.7 The Communications Regulation Bill 2022 was published on 25 September 2022[266], and it is proceeding through the Oireachtas. The SI transposing key provisions of the EECC has been published as S.I. No. 444 of 2022[267] but has not yet been commenced by the Minister.

[263] For the correlation table between relevant articles of the repealed Directives and the EECC, please see Annex XIII of the EECC available here- EUR-Lex - 02018L1972-20181217 - EN - EUR-Lex (europa.eu)
[264] With the exception of Articles 53(2), (3) and (4), and Article 54 (See Article 124).
[265] See, for example, https://assets.gov.ie/162712/1d774c6b-55d4-4b04-9253-8be6f24fb3ba.pdf
[266] Communications Regulation Bill 2022 – No. 86 of 2022 – Houses of the Oireachtas
[267] The European Union (Electronic Communications Code) Regulations 2022

A 3.8 ComReg understands that the EECC is unlikely to be transposed into national law until late 2022. However, for the avoidance **of doubt, electronic communications providers must continue to comply with their obligations, and ComReg will continue to regulate the electronic communications sector under its existing powers, and redress mechanisms for customers will continue unchanged until new legislation is introduced.**

A 3.9 Notwithstanding, and for the avoidance of doubt, ComReg is satisfied that, to the best of its knowledge, the proposals contained in this document will not conflict with the objectives of the EECC or the obligations likely to be imposed on ComReg under national legislation implementing same.

A 3.10 All references in this annex to enactments are to the enactment as amended at the date hereof unless the context otherwise requires.

Primary Functions and Objectives and Regulatory Principles under the 2002 Act and Common Regulatory Framework

A 3.11 ComReg's relevant functions pursuant to Section 10 of the Communications Regulation Act 2002 as amended include, the management of the radio frequency spectrum and the national numbering resource. It's primary objectives in carrying out its statutory functions in the context of electronic communications are to:

- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under section 13 of the 2002 Act;
- Promote competition[268];
- Contribute to the development of the internal market[269];
- Promote the interests of users within the Community[270]; and

[268] Section 12 (1)(a)(i) of the 2002 Act.
[269] Section 12 (1)(a)(ii) of the 2002 Act.
[270] Section 12(1)(a)(iii) of the 2002 Act.

- Unless otherwise provided for in Regulation 17 of the Framework Regulations, take the utmost account of the desirability of technological neutrality in complying with the requirements of the Specific Regulations[271] in particular those designed to ensure effective competition.[272]

Efficient management and use of the radio frequency spectrum

Framework Regulations

A 3.12 Regulation 17 of the Framework Regulations governs the management of radio frequencies of ECS. 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[273], ensure:

- The effective management of radio frequencies for ECS;
- That spectrum allocation used for ECS 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 EU.

A 3.13 Regulation 17(2) provides that, unless otherwise provided in Regulation 17(3), ComReg must ensure that all types of technology used for ECS may be used in the radio frequency bands that are declared available for ECS in the Radio Frequency Plan published under Section 35 of the 2002 Act in accordance with EU law.

[271] The 'Specific Regulations' comprise collectively the Framework Regulations, the Authorisation Regulations, 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).

[272] Regulation 16(1)(a) of the Framework Regulations.

[273] Broadly equivalent to Article 4 of the EECC.

A 3.14 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 ECS 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 A4.14 Regulation 17(4) requires that, unless otherwise provided in Regulation 17(5), ComReg must ensure that all types of ECS may be provided in the radio frequency bands, declared available for ECS in the Radio Frequency Plan published under Section 35 of the Act of 2002 in accordance with EU law.

A 3.15 Regulation 17(5) provides that, notwithstanding Regulation 17(4), ComReg may provide for proportionate and non-discriminatory restrictions to the types of ECS to be provided, including where necessary, to fulfil a requirement under the International Telecommunication Union Radio Regulations (“ITU-RR”).

A 3.16 Regulation 17(6) requires that measures that require an ECS to be provided in a specific band available for ECS 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 3.17 Regulation 17(7) provides that ComReg may only prohibit the provision of any other ECS 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 3.18 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 3.19 Regulation 17(9) provides that Regulations 17(2) to (7) only apply to spectrum allocated to be used for ECS, general authorisations issued and individual rights of use for radio frequencies granted after 1 July 2011. Spectrum allocations, general authorisations and individual rights of use which already existed on 1 July 2011 are subject to Regulation 18 of the Framework Regulations.

A 3.20 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 3.21 Regulation 17(11) requires ComReg to, in the fulfilment of its obligations under that Regulation, respect relevant international agreements, including the ITU-RR and any public policy considerations brought to its attention by the Minister.

Authorisation Regulations

Decision to limit rights of use for radio frequencies

A 3.22 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;
- 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 3.23 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 3.24 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 3.25 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 3.26 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 3.27 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 3.28 Regulation 10(1) of the Authorisation Regulations provides that, notwithstanding Section 5 of the Wireless Telegraphy Act,1926, but subject to any regulations under Section 6 of that 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 rights of use:

- 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[274] 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[275].
- 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.

[274] Note that the Framework Directive has now been replaced by the EECC.
[275] Note that the Framework Directive has now been replaced by the EECC.

A 3.29 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 3.30 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 3.31 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 3.32 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

A 3.33 Regulation 19 of the Authorisation Regulations permits ComReg to impose fees for rights of use which reflect the need to ensure the optimal use of the radio frequency spectrum.

A 3.34 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. It should be noted that Article 42 of the EECC contains provisions relating to "Fees for rights of use for radio spectrum and rights to install facilities" and provides at Article 42(1) that: "Member States may allow the competent authority to impose fees for the rights of use for radio spectrum or rights to install facilities on, over or under public or private property that are used for the provision of electronic communications networks or services and associated facilities which ensure the optimal use of those resources. Member States shall ensure that such fees are objectively justified, transparent, non-discriminatory and proportionate in relation to their intended purpose and shall take into account the general objectives of this Directive." Article 42(2) provides that: "With respect to rights of use for radio spectrum, Member States shall seek to ensure that applicable fees are set at a level which ensures efficient assignment and use of radio spectrum, including by: (a) (a) setting reserve prices as minimum fees for rights of use for radio spectrum by having regard to the value of those rights in their possible alternative uses; (b) taking into account costs entailed by conditions attached to those rights; and (c) (c) applying, to the extent possible, payment arrangements linked to the actual availability for use of the radio spectrum.

Amendment of rights and obligations

A 3.35 Regulation 15 of the Authorisation Regulations permits ComReg to amend rights and conditions concerning rights of use, 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).

Other Relevant Legislation and Policy Instruments

Wireless Telegraphy Act, 1926 (the "1926 Act")

A 3.36 Under Section 5(1) of the 1926 Act, ComReg may, subject to that Act, and on payment of the prescribed fees (if any), grant to any person a licence to keep and have possession of apparatus for wireless telegraphy in any specified place in the State.

A 3.37 Section 5(2) provides that, such a licence shall 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 may be prescribed in regard to it by regulations made by ComReg under Section 6.

A 3.38 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 3.39 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 following matters:

- 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 3.40 Section 6(2) provides that Regulations made by ComReg under Regulation 6 may authorise and provide for the granting of a licence 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.

A 3.41 Regulation 10(1) of the Authorisation Regulations provides that, notwithstanding section 5 of the Act of 1926 but subject to any regulations made under section 6 of that Act, where ComReg attaches conditions to rights of use for radio frequencies, it may only attach such conditions as are listed in Part B of the Schedule to the Authorisation Regulations.

Broadcasting Act 2009 (the "2009 Act")

A 3.42 Section 132 of the 2009 Act relates to the duties of ComReg in respect of the licensing of spectrum for use in establishing digital terrestrial television multiplexes and places an obligation on ComReg to issue:

- two DTT multiplex licences to RTÉ by request (see Sections 132(1) and (2) of the 2009 Act; and
- a minimum of four DTT multiplex licences to the BAI by request (see Sections 132(3) and (4) of the 2009 Act) for the provision of commercial TV content.

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

A 3.43 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.*
- *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 3.44 On 15 February 2012, the European Parliament adopted the five-year Radio Spectrum Policy Programme ("RSPP") which establishes a multi-annual radio spectrum policy programme for the strategic planning and harmonisation of the use of spectrum. The objective is to ensure the functioning of the internal market in the Union policy areas involving the use of spectrum, such as electronic communications, research, technological development and space, transport, energy and audiovisual policies.

A 3.45 Among other things, Article 5 of the RSPP, entitled "Competition", provides:

"*1. Member States shall promote effective competition and shall avoid distortions of competition in the internal market for electronic communications services in accordance with Directives 2002/20/EC and 2002/21/EC.*

They shall also take into account competition issues when granting rights of use of spectrum to users of private electronic communication networks.

2. For the purposes of the first subparagraph of paragraph 1 and without prejudice to the application of competition rules and to the measures adopted by Member States in order to achieve general interest objectives in accordance with Article 9(4) of Directive 2002/21/EC, Member States may adopt, inter alia, measures:

(a) limiting the amount of spectrum for which rights of use are granted to any undertaking, or attaching conditions to such rights of use, such as the provision of wholesale access, national or regional roaming, in certain bands or in certain groups of bands with similar characteristics, for instance the bands below 1 GHz allocated to electronic communication services. Such additional conditions may be imposed only by the competent national authority;

(b) reserving, if appropriate in regard to the situation in the national market, a certain part of a frequency band or group of bands for assignment to new entrants;

(c) refusing to grant new rights of use of spectrum or to allow new spectrum uses in certain bands, or attaching conditions to the grant of new rights of use of spectrum or to the authorisation of new spectrum uses, in order to avoid the distortion of competition by any assignment, transfer or accumulation of rights of use;

(d) prohibiting or imposing conditions on transfers of rights of use of spectrum, not subject to national or Union merger control, where such transfers are likely to result in significant harm to competition; and

(e) amending the existing rights in accordance with Directive 2002/20/EC where this is necessary to remedy ex post the distortion of competition by any transfer or accumulation of rights of use of radio frequencies.

3. Where Member States wish to adopt any measures referred to in paragraph 2 of this Article, they shall act in conformity with the procedures for the imposition or variation of such conditions on the rights of use of spectrum laid down in Directive 2002/20/EC.

4. Member States shall ensure that the authorisation and selection procedures for electronic communications services promote effective competition for the benefit of citizens, consumers and businesses in the Union."

Policy Directions[276]

A 3.46 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 3.47 The Policy Directions which are most relevant in this regard include the following:

Policy Direction No.3 on Broadband Electronic Communication Networks

A 3.48 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.

Policy Direction No.4 on Industry Sustainability

A 3.49 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.

[276] ComReg also notes, and takes due account of, the Spectrum Policy Statement issued by the Department of Communications Energy and Natural Resources in September 2010

Policy Direction No.5 on Regulation only where necessary

A 3.50 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 3.51 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 3.52 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 3.53 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 3.54 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; and

- the potential of alternative technology delivery platforms to support competition.

Promotion of Competition

A 3.55 Section 12(2)(a) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at the promotion of competition, including:

- encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources;
- ensuring that there is no distortion or restriction of competition in the electronic communications sector; and
- ensuring that users, including disabled users, derive maximum benefit in terms of choice, price and quality.

A 3.56 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 3.57 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.

Contributing to the Development of the Internal Market

A 3.58 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:

I. removing remaining obstacles to the provision of ECN, ECS and associated facilities at Community level;

II. encouraging the establishment and development of trans-European networks and the interoperability of transnational services and end-to-end connectivity; and

III. 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 3.59 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.

Promotion of Interests of Users

A 3.60 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 ECS;
- 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 3.61 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.

Technological Neutrality

A 3.62 As noted, unless otherwise provided for in Regulation 17 of the Framework Regulations, take the utmost account of the desirability of technological neutrality in complying with the requirements of the Specific Regulations in particular those designed to ensure effective competition.

Regulatory Principles

A 3.63 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 ECN and ECS;
- 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.

BEREC

A 3.64 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.

Other Obligations under the 2002 Act

A 3.65 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;[277]
- have regard to international developments with regard to the radio frequency spectrum[278]; and
- take the utmost account of the desirability that the exercise of its functions aimed at achieving its radio frequency management objectives does not result in discrimination in favour of or against particular types of technology for the provision of ECS.[279]

[277] Section 12(3) of the 2002 Act.
[278] Section 12(5) of the 2002 Act.
[279] Section 12(6) of the 2002 Act.

Annex 4: Draft Licensing Regulations

A 4.1 **Any final version of these regulations, which would be made by ComReg under section 6 of the Wireless Telegraphy Act 1926, is expressly subject to the consent of the Minister for the Environment, Climate and Communications under section 37 of the Communications Regulation Act 2002, as amended**

A 4.2 ComReg may make such editorial changes to the text of any final regulations as it considers necessary and without further consultation, where such changes would not affect the substance of the regulations

STATUTORY INSTRUMENTS.

S.I. No. of 2023

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WIRELESS TELEGRAPHY (RADIO LINK LICENCE) REGULATIONS 2023

S.I. No. of 2023

WIRELESS TELEGRAPHY (RADIO LINK LICENCE) REGULATIONS, 2023

The Commission for Communications Regulation, in exercise of the powers conferred on it by section 6(1) of the Wireless Telegraphy Act 1926 (No. 45 of 1926) as substituted by section 182 of the Broadcasting Act 2009 (No. 18 of 2009), and with the consent of the Minister for the Environment, Climate and Communications (as adapted by the Communications, Climate Action and Environment (Alteration of Name of Department and Title of Minister) Order 2020 (S.I. No. 373 of 2020)) in accordance with section 37 of the Communications Regulation Act 2002 (No. 20 of 2002), hereby makes the following Regulations:

Citation

1. (1) These Regulations may be cited as the Wireless Telegraphy (Radio Link Licence) Regulations 2023.

(2) These Regulations shall come into force at the end of the period of one year beginning with the day on which they were made.

Interpretation and Definitions

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

“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);

“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;

“Wireless Telegraphy” has the same meaning as set out in section 2 of the Act of 1926;

“Authorisation Regulations” means the European Communities (Electronic Communications) (Authorisation) Regulations, 2003 (S. I. No. 306 of 2003)

“Commission” means the Commission for Communications Regulation established under the Act of 2002;

“Congested Fixed Link” means a Point to Point Radio Link or Point to Multi-Point Radio Link that is in both a Congested Frequency Band and the Congestion Area

“Congestion Area” means the geographic area wherein a Congestion Charge applies to a Point to Point Radio Link or Point to Multi-Point Radio Link operating on a Congested Frequency Band;

“Congestion Charge” means the charge applied to links a Radio Link in a Congestion Area and set out in Schedule 2.

“Congested Frequency Band” means the frequency band, or bands, which has been identified as being congested within a specific geographic area;

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

“Central Statistics Office” means the Central Statistics Office of Ireland or its successor;

“EECC Regulations” means the European Union (European Electronic Communications Code) Regulations 2022 (S.I. No. 444 of 2022);

“Framework Regulations” means the European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No. 333 of 2011); - to potentially delete as will be repealed by the EECC Statutory Instrument];

“Harmful Interference” has the meaning set out in the Framework Regulations;

“High Usage Path” means a Radio Link Path on which a Licensee has Radio Links on the same Radio Link Path occupying 50% or greater of the available bandwidth within a band;

“High Usage Path Fixed Link” means Fixed Link on a High Usage Path;

“ICNIRP” means the International Commission on Non-Ionizing Radiation Protection;

“Licence” means a non-exclusive licence granted in accordance with section 5 of the Act of 1926 in accordance with and subject to the matters prescribed in these Regulations to keep, have possession of, install, maintain, work and use Apparatus in a specified place in the State granted to the licensee;

“Licensee” means the holder of a Licence;

“Non-exclusive”, in relation to a Licence, means that the Commission is not precluded from authorising the keeping and having possession by persons other than the Licensee, on a Non-Interference and Non-Protected Basis, of apparatus for wireless telegraphy for the radio frequency spectrum specified in the Licence;

“Non-Interference and Non-Protected Basis” means that the use of apparatus for wireless telegraphy is subject to no Harmful Interference being caused to any Radiocommunication Service, and that no claim may be made for the protection of apparatus for wireless telegraphy used on this basis against Harmful Interference originating from Radiocommunication Services;

“Point to Point Radio Link” means a Radio Link between two specified fixed points;

“Point to Multi-Point Radio Link” means a Radio Link between multiple fixed points;

“Radio Equipment Regulations” means the European Union (Radio Equipment) Regulations 2017 (S.I. No. 248 of 2017);

“Radio Link” means a fixed wireless link in frequency bands above 1 GHz by means of apparatus for wireless telegraphy;

“Radio Link Path” means a unique path as defined by the specified fixed points of a Point to Point Radio Link;

“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;

“Regulations” means the Wireless Telegraphy (Radio Link Licence) Regulations, 2023;

“Temporary Licence” means a Licence that is issued only for a period up to a maximum of eleven months and which shall not be renewed.

(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 a Schedule to, these Regulations, unless it is indicated that 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;

(e) 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;

(f) 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;

(g) 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.

Licences to which these Regulations apply

3. These Regulations apply to Licences to keep, have possession of, install, maintain, work and use apparatus for wireless telegraphy for the purpose of the provision of a Point to Point Radio Link or a Point to Multi-Point Radio Link in frequency bands above 1 GHz, having the characteristics set out in Part 2 of the First Schedule of the Licence and operating in accordance with the technical conditions set out in Part 2 of the First Schedule of the Licence and at the location or locations set out in Part 2 of the First Schedule of the Licence.

Limitation of Licence

4. (1) A Licence granted under these Regulations does not grant to the Licensee named therein any right, interest or entitlement other than the right to keep, install, maintain, work and use, at a specified location or locations in the State, apparatus for wireless telegraphy for the purpose of the provision of a Point-to-Point Radio Link or a Point to Multi-Point Radio Link.

(2) Nothing in these Regulations shall absolve the Licensee from any requirement in law to obtain such additional approvals, consents, licences, permissions and authorisations that may be necessary for the discharge of the obligations or the exercise of entitlements under the Licence. The Licensee is responsible for all costs, expenses and other commitments, financial and non-financial, in respect of the Licence and the provision of a Point-to-Point Radio Link or a Point to Multi-Point Radio Link and the Commission shall bear no responsibility for such costs, expenses or commitments.

Application for Licences and Form of Licences

5. (1) An application for a Licence will be made to the Commission and shall be in writing in such form as may be determined by the Commission.

(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 purpose of assessing the application and carrying out its functions under the Act of 1926, the Act of 2002 and the Authorisation Regulations and, if the person, without reasonable cause, fails to comply with this paragraph, the Commission may refuse to grant a Licence to the person.

(3) The Commission may issue a Temporary Licence for a period up to a maximum of eleven months which shall not be renewed.

(4) The grant of a Licence is subject to payment of the prescribed fee as set out in Schedule 2 to these Regulations.

(5) Subject to Regulation 7, a Licence shall be in the form specified in Schedule 1 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 in accordance with the Authorisation Regulations.

Duration and Renewal of Licences

6. (1) A Licence shall, unless it has been revoked, withdrawn or surrendered, remain in force from the date of grant for a period of one year unless renewed under these Regulations.

(2) A Licence may be renewed from time to time by the Commission under this Regulation.

(3) A Temporary Licence shall, unless it has been revoked, withdrawn or surrendered, remain in force from the date of grant until the expiry date as specified in the licence, which shall not be greater than an eleven-month period, and shall not be renewed.

(4) Prior to the expiration of a Licence, the Commission may, by notice in writing given to the Licensee or sent to the Licensee at the address of the Licensee specified in the Licence, renew the Licence for one year from the day following the expiration of the last previous period during which it was in force. The granting or renewal of a Licence shall be subject to the payment of the relevant fees in advance of the grant or expiry date and shall not be construed as warranting that the Licence shall be renewed at any time in the future.

(5) In considering whether to renew a Licence, the Commission shall have particular regard to:

(a) whether the Licensee has complied with these Regulations and the conditions attached to the expiring Licence;

(b) the efficient management and use of radio spectrum; and

(c) the avoidance of Harmful Interference.

Conditions of Licences

7. (1) It shall be a condition of a Licence that:

(a) the Licensee shall comply with these Regulations and the conditions attached to the Licence;

(b) the Licensee shall ensure that the Apparatus is used only on such radio frequency spectrum as may be specified in the Licence and such radio frequencies shall be used in an efficient manner having utmost regard to any guidelines that may be issued and amended by the Commission from time to time in relation to the keeping, installing, maintaining, working and use of apparatus for wireless telegraphy forming part of a Radio Link;

(c) the Licensee shall make payments of the fees as set out in Schedule 2 to these Regulations, and in accordance with Regulation 9 of these Regulations;

(d) the Licensee may not, without the prior written consent of the Commission, which shall not be unreasonably withheld, assign the Licence or any of the

powers, duties or functions conferred by it or otherwise transfer any of the rights or obligations conferred by it;

(e) the Licensee shall ensure that non-ionising radiation emissions from the Apparatus operated by the Licensee are within the limits specified by the guidelines published by ICNIRP, any radiation emission standards adopted and published by ICNIRP, or its successors, from time to time, any radiation emission standards of the European Committee for Electrotechnical Standardization and any radiation emission standards specified by national and European Community law;

(g) the Licensee shall as soon as possible request the Commission to consider and decide on an amendment to the licence to reflect any proposed changes to the information contained in the Licence;

(h) the Licensee shall furnish such information and reports in respect of the Licence, including relating to the Apparatus and its use, as may be requested by the Commission from time to time;

(i) the Licensee shall ensure that the Apparatus, or any part thereof, shall be installed, maintained, operated and used so as not to cause Harmful Interference;

(j) the Licensee shall ensure compliance with any special conditions imposed under section 8 of the Act of 1972 and subject to which this Licence is deemed by subsection (3) of that section to be issued;

(k) the Licensee shall ensure that, save as may be required by law, access to, and use of, the Apparatus is restricted to the Licensee, employees or agents of the Licensee, and persons authorised by or on behalf of the Licensee;

(l) where the Commission is satisfied that a Licensee has failed to comply with any provision of these Regulations or a condition of the Licence, and the Commission has served on the Licensee a written notice prohibiting the use of Apparatus by such date and time as may be specified in the notice, then the Licensee will cease to use that Apparatus on or before the applicable date and time until such notice has been withdrawn by the Commission, and the Licensee shall take such measures as may be specified by the Commission in the notice;

(m) the Licensee shall upon becoming aware of any event likely to materially affect their ability to comply with these Regulations, or any conditions set out or referred to in the Licence, notify the Commission of that fact in writing within 5 working days;

(n) the Licensee shall on request from an authorised officer of the Commission permit the inspection of the Apparatus, enable access to the site or sites on which the Apparatus is located and produce the associated Licence for inspection

(o) Having notified and obtained the written consent of the Commission, the Licensee may transfer the Licence to another Undertaking where the attached conditions are maintained.

(p) the Licensee shall comply with all obligations under relevant international agreements relating to the use of Apparatus or the frequencies to which they are assigned; and

(p) ensure that all Apparatus, or any part thereof, complies with the Radio Equipment Regulations.

Enforcement, Amendment, Revocation and Suspension

8. (1) Enforcement by the Commission of compliance by a Licensee with conditions attached to their Licence shall be in accordance with the Authorisation Regulations, and any other requirements under applicable national or European Community law.

(2) The Commission may amend the Licence from time to time where objectively justifiable and in a proportionate manner. Any amendment shall be made subject to and in accordance with the Authorisation Regulations, and any other requirements under applicable national or European Community law.

(3) Where the Commission is of the opinion that, in the interest of the efficient and orderly use of apparatus for wireless telegraphy or radio frequency spectrum, it is desirable to do so, it may amend the Licence in accordance with the Authorisation Regulations.

(4) 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 the 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.

(5) A Licence may be suspended or withdrawn by the Commission in accordance with the Authorisation Regulations, and any other requirements under applicable national or European Community law.

Licence Fees

9. (1) Fees as set out and provided for in the fees table in Schedule 2 are hereby prescribed in relation to Licences for the purpose of section 6 of the Act of 1926, as amended.

(2) The fees set out and provided for in Schedule 2 shall be payable by the Licensee to the Commission prior to the grant or renewal of a Licence.

(3) Fees shall be paid to the Commission by way of Electronic Funds Transfer or such other means, and on such terms (including terms as to the place of payment) as the Commission may decide. Where the date of payment falls on a Saturday, a Sunday or a public holiday payment shall be made on or before the last working day before the date of payment.

(4) Fees for any period of less than one year shall be calculated on a pro rata monthly basis for such period.

(5) If a Licence is surrendered by the Licensee, the Licensee may be entitled to a refund on a pro rata monthly basis for the remaining period of the Licence of the relevant Licence Fee.

(6) If a Licence is suspended or withdrawn due to a finding by ComReg of non-compliance with any relevant licence conditions, the Licensee shall not be entitled to be repaid any part of the Licence Fee paid by the Licensee, but shall still be liable to pay any sums, including interest, that are outstanding.

(7) An amount payable by a Licensee may be recovered by the Commission as a simple contract debt in any court of competent jurisdiction.

(8) The fees will be implemented, on a phased-in basis, in accordance with Schedule 3.

Congested Fixed Link

10. (1) The Congested Area is the geographic area as defined by National Grid 3122 and 3123 (Ordnance Survey of Ireland). A Radio Link is within this area when one or both of its' specified fixed points is located in this geographic area.

(2) The Congested Frequency Bands are:

(a) the 13 GHz Frequency Band (12.75 GHz to 13.25 GHz);

(b) the 15 GHz Frequency Band (14.5 GHz to 15.35 GHz);

(c) the 18 GHz Frequency Band (17.7 GHz to 19.7 GHz); or

(d) the 23 GHz Frequency Band (22.0 GHz to 22.6 GHz and 23.0 GHz to 23.6 GHz).

High Usage Path Fixed Link

11. (1) A *High Usage Path* is a Radio Link Path on which the Licensee has Radio Links on the same Radio Link Path occupying 50% or greater of the available bandwidth within a band.

(2) A Radio Link Path is the unique path as defined by the specified fixed points of a Point to Point Radio Link.

Transitional Arrangements

12. (1) Subject to paragraph 2, the Wireless Telegraphy (Radio Link Licence) Regulations 2009 (S.I. No. 370 of 2009) are hereby revoked.

(2) A licence issued under the Wireless Telegraphy (Radio Link Licence) Regulations 2009 (S.I. No. 370 of 2009) in force immediately before the commencement of these Regulations will continue in force as if it had run continuously from the date of its issue until its next renewal date.

SCHEDULE 1 WIRELESS TELEGRAPHY ACT, 1926

WIRELESS TELEGRAPHY (RADIO LINK LICENCE) REGULATIONS, 2023

LICENCE CERTIFICATE

Part 1

Licence Number: .....

The Commission for Communications Regulation, in exercise of the powers conferred on it by section 6 of the Wireless Telegraphy Act, 1926 (No. 45 of 1926), transferred to the Commission for Communications Regulation by section 4 of the Communications Regulation (Amendment) Act, 2007 (No. 22 of 2007), grants to the Licensee specified, authorisation to keep, have possession of, install, maintain, work and use apparatus as specified in Part 2 of this Licence subject to the Licensee observing the conditions contained in Regulation 7 of the Wireless Telegraphy (Radio Link Licence) Regulations, 2023 (S.I. of 2023)

Licensee: .....

Address: .....

Licence Type: .....

Commencement and Termination Dates (if applicable):

The Licence comes into effect on ***DD/MM/YY*** and, subject to revocation or suspension, expires on ***DD/MM/YY*** unless renewed in accordance with these Regulations.

or

This Temporary Licence comes into effect on ***DD/MM/YY*** and shall expire on ***DD/MM/YY.***

Signed: .....

on behalf of the Commission for Communications Regulation

Date: .....

Part 2

Licence Details

Description and Characteristics of Apparatus

Locations(s) and Technical Conditions of Apparatus

SCHEDULE 2 FEES PAYABLE

For the period 1 July 2023 to 30 June 2024, the annual payable fee for Fixed Link Licences are set as per Table 1 and 2.

Table 1: Initial Fee schedule for Fixed Link licences

Frequency Band	Annual Licence Fee BW < 3.5 MHz	Annual Licence Fee 3.5 MHz < BW < 20 MHz	Annual Licence Fee 20 MHz < BW < 40 MHz	Annual Licence Fee BW > 40 MHz
F < 1 GHz	€750	N/A	N/A	N/A
1 GHz ≤ F ≤ 17 GHz	€1,000	€1,100	€1,200	€1,500
17 GHz ≤ F ≤ 37 GHz	€750	€825	€900	€1,125
37 GHz ≤ F ≤ 39.5 GHz	€550	€605	€660	€825
F > 39.5 GHz	€100	€110	€120	€150

Table 2: Initial Fee schedule for Fixed Link Licences on a High Usage Path or in a Congested Area

Frequency Band	**Annual Licence Fee BW < 3.5 MHz**	**Annual Licence Fee 3.5 MHz < BW < 20 MHz**	**Annual Licence Fee 20 MHz < BW < 40 MHz**	**Annual Licence Fee BW > 40 MHz**
F < 1 GHz	€900	N/A	N/A	N/A
1 GHz ≤ F ≤ 17 GHz	€1,200	€1,320	€1,440	€1,800
17 GHz ≤ F ≤ 37 GHz	€900	€990	€1,080	€1,350
37 GHz ≤ F ≤ 39.5 GHz	€660	€726	€792	€990

F > 39.5 GHz	€120	€132	€144	€180

For the period 1 July 2024 to 30 June 2026, the annual fee payable for Fixed Link Licences is set by the following formula:

$$Fee\ Payable = \sum_{t}^{n} \frac{n-t}{n}\ PreviousFees + \frac{t}{n}\ AnnualFees$$

t represents the number of years from the implementation of the regulation, at the time of application (i.e., t=1 and t=2 for 12 months beginning 1 July 2024 and 2025, respectively).

n represents the duration in years of the Phase-in period (which includes 1 July 2023 to 30 June 2024 therefore n=3).

$InitialFee$ represents the fee applicable to Fixed Link for the period 1 July 2023 to 30 June 2024, shown in Table 1 and Table 2.

$AnnualFees$ represents the fee as calculated below.

Annual Fees

For all periods subsequent to 30 June 2026, the annual fee payable on a Point to Point Radio Link **(Annual Fee)** is equal to the fee for that Radio Link in the base year of 2023 (the "Base Fee"), indexed to the annual rate of inflation since the 2023 using the Consumer Price Index. The inflation adjustment, is set out in the following formula as follows:

$$\text{Indexing Multiplier} = \frac{CPI_t}{CPI_{2023}} * 100$$

Where CPI_t represents the 12 month, June on June Consumer Price Index figures published by the Central Statistics Office, for year *t*, the year immediately preceding the application. CPI_{2023} represents the 12 month, June on June Consumer Price Index figures published by the Central Statistics Office for 2023. The first indexation shall take place on the 30 June 2024 and shall occur annually thereafter on that same date.

The base fee for a Point to Point Radio Link in the base year (2023) are set out in Table 3, Table 4, Table 5 and Table 6 below, save for any adjustments outlined below for Radio Links in a Congested Area and/or on a High Usage Path Fixed Links.

Table 3: Base Fee for a Point to Point Radio Link in the 1.3/1.4 GHz and 1.3/1.5 GHz Bands, by channel size (MHz)

Frequency Band (GHz)	0.25 MHz	0.5 MHz	1 MHz
1.3/1.5	€100	€100	€100

1.3/1.4	€100	€100	€100

Table 4: Base Fee for a Point to Point Radio Link in the 2 GHz, 6 GHz, 7 GHz, and 8 GHz Bands, by channel size (MHz)

Frequency Band (GHz)	3.5 MHz	7 MHz	14 MHz	20 MHz	28 MHz	29.65 MHz	40 MHz	56 MHz	59.3 MHz	80 MHz
2.0/2.3	€170	€310	€495							
L6						€947			€1894	
L7			€434		€868			€1736		
L8						€901			€1802	
U6				€786			€1257			€2514
U7		€296	€538		€861			€1722		
U8	€131	€210	€420		€841			€1682		

Table 5: Base Fee for a Point to Point Radio Link in the 11 – 42 GHz Bands, by channel size (MHz)

Frequency Band (GHz)	3.5 MHz	7 MHz	14 MHz	27.5 MHz	28 MHz	40 MHz	55 MHz	56 MHz	80 MHz	110 MHz	112 MHz	220 MHz	224 MHz
11						€1105			€2210				
13	€134	€262	€502		€913			€1461					
15	€102	€201	€393		€753			€1368			€2189		
18				€641			€1166			€1865		€3730	
23	€100	€145	€285		€544			€990			€1584		€3167
26	€100	€145	€263		€421								
28	€100	€104	€203		€389			€706			€1130		€2261
38	€100	€100	€100		€136			€247			€396		€792
42		€100	€100		€100			€100			€108		

Table 6: Base Fee for a Point to Point Radio Link in the 80 GHz Band, by channel size (MHz)

Frequency Band (GHz)	250 MHz	500 MHz	750 MHz	1000 MHz	1250 MHz	1500 MHz	1750 MHz	2000 MHz	2250 MHz
80	€100	€150	€206	€240	€300	€360	€420	€480	€540

Congested Fixed Links and High Usage Path Fixed Links.

An increase is applied to the Annual Point to Point Radio Link Fee, in the following instances:

- Congested Fixed Links – where an increase of 200% is added to the Annual Point to Point Radio Link Fee for that Fixed Link
- High Usage Path Fixed Links – where an increase of 20% is added to the Annual Point to Point Radio Link Fee for that Fixed Link

Fees for Point to Multi-Point Fixed Links

In all periods, the fee payable for a Point to Multi-Point Radio Link is equal to the sum of the annual fee that would be payable for the Point to Point Radio Link equivalent of each link within the Point to Multi-Point Radio Link system up to the eighth link, and 25% of the payable fee for an equivalent link for each link beyond the eighth link in the Point to Multi-Point Radio Link system.

Temporary Licence Fees

Temporary Licence Fees are applied pro-rata to the relevant annual fee using the number of months for which the licence is granted. (i.e., if a licence is granted for a period of less than one month, then, for the purpose of these calculations only, the licence shall be considered as a licence granted for a period of one month)

GIVEN under the Official Seal of the Commission for Communications Regulation,

day of 2023

Chairperson

On behalf of the Commission of Communications Regulation

The Minister for the Environment, Climate and Communications (as adapted by the Communications, Climate Action and Environment (Alteration of Name of Department and Title of Minister) Order 2020 (S.I. No. 373 of 2020)), in accordance with section 37 of the Communications Regulation Act, 2002, consents to the making of the foregoing Regulations.

GIVEN under the Official Seal of the Minister for Environment, Climate and Communications

day of 2023

Minister for the Environment, Climate and Communications.

EXPLANATORY NOTE

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

These Regulations provide for the issue of licences for apparatus for Wireless Telegraphy for the provision of a Point to Point Radio Link, or a Point to Multi-Point Radio Link, for the regulation of such apparatus, and for the payment of fees by persons granted licences for that apparatus.

Annex 5: Frequency Bands and technical conditions

Radio Link Frequency Bands

A 5.1 Table 10 provides information about the frequency bands for Fixed Links including the channel spacings.

Band	Frequency	Transmit / Receive Spacing (Duplex Direction)	Band Plan	Chanel Spacing
1.3 GHz	1370-1375 MHz and 1512-1517 MHz	142 MHz	CEPT Recommendation T/R 13-01 E, Annex A	0.25 MHz 0.5 MHz 1 MHz
1.4 GHz	1375-1385MHz and 1427-1437 MHz	52 MHz	CEPT Recommendation T/R 13-01 E, Annex B	0.25 MHz 0.5 MHz 1 MHz
2 GHz	2025 - 2110 MHz and 2200 – 2290 MHz	175 MHz	CEPT Recommendation T/R 13-01 E, Annex C	3.5 MHz 7 MHz 14 MHz
L6 GHz	5.925 - 6.425 GHz	252.04 MHz	CEPT/ERC/REC 14-01, Annex 1	29.65 MHz 59.3 MHz
U6 GHz	6.425 - 7.125 GHz	340 MHz	CEPT/ERC/REC 14-02, Annex 1	20 MHz 40 MHz 80 MHz
L7 GHz	7.125 – 7.425 GHz	154 MHz	CEPT/ECC/REC 02-06 Annex 1	14 MHz 28 MHz

Band	Frequency	Transmit / Receive Spacing (Duplex Direction)	Band Plan	Chanel Spacing
				56 MHz
U7 GHz	7.425 – 7.725 GHz	154 MHz	CEPT/ECC/REC 02-06 Annex 1	7 MHz 14 MHz 28 MHz 56 MHz
L8 GHz	7.725 – 8.275 GHz	311.32 MHz	ITU-R F. 386-9, Annex 6	29.65 MHz 59.3 MHz
U8 GHz	8.275 – 8.5 GHz	126 MHz for 3.5 MHz, 7 MHz, 14 MHz & 56 MHz channel spacing and 119 MHz for 28 MHz channel spacing	ITU-R F. 386-9, Annex 2	3.5 MHz 7 MHz 14 MHz 28 MHz 56 MHz
11 GHz	10.7 - 11.7 GHz	490 MHz	CEPT/ERC/REC 12-06 Annex 1	40 MHz 80 MHz
13 GHz	12.75 - 13.25 GHz	266 MHz	CEPT/ERC/REC 12-02 E	3.5 MHz 7 MHz 14 MHz 28 MHz 56 MHz

Band	Frequency	Transmit / Receive Spacing (Duplex Direction)	Band Plan	Chanel Spacing
15 GHz	14.5 - 15.35 GHz	420 MHz	ITU-R F. 636-5	3.5 MHz 7 MHz 14 MHz 28 MHz 56 MHz 112 MHz
18 GHz	17.7 - 19.7 GHz	1010 MHz	CEPT/ERC/REC 12-03, Annex 1	27.5 MHz 55 MHz 110 MHz 220 MHz
23 GHz	22.0 - 22.6 GHz and 23.0 – 23.6 GHz	1008 MHz	CEPT Recommendation T/R 13-02 Annex 1	3.5 MHz 7 MHz 14 MHz 28 MHz 56 MHz 112 MHz 224 MHz
26 GHz	Part of 24.5 - 26.5 GHz band namely: 25.277 – 25.445 GHz and 26.285 – 26.453 GHz	1008 MHz	CEPT Recommendation T/R 13-02 Annex 2	3.5 MHz 7 MHz 14 MHz 28 MHz

Band	Frequency	Transmit / Receive Spacing (Duplex Direction)	Band Plan	Chanel Spacing
28 GHz	Part of 27.5 - 29.5 GHz band namely: 27.9405 - 28.4445 GHz paired with 28.9485 - 29.4525 GHz	1008 MHz	CEPT Recommendation T/R 13-02 Annex 3 & 5	3.5 MHz 7 MHz 14 MHz 28 MHz 56 MHz 112 MHz 224 MHz
38 GHz	37 - 39.5 GHz	1260 MHz	CEPT Recommendation T/R 12-01, Annex 1	3.5 MHz 7 MHz 14 MHz 28 MHz 56 MHz 112 MHz 224 MHz
42 GHz	40.5 - 43.5 GHz	1500 MHz	CEPT Recommendation (01)04 Annex 5	7 MHz 14 MHz 28 MHz 56 MHz 112 MHz
70 / 80 GHz	71-76 GHz / 81-86 GHz	10 GHz, < 5 GHz.	CEPT ECC/REC/(05)07 Annex 4	250 MHz – 2.25 GHz

Table 10: Radio Link Frequency bands

Technical Conditions for Deploying Fixed Links

A 5.2Table 11 provides information about the minimum requirements for deploying Fixed Links.

Band	Maximum Transmit Power	Minimum path length per link (km)	Minimum Transmission Capacity	Minimum Antenna Requirement	Mandatory Equipment Class	Notes
1.3 GHz	Minimum required to obtain required availability level	N/A	-	Class 2 EN 302 217-4	Classes 1, 2, 3 EN 302 217-2	Open The use of ATPC is permissible
1.4 GHz	Minimum required to obtain required availability level	N/A	-	Class 2 EN 302 217-4	Classes 1, 2, 3 EN 302 217-2	Open The use of ATPC is permissible
2 GHz	Minimum required to obtain required availability level	25 Km	4 Mbit/s	Class 3 EN 302 217-4	Classes 2, 3 EN 302 217-2	Open The use of ATPC is permissible
L6 GHz	Minimum required to obtain required availability level	25 Km	140 Mbit/s	Class 3 EN 302 217-4	Class 3 EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible
U6 GHz	Minimum required to obtain required availability level	25 Km	140 Mbit/s	Class 3 EN 302 217-4	Class 3 EN 302 217-2	Open The use of ATPC is permissible

Band	Maximum Transmit Power	Minimum path length per link (km)	Minimum Transmission Capacity	Minimum Antenna Requirement	Mandatory Equipment Class	Notes
						The use of MBA is permissible
L7 GHz	Minimum required to obtain required availability level	25 Km	4 Mbit/s 28 MHz - 140 Mbit/s	Class 3 EN 302 217-4	Class 3 EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible Note: Part of the L7 band (7.125 - 7.425 GHz) may be allocated towards unidirectional links such as ENG/OB
U7 GHz	Minimum required to obtain required availability level	25 Km	140 Mbit/s	Class 3 EN 302 217-4	Class 3 EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible

Band	Maximum Transmit Power	Minimum path length per link (km)	Minimum Transmission Capacity	Minimum Antenna Requirement	Mandatory Equipment Class	Notes
L8 GHz	Minimum required to obtain required availability level	25 Km	140 Mbit/s	Class 3 EN 302 217-4	Class 3 EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible
U8 GHz	Minimum required to obtain required availability level	25 Km	4 Mbit/s	Class 3 EN 302 217-4	Classes 1, 2, 3 applicable EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible
11 GHz	Minimum required to obtain required availability level	10 Km	140 Mbit/s	Class 3 EN 302 217-4	Class 3 EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible
13 GHz	Minimum required to obtain required availability level	9 Km	4 Mbit/s 56 MHz - 310 Mbit/s (2 x STM-1)	Class 3 EN 302 217-4	Classes 1, 2 applicable EN 302 217-2	Open The use of ATPC is permissible

Band	Maximum Transmit Power	Minimum path length per link (km)	Minimum Transmission Capacity	Minimum Antenna Requirement	Mandatory Equipment Class	Notes
						The use of MBA is permissible
15 GHz	Minimum required to obtain required availability level	9 Km	4 Mbit/s 56 MHz - 310 Mbit/s (2 X STM-1) 112 MHz - 620 Mbit/s (4 X STM-1)	Class 3 EN 302 217-4	Classes 1, 2 applicable EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible
18 GHz	Minimum required to obtain required availability level	6 Km (≤34Mbit/s) 0 Km (> 34Mbit/s)	34 Mbit/s 55 MHz - 310 Mbit/s (2 X STM-1) 110 MHz / 220 MHz - 620 Mbit/s (4 X STM-1)	Class 3 EN 302 217-4	PDH: Classes 1 & 2 applicable EN 302 217-2 SDH Classes 4,5 Applicable EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible
23 GHz	Minimum required to obtain required availability level	3 Km (≤34Mbit/s) 0 Km (> 34Mbit/s or 34Mbit/s in 14MHz channel spacing)	4 Mbit/s 56 MHz - 310 Mbit/s (2 X STM-1) 112 MHz / 224 MHz - 620 Mbit/s (4 X STM-1)	Class 3 EN 302 217-4	PDH: Class 2 applicable EN 302 217-2 Class3 applicable to SDH. EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible

Band	Maximum Transmit Power	Minimum path length per link (km)	Minimum Transmission Capacity	Minimum Antenna Requirement	Mandatory Equipment Class	Notes
26 GHz	Minimum required to obtain required availability level	3 Km (≤34Mbit/s) 0 Km (> 34Mbit/s or 34Mbit/s in 14MHz channel spacing)	4 Mbit/s	For Point to Point antennas: Class 3 EN 302 217-4 Note for Point to Multipoint antennas: EN 302 326-3	Class2 applicable to PDH. EN 302 217-2 Class3 applicable to SDH. EN 302 217-2 Class B equipment applicable (PDH and SDH) EN 302 326-1	Open The use of ATPC is permissible The use of MBA is permissible
28 GHz	Minimum required to obtain required availability level	3 Km (≤34Mbit/s) 0 Km (>34Mbit/s or 34Mbit/s in 14 MHz channel spacing)	4 Mbit/s 56 MHz - 310 Mbit/s (2 X STM-1) 112 MHz / 224 MHz - 620 Mbit/s (4 X STM-1)	Class 3 EN 302 217-4	Class 2 applicable to PDH. EN 302 217-2 Class 3 applicable to SDH. EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible
38 GHz	Minimum required to obtain required availability level	0 Km	4 Mbit/s 56 MHz - 310 Mbit/s (2 X STM-1) 112 MHz / 224 MHz - 620 Mbit/s (4 X STM-1)	Class 3 EN 302 217-4	Class 2 applicable to PDH. Class 3 applicable to SDH. EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible

Band	Maximum Transmit Power	Minimum path length per link (km)	Minimum Transmission Capacity	Minimum Antenna Requirement	Mandatory Equipment Class	Notes
42 GHz	Minimum required to obtain required availability level	0 Km	4 Mbit/s 56 MHz - 310 Mbit/s (2 X STM-1) 112 MHz - 620 Mbit/s (4 X STM-1)	Class 3 EN 302 217-4	Class 2 applicable to PDH. Class 3 applicable to SDH. EN 302 217-2	Open The use of ATPC is permissible The use of MBA is permissible
70 / 80 GHz	Minimum required to obtain required availability level	0 Km	150 Mbit/s (STM-1)	Class 3 EN 302 217-4	EN 302 217-3	Open These bands are open for both FDD and TDD systems The use of ATPC is permissible The use of MBA is permissible

Table 11: Technical Conditions for Deploying Fixed Links

Hi/lo search radius for given frequency band

A 5.3Table 12 provides information about the high/low search radius for Fixed Links.

Frequency Band (GHz)	Hi/Lo search radius (metres)
1.3	500
1.4	500
2	500

L6	500
U6	500
L7	500
U7	500
L8	500
U8	500
11	500
13	500
15	400
18	300
23	100
26	100
28	100
38	100
42	100

Table 12: Hi/lo search radius for given frequency band

Congestion Bands and Zone

A 5.4Table 13 provides information about the congestion zone and congestion bands for Fixed Links.

Band	Frequency	Congested Area[280]
13 GHz	12.75 - 13.25 GHz	falls within the range E310000 to E320000 and N220000 to N240000

[280] If either ends of a 13 GHz, 15 GHz, 18 GHz or 23 GHz link falls within the range E310000 to E320000 and N220000 to N240000, then a congestion charge applies.

15 GHz	14.5 - 15.35 GHz	falls within the range E310000 to E320000 and N220000 to N240000
18 GHz	17.7 - 19.7 GHz	falls within the range E310000 to E320000 and N220000 to N240000
23 GHz	22.0 - 22.6 GHz and 23.0 – 23.6 GHz	falls within the range E310000 to E320000 and N220000 to N240000

Table 13: Congestion Bands and Zone

Annex 6: Fixed Links Bands

Overview

A 6.1 Figure 3 displays the use of PP links by band in 2010, 2014, 2018 and 2022.

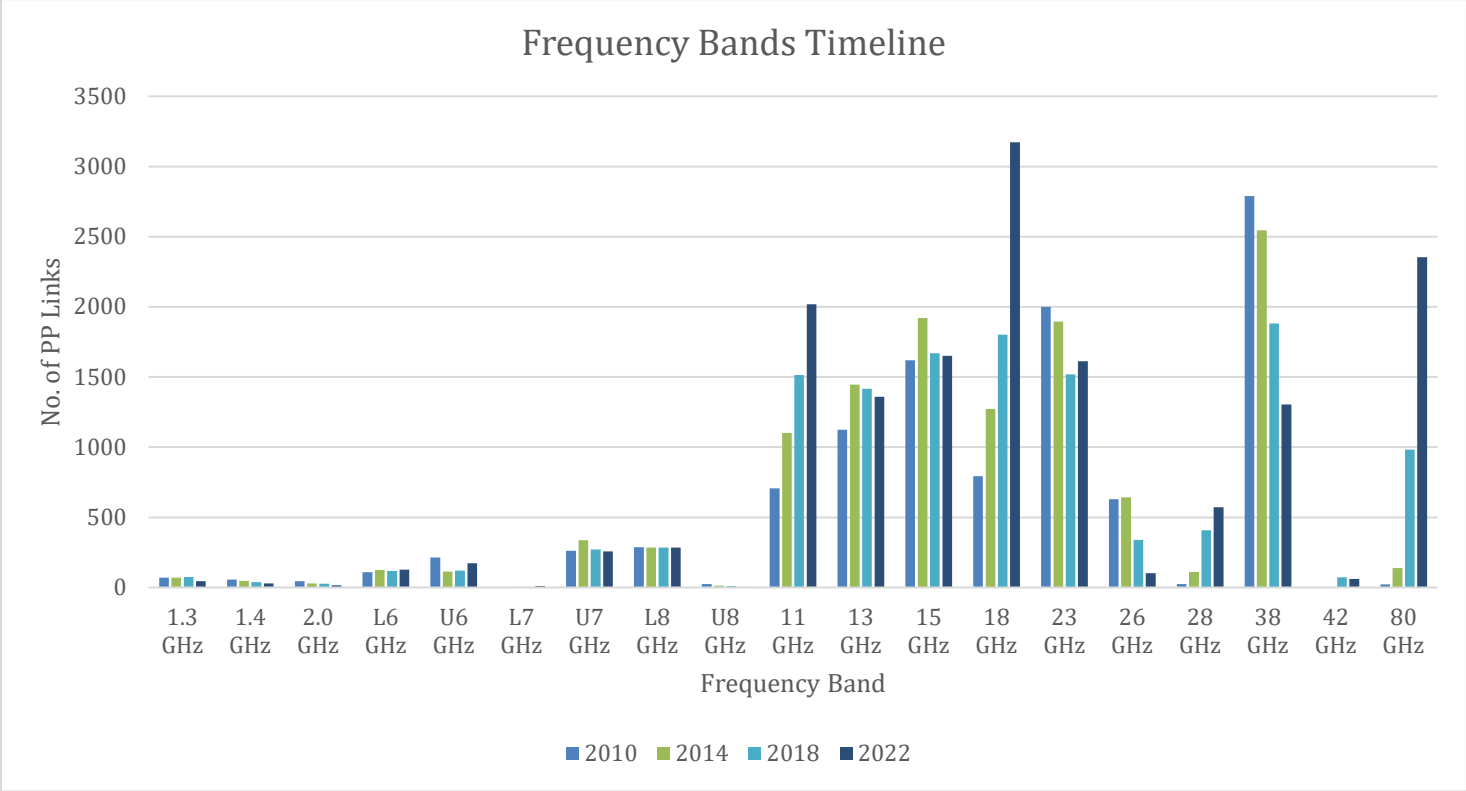

Figure 3: The use of PP Fixed Links by band, 2010, 2014, 2018 & 2022

The 1.3 GHz Frequency Band

A 6.2As of 30 June 2022, there were 45 PP links in the 1.3 GHz band. Since 2010, the number of licences granted for this band was steady until 2019 when there was a decline in the number of licences due to licensees not renewing their licences. This can be seen in figure 4 below.

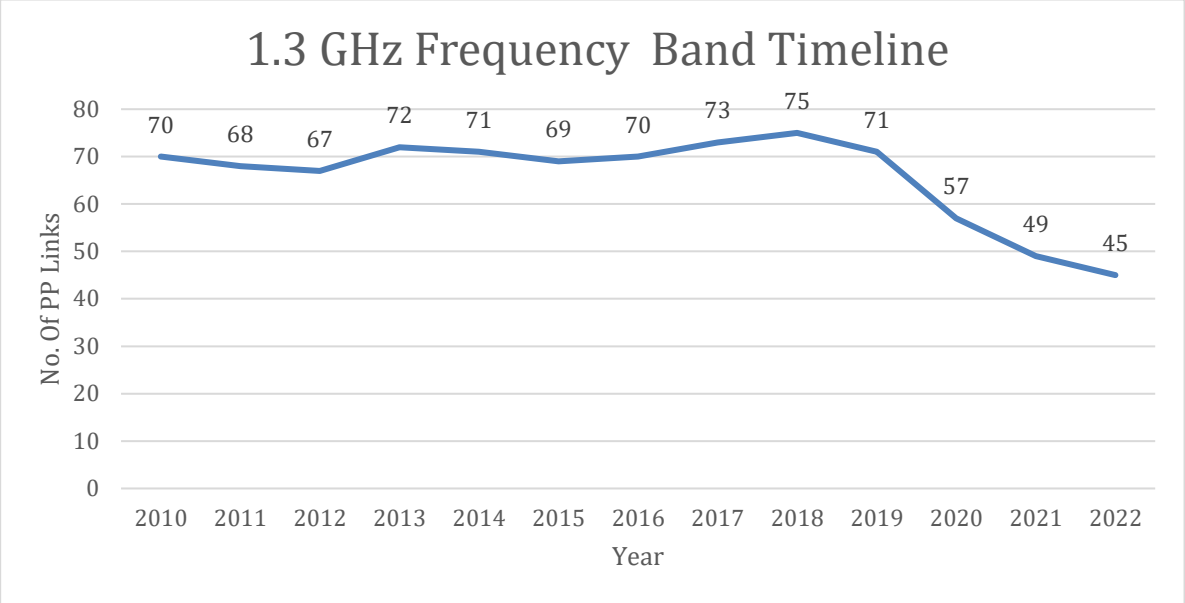

Figure 4: The 1.3 GHz frequency band

The 1.4 GHz Frequency band

A 6.3As of 30 June 2022, there were 29 PP Links in the 1.4 GHz band. The trend was steady from 2010 until 2012 when it starts to decline from 2013 onwards due to various licensees not renewing and cancelling their licences. This can be seen in figure 5 below.

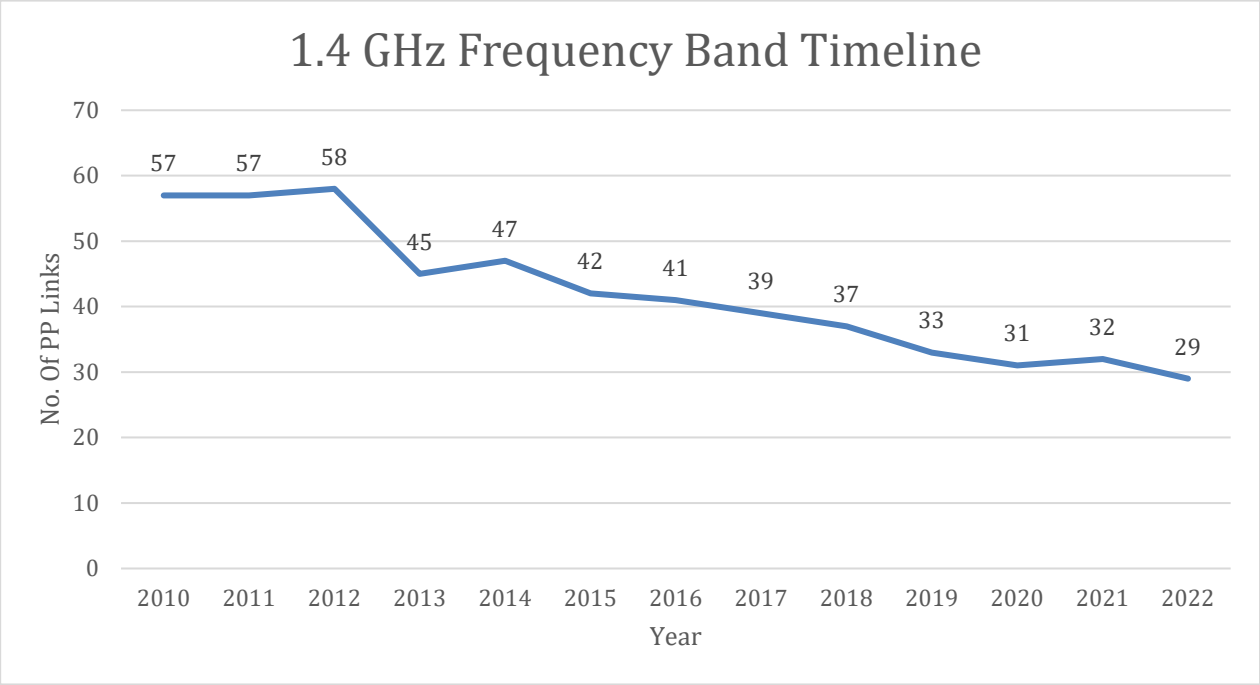

Figure 5: The 1.4 GHz frequency band

The 2 GHz Frequency Band

A 6.4As of 30 June 2022, there were 15 PP links in the 2 GHz band. The trend has been declining since 2010. This can be seen in figure 6 below.

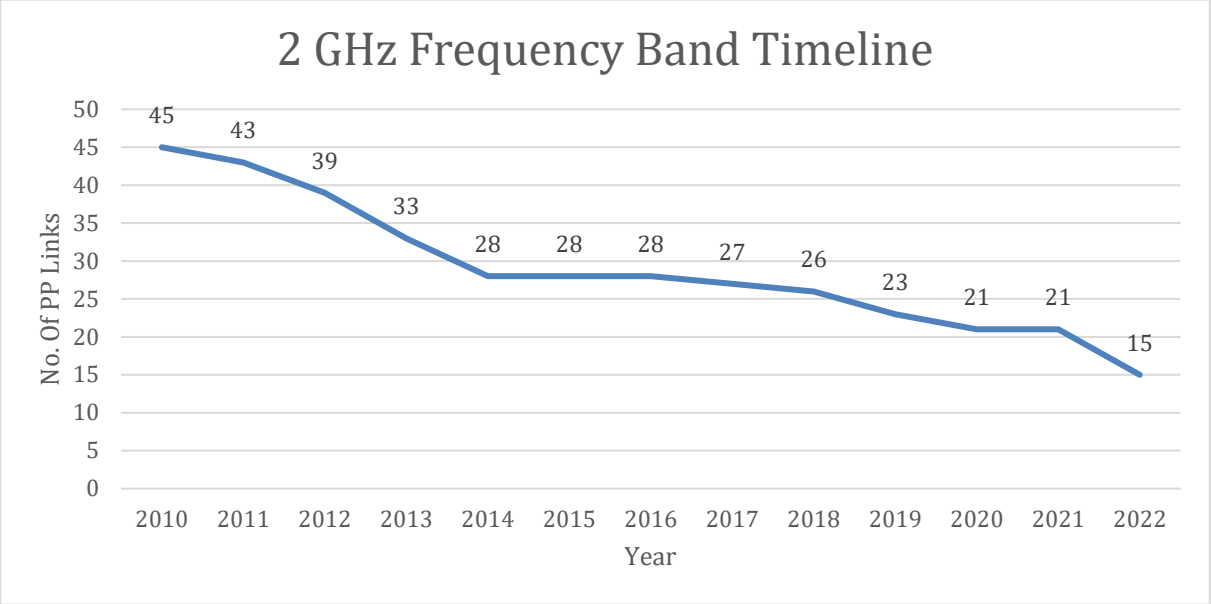

Figure 6: The 2 GHz frequency band

The L6 GHz Frequency band

A 6.5As of 30 June 2022, there were 127 PP links in the L6 GHz band. The number of links grew steadily between 2010 and 2016 before beginning to fall in 2017. The trend starts to increase again in 2020. This can be seen in figure 7 below.

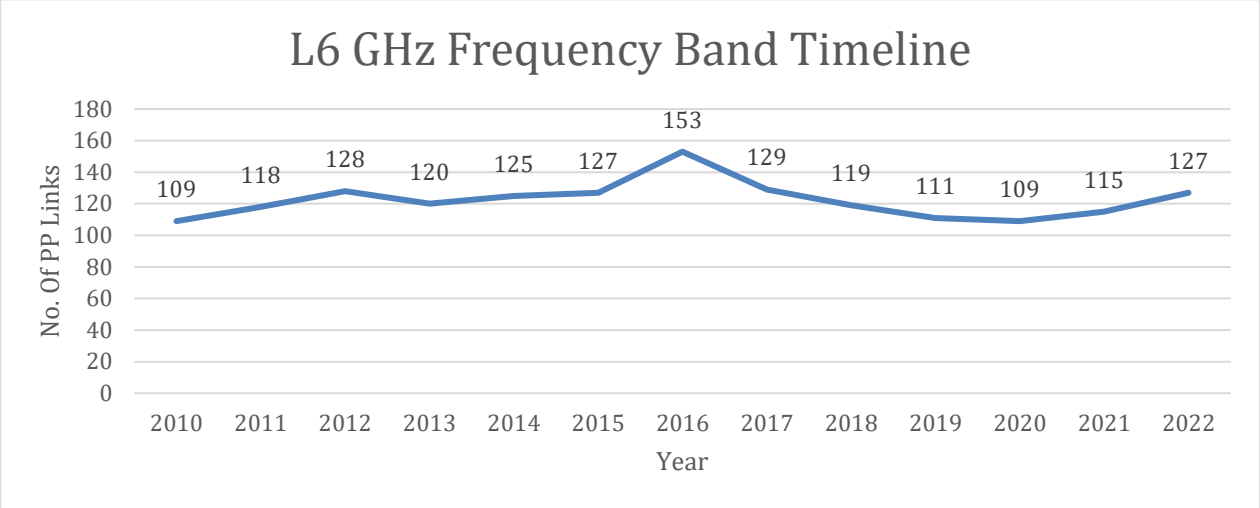

Figure 7: The L6 GHz frequency band

The U6 GHz Frequency band

A 6.6As of 30 June 2022, there were 173 PP links in the U6 GHz band. The trend increases from 2010 to 2011. From 2011 to 2015 there was a decrease. The trend increases again from 2018 until 2020 but decreases again in 2021 due to licensees not renewing and cancelling their licences. This can be seen in figure 8 below.

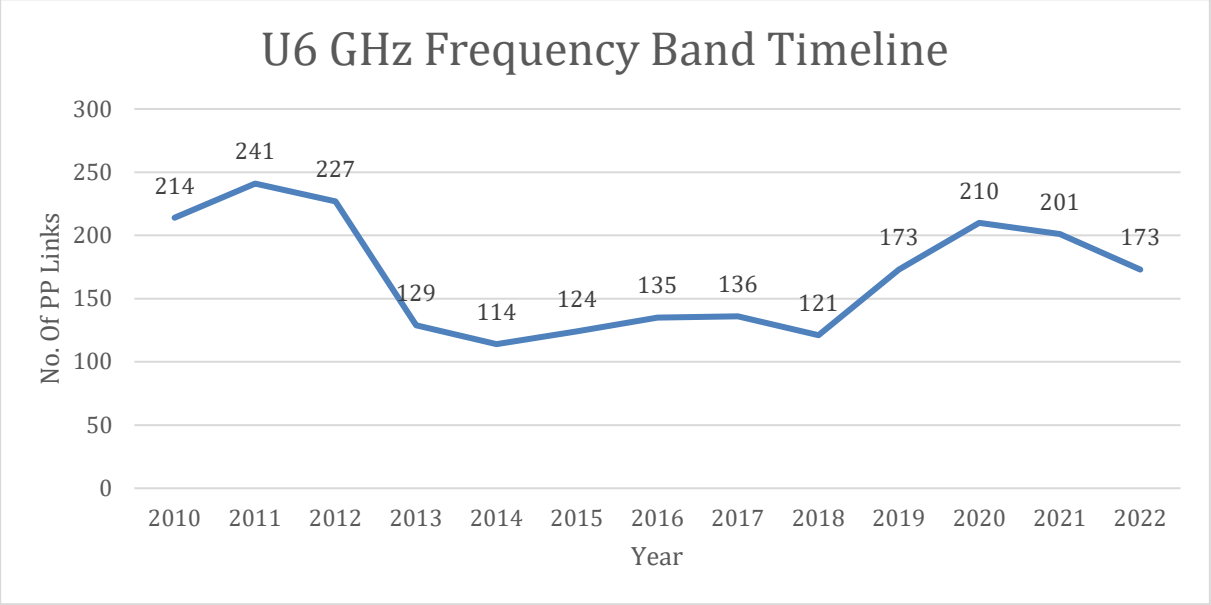

Figure 8: The U6 GHz frequency band

The L7 GHz Frequency band

A 6.7As of 30 June 2022, there were 10 PP links in the L7 GHz band. The trend was steady from 2010 to 2013. It increased from 2013 until 2014 and again in 2021. This can be seen in figure 9 below.

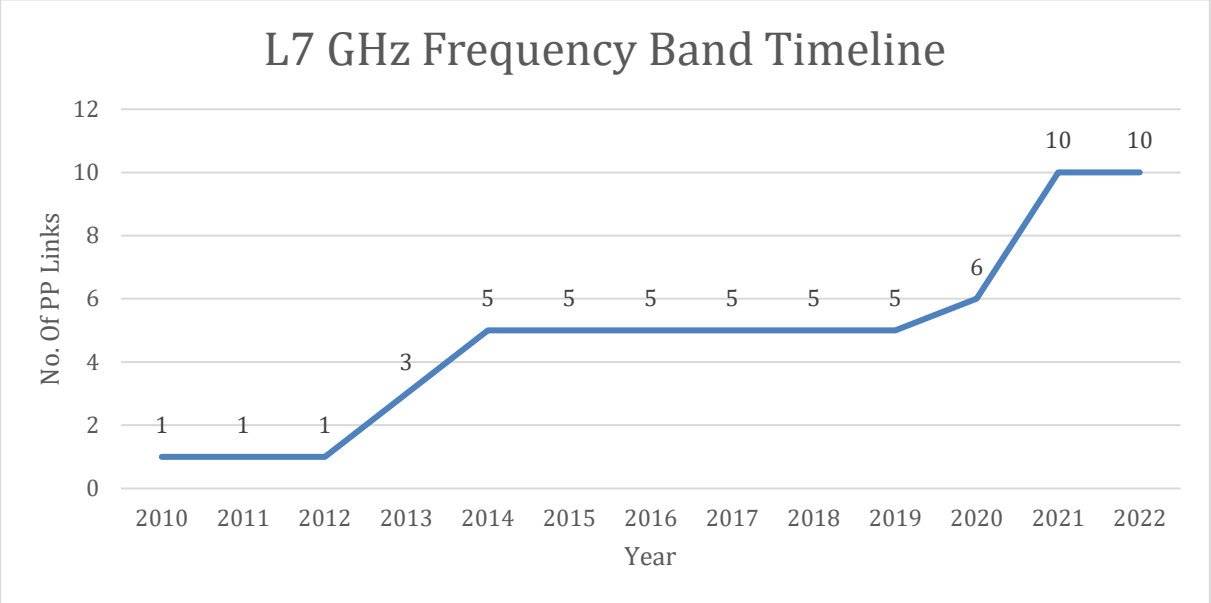

Figure 9: The L7 GHz frequency band

The U7 GHz Frequency band

A 6.8As of 30 June 2022, there were 256 PP links in the U7 GHz band. The trend increases from 2010 until 2014. From 2015 it starts to decrease and increases again in 2022. This can be seen in figure 10 below.

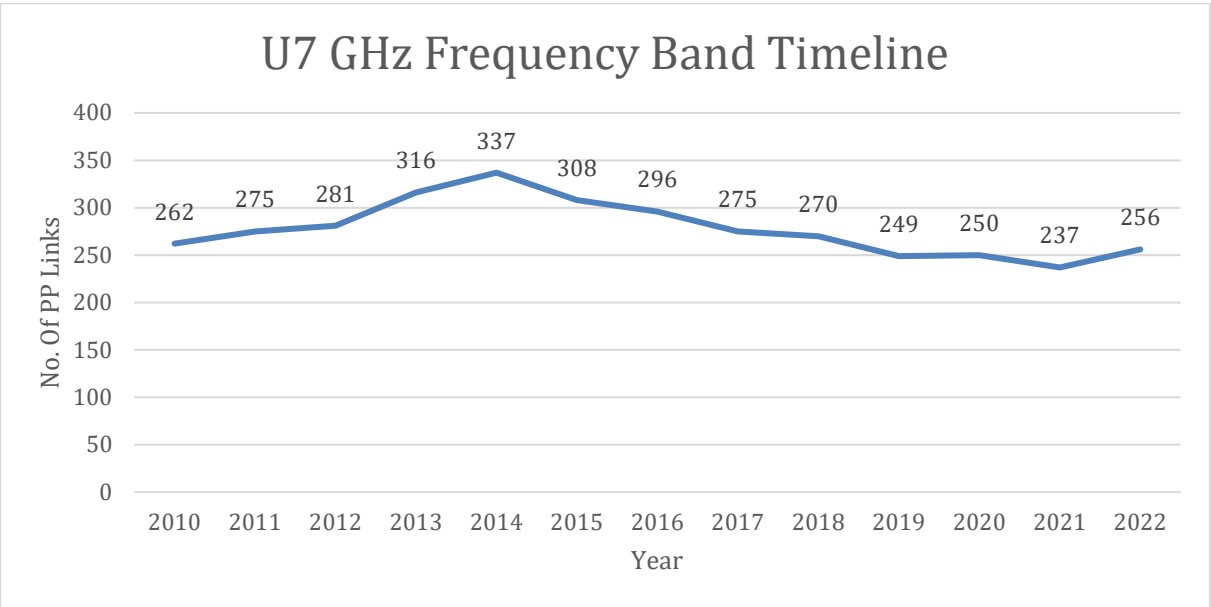

Figure 10: The U7 GHz frequency band

The L8 GHz Frequency band

A 6.9 As of 30 June 2022, there were 284 PP links in the L8 GHz band. The trend increases from 2010 to 2013 and decreases from 2013 to 2020. In 2021, the trend starts to increase but decreases in 2022. This is due to licensees not renewing and cancelling their licences in this band. This can be seen in figure 11 below.

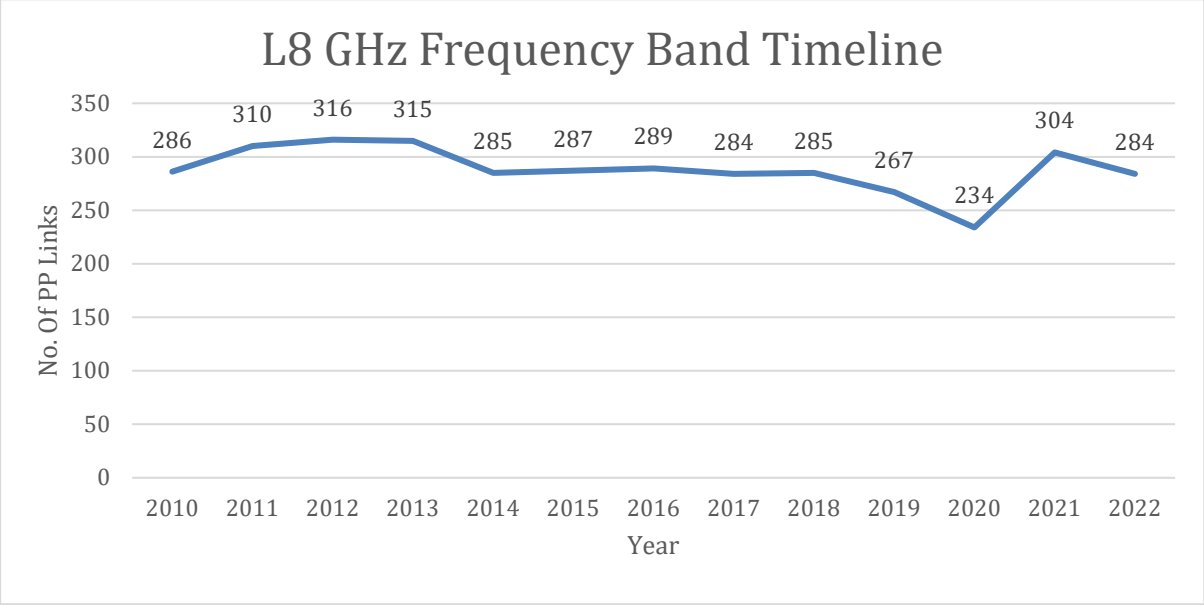

Figure 11: The L8 GHz frequency band

The U8 GHz Frequency band

A 6.10 As of 30 June 2022, there were 3 PP links in the U8 GHz band. This trend is decreasing since 2009 due to various licensees not renewing their licences. This can be seen in figure 12 below.

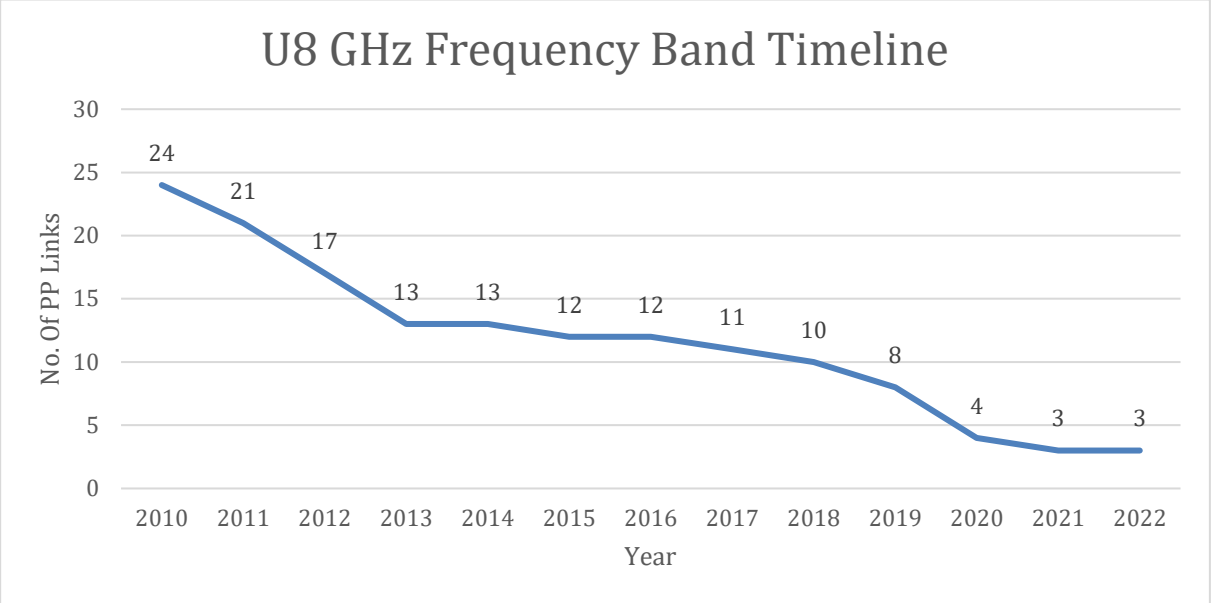

Figure 12: The U8 GHz frequency band

The 11 GHz Frequency band

A 6.11 As of 30 June 2020, there were 2018 PP links in the 11 GHz band. The trend is increasing since 2010. This can be seen in figure 13 below.

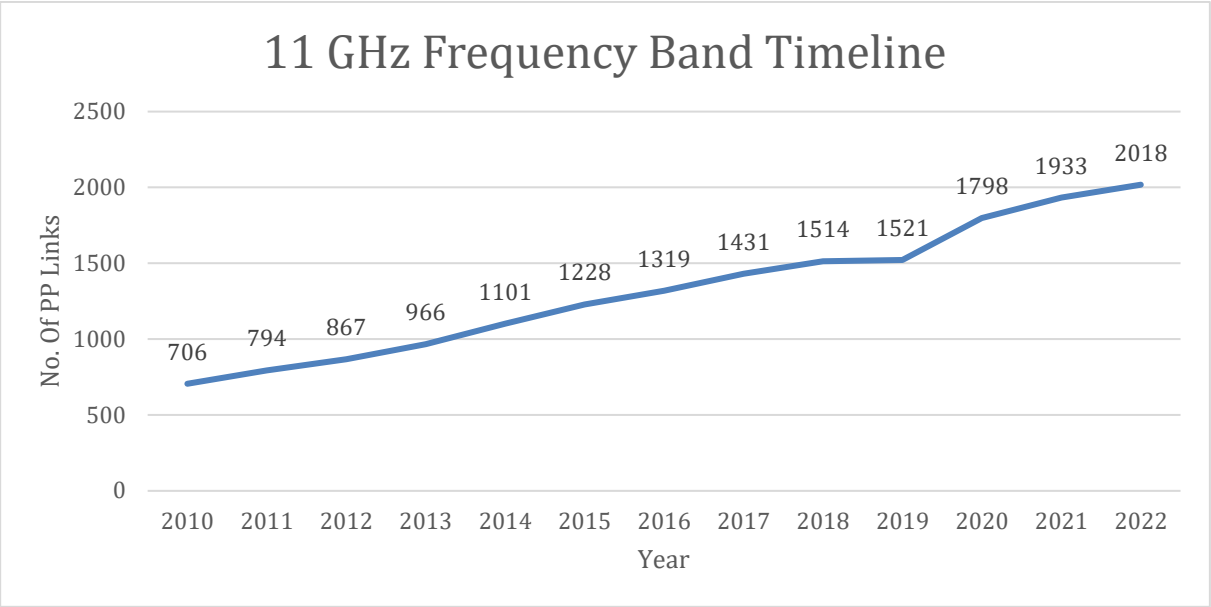

Figure 13: The 11 GHz frequency band

The 13 GHz Frequency band

A 6.12 As of 30 June 2022, there were 1359 PP links in the 13 GHz band. The trend increases from 2010 to 2015. The trend starts to decrease from 2016 until 2019. From 2020 onwards the trend is steady. This can be seen in figure 14 below.

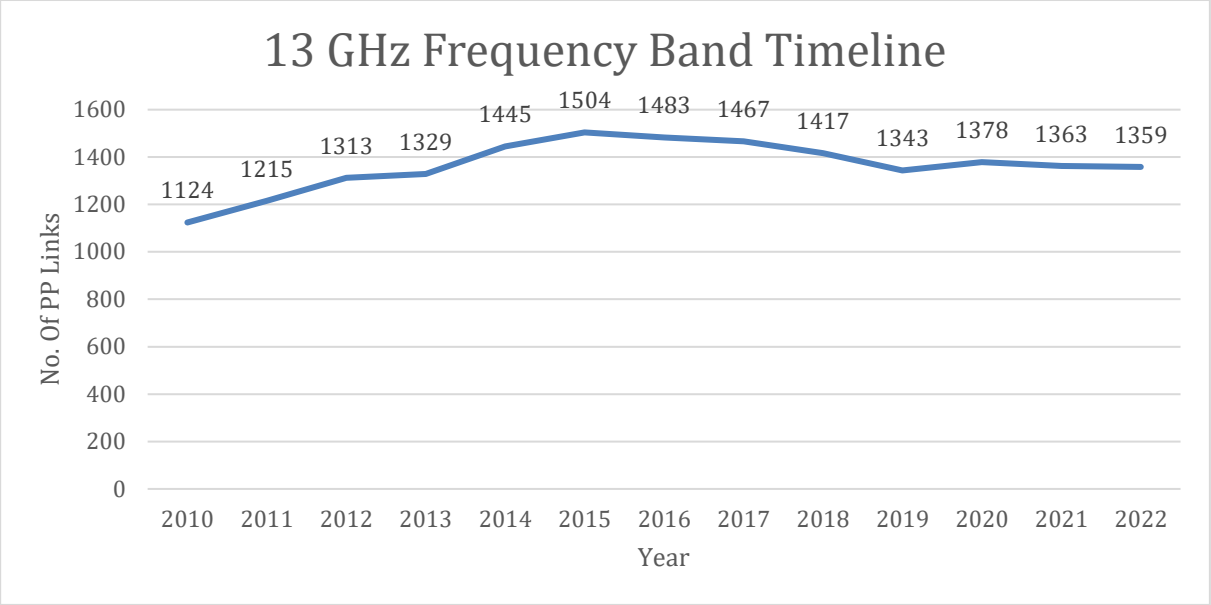

Figure 14: The 13 GHz frequency band

The 15 GHz Frequency band

A 6.13 As of 30 June 2022, there were 1650 PP links in the 15 GHz band. The trend increases from 2010 to 2015. It starts to decrease from 2016 to 2019 however it increases again from 2019. This can be seen in figure 15 below.

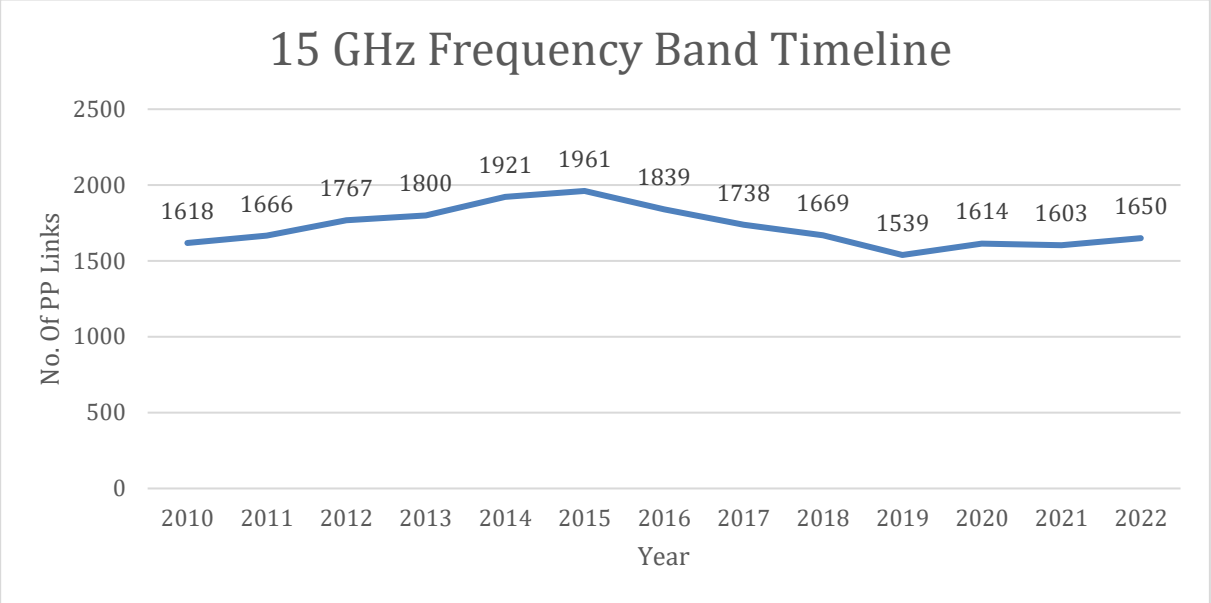

Figure 15: The 15 GHz frequency band

The 18 GHz Frequency band

A 6.14 As of 30 June 2022, there were 3173 PP links in the 18 GHz band. The trend is increasing since 2009. This can be seen in figure 16 below.

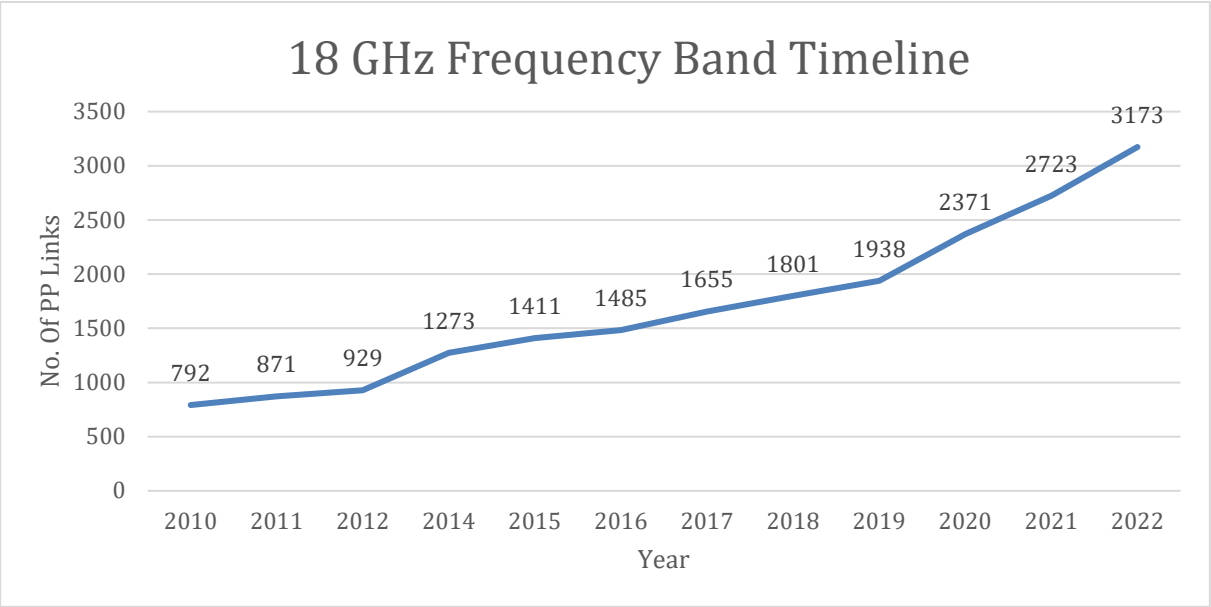

Figure 16: The 18 GHz frequency band

The 23 GHz Frequency band

A 6.15 As of 30 June 2022, there were 1613 PP links in the 23 GHz band. The trend decreases from 2010 to 2013. It starts to increase in 2014 but decreases from 2015. In 2020, the trend starts to increase. This can be seen in figure 18 below.

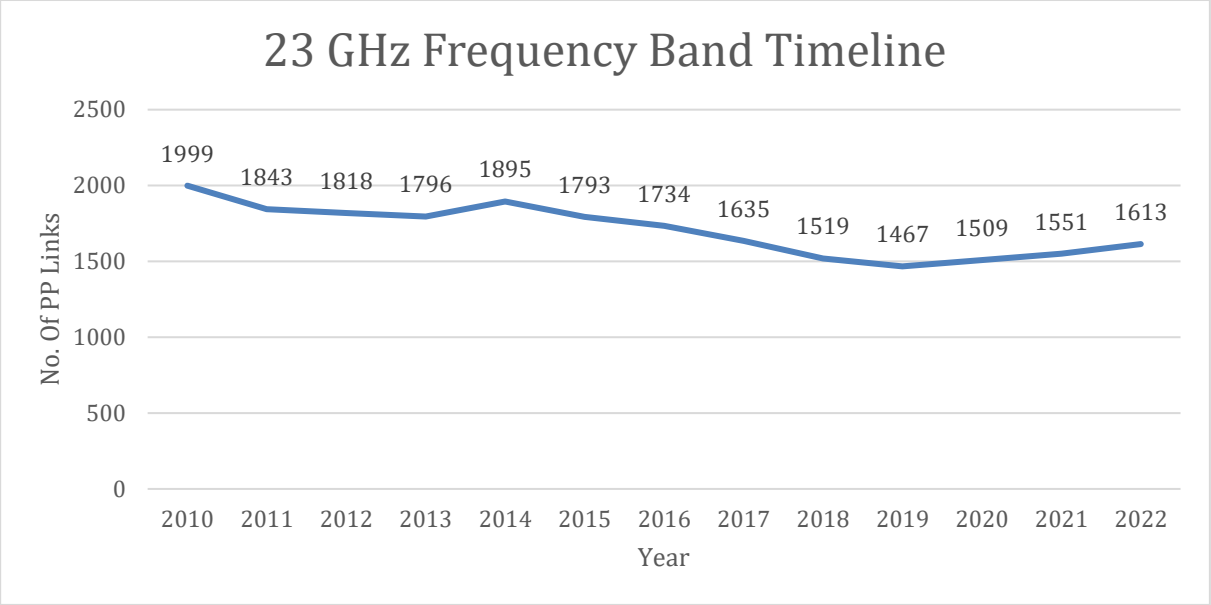

Figure 17: The 23 GHz frequency band

The 26 GHz Frequency band

A 6.16 As of 30 June 2022, there were 102 PP links in the 26 GHz individual licence band[281]. The trend decreases from 2013 onwards due to licensees not renewing and cancelling their licences. This can be seen in figure 18 below

[281] This does not include number of registrations in the 26 GHz band block licences

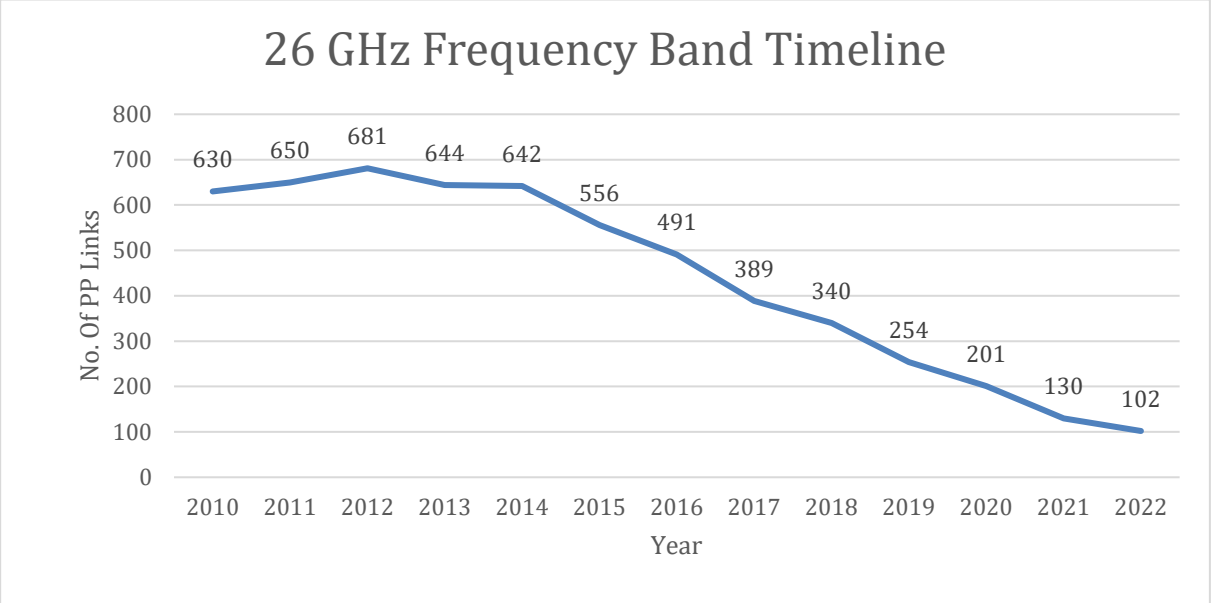

Figure 18: The 26 GHz frequency band

The 28 GHz Frequency band

A 6.17 As of 30 June 2022, there were 572 PP links & 2 P-MP licences for the 28 GHz band. The trend for PP links is increasing since 2009 and has been steady for P-MP. This can be seen in figure 19 and figure 20 below.

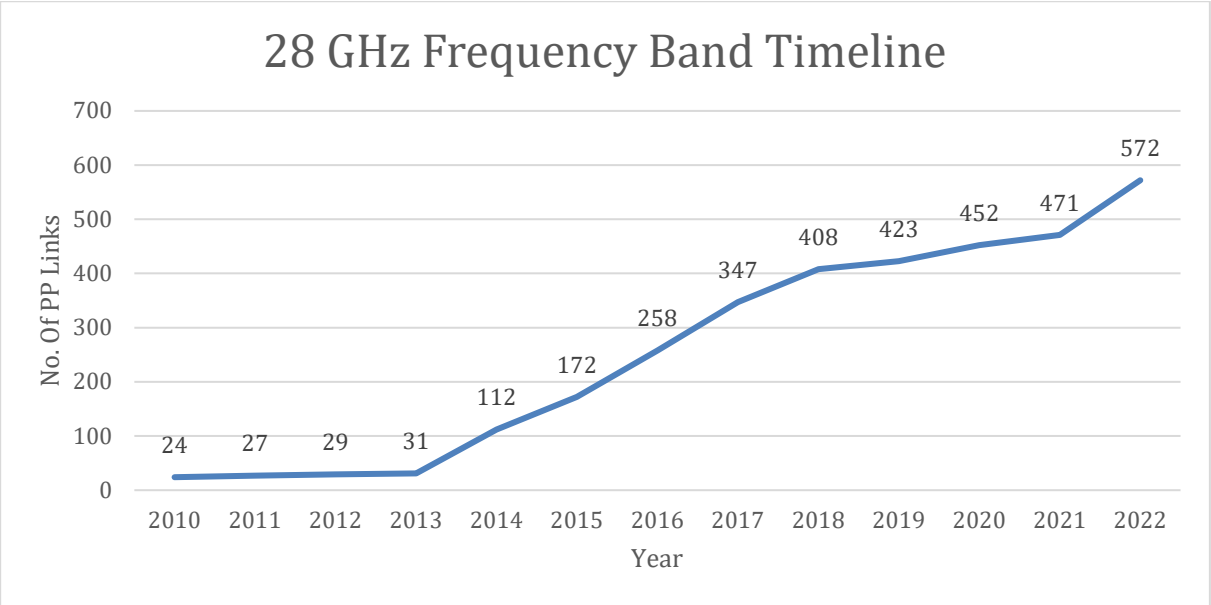

Figure 19: The 28 GHz frequency band

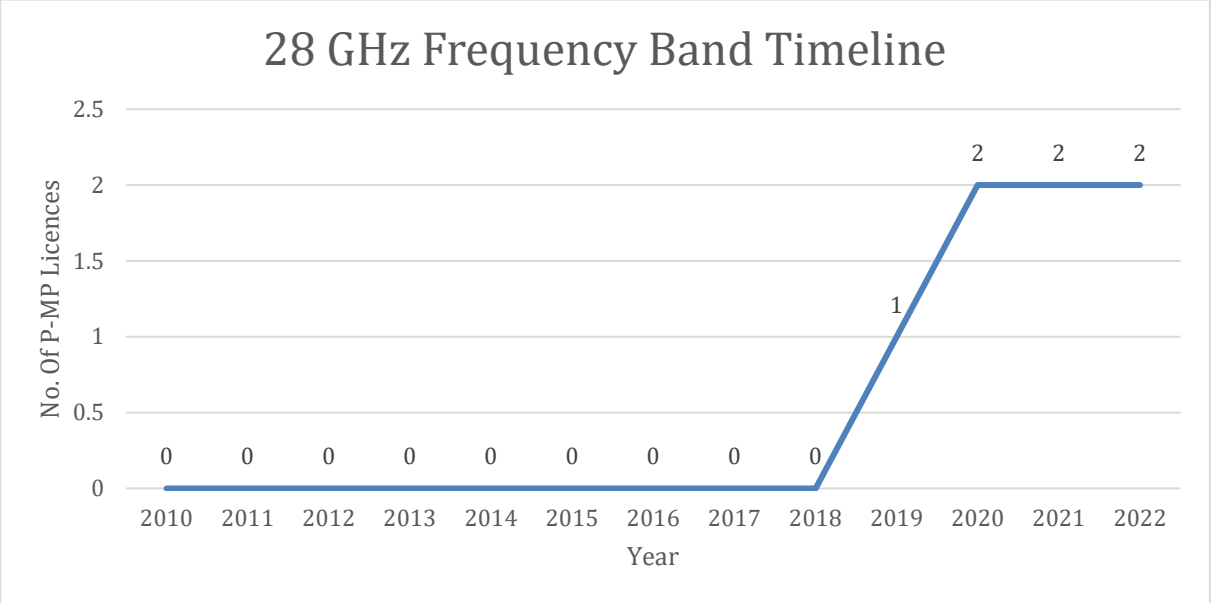

Figure 20: The 28 GHz frequency band P-MP

The 38 GHz Frequency band

A 6.18 As of 30 June 2022, there were 1304 PP links in the 38 GHz band. The trend is decreasing since 2010 due to various licensees not renewing or cancelling their licences. This can be seen in figure 21 below.

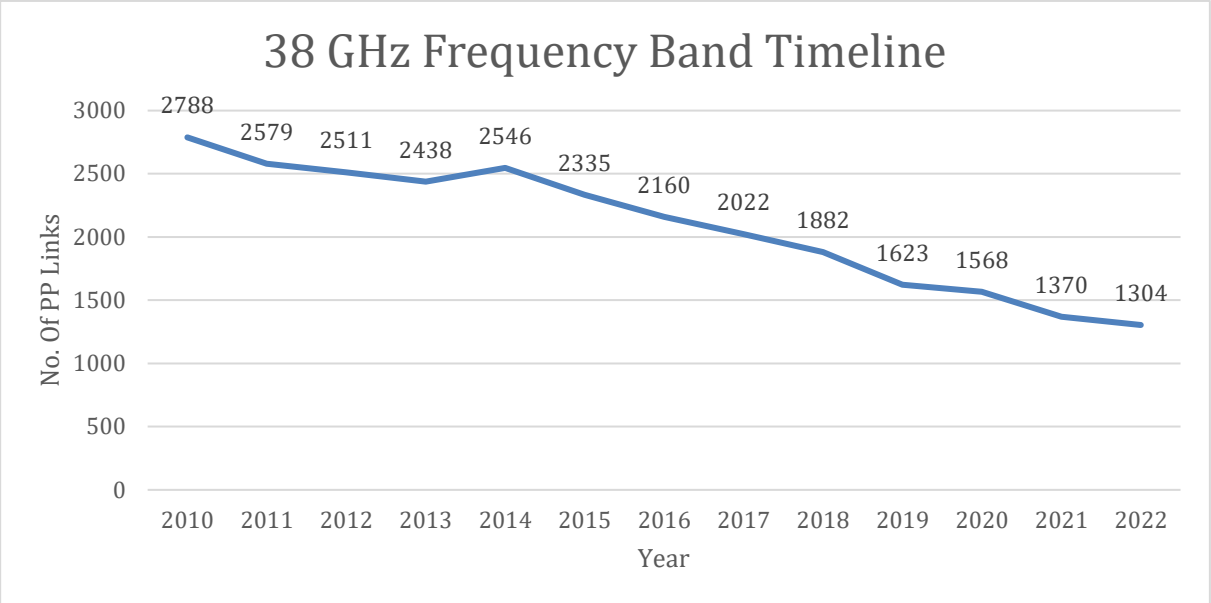

Figure 21: The 38 GHz frequency band

The 42 GHz Frequency Band

A 6.19 As of 30 June 2022, there are 61 PP links in the 42 GHz band. The trend was increasing from 2010 until 2019 but decreases in 2020. The trend has been steady since 2021. The sudden decrease is due to various licensees cancelling their licences. This can be seen in figure 22 below.

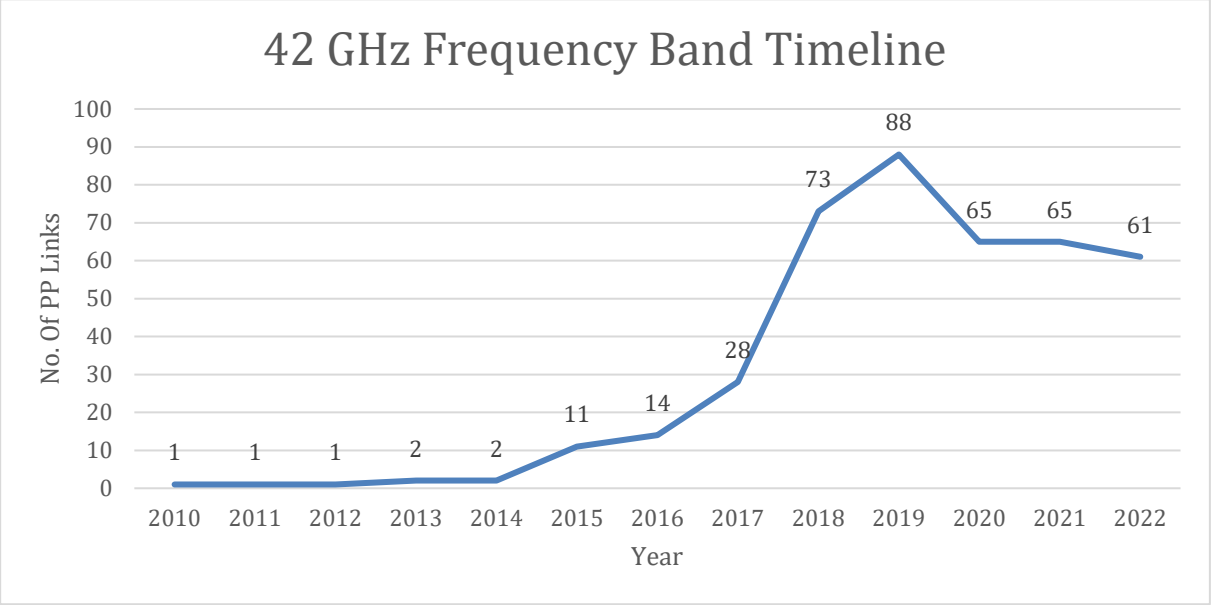

Figure 22: The 42 GHz frequency band

The 70 / 80 GHz Frequency band

A 6.20 As of 30 June 2022, there were 2354 PP links in the 70 / 80 GHz band. The trend is increasing since 2009. This can be seen in figure 23 below.

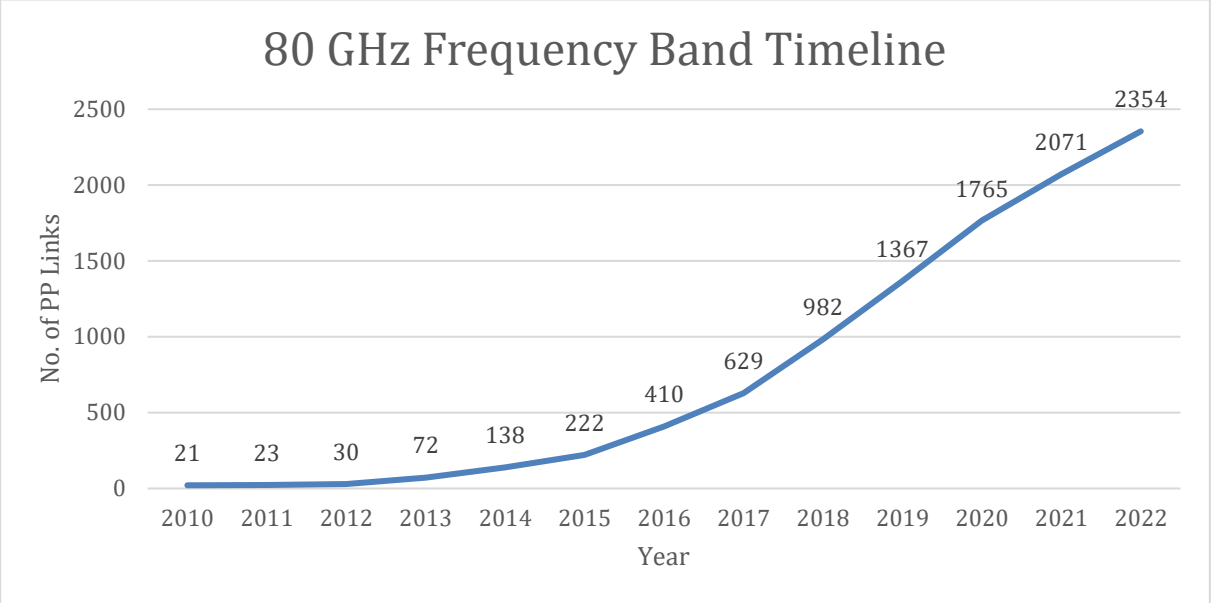

Figure 23: The 70 / 80 GHz frequency band

Annex 7: Information on harmonisation status, award status in Europe, and spectrum availability for the 1.4 GHz and 26 GHz Band

A 7.1 This annex sets out information for the 1.4 GHz and 26 GHz band on:

- the harmonisation status;
- award status in Europe; and
- the availability of radio spectrum in Ireland.

International harmonisation status of the 1.4 GHz and 26 GHz frequency band

A 7.2 Table 14 below provides information on the international harmonisation status of the 1.4 GHz and 26 GHz Bands.

Band	ECC Decision	EC Decision	Other
1.4 GHz Centre Band	ECC Decision (13)03 (Revised March 2018)	EC 2015/750 as amended by EU 2018/661	--
1.4 Extension Band	ECC Decision (17)06 (November 2017)	EC 2015/750 as amended by EU 2018/661	--
26 GHz Band	ECC Decision (18)06 (Revised November 2020	EU 2019/784 amended by EU 2020/594	Directive (EU) 2018/1972

Table 14: International Harmonisation Status of the 1.4 GHz and 26 GHz Bands

Status of 1.4 GHz and 26 GHz awards in Europe

A 7.3 Table 15 shows the status of the 1.4 GHz and 26 GHz awards since circa 2010 in twenty-three European countries.

European Country	1.4 GHz Centre Band	1.4 GHz Extension Band	26 GHz Band
Austria	✓	✓	✓
Belgium	✓	✓	--
Bulgaria	--	--	✓
Croatia	--	--	✓
Czech Republic	✓	✓	--
Denmark	✓	✓	✓
Finland	--	--	✓
France	✓	✓	--
Germany	✓	--	✓
Greece	✓	✓	✓
Hungary	--	--	--
Italy	✓	--	✓
Latvia	✓	✓	--
Netherlands	✓	--	--
Poland	--	--	--
Portugal	--	--	--
Romania	✓	--	--
Slovakia	--	--	--
Slovenia	✓	✓	✓

Spain	--	--	✓[282]
Sweden	✓	✓	✓
Switzerland	✓	✓	--
United Kingdom	✓	--	--

Table 15: Status of 1.4 GHz and 26 GHz awards in Europe[283]

Awarded / Ongoing = ✓ Proposed = ✓ Undecided or No Info. = --

Status of 1.4 GHz MFCN Network Deployments in Europe

A 7.4 Table 16 shows the countries in Europe where 4G/5G networks licensed to use the 1.4 GHz and 26 GHz Bands have been deployed and identifies the relevant network operators.

European Country	1.4 GHz Centre Band	1.4 GHz Extension Band
Austria	3 Austria A1 Telekom T-Mobile (Magenta Telekom)	A1 Telekom T-Mobile (Magenta Telekom)
Denmark	TDC (YouSee)	TDC (YouSee)
Italy	TIM	--
Netherlands	KPN T-Mobile VodafoneZiggo	--
Switzerland	Sunrise Communications (Yallo) Swisscom	Salt Swisscom
United Kingdom	3 UK Vodafone	--

[282] Source: Ministerio de Asuntos Económicos y Transformación Digital, Spain.
[283] Information is sourced from Cullen International (www.cullen-international.com) (a pay subscription website) unless otherwise stated.

Table 16: 4G/5G network deployments in the 1.4 GHz Band in Europe[284]

Equipment Availability for the 1.4 GHz and 26 GHz Bands

A 7.5 Table 17 provides an update of the number of 4G and 5G devices identified by the Global mobile Suppliers Association (GSA) as being capable of operating in each band as of October 2022. The table also compares current October 2022 device data with previous data from October 2020 which was presented in Annex 3 of Document 20/122[285].

Band	4G Devices[286] Oct 2020	4G Devices Oct 2022	5G Devices[287] Oct 2020	5G Devices Oct 2022
1.4 GHz Centre (B32, SDL)	214	664	--	0
1.4 GHz Extensions (B75, B76SDL) (n75, n76 SDL)	--	1	1	11
26 GHz (n258 TDD)	--	--	6	31
(n257 TDD)	--	--	16	35

Table 17: 4G/5G Devices available for the 1.4 GHz and 26 GHz Bands[288]

[284] Sources: GSA Gambod Database, https://gsacom.com/gambod/, and Cullen International, https://www.cullen-international.com/

[285] ComReg Document 20/122, "*Multi Band Spectrum Award - Response to Consultation and Decision - The 700 MHz Duplex, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands*", published 18 December 2020, See https://www.comreg.ie/

[286] 4G devices can include capabilities for previous mobile generations such as 2G and 3G.

[287] 5G devices can include capabilities for previous mobile generations such as 2G, 3G and 4G.

[288] Source: GSA Gambod Database, https://gsacom.com/gambod/.

1.4 GHz and 26 GHz band availability in Ireland

A 7.6 Table 18 sets out information on the availability of the 1.4 GHz and 26 GHz band in Ireland.

Band	Licensing Status
1.4 GHz Centre Band	Unused.
1.4 GHz Extension Band	Fixed Links used by various licensees including broadcasters and ESBN. As of 30 June 2022, there were 74[289] Fixed Links in this band.
26 GHz Band	There is 1458 MHz of unused spectrum in the 26 GHz Band in the ranges 24250 – 24549 MHz / 25445 – 25557 MHz / 26453 – 27500 MHz. In terms of used spectrum: • Fixed Wireless Access Local Area[290] • Individual PP licences[291] • ComReg awarded spectrum rights of use for 26 GHz National Block Licences in the frequency range 24745 – 25277 MHz / 25753 – 26285 MHz[292]

Table 18: 1.4 GHz and 26 GHz availability in Ireland

[289] There were 45 links in the 1.3 GHz band and 29 links in the 1.4 GHz band

[290] Licensed under S.I. 79 of 2003 as amended, in the frequency ranges 24605 – 24745 MHz / 25613 – 25753 MHz

[291] Licensed under S.I. 370 of 2009, in the frequency ranges 25277 – 25445 MHz / 26285 – 26453 MHz.

[292] Licences, which issued on foot of that award under S.I. 158 of 2018, will run for 10 years from their commencement date.