Future authorisation of the 1900–1920 MHz band

Consultation

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Contents

Section

Annex

1. Overview

1.1 We are proposing to make the 1900–1920 MHz ("1900 MHz") band available for the UK's rail network and the emergency services,[1] maximising the use of this spectrum and supporting long term improvements to the UK's critical national infrastructure.

1.2 The licences for the 1900 MHz band were awarded in 2000 for mobile services but have not been used.[2] In March 2024, we completed the process to revoke existing licensees' access to the band with five years' notice, allowing authorisation of new users from 3 April 2029.

1.3 In light of international and technological developments, we believe the optimal use of the 1900–1910 MHz spectrum will be for the latest 5G mobile technology for rail networks: the Future Rail Mobile Communication System (FRMCS). FRMCS will support greater digitalisation of the UK's railways by replacing existing 2G technology and enabling trains, signalling and workers to be better connected than before, helping to improve the running of the rail network. In addition, as these frequencies have been harmonised across Europe for FRMCS use, the UK rail industry will benefit from standardised equipment.

1.4 We consider that the optimal use of 1910–1915 MHz will be for providing extended coverage for the Emergency Services Network (ESN), through the use of repeater "gateways" installed on emergency vehicles such as ambulances. These will enable emergency services to communicate in hard to connect locations such as underground car parks or the most remote rural areas. This use was previously planned for 1899.9–1909.9 MHz but, given the characteristics of this service and the harmonisation of 1900–1910 MHz for FRMCS, we consider that ESN gateways can be operated in 1910–1915 MHz.

What we are proposing – in brief

Authorise 1900–1910 MHz for operational rail communications to enable the rollout of FRMCS. The proposed new FRMCS licences would:

- Be restricted to the provision of operational rail communications.
- Contain technical conditions suitable for the deployment of FRMCS.
- Require technical coordination with other existing or future FRMCS licensees in overlapping or neighbouring geographic areas.
- Be issued via a simple process, with checks on applicants' ability to comply with key licence conditions.

Authorise 1910–1915 MHz to enable Emergency Services Network (ESN) gateways. The proposed licence would:

- Be restricted to the provision of ESN gateways by the provider that is contracted by the UK Government to supply these gateways (currently BT/EE).
- Have a fixed duration, aligned with the contract to supply ESN gateways.
- Allow use throughout Great Britain.
- Contain technical conditions consistent with standards used by the ESN.

[1] Specifically for the emergency services in Great Britain where the Home Office's new Emergency Services Network (ESN) is being deployed. Different arrangements apply in Northern Ireland and Ofcom has separately consulted on spectrum options to support the Police Service of Northern Ireland (PSNI).

[2] These licences authorised use of both the paired 2100 MHz spectrum, and the unpaired spectrum from 1900–1920 MHz. The authorisation of the 1900 MHz band was outlined in Schedule 2 of these licences.

Set fees based on the opportunity cost of the spectrum. Our proposed annual fee for 1900–1910 MHz is £145,800 per MHz for a licence covering Great Britain and £4,200 per MHz for a licence covering Northern Ireland.[3] Fees would be half these levels in 1910–1915 MHz to reflect the lower power levels permitted. This means that the total annual fee would be:

- £1,458,000 for 1900–1910 MHz for a FRMCS licence covering Great Britain, and £42,000 for a licence covering Northern Ireland. Licences for smaller rail networks would pay a smaller fee, scaled by the length of the rail routes covered.
- £364,500 for 1910–1915 MHz for an ESN gateway licence covering Great Britain.

Fees would be payable from 3 April 2029 when the spectrum becomes available.

At present, we are not proposing to authorise any use in 1915–1920 MHz, primarily because of the power restrictions necessary to protect the mobile band above 1920 MHz from interference, as well as uncertainty over demand for the spectrum.

1.5 Given that both proposed uses would support operationally critical services, we have carefully assessed any risks of interference to them. We do not consider there to be any risk of interference to operation of ESN gateways. While in principle there are some scenarios where railway communications could experience interference from adjacent ESN gateways, we consider the risk is very small. Even if this were to occur, in most cases, it should only lead to a reduction in performance for a short period of time. However, we identify potential mitigations that the proposed licensees could take to reduce the risk further if necessary.

1.6 We are open to considering additional uses in the band in the future. However, we would need to see evidence of demand, as well as evidence that future uses could coexist with the proposed FRMCS and ESN gateway use, along with users in adjacent bands.

1.7 We welcome stakeholders' feedback on our proposals and the technical analysis underpinning them. Following consideration of stakeholder responses to this consultation, we intend to publish a statement setting out our decisions in Q3 2025/2026. Depending on our decisions, we will proceed to grant licences in due course.

1.8 The overview section in this document is a simplified high-level summary only. The proposals we are consulting on, and our reasoning, are set out in the full document.

[3] Based on their relative populations, the fees for Great Britian and Northern Ireland would be 97.2% and 2.8% respectively of the UK fee. However, at present there is no use planned in Northern Ireland.

2. Introduction

2.1 This document outlines our proposals for authorising future users of the 1900–1920 MHz band, following our December 2023 Statement on revoking existing authorisations for this band.

2.2 This section provides a brief background on the band, its technical characteristics and sets out the structure of the rest of the document.

Background

2.3 The 1900–1920 MHz ("1900 MHz") band (previously referred to as the "unpaired 2100 MHz band") was initially awarded to three mobile operators[4] through the 3G mobile auction in April 2000, authorising access to the 1899.9-1920 MHz[5] band.[6] The band has remained unused since then.

2.4 In March 2023, we consulted on the future of the 1900 MHz band ("the March 2023 Consultation") and how best to achieve optimal use of this spectrum given it had not been used for over 20 years.

2.5 We published a statement in December 2023 ("the December 2023 Statement") in which we outlined our plans to start the statutory process to vary the licences and revoke access to the 1900 MHz band, in order to secure its optimal use and deliver the greatest benefits to consumers and citizens. We identified rail communications as the optimal use of the 1900–1910 MHz spectrum. We saw the 1910–1915 MHz spectrum as a potential option for Emergency Service Network (ESN) gateways, which BT/EE (the provider of mobile services for the ESN) had intended to deploy using its 1899.9–1909.9 MHz spectrum. We also said that we would consult in due course on the future allocation of the 1900 MHz band and if necessary, on alternative spectrum for the ESN gateway.

2.6 In March 2024, we completed the statutory process to vary the licences to revoke authorisations for this band, with effect from **3 April 2029**.

Technical characteristics of the band

2.7 The 1900 MHz band is suitable for time division duplex (TDD) mobile services. However, spectrum use in the adjacent frequencies creates technical constraints on the use of the band and limits the range of applications that can operate in different portions of the band.

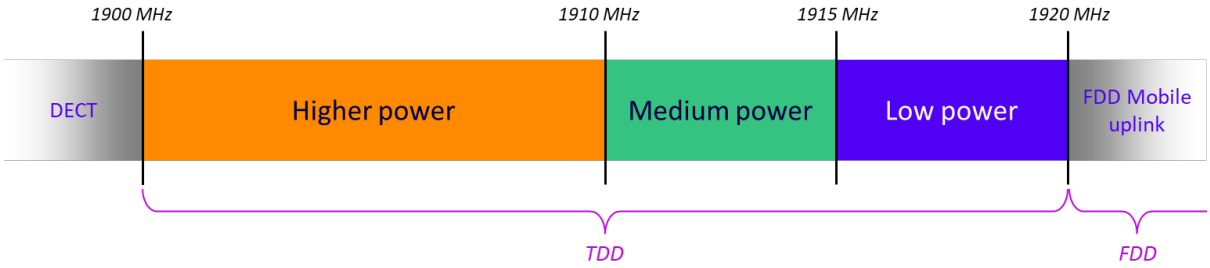
[4] Following a number of mergers and acquisitions, the licence holders are: EE (1899.9–1909.9 MHz), VMO2 (1909.9—1914.9 MHz), and H3G (1914.9–1920 MHz).

[5] Note that UMTS spectrum used a fixed 200k Hz channel raster at the time that these licences were issued, meaning that 5 MHz allocations were centred on 1902.4 MHz, 1907.4 MHz, 1912.4 MHz and 1917.4 MHz and the lower limit of the band was therefore 1899.9 MHz. Harmonisation for later generations of IMT spectrum uses a 100 kHz raster, so this band is adjusted to 1900–1920 MHz.

[6] As well as the 1900 MHz band (which is "unpaired" TDD spectrum), the licences awarded as a result of the 3G mobile auction granted access to the "paired" FDD spectrum in the 2100 MHz band. The authorisation to use the 1900 MHz band was outlined in Schedule 2 of the relevant licences, which can be found on Ofcom's website.

2.8 In particular, base station receivers in the mobile uplink band above 1920 MHz are vulnerable to interference from high power transmissions from nearby TDD base stations below 1920 MHz. As outlined in our December 2023 Statement,[7] to mitigate this risk of interference, we consider that the 1915–1920 MHz spectrum is only suitable for low power applications, whilst the 1910–1915 MHz spectrum will accommodate medium power applications. Higher power applications are possible in 1900–1910 MHz, assuming that the FDD mobile base stations above 1920 MHz have implemented enhanced selectivity.

Figure 2.1: Technical characteristics of the 1900 MHz band



Source: Ofcom

2.9 Further details on these constraints, and our proposed technical conditions taking them into account, are set out in Section 6.

Structure of the document

2.10 This document is structured as follows:

- **Section 3** discusses the potential new uses for the 1900 MHz band and outlines what we consider to be the optimal uses for different portions of the band.
- **Sections 4 and 5** set out our approach to authorising new uses in both 1900–1910 MHz and 1910–1915 MHz. These sections include proposed non-technical licence terms and conditions for new services.
- **Section 6** outlines our coexistence analysis and proposed technical licence condition for any potential new users.
- **Section 7** outlines our approach to setting fees for new users in the 1900 MHz band.
- **Section 8** sets out our next steps for authorising potential new users in the band, following the consultation process.

2.11 The consultation also includes the following annexes:

- Legal framework
- Legal duties and impact assessments
- Responding to the consultation
- Ofcom's consultation principles
- Consultation coversheet
- Consultation questions
- Draft licences

[7] December 2023 Statement, paragraph 3.52(b)

3. Optimal use of the 1900 MHz band

3.1 In this section we set out the different potential uses of the 1900 MHz band, and what we think is the optimal use of each part of the band, building on our views in the December 2023 Statement.

Potential demand for the 1900 MHz band

3.2 Taking into account responses to our March 2023 Consultation, our view is that the two most certain sources of demand for the 1900 MHz band are for the Future Railway Mobile Communications System (FRMCS) and Emergency Service Network (ESN) gateways, because there is clear intention for the future deployment of each. The demand for other uses of the band is in general more uncertain than these two applications.

Future Railway Mobile Communications System (FRMCS)

3.3 In 2020, the 1900–1910 MHz frequencies were internationally harmonised[8] for the Future Railway Mobile Communications System (FRMCS). FRMCS is the replacement for GSM-R,[9] the current 2G mobile system which provides operational communications on the railways, but which will eventually become obsolete.[10]

3.4 FRMCS, based on 5G technology, will support voice communications between the train driver and signaller, as GSM-R does today. In addition, FRMCS will support greater use of data, including enabling digital signalling and live CCTV video from trains to boost safety and improve fault monitoring. Like GSM-R, FRMCS is intended to support operational communications for the railway and not for passenger connectivity.

3.5 FRMCS equipment is expected to be widely available for the harmonised 1900–1910 MHz spectrum. Although Cellnex[11] suggested in response to our March 2023 Consultation that the entire band (i.e., 1900–1920 MHz) could be used by FRMCS, our view is that any FRMCS demand for 1910–1915 MHz will be more uncertain as equipment will not be so readily available and its use would be restricted to medium power, so could only be used for infill capacity. The 1915–1920 MHz spectrum is not suitable for FRMCS given its low power restriction.

3.6 FRMCS is also harmonised for the 876–880 MHz and 921–925 MHz spectrum (the "900 MHz band") which is currently used for GSM-R. 1900–1910 MHz spectrum is required in addition to the 900 MHz band to aid in the migration from GSM-R to FRMCS by enabling a period of

[8] In 2020, CEPT approved ECC Decision 20(02), harmonising the use of 874.4–880.0 MHz and 919.4–925.0 MHz (paired) and the unpaired 1900–1910 MHz band for Railway Mobile Radio (RMR) use, which includes FRMCS as well as GSM-R.
[9] Global System for Mobile Communications – Railway
[10] In response to our March 2023 Consultation, Network Rail said "The GSM-R system will become obsolete in the 2035-2040 period since suppliers will cease support".
[11] Cellnex response to March 2023 Consultation, p. 4

parallel running. Use of both bands for FRMCS in the future could also allow for the development of a multi-band network with greater capacity.[12]

Emergency Services Network (ESN) gateways

3.7 The new ESN will replace the current emergency services communications network, Airwave, which is based on Terrestrial Trunked Radio (TETRA) technology. The ESN will provide secure voice, data and video services for the emergency services in Great Britain over a 4G commercial mobile network.[13] The network will facilitate communication between emergency services users, including Police, Fire and Rescue, and Ambulance services. Transition to the new ESN is planned to start from 2029.

3.8 BT plc and EE Ltd (together, "BT/EE") were jointly awarded the Mobile Services Agreement (one of the two contracts that cover the provision of the ESN, the other being the User Services Agreement[14]) by the Secretary of State for the Home Department in December 2024, to provide the mobile network and related services to support the new ESN. This Agreement supersedes the previous contract with BT/EE, originally awarded in 2015, which expired on 31 December 2024.[15]

3.9 ESN gateways are vehicle-mounted repeaters[16] designed to extend the coverage of the ESN into areas where coverage is insufficient: either deep in-building or in rural areas, where coverage does not reach. These will replace the existing TETRA gateways which serve the same purpose in the current Airwave network. BT/EE is required to provide ESN gateways as part of the Mobile Services Agreement.[17]

3.10 BT/EE had originally planned to provide ESN gateways using its 1899.9–1909.9 MHz spectrum. However, in our December 2023 Statement, we decided that ESN gateways were not the optimal use of that portion of the band, because this spectrum had been harmonised across Europe for FRMCS. We therefore varied the licence to revoke access to this spectrum. We noted the important role ESN gateways could play in public safety and recognised that, according to our initial technical analysis, 1910–1915 MHz could be a potentially viable option for ESN gateways.

3.11 The demand for ESN gateways does not currently extend to Northern Ireland, where the Police Service of Northern Ireland (PSNI) provides emergency service communication. PSNI is separately seeking to replace its current Barracuda communications system.[18]

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[12] ECC Decision (20)02, p.3.
[13] Emergency Services Network: overview
[14] The Mobile Services Agreement covers the provision of the 4G mobile network and coverage required to run the ESN and the User Services Agreement covers the provision of end-to-end systems integration for the ESN, including data centres and ICT infrastructure. We do not consider the User Services Agreement further in this consultation.
[15] The new contract is for 7.25 years, with the possibility of extension.
[16] We specify here that ESN gateways are vehicle-mounted because this is our understanding of such gateways operate, and this has informed our technical assumptions. If other forms of ESN gateway with different technical characteristics were to be developed in future, we may need to assess these separately.
[17] In schedule 2.1 of the Mobile Services Agreement.
[18] The Barracuda system is a TETRA-based network provided by PSNI to support Police, Fire and Rescue, and Ambulance services in Northern Ireland, alongside key agencies for emergency response use. We have previously consulted on potential spectrum options for the PSNI to replace Barracuda.

Other potential demands

3.12 We have considered the following potential alternative demands for the 1900 MHz band:

a) **Public mobile services**: as set out in the December 2023 Statement, we do not think there is a realistic prospect of future public high power mobile use in this band, due to a lack of European harmonisation in these frequencies, and a subsequent lack of a mobile equipment ecosystem. We have not seen any further evidence that the band would likely be used by public mobile services since the publication of the December 2023 Statement.

b) **Utilities**: The utilities sector, particularly the energy sector, have growing communication needs and access to spectrum to support a private wide-area network would be one way of meeting those needs. In response to our March 2023 Consultation as well as our June 2023 Utilities CFI, stakeholders from the utilities sector noted that they preferred access to a sub-1 GHz band to provide the wide area coverage they need. They saw the value in the 1900 MHz band as being supplementary to sub-1 GHz spectrum, and not sufficient on its own to provide for that sector's needs.[19]

c) **DECT**[20]: In response to 2022 Ofcom's Spectrum Roadmap Consultation, the DECT Forum[21] and others suggested expanding DECT into the 1900–1920 MHz band. The DECT Forum argued that DECT-2020 NR (or "DECT NR+"), which is harmonised within ITU-R as an IMT-2020 technology, will enable new capabilities and applications, including smart cities, industrial Internet of Things (IoT) and Programme Making and Special Events (PMSE). We are aware of ongoing work in CEPT[22] to investigate whether it may be technically possible to allow DECT systems in the 1910–1920 MHz spectrum, although we do not expect this to conclude until later this year or early 2026.

d) **Satellite**: There may be demand to use the 1900 MHz band for satellite connectivity in the future. For example, in response to our March 2023 Consultation, Sateliot[23] suggested that the 1915–1920 MHz spectrum could be used for satellite-IoT applications and devices. However, the future of satellite use in this spectrum is uncertain ahead of any Mobile Satellite Service (MSS) allocations that may be made at the World Radiocommunications Conference 2027 (WRC-27) under agenda item 1.13. We are considering future demand for MSS spectrum as part of a wider review.[24]

Question 1: Do you agree with our analysis of potential demand for the 1900 MHz band? Are you aware of any other potential demand for this spectrum, including any demand specific to Northern Ireland?

Optimal use of the 1900 MHz band

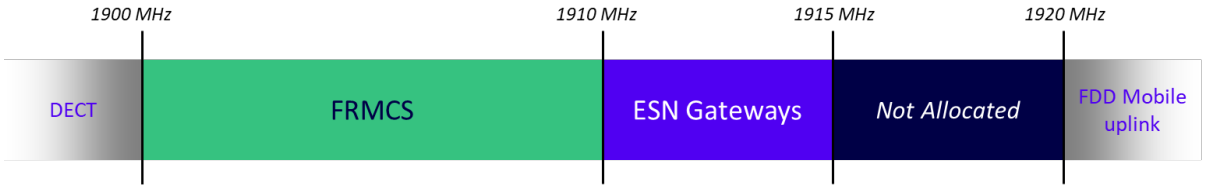
3.13 Our policy objective when considering the future use and authorisation of the spectrum is to secure its optimal use, in line with our duties (see Annex A2). We interpret optimal use to mean spectrum that is used in a way that maximises the benefits that people, businesses and other organisations derive from its use, including the wider social value of spectrum.[25]

[19] December 2023 Statement, paragraphs 3.23-3.29.
[20] Digital Enhanced Cordless Telecommunications.
[21] DECT Forum response to 2022 Spectrum Roadmap Consultation
[22] European Conference of Postal and Telecommunications Administrations (CEPT).
[23] Sateliot response to March 2023 Consultation
[24] Improving mobile connectivity from the sky and space, paragraph 3.12.
[25] Ofcom's Spectrum management strategy for the 2020s, July 2021, paragraph 2.5.

3.14 Further to our duties, we also have regard to the interests of everyone who may want to use the spectrum for wireless telegraphy, the desirability of encouraging investment to enable citizens and consumers to benefit from the development of new wireless services, and the desirability of promoting economic growth.

3.15 We set out below our provisional view on the optimal use of the three different parts of the band: 1900–1910 MHz; 1910–1915 MHz and 1915–1920 MHz, reflecting their different technical constraints (set out in Section 2) and potential demands.

Figure 3.1: Proposed band plan for 1900–1920 MHz, including adjacent channel users



Source: Ofcom

Optimal use of 1900–1910 MHz

3.16 In our December 2023 Statement, we considered that rail communications, specifically FRMCS, would be the optimal use of the 1900–1910 MHz spectrum, with most stakeholders agreeing with that view (including those from the rail and utilities sectors, and some mobile operators).[26]

3.17 In reaching the view that rail communication is the optimal use, we noted[27] that:

a) FRMCS, which will eventually replace GSM-R across the whole rail network, would make more intensive use of the spectrum than the more ad-hoc use by ESN gateways, or supplemental use by the utilities sector. It would support a wide variety of services in different scenarios, including signalling, the control of trains and communications for railway workers. In doing so, FRMCS will support services that are of high social and economic value.[28]

b) Harmonisation of the 1900–1910 MHz spectrum for rail communications in Europe means that any future rail communications services deployed in the UK in this band would benefit from lower costs than if it had to develop a bespoke system to operate in alternative frequencies. Stakeholders considered that without access to the spectrum, the value of the FRMCS would be undermined and the costs and risks associated with the rollout of FRMCS may rise to unreasonable levels.[29]

c) The ESN gateway, as a bespoke product developed for a socially valuable but specific use case, is better positioned to take advantage of other spectrum bands that also support LTE technology. The impact of moving ESN gateways to another band is likely to be simpler and significantly less costly than the development of a customised

[26] December 2023 Statement, paragraph 3.54.
[27] December 2023 Statement, paragraph 3.48.
[28] There were 1.7 billion passenger journeys in the 12 months to September 2024 (ORR Data Portal – Passenger rail usage 2024); The Rail Delivery Group reported in its Whole Industry Strategic Plan (2022) that rail freight contributes £2.45bn to the UK economy each year.
[29] Network Rail response to March 2023 Consultation.

ecosystem for FRMCS services if it uses spectrum other than that harmonised for rail communications use in Europe.[30]

3.18 We have considered whether there have been any material developments or changes since our December 2023 Statement, including with respect to the alternative demands above (paragraph 3.12), which could lead us to change our view on the optimal use of 1900–1910 MHz. We do not consider that there have been, and therefore remain of the provisional view that rail communications, and specifically the operational rail communications provided by FRCMS, is the optimal use of the 1900–1910 MHz spectrum.

3.19 Subsequently, Section 4 sets out how we propose to authorise FRMCS use in the 1900–1910 MHz spectrum.

Question 2: Do you agree with our identification of FRMCS as the optimal use of the 1900–1910 MHz spectrum?

Optimal use of 1910–1915 MHz

3.20 In our December 2023 Statement, we recognised that there was less certainty as to potential future use cases for 1910–1915 MHz. We also recognised that while ESN gateways were not the optimal use of 1900–1910 MHz, they could potentially be provided using 1910–1915 MHz, according to our initial technical analysis.

3.21 We have now considered whether any other potential uses of 1910–1915 MHz could deliver greater benefits than ESN gateways; in other words, whether ESN gateways are likely to be the optimal use of 1910–1915 MHz.

3.22 We recognise the important public safety role that ESN gateways would provide, even if their use will be on an ad-hoc and temporary basis and confined to specific locations (i.e., where there is insufficient coverage from the ESN's main mobile network). As the Home Office explained, ESN gateways enable "100% assured geographical coverage for emergency services to carry out their mandate of saving lives and property."[31]

3.23 In light of our consideration of the potential alternative uses above (at paragraph 3.12) our provisional view is that the important public safety benefits that could be delivered by ESN gateway use of 1910–1915 MHz are likely to be greater than the value of these alternatives. In addition, we note that the demand for 1910–1915 MHz from these alternative uses is more uncertain than from ESN gateways, which the Home Office and BT/EE have a clear intention to deploy. We therefore provisionally consider that ESN gateways are the optimal use for 1910–1915 MHz in Great Britain. Section 5 accordingly sets out how we propose to authorise ESN gateway use in the 1910–1915 MHz spectrum in Great Britain only.

3.24 As ESN gateways will not be deployed in Northern Ireland, and the alternative demands for this spectrum are uncertain at this stage, we are not identifying an optimal use for the 1910–1915 MHz spectrum in Northern Ireland at this time. However, we remain open to input from stakeholders on how this spectrum might best be used in Northern Ireland.

[30] December 2023 statement, paragraph 3.48.
[31] Home Office response to March 2023 Consultation, p.1.

Question 3: Do you agree with our identification of ESN Gateways as the optimal use of the 1910–1915 MHz spectrum in Great Britain? Do you agree that it is too early to identify an optimal use of the 1910–1915 MHz spectrum in Northern Ireland at present?

Optimal use of 1915–1920 MHz

3.25 As noted in Section 2 above and in our December 2023 Statement, the 1915–1920 MHz spectrum is not suitable for high or medium power uses due to the protection required for FDD mobile above 1920 MHz.

3.26 The only potential demand we are currently aware of for this part of the band is for satellite connectivity. However, as noted above in paragraph 3.12d, this demand is uncertain ahead of WRC-27 and we are separately considering future satellite spectrum demands as part of a wider review.

3.27 Therefore, we do not propose to authorise any new users in the 1915–1920 MHz spectrum at present. Nonetheless, we remain open to suggestions for low power uses that could fit the technical conditions of this spectrum.

Question 4: Are you aware of any low power use cases suitable for the 1915–1920 MHz spectrum?

4. Authorising use of 1900–1910 MHz

4.1 We propose to authorise 1900–1910 MHz for FRMCS to support future operational communications on the rail network, reflecting our provisional view in Section 3 that FRMCS is the optimal use of this spectrum.

4.2 This section sets out our proposed approach to authorising FRMCS in this spectrum, our proposed licence terms and conditions and the process for acquiring a licence. It also sets out our proposed position on potential non-FRMCS use of the band.

Approach to authorising this spectrum for FRMCS

4.3 We are proposing to create a specific licence product to enable FRMCS use.

4.4 We anticipate demand for this FRMCS licence would come from rail infrastructure managers, such as the existing GSM-R licensees (Network Rail and Eurotunnel), and potentially from others such as Transport for London (TfL), with varying timescales for deployment over the next 15 years.

4.5 Our proposals therefore reflect that there could be more than one rail infrastructure manager seeking an FRMCS licence, and that FRMCS licensees could have overlapping or adjacent areas of FRMCS operation, as Network Rail and Eurotunnel do today under the GSM-R licences.

Question 5: Do you have any comments on our proposed authorisation approach for FRMCS?

FRMCS licence proposed terms, conditions and process

4.6 We set out below the terms, provisions and limitations we propose to include in the FRMCS licence. For the first three conditions below ("Restriction to operational rail communications", "Requirement to coordinate with other FRMCS users" and "Geographic scope") we set out specifically why we consider they are objectively justifiable, do not unduly discriminate and are proportionate. The rest of the proposed conditions are consistent with Ofcom's standard licence conditions, and we are satisfied that these also meet these tests. We consider that we have met transparency requirements for all our proposed conditions as we have clearly set out what they are intended to achieve.[32]

[32] See Annex A2 for an overview of Ofcom's duties and legal requirements under the Wireless Telegraphy Act 2006 and the Communications Act 2003.

Non-technical licence terms

Restriction to operational rail communications

Draft FRMCS licence condition: operational railway business use only

References in this schedule to the Radio Equipment are references to any wireless telegraphy station or wireless telegraphy apparatus that is established, installed and/or used to form part of a radio telecommunications network ("the Network") used for operational railway business only, in which mobile user stations communicate by radio with the Radio Equipment to provide a telecommunications service.

4.7 We propose a licence condition that restricts the use of the licence to operational rail communications only to ensure the spectrum can be used for the identified optimal use.

4.8 We consider that this restriction is objectively justifiable, proportionate and non-discriminatory because at present, we do not consider that there are additional users that could be authorised alongside operational rail communications without risking harmful interference to FRMCS, which could impact the operation of the UK's railway network. In particular, we remain of the view[33] that it is not possible for ESN gateways and FRMCS to coexist in the same frequencies without causing harmful interference to each other.

4.9 However, as discussed below, we would consider making other licences available where other uses would be able to coexist with operational rail communications. Any additional future additional use of the spectrum would be subject to further consultation.

4.10 To give effect to this restriction of use we propose to grant a Limitation Order. We will consult on the Limitation Order separately.

Requirement to coordinate with other FRMCS users

Draft FRMCS licence condition: coordination with other users

The Licensee must liaise and co-operate with all co-channel FRMCS Licensees, both existing and future, with overlapping or adjacent coverage areas (if necessary adjusting transmission power and other technical parameters of transmission) in such a way that harmful interference is not caused by one network deployment to the network of another co-channel Licensee.

4.11 As noted in paragraph 4.5, it is possible that more than one rail infrastructure manager may be interested in deploying FRMCS in the future, and therefore we may, in time, have several licensed rail users in this band.

4.12 These licensees may operate FRMCS in adjacent or overlapping geographic areas, which without coordination could result in licensees causing harmful interference to each other. We therefore propose to include a licence condition requiring coordination between all FRMCS licensees.

4.13 This condition is objectively justified to ensure there is no harmful interference between different rail users which could affect the reliable and safe operation of the rail network. It is non-discriminatory because it is a reciprocal coordination requirement, applying equally to all FRMCS licensees regardless of when they acquire a licence, and therefore would not

[33] December 2023 Statement, paragraph 3.49

establish a hierarchy between earlier and later licensees. Specifically, our intention is to ensure that while no new user can enter the band without an existing licensee's knowledge and start causing interference to them, we would equally expect existing licensees to cooperate in good faith with any new applicant for an FRMCS licence. Applicants would be able to find details of any existing FRMCS licensees in the Wireless Telegraphy Register published on Ofcom's website.

4.14 Further, we believe this is a proportionate requirement because there are already established processes for cooperation between rail infrastructure managers.[34]

Geographic scope

4.15 We propose that the geographic area authorised by each FRMCS licence would be determined on a case-by-case basis based on the information that applicants provide about the location of their rail infrastructure (see "Licensing process" below). For example, we envisage:

- A licence for Network Rail would cover the whole of Great Britain, as it has rail infrastructure across England, Scotland and Wales.
- A licence for Northern Ireland Railways would cover the whole of Northern Ireland.
- The geographic boundaries for other licensees could be specified in a number of ways, such as a circle (a distance around a geographic point), or a rectangle (for example, specified by grid references of the corners of the rectangle) encompassing the rail infrastructure in question. Alternatively, we could define the geographic scope by reference to a specific rail line where the geographic location and extent of this is already defined (for example, by listing "the East Coast Main Line", "the Elizabeth Line", or "High Speed 1"). We provide an example of this in Schedule 2 to the draft FRMCS licence provided in Annex A7.

4.16 Licensees will be able to deploy FRMCS anywhere within the geographic area of the licence, subject to coordination with any geographically adjacent or overlapping licensees (see "Requirement to coordinate with other FRMCS users" above).

4.17 The licence will not, however, grant exclusive spectrum access to the licensee across the whole of the authorised area. This will allow potentially overlapping FRMCS licences, and we may also (as discussed below in paragraphs 4.34 and 4.35) consider future non-rail use of the band, where it is possible for this to coexist with rail use.

4.18 We consider this is an objectively justifiable, non-discriminatory and proportionate approach to defining licence area, as it will authorise use of spectrum by the relevant rail infrastructure while avoiding the administrative overhead of defining very detailed geographic areas. It could also allow for more flexibility in the event of future extensions of the rail network.

Licence commencement and duration

4.19 The licences will come into effect on or after 3 April 2029, and use before that date will not be permitted.

[34] For example, we know that Network Rail and Eurotunnel cooperate regarding the overlapping area in both of their GSM-R licences, and we are aware of cross-industry cooperation through bodies such as the Rail Safety and Standards Board.

4.20 In line with our standard approach to licence duration, we propose to grant a licence for an indefinite duration, subject to the payment of an annual licence fee. The licence also permits Ofcom to give five years' notice to revoke the licence for spectrum management purposes.

Licence transfer through spectrum trading

4.21 We do not propose to permit trading of FRMCS licences. This is because we are proposing that we undertake a number of checks before we will issue a licence (see below) which would be circumvented if licences could be traded to a third party without those checks being made.[35]

Access and Inspection

4.22 In accordance with our standard spectrum licence conditions, we propose that the licence includes a condition that reserves to Ofcom the right to access and inspect the licensee's radio equipment. This is so that we can check the licensee's compliance with the terms of its licence, should we decide that that is appropriate.

Modification, Restriction and Closedown

4.23 In accordance with our standard spectrum licence conditions, we propose that the licence includes a condition that reserves to Ofcom the right to require the licensee to modify, restrict or close down the use of its radio equipment, should we have reasonable grounds to believe that the licensee has breached the terms of its licence, or we consider this necessary in the event of a national or local state of emergency being declared.

Question 6: Do you have any views on our proposed non-technical conditions for the new FRMCS licence?

Technical licence conditions

4.24 The technical licence conditions for the proposed FRMCS licence can be found in **Section 6**.

Fees

4.25 We propose that FRMCS licences in this band would be charged at a rate of **£145,800 per MHz per year** for a licence covering all of Great Britain, meaning that such a licence would cost a total of **£1,458,000 per year** for the whole 10 MHz available in this band. A licence for Northern Ireland for the whole 10 MHz available would cost **£42,000 per year**. We will consult on amending the Wireless Telegraphy (Licence Charges) (Amending) Regulations 2024 in due course.

4.26 For users with smaller networks, we propose a system of fee scaling in line with the size of the network, based on total route length. We propose to require licensees to immediately inform us of any changes to their total route length covered by the FRMCS licence, if this change would result in an increase or a decrease in the total route length, rounded up to the nearest 100 miles. Licensees would **not** be required to notify Ofcom of changes to the

[35] Ofcom has a general duty to allow leasing or transfer under Section 30A of the Wireless Telegraphy Act 2006 ("WTA") except in cases excluded by section 30A(4) WTA. We consider our proposals in relation to the FRMCS licence are not subject to this general duty because the proposed licence would not be subject to individual frequency planning or co-ordination (see section 30A(4)(f) WTA).

length of the total route if, when rounded up to the nearest 100 miles, the total route length remains the same.

4.27 For example, if a licensee's total route length was 250 miles and this increased to 305 miles, the licensee would need to inform Ofcom, and the fee would accordingly increase, effective from the date on which the annual fee next falls due. If the total route length increased from 250 miles to 290 miles, there would be no need to notify Ofcom as this still rounds up to 300 miles, and therefore the fee would stay the same. If the route length were to decrease from 250 miles to 199 miles, the licensee should also inform Ofcom, as this would reduce the fee. This notification requirement would not apply to FRMCS licences with a geographic scope of all of Great Britain, or all of Northern Ireland.

4.28 We discuss in detail in **Section 7** our approach to fees for the new FRMCS licences.

Licensing process

4.29 We propose to authorise FRMCS licences via a simple licensing process.

4.30 We believe this is appropriate because, as discussed above in paragraph 4.4, we expect the demand for FRMCS licences to be limited to a small number of rail infrastructure managers. We also do not need to limit the number of FRMCS licences that can be issued, as we expect any overlapping or adjacent FRMCS licensees will be able to coordinate their use with each other.

4.31 We propose that applicants could apply to Ofcom for a licence at any time, although any licence would take effect on or after **3 April 2029**.

4.32 We propose that in order to be granted a licence, in addition to the standard information that we seek from licensees,[36] applicants would also need to submit the following information to confirm their ability to comply with the licence conditions, and to enable us to administer the licence:

- A declaration that the applicant intends to use the licence to provide operational rail communication services. This is necessary to ensure they will be able to comply with the proposed condition restricting use outlined above in paragraph 4.7.
- Where the operational area of existing and new licensees' networks overlap, or are adjacent to each other, evidence of plans or discussions between the relevant FRMCS licensees that demonstrate their ability to coordinate. This is necessary to ensure licensees will be able to comply with the proposed coordination condition outlined above (see paragraph 4.12). For example, if TfL were to apply for an FRMCS licence after Network Rail had already been assigned one, we would expect TfL to provide evidence of sufficient engagement with Network Rail, to show that both operators would be able to coexist (since TfL's network overlaps with Network Rail's network). Our expectation is that existing licensees in turn will, in line with the proposed coordination licence condition, cooperate in good faith with new applicants.
- The location of the infrastructure to be covered by the licence. The specific area to be authorised by the licence will be agreed between Ofcom and the licensee, noting that our proposed approach to geographic scope (see paragraph 4.15 above) does not require precise details of planned deployment locations to be provided on application.

[36] For example, contact details, and in some cases bandwidth or power level required.

- Information on the length of the applicant's routes, expressed in miles, on which FRMCS is to be deployed.[37] This is to determine the appropriate fee, as detailed in Section 7. (As set out above, we expect licensees to inform us immediately if this figure subsequently changes in the way described in paragraphs 4.26–4.27.)

4.33 If we confirm our proposals, we will consult on implementing these requirements through the Wireless Telegraphy (Licensing Procedures) Regulations 2010 and would provide further guidance for applicants on the information required.

Question 7: Do you have any views on our proposed licensing process for the FRMCS licence?

Non-rail use of this spectrum

4.34 As noted in Section 3, at present we do not consider that there are alternative uses that could share the 1900–1910 MHz spectrum with operational rail communications. Therefore, we are not proposing to authorise other uses alongside the optimal use (FRMCS) at this stage.

4.35 We are, however, open to other potential uses which could share the band with operational rail communications in the future, for example if these were sufficiently distant from any rail infrastructure, and would assess these on a case-by-case basis when demand emerges. Any additional future use of the spectrum would depend on careful consideration of the ability to coexist with operational rail communications without causing harmful interference, and would be subject to further consultation.

Question 8: Are you aware of any uses that can coexist with FRMCS without creating a risk of harmful interference? If so, please provide evidence.

[37] We expect this number to be readily available to rail infrastructure managers and not solely produced for the purpose of licensing.

5. Authorising use of 1910–1915 MHz

5.1 We are proposing to authorise access to 1910–1915 MHz to support the provision of ESN gateways. This reflects our provisional view set out in Section 3, that ESN gateways are the optimal use of this spectrum.

5.2 This section sets out our proposed approach to authorising ESN gateways, our proposed licence terms and conditions and process for acquiring a licence. It also sets out our proposed position on non-ESN gateway use of the band.

Approach to authorising this spectrum for ESN gateway use

5.3 We propose to limit the availability of these licences to the provision of ESN gateways by any provider that is contracted by the UK Government ("Government") to supply those gateways.

5.4 We would do this by granting a Limitation Order, which we will consult on separately.[38] As noted in Section 3, BT/EE is currently the Government appointed provider of mobile services, including ESN gateways, for the ESN.[39]

5.5 We consider that it is proportionate to limit the licensees that can hold an ESN gateway licence in order to ensure that this critical communication can operate without harmful interference, thereby securing the efficient use of spectrum.

Question 9: Do you agree with our proposed approach for authorising ESN gateways in 1910–1915 MHz?

ESN gateway licence proposed terms and conditions

5.6 We set out below the terms, provisions and limitations we propose to include in the ESN gateways licence.

5.7 For the first three terms below which depart from our standard licence conditions ("Restriction to provision of ESN gateways"; "Licence commencement and duration"; and "Licence revocation"), we set out specifically why we consider they are objectively justifiable, do not unduly discriminate and are proportionate. The rest of the proposed conditions are consistent with our standard licence conditions and we are satisfied that these meet these tests. We consider that we have met transparency requirements for all our proposed conditions as we have clearly set out what they are intended to achieve.[40]

[38] The Limitation Order will set out the criteria which we will apply in determining the limit on the number of wireless telegraphy licences granted and the persons to whom licences will be granted.
[39] Mobile Services Agreement – Schedule 2.1, 3.13.
[40] See Annex A2 for an overview of Ofcom's duties and legal requirements under the Wireless Telegraphy Act 2006.

Non-technical licence terms

Restriction to provision of ESN gateways

Draft ESN gateways licence condition: ESN gateways use only

The Radio Equipment shall form part of a radio telecommunications network in which ESN Gateways communicate by radio with ESN gateway terminal equipment to provide a telecommunications service to the Government.

5.8 This condition ensures that this spectrum may only be used to provide ESN gateway services to Government, thereby ensuring the optimal use of the spectrum.

5.9 We consider this restriction is objectively justifiable, proportionate and non-discriminatory because at present we do not consider that there are additional users that could be authorised alongside ESN gateways without risking harmful interference which could impact critical communications for the emergency services (see paragraph 5.26 below).

5.10 We propose to also grant a Limitation Order in relation to this restriction, which we will consult on separately.

Licence commencement and duration

5.11 The licence will come into effect on or after 3 April 2029, and use before this date will not be permitted.

5.12 We propose to impose a licence term the same length as the corresponding Government contract to provide ESN gateways. We note that the current Mobile Services Agreement between the Secretary of State for the Home Department and BT/EE, which includes provision of ESN gateways, ends on 29 February 2032.

5.13 We consider that this term is objectively justifiable, non-discriminatory and proportionate for the same reasons as given above for limiting the use of the licence.

Licence revocation

5.14 We propose to include a revocation clause in the licence which would enable Ofcom to revoke the licence, with immediate effect, in the event that the licensee's Government contract to provide ESN gateways is terminated.

5.15 We consider that this condition is objectively justifiable, non-discriminatory and proportionate both for the reason set out at paragraph 5.9 above (i.e., to limit disruption to critical services) and for reasons of efficient spectrum management.

Licence transfer through spectrum trading

5.16 We do not propose to make the ESN gateway licence tradable. As identified above, subject to Limitation Order, this licence type will only be available to parties providing ESN gateways to Government.[41]

[41] We do not consider that the proposed ESN licence is subject to the general duty to allow leasing or transfer (see footnote 33) because the licence contains terms, provisions or limitations as a result of which the purposes for which the use of the station or apparatus is authorised consist of or include safety of life services (see section 30A(4)(e) WTA).

Access and inspection

5.17 In accordance with our standard spectrum licence conditions, we propose that the licence includes a condition that reserves to Ofcom the right to access and inspect the licensee's radio equipment. This is so we can check the licensee's compliance with the terms of its licence, should we decide that that is appropriate.

Geographic scope

5.18 We propose that the geographic scope of the licence will be across Great Britain (i.e., England, Scotland, and Wales) only. The ESN will not be provided in Northern Ireland as the emergency service communication network in Northern Ireland is provided and managed separately by the Police Service of Northern Ireland (PSNI).[42]

Question 10: Do you have any views on our proposed non-technical licence terms for the ESN gateways licence?

Technical licence conditions

5.19 The technical licence conditions for the proposed ESN gateway licence can be found in **Section 6**.

Fees

5.20 We propose that the ESN gateways licence fee would be charged at a rate of **£72,900 per MHz per year** for a licence covering Great Britain. Therefore, the total cost of this licence for ESN would be **£364,500 per year**. We will consult on amending The Wireless Telegraphy (Licence Charges) (Amendment) Regulations 2024 in due course.

5.21 We discuss in detail in **Section 7** our approach to fees for the new ESN Gateways licence.

Licensing process

5.22 As noted above, subject to a separate consultation, we propose to grant a Limitation Order to limit the availability of these licences to the provision of ESN gateways by any provider that is contracted by Government to supply those gateways.

5.23 We would make licences available on request for anyone who holds such a government contract to provide ESN gateways. At the moment, we understand this is limited to BT/EE.

5.24 Upon receiving an application, we would verify with Government that the applicant holds such a contract before issuing the licence.

5.25 If we confirm our proposals, we would consult on implementing these requirements through the Wireless Telegraphy (Licensing Procedures) Regulations 2010.

Question 11: Do you have any views on our proposed licensing process for the ESN gateway licence?

[42] As discussed in Section 3, we have previously consulted on potential bands for the PSNI's planned replacement for the Barracuda system in Northern Ireland.

Non-ESN gateway use of the band

5.26 We are not aware of any additional use of this spectrum which at present could coexist with ESN gateways without creating a risk of harmful interference, particularly as ESN gateways will have unpredictable deployment locations across Great Britain. Therefore, we have no specific plans to authorise other uses alongside ESN gateways at present.

5.27 However, we may update our plans if we see evidence of applications, for example device to device communications for the emergency services, that could coexist in this part of the band without causing harmful interference.

Question 12: Are you aware of any uses that can coexist with ESN Gateways without causing risk of harmful interference? If so, please provide evidence.

6. Coexistence analysis and technical licence conditions

6.1 In Section 3 we set out our view that the optimal use of the 1900 MHz band is for 1900–1910 MHz to be used for FRMCS, 1910–1915 MHz to be used for ESN gateways, and 1915–1920 MHz to remain unallocated.

6.2 This section sets out our proposed technical licence conditions for FRMCS and ESN gateways that will allow both services to coexist within the 1900 MHz band, alongside the existing DECT users in 1880–1900 MHz and FDD mobile uplinks in 1920–1980 MHz.

6.3 In summary, we propose that:

- FRMCS will be permitted to operate in 1900–1910 MHz with a maximum transmit power (EIRP) of 65dBm.
- FRMCS can coexist with DECT and FDD mobile uplinks in adjacent bands by adopting the technical conditions recommended in ECC Report 314 and ECC Report 318 and providing that uplink power control is used in FRMCS train cab radios.
- The potential for FRMCS to interfere with FDD uplinks will be limited if licensees in 1920–1980 MHz adopt the enhanced receiver selectivity requirements specified in ETSI TS 103 807 V1.1.1 (2021-10).
- ESN gateways will be permitted to operate in 1910–1915 MHz with a maximum transmit power (EIRP) of 37dBm.
- FRMCS and ESN gateways must be aligned to a common TDD frame timing reference. They may operate with different TDD frame structures in a semi-synchronised manner in order to support the different throughput requirements of these systems. There is a small risk of interference causing temporary reduction in throughput to the FRMCS uplink if an ESN gateway is deployed close to a FRMCS base station.
- The risk of interference from ESN gateways to the FRMCS uplink can be further reduced if both systems use the same TDD frame structure (i.e., fully synchronised).

Future Rail Mobile Communications System (FRMCS)

6.4 In our analysis, we have made some assumptions about how FRMCS might be deployed and configured for the rail network. We explain these assumptions below and explain how these affect coexistence.

FRMCS deployment considerations

FRMCS user equipment

6.5 Two broad types of FRMCS user equipment are expected. The train cab6. radio is a railway mobile radio terminal installed on board the train capable of supporting voice and data applications. In addition, we expect there to be other railway mobile radio terminals (e.g., hand portable radios).

Network densification

6.6 Densification of the current GSM-R network will be required to support FRMCS. This will be necessary to support the additional data throughput of FRMCS services as well as to accommodate the different propagation characteristics of the 1900–1910 MHz band.

6.7 We have assumed that the current GSM-R sites will be upgraded to support FRMCS, with additional infill sites deployed to provide the necessary coverage and capacity in the 1900 MHz band. We expect that the current (GSM-R) maximum site spacing of up to 10–12 km apart in rural areas will be reduced to 6 km with infill sites. In high density urban areas, we expect FRMCS site spacing to remain the same as GSM-R (i.e., up to 2 km apart). This expected densification would increase the number of sites to 4,500, approximately 50% more than currently used by GSM-R.

6.8 We expect FRMCS site coverage to be focused linearly along the rail tracks, with wide area coverage not required. We assume that FRMCS base stations will have typical characteristics as follows:

- **macro cells**: typically located in suburban or rural areas, which have an antenna height of up to 20 metres, can support up to three sector antennas, and feature a beamwidth of 30–65 degrees;
- **micro cells**: primarily found in urban areas, which are 5 metres tall, can accommodate a maximum of two sector antennas, and have a beamwidth of 25 degrees.

FRMCS throughput requirements and TDD frame structure

6.9 Expected throughput requirements for FRMCS are given in ECC Report 294. This gives the expected throughput for a subset of critical services to be supported during the migration period when FRMCS and GSM-R are operating in parallel, and for the full set of services to be provided when FRMCS rollout is complete ("post migration"). This assumes both the 900 MHz and 1900 MHz band spectrum allocations will be used for rail communications, as previously mentioned in Section 3.

6.10 Uplink and downlink throughputs of around 3.5Mb/s per train are required (including video services) during the migration period. Uplink and downlink throughputs are therefore expected to be similar and a 2:2 frame structure (TDD frame structure 1) may be suitable in this initial period.

6.11 Post migration, throughput requirements are increased to around 7.4Mb/s in the uplink and 4.4Mb/s in the downlink, including video services. The maximum uplink traffic requirement is therefore around 1.7 times that of the downlink, meaning that a 1:3 frame structure may be more appropriate as in practice the uplink may have lower peak throughput per timeslot than the downlink.

6.12 ECC Report 294 gives accumulated traffic throughput per cell based on 8 km cells. We have adjusted these throughputs based on our assumptions about network densification discussed above. We estimate the throughput per cell to be approximately 10–22Mb/s in the uplink and 6–13Mb/s in the downlink, including video services, post migration.

6.13 If both the current 900 MHz (2 x 4 MHz paired) and 1900 MHz (10 MHz unpaired) bands are used for FRMCS post migration, we assume the traffic requirements for FRMCS in 1900–1910 MHz to be approximately half of the total.

FRMCS coexistence with DECT and FDD uplinks

6.14 We have based our proposed technical conditions for FRMCS on ECC Reports 314 and 318, and ECC recommendation 20(02).

6.15 ECC Report 314 considered coexistence between FRMCS and DECT. The report concluded that there may be some risk of interference from FRMCS to DECT use outdoors in isolated circumstances. In most cases harmful interference would be mitigated by walls and other clutter between FRMCS transmitters and DECT devices, and that FRMCS base station antennas would point along the rail tracks and would not be directed towards DECT deployments.

6.16 ECC Report 314 also recommended that FRMCS should use power control on its uplink transmissions to reduce the risk of FRMCS cab radios interfering with DECT systems close to rail tracks. We have included this in our technical licence conditions in Table 6.2.

6.17 ECC Report 318 considered the coexistence of FRMCS with FDD uplinks in the 1920–1980 MHz band. It concluded that the risk of a FRMCS base station interfering with FDD uplink (base station) receivers should be mitigated by additional filtering on the FDD uplink base station to improve selectivity. Enhanced receiver selectivity has been specified in the ETSI standard applicable to base stations in 1920–1980 MHz band.[43]

6.18 We have sought assurance that enhanced selectivity will be used by mobile networks above 1920 MHz. One equipment vendor has confirmed to us that enhanced selectivity has been included into their LTE band 1 radio products above 1920 MHz.

6.19 We have concluded that the risk of FRMCS cab radio interference into FDD uplinks is also considered acceptably low when enhanced selectivity is used by FDD base station receivers and uplink power control is used by the FRMCS system.

6.20 Some coordination may be required between mobile networks using 1920–1980 MHz and FRMCS base stations if they are deployed close to each other. FRMCS base stations may need to limit their EIRP in the direction of mobile uplink sites, for example using antenna downtilt and directivity and/or reducing the base station's power to less than the maximum allowed EIRP.

Question 13: Do you have any comments on our assessment of the coexistence of FRMCS in 1900–1910 MHz with existing DECT services and FDD uplinks?

ESN gateways

6.21 ESN gateways are vehicle-mounted mobile coverage extenders designed to provide additional coverage for emergency services users where ESN coverage may be marginal outdoors, or to provide extra coverage within buildings or other structures where the ESN coverage is weak due to building penetration losses.

6.22 Our analysis shows that ESN gateways may be deployed in 1910–1915 MHz providing that they do not transmit at a high-power level, and that out of band emissions are limited appropriately.

[43] ETSI TS 103 807 V1.1.1 (2021-10) Mobile Standards Group (MSG); IMT Cellular Networks Base Stations (BS) Additional Regulatory Requirements

ESN gateway deployment considerations

6.23 Our understanding of how ESN gateways will be deployed is set out as follows:

TDD frame structure

6.24 ESN gateways are required to provide voice, video and data communications to multiple users in group calls. A downlink-biased TDD frame structure may be desirable to accommodate the sending of messages from one user to multiple other users connected to the gateway.

6.25 However, the downlink traffic requirement may be lower if multicast capabilities such as group call system enablers (GCSE)[44] are incorporated into the gateway design to enable efficient resource utilisation for group communication.

Operational deployment

6.26 ESN gateways will use LTE radio technology. They will be enabled but will remain inactive[45] (i.e., in "idle mode") when the supporting vehicle is stationary at an emergency. Gateways will only become active when user equipment is connected and in use. Individual ESN user equipment will attempt to connect when the signal strength of the main ESN is below a certain threshold. The gateways will be configured so that only one is enabled in situations where multiple gateway-equipped emergency vehicles are present.

6.27 We have considered the following scenarios for the ESN gateways in our analysis:

a) The gateway is deployed in areas of good ESN coverage and so ESN user equipment will communicate via the main ESN and will not use the gateway. In this case, the gateway will transmit only its broadcast control channels. We expect ESN gateways to be in this idle state for most of the time that they are deployed.
b) The gateway is deployed in areas of good ESN coverage, including in urban areas, but is used to enhance coverage in buildings, tunnels or other enclosed areas where there may be limited or patchy coverage from the main ESN network. They could be used in the vicinity of rail infrastructure.
c) The gateway is deployed at the edge of the ESN coverage, providing a local coverage extension for ESN users that may not be served reliably from the main ESN. We expect ESN coverage to be good in most places in the UK, and so this use case will only be used in remote areas and may therefore be less likely to be close to rail infrastructure.

ESN Gateways coexistence with DECT and FDD uplinks

6.28 In our December 2023 Statement, we indicated that our coexistence analysis for ESN gateways showed that they could operate in 1910–1915 MHz without causing significant interference to adjacent users providing that they are limited to medium power transmission.

6.29 Our analysis shows that an out of band emissions limit of -41 dBm/5MHz above 1920 MHz will provide sufficient protection to FDD uplinks from the ESN gateways transmissions. The ESN gateway maximum EIRP of 37 dBm in the 1910–1915 MHz spectrum will also minimise the likelihood of it causing blocking in nearby FDD uplinks. While the FDD uplink enhanced selectivity will protect these receivers from blocking from FRMCS in 1900–1910 MHz as

[44] See ETSI TS 122 468 - V18.0.1.
[45] In an inactive state (idle mode), control channels will still be broadcast.

discussed above, it is likely that this filtering will also provide some limited additional protection against blocking from ESN gateways.

6.30 Our analysis also showed that ESN gateway use in 1910–1915 MHz, if adhering to the same -41 dBm/5MHz out of band emissions limit below 1900 MHz, will not cause additional interference to DECT services.

Question 14: Do you have any comments on our assessment of the coexistence of ESN Gateways in 1910–1915 MHz with existing DECT and FDD uplinks?

Coexistence between ESN Gateways and FRMCS

6.31 We analysed the potential risk of interference from ESN gateways in 1910–1915 MHz into FRMCS in 1900–1910 MHz.

Downlink coexistence

6.32 We have assessed that the risk of interference from the gateway to the FRMCS user equipment will be small because a train operating at the edge of FRMCS coverage is likely to suffer only momentary interference if it passes an ESN gateway operating nearby.

Uplink coexistence

6.33 There is a risk of interference when the base station of one system transmits and the base station of the other system receives in a particular time slot. Table 6.1 below shows a likely example: when FRMCS uses TDD configuration 0 (a 1:3 downlink to uplink ratio) and ESN gateways use TDD configuration 2 (a 3:1 downlink to uplink ratio) the gateway could cause interference to the FRMCS base station in four of the timeslots.

6.34 Where both systems are fully synchronised with the same TDD frame structure there would be no risk of interference into the FRMCS uplink.

Table 6.1: LTE TDD frame structures for ESN Gateway and FRMCS

Configuration											Ratio
	0	1	2	3	4	5	6	7	8	9	
0	D	S	U	U ↑	U ↑	D	S	U	U ↑	U ↑	1:3 DL:UL (FRMCS)
2	D	S	U	D	D	D	S	U	D	D	3:1 DL:UL (ESN Gateways)

6.35 When the gateway is in its idle mode, it will transmit only broadcast control channels using timeslots 0 and 5. These are downlink timeslots in all TDD frame structures, and will therefore not cause any uplink interference into FRMCS.

6.36 Our analysis[46] indicates that ESN gateways could cause some interference to a FRMCS uplink if the gateway is within:

[46] Our link budget analysis is based on the ITU-R P.1411 General Area propagation model using the median propagation characteristics for NLOS above and below rooftop scenarios. We used a net filter discrimination (NFD) of 44.7 dB based on our proposed out of band emission limits and receiver selectivity based on typical

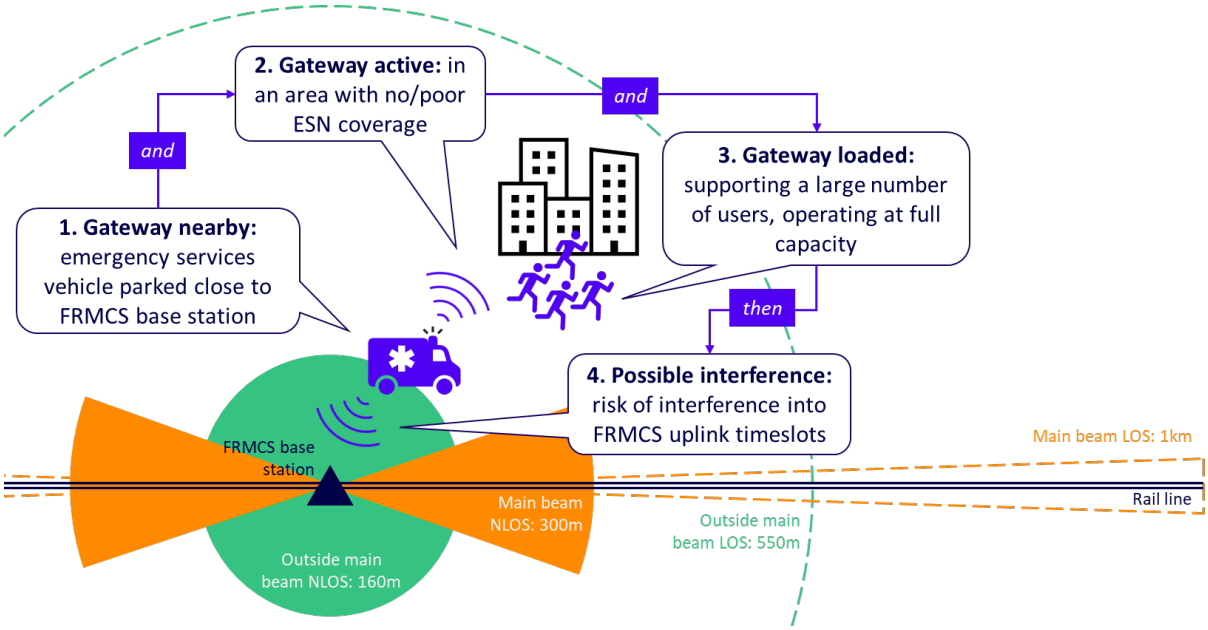
- 300m of a FRMCS macrocell base station when in the main beam, in non-line-of-sight (NLOS) conditions. This could increase to more than 1km if the gateway is in line-of-sight (LOS) to the FRMCS base station (e.g., on a bridge or level crossing); or
- 150m of the FRMCS base station when it is outside the FRMCS base station main beam, in NLOS conditions, or approximately 550m in LOS.

6.37 In the case of microcell sites with lower antenna heights and typically narrower beamwidths, interference could occur if the gateway is within approximately 200m inside the main beam, and 70m outside the main beam, in NLOS conditions.

6.38 Figure 6.1 below shows how this may occur if an ESN gateway is deployed close to a FRMCS base station covering a stretch of railway line. The ESN gateway may impact the FRMCS uplink if:

- It is deployed close to a FRMCS base station (within the areas described above, which we estimate to correspond to 0.5% of the UK landmass); *and*
- It is in an area where ESN main network coverage is marginal for ESN users; *and*
- A large number of ESN users are being supported, so the gateway is operating at full capacity, and therefore transmitting at its maximum EIRP.

Figure 6.1: FRMCS coverage on a rail line, showing where it may be vulnerable to interference from an ESN Gateway deployed nearby



Source: Ofcom

6.39 Overall, we conclude that FRMCS and ESN gateways can coexist in the 1900 MHz band if they are semi-synchronised, i.e., their TDD frames are aligned to a common time reference, but they use different TDD uplink and downlink configurations.

values given in CEPT report 39. We have assumed an interference to noise ratio (I/N) of 0dB for the onset of harmful interference.

6.40 There remains a very small risk that ESN gateways in some circumstances could cause interference to FRMCS uplinks. However, we believe the risk is acceptably low because:

- ESN main network coverage is expected to be good in most areas where FRMCS will be in use, therefore it is unlikely that the ESN gateways will be required at these locations. It is likely that they will be required only where indoor ESN coverage is low.
- ESN gateways will likely spend much of their deployed time in an idle mode, where they will not cause any interference to FRMCS uplinks.
- Even when the gateway is active, it may not be operating at full capacity (and therefore transmitting at less than its maximum EIRP). The use of multicast technology for large talk groups will reduce the downlink traffic demands on the ESN gateway.

6.41 The coverage of FRMCS will be focused on the rail network, whilst the ESN gateways will be principally deployed on roads. ESN gateways are therefore unlikely to be deployed within the main beams of FRMCS base station antennas and will have low antenna heights compared with the surrounding clutter. We expect there to be high coupling loss between the two systems in most cases.

Question 15: Do you have any comments on our assessment of the coexistence of ESN Gateways in 1910–1915 MHz with FRMCS in 1900–1910 MHz?

FRMCS throughput and the impact of interference

6.42 Our analysis[47] shows that, on average, a gateway operating at full capacity at 300m from a FRMCS macrocell base station and within its main beam (or at 150m outside its main beam) would degrade the FRMCS uplink SINR sufficiently to reduce the throughput of affected TDD timeslots by around 20%, depending on how close the train cab radio is to the FRMCS cell edge.

6.43 The FRMCS uplink for individual train user equipment may suffer an aggregate reduction less than this in the semi-synchronised arrangement shown in Table 6.1 above, since only four out of six TDD slots will be affected.

6.44 For a train at the edge of the cell, operating at or close to its minimum sensitivity level, this may trigger an early handover to a neighbouring cell if it is available. We anticipate that trains will be in motion for most of the time and therefore reductions in uplink signal quality and throughput will be short lived in most cases.

6.45 By contrast, if the ESN gateway and FRMCS use the same TDD frame structure (fully synchronised), there will be no risk of uplink interference but it could reduce the throughput of both systems. For example, if they both use a 2:2 frame structure (configuration 1) the maximum FRMCS uplink throughput will be limited to 66% of the capacity achieved with configuration 0 (1:3).

6.46 If the proposed licensees wished to further reduce the likelihood of interference should a semi-synchronised approach be adopted, there are a number of additional mitigation measures that could be used. These could include:

- Coordination where possible between ESN gateway use and FRMCS, for example by including location specific operation in the gateway, or through operator cooperation.

[47] We assessed the signal to interference and noise ratios (SINR) required to support the FRMCS uplink traffic, using the link level throughput analysis (truncated Shannon model) specified in 3GPP TR 36.942 Annex A.

This will be applicable in situations where there is an emergency incident on or near a train track involving disruption to rail services.

- Inclusion of contingency frequency band capabilities within the ESN gateway hardware (e.g., to make use of alternative bands from the ESN service provider's own spectrum allocation).
- Use of multicast capabilities in the ESN gateway implementation for group calls to reduce the downlink transmission utilisation (and therefore reducing its typical transmit power) for efficient data sharing and reduced interference.

Question 16: Do you have any comments on the feasibility of the additional mitigation measures we have identified, or additional suggestions for measures that could further reduce the likelihood and/or impact of interference?

Our proposals

6.47 We propose to authorise FRMCS use in 1900–1910 MHz and ESN gateways in 1910–1915 MHz with the technical licence conditions given in Tables 6.2 and 6.3. The 1910–1915 MHz band is not suitable for high power use, and so ESN gateways will be limited to medium power (37 dBm EIRP) in this band.

Table 6.2: Proposed technical licence conditions for FRMCS

Parameter	Requirement
Permitted Frequency Range	1900–1910 MHz
BS Maximum Transmit Power	65 dBm/10 MHz EIRP
BS Baseline requirement outside permitted Frequency range	1920–1980 MHz: -43 dBm/5 MHz 1880–1900 MHz: 20 dBm/5 MHz
Cab radio Maximum output power	31 dBm/10MHz EIRP *
Cab radio maximum unwanted output power outside permitted Frequency Range	1920–1925 MHz: -25dBm/MHz 1925–1980 MHz: -30 dBm/MHz 1880–1900 MHz: -2 dBm/MHz
Railway Mobile Radio Terminal Maximum power	23 dBm/10MHz EIRP *
***Uplink Power control is required for all FRMCS user equipment**	

Table 6.3: Proposed technical licence condition for ESN gateways

Parameter	Requirement	
ESN Gateway permitted frequency range	1910–1915 MHz	
ESN Gateway maximum transmit power within permitted frequency range	37 dBm/5MHz	
ESN Gateway maximum transmit power outside permitted frequencies	1880–1900 MHz	-41 dBm/5 MHz
	1900–1905 MHz	-41 dBm/5 MHz
	1905–1910 MHz	-8 dBm/5 MHz
	1915–1920 MHz	-8 dBm/5 MHz
	1920–1980 MHz	-41 dBm/5 MHz

Source: Ofcom

6.48 We propose not to impose any restrictions on the TDD frame structure that licensees may use to meet their needs. However, to further mitigate the potential for interference from a gateway into FRMCS, licensees could mutually agree a common TDD frame structure for a fully synchronised approach. Our throughput analysis shows that a 2:2 configuration could be a possible compromise.

Question 17: Do you have any comments on our proposed technical licence conditions for FRMCS and ESN gateways?

7. Setting fees for new users of 1900–1915 MHz

Introduction

7.1 As set out in our Strategic Review of Spectrum Pricing ("SRSP") we currently employ three mechanisms for setting fees for rights to use spectrum: cost-based pricing, administered incentive pricing ("AIP") and auctions.

7.2 We charge cost-based fees where there would not be excess demand for the spectrum if those fees were applied. In these instances there is no opportunity cost to other users and we set fees that reflect our spectrum management costs in line with our framework for setting cost-based fees.

7.3 If we decide that there would be excess demand for the spectrum if cost-based fees applied, we typically deploy market mechanisms, such as auctioning the spectrum or setting an AIP based fee.[48]

7.4 In this section, following the approach set out in the SRSP, the first step of our assessment is to consider whether we expect there to be excess demand for the 1900 MHz band from existing and/or feasible alternative users, in future, if cost-based fees were applied. We then consider the approaches to market-based fees and apply our preferred approach (AIPs set using benchmarks) to the spectrum.

Would cost-based fees lead to excess demand for the 1900 MHz band?

7.5 We focus our analysis on 1900–1910 MHz and 1910–1915 MHz, given these are the parts of the band that we are considering authorising and setting fees for at this stage.

7.6 In Section 3 we consider what the optimal use of the band is, given the various potential use cases for it. The question we are considering here is different. The focus is not on what the optimal use is but whether we expect there to be excess demand for the spectrum in future if cost-based fees applied.[49] This is because it is possible to have a clear single optimal use, but still have multiple potential uses competing for the limited available spectrum, creating excess demand.

a) Broadly, we would expect the key characteristics of 1900–1915 MHz to lead to demand for several uses; it is a sub-2 GHz TDD band that can accommodate medium and (in 1900–1910 MHz) high power use cases on a national basis. As set out in Section 3, the potential future use cases include FRMCS,[50] ESN gateways, DECT and utilities.

[48] See Ofcom, Supporting the UK's wireless future: Our spectrum management strategy for the 2020s, paragraph 2.18.
[49] A cost-based licence fee would likely be less than £1,000 per year.
[50] See Section 3 (paragraph 3.5) where we note that FRMCS demand for 1910–1915 MHz is more uncertain than demand for 1900–1910.

7.7 Given the technical characteristics of this spectrum and that there are several potential use cases, we would expect that there would be excess demand if we were to set cost-based fees. This excess demand could arise from:

a) some of the alternative uses of the band set out above. While some of these are more speculative at this stage, we consider they may seek to acquire spectrum to give them the option to deploy in the future even if they do not have an immediate concrete use case if cost-based fees applied; or
b) the proposed users who might wish to increase their holdings of contiguous spectrum. For example, ESN gateways might want access to more than 5 MHz if cost-based fees applied.

7.8 On this basis, we provisionally conclude that cost-based fees are likely to lead to excess demand, and therefore it is appropriate to take a market-based approach.

Question 18: Do you agree with our provisional conclusion that there is likely to be excess demand for the 1900–1915 MHz band, in future, if cost-based fees were applied; and, therefore, that an AIP fee is appropriate? Please provide any evidence to support your position.

Provisional assessment of market value

Introduction

7.9 Having provisionally concluded that a market-based approach to fees is appropriate, the next stage in our assessment is to establish the market value for the band (i.e., the opportunity cost of the spectrum).

7.10 Given a clear optimal use and more uncertain alternative uses, we do not believe it would be proportionate to auction this spectrum. Instead, our objective of efficient spectrum allocation can be achieved using a less resource-intensive approach, and we propose to set an AIP.

7.11 In doing this, we first estimate the value of a national licence. We then consider how to adjust the fees for geographic scope and power levels allowed by the licences. For ESN gateways, the geographic adjustments are needed because the service is due to be rolled out in Great Britain only. For FRMCS, prospective licensees would be able to request a licence covering Great Britain, a licence covering Northern Ireland, or a licence for a smaller, specific geographic area, with varying timescales for deployment.

Our approach to assessing the market value

7.12 There are various alternative approaches to setting AIP:

a) Benchmarking approach – looking at the values of different bands that share some similarities in technical characteristics and application with the 1900 MHz band. Alternatively, looking at international benchmarks, i.e. analysing auction prices in other countries that could be considered as reasonably good comparators.
b) Developing a fee algorithm as set out in our Review of Spectrum Fees for Fixed Links and Satellite Services. Fees algorithms are used for bands shared by different individual licensees and are intended to reflect individual licensees' use of spectrum and incentivise its efficient use. The algorithms can take into account bandwidth, power levels, and location factors, among other things.

7.13 We do not consider that developing a fee algorithm would be appropriate in this case since potential licensees would not have choice over many factors, such as bandwidth.

7.14 Instead, we propose to take a benchmarking approach. By comparing the similarities and differences of those bands (in terms of technical characteristics and uses) with the 1900 MHz band we have sought to infer whether the value of the 1900 MHz band is likely to be higher or lower than that of the different benchmarks. Considering this evidence in the round, we have then reached a provisional view for what we consider to be an appropriate fee level. We recognise that analysing and interpreting such evidence is not always straightforward and involves us exercising our regulatory judgement.

Benchmarking exercise

7.15 In terms of international comparators, we are not aware of any recent auctions of the 1900 MHz band in Europe that could provide an indication of the value of the band.

7.16 In terms of other benchmarks, we note that there are few direct comparisons to the 1900 MHz band, which has the unusual combination of characteristics of being harmonised for mobile use, but with very little equipment available. Despite having been authorised for mobile for over two decades, the band has not had any deployment in the UK. Additionally, the requirement to protect DECT immediately below and FDD mobile immediately above the band imposes some restrictions on what this TDD spectrum can be used for.

7.17 The table below provides a summary of the values of spectrum bands that share some similarities in technical characteristics and application with the 1900 MHz band. We have included bands that were awarded in an auction as well as bands for which we currently charge fees.

7.18 We discuss the benchmarks in more detail below.

Table 7.1: Benchmark fees and implications for 1900 MHz national AIP fees

Frequency (auction date or date fee was last set)	Fee setting method	Current use / technology	Current (or implied) annual fee, per MHz[51]	Implied AIP national fee for 10 MHz
700 MHz SDL *(2021)*	Auction	Mobile	£15.7k	£157k
2.6 GHz (unpaired)[52] **(2013)**	Auction	Mobile	£113k[53]	£1.13m

[51] To calculate the implied annual licence fee we used the auction price adjusted for inflation and applied an annualisation rate (6.38%) consistent with that being proposed in the ALF review.

[52] This was a combinatorial auction and a total of 250 MHz of spectrum was auctioned in the 800MHz and 2.6GHz bands (paired and unpaired).

[53] "There is no uniquely correct way to derive band-specific prices. The figure of more than £6 million per 5 MHz reflects one approach, namely estimating the linear prices that were closest to market-clearing prices". See: Myers, Geoffrey (2023) *Spectrum Auctions: Designing markets to benefit the public, industry and the economy*, London: LSE Press.

Frequency (auction date or date fee was last set)	Fee setting method	Current use / technology	Current (or implied) annual fee, per MHz[51]	Implied AIP national fee for 10 MHz
2 GHz MSS (2009)	AIP	Mobile Satellite Service	£277k[54]	£2.77m
900 MHz (1990s)	AIP	GSM-R	£396k (Based on Business Radio fees)	£3.96m
2.3 GHz (2018)	Auction	Mobile	£418k	£4.18m
2.1 GHz (paired) (2021)	AIP	Mobile	£688k[55]	£6.88m

Source: Ofcom

7.19 To assess the comparability of these benchmarks with the 1900 MHz band, we have considered the extent to which each benchmark is a similar frequency, has similar technical characteristics, and the extent to which there is an equipment ecosystem for public mobile.

7.20 Looking at the different benchmarks we have, we provisionally consider that:

a) the value of the 1900 MHz band is likely to be considerably less than that of both the 2.1 GHz (paired) spectrum and the 2.3 GHz unpaired spectrum. Whilst these are also of similar frequency, both the paired 2.1 GHz and 2.3 GHz bands are mainstream mobile bands with well-established equipment ecosystems. By contrast, a lack of equipment ecosystem has meant that the 1900 MHz band has not been deployed for public mobile in Europe to date and we consider that is unlikely to change in the foreseeable future.

b) the value of the 1900 MHz band is also likely to be considerably less (on a per MHz basis) than the value of the 900 MHz spectrum currently used for GSM-R. This is because the 900 MHz spectrum benefits from greater propagation characteristics (allowing licensees to achieve the same level of coverage with fewer base stations), and because there are likely to be higher value alternative uses of the 900 MHz GSM-R spectrum than 1900 MHz.

c) the value of 1900 MHz is likely to be higher than that of 700 MHz supplementary downlink (SDL). 700 MHz SDL is downlink-only spectrum designed to add capacity to other bands, i.e. it cannot be used on its own and needs to be aggregated with another band to make it useable. The 1900 MHz band, in comparison, is usable on a stand-alone basis since it provides both uplink and downlink. The 700 MHz SDL spectrum sold at reserve price in the 2021 auction and, as far as we are aware, has not yet been deployed.

[54] See "Authorisation of terrestrial mobile networks complementary to 2 GHz mobile satellite systems (MSS)".

[55] In December 2024, we consulted on proposals to revise the ALF for 2100 MHz to £766,000 per MHz.

d) there are similarities between 1900 MHz and unpaired 2.6 GHz spectrum, such that they could have similar values. In particular, both are TDD bands of similar bandwidth. In addition, both have similar power restrictions in the upper part of the band to protect adjacent users. 1900 MHz might be expected to be more valuable on a per MHz basis given its superior propagation characteristics. Although we note there is a developed equipment ecosystem for public mobile in the unpaired 2.6 GHz band, unlike in 1900 MHz, which could make it comparatively more valuable.
e) the fee levels charged for 2 GHz Mobile Satellite Services (MSS) are a useful comparator given it is for a high power non-public mobile use of spectrum close to the 1900 MHz band. In addition, we note that 1900 MHz band could potentially also be used for MSS in the future, as set out in Section 3. The main difference is that the 2 GHz MSS is paired rather than unpaired.

7.21 On this basis, we provisionally consider that the value of 1900 MHz should be greater than £16,000 per MHz (the implied fee based on 700 MHz SDL); considerably less than £396,000 per MHz (the current national fee for GSM-R); and that an appropriate range for the fee is likely to be somewhere between the implied fee based on the unpaired 2.6 GHz auction price and the fee levels charged for a national 2 GHz MSS licence, that is in the range of £113,000 to £277,000 per MHz.

7.22 Considering all these benchmarks in the round, and taking a conservative approach to interpreting the evidence we provisionally conclude that that it would be appropriate to set the fee for this band at a rate of **£150,000 per MHz**, for a UK-wide licence. This lies towards the lower end of the range between the benchmarks for unpaired 2.6 GHz spectrum and 2 GHz MSS spectrum.

Adjusting of fee for geographic area and power levels

7.23 We have set out above a proposed UK-wide fee for the band. We will now consider how to scale this fee by geographic area and how to adjust it for different licence conditions.

Adjusting for geographic area

7.24 The ESN is due to be rolled out in Great Britain. Northern Ireland has its own provision for emergency services communications. The same is true of the rail sector, where Network Rail manages the bulk of rail infrastructure in Great Britain, and Northern Ireland Railways manages Northern Ireland's rail network separately.

7.25 In order to calculate a fee for Great Britain-wide and Northern Ireland-wide licences, we propose to adjust the national fee by population, where Great Britain represents 97.2% of the UK, and Northern Ireland represents 2.8%.[56] Based on our proposed UK-wide fee of £150,000 per MHz, this would result in:

a) a fee of **£145,800 per MHz** for a licence covering Great Britain; and
b) a fee of **£4,200 per MHz** for a licence covering Northern Ireland.

7.26 For the proposed FRMCS licences in 1900–1910 MHz, we also envisage applicants being able to request a licence for a smaller geographic area (than the whole of Great Britain or Northern Ireland) that encompasses a rail network where FRMCS is to be deployed.

[56] Source: ONS, mid-2023 figures.

7.27 We considered three possible approaches to scaling the fee for these smaller licences: population, land mass, and length of route.

a) Whilst we are proposing to use population to adjust the fees from a UK-level to GB-level, our view is that, in this case, when considering smaller geographic areas, scaling the fee based on population has the drawback that spectrum opportunity costs can occur in areas with no residential premises.
b) Both land mass and length of route offer a more straightforward application. However, relying on land mass would require making assumptions about the area covered around the tracks. That is, buffer zones that would be sterilised by railway use of the spectrum.

7.28 We therefore propose scaling the fee based on the overall length of the rail route to be covered by the licence. We propose to use total route length rather than track length, i.e., not double counting tracks that cover the same geographic area. This is because tracks located in close proximity would not sterilise significantly larger areas of spectrum use. Therefore, this would not increase the opportunity cost of spectrum.

7.29 We propose to set the fee for 10,000 miles of route equal to the fee for a licence covering Great Britain of £145,800 per MHz. This is because Network Rail's current route length is approximately 10,000 miles.[57] We then propose to apply a 1% fee increment, i.e. a fee of £1,458 per MHz for every 100 miles of route (rounded up) to be covered by the licence. We propose a licence condition requiring licensees to immediately inform Ofcom if the total route length changes in the manner set out in paragraphs 4.26–4.27.

7.30 Our proposed approach would result in a total fee of **£1,458,000 per year** for a licence covering Great Britain. For a licence covering Northern Ireland, the total fee would amount to **£42,000 per year**. For licences covering the smallest geographic areas (up to 100 miles of route), the total cost would be **£14,580 per year**.

Adjusting for power levels

7.31 We also propose to adjust the fee to reflect differences in power levels allowed by the licence. As set out in paragraph 6.47, the proposed allowable power level in 1910–1915 MHz is significantly lower than in 1900–1910 MHz, i.e., only medium power is permitted in 1910–1915 MHz compared to high power in 1900–1910 MHz. This is to ensure out-of-band emissions above 1920 MHz stay within acceptable levels.

7.32 Due to the limitation on power level, we consider that this part of the band would be less valuable to other users. As such, the opportunity cost will be lower, although by how much is uncertain.

7.33 Our provisional view is that applying a factor of 0.5 would be a reasonable adjustment to reflect the limitations on power in 1910–1915 MHz. This gives a fee of **£72,900 per MHz** for a GB-wide licence in 1910–1915 MHz. Therefore, the total cost of this licence for ESN Gateway would be **£364,500 per year**.

[57] According to the ORR, Network Rail's network is 15,849 km (9,848 miles). See p.9 in the "Rail infrastructure and assets", October 2024.

Summary of fee proposals

7.34 Tables 7.2 and 7.3 below summarise our fee proposals and show the total annual fees payable.

Table 7.2: Summary of fee proposals

Licence area	FRMCS annual licence fee (per MHz)	ESN gateway annual licence fee (per MHz)
National (UK-wide)	£150,000	£75,000
Great Britain	£145,800	£72,900
Northern Ireland	£4,200	-
Smaller FRMCS deployments	£1,458 for every 100 miles of route (rounded up)	-

Source: Ofcom

Table 7.3: Total annual fees payable

Licence area	FRMCS total annual fee for 10 MHz in 1900–1910 MHz	ESN gateway total annual fee for 5 MHz in 1910–1915 MHz
Great Britain	£1,458,000	£364,500
Northern Ireland	£42,000	-
FRMCS deployment of up to 100 miles of route	£14,580	-

Source: Ofcom

Question 19: Do you agree with our approach to fees, including fee level and adjustments? Please provide any evidence to support your position.

8. Next steps

Confirming our approach

8.1 This consultation will be open for responses for 10 weeks, closing on **19 May 2025**.

8.2 After this we will consider responses to this consultation, before publishing our final decision on our approach to authorising new users in the 1900–1920 MHz band.

8.3 We expect to publish a final statement in Q3 2025/2026.

Availability of licences

8.4 If we confirm the proposals we have outlined in this consultation, we would consult on the Limitation Orders, as outlined above, and expect to make licences available for both FRMCS and ESN Gateways following the publication of our statement. Any licences issued would take effect on, or after, 3 April 2029. We will also consult on amending the Wireless Telegraphy (Licence Charges) (Amending) Regulations 2024 in due course.

8.5 Any users who would like to test or trial any developing technologies or devices in this spectrum will be able to apply for Innovation & Trial licences from Ofcom in the usual way. These licences are intended to support testing, demonstrations, and other non-commercial uses of spectrum to support development of new devices and systems. Further information on Innovation and Trial licensing can be found on our website.

A1. Legal framework

Ofcom's general duties

A1.1 Ofcom has a number of duties under the Communications Act 2003 (the "Act") and the Wireless Telegraphy Act 2006 ("WTA"), which are relevant to its spectrum management functions.

A1.2 The Act sets out Ofcom's general duties, including its principal duty to further the interests of citizens in relation to communications matters and to further the interests of consumers in relevant markets, where appropriate by promoting competition.[58] Ofcom is required to secure certain things in the carrying out of its functions. Particularly relevant here are the requirements for Ofcom to secure the optimal use for wireless telegraphy of the electro-magnetic spectrum and the availability of a wide range of electronic communications services throughout the United Kingdom.[59]

A1.3 In performing its duties, Ofcom also has to have regard to a number of factors as it appears relevant in the circumstances, including the desirability of promoting competition and encouraging investment and innovation in relevant markets and the different needs and interests of everyone who may wish to use the spectrum for wireless telegraphy.[60] The Act further provides that Ofcom must in all cases have regard to the principles of transparency, accountability, proportionality, and consistency, as well as ensuring that its actions are targeted only at cases in which action is needed.[61]

A1.4 In carrying out our spectrum functions, we have a duty under the WTA to have regard, in particular, to the extent to which the spectrum is available for use (or further use) for wireless telegraphy, the demand for use of that spectrum for wireless telegraphy and the demand that is likely to arise in future for the use for wireless telegraphy.[62]

A1.5 We also have a duty to have regard, in particular, to the desirability of promoting the efficient management and use of the part of the spectrum available for wireless telegraphy, the economic and other benefits that may arise from the use of wireless telegraphy, the development of innovative services, and competition in the provision of electronic communications services.[63]

UK Government's Statement of Strategic Priorities

A1.6 Under section 2B(2) of the Communications Act, when exercising our functions relating to telecoms, management of radio spectrum and postal services, we are required to have regard to the UK Government's Statement of Strategic Priorities (SSP). The SSP for telecommunications, the management of radio spectrum, and postal services was designated on 29 October 2019, having been laid in draft before Parliament on 18 July 2019.

[58] Section 3(1) of the Act.
[59] Section 3(2) of the Act.
[60] Section 3(4) of the Act.
[61] Section 3(3) of the Act.
[62] Section 3(1) WTA.
[63] Section 3(2) WTA.

The desirability of promoting economic growth

A1.7 In exercising our regulatory functions, we are also required to have regard to the desirability of promoting economic growth (the "growth duty").[64] In particular, we must consider the importance for the promotion of economic growth of exercising the regulatory function in a way which ensures that regulatory action is taken only when it is needed, and any action taken is proportionate. Section 110(3) of the Deregulation Act 2015 requires us to have regard to the "Growth Duty: Statutory Guidance" (revised by Government in May 2024).

Ofcom's licensing regime

A1.8 Under the WTA, and subject to some exceptions, [65] it is unlawful to establish or use a wireless telegraphy station or to install or use wireless telegraphy apparatus, unless under and in accordance with a licence granted by Ofcom (also known as a 'wireless telegraphy licence').[66] Ofcom has the power to grant a wireless telegraphy licence in relation to a particular station or particular apparatus or in relation to any station or apparatus described by the wireless telegraphy licence itself.[67]

A1.9 A wireless telegraphy licence may be granted by Ofcom subject to such terms, provisions, and limitations as Ofcom thinks fit.[68] In the case of a wireless telegraphy licence to establish a station, the limitation may in particular include limitations to position and nature of the station, the purpose for which the circumstances in which and the person by whom the station may be used and the apparatus that may be installed or used in the station.[69]

A1.10 In the case of other licences the limitations may, in particular, include limitations to the apparatus that may be installed or used and the places where, the purpose for which, the circumstances in which and the persons by whom the apparatus may be used.[70]

A1.11 Ofcom has the power to impose terms, provisions and limitations to the extent that it is satisfied that these are: [71]

- objectively justifiable in relation to the networks and services to which they relate;
- are not such to unduly discriminate against particular persons or a description of persons;
- proportionate to what we want to achieve; and
- transparent in relation to what they are intended to achieve.

[64] Section 108 of the Deregulation Act 2015, which was extended to Ofcom's regulatory functions by The Economic Growth (Regulatory Functions) (Amendment) Order 2024.
[65] Exceptions include the use of a television receiver for receiving a television programme or the installation of a television receiver for use solely for that purpose (section 8(2) WTA). Ofcom may also make regulations which exempt the establishment, installation or use of wireless telegraphy stations or wireless telegraphy apparatus from the requirement of having a licence (section 8(3) WTA).
[66] Section 8 WTA.
[67] Section 9(5) WTA.
[68] Section 9(1) WTA.
[69] Section 9(2) WTA.
[70] Section 9(3) WTA.
[71] Section 9(7) WTA.

Granting an order to impose limitations on the number of licensees

A1.12 If Ofcom decides it is appropriate to impose limitations on the use of particular frequencies for the purpose of securing the efficient use of the electromagnetic spectrum, Ofcom must make an order imposing the limitations.[72] An order may:[73]

a) specify frequencies for the use of which Ofcom will grant or make only a limited number of wireless telegraphy licences and grants of recognised spectrum access; and/or

b) specify uses for which, on specified frequencies, Ofcom will grant or make only a limited number of wireless telegraphy licences and grants of recognised spectrum access.

A1.13 The order must also set out the criteria which Ofcom will apply in determining:[74]

a) the limit on the number of wireless telegraphy licences and grants of recognised spectrum access to be granted or made for the specified frequencies or uses;

b) the persons to whom licences will be granted or grants of recognised spectrum access made.

A1.14 In setting these criteria, Ofcom must be satisfied that they are objectively justifiable, do not unduly discriminate, and are proportionate and transparent.[75]

Ofcom's powers to set fees

A1.15 Under section 12 of the WTA, Ofcom has power to require licensees to pay fees to Ofcom on the grant of a licence and subsequently at such times during the licence term.[76] The requirement to pay fees at times after the grant of a licence must be imposed by way of regulations made by Ofcom.[77] The timing of the fee payment must be set out in the regulations,[78] and the amount of the fee can be prescribed in the regulations, or alternatively the regulations may provide for the amount to be determined by Ofcom in accordance with the regulations.[79]

A1.16 Section 13 of the WTA provides that Ofcom can set fees at an amount that is higher than the cost to us of carrying out our radio spectrum functions, if we think that is appropriate, in particular in light of our statutory duties in section 3 of the WTA.[80]

A1.17 Section 122 of the WTA is a general provision about matters relating to Ofcom's powers to make statutory instruments (including fees regulations under section 12 of that Act). It includes a requirement that where we are proposing to make regulations we must publish

[72] Section 29(1) WTA.
[73] Section 29(2) WTA.
[74] Section 29(3) WTA
[75] Section 29(4) WTA.
[76] Section 12(1) WTA.
[77] Section 12(1)(b) WTA.
[78] Section 12(1)(b) WTA.
[79] Section 12(2) WTA.
[80] Section 13(2) WTA.

a notice setting out the general effect of the regulations[81] and give a period of at least one month within which representations on the proposed regulations may be made to us.[82]

[81] Section 122(5) WTA.
[82] Section 122(6) WTA.

A2. Legal duties and impact assessments

Our duties under the Act and the WTA

A2.1 In formulating our proposals, we have taken account of our general duties under the Act and the WTA, as set out in Annex A1, and we consider that our proposals are consistent with these duties. Section 3 ("Optimal use of the 1900 MHz band"), Section 4 ("Authorising use of 1900–1910 MHz") and Section 5 ("Authorising use of 1910–1915 MHz") set out our detailed reasoning of how these duties are met.

A2.2 We have also had regard to our growth duty. In particular, we believe that enabling the deployment of a modern operational communications system for the rail network (FRMCS) will support the efficient running of the railways, which will be conducive to economic growth.

A2.3 We also have had regard to the Government's Statement of Strategic Priorities (SSP) in developing our proposals.

Impact assessment

A2.4 Section 7 of the Communications Act requires us to carry out and publish an assessment of the likely impact of implementing a proposal which would be likely to have a significant impact on businesses or the general public, or when there is a major change in Ofcom's activities.

A2.5 More generally, impact assessments form part of good policy making, and we therefore expect to carry them out in relation to a large majority of our proposals. We use impact assessments to help us understand and assess the potential impact of our policy decisions before we make them. They also help us explain the policy decisions we have decided to take and why we consider those decisions best fulfil our applicable duties and objectives in the least intrusive way. Our impact assessment guidance sets out our general approach to how we assess and present the impact of our proposed decisions.

A2.6 The relevant duties in relation to the proposals on which we are consulting on are set out in Annex A1, "Legal framework". Below we discuss the impact of the proposals set out in this consultation.

Authorising 1900–1915 MHz for FRMCS and ESN Gateway use

A2.7 We are proposing to authorise use of 1900–1910 MHz for FRMCS (see Section 4) and 1910–1915 MHz for ESN Gateway use (see Section 5) from 3 April 2029.

A2.8 As explained in Section 3, we provisionally consider that these are the optimal uses of this spectrum, and as such will deliver the greatest benefits to citizens and consumers compared to the counterfactual of allocating this spectrum to alternative uses.

A2.9 The proposed spectrum allocations will support ESN gateways and operational rail communication networks, such as FRMCS, that provide services of high social and economic value to UK consumers and citizens. In the case of ESN gateways, there is

potential for this service to be especially valuable to vulnerable consumers and those living in rural areas, as set out in Section 3. Additionally, aligning with European harmonisation of the band for operational rail use means UK rail infrastructure managers will have access to a wider equipment ecosystem compared to the counterfactual of allocating different frequencies to FRMCS.

Impact on existing users of adjacent spectrum

A2.10 We have considered the potential impact of our proposed authorisations on existing users of adjacent spectrum. As explained in Section 6, adjacent spectrum is used by DECT services in 1880–1900 MHz and mobile users in the paired spectrum in 1920–1980 MHz.

A2.11 We have proposed technical licence conditions for FRMCS in 1900–1910 MHz that will limit the risk of harmful interference to the existing users of adjacent spectrum, by following internationally agreed harmonised recommendations. Existing mobile licensees using 1920–1980 MHz may need to upgrade at least some of their network deployments to adopt enhanced receiver selectivity to facilitate coexistence with FRMCS.

A2.12 We have also proposed to limit the maximum transmit power (EIRP) of ESN Gateways to a medium power level in 1910–1915 MHz. This condition will allow licensees to provide the necessary coverage to ESN users while limiting the risk of harmful interference to the users of adjacent spectrum.

A2.13 Overall, we consider that our proposals will limit or mitigate any potential impact on existing users of adjacent spectrum while still providing the necessary coverage and benefits to rail and ESN users.

Impact of proposed licence conditions

A2.14 We have considered the potential impacts of our proposed licence conditions.

FRMCS: Non-exclusive licence with requirement to coordinate

A2.15 Our proposal is to allow multiple FRMCS licensees to operate in the same geographic area and to require them to co-ordinate with each other in areas of overlapping or adjacent use. We recognise that this co-ordination will impose a cost on these licensees. However, we also note that there are already established processes for cooperation within the rail industry. We consider that these costs will be outweighed by the benefits of limiting interference between users and is preferable to the alternative of restricting access to the spectrum to one FRMCS licensee in any given geographic location. In particular, we consider that our proposed approach, by preventing any licensee from acquiring exclusive access to the band in a given area, mitigates against any negative competition impact that could arise from such exclusivity.

Power limits on 1910–1915 MHz

A2.16 We consider that the benefits of the proposed power limitations in 1910–1915 MHz outweigh the costs of potential interference to existing users in the adjacent 1920–1980 MHz. In particular, we consider that (i) the ESN Gateway will be able to operate effectively at the proposed power levels such that there would be limited additional benefit to relaxing those restrictions; and (ii) given the valuable use of the 1920–1980 MHz spectrum for public mobile services the potential negative impact of any interference could be large.

Licence duration and revocation

A2.17 We propose for the FRMCS licences to be indefinite, subject to a five-year revocation period. We consider that, in this case, this is preferable to a shorter licence period as it

provides rail infrastructure managers with a degree of certainty as to future access to the band which is likely to have a positive impact on investment.

A2.18 We propose to limit the availability of ESN gateways licences to any provider that is contracted by Government to provide ESN gateways, and to set a licence term the same length as that contract. We are also proposing a clause in the licence which would enable Ofcom to revoke the licence, with immediate effect, if that Government contract is terminated (see paragraph 5.14). These conditions have the effect of ensuring that potential future holders of the Government contract to provide ESN gateways will be able to access 1910–1915 MHz.

A2.19 We consider this approach will have a positive impact on competition for the provision of ESN gateways to Government compared to the counterfactual of allocating the spectrum directly to the current holder of the contract to provide ESN gateways without additional restrictions. This approach removes the risk that alternative providers of ESN gateways would be at a competitive disadvantage in any future Government tender process because they did not have access to the 1910–1915 MHz spectrum.

A2.20 Linking the ESN Gateway licence to the contract to provide ESN gateways in this way means that Ofcom does not directly determine the licence duration. This could lead to the risk that too short a licence duration negatively impacts on the licensee's incentives to invest. In practice, this is unlikely to be the case because the Government and future licensees will likely take such factors into consideration when negotiating the contract duration.

Fees

A2.21 We propose to set fees that reflect our view of the market value of spectrum.[83] By setting fees at this conservative level we aim to replicate the price signal licensees would receive in a well-functioning market for spectrum, which would encourage licensees to consider the opportunity cost of spectrum. In general terms, as set out in the Strategic Review of Spectrum Pricing (SRSP), benefits to society will be maximised over time if spectrum is priced to reflect opportunity cost.

A2.22 We propose to adjust the fees to reflect the geographic scope of the licence and the power levels allowed. The applicants for FRMCS licences will be required to self-report the length of their rail routes covered by the FRMCS licence, and inform Ofcom immediately if their total route length changes in the way outlined in paragraphs 4.26–4.27 above. We consider that this approach is proportionate and ensures low administrative burden on the licensees.

A2.23 We consider that setting fees for 1900–1915 MHz spectrum at the proposed level will secure and further the performance of our general duties (within the meaning the legal framework set out in Annex A1).

Equality impact assessment

A2.24 We have given careful consideration to whether our proposal will have a particular impact on persons sharing protected characteristics (broadly including race, age, disability, sex, sexual orientation, gender reassignment, pregnancy and maternity, marriage and civil

[83] See Strategic Review of Spectrum Pricing (December 2010) and Review of Ofcom's market-based approach to mobile spectrum management (January 2024).

partnership and religion or belief in the UK and also dependents and political opinion in Northern Ireland), and in particular whether they may discriminate against such persons or impact on equality of opportunity or good relations. This assessment helps us comply with our duties under the Equality Act 2010 and the Northern Ireland Act 1998.[84]

A2.25 Due to the nature of our proposals, we do not consider that our proposals will affect any specific groups of persons (including persons that share protected characteristics under the 2010 Act or the 1998 Act) differently to the general population.

Welsh language

A2.26 Ofcom is required to take Welsh language considerations into account when formulating, reviewing, or revising policies which are relevant to Wales (including proposals which are not targeted at Wales specifically but are of interest across the UK).

A2.27 We do not consider our proposals have any impact on opportunities for persons to use the Welsh language or treating the Welsh language no less favourably than the English language.

[84] Further detail is set out in section 149 of the Equality Act 2010 and section 75 of the Northern Ireland Act 1998.

A3. Responding to this consultation

How to respond

A3.1 Ofcom would like to receive views and comments on the issues raised in this document, by 5pm on 1 May 2025.

A3.2 You can download a response form from https://www.ofcom.org.uk/spectrum/frequencies/future-authorisation-of-the-19001920-mhz-band/. You can return this by email or post to the address provided in the response form.

A3.3 If your response is a large file, or has supporting charts, tables or other data, please email it to 1900futureuse@ofcom.org.uk, as an attachment in Microsoft Word format, together with the cover sheet. This email address is for this consultation only and will not be valid after 19 May 2025.

A3.4 Responses may alternatively be posted to the address below, marked with the title of the consultation:

Future of 1900 MHz Team
Ofcom
Riverside House
2A Southwark Bridge Road
London SE1 9HA

A3.5 We welcome responses in formats other than print, for example an audio recording or a British Sign Language video. To respond in BSL:

- send us a recording of you signing your response. This should be no longer than 5 minutes. Suitable file formats are DVDs, wmv or QuickTime files; or
- upload a video of you signing your response directly to YouTube (or another hosting site) and send us the link.

A3.6 We will publish a transcript of any audio or video responses we receive (unless your response is confidential)

A3.7 We do not need a paper copy of your response as well as an electronic version. We will acknowledge receipt of a response submitted to us by email.

A3.8 You do not have to answer all the questions in the consultation if you do not have a view; a short response on just one point is fine. We also welcome joint responses.

A3.9 It would be helpful if your response could include direct answers to the questions asked in the consultation document. The questions are listed at Annex A6. It would also help if you could explain why you hold your views, and what you think the effect of Ofcom's proposals would be.

A3.10 If you want to discuss the issues and questions raised in this consultation, please contact the Future of 1900 MHz Team by email to 1900futureuse@ofcom.org.uk.

Confidentiality

A3.11 Consultations are more effective if we publish the responses before the consultation period closes. This can help people and organisations with limited resources or familiarity with the issues to respond in a more informed way. So, in the interests of transparency and good regulatory practice, and because we believe it is important that everyone who is interested in an issue can see other respondents' views, we usually publish responses on the Ofcom website at regular intervals during and after the consultation period.

A3.12 If you think your response should be kept confidential, please specify which part(s) this applies to and explain why. Please send any confidential sections as a separate annex. If you want your name, address, other contact details or job title to remain confidential, please provide them only in the cover sheet, so that we don't have to edit your response.

A3.13 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and try to respect it. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A3.14 To fulfil our pre-disclosure duty, we may share a copy of your response with the relevant government department before we publish it on our website.

A3.15 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's intellectual property rights are explained further in our Terms of Use.

Next steps

A3.16 Following this consultation period, Ofcom plans to publish a statement in Q3 2025/2026.

A3.17 If you wish, you can register to receive mail updates alerting you to new Ofcom publications.

Ofcom's consultation processes

A3.18 Ofcom aims to make responding to a consultation as easy as possible. For more information, please see our consultation principles in Annex A4.

A3.19 If you have any comments or suggestions on how we manage our consultations, please email us at consult@ofcom.org.uk. We particularly welcome ideas on how Ofcom could more effectively seek the views of groups or individuals, such as small businesses and residential consumers, who are less likely to give their opinions through a formal consultation.

A3.20 If you would like to discuss these issues, or Ofcom's consultation processes more generally, please contact the corporation secretary:

Corporation Secretary
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA
Email: corporationsecretary@ofcom.org.uk

A4. Ofcom's consultation principles

Ofcom has seven principles that it follows for every public written consultation:

Before the consultation

A4.1 Wherever possible, we will hold informal talks with people and organisations before announcing a big consultation, to find out whether we are thinking along the right lines. If we do not have enough time to do this, we will hold an open meeting to explain our proposals, shortly after announcing the consultation.

During the consultation

A4.2 We will be clear about whom we are consulting, why, on what questions and for how long.

A4.3 We will make the consultation document as short and simple as possible, with an overview of no more than two pages. We will try to make it as easy as possible for people to give us a written response.

A4.4 We will consult for up to ten weeks, depending on the potential impact of our proposals.

A4.5 A person within Ofcom will be in charge of making sure we follow our own guidelines and aim to reach the largest possible number of people and organisations who may be interested in the outcome of our decisions. Ofcom's Consultation Champion is the main person to contact if you have views on the way we run our consultations.

A4.6 If we are not able to follow any of these seven principles, we will explain why.

After the consultation

A4.7 We think it is important that everyone who is interested in an issue can see other people's views, so we usually publish the responses on our website at regular intervals during and after the consultation period. After the consultation we will make our decisions and publish a statement explaining what we are going to do, and why, showing how respondents' views helped to shape these decisions.

A5. Consultation coversheet

Basic details

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

Confidentiality

Please tick below what part of your response you consider is confidential, giving your reasons why

- Nothing ☐
- Name/contact details/job title ☐
- Whole response ☐
- Organisation ☐
- Part of the response ☐

If you selected 'Part of the response', please specify which parts:

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

Yes ☐ No ☐

Declaration

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom aims to publish responses at regular intervals during and after the consultation period. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name Signed (if hard copy)

A6. Consultation questions

Question 1: Do you agree with our analysis of potential demand for the 1900 MHz band? Are you aware of any other potential demand for this spectrum, including any demand specific to Northern Ireland?

Question 2: Do you agree with our identification of FRMCS as the optimal use of the 1900–1910 MHz spectrum?

Question 3: Do you agree with our identification of ESN Gateways as the optimal use of the 1910–1915 MHz spectrum in Great Britain? Do you agree that it is too early to identify an optimal use of the 1910–1915 MHz spectrum in Northern Ireland at present?

Question 4: Are you aware of any low power use cases suitable for the 1915–1920 MHz spectrum?

Question 5: Do you have any comments on our proposed authorisation approach for FRMCS?

Question 6: Do you have any views on our proposed non-technical conditions for the new FRMCS licence?

Question 7: Do you have any views on our proposed licensing process for the FRMCS licence?

Question 8: Are you aware of any uses that can coexist with FRMCS without creating a risk of harmful interference? If so, please provide evidence.

Question 9: Do you agree with our proposed approach for authorising ESN gateways in 1910–1915 MHz?

Question 10: Do you have any views on our proposed non-technical licence terms for the ESN gateways licence?

Question 11: Do you have any views on our proposed licensing process for the ESN gateway licence?

Question 12: Are you aware of any uses that can coexist with ESN Gateways without causing risk of harmful interference? If so, please provide evidence.

Question 13: Do you have any comments on our assessment of the coexistence of FRMCS in 1900–1910 MHz with existing DECT and FDD uplinks?

Question 14: Do you have any comments on our assessment of the coexistence of ESN Gateways in 1910–1915 MHz with existing DECT and FDD uplinks?

Question 15: Do you have any comments on our assessment of the coexistence of ESN Gateways in 1910–1915 MHz with FRMCS in 1900–1910 MHz?

Question 16: Do you have any comments on the feasibility of the additional mitigation measures we have identified, or additional suggestions for measures that could further reduce the likelihood and/or impact of interference?

Question 17: Do you have any comments on our proposed technical licence conditions for FRMCS and ESN gateways?

Question 18: Do you agree with our provisional conclusion that there is likely to be excess demand for the 1900–1915 MHz band, in future, if cost-based fees were applied; and, therefore, that an AIP fee is appropriate? Please provide any evidence to support your position.

Question 19: Do you agree with our approach to fees, including fee level and adjustments? Please provide any evidence to support your position.

A7. Draft licences for FRMCS and ESN gateways

The draft licences can be found on the Ofcom website:

- Draft ESN licence template
- Draft FRMCS licence template