Expanding Access to Shared Spectrum

Statement and further consultation on enhancing the Shared Access Licence Framework

Statement and Consultation

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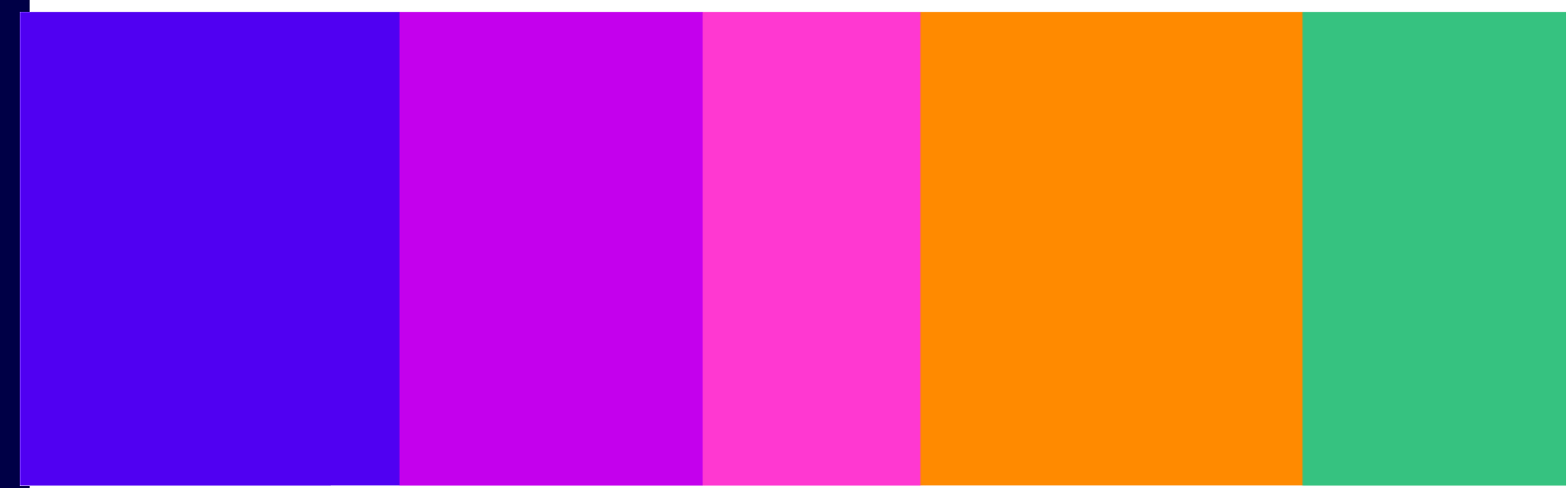

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1. Overview

1.1 We want to support continued growth in innovative spectrum uses, by improving stakeholders' access to shared spectrum and providing a platform for the economic and consumer benefits that new wireless services can unlock.

1.2 In 2019, Ofcom recognised emerging demand from new and existing stakeholders for direct access to spectrum, on a localised basis, in bands with existing or developing ecosystems for mobile equipment. We launched our Shared Access framework to enable that access and support innovative new services.

1.3 Shared Access has opened opportunities for new private networks for the logistics industry, connected rural communities with high-speed broadband and has supported the broadcast of major events such as the King's Coronation.

1.4 As the Shared Access market evolves and new opportunities arise, we want to ensure our framework offers users the best opportunities to access the spectrum, and the freedom to innovate.

1.5 Having sought stakeholder input on our approach over the last year, this document sets out the decisions we are taking to update our framework. We have refined our approach to coexistence and sharing between users to increase spectrum supply, are providing more deployment flexibility to users, and giving more businesses the chance to share the spectrum across the UK.

1.6 We are also consulting on further proposals that build on this new coordination and sharing approach to offer even more flexibility and new opportunities in the future.

What we have decided – in brief

To increase the availability of spectrum, and enable new use cases, we are taking the following steps:

- **Updating our coordination approach to improve spectrum supply across the UK:**

  - In the 3.8-4.2 GHz band, we are taking steps to significantly reduce separation distances between Shared Access users. In combination with an updated approach to coordinating with UK Broadband, and new Building Entry Loss assumptions, this will increase access to the spectrum required to deliver innovative new services.
  - Across all Shared Access bands, we are also improving users' ability to access and share spectrum. We will now allow users to include antenna details in our coordination process to support more sharing, and free up applicants to make their own local coordination agreements.

- **Liberalising our rules for sharing to support the development of new use cases**. We will increase by 3 dB the maximum power limit of our 'Low Power' product in 3.8-4.2 GHz, supporting wider coverage and lessening deployment challenges. We are also removing a requirement to maintain records for mobile terminals connected to Low Power indoor base stations in the 3.8-4.2 GHz band (the

'Terminal Registration Requirement (TRR)'), enabling more 'neutral host' style solutions.

- **Making more spectrum available by adding 2320-2340 MHz to the framework**. This new spectrum will be available for Low Power indoor use only, reflecting the sharing arrangements we have provisionally agreed with the Ministry of Defence to protect its uses (subject to final steps in MOD's due diligence process).
- **Increasing responsiveness and predictability for many Shared Access applications**. A clear and simple 'premises sterilisation test' will streamline decisions for exception requests in 3.8-4.2 GHz and 1800 MHz (to authorise use of Medium Power in urban areas and non-standard antenna heights). We will also publish new spectrum availability maps to help users make more informed applications. Finally, we are continuing to work with our spectrum management system supplier to support online applications for Shared Access licences later this year.

In combination, these changes will significantly increase the availability of spectrum. As a result of this improved supply and consultation feedback, we will not proceed with our proposals to increase prices on our existing Shared Access products in 3.8-4.2 GHz.

What we are proposing – in brief

Respondents to the consultation indicated a desire for additional flexibility to offer services beyond what we had proposed. In response we are proposing additional measures:

- **Providing users with more freedom to operate at Medium Power in most urban areas** (in the 1800 MHz and 3.8-4.2 GHz bands, and at heights up to 10m). Whilst we would retain the exceptions process to match demand and supply in the busy Greater London area, applicants for Medium Power in other urban areas would no longer need exceptions. As many exception requests are for Medium Power, this should streamline the application process for many users.
- **Encouraging efficient use through a new price point for Medium Power deployments in urban areas that is twice the price of Low Power** (i.e. moving to £160/10 MHz in 3.8-4.2 GHz, and to £160 for 2 x 3.3 MHz in the 1800 MHz band). This is to encourage users to use Low Power where this is sufficient for their needs.
- **Enabling new business models by removing the Terminal Registration Requirement for mobile terminals connected to Low Power outdoor base stations** in the 3.8-4.2 GHz band. This would build on our decision to remove this requirement indoors and support new 'campus' style networks and local mobile capacity enhancements.

Next Steps on Implementation

1.7 We are now moving to implement our decisions, with a pipeline of activity over the coming months. Some of the decisions can be implemented immediately, whilst some will require us to update our licensing and coordination software, so will take longer to bring online. We are finalising plans with our spectrum management software provider and are aiming for most of today's updates to be available by the end of the year, as set out in Table 1 below.

Table 1: Overview of planned implantation pipeline

Changes we are making today	Lifting the TRR for Low Power indoor base stations in 3.8-4.2 GHz for new licensees (with variations available on request for existing users).
	Simplified 'exceptions' process, with a transparent premises sterilisation test for 3.8-4.2 GHz and 1800 MHz.
	More sharing opportunities through a User-Led coordination option.
Changes to be made in Q4 2024[1]	Publish new, searchable spectrum availability maps for 3.8-4.2 GHz.
	More flexibility for users with a power increase in 3.8-4.2 GHz for new Low Power licensees.
	Variations proposed for all existing 3.8-4.2 GHz licensees to include the Low Power increase and removal of the TRR indoors.
	Updated Coordination Approach for 3.8-4.2 GHz, including: - moving to base station to terminal coordination - updated BEL assumptions - new adjacent channel coordination with UK Broadband.
Changes to be made in Q1 2025	Increase spectrum supply by adding more 2.3 GHz spectrum to the framework (subject to final MOD approvals).
	New option for all bands to select from a library of antenna envelopes to inform coordination decisions.
Changes subject to consultation	Permitting Medium Power in urban areas without requiring an 'exception' in 3.8-4.2 GHz and 1800 MHz (at heights up to 10m).
	Removal of TRR for Low Power outdoor base stations in 3.8-4.2 GHz.

1.8 We set out further details on our decisions and proposals, and the reasoning behind them, in the remainder of this document.

[1] By which we mean the fourth quarter of the calendar year.

2. Introduction

2.1 Spectrum sharing is a key part of Ofcom's strategy for spectrum management. In 2019, we recognised emerging demand from new and existing stakeholders for direct access to spectrum, on a localised basis, in bands with existing or developing ecosystems for mobile equipment.

2.2 We envisaged that the Shared Access framework - and the different opportunities offered across a range of bands - could support a broad set of potential use cases, from new private networks for industrial connectivity to Fixed Wireless Access for rural broadband.

2.3 We made spectrum available to support this diverse mix of potential users across 4 frequency bands: 1800 MHz, 2.3 GHz, 3.8-4.2 GHz and 26 GHz.[2] We introduced a mix of Low Power and Medium Power products across these bands, with cost-based fees (that increase with bandwidth). We also provided an 'exceptions' process for users to request non-standard products, where they would not significantly impact opportunities for other users.

2.4 This mix of spectrum options gives users the opportunity to design their own networks and tailor solutions to their needs, such as specific latency and reliability requirements. Dedicated spectrum access can support very high bandwidth applications and meet stringent quality of service requirements in a way other models may not.[3]

[2] We confirmed our decision to add additional spectrum to the framework at 26 GHz (including for outdoor and medium power use), and at 40 GHz, in September 2023. We expect the new 26 GHz spectrum to be available shortly.

[3] We note that there are a range of different models that can provide good quality local connectivity and that other solutions (for example WiFi or IoT) can also be suitable depending on the specific user needs.

Figure 1: Illustration of Shared Access Use Cases and Core Product Rules from 2019 (conditions highlighted in orange are subject to change following this statement and consultation)

	Low Power[4]	Medium Power Rural	Medium Power Urban
1.8 GHz	24 dBm per carrier Outdoor Antenna up to 10m	42 dBm per carrier Antenna up to 10m	Exception Only
2.3 GHz	24 dBm per carrier Indoor only	NA	NA
3.8-4.2 GHz	24 dBm for carriers up to 20 MHz Outdoor Antenna Up to 10m	42 dBm for carriers up to 20 MHz No height Limit	Exception Only
26 GHz	23 dBm per 200 MHz Indoor Only	NA	NA

2.5 We launched a review in May 2023 to consider how the framework could be improved to enable greater access to spectrum and meet evolving stakeholder needs. We were particularly mindful that in busy locations in the 3.8-4.2 GHz band there had been occasions where spectrum supply could not meet stakeholder demands.

An evolving ecosystem

2.6 In parallel to this review, we are also seeing significant developments across the regulatory environment and industry that could affect future demand and growth. In particular,

[4] All power levels listed are EIRP (equivalent isotropically radiated power), except for 26 GHz which is expressed as TRP (total radiated power).

discussions have continued in CEPT[5] to look at harmonising shared use of the 3.8-4.2 GHz band in Europe, with new proposals now subject to an ongoing consultation[6]. This could improve equipment availability and lower deployment costs in the coming years. Since our November Consultation[7], the UK Government has announced further funding for innovative 'proof of concept' uses of wireless technology, which is driving new interest in Shared Access.[8] New 'spectrum sandbox' projects have also been announced. These will explore enhanced sharing solutions that could enable an increased number of users and use cases to access spectrum on a localised basis.[9]

2.7 We have also been monitoring overall demand for Shared Access licences over this period. Through late 2023 and the first half of 2024, we have seen a reduction in the total number of Shared Access licences, particularly in 1800 MHz and 3.8-4.2 GHz. However, we note that these reductions are largely the result of a small number of users changing their approach, rather than widespread changes in demand.[10]

Table 2: Overview of current licence volume across Shared Access bands[11]

	1800 MHz	2.3 GHz	3.8-4.2 GHz	26 GHz	Total
Low Power	227	29	176	1	433
Medium Power	122	-	320	-	442
Total Live Licences	**349**	**29**	**496**	**1**	**875**

2.8 This continuing evolution in demand is reflected in a steady flow of new requests for Shared Access licences from a mix of different users in recent months, as shown in Table 3 below.

Table 3: Overview of current monthly demand (in issued licences) across Shared Access bands

	1800 MHz	2.3 GHz	3.8-4.2 GHz	26 GHz	Total
Average Issued Monthly[12]	14	1	24	0	39

[5] The European Conference of Postal and Telecommunications Administrations

[6] ECC, Draft ECC Decision (24)01: "Harmonised technical conditions for the shared use of the 3.8-4.2 GHz frequency band by low/medium power terrestrial wireless broadband systems (WBB LMP) providing local-area network connectivity, 2024

[7] Ofcom, Supporting increased use of shared spectrum (ofcom.org.uk), 2023

[8] Department of Science, Innovation and Technology, 5G Innovation Regions: Successful Regions

[12] Based on the average of new licences per month between the beginning of January and end of May 2024.

2.9 Through our review, we want to support these existing users and put our framework on a footing that supports a greater density of use in the future.

Our approach to this review

Policy Objectives

2.10 We want to facilitate innovation and growth and ensure the optimal use of the spectrum by providing opportunities for an increasing set of use cases and business models. To do this we have explored options to increase the available spectrum supply by updating our coordination approach. We have focused particularly on how to ensure as many users as possible can access the spectrum while managing the risk of interference.[13] To enable this innovation and growth, we also want to maintain a simple, user-friendly and relatively low-cost process to access the spectrum.

Consultation position and summary of stakeholder feedback

The proposals we consulted on – in brief

2.11 Our November Consultation focussed mainly on the 3.8-4.2 GHz band (where we have observed the greatest demand) whilst also considering wider opportunities to update the framework. Significant proposals included:

- Improving spectrum supply across the UK. by updating our coordination approach in the 3.8-4.2 GHz band, to allow more users to innovate in this spectrum.
- Supporting the development of new use cases and liberalising our rules for sharing, by:
  - increasing the allowed transmit power for Low Power users in 3.8-4.2 GHz and;
  - removing the Terminal Registration Requirement (TRR) for Low Power indoor base stations in 3.8-4.2 GHz.[14]
- Encouraging efficient spectrum sharing by a potential new approach to pricing in the 3.8-4.2 GHz band, with illustrative fees to address early indications of spectrum scarcity.

[10] For example, the large reduction in 1800 MHz licences has resulted almost entirely from BT EE surrendering licences supporting BT One Phone. These were legacy licences that predated the Shared Access framework. In 3.8-4.2 GHz, we understand that a significant proportion of surrendered licences in the last year relate to equipment upgrades (where older equipment had required multiple licenses for individual sites).
[11] Data retrieved from Ofcom licensing database on 28th May 2024.
[12] Based on the average of new licences per month between the beginning of January and end of May 2024.
[13] This is in line with our 2019 spectrum strategy commitment to enable more sharing, supported by proportionate interference protection for licensees. See Ofcom, Supporting the UK's Wireless Future: our spectrum management strategy for the 2020s (2021), pg 16.
[14] Through this document we use TRR to refer to the requirement placed on licensees to keep a record of the address at which mobile/nomadic terminals connecting to a base station in the 3.8-4.2 GHz band will be used.

2.12 We also set out our roadmap to move the application process for Shared Access online, to update the propagation model we use for coordination in all these bands and provide new maps to help applicants understand spectrum availability. We currently expect to bring the Shared Access application process online by Q4 2024, and will begin coordinating with the updated propagation model ITU-R P.452-18 at the same time. We are publishing updated maps as part of this document (see Figure 2 and Annex 8), and expect to make more searchable information available on our website later this year.

Overview of themes in Stakeholder Responses

2.13 We received 26 responses to our consultation, covering a diverse range of stakeholders. This included mobile equipment vendors, PMSE suppliers, mobile network operators, fixed wireless access operators and operators of Satellite Earth Stations.

2.14 Whilst stakeholders expressed a wide range of views, a majority were broadly supportive of our proposals to improve coordination. Some concerns were expressed about our intention to assume that users' transmissions were synchronised when coordinating them, with several stakeholders seeking to better understand the impacts where users are not in reality synchronised. The adoption of extra antenna details and implementing a 'User-Led' coordination route received very strong support.

2.15 Most respondents also expressed positive views on our proposals to provide greater flexibility for users by liberalising our Shared Access rules. Some respondents were eager for Ofcom to consider going further, for instance by allowing further increases to the maximum allowed transmit power for the Low Power product, liberalising access to Medium Power in urban areas, or removing the TRR outdoors. The most common concerns were around risks to incumbent users, particularly if new sharers were operating at higher power, or in greater volume.

2.16 There was predominantly negative feedback to our proposal to increase fees. Whilst a small number of respondents recognised the potential for pricing measures to play a role in managing access, many considered it was too early in the development of Shared Access to do so now. There was particularly strong concern expressed about the potential for Medium Power urban licences to rise to £10,000 (for 100 MHz assignments). Several respondents noted our intention to review our final position in light of the impact of our decision on a new coordination approach.

2.17 The decisions we are taking today are set to increase spectrum supply, provide greater clarity for users and increased deployment flexibility. In light of this, we are setting out new consultation proposals to further liberalise opportunities for users and support more growth and innovation, especially in the 3.8-4.2 GHz spectrum.[15]

[15] We also note that a separate consultation on UK Broadband's licence conditions in 3.9 GHz published on 21st May 2024 includes additional proposals that could allow more sharing between Shared Access users and UK Broadband in the future. We will provide an update on these issues when we make our statement on this.

Ofcom's duties

2.18 Ofcom's statutory powers and duties in relation to spectrum management are set out primarily in the Communications Act 2003 (the "2003 Act") and the Wireless Telegraphy Act 2006 ("WT Act").

Communications Act 2003

2.19 Our principal duties under the 2003 Act are to further the interests of citizens and consumers in respect to communications matters, where appropriate by promoting competition. In doing so, we are also required (among other things) to secure the optimal use of spectrum and the availability throughout the United Kingdom of a wide range of electronic communications services.

2.20 When carrying out our spectrum management duties we must have regard to:

i) the desirability of promoting competition in relevant markets;
ii) the desirability of encouraging investment and innovation in relevant markets;
iii) the different needs and interests, so far as the use of the electro-magnetic spectrum for wireless telegraphy is concerned, of all persons who may wish to make use of it;
iv) the desirability of ensuring the security and availability of public electronic communications networks and services; and
v) the different interests of persons in the different parts of the United Kingdom, of the different ethnic communities within the United Kingdom, and of persons living in rural and in urban areas.

2.21 In performing our duties, we are required under section 3(3) of the 2003 Act to have regard in all cases to the principles under which regulatory activities should be transparent, accountable, proportionate, consistent and targeted only at cases in which action is needed, and any other principles appearing to Ofcom to represent best regulatory practice.

2.22 Further, in exercising certain regulatory functions, we must have regard to the desirability of promoting economic growth.[16]

Wireless Telegraphy Act 2006

2.23 We permit the use of the radio spectrum by granting wireless telegraphy licences under the WT Act. It is unlawful and an offence to install or use wireless telegraphy apparatus without holding a licence granted by Ofcom, unless the use of such equipment is exempted.

2.24 In carrying out our spectrum functions we have a duty under section 3 of the WT Act to have regard in particular to:

i) the extent to which the spectrum is available for use, or further use, for wireless telegraphy;
ii) the demand for use of that spectrum for wireless telegraphy; and

[16] Deregulation Act 2015, s 108. Section 111 defines 'regulatory function'. The Economic Growth (Regulatory Functions) (Amendment) Order 2024 applies the duty set out in s 108 to Ofcom.

iii) the demand that is likely to arise in future for such use.

2.25 We also have a duty to have regard to the desirability of promoting:

a) the efficient management and use of the spectrum for wireless telegraphy;
b) the economic and other benefits that may arise from the use of wireless telegraphy;
c) the development of innovative services; and
d) competition in the provision of electronic communications services.

2.26 Section 8(3B) of the WT Act says the terms, provisions and limitations specified in licences must be:

i) objectively justifiable in relation to the wireless telegraphy stations or wireless telegraphy apparatus to which they relate;
ii) not such as to discriminate unduly against particular persons or against a particular description of persons;
iii) proportionate to what they are intended to achieve; and transparent in relation to what they are intended to achieve.

Structure of this document

2.27 The remainder of this document is structured as follows:

- Chapter 3 sets out our decision to improve spectrum supply by updating our coordination approach, with specific measures for 3.8-4.2 GHz and updates for all Shared Access bands;
- Chapter 4 sets out the decisions we are taking to support the development of new business models and provide greater user flexibility, especially in 3.8-4.2 GHz;
- Chapter 5 sets out new consultation proposals to provide even more user opportunities (including to permit more Medium Power in urban areas and remove the 'TRR' for licences covering Low Power outdoor base station);
- Chapter 6 sets out an impact assessment for our decisions and consultation proposals;
- Chapter 7 sets out next steps, including licence changes and implementation timelines.

3. Improving Spectrum Supply Across the UK

3.1 Coordination plays an important role in ensuring that different users who are sharing spectrum can co-exist effectively with each other. The approach we take must strike a balance between the level of interference risk for individual users and the amount of spectrum available for other users.

3.2 The first part of the chapter focusses on coordination for the 3.8-4.2 GHz band; this is where we have seen the greatest demand and experienced the most challenges to enabling access to the spectrum.

3.3 To support more and better sharing (and the innovation and growth this can support), we are confirming that in 3.8-4.2 GHz we will adopt:

a) a new approach to coordination, based on the assumption that different Shared Access networks are synchronised[17];
b) a new approach to adjacent channel coordination with UK Broadband; and
c) an increased Building Entry Loss value of 14 dB to improve indoor coordination.

3.4 In the second part of the chapter, we set out steps we are taking to update our coordination approach for all Shared Access bands, by:

d) allowing users to select more detailed antenna parameters to improve coordination; and
e) implementing a new 'User-Led' coordination option.

Updated Coordination Rules for 3.8-4.2 GHz

Assuming users are synchronised

Our proposal

3.5 In our November Consultation we set out proposals for a more flexible and less conservative approach to coordinate Shared Access users in 3.8-4.2 GHz[18], assuming different users' transmissions are 'synchronised' – though not mandating synchronisation.

3.6 Coordinating on this assumption of synchronised use, will allow us to consider interference paths from base stations to terminals, rather than the existing assumption of base station to base station. This change would result in a significant reduction in the separation distances needed between users, reducing sterilisation areas for individual deployments and increasing spectrum availability.

[17] By this we mean the assumption that different base stations and networks use the same uplink/downlink frame structure, and their transmissions are synchronised in time.
[18] We did not propose amending coordination with other users (e.g. Satellite Earth Stations and Fixed Links).

3.7 We proposed two options for the protection of terminals for this new approach: [19]

- Option A (preferred): a **protection threshold of -88 dBm/20 MHz at a height of 1.5m**, based on an interference-to-noise (I/N) ratio of +3 dB and a 10 dB noise figure.
- Option B (alternative): a more conservative **protection threshold of -91 dBm/20 MHz at a height of 3m**, based on an I/N ratio of 0 dB and a 10 dB noise figure.

3.8 We noted that we would retain the option to take measures locally to combat any problems that might result from this, including but not limited to imposing a localised requirement to synchronise based on a specific frame structure.[20]

3.9 Both options are less conservative than the previous approach of coordinating on the basis of base station to base station interference. They would address the need for effective coordination and take a proportionate approach to managing potential interference. This approach also aligns with stakeholder feedback that equipment is more tolerant to interference than we had previously assumed.

Summary of responses

3.10 A majority of stakeholders who responded on this issue expressed support for one or other of the options we provided for adopting the assumption that user's transmissions are synchronised in our coordination approach. Of the two options we provided to give effect to this proposal, 10 respondents supported Option A. Many of these respondents noted that the approach we proposed could enhance the efficient use of spectrum and welcomed the flexibility of not mandating synchronisation. 3 respondents indicated a preference for Option B (although in some cases were not supportive of a move to coordinate on the assumption that user transmissions were synchronised). [21]

3.11 Four stakeholders (Nokia, Tech UK, Freshwave, and the University of Strathclyde) suggested that Ofcom could gather details about the uplink and downlink ratios (i.e., frame structures) of different users to support better coordination. They believed this information could either be used in coordination, or shared to inform local deployment design choices and so reduce potential interference risks.

3.12 BT EE went further, and suggested Ofcom develop a coordination approach that took account of different local scenarios. They suggested using existing coordination rules where there was enough spectrum available to support this, and where this was not possible coordinating with different synchronisation assumptions depending on the uplink/downlink patterns dominant in that local area.

[19] We provided two options because we recognised that the preferred Option A might be appropriate in many scenarios, whilst Option B might be more appropriate for certain other scenarios such as for FWA deployments.

[20] We noted that in such cases our default approach would be to find a reasonable compromise, for example a 2:2 frame structure.

[21] These three were Goonhilly, Shure and Nokia. We note that although Shure preferred Option B it did not support the proposal to assume user transmissions are synchronised, while Nokia suggested the overall approach would 'allow more licensees [but] less flexibility'.

3.13 DECT Forum and Meta stressed the importance of maintaining freedom to use different uplink and downlink ratios to avoid stifling innovation, undermining technology neutrality, and incurring additional deployment costs.

3.14 Nokia, Ericsson, Shure and the GSOA also expressed concerns about the interference impacts of unsynchronised use, and the ability of different users to mitigate this. Nokia emphasised how many private networks need custom frame structures and suggested this could mean a risk of interference with nearby systems under our proposal. Ericsson highlighted ECC PT1 studies into the impacts of unsynchronised use.[22] Shure and GSOA emphasised that not all users would be able to synchronise as a mitigation to interference.

3.15 Finally, there were some concerns raised about the protection of other users of the 3.8-4.2 GHz, particularly Satellite Earth Stations. Speedcast sought reassurance that we would maintain or extend its existing protections. GSOA also noted that the increased volume of Shared Access users that assumed synchronisation might support, could conversely limit future opportunities for Earth Stations.

Our decision

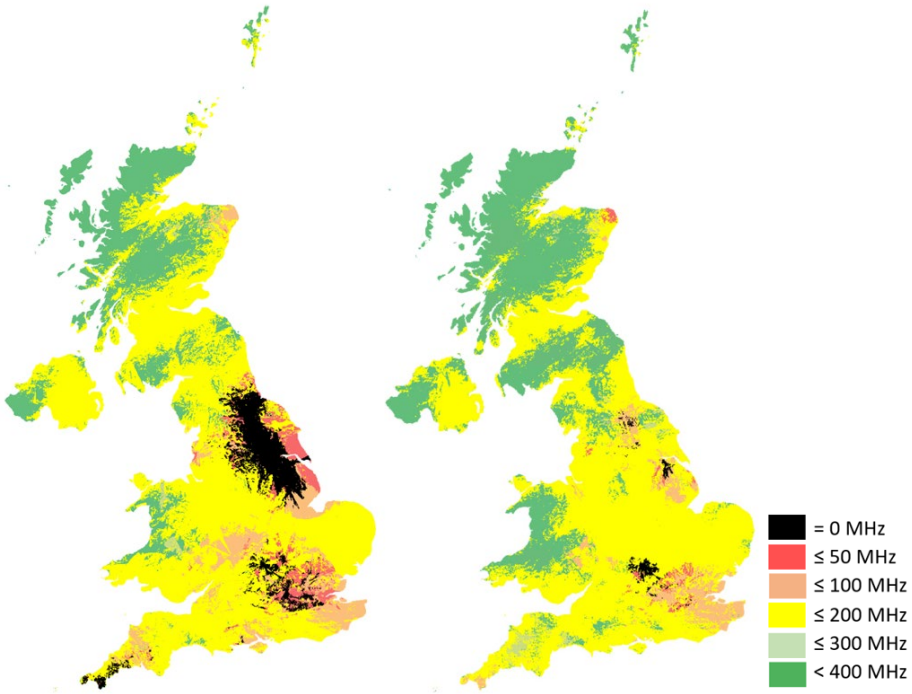
3.16 After careful consideration of stakeholders' responses, we have **decided to:**

- **implement our proposal to coordinate Shared Access users based on the assumption that transmissions are synchronised.**
- **adopt the more conservative Option B terminal protection threshold of -91dBm at a height of 3m.**

3.17 As shown in Figure 2 (below), this will allow us to support more sharing and more users, effectively increasing spectrum supply, whilst retaining proportionate protection levels for licensees. As set out further in Para 3.24, we consider that Option B best balances some of the potential interference risks that stakeholders have highlighted with the extra opportunities we can now provide. This should also support faster turnaround times for licensees, by reducing the need to explore alternative technical parameters at the application stage.

[22] Ericsson, Coexistence analysis: unsynchronized MFCN and WBB LMP, 2024

Figure 2: Illustration of spectrum supply in 3.8-4.2 GHz, under our 2019 base station to base station coordination approach (left) and proposed new base station to terminal approach (right)[23]



3.18 We note the concerns of some stakeholders that assuming different licensees' transmissions are synchronised might see an increased risk of interference, given the different uplink and downlink ratios preferred by different licensees in the band. However, the size of any negative impact will depend on the geometry of the specific deployments and where terminals and interfering base stations are in relation to the wanted base station. Any negative impacts are in most cases likely to be limited to some uplink timeslots of more uplink heavy base station configurations. They are also likely to only affect a small proportion of user terminals.

3.19 We consider that there is a very low risk of interference between unsynchronised Low Power users. This is because Low Power base stations will only exclude other users within a few hundred metres as they are often found in urban areas and shielded from each other by local clutter. Direct base station to base station signal paths are therefore unlikely.

3.20 The risk of co-channel interference is higher between two unsynchronised Medium Power licensees (which are using different frame structures) in some situations. We expect this could be managed locally in most cases.

[23] This map provides an indicative representation of the amount of contiguous spectrum available across the UK, based on unsynchronised (-97 dBm at 15m) and assumed synchronised coordination (-91 dBm at 3m). Unsynchronised coordination was based on licensee data from July 2023, and synchronised coordination was based on licensee data from June 2024. Note that it does not completely replicate all the checks which are undertaken in Ofcom's planning tool, and that it does not take account of adjacent band coordination with UK Broadband (which can further reduce availability in some locations).

- **In urban areas**, where local clutter restricts line of sight between different systems, that risk is likely to be limited to networks which are close to each other (up to around a kilometre apart).[24] We think it is unlikely that several Medium Power unsynchronised base stations would be operating this close to each other. Any risk would be limited to scenarios involving a small number of neighbouring users who would be well placed to discuss and resolve any interference issues locally.
- **In rural areas**, there could be some risk of interference over larger distances (e.g., up to around 10 km). Any impact very much depends on local topography and the geometry of neighbouring base station antennas and associated terminals. Users adopting a more uplink heavy frame structure would be more prone to interference from those adopting a balanced or downlink heavy transmit pattern.

  However, a majority of rural licences currently support FWA services, which are likely to have similar, downlink heavy frame structures. We also consider it likely that most rural base stations will be separated by several kilometres, because the demand for Shared Access connectivity is more widely distributed in these more sparsely populated locations.

3.21 We believe this approach is proportionate given the benefit that assuming synchronisation can bring. It will allow many more users to access the spectrum, innovate, and encourage growth, and provides a basis for a more efficient take-up of Shared Access in the band.

3.22 We consider that the circumstances where there may be negative impacts on performance where users are not synchronised are limited and manageable. Also, licensees who might experience some performance degradation when close to each other would still derive benefits compared with the likelihood of no spectrum availability under the old regime.

3.23 This approach is in line with our Spectrum Strategy commitment to achieving an efficient balance between interference protection and opportunities for other users.[25]

3.24 As shown in Figure 2 (see above), Option B already provides a substantial increase in spectrum availability and mitigates the chance of spectrum scarcity in most locations. Given the increased potential for negative impacts on the performance of base station uplinks (particularly in rural areas) we consider that Option B allows us to better manage the risks compared to Option A at this point. However, we will keep the benefits of adopting a more relaxed approach under review as demand evolves and we gain more experience.

Interference mitigation approaches

3.25 We acknowledge the concerns from some stakeholders that relying on a fallback option to impose local synchronisation may not be something that would be practical to implement for all users (particularly where different technologies are being used). However, we do not

[24] We note that Medium Power is currently only available in urban areas through an 'exceptions' process, although we set out in Chapter 5 proposals to enable this more widely.
[25] Ofcom, Supporting the UK's wireless future: Our spectrum management strategy for the 2020s, 19 July 2021, p 4.

propose to rely on requiring synchronisation as our only interference management strategy.[26]

3.26 Under Shared Access licences, Ofcom has the power to notify Licensees to comply with additional technical requirements in certain circumstances. In the event interference does occur, we expect licensees to work together to agree appropriate measures to mitigate this. Such mitigation could include adjusting base station power, adjusting antenna direction and downtilt, and mutual agreement of frame structures. We could also consider assigning new spectrum or re-coordinating users on any alternative channels available in the area. If none of these mitigations proved sufficient, we could also consider imposing synchronisation based on a specific frame structure.

3.27 If it becomes necessary to require users to synchronise, we will do so considering the local circumstances that apply. We do not believe it is necessary to design a plan for different, localised synchronisation regimes in advance as suggested by some stakeholders. However, we would take account of the needs of local users, and place particular weight on requirements of users who entered the band before our decision to update the coordination approach. Where a locally suitable compromise is not found, we would begin by considering if users should switch to a more balanced uplink and downlink structure.

Protection of other users

3.28 Although some stakeholders expressed concerns about the protection of other (non-Shared Access) users in 3.8-4.2 GHz, there will be no reduction in the protection of Satellite Earth Stations or Fixed Links sharing the band with newer Shared Access users. We will continue with our existing coordination thresholds when coordinating these other users with Shared Access licensees, as set out in OfW 590. [27] Future opportunities for such other users will also continue to be assessed on a first come, first served basis, in line with our existing policy for this band.

Updating adjacent band coordination with UK Broadband

Our Proposal

3.29 UK Broadband, owned by Hutchison 3G UK (H3G),[28] has a licence granting access to 3925–4009 MHz (3.9 GHz Spectrum).

3.30 In our November Consultation, we proposed amending our approach to coordinating Shared Access deployments with H3G. We suggested we should limit coordination to co-channel uses and the first 5 MHz either side of the 3.9 GHz spectrum, rather than our current approach of coordinating across 2.5x the bandwidth.

3.31 We considered that coordination across more than the adjacent 5 MHz was constraining opportunities for users (and the innovation and growth this could support) and was likely to be unnecessary. This is because out-of-block emissions beyond 5 MHz are often significantly

[26] We note that we expect to keep our policy approach to Shared Access under regular review and may consider again in future whether (amongst other things) to include synchronisation requirements in the 3.8-4.2GHz band. This would be subject to our usual stakeholder engagement and consultation processes.
[27] OfW 590 Technical Frequency Assignment Criteria for Shared Access Radio Services (ofcom.org.uk)
[28] For simplicity, we will refer to H3G for the remainder of this document.

better than the limits set in our licences; and receiver performance can also be better than the minimum requirements set in technical standards. We had already taken this into account in our original 2019 work when considering coexistence between Shared Access users and high-power mobile services below 3.8 GHz. Our proposed approach is consistent with our previous approach at the 3.8 GHz boundary.

3.32 We have subsequently consulted on amending the technical conditions of the H3G licence (including a potential increase in its out-of-block emissions) to facilitate its use of 5G for fixed wireless access. [29]

Summary of responses

3.33 The majority of respondents supported our proposal, including Airspan, Jet Engineering, Nokia, BBC, Shure, Freshwave, BT EE, Cellnex, ✂ and ✂. Telet and Strathclyde University were also supportive, and indicated that if interference arose, it should be possible to deal with this, and that this was more efficient than leaving the spectrum fallow.

3.34 Whilst Dense Air was broadly supportive, it noted that from its experience, there were some indications 5 MHz was not always sufficient to protect from out-of-block emissions at the 3.8 GHz boundary. Additionally, Ericsson noted that ECC PT1 studies have suggested a 5 MHz guard band from higher power services may be insufficient. It therefore suggested that Ofcom should consider an alternative such as a fallback TDD[30] pattern (e.g. a default uplink and downlink transmission pattern all users should follow in the case of interference) or case by case synchronisation.

Our decision

3.35 Based on the existing H3G out-of-block mask that was in place at the time of our November Consultation, **we have decided to proceed with our proposal to limit adjacent band coordination with H3G to the first 5 MHz.** We consider that this will deliver significant benefits in terms of improved spectrum access.

3.36 We think that interference risks are low, and that emissions beyond 5 MHz of separation are unlikely to cause harmful interference.[31] Whilst we recognise comments from some stakeholders that our experience of the similar approach we use today at the 3.8 GHz boundary may change as more sites are rolled out, we have received no formal interference reports to date.

3.37 We note that if harmful interference was experienced, there would also be a number of possible mitigations that could be applied, similar to those set out in Para 3.25-3.27 above. Given this, we consider Ericsson's suggestion to define a specific TDD pattern unduly restrictive.[32]

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[29] Consultation: Optimal use of 3.9 GHz spectrum - Ofcom

[30] Time Division Duplex.

[31] We note that because the 3.9 GHz licence conditions have a slightly lower in-block power limit than those for the band below 3.8 GHz, any risk from adopting this approach should be lower here than at the 3.8 GHz boundary.

[32] We note that H3G deployments are expected to use a pattern compatible with a 3:1 frame structure similar to those defined in spectrum licences for the 3.6-3.8 GHz band, which therefore provides a guide for how other users could minimise interference risk.

3.38 We are separately consulting on a licence variation for H3G which might permit different (higher) out of block emissions. We will consider, as part of our decision on this separate H3G variation proposal, whether a 5 MHz separation would remain sufficient, or might need to be adjusted (if the proposed H3G licence variation is to be made).

Improving spectrum supply for indoor users with an updated Building Entry Loss for 3.8-4.2 GHz

Our proposal

3.39 In our November Consultation, we proposed to update the Building Entry Loss (BEL) from the current 12 dB to 14 dB. This proposal was limited to the 3.8-4.2 GHz band only.

3.40 An increased BEL of 14 dB takes more account of the shielding effect of buildings for indoor deployments at these frequencies, which would consequently support a greater density of use. We made this specific proposal for pragmatic reasons to align with the BEL value adopted for mmWave shared access as detailed in our May 2023 statement on "Enabling mmWave spectrum for new uses".[33]

Summary of responses

3.41 Fifteen stakeholders responded to the proposed increase in BEL. The vast majority were supportive of us adopting a higher value, and no respondents fundamentally opposed the proposal. Four of these stakeholders (Dense Air, Nokia, Cellnex and BBC) felt allowing for an even greater increase would also be appropriate. A further two (GSOA and a confidential respondent) requested clarification on how we arrived at the figure we had proposed.

Our decision

3.42 To improve spectrum supply and support more sharing, we have **decided to proceed with our proposal to adopt a BEL of 14 dB for Shared Access coordination in 3.8-4.2 GHz.**

3.43 In assessing the BEL value to use for coordination, we have taken into account Recommendation ITU-R P.2109 : Prediction of building entry loss (itu.int), analysing BEL for two building types, traditional and thermally efficient. Thermally efficient buildings typically have a significantly higher BEL than traditional buildings. The 14 dB value adopted for mmWave was taken at the 30th percentile of locations for traditional buildings only, and we considered that this BEL value might represent an indoor environment with light obstacles and some reflections within the building.

3.44 In developing our consultation proposals, we considered that commercial building stock was likely to be more relevant for Shared Access in 3.8-4.2 GHz, and likely to include a reasonable proportion of thermally efficient buildings. On this basis, BEL values could rise as high as 20 dB, if we assumed that the majority of relevant buildings are thermally efficient commercial buildings. However, we concluded that given the uncertainty over the relevant building mix, a more conservative increase in value would be more appropriate.

3.45 Aligning the BEL value we adopt for 3.8-4.2 GHz with the 14 dB value we have adopted for mmWave will reduce the number of modifications required to our coordination software.

[33] Statement and consultation: Enabling mmWave spectrum for new uses (ofcom.org.uk)

3.46 We will keep the BEL values we use for each Shared Access band under review and may bring forward proposals for updated, less conservative, values in future.

Updated spectrum availability maps for stakeholders

3.47 As a result of the changes to our coordination approach set out above, we will be delivering significant improvements in spectrum availability in 3.8-4.2 GHz.

3.48 To assist stakeholders in identifying Shared Access spectrum availability and areas of opportunity, we will shortly publish new Spectrum Availability Maps on the Ofcom Website. These maps will be generated periodically from our licence database. The impact of the new coordination approach will be incorporated into these maps as it is implemented. We expect to provide searchable maps similar to those shown in Figure 2 above (and in the interim are providing an additional indicative view of total spectrum supply in 3.8-4.2 GHz in Annex 8).

Updating our coordination approach across the Shared Access bands

3.49 In addition to updates for the 3.8-4.2 GHz band, we are also introducing improvements that will support better coordination across the whole Shared Access framework. For the 1800 MHz, 2.3 GHz, 3-8-4.2 GHz and 26 GHz bands we set out:

i) a new mechanism for users to input antenna information into our coordination process;
ii) a new 'User-Led' process for licensees to negotiate their own coordination agreements.

3.50 We are also taking the opportunity to bring certain details in the implementation of our coordination approach in 1800 MHz and 2.3 GHz in line with the policy approach we set out for these bands in 2019. This includes small adjustments in the Interference to Noise ratio (and the Noise Floor for Low Power licensees) when coordinating users.

Expanding sharing opportunities by including antenna details in our coordination process (and licences)

Our Proposal

3.51 In our current Shared Access coordination process, we do not take any antenna directivity into account (i.e. we model assuming an isotropic antenna with gain). This allowed us to introduce a simple, one-size fits all coordination methodology in 2019, and minimise technical barriers to users.

3.52 To improve spectrum supply and increase the chances of applications being approved, our November Consultation proposed that we take account of base station antenna pattern and down tilt.

3.53 We indicated that this would be optional, and suggested two alternatives for capturing details of antenna directionality and pattern:

i) Ofcom specified 4-5 'standard' patterns, based on stakeholder feedback and market engagement, and for the applicant to select a 'best fit' option; or
ii) Request that each stakeholder submits details of the antenna systems they plan to use at the stage of application, and Ofcom uses this information to build a 'library' of real-world antenna parameters.

3.54 We envisaged that either approach could improve our ability to coordinate users and so support greater usage and enable more innovation and growth.

Summary of responses

3.55 There was a consensus among respondents that providing an option to include antenna details during the application process would be a useful step. This is because it would allow us to predict the sterilisation area around each deployment more accurately.

3.56 There were different views on which of the two options we should pursue. Some respondents - including Nokia, Freshwave and VMO2 - expressed a preference for users to provide specific antenna parameters of each deployment. They noted that an antenna library may not be extensive enough to capture the diversity of real-world equipment. Cellnex indicated that they could see value in both approaches, and that Ofcom could consider running both approaches in parallel.

3.57 Other respondents - including the BBC, Shure, and Strathclyde - supported Ofcom developing a simplified library based on certain predefined antenna envelopes, which could be easier to operate with a wide set of users. Both Strathclyde and Dense Air noted that Ofcom should provide additional flexibility for more advanced users to provide more information where relevant.

3.58 BT EE and some Tech UK members said that Ofcom should go further by making the provision of antenna details mandatory rather than optional.

Our decision

3.59 **We have decided to create an antenna library, covering a range of base station antenna types typically in use, which can be selected by Medium Power Shared Access users**.

3.60 Our antenna library will be populated with generic antennas based on antenna patterns generated by Recommendation ITU-R Rec F.1336-5 for the 3.8-4.2 GHz band. We have set out in Annex 5 the indicative base station antenna characteristics that will be used to develop the antenna pattern envelopes initially included in the library. This will include different options to reflect the sectorisation and different down tilt values in an applicants' deployment plan. We will ask applicants to consider selecting the most appropriate antenna option for them, but will not make this step mandatory, for reasons set out below.[34] We will use this information to improve the accuracy of coordination between Shared Access users, and when coordinating between Shared Access and other services in the relevant band.

3.61 Adopting a library means that we can better control the antenna characteristics used in our coordination tool. This allows us to improve consistency - which would not be possible with individually supplied characteristics - and avoids the risk of duplication which could make a user-populated library impractical.

3.62 We will undertake further stakeholder engagement before finalising the patterns we use in our library (along the lines indicated in Annex 5). We will also keep our library under review and supplement it with additional antennas as necessary to ensure it covers the common

[34] Note that in future, existing licensees could also request a technical variation to include such extra antenna parameters, should they wish to do so.

antenna characteristics used. **We would welcome any suggestions from stakeholders to sharedaccessresponses@ofcom.org.uk over the coming months (as we prepare for implementation) where they think any additional antenna envelopes should be included.**

3.63 We are providing this library only for Medium Power users because we consider this the most proportionate approach. The Low Power licence allows users to deploy multiple base stations in a 50m area, and these base stations might have different characteristics which could be complex to capture. Given the much smaller sterilisation areas for Low Power users, there are unlikely to be many circumstances in which capturing these details would dramatically improve coordination.

3.64 As noted above, the policy objective underpinning this measure is to support better coordination between users. However, we can only achieve this objective if the information appearing in our system about a licensee's antenna type reflects real deployments. Therefore, in order to achieve our objective, we consider that it is necessary to require licensees to maintain antenna characteristics within the antenna envelope that they inform Ofcom they will use. Therefore, we will add into the licence the relevant details of the antenna envelope a user is required to operate within. This change is shown at Annex 10.

3.65 We recognise that the options in the library we will provide (and shown at Annex 5) may not precisely match applicants' antennas. Therefore, applicants should select the antenna whose envelope covers the antenna(s) they will actually deploy. Where an applicant considers that there is not a matching envelope then they should select an isotropic antenna. However, we note that providing less information in this way will affect how an applicant can be coordinated with other users and could impact their access to the spectrum.

3.66 We note that some stakeholders said we should make the provision of antenna details mandatory. We consider that a voluntary approach is a proportionate initial step. It allows us to include more detailed information in our coordination process, where it is available, without creating new barriers to entry. The incentive to provide antenna details is that it increases the chance applications will pass the coordination process.

3.67 Our library will include a range of antenna types, including patterns representing single and two sector antennas. As we believe that this will lead to greater spectrum efficiency from the current isotropic antenna model, we are not proposing to differentiate the licence fee based on the type of antenna selected. For example, a user with a two sector site who would previously have been coordinated on the basis of a single isotropic antenna, and paid a single licence fee, could now choose to select a two sector antenna and still pay a single licence fee.

3.68 We intend to add antenna envelopes for other bands over time and as demand requires.

Supporting more sharing opportunities for more users through a new 'User- Led' coordination route

Our proposal

3.69 To provide more flexibility in how we support sharing and the innovation and growth this can deliver, we consulted on the introduction of a new 'User-Led' coordination route.

3.70 This would apply where applications do not initially pass our coordination assessment. We would allow an applicant to override this decision in certain circumstances. This includes

where coordination failed because the applicant was themselves expected to experience interference (and the applicant is happy to accept this), or where all neighbouring users are content for the new application to be approved (e.g., because they did not consider there to be a material risk of harmful interference to their uses in practice).

3.71 We proposed that this would be available across all the different Shared Access bands, but only apply for applications that fell within the standard licence parameters for Shared Access (i.e., the process could not be used to authorise deployments with greater transmit powers or heights than our overall rules allow).

Summary of responses

3.72 There was widespread support for the principles of enabling more 'User-Led' coordination, and the overall approach. Supportive responses included Manchester Airport Group, Nokia, Shure, BBC, VMO2, Telet, Quickline, Ericsson, Dense Air, Cellnex, BT EE.

3.73 Most of these respondents recognised the potential for users to collaborate to support greater efficiency in the use of the spectrum. BT EE and Cellnex indicated that they would like to see more detail on how the process would operate in practice. Speedcast and the University of Strathclyde wanted to better understand how any disputes under this process would be managed. Cellnex also noted that it was important to ensure a time limit, to avoid protracted negotiations and noted that Ofcom should keep under review the option of a different approach, with greater freedom, for some 'certified providers'.

3.74 A small number of respondents (including Tech UK and Freshwave) considered that the process could be extended to facilitate more non-standard deployments, for example greater operating powers and heights, where all neighbouring users were content.

3.75 Conversely, some respondents (including Nokia, ✂ and the BBC) cautioned that this 'User-Led' approach might not be suitable for all users. The BBC emphasised that it was important that Shared Access remained open to users with less technical knowledge.

3.76 Some stakeholders, predominantly in the Satellite Earth Station community, raised concerns that this approach might lead to reduced protection for existing users and prove burdensome. Goonhilly noted that in the event of a disagreement, Ofcom's assessment should take precedence.[35]

Our decision

3.77 **We have decided to implement a 'User-Led' coordination process in line with our original proposal**.

3.78 There was significant support for the principle of empowering users to enter into agreements informed by detailed knowledge of their own network requirements. We believe this measure will enable more users to access the spectrum, and that encouraging collaboration between users will help build sharing capabilities for the future.

[35] Similar concerns were raised by Eutelsat, Speedcast, whilst the GSOA suggested a potential risk from a rise in aggregate interference.

3.79 We note the concerns that this process may not be suited to all spectrum users. To address this, the updated guidance we are publishing makes clear this is an optional route. Existing licensees need not agree where they are not comfortable to do so.[36]

3.80 In response to the concerns raised by some operators of Satellite Earth Stations, we note that it is entirely open to such users not to agree to any proposals put to them. However, we would hope that all users engage with proposals in a spirit of good faith.

3.81 We are meeting the request for additional information from Cellnex and BT EE by setting out more details of this process in our updated guidance. In summary we will:

- provide applicants interested in the 'User-Led' coordination route with details of any neighbouring users who may be affected by the proposed assignment.
- allow a 3-week window to make agreements with all the relevant neighbouring users.
- provide an 'agreement form' (see Annex 7) for applicants to set out the relevant details of their plans, and capture neighbouring user's consent.

3.82 We do not consider it appropriate at this point to allow users to agree to non-standard operating parameters (e.g. higher transmit powers) through this process. This is because the impact of these non-standard parameters could extend further than initially calculated, potentially impacting other users. It is also more difficult to record such non-standard licence parameters on our systems, which could present a risk when seeking to authorise other users in an area in future.

Adjustments in implementation of coordination approach in 1800 MHz and 2.3 GHz

3.83 In assessing our decision to assume that users' transmissions are synchronised in 3.8-4.2 GHz, we have also reviewed how our approach to coordination has been implemented in other bands.

3.84 In 2019 we noted that the dominant interference path between Shared Access users in 1800 MHz and 2.3 GHz was from base stations to terminals (as in the approach described above). The 1800 MHz band separates uplink and downlink transmissions by frequency, and we require synchronisation for outdoor base stations in 2390-2400 MHz.

3.85 However, for simplicity of aligning implementation with our prior approach to 3.8-4.2 GHz we have been coordinating Shared Access users across all bands based on the interference received at their base stations.

3.86 Our updated approach in 3.8-4.2 GHz is moving away from this simplified approach and we are updating our coordination tools accordingly. This means we can now coordinate between users based on the interference risk that exists in practice. This will be based on

[36] For the avoidance of doubt, we note that Ofcom will not re-assess the technical details of these agreements and that it is for the users involved to ensure they are content with the proposal.

the interference to terminals when coordinating with other SAL users; and the interference to Shared Access base stations when coordinating with Fixed Links and H3G[37].

3.87 We are taking advantage of these software updates to align our 'in-practice' coordination approach in 1800 MHz and 2.3 GHz with the policy view we took in 2019 (that the dominant interference risk is to terminals).[38] Our Technical Frequency Assignment Criteria requires some minor adjustments to give effect to this.[39] We will implement this update, and publish a new TFAC in the coming months.

3.88 During this review of the Technical Frequency Assignment Criteria, we also found that the out of block 3.8-4.2 GHz transmission mask (used for coordinating Shared Access with Satellite Earth Stations and Fixed Links) had not been implemented as set out in our 2019 decision.[40] Therefore, we are taking this opportunity to update and align the coordination approach defined in the Technical Frequency Assignment Criteria with our decision set out in 2019.

[37] We have proposed to amend this to interference to terminals when coordinating with H3G in our recent Consultation: Optimal use of 3.9 GHz spectrum - Ofcom

[38] As noted above, we envisage a small (1-3 dB) change in the I/N ratio and noise floor assumed for all Low Power systems, and to apply a terminal height for the 2.3 GHz band that is more consistent with mobile handset usage.

[39] OfW 590 Technical Frequency Assignment Criteria for Shared Access Radio Services (ofcom.org.uk)

[40] Because this applies only to out of block emissions when coordinating with Satellite Earth Stations and Fixed Links, we think it unlikely this will have materially impacted many coordination decisions we have taken.

4.Supporting New Use Cases and Expanding Opportunities

4.1 In this chapter, we explain how we now plan to proceed with our consultation proposals to support more use cases, allow greater user flexibility and encourage growth and innovation. We cover our decisions to;

i) Enable new business cases by lifting the Terminal Registration Requirement (TRR) in Low Power licences in 3.8-4.2 GHz, to the extent that it applies to indoor base stations and any mobile terminals connected to them;
ii) Provide additional freedom and flexibility by increasing the transmit power limit for Low Power base stations in 3.8-4.2 GHz by 3 dB;
iii) Provide greater clarity for applicants by limiting our 'exception' process to the 3.8-4.2 GHz and 1800 MHz bands and apply a transparent 'premises sterilisation test' to decide if we can grant licences this way.
iv) Improve spectrum supply by adding 20 MHz of spectrum between 2320-2340 MHz to the Shared Access framework, for Low Power indoor use (sharing with military systems present in the band today);

4.2 We also explain why our improved view of spectrum availability means we are not continuing with the potential pricing framework we set out in the November Consultation.

Enabling new business cases by removing the Terminal Registration Requirement for Low Power indoor uses

Our Proposal

4.3 In our 2019 statement on Shared Access, we set out our decision that Shared Access licensees in 3.8-4.2 GHz would need to keep a record of the address at which mobile and nomadic terminals connecting to base stations will be used ('the TRR'). [41] This requirement was designed to give effect to our broader policy that Shared Access in this band should not be used as a mechanism to provide wide area mobile networks.

4.4 We received feedback through the CFI process and ongoing stakeholder engagement that this requirement was limiting opportunities for private networks and new neutral host business models. Some stakeholders suggested the TRR made it difficult to support localised improvements in mobile coverage and to carry public network traffic alongside a new private network. Stakeholders indicated that the additional revenue from such public network traffic could be a deciding factor in the business case for new private networks.

[41] The requirement only applies in 3.8-4.2 GHz, it does not apply in other Shared Access bands including 2.3 GHz, 1800 MHz and the mmWave bands.

4.5 In our November Consultation, we proposed to remove this requirement for Low Power indoor deployments. This would free up neutral host providers to deliver additional services and support additional private networks. Our proposal sought to enable these use cases in areas where they would have limited impact on other users (i.e. Low Power indoors), whilst managing the potential impact that outdoor and Medium Power deployments might have.

Summary of responses

4.6 Overall, our proposal to liberalise the TRR was well received. Sixteen responses fully supported our proposal. Three were broadly supportive, with a proviso that certain concerns were addressed. Seven respondents did not address this question in their response.

4.7 Respondents including VM02, Tech UK, and Dense Air noted that the proposal could enable new neutral host solutions (for example to provide improved indoor mobile coverage). Meta supported the proposal and suggested that "delivering both neutral host and private networks services from a single infrastructure…improves the investment rationale for local indoor networks". BT EE was also supportive, subject to the spectrum being made available "on a fair, transparent and non-discriminatory basis".

4.8 Shure, BBC and Quickline welcomed the beneficial reduction of administrative or operational burden on licensees that the proposal would provide, whilst Telet suggested the previous requirement had been unworkable. Airspan also noted that the proposal could accelerate the deployment of 5G technology.

4.9 Whilst Freshwave supported the proposal, they suggested the TRR should also be removed in outdoor environments. A confidential respondent and some members of Tech UK also suggested lifting the restriction for outdoor use cases. Dense Air requested clarification on whether certain high traffic locations (such as railway stations and airports) would qualify as indoors under the Low Power Shared Access licence.[42] They also requested that the TRR be removed "where a neutral host deployment enables public MNO services by stacking this use case onto a 5G private network".

4.10 Other respondents, including Speedcast, were satisfied with the proposal on the condition that their existing services receive adequate protection. GSOA and the University of Strathclyde both agreed with the proposal subject to the understanding that Shared Access should not be used as a mechanism to provide national or regional mobile networks.

Our decision

4.11 To ensure we can support a range of different business models that could drive innovation and growth, we have decided to proceed with our proposal as set out in our November Consultation. This means that **Low Power licensees in the 3.8-4.2 GHz band will no longer be required to keep a record of the address where mobile and nomadic terminals connecting to indoor base stations will be used**. The changes we are making to the Low Power licence to give effect to this decision are set out in markup at Annex 10.

4.12 As indicated in our November Consultation (para 3.37), we are now satisfied that such Low Power indoor deployments will not be used to constitute a wide area network. Our updated

[42] It was suggested that if not, the definition of indoors be amended to include such locations.

coordination approach (set out in Chapter 3) means that the sterilisation effect from such deployments will be limited. Consequently, the potential impact on other users will be small.

4.13 We are confident that our coordination framework provides adequate protection to incumbent users' existing services, which will continue to be coordinated with their existing protection thresholds. We are also confident that any resultant increase in the number of mobile terminals operating in this band will not pose a material interference risk to existing services. These mobile terminals will operate at a low power and will be connecting to indoor base stations.[43]

4.14 We note that a definition of what constitutes an 'indoor' location is already included in our Shared Access Licences. This is:

""Indoor" or "indoors" means inside premises which have a ceiling or a roof; and except for any doors, windows or passageways, are wholly enclosed."

4.15 Therefore, the parts of (for example) railway stations and airports that are wholly enclosed would be considered 'indoors'; but parts which are not wholly enclosed would not.

4.16 We considered amending this definition or introducing a new definition that would capture locations like railway stations and airports as a whole, as we know these locations are of interest to stakeholders. However, we are mindful that such a change might undermine the building entry loss assumptions we make when coordinating indoor users (i.e. it could incentivise users to class locations as indoors when this is not fully the case).[44]

4.17 Instead, to address these borderline indoor/outdoor locations, and further stakeholder interest in outdoor use, we set out new proposals to remove the TRR for Low Power outdoors in Chapter 5.

Additional freedom and flexibility with a Low Power increase for 3.8-4.2 GHz

Our Proposal

4.18 In our November Consultation, we proposed increasing by 3 dB the maximum power limit of our 'Low Power' product. This would move the permitted maximum EIRP level for Low Power base stations in 3.8-4.2 GHz from 24 dBm to 27 dBm / 20 MHz.

4.19 We proposed this to increase compatibility with the equipment ecosystem developed for CBRS, and to support wider coverage that could simplify deployments.[45]

[43] Because these terminals are intrinsically mobile, this also means that in the unlikely event any interference did occur this would likely be limited to a specific moment, in a specific location. It is for this reason we have not coordinated mobile terminals in the Shared Access bands since 2019, and our approach here will remain in line with this.

[44] We also note that this definition of 'indoors' applies across various licence products, and that introducing new additional definitions could cause confusion across these products.

[45] This followed stakeholder feedback from our May CFI suggesting that our existing power limits were constraining users.

Summary of Responses

4.20 VMO2, BBC, Shure, Nokia, Manchester Airports Group and Airspan were all supportive of the proposed increase of the Low Power level. Manchester Airports Group and the University of Strathclyde noted they expected this increase to have a negligible impact on sterilisation areas once the clutter model updates were implemented. Others welcomed the additional opportunities that this presented to deploy at a higher power in an urban area without obtaining an exception (BBC), and the chance to use higher modulation and coding schemes as a result (Shure).

4.21 While welcoming our suggested change, Freshwave and Dense Air requested that we increase the Low Power levels by a further 3-6 dB to match CBRS levels. ✂ . Similarly, Telet commented that the proposal did not go far enough and suggested more work was needed to analyse propagation in this band.

4.22 Although Goonhilly Earth Station and the GSOA thought that the proposed power uplift was reasonable, they emphasised that the higher power level should not be allowed to cause interference to existing and future Earth Station deployments.[46]

Our Decision

4.23 To provide users with additional freedom and flexibility, **we are proceeding with our proposal to increase the power level in Low Power licences in 3.8-4.2 GHz by 3 dB. The existing EIRP limit will rise from 24 dBm to 27 dBm for bandwidths up to 20 MHz, and to 21 dBm per 5 MHz for larger bandwidths**.

4.24 We have carefully considered the comments from GSOA and Goonhilly Earth Station seeking assurances that the revised power level would not cause interference to Earth Stations.

4.25 We note that any future Shared Access deployments will still be coordinated against Earth Stations and we are not changing the protection thresholds we have in place. We would therefore account for the higher transmit power of new deployments and maintain the same level of protection.[47]

4.26 We have also carried out analysis to ensure that enabling this increase for existing licensees would not have a detrimental effect on Earth Stations in 3.8-4.2 GHz. We found only one location where the protection threshold could be breached, and this was a site where the Earth Station and Shared Access licence were located within 100m of each other, and the licence is held by the same company.[48] We are therefore content that it is proportionate to make this power increase available to existing licensees as well.

4.27 Given the unchanged protection criteria for Earth Stations and our assessment that existing assignments will not cause interference, **we will also implement this change in existing Low Power licences for 3.8-4.2 GHz**. The process for varying these existing licences will

[46] Eutelsat also suggested that Ofcom should await the outcome of the CEPT work on 3.8-4.2 GHz before concluding an approach. We note that CEPT is currently consulting on a proposal for a slightly lower 'Low Power' limit (but that our proposals remain within the overall power envelope being consulted on by CEPT).
[47] We recognise that more users sharing the band at a higher power may limit future opportunities for more Earth Station deployments, however, this is in line with our first come, first served approach to the band. New applications will continue to be considered alongside other users and coordinated in the usual way.
[48] In this case, the protection threshold had already been agreed to be exceeded for the existing power level.

commence once this change is implemented in our coordination software (which we expect to be by Q4 2024).

4.28 We also considered comments requesting that we further increase this power level, however we do not consider this appropriate at this point in time for the following reasons:

- An increase of 3 dB represents a doubling of the current permitted power, which is already a significant increase and provides closer alignment with CBRS compliant equipment (which should expand the equipment options available to users).
- For users who require higher power levels, we offer a Medium Power licence product in rural areas and offer access in urban areas via our exceptions process. We are proposing to allow more access to Medium Power in urban areas (see Chapter 5) which will further expand opportunities for users seeking to utilise higher powers in urban areas.

4.29 We discuss the implementation of this decision in Chapter 7.

Simplifying our 'Exceptions' criteria for applicants

4.30 We currently consider requests that fall outside of the standard Shared Access product rules under an 'exception request' process. We introduced this process in 2019 because we recognised that there was some uncertainty around the potential use cases for Shared Access and wanted to take a flexible but fair approach as we learned from evolving demand.

4.31 These 'exception requests' could include granting a Medium Power licence in an urban area, or where an applicant wishes to use an antenna height greater than those set out in our rules. We envisaged that licences would be granted by exception when the proposed licence was on the outskirts of an urban area, or the sterilisation area was similar to a Low Power licence (e.g. if an antenna was directed over water and so impacted very few premises).

Our Proposal

4.32 In our November Consultation, we proposed updating our exceptions criteria to provide clarity and transparency for users and streamline the process for stakeholders and Ofcom. We suggested doing this by clarifying that:

i) exceptions would only be available in the 1800 MHz and 3.8-4.2 GHz bands.
ii) exceptions would only be considered for non-standard antenna heights, and requests for Medium Power in urban areas (as these are the main drivers of exceptions);
iii) when considering exceptions, we would apply a 'premises sterilisation test'. If the number of premises impacted by a deployment was lower than a specified threshold (see Figure 3 below), we would grant the exception;
iv) where the number of premises sterilised was higher than the threshold, we would also consider approving the request if there was 'plenty of spectrum' available in the area.

Figure 3: Our proposed Premises Sterilisation Test Thresholds[49]

Spectrum Band	1800MHz	3.8-4.2GHz
Premise Sterilisation Number	57,000	44,200

Summary of Responses

4.33 Many respondents were generally supportive of the exceptions process and several supported the new proposals. In particular, Tech UK members, Freshwave, and the BBC supported the objective of a simplified process with transparent assessment criteria. Eutelsat were also supportive of our proposals, while Tech UK additionally welcomed Ofcom considering the amount of spectrum available in the 3.8-4.2 GHz band when assessing exceptions requests.

4.34 Several respondents asked that the exceptions process be made more flexible:

- Freshwave and Nokia requested that options for using higher power be made available and Ericsson considered that Medium Power should be widely accessible in urban areas.
- Highlands and Islands Enterprise and Tech UK members suggested we consider further increasing power levels in very rural areas (beyond Medium Power levels). Telet also noted that there can sometimes be a need to use higher powers, which the new proposals would restrict and asked for this additional flexibility to be included.
- The BBC requested that the exceptions process take into account the short-term usage of content production applications when assessing coexistence.
- Professor Stephen Temple suggested that we introduce further assessment parameters, including the spectral efficiency of the proposed deployment, and whether the proposal offers wider societal benefits (to compensate for the impacts it has).

4.35 Nokia also requested additional information on the details of the premises sterilisation test including which data set was used, while Cellnex argued that the premises sterilisation test was a simplistic measure since it did not distinguish different types of premises which might have a different propensity to use the spectrum.

4.36 Shure and GSOA noted that they did not see it as desirable to support Medium Power use in urban areas. Shure felt that Shared Access should instead facilitate multiple Low Power deployments in cities. GSOA also argued that Medium Power deployments in urban areas should be discouraged.

Our Decision

4.37 **To streamline our process for users, we will proceed with our proposal to limit exceptions to the 1800 MHz and 3.8-4.2 GHz band only.** We will not accept exceptions requests for 2.3

[49] We use the Ordnance Survey AddressBase product to define potential premises. We use Epoch 70, as this was in use when Shared Access was launched. https://www.ordnancesurvey.co.uk/products/addressbase

GHz or 26 GHz in future due to coexistence requirements with other users and Ministry of Defence uses.

4.38 We consider that streamlining the exceptions process will provide greater clarity and improve user experience of the application process. We are also mindful that the exceptions process can be time consuming for users (and Ofcom) and that the existing process introduces uncertainty into our licensing framework.

4.39 **Consequently, we will also proceed with our proposal to apply the premises sterilisation test where applicants wish to use a higher antenna height, or to deploy at Medium Power in an urban area.**[50] We note, however, that our new proposal to expand access to Medium Power (see Chapter 5) could significantly lessen the number of exceptions required in future.

4.40 We acknowledge that not all premises caught by this test will necessarily wish to use a Shared Access licence, and that this test is a proxy for potential demand. We also acknowledge that as demand could evolve in the future, it may be appropriate to update the sterilisation test thresholds over time (although we expect them to be appropriate for several years).[51]

4.41 **We have decided not to proceed with our proposal to apply the 'plenty of spectrum' test,** where an application fails the 'premises sterilisation' test.

4.42 We acknowledge that some stakeholders welcomed the flexibility provided by this test. However, we consider that in most areas of the country a carefully designed deployment should now typically be able to pass the premises thresholds we have set out. In part, this is because the premises sterilisation thresholds we are using are based on typical sterilisation areas generated under our previous coordination approach, where sterilisation effects were greater. We were also conscious that an additional 'plenty of spectrum' test was likely to be unhelpfully subjective. Our new approach should provide more clarity for stakeholders and incentivise carefully planned usage. In addition, we are setting out new proposals in Chapter 5 to reduce the need for the exceptions process outside of London, which would further reduce the need for such an additional check.

4.43 We are not persuaded that we should extend the exceptions process to other bands or for deployments seeking to use powers exceeding our standard Medium Power limit. We have enabled some flexibility for users to request higher antenna heights but will not be accepting requests to use higher powers. We appreciate that some users would prefer to request higher power but we are seeking to strike a balance between individual users' preferences and effective sharing of the spectrum.

[50] We note that in undertaking this test we will in future be able to take account of additional antenna information (with users able to select from our standard antenna library when submitting requests).

[51] As set out in our consultation, these sterilisation numbers were based on our assessment of equivalent Low Power sterilisation levels based on our 2019 coordination rules. Retaining these thresholds with our updated approach means that we are being more permissive, and more applications are likely to pass. We deem this to be appropriate in a context where we wish to support users, whilst preventing very sterilising deployments.

Improving spectrum supply with additional spectrum in the 2300 MHz band

Our Proposal

4.44 In our November Consultation we indicated that we expected to make available additional spectrum from within the range 2302-2350 MHz We expected this would be for Low Power indoor use only, based on work with Ministry of Defence (MOD) to ensure that MOD locations and defence capabilities remain adequately protected.

4.45 There is an established global equipment ecosystem for mobile devices in the 2300 MHz band, meaning this proposal aligns with our overall policy intention for Shared Access to provide localised users access to spectrum where mobile technology (LTE, 5G NR, or proprietary adaptations) is supported. It would add to the 10 MHz of spectrum already available in the 2300 MHz band (2390-2400 MHz) as part of the Shared Access framework.[52]

Summary of Responses

4.46 The BBC's consultation response supported Ofcom's work towards creating opportunities for Shared Access in the 2302-2350 MHz band, suggesting it is interested in pursuing access to spectrum in this band.

4.47 We also received a mix of responses on this topic following the CFI we published in May 2023, when we first indicated that we were minded to add the lower 2.3 GHz to the Shared Access framework. This initial proposal was welcomed by Dense Air and Cellnex as potentially supporting additional neutral host style activity (although Cellnex suggested that limiting this to indoor only use could restrict use cases).[53] Conversely VMO2 noted that it considered that this spectrum might be better utilised for high power public mobile use.[54]

Our Decision

4.48 **Our continued work with MOD has confirmed that it is possible to make 2320-2340 MHz available for Low Power indoor Shared Access deployments**, and licencing of this spectrum for these types of deployments has been provisionally agreed subject to the final steps of the MOD due diligence process's scrutiny of the project. These deployments would coexist alongside MOD use. Our work with MOD has also indicated that offering a nationwide licence would not be possible, making localised use an appropriate approach.[55] Other Shared Access options, such as outdoor use or higher power uses, are not possible due to the need to protect existing MOD capabilities in the band.

4.49 Therefore, we consider that making this spectrum available under the Shared Access framework provides the most efficient balance of spectrum use in this band. It will make more spectrum available over a wider bandwidth than is currently available in the 2300 MHz band Shared Access offering. This will provide additional spectrum for indoor use cases, while ensuring that MOD locations and defence capabilities in this band remain protected.

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[52] This spectrum is available for Low Power licence applications, and is intended for indoor-only use.
[53] See Cellnex UK Response and Dense Air response
[54] See VM02 CFI response
[55] Following several years of engagement with MOD, we do not believe there is a plausible route to remediating incumbent systems within a realistic time and cost envelope.

4.50 As mobile handsets already operate in the 2300 MHz band, this spectrum could be used by neutral host providers to provide indoor capacity offload from MNO networks.[56] This spectrum could also supplement the spectrum options available for other innovative uses (particularly where there is a preference to rely on existing mobile technology solutions LTE or 5G NR). Therefore, we can now confirm that we expect to be offering Low Power Shared Access licences in the 2320-2340 MHz band, for indoor base stations only. Following the completion of the MOD due diligence process (expected to conclude by the end of September 2024), we will add this spectrum to our implementation pipeline (with implementation expected by Q1 2025).

4.51 Our work with MOD identified some locations which will require protection to ensure that defence capabilities at these locations remain adequately protected in this band. The coordination of Shared Access licence applications in this band will include coordination against these locations to ensure their protection.[57]

4.52 These licences will be available at the same price as other low power Shared Access licences (£80 per 10MHz).

4.53 Additionally, we can now confirm that we will be expanding the authorisation of 2390-2400 MHz, to include Low Power licences in Northern Ireland (for indoor base stations only).

4.54 For a more detailed outline of the technical parameters for accessing this spectrum, please see Annex 6. The draft Low Power licence appearing at Annex 10 includes terms which reflect the availability of this spectrum.

Licence fees in in the 3.8-4.2 GHz band

4.55 Shared Access fees are paid annually and are primarily cost-based.[58]

4.56 In our November Consultation, we identified that the spectrum bandwidth users choose to deploy and the geographic area sterilised by their deployment are the primary drivers of spectrum scarcity (with licences for 100 MHz accounting for almost 80% of licences).[59]

4.57 We set out a potential pricing framework for the 3.8-4.2 GHz band that took these factors into account by creating new geographic and power categories for pricing, with an increased focus on bandwidths we considered more likely to result in scarcity. We did not consult on firm proposals for new prices, which were to be the subject of a further consultation, but provided some illustrative prices to inform discussion with stakeholders.[60]

[56] There will be no TRR in this spectrum, aligning with 2390-2400 MHz.
[57] Applications which fail coordination will have the option to pursue the 'User-Led' coordination route, which in the case of MOD coordination will be facilitated via Ofcom.
[58] Although fees are primarily cost-based, the cost of licences varies with bandwidth. Our rationale for the current fees is set out in the July 2019 statement, paragraphs 3.157-3.170.
Enabling Wireless Innovation through Local Licensing,
[59] See paragraph 5.9 of the November Consultation.
[60] November Consultation, Table 5.4 p. 40

Our initial proposal

4.58 In the November Consultation we considered that there was a risk that demand will exceed supply in some geographic locations in the 3.8-4.2 GHz band. To address this, we were minded to set fees above cost in the 3.8-4.2 GHz band.

4.59 The main elements of the potential pricing approach were: (a) creating four price categories, namely Rural Low Power, Urban Low Power, Rural Medium Power, and Urban Medium Power; and (b) within these categories:

- Maintaining the current fees schedule for Rural Low Power.
- For Urban Low Power and Rural Medium Power, retaining the current fees schedule for bandwidths up to 50 MHz.
- For all price categories except Rural Low Power, setting higher per MHz prices for bandwidths above 50 MHz.
- Adding an additional pricing factor for all bandwidths with Urban Medium Power (exceptions), in view of the large number of premises typically affected/sterilised by such deployments.

4.60 We noted that our view on pricing would be influenced by our decisions on our new approach to coordination, which would impact our final assessment of spectrum scarcity.[61]

Summary of responses

4.61 In general, stakeholders expressed concern about the proposed approach to setting fees and particularly the level of the illustrative fees.

4.62 There was some limited support for the idea that pricing could be a useful incentive to use spectrum efficiently from DECT Forum, Eutelsat, Shure and VMO2.

4.63 However, many stakeholders raised concerns about the impact of aspects of our proposed fee increases on the commercial viability of business cases, including private networks, Fixed Wireless Access and neutral host type solutions. These stakeholders included Airspan, BT EE, Cellnex, ✂, Dense Air, Freshwave, Highlands and Islands Enterprise, ✂, Nokia, Quickline, TechUK, Telet, and VMO2. Of these, Airspan, Dense Air, Highlands and Islands Enterprise and ✂ specifically commented on the need for 100 MHz bandwidths.

4.64 The BBC suggested an alternative pricing structure for short-term deployments, while Shure suggested that pricing should be amended based on the characteristics of the deployment including operation time of the network and capacity to synchronise.

4.65 BT EE and TechUK thought that our review of pricing was premature, and that with the proposed enhancements to the coordination process it would be unlikely that congestion would occur. They suggested we reconsider introducing incentive-based pricing in two or three years.

Our decision

4.66 **As a consequence of the changes we are making to our coordination approach, spectrum availability has improved. We have reviewed our potential approach in light of this, as well as comments from stakeholders, and no longer consider it necessary to raise prices for**

[61] November Consultation paragraph 5.6

Low Power licences, or Medium Power licences in rural areas.[62] We set out our reasoning in more detail below.

4.67 However, in Chapter 5 we discuss a new approach to fees for Medium Power licences in urban areas in the 3.8 – 4.2 GHz band. We are consulting on proposals for a smaller price increase as part of a wider liberalisation of Medium Power licences. The proposed fees are significantly lower (with a top price of £1,600 per annum for 100 MHz bandwidth) than the illustrative prices in the November Consultation, and no longer include non-linear scaling of pricing with bandwidth.[63] We are also consulting on proposals to extend revised pricing for Medium Power licences in urban areas to the 1800 MHz band. We do not discuss these proposals in detail in this chapter, but address them in detail in Chapter 5.

Retaining existing prices for Low Power and Medium Power in rural areas

4.68 In the November Consultation we were of the view that there was potential for Rural Medium Power and Urban licences to drive scarcity because:

- Rural Medium Power deployments sterilise significantly more places than Low Power deployments, increasing the chance that neighbouring deployments (including neighbouring locations in urban areas) are impacted.
- All urban deployments have potential to sterilise a significant number of premises, with this effect exacerbated at higher power levels.

4.69 Our decisions on our new coordination approach mean that we are no longer of the view that rural Medium Power and urban Low Power licences are currently likely to drive scarcity in a significant number of locations. This is because:

- The area that Medium Power deployments sterilise will decrease significantly. While Medium Power deployments will still sterilise a greater area than Low Power deployments, lower population densities and fewer potential users in rural locations mean this is unlikely to drive scarcity. The risk that a Rural Medium Power deployment would sterilise a nearby urban area is also reduced.
- Low Power sterilisation areas are likely to be very small.

4.70 As a result, we consider it is appropriate to retain the existing cost-based fees for Low Power licences and Medium Power licences in rural areas.[64] These are set out in Table 4 below.

[62] We did not propose to change the fee for Low Power licences in rural areas in the November consultation.
[63] BT EE opposed non-linear pricing in its consultation response, saying it is not clear why illustrative fees should not scale linearly with bandwidth, as is the current practice with mobile and fixed links. Dense Air also objected on the basis that it is not clear why two 50 MHz licences at same location, which might be combined using carrier aggregation to create a 100 MHz service should attract lower fees than a single 100 MHz licence. A similar point was made by GSOA.
[64] In line with our typical approach to spectrum pricing, as set out in paragraphs 5.16 and 5.17 in the November Consultation.

Table 4: Shared Access licence fees (per annum) for Low Power licences, and Medium Power in rural areas in the 3.6 – 3.8 GHz band

Bandwidth	Per Annum Fee (£)
10 MHz	80
20 MHz	160
30 MHz	240
40 MHz	320
50 MHz	400
60 MHz	480
80 MHz	640
100 MHz	800

4.71 In our November Consultation, we suggested that there are other factors that we could take into account in pricing, which may reduce the impact of the illustrative fee changes we set out.[65] As we are no longer proposing changes to the fees for Low Power and Rural Medium Power products, we consider that such mitigations are no longer necessary for these licenses. To the extent that these factors are relevant to Medium Power in urban areas, we consider them in Chapter 5.

[65] For example, we discussed the potential to take account of closely clustered sites with overlapping sterilisation areas, or the impact of antenna tilt and directionality.

5. New consultation proposals to further support users

5.1 We want to provide licensees with the flexibility to operate where and how they want, whilst preserving sharing opportunities for other users. Taking advantage of the improved spectrum supply our new coordination approach delivers, we have considered how we can further reduce deployment challenges and support greater take up for the longer term.

5.2 In this chapter, we set out consultation proposals for additional measures to support users and enable more innovation and growth through the Shared Access spectrum. These are:

a) to provide more freedom to licensees by offering Medium Power licences in urban areas for 1800 MHz and 3.8-4.2 GHz as a standard licence product, with the following balancing measures:

i) retaining exceptions in Greater London, to help manage supply and demand;
ii) formalise a limit of 100 MHz that can be held per user in any urban location;
iii) a new price point of £160 per 10 MHz, per annum, for these licences[66];

b) to support a wider set of business models (e.g. neutral host style deployments) by removing the TRR for Low Power deployments outdoors in 3.8-4.2 GHz.

Freedom to operate at Medium Power in urban areas with less reliance on an 'exceptions' process

5.3 In 2019, we allowed exceptions to our standard rules for Shared Access, where it was clear that the proposed deployment would not have a major impact on opportunities for others.

5.4 We have now confirmed our November Consultation proposal to provide greater clarity for users by applying a simple 'premises sterilisation test' to assess exceptions requests for 3.8-4.2 GHz and 1800 MHz. This process covers requests to use higher antenna heights and to use Medium power in urban areas. [67]

5.5 Having decided to simplify our existing processes for applicants, we have considered whether the improved spectrum supply provided by our new coordination approach could allow us to go further. We know that requests to use Medium Power in urban areas are a main driver for exception requests and that, whilst we have simplified this process, it would be less burdensome for users (and Ofcom) if this extra check was not required. [68]

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[66] For assignments of less than 10 MHz (including the 2x3.3 MHz of spectrum available in 1800 MHz) the 10 MHz fee would apply.

[67] At the moment, Medium Power applications are typically limited to rural areas (as defined by the Office for National Statistics, the Scottish Government's Urban Rural classification and locations in Northern Ireland that fall into bands G or H of the Northern Ireland Statistics and Research Agency's settlement classification bands).

[68] Feedback from both our CFI and consultation also suggests that users have found the option to apply for Medium Power in an urban area useful, although we note some consultation comments indicating it is not essential to support Medium Power use in urban areas.

5.6 We recognise that there can be potential benefits to users transmitting with increased power in urban areas. This needs to be balanced with the potential impacts on opportunities for neighbouring use, which can be limited by relatively higher power operations. However, our new coordination approach means that many urban areas of the UK now have at least 200 MHz of spectrum available (see Figure 2, Chapter 2). It also means the area sterilised by any new Medium Power deployment will be substantially reduced.

5.7 Consequently, the chances of a single Medium Power user foreclosing opportunities for others are fairly low in most locations, and we consider that there are opportunities to provide users with more freedom in where and how they operate.

Our proposal

5.8 **We now propose to remove the requirement for an exceptions test for Medium Power deployments (up to 10m antenna height) in most of the country, for the 3.8-4.2 GHz and 1800 MHz bands.** In other words, we propose offering Medium Power licences in these bands which permit antenna heights up to 10m as a matter of course,[69] without the need to go through the exceptions process (except in Greater London, as discussed below).

5.9 We recognise that some stakeholders may wish to use antenna heights higher than 10m. Our current view is that in these cases, they would still need to apply for a licence granted by exception. This is because, in our view, such deployments have a greater impact on other users, especially where they are above the clutter[70] (as shown in Figure 6.2 of our consultation). We acknowledge that a relatively small increase in this permitted height would have a more limited effect in some locations, but are also conscious that many users who ask for additional antenna height are looking to use much greater heights (e.g. 20m+).

5.10 We recognise there is not the same improvement in spectrum supply in the 1800 MHz band as there is in the 3.8-4.2 GHz. This is because our coordination approach in 1800 MHz is not impacted by our updated approach to synchronisation (which is not relevant in an FDD band).[71] However, there will be some improvements in 1800 MHz availability as we adopt our updated propagation model. Given this, and the relatively limited and geographically dispersed nature of users in the 1800 MHz band, we consider that more Medium Power use is unlikely to pose significant issues for licensees and would provide substantial benefits. Consequently, we consider it proportionate to align this opportunity across the two bands.

[69] Subject to our usual coordination checks, including with other services in these bands.
[70] For example, above the predominate height of local building stock.
[71] FDD or Frequency Division Duplex means different frequencies are used to support uplink and downlink transmission. TDD or Time Division Duplex separates uplink and downlink through different time 'slots'.

We cannot extend this proposal to 2.3 GHz and are not currently proposing to extend this to the 26 GHz band, subject to stakeholder feedback.[72][73]

Supporting sharing with proposed balancing measures to ensure demand in urban areas does not outstrip supply

5.11 To support long term sharing opportunities for a mix of users and manage the risk that high demand for Medium Power in urban areas might, in the long run, reduce opportunities for other users, we are proposing three balancing measures:

i) a requirement that a licensee should not use more than 100 MHz of spectrum in a given location in the 3.8-4.2 GHz band.
ii) retaining the exception process for Medium Power licences in Greater London, where spectrum supply is more limited, and there is already significant Low Power use.
iii) a new price for Medium Power licences in urban areas in 3.8-4.2 GHz and 1800 MHz, to encourage users to only request this extra power where it is required.

100 MHz Limit (for 3.8-4.2 GHz)

5.12 Today, the maximum bandwidth available under a Shared Access licence is 100 MHz. This reflects our general expectation in 2019 that this would be the upper bound of user needs.

5.13 However, an applicant could circumvent this by applying for additional licences in the same location. We consider the incentives to do this are generally limited, given the cost in licence fees it would involve and the requirement to commence transmissions within six months. However, we think there is more risk that an individual user of 3.8-4.2 GHz might wish to do this in an urban area. We also think that the risk that this could limit access for others might be larger in urban areas, where there could be more demand. Preventing this would help ensure that new Medium Power use does not exhaust spectrum supply in urban areas.

5.14 **To address this, we intend to limit the ability of a Medium Power licensee in an urban location to use more than 100 MHz of spectrum.** The specific elements of this proposal are:

a) The restriction will apply where:

i) The licensee is granted a Medium Power licence in the 3.8-4.2 GHz band;
ii) The licensee also holds another 3.8-4.2 GHz Medium Power licence(s);

[72] The 2.3 GHz band is currently only available for indoor low power licences (reflecting our coordination agreements with MOD) and, therefore, we would not be able to offer applicants options for deployments outside these parameters. For 26 GHz, most of this spectrum in high density urban areas will be auctioned and, therefore, Medium Power Shared Access licences will not be available in these areas. However, we note that Shared Access will be permitted in the 650 MHz above 24.45 MHz, which could be considered for Medium Power in the future.

[73] For the avoidance of doubt, we will also continue to require that those using 1800 MHz at Medium Power in an urban area as a standard product do not exceed an antenna height of 10m. This is consistent with our objective to ensure that many users can take advantage of accessing Medium Power in urban areas, because a higher antenna heights could increase sterilisation area and potentially prevent others deployments.

iii) That other licence(s) authorises a base station(s) that is located in an urban area[74] and is within 500m of the base station authorised by the first-mentioned licence;

iv) The frequencies authorised by the licences, taken together, cover more than 100 MHz of the 3.8-4.2 GHz band;

b) Where the restriction applies, the licensee will not be able to use the base station authorised by the licence.

5.15 We intend to carry out periodic audits to identify circumstances in which this restriction is engaged. Where that is the case:

i) The licensee may request that we vary one or more of its licences so that the frequencies authorised, taken together, do not cover more than 100 MHz of the 3.8-4.2 GHz band;

ii) To the same end, we may exercise our power under the licence to require the licensee to change its frequency within a timescale that we specify;[75] or

iii) We may consider exercising our power under the licence to revoke one or more of the licensee's licences for reasons related to the management of spectrum on one month's notice.[76] In doing so we would have regard to our policy position that a single licensee holding rights to more than 100 MHz of the 3.8-4.2 MHz band under Medium Power licences in a single urban location may limit access for others and risk exhausting spectrum supply.

5.16 In proposing this requirement, we considered whether it would be feasible to instead change our licensing systems to ensure that a licence which would engage the restriction set out above is not issued. However, in certain limited cases our licensing system might need to offer an applicant two (or more) licences that, together, cover more than 100 MHz, even where this was not their preference. For example, this could happen because there is another user nearby who has been allocated their preferred spectrum.

5.17 Updating our licensing system to still permit this, but not issue more than 100 MHz in other cases, would require a fundamental system change. Our proposed approach will allow us to take this (i.e. that it was Ofcom's licensing tool that suggested allocating the additional spectrum) into account as a mitigating factor when it comes to prioritising enforcement of this clause. We consider this approach to be more proportionate than fundamentally changing our licensing system. The draft clause which would give effect to this is at Annex 10.

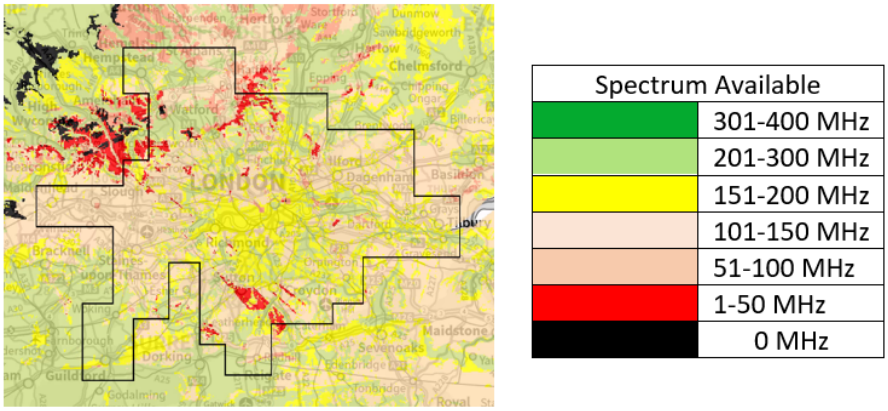
[74] We propose to use the same definition of 'urban area' as we currently use for the purpose of considering Shared Access licence applications. This is set out at paragraph 4.28 of our updated guidance.
[75] See Schedule 1 clause 5 of the template Medium Power licence appearing at Annex 10.
[76] See clause 3(e) of the template Medium Power licence appearing at Annex 10.

Proposal to retain exceptions for London

5.18 Our current view is that we should retain the existing exceptions process for Medium Power licences in the Greater London area. [77] We are proposing to retain this measure for two reasons.

- First, because there is relatively limited spectrum supply in London compared with other areas of the country – partly caused by incumbent Fixed Links and Earth Stations.
- Second, because we consider it likely that there could be significant demand for Shared Access in London, and that consequently a small number of Medium Power users might preclude a greater density of Low Power uses. There are already around 30 existing Low Power licensees in this area, which demonstrates the feasibility of Low Power use in this busy area and the already significant levels of demand in the city.

Figure 4: Overview of Spectrum Availability in Greater London for the 3.8-4.2 GHz band



5.19 We consider that retaining this process would preclude deployments that had the biggest impact on other potential users, while carefully planned and targeted deployments will stand a good chance of passing these thresholds. [78] Retaining this exceptions check could therefore help to incentivise more carefully planned deployments in this busy area. This aligns with our objective of supporting widespread use and sharing of the band, without unduly restricting users.

5.20 We are proposing to define Greater London for these purposes using the London high density area adopted in our mmWave work (as indicated in Figure 4 and shown in detail in Annex 8). This represents a recognised definition of areas of high demand in and around

[77] I.E., we would continue to apply our premises sterilisation test within this area to determine whether a Medium Power licence should be granted by exception in this area. If the number of premises sterilised by the deployment is less than 57,000 in the 1800 MHz band, or 44,200 in the 3.8-4.2 GHz, we will grant the request.

London.[79] We welcome comments from stakeholders on the value of retaining this approach in Greater London.[80]

A new price for Medium Power use in urban areas

5.21 In Chapter 4 (see paras 4.55 – 4.71), we set out our decision not to proceed with price increases for Low Power licences or Medium Power licences in rural areas. We are now consulting formally on revised annual prices for Medium Power licences in urban areas in the 3.8 – 4.2 GHz and 1800 MHz bands.[81]

5.22 Under the WT Act, we may, if we consider it appropriate in light of the matters to which we must have regard under section 3 of the WT Act, set licence fees which are higher than those necessary to recover the costs incurred by carrying out our spectrum functions.[82] These matters include the extent to which the spectrum is available; present and likely future demand; and the desirability of promoting efficient management and use of the spectrum, economic and other benefits, innovation and competition.[83]

5.23 When determining an appropriate fee level, we are aiming to balance the incentive towards efficient use with the potential impacts on user take up, and related investment and innovation. Setting higher prices creates a risk that we could inadvertently discourage efficient entry, investment or innovation.

5.24 As we set out in Chapter 4 (para 4.63), stakeholders had a strongly negative response to the illustrative prices in the November Consultation, especially the £10k price for 100 MHz bandwidth in urban areas. However, there was little evidence provided about why this price level would not be viable. Several stakeholders told us that they required 100 MHz, but little evidence was given as to why these large amounts of spectrum are required. As a result, there is uncertainty around the level of prices above which viability of business case would be affected.

5.25 Given that our new coordination approach significantly improves spectrum supply and reduces the sterilisation effects of Medium Power in urban areas, we consider that it is unlikely that we would need prices as high as £10,000 per 100 MHz to efficiently manage use of the spectrum. However, it remains the case that Medium Power use will sterilise a much larger area than Low Power and can therefore impact the number of innovative users we can accommodate. **We think that setting a moderately higher fee for Medium Power in urban areas than for Low Power can help mitigate the risk of discouraging investment and also help encourage efficient use of spectrum, similar to the way existing Shared Access fees increase with bandwidth**. We intend to incentivise users to consider if Low Power

[79] Whilst we recognise that demand for Shared Access may not perfectly match this area, we think it is administratively appropriate to minimise the number of London definitions in the Shared Access ecosystem, and consider that any alternatively defined shape is unlikely to materially impact users access to spectrum.

[80] For the avoidance of doubt, we do not envisage using the plenty of spectrum test, which we are removing for exceptions more broadly, for these London specific requests.

[81] To define the urban and rural categories we will use the same definition as we have used for determining whether Medium Power is restricted – this is set out in our 2019 Statement, see: Ofcom, Enabling wireless innovation through local licensing, July 2019, paragraph 3.55.

[82] WT Act, s 13(2).

[83] Ofcom, SRSP: The Revised Framework for Spectrum Pricing, December 2010, paragraph 3.8.

deployments would suit their needs. This would avoid users unnecessarily obtaining Medium Power licences and therefore lead to a more efficient use of spectrum.[84]

5.26 We consider an appropriate initial balance would be to set prices for Medium Power in urban areas at double the price of other Shared Access licenses, because:

i) A higher price reflects the potential for the increased range of Medium Power applications to limit more opportunities that could be available to other users.

ii) This price increase would be conservative relative to the difference in the sterilisation effect; we estimate that Medium Power might typically sterilise between 3-7 times the area of Low Power in urban locations.[85] We think a conservative increase is appropriate given the uncertain impacts of a much higher price.

iii) We think it unlikely that this modest price increase would materially harm business cases where Medium Power would be beneficial.[86]

In line with the fees for other Shared Access licences, we propose that fees will increase with bandwidth (at a consistent per MHz price) to continue to give a modest incentive to encourage efficient use of the spectrum.[87]

5.27 The fees that we are proposing are set out in Table 5 below. As with other Shared Access licence fees, these fees would be applicable per licence and are payable annually.

Table 5: Comparison of existing and proposed per annum fees for Medium Power licences in urban areas in 3.6 - 3.8 GHz and 1800 MHz bands

Bandwidth	Current per annum fee (£)	Proposed new per annum fee (£)
Up to 10 MHz[88]	80	160
20 MHz	160	320
30 MHz	240	480
40 MHz	320	640
50 MHz	400	800

[84] Until now, while prices were the same, the restrictions of the exceptions process may have provided an incentive to use Low Power.

[85] See our updated technical analysis published in May 2024 - Technical modelling correction

[86] For example, it is likely that in many cases, the savings in the number of base stations required to cover a site with Medium Power will outweigh the difference in licence cost between Medium Power and Low Power. But it should mean that users who only need Low Power have a cost incentive not to request Medium Power.

[87] In the illustrative prices in the November Consultation, an Urban Medium Power licence was set so that 100 MHz would cost four times more than 50 MHz, to give licensees a greater incentive to minimise the amount of spectrum they request (paragraph 5.28 of the November Consultation). Given the uncertainty around the requirements for large bandwidths, and the improved spectrum availability, we are no longer proposing such non-linear pricing.

[88] This includes allocations for 2x3.3 MHz of spectrum in the 1800 MHz band.

Bandwidth	Current per annum fee (£)	Proposed new per annum fee (£)
60 MHz	480	960
80 MHz	640	1,280
100 MHz	800	1,600

5.28 We are of the view that setting Urban Medium Power licence fees at this level strikes the right balance between managing a scarce resource and the risk of discouraging investment. The approach of charging more for a more sterilising product is also consistent with our current approach of charging more for larger-bandwidth licences than for small bandwidths. We would keep this price point under review, in the event that new evidence suggested that demand might outstrip supply at these levels (but would consult on any future change).

Additional factors we are not minded to include in our pricing structure

5.29 In the November Consultation, we suggested that there are other factors that we could take into account in pricing, which may reduce the impact of any fee changes.[89] These were:

- **Reflecting closely clustered sites in pricing**: whether pricing should account for deployments that are very close together with substantially overlapping sterilisation areas (e.g. with lower prices for additional sites close to an initial deployment).
- **Reflecting technical characteristics of actual deployments**: whether to take account of factors such as antenna sectorisation, directionality and tilt, where this has a substantial impact on sterilisation.
- **Accounting for indoor use**: whether lower prices could be justified where uses are indoors, if these deployments are likely to have a smaller impact on other users.
- **More refined reflection of geographical demand**: for example, additional categories within "urban" to reflect different population density, or only implementing a higher price once an area becomes congested.

5.30 There was some support from stakeholders for developing approaches to account for some of these factors. [90] In particular, a number of stakeholders including Cellnex, BT EE, ✂, Highlands and Islands Enterprise, and TechUK were in favour of recognising closely clustered sites in our pricing. Several stakeholders including the BBC, Freshwave and Meta were supportive of reflecting indoor use.

[89] See paragraphs 5.42 – 5.50 in the November Consultation. The fees that we are proposing are shown in Table 5.4. As with other Shared Access licences, these fees will be applicable per licence and payable annually.

[90] We note that our consultation also mentioned a potential alternative approaches to authorising users, based upon meeting a specified power flux density in an area. There was relatively limited interest expressed in this area model, although Freshwave expressed interest in Ofcom reviewing this approach. We will continue to monitor other international implementations of this model, noting that it may become more important in the future.

5.31 However, our revised proposals are for a smaller increase in price for Medium Power deployments in urban areas compared with the positions set out in our November Consultation. We also consider that our new approach to coordination means the need for these mitigations is reduced; for example, because the sterilisation area of individual sites is much smaller, the chances of sites that are some distance apart having substantively overlapping sterilisation areas is much reduced.

5.32 We want a pricing framework that meets our objectives without being unduly complex and think it is proportionate to proceed with our new pricing proposals without additional mitigations.

Enabling additional business models by removing the TRR for Low Power outdoor uses in 3.8-4.2GHz

5.33 Having reflected on stakeholders' comments, and our updated view of spectrum availability, we also consider we can now go further to liberalise the Terminal Registration Requirement in 3.8-4.2 GHz, by removing it for Low Power outdoor use.

Further feedback from consultation responses

5.34 Our November consultation focussed on the proposal to remove the TRR for Low Power indoors in 3.8-4.2 GHz. Nevertheless, several stakeholders suggested we consider further relaxing the requirement:

- Freshwave argued that lifting this restriction outdoors would help neutral host providers to deliver extra mobile capacity in busy outdoor locations. It noted that neutral host providers can offer cost (and energy) efficient solutions in some of these locations, where MNOs are not always incentivised to densify their networks.[91]
- The BBC similarly indicated that it saw benefit in liberalising use, including in outdoor locations, on the basis that Low Power deployments, when confined in small areas, have short signal paths.
- Dense Air suggested removing the TRR outdoors specifically where this could improve the business case for a new private network or extract more benefit from an existing private network (for example, by carrying MNO traffic alongside the private network).
- Tech UK also said that some of its members felt the requirement should be removed for outdoor base stations, for similar reasons to those set out above.

5.35 We have considered these comments in developing our further proposals, alongside the improved view of spectrum availability our new coordination approach provides.

[91] Freshwave also provided a further response in June 2024, noting Ofcom's corrected analysis of the sterilisation impacts of Medium Power deployments and encouraging Ofcom to open opportunities for neutral host public mobile services outdoors and to allow Medium Power deployments in urban areas.

Options Analysis

5.36 We remain of the view that the 3.8-4.2 GHz band should not be used to assemble wide area public mobile networks, as part of our broader intention for Shared Access to support innovative new services.

5.37 However, we recognise there could be benefits in supporting neutral host providers to carry public network traffic alongside private networks and in providing more opportunities for users to deploy extra capacity in busy areas.

5.38 We explored various policy options to enable these benefits in ways that are easy to implement, provide clarity for users and still gave effect to our policy intent that this spectrum should not be used to support wide area mobile networks. Options included:

i) Option 1: removing the requirement for all Low Power outdoor deployments;
ii) Option 2: only removing the requirement for Low Power deployment in hybrid indoor/outdoor locations, or for outdoor deployments that also host a private network (i.e. excluding solutions hosting only MNO traffic);
iii) Option 3: removing the requirement for all Medium Power deployments (as well as Low Power outdoors).

5.39 We consider Option 1 is most likely to support our overall objective of providing more opportunities for users, allowing neutral host providers to supplement the business case for some private networks, and supporting localised improvements in mobile coverage. This is because:

- It provides significant extra flexibility for Shared Access users, whilst minimising operational and implementation complexity.
- It is unlikely to support wide area mobile networks, because the Low Power limit of 27 dBm in 3.8 – 4.2 GHz is unlikely to be conducive to this.[92]
- While this Option could see neutral host style deployments become more widespread, we expect that any sterilising effect would be modest, given the limited coverage reach of Low Power.[93]

5.40 We consider that any variants of Option 2 would be very cautious approaches to expanding opportunities in this band. While they help make sure that any take up of Low Power licences is even less likely to crowd out other competing use cases, this would also limit benefits for users. Both variants of this option also have significant practical implementation challenges (i.e. reaching suitable definitions of private land or private networks could be complex, and might lead to inadvertent exclusions). We are not convinced that there is a benefit to justify this extra complexity, compared with the simplicity of Option 1.

5.41 Conversely, we believe that removing the TRR for Medium Power (i.e. Option 3) would be too permissive at this time. We do not consider Medium Power levels are necessary for most neutral host style deployments and remain concerned they could encourage wide area use and have a significant sterilising effect. We recognise this risk may be lower where Medium

[92] We also note that the requirement to use Shared Access licences within 6 months could make it difficult for a licensee to obtain large chunks of spectrum and roll out a wide area mobile network at Low Power.
[93] Our new coordination approach means we are more confident that several different Low Power users should be able to co-exist in quite close proximity.

Power users are indoors, or in very rural areas. However, as we noted in November, we are not aware of major use cases requiring Medium Power indoors.[94] We also consider that the benefits of removing the TRR in rural areas are limited and do not outweigh the possible risks of doing so (i.e. for wide area use).

Our Proposal

5.42 In light of our analysis, **we are proposing to offer more flexibility and support for new business models by removing the TRR for Low Power outdoor deployments in 3.8-4.2 GHz**, as per Option 1.

5.43 We consider that this will reduce administrative burdens for private networks, open up opportunities for neutral host providers to deliver capacity improvements and improve the business cases for some private networks. We believe that this proposal remains consistent with our overall support for innovation in the 3.8-4.2 GHz band, and our intention that this spectrum is not used to support wide area mobile networks.

Question 1: Do you have any comments on our proposal to make Medium Power licences (42 dBm EIRP, up to 10m height) commonly available in urban areas across most of the UK, for the 3.8-4.2 GHz and 1800 MHz bands?

Question 2: Do you have any comments on our proposed balancing measures:

i) to continue to only grant Medium Power licences in the Greater London area (as defined in our mmWave work) by exception, applying the 'premises sterilisation' test?
ii) to apply a 100 MHz limit to the amount of spectrum a licensee can transmit at Medium Power in a particular urban area?
iii) to apply a new price as part of this liberalisation, set at £160 per 10 MHz for Medium Power licences in urban areas?

Question 3: Do you agree with our proposal to remove the TRR in relation to outdoor base stations in the 3.8-4.2 GHz band? (Please provide reasoning for your response).

[94] Ofcom, Supporting increased use of shared spectrum (ofcom.org.uk) , 2024, para 5.46, p48

6.Impact Assessment and legal duties

6.1 This chapter sets out:

i) our impact assessment;
ii) how we have had regard to our legal duties;
iii) our equality impact assessment; and
iv) our Welsh language impact assessment.

Impact Assessment

6.2 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.

6.3 Below we discuss the impact that we expect from the decisions we are taking, before also considering our new consultation proposals.

Assessment of our final decisions

Assessment of our new coordination approach

Updates to our 3.8-4.2 GHz coordination approach

6.4 As set out in our November Consultation, we began by considering a counterfactual in which we took no action on our coordination approach. We continue to recognise that this approach might offer maximum protection to existing deployments, but we also consider it could inhibit the further utility of the band, including for existing licensees seeking new deployments, and our ability to support sustainable long-term user growth. Consequently, we are moving to a more flexible and less cautious coordination approach, which will reduce separation distances between users. This should enable more users to use the spectrum and support more innovation and the benefits this can bring for citizens and consumers.

6.5 In reaching this decision, we have carefully considered feedback from users, many of whom welcomed the potential to support more opportunities to access the spectrum. We have also considered concerns about the potential to increase the risk of interference. We set out in Chapter 3 our reasoning for why we consider these impacts should be both manageable and proportionate in light of the benefit delivered. We also clarified the mitigation approaches open to users and Ofcom in the event interference did occur. On balance, we consider it is appropriate to adopt this more flexible approach, which avoids over-protecting users and allows increased use of the spectrum. However, we are adopting the more conservative of the two terminal protection thresholds we proposed in our consultation (-91 dBm) to ensure any negative impacts to users are minimised.

6.6 We have also decided to update our approach to coordination between Shared Access users and H3G, and to update the BEL levels we apply in the 3.8-4.2 GHz band.

i) Our new approach to coordination with H3G should allow significantly more users to access spectrum adjacent to these H3G deployments. This will support more innovation and growth. We will continue to ensure that services are protected by coordinating over the adjacent 5 MHz of spectrum. Our experience leads us to consider there is unlikely to be significant harmful interference beyond 5 MHz.

ii) The increase in BEL will support extra deployments in indoor locations, allowing us to fit more users into the band, and so support more services for business and consumers. We also consider that this increase is likely to better reflect the mix of thermally efficient building stock relevant to Shared Access users in 3.8-4.2 GHz, while still protecting more traditional buildings. Whilst recognising feedback from stakeholders that we could further increase the BEL level we use to coordinate, we consider that, given the variance in UK building stock, it remains sensible to adopt a relatively small increase.

Assessment of wider coordination changes to the Shared Access framework

6.7 We are also taking further measures to improve coordination across the Shared Access framework by:

i) providing the opportunity to use additional antenna details in our coordination; and
ii) by enabling a User-Led coordination process.

6.8 We are taking a pragmatic approach to introducing additional antenna details and 'User-Led' coordination by making these voluntary processes. We consider that these measures have the potential to significantly improve coordination compared with a counterfactual where they are not adopted. However, we recognise that the Shared Access user community is diverse, with different levels of technical expertise, and that requiring mandatory engagement with these measures might represent a barrier to entry at this stage.

6.9 We recognise that, where Ofcom is incurring additional cost in administering the updated process improvements for Shared Access we set out, there is the potential for this to result in increased fees for users where such costs need to be recouped. However, as set out at consultation, we consider that the expected growth in demand these changes can support will mean these costs do not need to be passed on to individual licensees.

6.10 We think these measures will have a positive impact on Shared Access users (and support wider economic benefits) by allowing more sharing and so more deployments, whilst their voluntary nature mitigates any potential burdens.

Assessment of additional flexibilities to support new use cases

6.11 Our decision to double the permitted power of the Low Power licence in 3.8-4.2 GHz has the potential to lower deployment costs for many users. It makes our rules more compatible with the emerging equipment ecosystem and provides more coverage and capacity to users.

6.12 We did not receive any feedback from our consultation that leads us to consider there are material downsides to this increase. We explained (in Chapter 4) that we will continue to protect Earth Stations and other users sharing the band at the same protection levels they enjoy today. We recognise that arguments have been made for increasing this power level further, but are now proposing different steps to support users who would like an increased power in urban areas.

6.13 Our decision to lift the Terminal Registration Requirements for Low Power indoors is also designed to support new use cases, whilst limiting any impacts on others. Continuing with this restriction risks unduly inhibiting the benefits of Shared Access by preventing neutral host style deployments that could otherwise occur. Such deployments could support new Shared Access uses, and also enhance consumer mobile experience. By limiting this relaxation to indoor deployments, our initial proposals sought to limit the potential for very significant uptake of these new models to unduly sterilise the spectrum for other users. We recognise that there may be an argument for taking a more permissive approach, and are now consulting on removing this requirement for Low Power deployments outdoors.

6.14 In making these proposals, we have considered whether it would be appropriate to go even further, for example by loosening restrictions on permitted deployment heights or further amending permitted power levels. We have not done so in consideration of the potential impacts of other users, as set out in more detail at paragraphs 4.28 and 4.43.

Assessment of November 2023 pricing proposals

6.15 We have determined that we should step back from the majority of our initial proposals to implement pricing changes in the 3.8-4.2 GHz band. This is because the improved spectrum availability our new coordination approach provides significantly reduces the need to set stronger pricing incentives across most of the country.

Assessment of new consultation proposals

New proposals for Medium Power

6.16 Given the improved spectrum supply our new coordination approach provides, we have re-assessed the benefits of existing restrictions on Medium Power deployments in urban areas. We are proposing to permit Medium Power in urban areas at heights up to 10m as a standard product across most of the country for the 3.8-4.2 GHz and 1800 MHz bands.

6.17 By removing the need to obtain an exception to access Medium Power in urban areas, we are simplifying the licensing process for users. It could also support services that would benefit from additional capacity for users, and reduce deployment costs. We consider that this approach will foster further innovation.

6.18 These proposals should not have a negative impact on existing users, because their usage will continue to be protected through our coordination approach.

6.19 We consider that retaining the premises sterilisation test for Greater London will not unduly restrict carefully planned deployments in this area, while still providing an incentive for users to minimise their impact on others in this busy location. In turn, we expect this to facilitate more users (and more net benefits) in London than if we removed these restrictions entirely.

Balancing measures, including a new price for urban Medium Power

6.20 As part of our proposal to expand the availability of Medium Power, we have proposed a set of balancing measures.

Impact of 100 MHz limit

6.21 Our proposal to apply a 100 MHz limit on the spectrum a Medium Power user can hold in an urban location is intended to have as small an impact on individual users as possible, whilst protecting other future users. We have proposed the limit at the upper end of available

channel sizes, so that new users can continue to access the maximum amount of spectrum an individual licence supports today. We are also suggesting we apply this limit only in a very small (500m) area. As we discuss in Para 5.13, this limit supports our assessment that a good spectrum supply will remain in most parts of the UK while liberalising Medium Power usage.

Impact of new pricing for existing users

6.22 As Medium Power licences in urban areas are currently authorised via the exceptions process, there are a relatively small number of these licences (106 licences held by 14 licensees across the 1800 MHz and 3.8-4.2 GHz bands).[95] [96] This small number of Shared Access licensees will experience a price increase as a result of our proposals.

6.23 We recognise that the increase is proportionally large, i.e. a doubling of fee. However, we also note that the increase in pound value is modest, at £800 per year for 100 MHz bandwidth. For the reasons we set out in [5.27] we consider that the fees are themselves set conservatively.

6.24 We also recognise that stakeholders with many licences (especially licences for larger bandwidths) would see a larger total increase across their full set of licences. However, the vast majority of affected licensees (11 out of 14) will face an increase less than £5,000. The licensee facing the largest impact will face an additional annual fee of £13,600.[97] We have not seen any evidence that the price increase we propose could have material impact on existing users' business cases.

Impact on potential future users

6.25 The proposed pricing for Medium Power in urban areas is intended to reflect the larger sterilisation areas of a Medium Power licence compared to a Low Power licence, and to provide an incentive for users who do not need Medium Power to opt for the Low Power licence. This is in line with our policy objective to encourage efficient spectrum use.

6.26 For future users who can meet their needs in urban areas with a Low Power licence, there will be no negative effect.

6.27 For future users who need Medium Power in urban areas, they would need to pay higher fees compared to fees in place today (although noting that under today's rules they can only access the spectrum at all if they pass an additional 'exception' process). In any case, as set out in paragraph 5.27, we consider that our pricing proposals strike the right balance between encouraging efficient use of the spectrum and the risk of discouraging future investment. By incentivising urban users to rely on Low Power where this meets their needs, the proposal may benefit some future users, who may otherwise not have access to spectrum resources.

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[95] Based on licence data as of 28 May 2024.

[96] We note that a small number of Medium Power licences are actually for very low power applications, because the Medium Power coordination process allows us to calculate the specific EIRP of a user. We do not currently envisage passing on fee increases to Medium Power licensees operating at or below the Low Power EIRP limit.

[97] Analysis based on licence data as of 28 May 2024.

Impact on investment, innovation, and competition

6.28 We do not think the increased price for urban Medium Power would hinder investment by existing and potential users. As set out in Chapter 5, we consider the price increase to be relatively modest given that Medium Power sterilises much larger areas than Low Power.[98]

6.29 By encouraging efficient spectrum use, we can also help to create an environment where more sharing is possible in busy urban locations (including amongst potential competitors) and so encourage innovative use cases and more growth in the two bands.

Impact on consumers and citizens

6.30 We consider that the proposed prices would have a net positive impact on consumers and citizens by allowing more future users to access spectrum and provide innovative services, with only limited additional costs which could be passed on.

Removal of Terminal Registration Requirement for all Low Power uses

6.31 In arriving at our proposal to remove the TRR for Low Power outdoor deployments in 3.8-4.2 GHz, we began by considering the impact of not taking more measures in this area, and relying solely on the decision we have taken to remove this requirement indoors.

6.32 However, as we noted in Chapter 5, we are conscious that retaining the TRR outdoors may prevent some potentially beneficial use cases. This could include new private networks outdoors, and improving consumers' mobile coverage experience.

6.33 We now see limited grounds to believe that uptake for such Low Power use cases will occur so widely as to substantially limit opportunities for other users. This is because the coverage area of Low Power deployments is small, and the costs of building a wide network (with more sites) are likely to be prohibitive. Consequently, the benefits of relaxing this requirement outdoors are likely to be greater (for consumers and businesses) than any negative impact on spectrum supply.

6.34 Whilst we did consider if there would be benefits of going further still and dropping the TRR for Medium Power deployments, we believe that these higher power levels would present a greater risk of impacting other users and in any case are unlikely to be required.

How we have had regard to our legal duties

6.35 In formulating our decisions (and developing our new proposals) we have taken account of our duties under the 2003 Act, the WT Act and have had regard to the desirability of promoting economic growth under the Deregulation Act 2015, (the 'Growth Duty').[99] We consider that our decisions, and new proposals, are consistent with these duties.

[98] In many cases this price increase (even when considered over several years) might be less than the licence costs of multiple extra Low Power sites, and relatively small compared with other network investment costs.
[99] Section 108, Deregulation Act 2015 c.20. This new duty applies to Ofcom where it exercises certain regulatory functions.

6.36 In particular, we have taken account of:

i) the need to secure the optimal use of spectrum;
ii) the different needs of persons who wish to make use of spectrum;
iii) the extent to which spectrum is available for use;
iv) the future demand for spectrum;
v) the desirability of promoting the efficient management and use of spectrum; and
vi) the desirability of promoting innovation, investment and competition.

6.37 The decisions we set out in Chapter 3 and 4 will support more sharing of spectrum, thereby ensuring the optimal use of spectrum and promoting efficient use of spectrum. For example, our updated coordination approach will shrink separation distances between users and therefore significantly improve the availability of spectrum across the UK.

6.38 Furthermore, we are taking decisions to support new use cases. We are increasing the maximum power limit for Low Power licences in 3.8-4.2 GHz band. We are also removing the TRR as it applies to Low Power indoor base stations in the same band, enabling more neutral host solutions. These decisions take account of future demand for spectrum (for example by neutral host providers), and promote investment and innovation, while ensuring appropriate protection for other users.

6.39 Our new approach means that more spectrum is available in the popular 3.8-4.2 GHz band. We have therefore proposed further measures which offer licensees greater opportunity to obtain Medium Power licences and to deploy a greater range of neutral host deployments using Low Power licences whilst securing the optimal use of spectrum. These include making Medium Power licences available without the need to go through the exceptions process (except in Greater London) in the 1800 MHz and 3.8-4.2 GHz bands, and removing the TRR entirely for Low Power licences in the 3.8-4.2 GHz band. These will enable greater use of Shared Access spectrum by innovative services. At the same time, they strike an appropriate balance between the needs of different existing users and potential users (e.g. by maintaining the exceptions process for Medium Power licences in Greater London, where there is relatively limited supply of spectrum and where there could be significant demand) and changes in our approach to coordination, which we expect should reduce separations distances typically required between co-channel users.

6.40 We consider that our decisions, and further proposals, are:

i) objectively justifiable insofar as they are likely to meet our policy objectives of supporting and encouraging innovating services and applications using the Shared Access band, and are intended to ensure that more users have greater opportunities to access Shared Access spectrum across the UK;
ii) not unduly discriminatory against particular persons or against a particular descriptions of persons in that they are intended to apply to all users and potential users of Shared Access spectrum, and any differences in the treatment of different users (e.g. depending on the location of their deployment) are justified;
iii) proportionate to what they are intended to achieve, in that our proposals are necessary to ensure that users are able to enjoy the benefits of Shared Access spectrum, support the continuing coexistence of different services and users, and ensure administrative remain reasonable; and

iv) transparent in relation to what they are intended to achieve, in that they are clearly described and explained in this statement and consultation document.

6.41 We believe that these decisions and proposals are consistent with the Growth Duty and are necessary and proportionate to supporting the drivers of economic growth. In particular, our decisions and proposals support innovation and investment while ensuring that existing users do not face undue interference from other users or face disproportionate burdens. We also believe these decisions and our proposals will establish a regulatory framework for licensees which is stable, transparent and responsive to the changing demands for spectrum.

Welsh Language Impact Assessment

6.42 The Welsh Language (Wales) Measure 2011 made the Welsh language an officially recognised language in Wales. This legislation also led to the establishment of the office of the Welsh Language Commissioner who regulates and monitors our work. 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).[100]

6.43 Where the Welsh Language Standards are engaged, we consider the potential impact of a policy proposal on (i) opportunities for persons to use the Welsh language; and (ii) treating the Welsh language no less favourably than the English language. We also consider how a proposal could be formulated so as to have, or increase, a positive impact, or not to have adverse effects or to decrease any adverse effects.

6.44 We do not consider our proposals have any impact on opportunities for persons to use the Welsh language or treat the Welsh language less favourably than the English language. We also do not think there are ways in which our proposal could be formulated so as to have, or increase, a positive impact. This is because our proposals relate to a nationwide licensing regime and the relevant licence products are available to anyone within the UK.

6.45 We note that Ofcom's current practice is to offer to produce spectrum licences in Welsh, and when requested does provide licenses in Welsh, in accordance with its obligations set by the Welsh Language Commissioner. Ofcom will continue to take this approach in the future in relation to Shared Access licences.

Equality Impact Assessment

6.46 We have carefully considered whether our proposals will have a particular impact on persons sharing protected characteristics, and in particular whether they may discriminate against such persons or impact on equality of opportunity or good relations. We have also had regard to the matters in section 3(4) of the Communications Act. We do not consider that our proposals will affect any specific groups of persons differently to the general population.

[100] See Standards 84 – 89 of Hysbysiad cydymffurfio (in Welsh) and compliance notice (in English). Section 7 of the Welsh Language Commissioner's Good Practice Advice Document provides further advice and information on how bodies must comply with the Welsh Language Standards.

6.47 We have not carried out separate equality impact assessments in relation to the additional equality groups in Northern Ireland: religious belief, political opinion and dependents. This is because we anticipate that our proposals would not have a differential impact in Northern Ireland compared to consumers in general.

Question 4: Do you agree with our Impact Assessment of the potential impacts of the further proposals we are making?

Question 5: In relation to our equality impact assessment, do you agree with our assessment of the potential impact of the further proposals we are making on specific groups of persons?

Question 6: In relation to our Welsh Language impact assessment, do you agree with our assessment of the potential impact of our further proposals on the Welsh language? Do you think our further proposals could be formulated or revised to ensure, or increase, positive effects, or reduce/ eliminate any negative effects, on opportunities to use the Welsh language and treating the Welsh language no less favourably than English?

7. Next steps and licence changes

7.1 In this document, we have set out the decisions we are taking to update and improve the Shared Access framework, as well as additional proposals which we are consulting on.

7.2 The changes we are making, and the new measures we are proposing, are intended to increase spectrum supply and support a greater density of use to maximise the long run benefits this spectrum can provide. **Responses to this consultation are due by 18th September 2024 and we expect to make a further statement with our decision on these steps by the end of the year**.

7.3 As we noted in our Introduction, the Shared Access ecosystem remains an evolving one. We will continue to monitor developments, including equipment availability, demand levels and new use cases, to ensure our framework remains appropriate.

7.4 We have highlighted the ongoing work in CEPT to consider a harmonised sharing approach across Europe in the 3.8-4.2 GHz band. We note the recent CEPT consultation on this approach, and will consider if further changes should be made to align our framework when final decisions on these CEPT proposals are made (which we would expect by early 2025).[101]

7.5 Work is also underway on a range of new 'Spectrum Sandbox' projects, funded by the UK Government, that could be relevant for the future development of Shared Access. Amongst other things, these projects will explore new ways to support multiple users in the 3.8-4.2 GHz band, and will gather more data on real world propagation and interference impacts.[102]

7.6 We will closely monitor the progress of these projects to consider how we can apply lessons to the future evolution of the Shared Access framework.

Implementation timing and associated licence changes

7.7 We will now begin a pipeline of work to implement the decisions we are taking, and to prepare for potential decisions on the measures we are consulting on. We are finalising plans with our spectrum management software provider and are aiming for most of today's updates to be available by the end of the year.

7.8 We are also issuing updated guidance to applicants alongside this Statement and Consultation, to reflect the new measures we are adopting today. We will publish periodic

[101] We note that these proposals indicate a different approach to licence requirements for out of block emissions (such as those currently specified in our template licence at Annex 10). We understand that it has been argued this approach (which would lean on harmonised standards to manage these emissions) could be more technology agnostic, and make it simpler for non 3GPP technologies (for example DECT NR) to access the band. We also note that the CEPT consultation includes further proposals on conditions for Active Antenna use in 3.8-4.2 GHz.

[102] Spectrum Sandbox winners announcement | UKTIN

updates of this guidance to reflect the implementation of these measures (and any extra steps we take on the further measures we are consulting on).

7.9 We provide more detail on the timelines and process we envisage in Table 6 below, including our plans to update licenses with the relevant changes.

Table 6: Our planned implementation pipeline (and adoption in licences)

Changes we are making today	**Removing terminal registration requirement (TRR) for indoor base stations in 3.8-4.2 GHz.** *This will be available immediately for new licensees, whilst existing licensees may request a licence variation to give effect to this.*
	Simplified Exceptions Process, with a transparent premises sterilisation test *No licence change required. We will apply a premises sterilisation check to licensees in the 3.8-4.2 GHz (44,200) and 1800 MHz band (57,000) who wish to use higher antenna, or operate at Medium Power in an urban area.*
	More sharing opportunities through a User-Led coordination option. *No licence change required. We will begin by immediately offering this in the 3.8-4.2 GHz band and progressively roll this out to other bands as demand requires.*
Changes to be made in Q4 2024[103]	**Publish new, searchable spectrum availability maps for 3.8-4.2 GHz**. *Maps will be made available on the Ofcom website and updated periodically to provide stakeholders with insight on where spectrum is available.*
	More flexibility for users with a Low Power increase in 3.8-4.2 GHz. *New licences will include this change once implemented. When implemented, we will also propose to vary licences for all existing 3.8-4.2 GHz licensees to reflect this Low Power increase and the removal of the TRR indoors.*
	Updated Coordination Approach for 3.8-4.2 GHz, including:[104] - **moving to base station to terminal coordination** - **updated BEL assumptions** - **new adjacent channel coordination with UK Broadband** *No licence change required. We will issue a further update of our guidance to users, and a further update of our Technical Frequency Assignment Criteria* [here] *when this process is complete.*
Changes to be made in Q1 2025	**Increase spectrum supply by adding more 2.3 GHz spectrum to the framework (subject to final MOD approvals).** *New licences in 2320-2340 MHz will be available from the point of implementation. This spectrum will be added to our systems following the completion of the MOD due diligence process (expected to conclude by September 2024).*

[103] By which we mean the fourth quarter of the calendar year.

[104] We also note that, subject to the outcome of our consultation on changes to the technical conditions applying in the 3.9 GHz band, the out of band emission mask used to coordinate adjacent channel Shared Access assignments with UK Broadband assignments may be updated in future.

	New option for all bands to select from a library of antenna envelopes to inform coordination decisions and to specify these details in licences. *New licences will include this change at the point of implementation. We will begin by providing a library of selectable antenna patterns in 3.8-4.2 GHz, and will consider additions to this library (including requirements for other bands) as demand requires.*
Changes subject to consultation	**Permitting Medium Power in urban areas in 3.8-4.2 GHz and 1800 MHz.** *Subject to consultation, we would expect to adopt our new approach to Medium Power, including fee changes, a new definition of greater London, and a 100 MHz spectrum limit from the first half of 2025. We note that we would need to propose amendments to our fees regulations to give effect to this new price point.*
	Removal of TRR for Low Power outdoor base stations in 3.8-4.2 GHz. *Subject to consultation, we would expect to remove the TRR for Low Power outdoor base stations from new licences by early 2025 (with variations available for existing users on request).*

7.10 To assist licensees, we have marked up the changes we are making, and the changes we are proposing template new licenses at Annex 10[105]

Additional editorial changes to licences and corrections to the licence templates

7.11 We are also making a small number of minor editorial changes and corrections to our Shared Access licence templates, to improve their clarity and align with our policy positions

7.12 From today, we will begin issuing Low and Medium Power licences which omit a clause referring to Ofcom's 'Dynamic Spectrum Approach' (an editorial change proposed in our consultation). This is change is marked up in the templates at Annex 10. We do not consider it necessary to vary existing licences to reflect this.

7.13 In Annex 6 of our November Consultation, we included a draft Low Power licence showing our proposed changes in markup. In that draft licence, the clause in Schedule 2 concerning the maximum power in 3.8-4.2 GHz erroneously omitted 'EIRP'. We have therefore included this within the template Low Power licence in Annex 10 to this document (marked up in teal to indicate that this will be included in new licences by Q4 2024).

7.14 Further, we became aware that the template Medium Power licence appearing at Annex A6 to our November Consultation[106] included some inadvertent errors in relation to the 2300 MHz band. These were:

- In Schedule 2, a heading referred to '2300 GHz' rather than MHz, and the table below this heading related to the 26 GHz band rather than the 2300 MHz band;
- In Schedule 2, we omitted provisions setting out the maximum power within the Permitted Channel in relation to the 2300 MHz band; and

[105] Confirmed decisions we are implementing from today are shown in green; confirmed decisions we will introduce when we move to implementation are shown in teal; confirmed deletions are in red and consultation proposals are shown in yellow.
[106] Ofcom, Pages 87-102.

- In Schedule 3, we omitted provisions setting out maximum power outside the Permitted Channel in relation to the 2300 MHz band.

7.15 We have corrected these errors in the template Medium Power licence at Annex 10 to this document. These corrections are not substantive changes to the template Medium Power licence that appeared at Annex 6 to our 2019 shared access statement.[107] Therefore, we have not marked these corrections up in Annex 10 to this document, but we will include these corrected provisions in any Medium Power licences we issue from today.

7.16 In addition, we have responded to stakeholder feedback by clarifying how we capture a licensee's receive antenna gain. 'Antenna Gain' is a field appearing in Schedule 2 of Medium Power Shared Access Licences. We wish to clarify that this field represents the receive antenna gain we use in our coordination process to ensure an appropriate level of protection. However, we do not intend for licensees to be limited to this receive antenna gain. A licensee may choose to operate with a higher receive antenna gain, at their own risk. We have clarified this in the template licence, and we consider that this clarification provides further flexibility for licensees to make the decisions most appropriate to them. This clarification is marked up in Annex 10 and will be included in Medium Power licences we issue in the future.

Changes in the 26 GHz and 40 GHz bands

7.17 In addition to the changes set out as part of this review, in September 2023 we published our decision to extend Shared Access use in the 26 GHz band and add the 40 GHz band to the licence. The changes to 26 GHz band will be introduced shortly and 40 GHz will be available in 2028.[108]

[107] Ofcom, 'Statement: Enabling wireless innovation through local licensing', 25 July 2019.
[108] We are not including templates for these licences in the Annex to this document because they are not impacted by the policy decisions and new proposals we are making here.

A1. Responding to this consultation

How to respond

A1.1 Ofcom would like to receive views and comments on the issues raised in this document, by 5pm on 18 September 2024.

A1.2 You can download a response form from https://www.ofcom.org.uk/spectrum/frequencies/consultation-supporting-increased-use-of-shared-spectrum. You can return this by email or post to the address provided in the response form.

A1.3 If your response is a large file, or has supporting charts, tables or other data, please email it to sharedaccessresponses@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 2nd October 2024.

A1.4 Responses may alternatively be posted to the address below, marked with the title of the consultation:

Jack Hindley
Ofcom
Riverside House
2A Southwark Bridge Road
London SE1 9HA

A1.5 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.

A1.6 We will publish a transcript of any audio or video responses we receive (unless your response is confidential).

A1.7 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.

A1.8 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.

A1.9 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 4. 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.

A1.10 If you want to discuss the issues and questions raised in this consultation, please contact Jack.Hindley@ofcom.org.uk

Confidentiality

A1.11 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.

A1.12 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.

A1.13 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.

A1.14 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.

A1.15 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

A1.16 Following this consultation period, Ofcom plans to publish a statement in Q4 2024.

A1.17 If you wish, you can register to receive mail updates alerting you to new Ofcom publications.

Ofcom's consultation processes

A1.18 Ofcom aims to make responding to a consultation as easy as possible. For more information, please see our consultation principles in Annex 2.

A1.19 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.

A1.20 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

A2. Ofcom's consultation principles

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

Before the consultation

A2.1 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

A2.2 We will be clear about whom we are consulting, why, on what questions and for how long.

A2.3 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.

A2.4 We will consult for up to ten weeks, depending on the potential impact of our proposals.

A2.5 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.

A2.6 If we are not able to follow any of these seven principles, we will explain why.

After the consultation

A2.7 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.

A3. 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)

A4. Consultation questions

A4.1 We set out below the full set of consultations we are asking for feedback on in this document:

Question 1: Do you have any comments on our proposal to make Medium Power licences (42 dBm EIRP, up to 10m height) commonly available in urban areas across most of the UK, for the 3.8-4.2 GHz and 1800 MHz bands?

Question 2: Do you have any comments on our proposed balancing measures:

i) to continue to only grant Medium Power licences in the Greater London area (as defined in our mm Wave work) by exception, applying the 'premises sterilisation' test?

ii) to apply a 100 MHz limit to the amount of spectrum a licensee can transmit at Medium Power in a particular urban area?

iii) to apply a new price as part of this liberalisation, set at £160 per 10 MHz for Medium Power licences in urban areas?

Question 3: Do you agree with our proposal to remove the TRR in relation to Low Power outdoor base stations in 3.8-4.2 GHz?

Question 4: In relation to our impact assessment, do you agree with our assessment of the potential impact of the further proposals we are making?

Question 5: In relation to our equality impact assessment, do you agree with our assessment of the potential impact of the further proposals we are making on specific groups of persons?

Question 6: In relation to our Welsh Language impact assessment, do you agree with our assessment of the potential impact of our further proposals on the Welsh language? Do you think our further proposals could be formulated or revised to ensure, or increase, positive effects, or reduce/ eliminate any negative effects, on opportunities to use the Welsh language and treating the Welsh language no less favourably than English?

Question 7: Do you have any further comments on our proposals?

A5. Antenna Library

Antenna Library Table

The generic base station antenna patterns we intend to include in the library are provided in Table A1 below, together with their main defining parameters. At this stage, these are indicative only. We will use Recommendation ITU-R F.1336-5 to generate the final patterns. Further stakeholder engagement will be undertaken before finalising these patterns.

The “real” antennas that have been used to inform the choice of antenna patterns we have decided to include in the library are:

- KP Performance Antennas-KPP-3DP65S.
- Amphenol Antennas-4U4VTSP1XO6fxys5.
- Alpha Wireless- AWT2-3836

We are not using these antennas directly.

Key Abbreviations

AZ-Azimuth

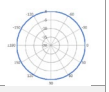
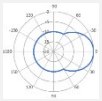
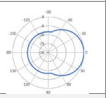
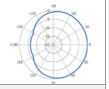
HPBW- Horizontal Plane Beam Width

EL-Elevation

L- Lower boundary

U-Upper boundary

Table A1: Indicative antenna envelopes

Antenna Type	Model				Valid range						Indicative Pattern
	AZ HPBW	AZ no. sectors	EL HPBW	Down tilt	AZ HPBW		EL HPBW		Down tilt		
					L	U	L	U	L	U	
	°		°	°	°	°	°	°	°	°	
Isotropic	360	1	180	0	360	360	180	180	0	0	
60° coverage	70	1	8	user spec	0	70	0	8	user spec		
90° coverage	100	1	8	user spec	70	100	0	8	user spec		
120° coverage	130	1	8	user spec	100	130	0	8	user spec		
240° coverage	240	2	8	user spec	0	240	0	8	user spec		
Dual Sector 180° Separation	70	2	8	0	0	70	0	8	0	0	
Dual Sector 180° Separation	70	2	8	6	0	70	0	8	6	>6	
Multi-Sector 60° Boresight Separation, each sector 60°	N/A	6	8	0	N/A	N/A	0	8	0	6	
Multi-Sector 60° Boresight Separation, each sector 60°	N/A	6	8	6	N/A	N/A	0	8	6	12	
Multi-Sector 60° Boresight Separation, each sector 60°	N/A	6	8	12	N/A	N/A	0	8	12	>12	

A6. Technical conditions for 2.3 GHz

Technical licence conditions

A6.1 The following table contains the technical licence conditions for the low power Shared Access licence in 2320-2340 MHz.

Table 1: Technical licence conditions for low power Shared Access licences in 2320-2340 MHz

Condition	Parameter
Permitted deployment	Indoor only
Authorised bandwidth	10, 20 MHz
Maximum base station power	24 dBm / carrier (up to 20 MHz) EIRP
Maximum terminal station (TRP for mobile/nomadic, EIRP for fixed/installed)	25 dBm[109]
Frame structure requirements	N/A

A6.2 The tables on the following pages outline the out of channel emissions limits for the 2320-2340 MHz band.

Table 2: 2320-2340 MHz shared spectrum base station out of channel limits

Frequency offset	Maximum mean EIRP density
-5 to 0 MHz offset from lower channel edge 0 to 5 MHz offset from upper channel edge	(Pmax – 40) dBm / 5 MHz EIRP per antenna (Note 1)
-10 to -5 MHz offset from lower channel edge 5 to 10 MHz offset from upper channel edge	(Pmax – 43) dBm / 5 MHz EIRP per antenna (Note 1)
< -10 MHz offset from lower channel edge > 10 MHz offset from upper channel edge	(Pmax – 43) dBm / 5 MHz EIRP per antenna (Note 1)
Note 1: Pmax is the maximum mean carrier power in dBm for the base station in question measured in EIRP per carrier	

[109] The authorisation will list this as 25 dBm **including** a 2 dB tolerance consistent with the European harmonisation.

Table 3: 2320-2340 MHz shared spectrum base station additional limits

Frequency	Parameter
2400-2403 MHz	(Pmax − 40) dBm / 5 MHz EIRP per antenna (Note 1)
Above 2403 MHz	−17 dBm / 5 MHz EIRP (Note 2)
Note 1: Pmax is the maximum mean carrier power in dBm for the base station in question measured in EIRP per carrier Note 2: The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antenna	

Synchronisation

A6.3 Synchronisation is not required in the 2320-2340 MHz shared spectrum for indoor-only deployment. If base stations cause undue interference to the authorised user in the 23402345 MHz band, we reserve the right to require the base stations to transmit using a frame structure which mitigates this interference.

A7. User-Led coordination form

Shared Access 'User-Led' coordination form

Purpose

This Form sets out the process to agree and record the consent of existing licensees (in any Shared Access band) to the installation, operation and use of new radio equipment by the Applicant, in accordance with the technical parameters as set out in this form.

The User Led Coordination process

An Applicant's licence application may fail technical coordination because Ofcom's tools estimate that the Applicant's planned operations may cause some harmful interference to neighbouring users. Where the Applicant believes this interference will not occur, or not be harmful to them[110] they may seek the agreement of the existing Shared Access licensees to the proposed deployment on their planned parameters to 'override' the rejection.

Ofcom can override the rejection and proceed to authorise the application where the Applicant:

1. has notified each licensee in the Shared Access bands identified by Ofcom111 which could experience interference from, or could cause interference to the Applicant's planned deployment;
2. has informed each relevant existing licensee of the technical details of their planned deployment as set out in the Table 1 and obtained their agreement to the planned deployment;
3. has submitted the completed Form within [21] days of Ofcom notifying the applicant of the licensees who could experience interference from the planned deployment.112 The Applicant must copy in the lead contact email of all parties to this Form, to record their consent to the Applicant's planned deployment.

This process applies only where the Applicant's proposed operations fall within the general conditions of Shared Access. For example, they shall comply with permitted heights and powers specified in standard licence conditions. It is for each existing licensee to satisfy themselves as to the risk of interference from an Applicant's proposed deployment.

[110] Due to local geography, signal processing capabilities or quality of service requirements.
[111] Ofcom will provide the applicant with the details of each relevant organisation(s) for the purposes of completing the User-Led Coordination process.
[112] Agreements returned outside the 21 day period may not be accepted, and outside this period Ofcom reserves the right to have allocated spectrum rights to another applicant, to ensure that spectrum is not set aside.

Once the agreement is made and a license is issued, each party to the agreement shall enjoy equal rights to their deployments.[113]

Where parties cannot agree on the original application, but believe an agreement could be found for an amended application (e.g. different transmit power, antenna details or location) the Applicant must first submit a new application, with the relevant details, to Ofcom.

The Agreement

The following licensees have been informed by the Applicant of its intention to install and use radio equipment in accordance with the parameters set out below and have consented to the proposed deployment.

Table 1: Applicant

Company Name	
Lead Contact	
Company Address	
Ofcom reference number	

Table 2: Applicant's planned operations

Location	Easting and Northing
Shared Access Product	(Low Power/Medium Power)
Transmit Power	
Antenna Height	
Antenna Details	(Tilt, Azimuth, Gain, Vertical Beamwidth, Horizontal Beamwidth,)
Bandwidth	
Centre Frequency	

Table 3: Agreement 1

Company Name	
Licence Number(s)	(for relevant licences where this agreement applies)
Lead Contact Full Name	
Lead Contact Signature	
Lead Contact Email	

Agreement 2, Agreement 3, etc.

[113] Should one user who is party to this agreement seek a subsequent licence variation that could impact other parties to this agreement, this shall only be agreed where Ofcom considers there is no interference impact, or where all parties agree to it.

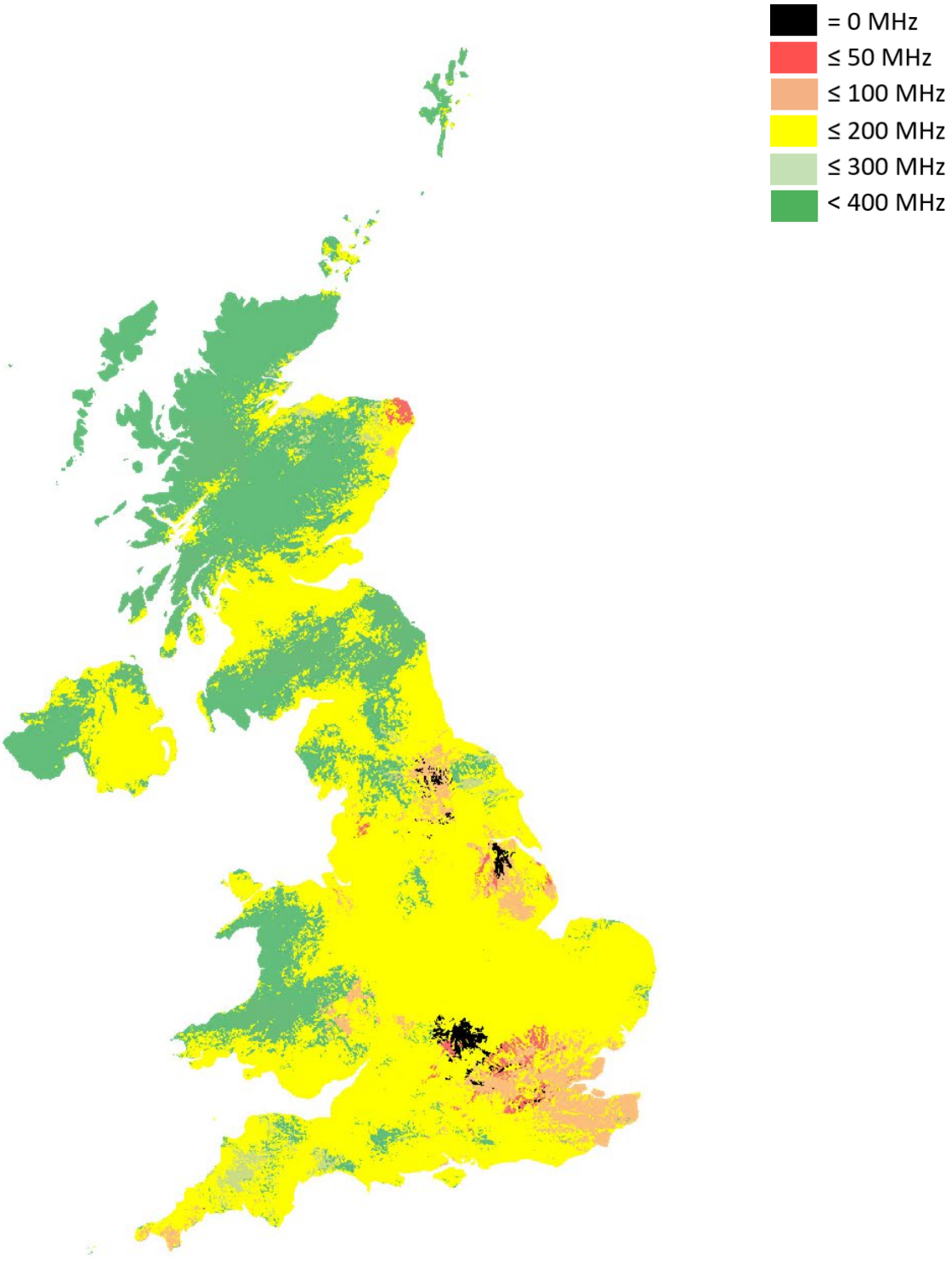
A8. Spectrum availability maps

A8.1 Below we provide maps that give a more detailed view of the spectrum availability we expect to achieve in 3.8-4.2 GHz (based on assignment data as of June 2024) when we have implemented our new coordination approach. We provide this view assuming a Medium Power user, and for both contiguous available bandwidth, and total available bandwidth.

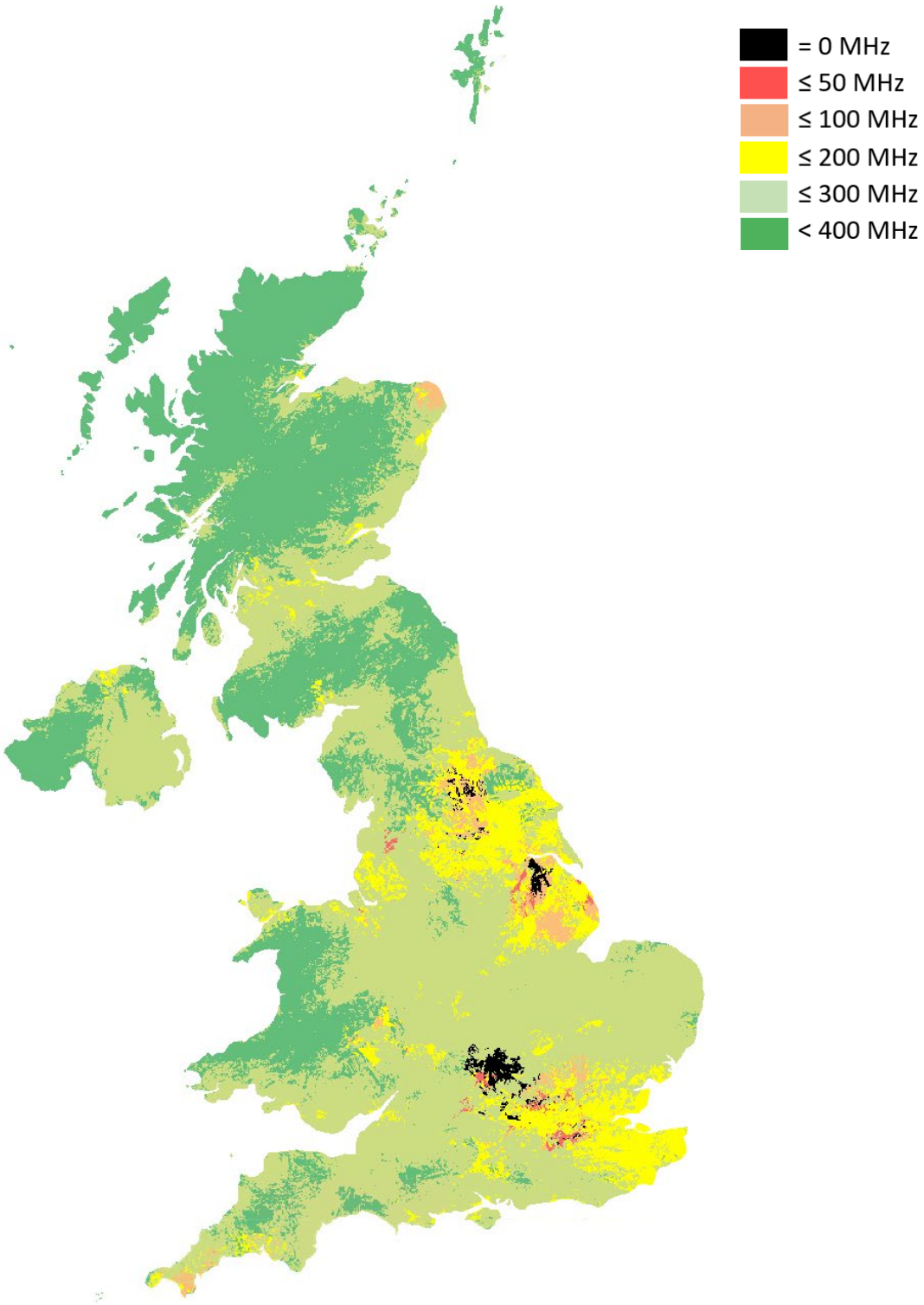
A8.2 We are also providing the same view using the 2019 coordination approach (and based on June 2024 assignment data). We are doing this to help inform stakeholders because this view will remain relevant for the next few months, as we move to implement our new coordination approach.

A8.3 Note that these maps do not fully replicate every detail of the assessment performed by our coordination software and are therefore only indicative of the spectrum supply you can expect in an area. We intend to make similar maps available in a more searchable format on our website in the coming months.

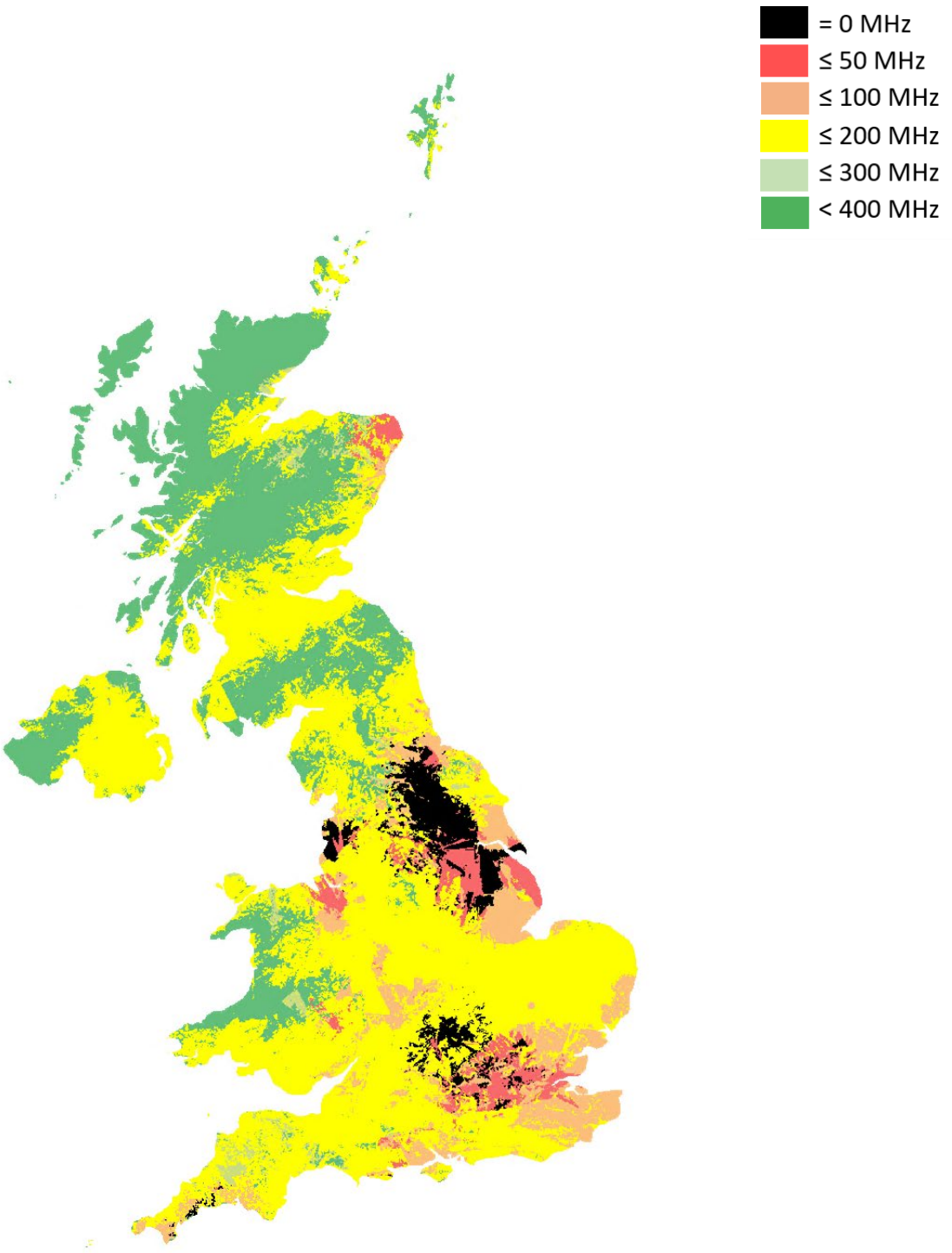
New approach, contiguous bandwidth available to a Medium Power user (3.8-4.2 GHz)



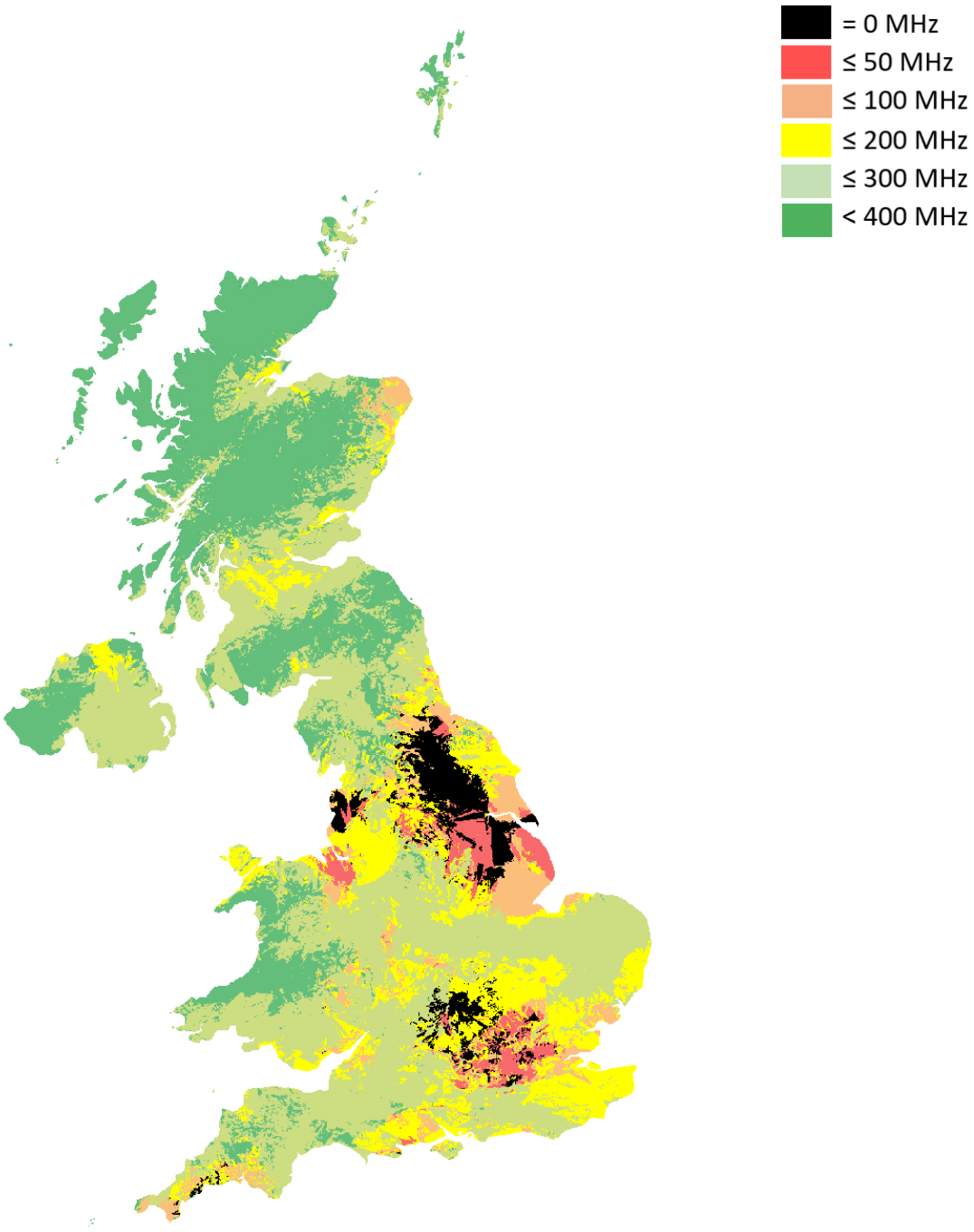
New approach, total bandwidth available to a Medium Power user (3.8-4.2 GHz)



2019 approach, contiguous bandwidth available to a Medium Power user (3.8-4.2 GHz)



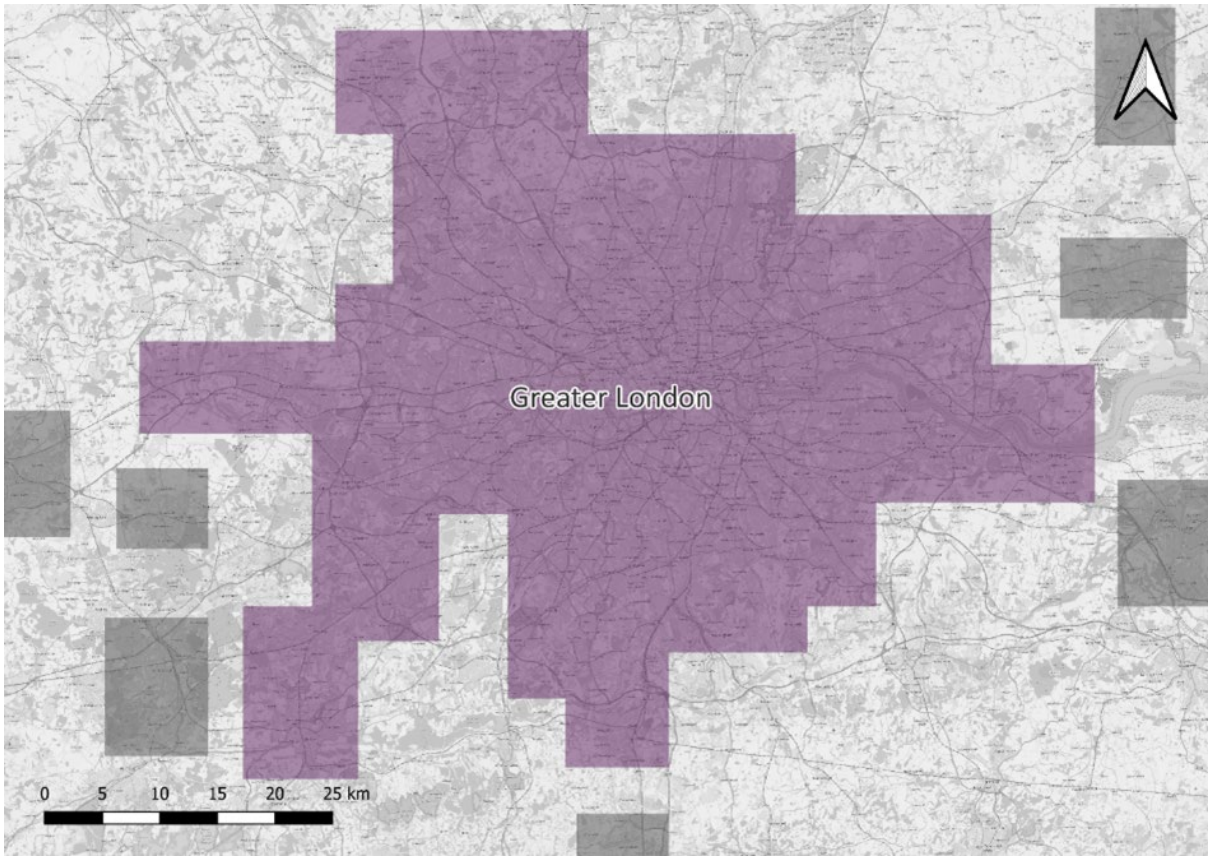
2019 approach, total bandwidth available to a Medium Power user (3.8-4.2 GHz)



A9. Defining Greater London for Exceptions

We provide below a plot of the Greater London area in which we propose to continue applying the exceptions process to authorise standard Medium Power requests in urban areas.

A detailed definition of this area is available on our website. It is available in shapefile, CSV and KML format in Supporting documents.



Source: Ofcom; base map © OpenStreetMap contributors

A10. Shared Access Licence Templates

In order to aid stakeholders' understanding of planned changes, we are providing sample Shared Access Licence's for Low and Medium Power below. Changes are marked as follows:

b) Additions we have decided to make are marked up in green and underlined.
c) Additions we have decided to make and will introduce upon implementation of the relevant measures are marked in teal and double-underlined.
d) Deletions we have decided to make are marked up in ~~red~~ and struck through.
e) Additions we are proposing to make, by way of further consultation, are marked up in *yellow* and italicised.

Office of Communications (Ofcom)
Wireless Telegraphy Act 2006

SHARED ACCESS LOW POWER LICENCE

Sector/Class/Product:	615001 - Shared Access (Low Power) / Shared Access
Licence number:	
Licensee:	
Company Registration:	
Licensee Address:	
Email:	
Date of Issue:	
Valid From:	
[Licence end date:]	
Payment Interval:	1 Year

1. The Office of Communications (Ofcom) grants this wireless telegraphy licence ("the **Licence**") to [*Licensee's name*] to establish, install and use wireless telegraphy stations and/or wireless telegraphy apparatus as described in the schedules to this Licence (together "the **Radio Equipment**") subject to the terms set out below.

Licence Term

2. This Licence shall continue in force until revoked by Ofcom or surrendered by the Licensee or if it is a Short Term Licence, when it reaches its expiration date.

Licence Revocation

3. Pursuant to schedule 1 paragraph 8 of the Wireless Telegraphy Act 2006 ("the Act"), Ofcom may not revoke this Licence under schedule 1 paragraph 6 of the Act except:

a) at the request, or with the consent, of the Licensee;
b) if there has been a breach of any of the terms of this Licence;
c) in accordance with schedule 1 paragraph 8(5) of the Act;
d) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purpose of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003;
e) for reasons related to the management of the radio spectrum provided that in such a case the power to revoke may only be exercised after at least one month's notice is given in writing.

4. Ofcom may only revoke this Licence by notification in writing to the Licensee and in accordance with schedule 1 paragraphs 6, 6A and 7 of the Act.

Licence variation

5. Ofcom may only vary this Licence by notification in writing to the Licensee and in accordance with schedule 1 paragraphs 6, 6A and 7 of the Act.

Requirement to commence and maintain transmission within 6 months

6. The Licensee must establish, install and use the Radio Equipment to commence regular wireless telegraphy transmissions in accordance with the provisions of this Licence within six months of the date that this Licence is issued, and maintain such transmissions thereafter.

Transfer

7. This Licence may not be transferred. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30 of the Act.[114]

Changes to Licensee details

8. The Licensee shall give prior notice to Ofcom in writing of any proposed changes to the Licensee's name, email address and/or address as recorded above paragraph 1 of this Licence.

Fees

9. The Licensee shall pay to Ofcom the relevant fee(s) as provided in section 12 of the Act and the regulations made thereunder on or before the fee payment date shown above, or on or before such dates as are notified in writing to the Licensee.

10. If the Licence is surrendered, revoked or varied, no refund, whether in whole or in part, of any amount which is due under the terms of this Licence, payable in accordance with any regulations made by Ofcom under sections 12 and 13(2) of the Act will be made, except at the absolute discretion of Ofcom.

Radio Equipment Use

11. The Licensee shall ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in the schedules to this Licence. Any proposal to amend any detail specified in any of the schedules to this Licence must be agreed with

[114] See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

12. The Licensee shall ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

Access and Inspection

13. The Licensee shall permit any person authorised by Ofcom:

    a) to have access to the Radio Equipment; and
    b) to inspect this Licence and to inspect, examine and test the Radio Equipment,

at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time, to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

Modification, Restriction and Closedown

14. Any person authorised by Ofcom may require the Radio Equipment or any part thereof, to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:

    a) a breach of this Licence has occurred; and/or
    b) the use of the Radio Equipment is, or may be, causing or contributing to undue interference to the use of other authorised radio equipment.

15. Ofcom may require any of the Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice has been served on the Licensee or a general notice applicable to holders of a named class of licence has been published.

Geographical Boundaries

16. Subject to the requirements of any coordination procedures notified to the Licensee pursuant to the schedules to this Licence, the Licensee is authorised to establish, install and use a base station at the location set out the schedules to this Licence and any terminals connecting to it.

Synchronisation requirement

17. Where synchronisation requirements are set out in Schedule 3 to this Licence, the Licensee must transmit within the transmission limits specified.

18. Where synchronisation requirements have not been specified, in the event that harmful interference arises, the Licensee shall endeavour to discuss and agree with the other licence holder(s) how to coordinate their use. If agreement between licence holders cannot be reached, Ofcom may notify the Licensee to comply with additional technical conditions relating to synchronisation requirements.

19. The Licensee must comply with such technical conditions relating to synchronisation requirement notified to it by Ofcom from time to time.

20. The Licensee accepts that they may need to alter or replace Radio Equipment in order to comply with any synchronisation requirement notified from time to time.

~~Future Dynamic Spectrum Approach~~

~~21. On 25 July 2019, Ofcom published a statement called Enabling wireless innovation through local licensing containing a spectrum management decision to enable shared access to spectrum supporting mobile technology. In that decision, Ofcom stated that it will assess whether it is appropriate to transition towards a Dynamic Spectrum Approach in order to provide users more access to spectrum by means of automatic database frequency assignment. The Licensee is therefore notified that Ofcom currently intends to vary this Licence in accordance with paragraph 5 from time to time in future, or may re-issue the Licence, to give effect to that decision.~~

Notification in electronic form

22. The Licensee shall accept notifications and other related documents under this Licence electronically to the designated email address as recorded above paragraph 1 of this Licence. The Licensee must update Ofcom about changes to the designated email address in accordance with paragraph 8.

Interpretation

23. In this Licence:

    a) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of wireless telegraphy stations and installation and use of wireless telegraphy apparatus for wireless telegraphy as specified in section 8(1) of the Act;
    b) the expression "**interference**" shall have the meaning given by section 115 of the Act;
    c) the expressions "**wireless telegraphy station**" and "wireless telegraphy apparatus" shall have the meanings given by section 117 of the Act;
    d) the schedule(s) form part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence; and
    e) the Interpretation Act 1978 shall apply to the Licence as it applies to an Act of Parliament.

Issued by Ofcom

SCHEDULE 1 TO LICENCE NUMBER: [xxx]

Description of Radio Equipment

1. References in this schedule(s) to the Radio Equipment are references to any wireless telegraphy station or wireless telegraphy apparatus that is established, installed and/or used under this schedule(s).

Interface Requirements for the Radio Equipment

2. Use of the Radio Equipment shall be in accordance with the following Interface Requirement:

IR 2103 Shared Access Low power

Special conditions relating to the Radio Equipment

3. This Licence authorises the use of the Radio Equipment within the Permitted Frequency Band and the Licensee warrants that the Radio Equipment is capable of transmitting across the Permitted Frequency Band.

4. However, the Licensee is only authorised to transmit on the Permitted Channel Centre Frequency within the Permitted Frequency Band, as set in Schedule 2 to this Licence or as notified to the Licensee by Ofcom from time to time.

5. The Licensee must comply with any change to the Permitted Channel Centre Frequency notified by Ofcom within the timescale indicated in the notification.

6. During the period that this Licence remains in force, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of the following details relating to the Radio Equipment:

   a) For all base stations the:

      i) postal address (including post code); and
      ii) Antenna height (above ground level), type: and

   b) For all fixed/ installed terminals the:

      iii) postal address (including post code);
      iv) National Grid Reference (to 1m resolution); and
      v) Antenna height (above ground level), type, and boresight bearing east of true north (if applicable); and

   c) For all mobile and nomadic terminals in the 3.8-4.2 GHz band connecting to an outdoor base station, the postal address (including post code) of where it will be used.

   f)

   ~~g) For all mobile and nomadic terminals in the 3.8-4.2 GHz band connecting to an outdoor base station, the postal address (including post code) of where it will be used.~~

7. The Licensee shall submit to Ofcom in such manner and within such period as specified by Ofcom, such other information in relation to the Radio Equipment, or any wireless telegraphy station or wireless telegraphy apparatus which the Licensee is planning to use, as Ofcom may from time to time request. Such information may include, but is not limited to, information in relation to the radio frequency, transmitted power and date of first use for

wireless telegraphy stations or wireless telegraphy apparatus to be established, installed or used within such timeframe and in such areas as Ofcom may reasonably request.

8. The use of the Radio Equipment is not permitted airborne.

Coordination at frequency and geographical boundaries

9. The Licensee shall ensure that the Radio Equipment is operated in compliance with such coordination procedures as may be notified to the Licensee by Ofcom from time to time.

Cooperation between licensees

10. In addition to complying with the specific transmission terms, conditions and limitations set out in this Licence, the Licensee must liaise and co-operate with other holders of licences in the Permitted Frequency Band (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 that of another licensee within the band.

Interpretation of terms in this schedule

11. In this schedule:

    a) "**Fixed or installed**" means used or installed at specific fixed points.
    b) "**IR**" means a United Kingdom Radio Interface Requirement published by Ofcom in accordance with the Radio Equipment Regulations 2017, as amended by the Product Safety and Metrology etc. (Amendment etc.) (EU Exit) Regulations 2019.
    c) "**mobile or nomadic**" means intended to be used while in motion or during halts at unspecified points.
    d) "**Permitted Channel Centre Frequency**" means the frequency assigned by Ofcom that is the midpoint between the upper and lower channel edge frequencies.
    e) "**Permitted Frequency Band**" means the frequency range within which Ofcom will assign the Permitted Channel Centre Frequency.

SCHEDULE 2 TO LICENCE NUMBER: [xxx]

Licence category:	Shared Access Low Power

1800 MHz

Transmitter(s)	
Authorised Base Station Deployment Area	Area of 50 m radius from the following location: NGR [**xxx xxx**]
Station Name/Address	
Deployment location	[Indoor only/Indoor or Outdoor] NB. Indoors only does not permit the deployment of outdoor base stations and fixed/installed terminal devices.
Permitted Frequency Band	1871.7 - 1880 MHz
Permitted Channel Centre Frequency Tx	1878.35 MHz
Permitted Channel Centre Frequency Rx	1783.35 MHz
Permitted Channel frequency bandwidth	3.3 MHz
Antenna height	maximum 10m outdoors

Maximum power within the Permitted Channel

1. When transmitting, the licensee must transmit within the limits set out below.

Radio Equipment	**Band**	**Maximum Power**	
Base Station	1876.7-1880 MHz	24 dBm / carrier (up to 3 MHz) EIRP per cell	
		Frequency offset from the lower frequency of the band edge	**Maximum Mean EIRP density** per cell
		0 to 0.05 MHz	-33.6 + 153.3 x ΔFL* dBm / kHz
		0.05 to 0.1 MHz	-26 + 60 x (ΔFL*- 0.05) dBm / kHz
		0.1 to 0.2 MHz	-23 + 230 x (ΔFL*- 0.1) dBm / kHz
		0.2 to 3.2 MHz	24 dBm / carrier
		3.2 to 3.3 MHz	-23 + 230 x (3.3 - ΔFL*) dBm / kHz

Radio Equipment	Band	Maximum Power
		* Note: ΔFL in MHz is the offset from the lower edge of the permitted frequency band at 1876.7 MHz (it has values in the range 0 to +0.2 MHz and +3.2 to +3.3MHz)
Fixed / installed terminal Station[a]	1781.7 - 1785 MHz	23 dBm EIRP
Mobile or nomadic terminal station[a]	1781.7 - 1785 MHz	23 dBm TRP
[a] The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.		

2300 MHz

Transmitter(s)	
Authorised Base Station Deployment Area	Area of 50 m radius from the following location: NGR [**xxx xxx**]
Station Name/Address	
Deployment location	[Indoor only/Indoor or Outdoor] NB. Indoors only does not permit the deployment of outdoor base stations and fixed/installed terminal devices.
Permitted Frequency Band	[2320-2340 MHz, 2390-2400 MHz]
Permitted Channel Centre Frequency Tx	
Permitted Channel Centre Frequency Rx	
Permitted Channel frequency bandwidth	[10, 20 MHz]

Maximum power within the Permitted Channel

2300 MHz shared spectrum

1. When transmitting, the Licensee must transmit within the limits set out below.

Radio Equipment	Band	Maximum Power
Base Station	2320-2340 MHz, 2390-2400 MHz	24 dBm / carrier (up to 20 ~~10~~ MHz) EIRP per cell
Fixed / installed terminal Station[a]	2320-2340 MHz, 2390-2400 MHz	25 dBm EIRP (includes a 2 dB tolerance)

Radio Equipment	Band	Maximum Power
Mobile or nomadic terminal station[a]	2320-2340 MHz, 2390-2400 MHz	25 dBm TRP (includes a 2 dB tolerance)
[a] The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.		

3.8 – 4.2 GHz

Transmitter(s)	
Authorised Base Station Deployment Area	Area of 50 m radius from the following location: NGR [**xxx xxx**]
Station Name/Address	
Deployment location	[Indoor only/Indoor or Outdoor] NB. Indoors only does not permit the deployment of outdoor base stations and fixed/installed terminal devices.
Permitted Frequency Band	3805 – 4195 MHz
Permitted Channel Centre Frequency Tx	
Permitted Channel Centre Frequency Rx	
Permitted Channel frequency bandwidth	[10, 20, 30, 40, 50, 60, 80 and 100 MHz]
Antenna Height	maximum 10m outdoors

Maximum power within the Permitted Channel

3.8 – 4.2 GHz shared spectrum

1. When transmitting, the Licensee must transmit within the limits set out below.

Radio Equipment	Band	Maximum Power
Base Station	3805 – 4195 MHz	27 dBm / carrier EIRP per cell for carriers ≤ 20 MHz; OR 21dBm / 5 MHz EIRP per cell for carriers > 20 MHz
Fixed / installed terminal Station[b]	3805 – 4195 MHz	28 dBm EIRP (includes a 2 dB tolerance)
Mobile or nomadic terminal station[b]	3805 – 4195 MHz	28 dBm TRP (includes a 2 dB tolerance)

Radio Equipment	Band	Maximum Power
[b] The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.		

26 GHz and 40 GHz

The technical schedules for 26 GHz and 40 GHz are set out in Annex A4 of the Enabling mmWave spectrum for new uses statement published in September 2023.

All bands

Interpretation of terms in this schedule

2. In this schedule:

~~a) "**Active antenna systems (AAS)**" means a base station and an antenna system where the amplitude and/or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This excludes long-term beam shaping such as fixed electrical down tilt. In AAS base stations the antenna system is integrated as part of the base station system or product.~~

b) "**dBm**" means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

h) "**EIRP**" means the equivalent isotropically radiated power. This is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain), measured during the "on" part of the transmission;

c) "**Fixed or installed**" means used or installed at specific fixed points;

d) "**Indoor**" or "**indoors**" means inside premises which have a ceiling or a roof; and except for any doors, windows or passageways, are wholly enclosed;

e) "**mobile or nomadic**" means intended to be used while in motion or during halts at unspecified points;

f) "**NGR**" means National Grid Reference;

g) "**outdoor**" or "**outdoors**" means anywhere that is not indoor;

h) **"per cell"** means per specific piece of Radio Equipment. For a multi-sector base station, per cell refers to each one of the individual sectors irrespective of the number of transmit antennas;

i) "**Permitted Channel**" means the frequency assigned by Ofcom that is the upper and lower cutoff frequencies;

j) "**Permitted Channel Centre Frequency**" means the frequency assigned by Ofcom that is the midpoint between the upper and lower cutoff frequencies.

k) "**Permitted Channel Frequency Bandwidth**" means the total amount of spectrum assigned to the channel;

l) "**Permitted Frequency Band**" means the frequency range within which Ofcom will assign the Permitted Channel Centre Frequency;

m) “**TRP**” means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere, measured during the on part of the transmission;

SCHEDULE 3 TO LICENCE NUMBER: [xxx]

Maximum power of Radio Equipment outside the Permitted Channel

1800 MHz

1. When transmitting, the Licensee must transmit within the limits set out below.

Frequency offset from the lower frequency of the band edge	Maximum mean EIRP density
-6.2 to -3.2 MHz	-55 dBm / kHz
-3.2 to 0 MHz	-45 + 10 x (ΔFL*+ 0.2) / 3 dBm / kHz

Frequency offset from the upper frequency of the band edge	Maximum mean EIRP density
0 to 0.05 MHz	-23 - 60 x ΔFH* dBm / kHz
0.05 to 0.1 MHz	-26 - 153.3 x (ΔFH* - 0.05) dBm / kHz
0.1 to 2.8 MHz	-45 - 10 x (ΔFH* + 0.2) / 3 dBm / kHz
2.8 to 5.8 MHz	-55 dBm / kHz

*Notes ΔFL in MHz is the offset from the lower edge of the permitted frequency band at 1876.7 MHz (it has values in the range -3.2 to 0 MHz)
ΔFH in MHz is the offset from the upper edge of the permitted frequency band at 1880 MHz (it has values in the range 0 to 2.8 MHz)

2300 MHz

1. When transmitting, the Licensee must transmit within the limits set out below.

Frequency offset from the Permitted Channel edge	**Power**
-5 to 0 MHz offset from lower Permitted Channel edge 0 to 5 MHz offset from upper Permitted Channel edge ~~2385 to 2390 MHz~~ ~~2400 to 2403 MHz~~	(PMax – 40) dBm / 5 MHz EIRP per antenna
-10 to -5 MHz offset from lower Permitted Channel edge 5 to 10 MHz offset from upper Permitted Channel edge ~~2300 to 2385 MHz~~	(PMax – 43) dBm / 5 MHz EIRP per antenna
< -10 MHz offset from lower Permitted Channel edge > 10 MHz offset from upper Permitted Channel edge	(PMax – 43) dBm / 5 MHz EIRP per antenna

2. In addition, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Channel shall not exceed the following additional requirements:

Frequency	Power
2400-2403 MHz	(PMax – 40) dBm / 5 MHz EIRP per antenna
Above 2403 MHz*	–17 dBm / 5 MHz EIRP**

*The limit defined above 2403 MHz given here takes precedence over the limits defined in paragraph 1

**The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.

7.1 For licensees with a Permitted Channel within the range 2390-2400 MHz, the licensee's base stations must transmit within the limits of transmission Frame Structure A, except for indoor base stations. If indoor base stations cause undue interference to the licensee in the 2350-2390 MHz band, we reserve the right to require the indoor base stations to transmit within the limits of transmission Frame Structure A.

7.2 Frame Structure A means:

- timeslots (or subframes) 0, 2 to 5 and 7 to 9 must be allocated to Downlink (D) or Uplink (U) transmissions as indicated or may be left with no transmissions;
- the Licensee must ensure that the special subframe (S) in timeslots 1 and 6 has a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2;
- all timeslots must be 1 millisecond in duration and the frame must start at a common reference time so that frames are aligned with licensee(s) that hold a Spectrum Access licence in 2350-2390MHz and transmissions synchronised; and
- TD-LTE frame configuration 2 (3:1) is compatible with this frame structure. Other technologies are permitted provided that the requirements are met.

Frame Structure A

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

7.3 For licensees with a Permitted Channel within the range 2320-2340 MHz, no such synchronisation requirements apply. If the 2320-2340 MHz licensee causes undue interference to the authorised user in the 2340-2345 MHz band, we reserve the right to require the licensee to transmit using a frame structure which mitigates this interference.

3.8 – 4.2 GHz

1. When transmitting, the Licensee must transmit within the limits set out below.

Frequency	Power
-5 to 0 MHz offset from lower channel edge 0 to 5 MHz offset from upper channel edge	(PMax – 40) dBm / 5 MHz EIRP per antenna
-10 to -5 MHz offset from lower channel edge 5 to 10 MHz offset from upper channel edge	(PMax – 43) dBm / 5 MHz EIRP per antenna
< -10 MHz offset from lower channel edge > 10 MHz offset from upper channel edge	(PMax – 43) dBm / 5 MHz EIRP per antenna

2. In addition, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Channel shall not exceed the following additional band edge requirements:

Frequency	Power
3795 MHz – 3800 MHz 4200 MHz – 4205 MHz	(PMax – 40) dBm / 5 MHz EIRP per antenna
3760 MHz - 3795 MHz 4205 MHz – 4240 MHz	(PMax – 43) dBm / 5 MHz EIRP per antenna
Below 3760 MHz Above 4240 MHz	-2 dBm / 5 MHz EIRP per antenna

26 GHz and 40 GHz

The technical schedules for 26 GHz and 40 GHz are set out in Annex A4 of the Enabling mmWave spectrum for new uses statement published in September 2023.

Interpretation of terms in this schedule

1. In this schedule:

   a) "**dBm**" means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

   b) "**Permitted Channel**" means the frequency assigned by Ofcom that is the upper and lower cut-off frequencies;

   c) "**PMax**" is the maximum mean power for the base station in question, measured as EIRP per carrier and determined irrespective of the number of antennas;

   ~~d) "**TRP**" means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere, measured during the on part of the transmission;~~

Office of Communications (Ofcom)
Wireless Telegraphy Act 2006

SHARED ACCESS MEDIUM POWER LICENCE

Sector/Class/Product:	**615002 - Shared Access (Medium Power) / Shared Access**
Licence number:	
Licensee:	
Company Registration:	
Licensee Address:	
Email:	
Date of Issue:	
Valid From:	
[Licence end date:]	
Payment Interval:	1 Year

1. The Office of Communications (Ofcom) grants this wireless telegraphy licence ("the Licence") to [the Licensee's name] to establish, install and use wireless telegraphy stations and/or wireless telegraphy apparatus as described in the schedules to this Licence (together "the Radio Equipment") subject to the terms set out below.

Licence Term

2. This Licence shall continue in force until revoked by Ofcom or surrendered by the Licensee or if it is a Short Term Licence, when it reaches its expiration date.

Licence Revocation

3. Pursuant to schedule 1 paragraph 8 of the Wireless Telegraphy Act 2006 ("the Act"), Ofcom may not revoke this Licence under schedule 1 paragraph 6 of the Act except:

   a) at the request, or with the consent, of the Licensee;
   b) if there has been a breach of any of the terms of this Licence;
   c) in accordance with schedule 1 paragraph 8(5) of the Act;
   d) if it appears to Ofcom to be necessary or expedient to revoke the Licence for the purpose of complying with a direction by the Secretary of State given to Ofcom under section 5 of the Act or section 5 of the Communications Act 2003;
   e) for reasons related to the management of the radio spectrum provided that in such a case the power to revoke may only be exercised after at least one month's notice is given in writing.

4. Ofcom may only revoke this Licence by notification in writing to the Licensee and in accordance with schedule 1 paragraphs 6, 6A and 7 of the Act.

Licence variation

5. Ofcom may only vary this Licence by notification in writing to the Licensee and in accordance with schedule 1 paragraphs 6, 6A and 7 of the Act.

Requirement to commence and maintain transmission within 6 months

6. The Licensee must establish, install and use the Radio Equipment to commence regular wireless telegraphy transmissions in accordance with the provisions of this Licence within six months of the date that this Licence is issued, and maintain such transmissions thereafter.

Transfer

7. This Licence may not be transferred. The transfer of rights and obligations arising by virtue of this Licence may however be authorised in accordance with regulations made by Ofcom under powers conferred by section 30 of the Act.[115]

Changes to Licensee details

8. The Licensee shall give prior notice to Ofcom in writing of any proposed changes to the Licensee's name, email address and/or address as recorded above paragraph 1 of this Licence.

Fees

9. The Licensee shall pay to Ofcom the relevant fee(s) as provided in section 12 of the Act and the regulations made thereunder on or before the fee payment date shown above, or on or before such dates as are notified in writing to the Licensee.

10. If the Licence is surrendered, revoked or varied, no refund, whether in whole or in part, of any amount which is due under the terms of this Licence, payable in accordance with any regulations made by Ofcom under sections 12 and 13(2) of the Act will be made, except at the absolute discretion of Ofcom.

Radio Equipment Use

11. The Licensee shall ensure that the Radio Equipment is established, installed and used only in accordance with the provisions specified in the schedules to this Licence. Any proposal to amend any detail specified in any of the schedules to this Licence must be agreed with Ofcom in advance and implemented only after this Licence has been varied or reissued accordingly.

12. The Licensee shall ensure that the Radio Equipment is operated in compliance with the terms of this Licence and is used only by persons who have been authorised in writing by the Licensee to do so and that such persons are made aware of, and of the requirement to comply with, the terms of this Licence.

13. The Licensee must ensure that all Radio Equipment is established, installed, modified and used only in accordance with the provisions specified in schedule 4 (EMF Licence Condition) of this Licence.

Access and Inspection

14. The Licensee shall permit any person authorised by Ofcom:

    a) to have access to the Radio Equipment; and
    b) to inspect this Licence and to inspect, examine and test the Radio Equipment,

[115] See Ofcom's website for the latest position on spectrum trading and the types of trade which are permitted.

at any and all reasonable times or, when in the opinion of that person an urgent situation exists, at any time, to ensure the Radio Equipment is being used in accordance with the terms of this Licence.

Modification, Restriction and Closedown

15. Any person authorised by Ofcom may require the Radio Equipment or any part thereof, to be modified or restricted in use, or temporarily or permanently closed down immediately if in the opinion of the person authorised by Ofcom:

    a) a breach of this Licence has occurred; and/or
    b) the use of the Radio Equipment is, or may be, causing or contributing to undue interference to the use of other authorised radio equipment.

16. Ofcom may require any of the Radio Equipment to be modified or restricted in use, or temporarily closed down either immediately or on the expiry of such period as may be specified in the event of a national or local state of emergency being declared. Ofcom may only exercise this power after a written notice has been served on the Licensee or a general notice applicable to holders of a named class of licence has been published.

Geographical Boundaries

17. Subject to the requirements of any coordination procedures notified to the Licensee pursuant to the schedules to this Licence, the Licensee is authorised to establish, install and use a base station at the location set out the schedules to this Licence and any terminals connecting to it.

Synchronisation requirement

18. Where synchronisation requirements are set out in Schedule 3 to this Licence, the Licensee must transmit within the transmission limits specified.

19. Where synchronisation requirements have not been specified, in the event that harmful interference arises, the Licensee shall endeavour to discuss and agree with the other licence holder(s) how to coordinate their use. If agreement between licence holders cannot be reached, Ofcom may notify the Licensee to comply with additional technical conditions relating to synchronisation requirements.

20. The Licensee must comply with such technical conditions relating to synchronisation requirement notified to it by Ofcom from time to time.

21. The Licensee accepts that they may need to alter or replace Radio Equipment in order to comply with any synchronisation requirement notified from time to time.

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~~22. On 25 July 2019, Ofcom published a statement called Enabling wireless innovation through local licensing containing a spectrum management decision to enable shared access to spectrum supporting mobile technology. In that decision, Ofcom stated that it will assess whether it is appropriate to transition towards a Dynamic Spectrum Approach in order to provide users more access to spectrum by means of automatic database frequency assignment. The Licensee is therefore notified that Ofcom currently intends to vary this Licence in accordance with paragraph 5 from time to time in future, or may re-issue the Licence, to give effect to that decision.~~

Notification in electronic form

23. The Licensee shall accept notifications and other related documents under this Licence electronically to the designated email address as recorded above paragraph 1 of this Licence. The Licensee must update Ofcom about changes to the designated email address in accordance with paragraph 8.

Interpretation

24. In this Licence:

    a) the establishment, installation and use of the Radio Equipment shall be interpreted as establishment and use of wireless telegraphy stations and installation and use of wireless telegraphy apparatus for wireless telegraphy as specified in section 8(1) of the Act;
    b) the expression "**interference**" shall have the meaning given by section 115 of the Act;
    c) the expressions "**wireless telegraphy station**" and "**wireless telegraphy apparatus**" shall have the meanings given by section 117 of the Act;
    d) the schedule(s) form part of this Licence together with any subsequent schedule(s) which Ofcom may issue as a variation to this Licence; and
    e) the Interpretation Act 1978 shall apply to the Licence as it applies to an Act of Parliament.

Issued by Ofcom

SCHEDULE 1 TO LICENCE NUMBER: [xxx]

Schedule Date:	[**xxx**]
Licence category:	Shared Access Medium Power

Description of Radio Equipment

1. References in this schedule(s) to the Radio Equipment are references to any wireless telegraphy station or wireless telegraphy apparatus that is established, installed and/or used under this schedule(s).

Interface Requirements for the Radio Equipment

2. Use of the Radio Equipment shall be in accordance with the following Interface Requirement:

IR 2104 Shared Access Medium power

Special conditions relating to the Radio Equipment

3. This Licence authorises the use of the Radio Equipment within the Permitted Frequency Band and the Licensee warrants that the Radio Equipment is capable of transmitting across the Permitted Frequency Band.

4. However, the Licensee is only authorised to transmit on the Permitted Channel Centre Frequency within the Permitted Frequency Band, as set in Schedule 2 to this Licence or as notified to the Licensee by Ofcom from time to time.

5. The Licensee must comply with any change to the Permitted Channel Centre Frequency notified by Ofcom within the timescale indicated in the notification.

6. During the period that this Licence remains in force, unless consent has otherwise been given by Ofcom, the Licensee shall compile and maintain accurate written records of the following details relating to the Radio Equipment:

   a) For all fixed/ installed terminals the:

      i) postal address (including post code);
      ii) National Grid Reference (to 1m resolution); and
      iii) Antenna height (above ground level), type, and boresight bearing east of true north (if applicable); and

   b) For all mobile and nomadic terminals in the 3.8-4.2 GHz band the postal address (including post code) of where it will be used.

7. The Licensee shall submit to Ofcom in such manner and within such period as specified by Ofcom, such other information in relation to the Radio Equipment, or any wireless telegraphy station or wireless telegraphy apparatus which the Licensee is planning to use, as Ofcom may from time to time request. Such information may include, but is not limited to, information in relation to the radio frequency, transmitted power and date of first use for wireless telegraphy stations or wireless telegraphy apparatus to be established, installed or used within such timeframe and in such areas as Ofcom may reasonably request.

8. The use of the Radio Equipment is not permitted airborne.

9. Paragraph 10 applies where the following conditions are fulfilled:

a. The Permitted Frequency Band for this Licence is 3805 – 4195 MHz; and

*b. The Licensee holds another Shared Access Medium Power Licence(s) for which the Permitted Frequency Band is 3805 – 4195 MHz which was issued after [**date of consultation**]; and*

c. That other licence(s) authorises Radio Equipment that is located:

i. in an Urban Area; and

ii. within 500m of the Radio Equipment to which this Licence relates; and

d. The Permitted Channel frequency bandwidths authorised by this Licence, and that other licence(s), taken together, authorise the Licensee to use more than 100MHz of the Permitted Frequency Band.

10. Where this clause applies the Licensee must not establish, install and use the Radio Equipment to which this Licence relates.

Coordination at frequency and geographical boundaries

11. The Licensee shall ensure that the Radio Equipment is operated in compliance with such coordination procedures as may be notified to the Licensee by Ofcom from time to time.

Cooperation between licensees

12. In addition to complying with the specific transmission terms, conditions and limitations set out in this Licence, the Licensee must liaise and co-operate with other holders of licences in the Permitted Frequency Band (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 that of another Licensee within the band.

Interpretation of terms in this schedule

13. In this schedule:

a) “Fixed or installed” means used or installed at specific fixed points.

b) "IR" means a United Kingdom Radio Interface Requirement published by Ofcom in accordance with the Radio Equipment Regulations 2017, as amended by the Product Safety and Metrology etc. (Amendment etc.) (EU Exit) Regulations 2019.

c) “mobile or nomadic” means intended to be used while in motion or during halts at unspecified points.

d) “Permitted Channel” means the frequency assigned by Ofcom that is the upper and lower cutoff frequencies;

e) “Permitted Channel Centre Frequency” means the frequency assigned by Ofcom that is the midpoint between the upper and lower channel edge frequencies.

f) “Permitted Frequency Band” means the frequency range within which Ofcom will assign the Permitted Channel Centre Frequency

g) “Urban Area” means an area which is not:

i) A location in England or Wales in an ONS 2011 Census Output Area which falls into categories D1, D2, E1, E2, F1 or F2 (i.e. "town and fringe", "villages" and "hamlets and isolated dwellings"); [116]

ii) Any location in Scotland which falls into categories 3-8 based on the Scottish Government's 8-fold Urban Rural Classification; [117]

iii) any location in Northern Ireland which falls into bands E-H of the Northern Ireland Statistics and Research Agency's settlement classification bands. [118]

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[116] Office of National Statistics, "2011 Rural/Urban Classification", https://www.ons.gov.uk/methodology/geography/geographicalproducts/ruralurbanclassifications/2011ruralurbanclassification

[117] Scottish Government, "Scottish Government Urban Rural Classification", https://www.gov.scot/Topics/Statistics/About/Methodology/UrbanRuralClassification

[118] Northern Ireland Statistics and Research Agency, "Urban-Rural Classification", https://www.nisra.gov.uk/support/geography/urban-rural-classification

SCHEDULE 2 TO LICENCE NUMBER: [xxx]

Schedule Date:	[**xxx**]
Licence category:	Shared Access Medium Power

1800 MHz

Transmitter(s)	
Base station location	NGR [**xxx xxx**]
Station Name/Address	
Deployment location	[Indoor only/Indoor or Outdoor]
Permitted Frequency Band	1871.7 - 1880 MHz
EIRP Tx	
Permitted Channel Centre Frequency Tx	1878.35 MHz
Permitted Channel Centre Frequency Rx	1878.35 MHz
Permitted Channel frequency bandwidth	3.3 MHz
Antenna Type	[Antenna Library Reference, Azimuth, Elevation]
Antenna Height (Metres)	
Relevant Receiver Parameters	
Receive Antenna Gain used in coordination[110]	X dBi

Maximum power within the Permitted Channel

1. When transmitting, the licensee must transmit within the limits set out below.

Radio Equipment	**Band**	**Maximum Power**	
Base Station	1876.7-1880 MHz	42 dBm / carrier (up to 3 MHz) EIRP per cell	
		Frequency offset from the lower frequency of the band edge	**Maximum Mean EIRP density** per cell
		0 to 0.05 MHz	-33.6 + 153.3 x ΔFL* dBm / kHz

[110] This is the value which the Licensee supplied to Ofcom for coordination purposes. For the avoidance of doubt, the Licensee is not bound by this value and may use a higher value at the Licensee's own risk.

Radio Equipment	Band	Maximum Power	
		0.05 to 0.1 MHz	-26 + 60 x (ΔFL*- 0.05) dBm / kHz
		0.1 to 0.2 MHz	-23 + 230 x (ΔFL*- 0.1) dBm / kHz
		0.2 to 3.2 MHz	42 dBm / carrier
		3.2 to 3.3 MHz	-23 + 230 x (3.3 – ΔFL*) dBm / kHz
		* Note: ΔFL in MHz is the offset from the lower edge of the permitted frequency band at 1876.7 MHz (it has values in the range 0 to +0.2 MHz and +3.2 to +3.3MHz)	
Fixed / installed terminal station[a]	1781.7 – 1785 MHz	23 dBm EIRP	
Mobile or nomadic terminal station[a]	1781.7 – 1785 MHz	23 dBm TRP	
[a] The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.			

2300 MHz

Transmitter(s)	
Base station location	NGR [**xxx xxx**]
Station Name/Address	
Deployment location	[Indoor only/Indoor or Outdoor]
Permitted Frequency Band	2390-2400 MHz
EIRP Tx	
Permitted Channel Centre Frequency	2395 MHz
Permitted Channel frequency bandwidth	10 MHz
Antenna Type	[Antenna Library Reference, Azimuth, Elevation]
Antenna Height (metres)	
Relevant Receiver Parameters	

Transmitter(s)	
Receive Antenna Gain used in coordination[120]	

Maximum power within the Permitted Channel

2300 MHz shared spectrum

1. When transmitting, the Licensee must transmit within the limits set out below.

Radio Equipment	Band	Maximum Power
Base Station	2390-2400 MHz	42 dBm / carrier (up to 10 MHz) EIRP per cell
Fixed / installed terminal Station[a]	2390-2400 MHz	25 dBm EIRP (includes a 2 dB tolerance)
Mobile or nomadic terminal station[a]	390-2400 MHz	25 dBm TRP (includes a 2 dB tolerance)
[a] The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.		

3.8 – 4.2 GHz

Transmitter(s)	
Base station location	NGR [**xxx xxx**]
Station Name/Address	
Deployment location	[Indoor only/Indoor or Outdoor]
Permitted Frequency Band	3805 – 4195 MHz
EIRP Tx	
Permitted Channel Centre Frequency	
Permitted Channel frequency bandwidth	
Antenna Type	[Antenna Library Reference, Azimuth, Elevation]

[120] This is the value which the Licensee supplied to Ofcom for-coordination purposes. For the avoidance of doubt, the Licensee is not bound by this value and may use a higher value at the Licensee's own risk.

Transmitter(s)	
Antenna Height (Metres)	
Relevant Receiver Parameters	
Receive Antenna Gain used in coordination[121]	

Maximum power within the Permitted Channel

3.8 – 4.2 GHz shared spectrum

1. When transmitting, the Licensee must transmit within the limits set out below.

Radio Equipment	Band	Maximum Power
Base Station	3805 – 4195 MHz	42 dBm / carrier EIRP per cell for carriers ≤ 20 MHz; or 36 dBm / 5 MHz EIRP per cell for carriers > 20 MHz ~~(EIRP)~~
Fixed / installed terminal station[a]	3805 – 4195 MHz	28 dBm TRP and 35 dBm/5 MHz EIRP (includes a 2 dB tolerance)
Mobile or nomadic terminal station[a]	3805 – 4195 MHz	28 dBm TRP (includes a 2 dB tolerance)
[a] The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.		

26 GHz and 40 GHz

The technical schedules for 26 GHz and 40 GHz are set out in Annex A4 of the Enabling mmWave spectrum for new uses statement published in September 2023.

All bands

Interpretation of terms in this schedule

2. In this schedule:

   a) "Active antenna systems (AAS)" means a base station and an antenna system where the amplitude and/or phase between antenna elements is continually adjusted resulting in an antenna pattern that varies in response to short term changes in the radio environment. This excludes long-term beam shaping such as fixed electrical down tilt. In

[121] This is the value which the Licensee supplied to Ofcom for-coordination purposes. For the avoidance of doubt, the Licensee is not bound by this value and may use a higher value at the Licensee's own risk.

AAS base stations the antenna system is integrated as part of the base station system or product.

b) “dBm” means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 1 milliwatt);
c) “Fixed or installed” means used or installed at specific fixed points;
d) “Indoor” or “indoors” means inside premises which have a ceiling or a roof; and except for any doors, windows or passageways, are wholly enclosed;
e) “mobile or nomadic” means intended to be used while in motion or during halts at unspecified points;
f) “NGR” means National Grid Reference;
g) “outdoor” or “outdoors” means anywhere that is not indoor;
h) **“per cell”** means per specific piece of Radio Equipment. For a multi-sector base station, per cell refers to each one of the individual sectors irrespective of the number of transmit antennas;
i) “Permitted Channel” means the frequency assigned by Ofcom that is the upper and lower cutoff frequencies;
j) “Permitted Channel Centre Frequency” means the frequency assigned by Ofcom that is the midpoint between the upper and lower cutoff frequencies.
k) “Permitted Channel Frequency Bandwidth” means the total amount of spectrum assigned to the channel;
l) “Permitted Frequency Band” means the frequency range within which Ofcom will assign the Permitted Channel Centre Frequency;
m) “TRP” means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere, measured during the on part of the transmission.

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SCHEDULE 3 TO LICENCE NUMBER: [xxx]

Maximum power of Radio Equipment outside the Permitted Channel

1800 MHz

1. When transmitting, the Licensee must transmit within the limits set out below.

Frequency offset from the lower frequency of the band edge	Maximum mean EIRP density
-6.2 to -3.2 MHz	-55 dBm / kHz
-3.2 to 0 MHz	-45 + 10 x (ΔFL*+ 0.2) / 3 dBm / kHz

Frequency offset from the upper frequency of the band edge	Maximum mean EIRP density
0 to 0.05 MHz	-23 - 60 x ΔFH* dBm / kHz
0.05 to 0.1 MHz	-26 - 153.3 x (ΔFH* - 0.05) dBm / kHz
0.1 to 2.8 MHz	-45 - 10 x (ΔFH* + 0.2) / 3 dBm / kHz
2.8 to 5.8 MHz	-55 dBm / kHz

*Notes ΔFL in MHz is the offset from the lower edge of the permitted frequency band at 1876.7 MHz (it has values in the range -3.2 to 0 MHz)
ΔFH in MHz is the offset from the upper edge of the permitted frequency band at 1880 MHz (it has values in the range 0 to 2.8 MHz)

2300 MHz

1. When transmitting, the Licensee must transmit within the limits set out below.

Frequency	Power
2385 to 2390 MHz 2400 to 2403 MHz	(PMax – 40) dBm / 5 MHz EIRP per antenna
2300 to 2385 MHz	(PMax – 43) dBm / 5 MHz EIRP per antenna
Above 2403 MHz 24 dBm < Pmax ≤ 42 dBm Pmax ≤ 24 dBm	 (PMax – 41) dBm / 5 MHz EIRP* –17 dBm / 5 MHz EIRP*

*The maximum mean power relates to the EIRP of a specific piece of Radio Equipment irrespective of the number of transmit antennas.

2. The licensee's base stations must transmit within the limits of transmission Frame Structure A.

3. Frame Structure A means:

- timeslots (or subframes) 0, 2 to 5 and 7 to 9 must be allocated to Downlink (D) or Uplink (U) transmissions as indicated or may be left with no transmissions;
- the Licensee must ensure that the special subframe (S) in timeslots 1 and 6 has a structure that is compatible with TD-LTE special subframe configuration 6, also known as 9:3:2;
- all timeslots must be 1 millisecond in duration and the frame must start at a common reference time so that frames are aligned with licensee(s) that hold a Spectrum Access licence in 2350-2390MHz and transmissions synchronised; and
- TD-LTE frame configuration 2 (3:1) is compatible with this frame structure. Other technologies are permitted provided that the requirements are met.

Frame Structure A

DL/UL ratio	Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

3.8 – 4.2 GHz

1. When transmitting, the Licensee must transmit within the limits set out below.

Frequency	Power
-5 to 0 MHz offset from lower channel edge 0 to 5 MHz offset from upper channel edge	(PMax – 40) dBm / 5 MHz EIRP per antenna
-10 to -5 MHz offset from lower channel edge 5 to 10 MHz offset from upper channel edge	(PMax – 43) dBm / 5 MHz EIRP per antenna
< -10 MHz offset from lower channel edge > 10 MHz offset from upper channel edge	(PMax – 43) dBm / 5 MHz EIRP per antenna

2. In addition, the EIRP emanating from the Radio Equipment transmissions at any frequency outside the Permitted Frequency Channel shall not exceed the following additional band edge requirements:

Frequency	Power
3795 MHz – 3800 MHz 4200 MHz – 4205 MHz	(PMax – 40) dBm / 5 MHz EIRP per antenna
3760 MHz - 3795 MHz 4205 MHz – 4240 MHz	(PMax – 43) dBm / 5 MHz EIRP per antenna
Below 3760 MHz Above 4240 MHz	-2 dBm / 5 MHz EIRP per antenna

26 GHz and 40 GHz

The technical schedules for 26 GHz and 40 GHz are set out in Annex A4 of the Enabling mmWave spectrum for new uses statement published in September 2023.

All bands

Interpretation of terms in this schedule

1. In this schedule:

   a) "dBm" means the power level in decibels (logarithmic scale) referenced against 1 milliwatt (i.e. a value of 0 dBm is 1 milliwatt);

   b) "Permitted Channel" means the frequency assigned by Ofcom that is the upper and lower cutoff frequencies;

   c) "PMax" is the maximum mean power for the base station in question, measured as EIRP per carrier and determined irrespective of the number of antennas;

   ~~d) "TRP" means the total radiated power. This is the integral of the power transmitted in different directions over the entire radiation sphere, measured during the on part of the transmission.~~

SCHEDULE 4 – EMF Licence Condition

Schedule Date:	[**xxx**]
Licence category:	Spectrum Access Licence

Sites which are not shared with another licensee

1. The Licensee shall only establish, install, modify or use Relevant Radio Equipment if the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment do not exceed the basic restrictions[122] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[123] in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

Sites which are shared with another licensee

2. In the case of a shared site where the Shared Site Exemption applies to the Licensee, the Licensee shall comply with paragraph 1 above.

3. In the case of a shared site where the Shared Site Exemption does not apply to the Licensee, the Licensee shall only establish, install, modify or use the Relevant Radio Equipment if:

   a) the total electromagnetic field exposure levels produced by the Licensee's On-Site Radio Equipment, together with
   b) the total electromagnetic field exposure levels produced by all other wireless telegraphy stations and wireless telegraphy apparatus operated by another licensee on the same site for which the Licensee can reasonably assume that a Shared Site Exemption does not apply,

   do not exceed the basic restrictions[124] in the relevant tables for general public exposure identified in the ICNIRP Guidelines[125] in any area where a member of the general public is or can be expected to be present when transmissions are taking place.

Emergency Situations

4. The obligations in paragraphs 1, 2 and 3 above will not apply if the Relevant Radio Equipment is being used for the purpose of seeking emergency assistance or reporting and responding to an emergency situation (in the vicinity of that situation) including for search and rescue activities and maritime emergency communications[126].

[122] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[123] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".
[124] Compliance with the reference levels for general public exposure identified in the ICNIRP Guidelines will ensure compliance with the basic restrictions.
[125] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".
[126] Further information on emergency situations in set out in Ofcom's "Guidance on EMF Compliance and Enforcement".

Relationship with authorised transmission levels

5. The Licensee shall comply with paragraphs 1, 2 and 3 above notwithstanding the maximum transmission levels authorised in the Licence.

Records

6. The Licensee shall keep, or shall procure that a third party shall keep, and shall make available to Ofcom on request, records (including the type of records identified in Ofcom's "Guidance on EMF Compliance and Enforcement") that demonstrate how it has complied with paragraphs 1, 2 and 3 above when Relevant Radio Equipment is established, installed, modified or used.

Ofcom's "Guidance on EMF Compliance and Enforcement"

7. When evaluating its compliance with paragraphs 1, 2 and 3 above, the Licensee shall take into account Ofcom's "Guidance on EMF Compliance and Enforcement" that is in force at the relevant time.

Interpretation

8. In this schedule:

   a) **"dBi"** means the ratio in dB (decibel) when comparing the gain of the antenna to the gain of an isotropic antenna. An isotropic antenna is a theoretical antenna which radiates power uniformly in all directions;

   b) **"EIRP"** means equivalent isotropically radiated power which is the product of the power supplied to an antenna and the absolute or isotropic antenna gain in a given direction relative to an isotropic antenna;

   c) **"ERP"** means effective radiated power which is the product of the power supplied to an antenna and its gain in a given direction relative to a half-wave dipole;

   d) "**general public**" means any person who is not: (a) the Licensee, owner, operator or installer of the Relevant Radio Equipment; or (b) acting under a contract of employment or otherwise acting for purposes connected with their trade, business or profession or the performance by them of a public function;[127]

[127] There is pre-existing health and safety legislation which already requires employers to protect workers from exposure to electromagnetic fields ("EMF") including the following legislation specifically relating to EMF (as amended from time to time): The Control of Electromagnetic Fields at Work Regulations 2016, The Control of Electromagnetic Fields at Work Regulations (Northern Ireland) 2016 and The Merchant Shipping and Fishing Vessels (Health and Safety at Work) (Electromagnetic Fields) Regulations 2016.

e) **"ICNIRP Guidelines"** means the version of the Guidelines published by the International Commission on Non-Ionizing Radiation Protection for limiting exposure to electromagnetic fields which are identified in Ofcom's "Guidance on EMF Compliance and Enforcement" that is in force at the relevant time.[128]

f) **"Licensee's On-Site Radio Equipment"** means the Relevant Radio Equipment and any other wireless telegraphy station(s) and wireless telegraphy apparatus on the same site which transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP.[129]

g) **"Relevant Radio Equipment"** means all the Radio Equipment that is authorised by this Licence to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP.

h) **"Shared Site Exemption"** means any of the following three situations apply on a shared site in relation to the Licensee's or another licensee's wireless telegraphy station(s) or wireless telegraphy apparatus that is authorised to transmit at powers higher than 10 Watts EIRP or 6.1 Watts ERP:

- The first situation is that all of the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus on a shared site do not transmit at a combined total radiated power in any particular direction[130] that is higher than 100 Watts EIRP or 61 Watts ERP;[131]
- The second situation is that the total electromagnetic field exposure levels produced by the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus in any area where a member of the general public is or can be expected to be present when transmissions are taking place is no more than 5% of the basic restrictions or 5% of the reference levels in the relevant tables for general public exposure identified in the ICNIRP Guidelines;[132]

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[128] Ofcom's "Guidance on EMF Compliance and Enforcement" will initially require the Licensee to comply with the ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz), published in: Health Physics 74(4):494-522, dated April 1998 and available at: https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf ("1998 Guidelines") or the ICNIRP Guidelines for limiting exposure to electromagnetic fields (100 KHz to 300 GHz), published in: Health Physics 118(5): 483–524; 2020 and available at: https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf ("2020 Guidelines"). However, once work on the relevant standards explaining the methodology for assessing compliance with the 2020 Guidelines has progressed sufficiently, Ofcom will publish a public consultation on updating its "Guidance on EMF Compliance and Enforcement" to explain that going forward Ofcom will be requiring the Licensee to comply with the 2020 Guidelines only. Following this public consultation, Ofcom will publish an updated version of Ofcom's "Guidance on EMF Compliance and Enforcement" on its website. Ofcom will follow the same process for any subsequent versions of the ICNIRP Guidelines.

[129] 10 Watts EIRP is equivalent to 6.1 Watts ERP. In linear units EIRP (W) = 1.64 x ERP (W); in decibels EIRP (dB) = ERP (dB) + 2.15. Ofcom's "Guidance on EMF Compliance and Enforcement" explains how the Licensee can determine if wireless telegraphy station(s) or wireless telegraphy apparatus "transmits at powers higher than 10 Watts EIRP or 6.1 Watts ERP".

[130] For the purpose of this situation, the combined total radiated power is a simple sum of the radiated powers (in EIRP or ERP) of all of the licensee's wireless telegraphy station(s) or wireless telegraphy apparatus on the shared site that transmits signals covering the same or overlapping areas.

[131] 100 Watts EIRP is equivalent to 61 Watts ERP.

[132] The relevant tables for general public exposure are identified in Ofcom's "Guidance on EMF Compliance and Enforcement".

- The third situation is where the licensee's wireless telegraphy station or wireless telegraphy apparatus has an antenna gain that is equal to or higher than 29 dBi and has a fixed beam;

i) **"shared site"** means a site that is shared by the Licensee and at least one other licensee for the purposes of establishing, installing, modifying or using wireless telegraphy stations or wireless telegraphy apparatus;

j) **"site"** means a physical structure, building, vehicle or moving platform;

k) **"wireless telegraphy apparatus"** has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006; and

l) **"wireless telegraphy station"** has the meaning given to it in section 117 of the Wireless Telegraphy Act 2006.

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