Enabling mmWave spectrum for new uses

Coordination procedures under the Spectrum Access High Density 26 GHz/40 GHz licences

Notice

Contents

Section

1. Introduction

1.1 The Spectrum Access High Density 26 GHz licences and the Spectrum Access High Density 40 GHz licences (Sch. 1, paragraph 9) contain the following condition ("*Coordination*"):

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

1.2 This Notice, which is notified to the holders of the Spectrum Access High Density 26 GHz licences (the "**26 GHz Spectrum Access Licensees**") and the holders of the Spectrum Access High Density 40 GHz licences (the "**40 GHz Spectrum Access Licensees**") under their respective licences, sets out the following coordination procedures:

a) the procedures for coordinating the 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees with incumbent licensees in the 25.1 GHz to 26.5 GHz band and the 40.5-43.5 GHz band until these bands are cleared of the fixed links which are likely to suffer harmful interference from mobile deployments in high density areas (Section 3);
b) the procedures for coordinating the 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees at the boundary of the high density areas for the purpose of preventing harmful interference to other authorised spectrum users outside the boundaries of such areas (Section 4); and
c) the procedure for coordinating the 40 GHz Spectrum Access Licensees with the radio astronomy site operating in the 42.5-43.5 GHz band near Cambridge (Section 5).

2. Definitions

2.1 In this Notice:

26 GHz band	means the following frequencies: 25.1 GHz to 27.5 GHz
40 GHz band	means the following frequencies: 40.5 GHz to 43.5 GHz
40 GHz deployment	Means: (i) base stations which are licensed to transmit using frequencies in the 40 GHz band and (ii) fixed or installed terminal stations which are not exempt from the requirement to hold a wireless telegraphy licence and which are licensed to transmit using frequencies in the 40 GHz band, excluding any smart/intelligent repeaters which are located indoors.
26 GHz Spectrum Access Licensee	means the holder of a Spectrum Access High Density 26 GHz licence
40 GHz Spectrum Access Licensee	means the holder of a Spectrum Access High Density 40 GHz licence
high density areas	means the areas where the holders of the Spectrum Access High Density 26 GHz licences and the holders of the Spectrum Access High Density 40 GHz licences are authorised to transmit under these licences
indoor	means inside premises which have a ceiling or a roof; and except for any doors, windows or passageways, are wholly enclosed
low power base station	means an *outdoor* base station with a TRP of up to 25 dBm / 200 MHz and antenna height up to 10 m or an *indoor* base station with a TRP of up to 25 dBm / 200 MHz, regardless of its antenna height
medium power base station	means a base station with TRP of between 25 and 36 dBm / 200 MHz or an *outdoor* base station with antenna height greater than 10 m (regardless of its TRP)
RAS	means radio astronomy service
Smart smart/intelligent repeater	has the same meaning as set out in the Spectrum Access High Density 26 GHz licences and the Spectrum Access High Density 40 GHz licences
spectrum quality benchmark (SQB)	means the maximum allowable received interference power at a radio astronomy location
SSB	means synchronisation signal block

terminal station means radio equipment that receives downlink transmissions from a base station.

3. Coordination procedures for 26 and 40 GHz Spectrum Access Licensees during the period that fixed links remain in and around high density areas

Purpose

3.1 There are incumbent fixed links in and around the high density areas which operate: (i) in the 24.5-26.5 GHz band under point-to-point Fixed Link licences and (ii) in the 40 GHz band under three block assigned Spectrum Access licences.

3.2 In December 2023, Ofcom issued notices of its decision to revoke all point-to-point Fixed Link licences authorising use of 24.5-26.5 GHz that Ofcom considers likely to suffer harmful interference from mobile deployments in high density areas, with effect from 31 December 2028.[1]

3.3 Similarly, in May 2023, Ofcom issued notices of its decision to revoke the block assigned Spectrum Access licences authorising use of the 40 GHz band with effect from 1 June 2028. Ofcom will offer to grant MBNL individual temporary licences – starting on 1 June 2028 and expiring on 1 January 2030 – for up to 500 of its existing fixed links that meet certain conditions.[2]

3.4 The procedures set out below are intended to coordinate the 26 GHz Spectrum Access Licensees with incumbent licensees in the 25.1 GHz to 26.5 GHz band and the 40 GHz Spectrum Access Licensees with incumbent licensees in the 40 GHz band until these bands are cleared of the fixed links which Ofcom considers likely to suffer harmful interference from mobile deployments in high density areas.

Scope

3.5 These procedures apply to all 26 GHz Spectrum Access Licensees and 40 GHz Spectrum Access Licensees in relation to certain base stations (the "**Relevant Base Stations**") until the end of the "**Revocation Period**" (as defined below).

3.6 Specifically, until the end of the Revocation Period, the 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees must comply with the coordination procedures

[1] Update note of 13 December 2023
[2] Update note of 30 May 2023.

described in the following paragraphs prior to transmitting from any of the following base stations (the "**Relevant Base Stations**"):

a) any new medium power base stations operating (partially or fully) in 25.1-26.5 GHz and/or the 40 GHz band; and
b) any new low power base stations operating (partially or fully) in 40.5-40.75 GHz and/or 42-42.25 GHz.

3.7 For the avoidance of doubt, these procedures do not apply in relation to low power base stations operating wholly within 25.1-26.5 GHz, 40.75-42 GHz or 42.25-43.5 GHz.

3.8 The "Revocation Period" means:

a) until 31 December 2028 in relation to any Relevant Base Station operating in 25.1-26.5 GHz;
b) until 1 January 2030 in relation to any Relevant Base Station operating in 40.5-40.75 GHz and/or in 42-42.25 GHz; and
c) until 1 June 2028 in relation to any Relevant Base Station operating in 40.75-42 GHz and/or in 42.25-43.5 GHz.

Procedures

3.9 The procedures for coordinating Relevant Base Stations in the 26 GHz band are different from those that apply to Relevant Base Stations operating in the 40 GHz band:

a) Licensees wishing to deploy a Relevant Base Station in the 26 GHz band must first consult a coordination zones map, to check whether the area in which they want to deploy falls within a coordination zone. If it does, the licensee must submit coordination requests to Ofcom before deploying a Relevant Base Station.
b) Licensees wishing to deploy a Relevant Base Station operating in the 40 GHz band must submit a coordination request to Ofcom before deploying a Relevant Base Station.

3.10 Further details on these procedures are set out below.

Procedure for the 26 GHz Spectrum Access Licensees

3.11 The 26 GHz Spectrum Access Licensees must check whether any Relevant Base Station is at risk of causing harmful interference to incumbent fixed links by checking the Relevant Base Station location for the relevant spectrum block in the coordination zone maps downloaded from Ofcom's website. The coordination zone maps are shapefiles (.shp) which are compatible with most GIS tools.

3.12 If there is no risk of harmful interference at the location of the Relevant Base Station for the relevant spectrum block, then that base station has passed coordination and the 26 GHz Spectrum Access Licensee may proceed with the relevant deployment without further action.

3.13 If a risk of harmful interference is identified (i.e., the Relevant Base Station location lies within one or more coordination zone tubes), then the 26 GHz Spectrum Access Licensee shall submit to Ofcom the technical details, as defined in Table 1 below, for detailed

technical coordination[3] prior to transmitting on any frequency within the 25.1-26.5 GHz band. The 26 GHz Spectrum Access Licensee may only proceed with the deployment if they receive confirmation from Ofcom that the relevant deployment is not likely to cause harmful interference to an incumbent fixed link.

3.14 For the avoidance of doubt, Spectrum Access Licensees wishing to deploy a Relevant Base Station operating over bandwidths greater than 200 MHz (e.g., 400 MHz or 800 MHz) must check all of the coordination map channel layers in the occupied bandwidth of the Relevant Base Station ("**the relevant coordination zone channel layers**"). If any of the relevant coordination zone channel layers contains one or more coordination zone tubes at the location of the Relevant Base Station, then the Spectrum Access Licensee must submit to Ofcom the technical details, as defined in Table 1 below, for detailed technical coordination. If the Relevant Base Station location is outside of all of the coordination zone tubes in the relevant coordination zone channel layers, then the Spectrum Access Licensee may proceed with the deployment without further action.

3.15 In Annex 2 we provide additional information about how to interpret the coordination zone maps and an indicative estimate of the impact of mitigation techniques on licensees' ability to deploy within the coordination zone tubes shown in the maps.

Procedure for the 40 GHz Spectrum Access Licensees

3.16 For each Relevant Base Station, the 40 GHz Spectrum Access Licensees shall submit to Ofcom the technical details shown in Table 1 for detailed technical coordination prior to transmitting on any frequency within the 40 GHz band.

3.17 The 40 GHz Spectrum Access Licensee may only proceed with the deployment if they receive confirmation from Ofcom that the relevant deployment is not likely to cause harmful interference to an incumbent fixed link.

Procedure for submitting coordination requests to Ofcom

3.18 As it is more efficient for Ofcom to process larger batch sizes, the 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees are encouraged to submit a single request for batches of Relevant Base Stations that are as large as possible (up to a maximum batch size of 500 base stations). Submitting multiple requests for small batches of Relevant Base Stations will result in slower processing through the coordination tool and may lead to delays in Ofcom providing results.

3.19 Upon receipt of a request for a batch of Relevant Base Stations (including all the required technical details for each base station), Ofcom will determine, using the coordination tool,

[3] The detailed technical coordination will be carried out using the same technical analysis as we use for coordinating 26 and 40 GHz Shared Access licensees with incumbent fixed links. In particular, we will apply a minimum separation distance of 200m from any fixed link station and also carry out detailed technical assignment. The minimum separation distance of 200m will apply when coordinating new deployments which are co-channel with a fixed link receiver or close in frequency to a fixed link receiver (i.e., within a frequency separation of 2.5 times the bandwidth of the fixed link receiver or less). This is in line with our standard approach to coordination to protect fixed links (OfW 446, paras. 2.1 and 2.5).

whether any Relevant Base Station in the batch is likely to cause harmful interference to a fixed link.

3.20 In the case that harmful interference is predicted, Ofcom will inform the relevant 26 GHz Spectrum Access Licensee and 40 GHz Spectrum Access Licensee of all Relevant Base Stations that have failed coordination and will provide information indicating the margin of each failure. Licensees shall not transmit from base stations that have failed coordination on any frequency within the 25.1-26.5 GHz band and the 40 GHz band until the end of the Revocation Period. Licensees may transmit from bases stations that have passed coordination provided they transmit only in accordance with the submitted technical details.

3.21 At their choice, the 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees may resubmit, with amended technical details, a request for any Relevant Base Stations that have failed coordination. If they then pass coordination, the licensee may transmit from these base stations provided they transmit only in accordance with the re-submitted technical details.

3.22 For the avoidance of doubt, Ofcom will normally inform the relevant 26 GHz Spectrum Access Licensee and 40 GHz Spectrum Access Licensee only of the fixed link against which any Relevant Base Station has failed coordination and the margin of each failure, without providing any further information, guidance or advice; and without facilitating further/detailed discussion with the relevant fixed link licensees.

Technical details

3.23 The table below shows the information that 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees are required to submit with all coordination requests.

3.24 Files should be submitted in a specific format (a .xlsb Excel binary file), with the following columns:

Table 1: Required technical details

Index Column	Name	Comments
1	Assignment ID	
2	Licensee name	
3	Link ID	
4	Type	Tx
5	Name of Station	Alphanumerical, as defined by stakeholder
6	Service	Reference given by Ofcom
7	Sub-Service	Reference given by Ofcom
8	Class of Station	FB
9	Co-ordinate Reference	NGR
10	Station Location X	6-digit NGR location
11	Station Location Y	

Index Column	Name	Comments
12	Network ID	
13	Antenna Location	OUTDOOR/INDOOR
14	Antenna Height (m) - AGL	Antenna above ground level value (m)
15	HCM V Code	
16	HCM H Code	
17	Antenna Gain	Antenna boresight gain (dBi)
18	Antenna Azimuth (degrees)	
19	Antenna Elevation	
20	Tx Frequency (MHz)	Transmission frequency (MHz)
21	Rx Frequency (MHz)	
22	Bandwidth (MHz)	Bandwidth (MHz)
23	Channel Spacing (MHz)	Channel Spacing (MHz)
24	Power Reference	
25	Radiated Power (dBW)	E.I.R.P (dBW)
26	Antenna Polarisation	Horizontal or Vertical
27	Coverage Radius (km)	
28	Validity Start Date	
29	Validity End Date	
30	MPL (dBm)	
31	T/I (dB)	
32	Result	
33	Result Margin (dB)	
34	Description of Result	
35	Channel Priority	
36	Location (Indoor, Outdoor)	
37	Airborne (for information)	
38	Antenna Type	Omni
39	Antenna Beamwidth (Degrees)	
40	Tx Station Activity Factor	
41	Tuning Range Start (MHz)	
42	Tuning Range End (MHz)	

Index Column	Name	Comments
43	Tuning Range Step (kHz)	
44	Tuning Range Duplex Space (kHz)	
45	Spec Efficiency Class	Reference given by Ofcom
46	Antenna Ident	Omni

4. Coordination procedures for 26 GHz and 40 GHz Spectrum Access Licensees at the boundaries of high density areas

Purpose

4.1 The procedures set out below are intended to coordinate the 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees at the boundary of the high density areas for the purpose of preventing harmful interference to other authorised spectrum users outside the boundaries of such areas.

Scope

4.2 The 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees must comply with:

a) the separation distances (to the boundaries of the high density areas) specified below in relation to their low power base stations; and
b) the field strength limits specified below in relation to their medium power base stations.

Procedures

Procedure for low power base stations (separation distances)

4.3 In order to deploy any low power base station operating in the 26 GHz band or the 40 GHz band in a high density area, the 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees must ensure that the base station complies with the minimum separation distances from the boundary of the relevant high density area shown in Table 2 below.

4.4 The boundaries of the high density areas are set out in Ofcom's document entitled "*Final high density area shapefiles*", which is published on Ofcom's website.

Table 2: Low power base station minimum separation distance from the high density area boundary in the 26 GHz band and the 40 GHz band

Base station type	Minimum distance from the high density area boundary
low power indoor	50m
low power outdoor	100m

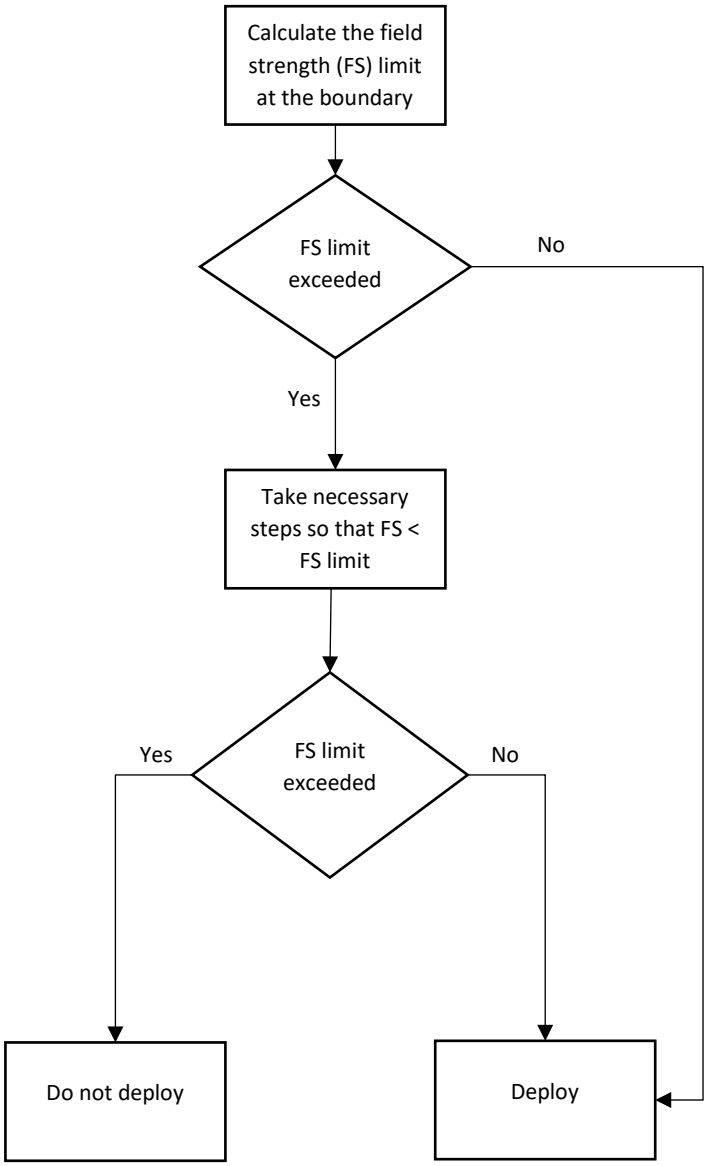
Procedure for medium power base stations (field strength limits)

4.5 In order to deploy any medium power base station operating in the 26 GHz band or the 40 GHz band in a high density area, the 26 GHz Spectrum Access Licensee and the 40 GHz Spectrum Access Licensee must determine the field strength ("**FS**") value generated by that medium power base station and calculated at 3m height at the boundary of the relevant high density area and ensure that it complies with the median field strength limit set out in Table 3 (or the equivalent SSB/peak field strength limits), using the propagation model specified in Annex A1.

4.6 If the calculated field strength value exceeds the median field strength limit set out in Table 3 (or the equivalent SSB/peak field strength limits), the Licensee must take necessary steps to modify the relevant deployment.

4.7 A flow chart depicting this procedure is shown in Figure 1.

Figure 1: Flowchart illustrating coordination procedure for coordination at the boundary of high density areas for medium power base stations deployments



The field strength limits

4.8 The 26 GHz Spectrum Access Licensee and the 40 GHz Spectrum Access Licensee must ensure that medium power base statins comply with one of the following field strength limits, which are all equivalent:

a) the median field strength limit shown in Table 3 below; or
b) the synchronisation signal block (SSB) field strength limit equivalent to the median field strength limit shown in Table 3 below; or
c) the peak field strength limit equivalent to the median field strength limit given in paragraph 4.9 below.

Table 3: Field strength value at 3m height for unsynchronised operation from ECC Recommendation (23)02.[4] The field strength value is the median value for base stations using AAS

Unsynchronised operation
All PCIs[5]
62 dBµV/m/(200 MHz) @ 0 km
@ stands for "at a distance from the borderline into the neighbouring country". The value of 62 dBµV/m/(200 MHz) corresponds to SSB field strength level of 52 dBµV/m/(120 kHz) for 5G new radio (NR) considering the subcarrier spacing (SCS) of 120 kHz

Derivation of the peak field strength limit

4.9 The value of 62 dBµV/m/(200 MHz) from ECC Recommendation (23)02 is a median field strength value and so the peak power of beams pointing towards the border could be substantially higher than this, depending on: network loading; the location of terminals relative to the base station; and beamforming behaviour of the base station. For this reason, the 26 GHz Spectrum Access Licensees and the 40 GHz Spectrum Access Licensees may choose to comply with the peak field strength limit, which considers the peak envelope antenna pattern of the AAS, the calculation for which is shown below in Equation 1. This calculation takes the synchronisation signal block ("**SSB**") field strength value of 52 dBµV/m/(120 kHz) specified in ECC Recommendation (23)02 and calculates the equivalent peak field strength value to be **93 dBµV/m/(200MHz)**. The SSB field strength value is more relevant for calculating the peak power field strength than the median field strength value because SSB beams are subject to less EIRP variability than the traffic beams which dominate the median field strength calculation.

Equation 1

$$FS_{peak} = FS_{SSB} + F_{BWN} + G_{diff}$$

Where:

FS_{peak} is the calculated peak field strength value in units of dBµV/m/(200 MHz) and has a value of **93 dBµV/m/(200MHz)** which applies at the boundary at a height of 3m.

FS_{SSB} is the SSB field strength which has a value of 52 dBµV/m/(120 kHz) in ECC Recommendation (23)02.

F_{BWN} is the bandwidth normalisation factor going from 120 kHz to 200 MHz and has a value of 32 dB.

[4] Annex 1, ECC Recommendation 23(02), 07 July 2023
[5] All physical-layer cell-identity numbers used in case of 5G new radio (NR).

G_{diff}	is the difference in antenna gain between the SSB beams and the traffic beams. ECC Recommendation (23)02 says that this value is 9 dB

5. Coordination procedure for 40 GHz Spectrum Access Licensees with radio astronomy near Cambridge

Purpose

5.1 The procedure set out below is intended to coordinate the 40 GHz Spectrum Access Licensees with the radio astronomy site operating in the 42.5 43.5 GHz band near Cambridge, which holds a grant of recognised spectrum access.

Scope

5.2 This procedure applies to all 40 GHz Spectrum Access Licensees deploying within 50 km of the Cambridge radio astronomy site.

Procedures

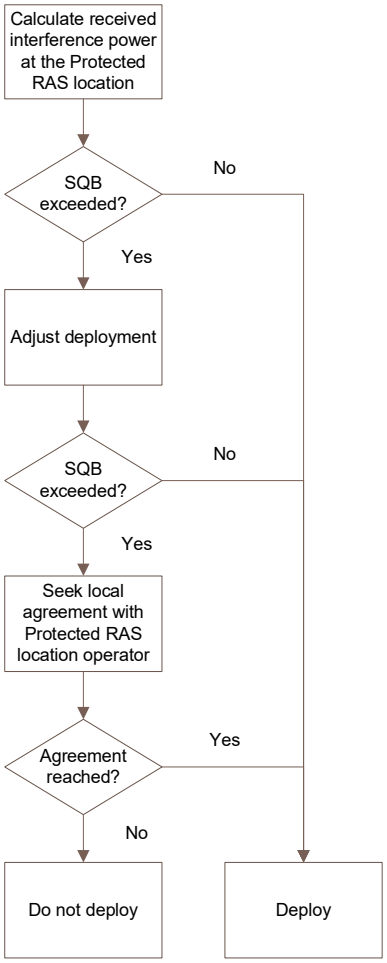
5.3 When planning their network deployment, the 40 GHz Spectrum Access Licensees must check whether the spectrum quality benchmark set out in Table 4 below would be exceeded as a result of any proposed 40 GHz deployment within a 50 km coordination zone centred on the "**Protected RAS location**", which is at NGR TL 39400 54000. To do so, the 40 GHz Spectrum Access Licensees will need to calculate the in-block emissions[6] and out-of-block emissions[7] arriving at the Protected RAS location. If these calculations show that the relevant spectrum quality benchmark would not be exceeded as a result of the planned 40 GHz deployment, then deployment can go ahead. If the calculations show that the relevant spectrum quality benchmark would be exceeded as a result of the planned 40 GHz deployment, the 40 GHz Spectrum Access Licensee shall not make the deployment as planned, but may consider adjusting the deployment.

5.4 If it is not possible to adjust the deployment so that the spectrum quality benchmark is not exceeded, the 40 GHz Spectrum Access Licensee may only deploy if agreement is reached with the holder of the grant of recognised spectrum access relating to the radio astronomy site at the Protected RAS location (in accordance with paragraph 5.11 below). A flow chart depicting this procedure is shown in Figure 2.

[6] The "in-block-emissions" are the radio emissions from 40 GHz deployments in the permitted frequency blocks in the relevant Spectrum Access High Density 40 GHz licence.

[7] The "out-of-block" emissions are the radio emissions from 40 GHz deployments outside of the permitted frequency blocks in the relevant Spectrum Access High Density 40 GHz licence.

Figure 2: Flowchart illustrating coordination procedures for the protected RAS in Cambridge



The Protected RAS location and the 50km coordination zone around it

5.5 The Protected RAS location is at national grid reference (NGR) TL 39400 54000.

5.6 The coordination zone is a 50km zone centred on NGR TL 39400 54000. This coordination zone intersects fully with the Cambridge and Stansted high density areas, and partially also in four other high density areas (Peterborough, Luton, Milton Keynes and Greater London).

5.7 The 40 GHz Spectrum Access Licensees must ensure that any planned 40 GHz deployment within the 50 km coordination zone complies with the spectrum quality benchmark set out in Table 4 below, based on the methodology in this Notice.

Radio astronomy spectrum quality benchmark

5.8 Table 4 shows the value for the spectrum quality benchmark. Subject to paragraph 5.11, the 40 GHz Spectrum Access Licensee must ensure that emissions from each 40 GHz deployment (based on the methodology in this Notice) do not exceed the spectrum quality benchmark in Table 4 at the Protected RAS location.

Table 4: Radio astronomy spectrum quality benchmark

	Spectrum quality benchmark in 42.5-43.5 GHz **(Applicable from in-block or out-of-block signals in 40.5-43.5 GHz)**
RAS spectrum quality benchmark *per Base Station*	-207 dBW / 500 kHz
Area where calculation is to be performed	Within a 50 km zone centered on NGR TL 39400 54000
Where: The spectrum quality benchmark is defined using a 0 dBi antenna gain at 32m height above ground level at the Protected RAS location. The spectrum quality benchmark is defined during the "on" period of the transmit signal.	

Compliance with the spectrum quality benchmark

5.9 Prior to deployment, the 40 GHz Spectrum Access Licensee must use the process described above to assess whether the spectrum quality benchmark specified in Table 4 would be exceeded at the Protected RAS location as a result of its planned 40 GHz deployment within the 50 km coordination zone.

5.10 In carrying out this assessment, the 40 GHz Spectrum Access Licensee must use the most up to date version of ITU-R P.452 available[8] at the time the assessment is carried out, with the parameters given in Table 5. Once a 40 GHz deployment has been coordinated, it does not need to be coordinated again when the propagation model is updated.

5.11 The radio astronomy site antenna gain (which is 0 dBi in the sidelobe of the radio astronomy antenna) is accounted for in the spectrum quality benchmark. When considering whether the spectrum quality benchmark is exceeded, the 40 GHz Spectrum Access Licensee shall take into account the peak envelope EIRP of the 40 GHz deployment in the direction of the protected RAS location (i.e., NGR TL 39400 54000), including those deployments using Adaptive Antenna Systems (**AAS**) operating at a defined Total Radiated Power (**TRP**).

5.12 The 40 GHz Spectrum Access Licensee shall apply a worst case reduction factor to increase realism when assessing whether 40 GHz deployments using AAS would exceed the spectrum quality benchmark. The value is F_{WCR} (Worst Case Reduction Factor) = 12 dB which shall be subtracted from the calculated received interference power at the Protected RAS location.

5.13 The received interference power at the Protected RAS location is the value that must not exceed spectrum quality benchmark.

[8] As of 1 September 2023, the most up to date version is ITU-RP.452-18.

5.14 The 40 GHz Spectrum Access Licensee must maintain records of its calculations and assessments and make these available to Ofcom if required.

Exceeding the spectrum quality benchmark

5.15 The spectrum quality benchmark may only be exceeded in relation to the Protected RAS location if the 40 GHz Spectrum Access Licensee has reached an agreement with the holder of the grant of recognised spectrum access (RSA) relating to the radio astronomy site near Cambridge. Any such agreement must be recorded in writing in a form agreed by both the 40 GHz Spectrum Access Licensee and the RSA grant holder. The 40 GHz Spectrum Access Licensee must maintain a record of all such agreements, and make them available to Ofcom on request.

A1 Propagation Model

A1.1 The 26 GHz Spectrum Access Licensee and the 40 GHz Spectrum Access Licensee shall calculate the path loss using the most up to date version of Recommendation ITU-R P.452 "*Prediction procedure for the evaluation of microwave interference between stations on the surface of the Earth at frequencies above 0.7 GHz*".[9]

A1.2 Predictions are based on the terrain profile with the addition of clutter along the path. The ITU-R P.452 parameters are given in Table 5.

A1.3 A propagation correction due to clutter shall be applied. This is based on a representative clutter height assigned to each clutter category.

Table 5: ITU-R P.452 parameters

Parameter	Value	Unit
Time percentage	50	%
Sea level surface refractivity, N_0	325	N-units
The average radio-refractive index lapse-rate through the lowest 1km of the atmosphere, ΔN	45	N-units/km
Dry air pressure	1013	hPa
Temperature	15.0	°C
Path centre latitude, φ		
The Protected RAS location	52.2	°
Generic UK for boundary field strength calculations	51.0	°
Clear-air propagation attenuation components included:	Line of sight/Diffraction - Diffraction - Multipath and focussing effects - Gaseous absorption Tropospheric scatter - Gaseous absorption Ducting/Layer reflection - Gaseous absorption	
The path centre latitude φ may be selected on a case by case basis, in this case N_0 and ΔN should be calculated using the following equations: $N_0 = 328 - (\varphi - 50); \quad \Delta N = 42.5 - 0.25(\varphi - 50)$		

[9] www.itu.int/rec/R-REC-P.452/en

Terrain database

A1.4 Digital terrain map data with ≤50m resolution shall be used. Examples include Siradel "DTM" with 40m resolution, Ordnance Survey "Landform Panorama®" or "OS Terrain® 50" datasets[10] with 50m resolution.

Clutter database

A1.5 A digital land classification ("clutter") dataset with ≤50m resolution such as Siradel "DLU" with 40m resolution, "Infoterra 50m clutter"[11] or other equivalent shall be used.

A1.6 The Infoterra dataset identifies 10 different clutter categories. For location variation these are mapped to the required clutter designations with nominal clutter heights and nominal obstacle distances.

A1.7 The default parameters, given in Table 6 for nominal clutter heights and nominal obstacle distances are as defined in ITU-R P.452-16.

Table 6: Clutter code mapping

Siradel clutter code and Description	Profile clutter height (m)	Infoterra clutter code and Description	Nominal clutter height (m)	Nominal obstacle distance (km)
1 Sea	N/A	6 Water	N/A	N/A
2 River	N/A		N/A	N/A
3 Lake	N/A		N/A	N/A
4 Open	N/A		N/A	N/A
5 Low Density Vegetation	N/A	0 Open 4 Open in Urban	4	0.1
6 High Density Vegetation	15	5 Forest	15	0.05
7 Park	15	8 Park Recreation	4	0.1
8 Village	10	3 Villages	5	0.07
9 Residential	10	1 Suburban	9	0.025
10 Dense Residential	10		12	0.02

[10] http://www.ordnancesurvey.co.uk/business-and-government/products/opendata-products-grid.html
[11] http://www.space-airbusds.com

Siradel clutter code and Description	Profile clutter height (m)	Infoterra clutter code and Description	Nominal clutter height (m)	Nominal obstacle distance (km)
11 Urban	15	2 Urban	20	0.02
12 Mean Dense Urban	15		25	0.02
13 Dense Urban	15	7 Dense Urban	25	0.02
14 High Dense Urban	20		35	0.02
15 Building Blocks	15		9	0.025
16 Industrial	15	10 Industry	20	0.05
17 Airport	N/A		N/A	N/A

A2 Coordination zone maps for the 25.1 GHz–26.5 GHz band

Introduction

A2.1 As set out in Section 3 (paragraphs 3.11-3.14), until 31 December 2028, 26 GHz Spectrum Access Licensees must consult the maps showing coordination zones around incumbent fixed links (the "**coordination zone maps**") before deploying any medium power base stations operating (partially or fully) in the 25.1-26.5 GHz band, to check whether the area in which they want to deploy the base station falls within a coordination zone tube. If it does, licensees must submit a coordination request to Ofcom before deploying.

A2.2 In this annex we provide additional information on how to interpret the coordination zone maps and an indicative estimate of the impact of mitigation techniques on licensees' ability to deploy within the coordination zone tubes shown in the maps.

A2.3 For the avoidance of doubt, the purpose of the coordination zone maps is to facilitate coordination between spectrum users. These maps are not intended to be used as a tool for valuing the 26 GHz spectrum.

The coordination zone maps

One coordination zone channel layer for each 200 MHz channel

A2.4 In line with the approach set out in the September 2023 Statement (paragraphs 4.63-4.66), the coordination zone maps consist of seven coordination zone channel layers, one for each 200 MHz channel in the 25.1-26.5 GHz band. We list these channels in the table below (Table 7).

Table 7: Channelisation table and indexing

Freq Range (GHz)	Channel ID
25.1-25.3	1
25.3-25.5	2
25.5-25.7	3
25.7-25.9	4
25.9-26.1	5
26.1-26.3	6
26.3-26.5	7

A2.5 Each coordination zone channel layer is represented by a shapefile (.shp) which can be downloaded from Ofcom's website.

Coordination zone tubes

A2.6 The coordination zone maps contain coordination zone tubes. Each coordination zone tube shows the area in which any new medium power base station operating partially or fully in the relevant channel must be coordinated with incumbent fixed links, as described in the coordination procedures. We also provide the information shown in Table 8 about the relevant incumbent fixed link and its associated coordination zone tubes.

Table 8: Coordination zone tubes shapefile field names

Field name	Description	Unit
License number	Licence number of a fixed link	
Easting	Location of a fixed link receiver	
Northing		
Azimuth	Azimuth of a fixed link receiver	Degrees (°)
Frequency	Assigned frequency of a fixed link receiver	MHz
Bandwidth	Bandwidth of a fixed link receiver	kHz

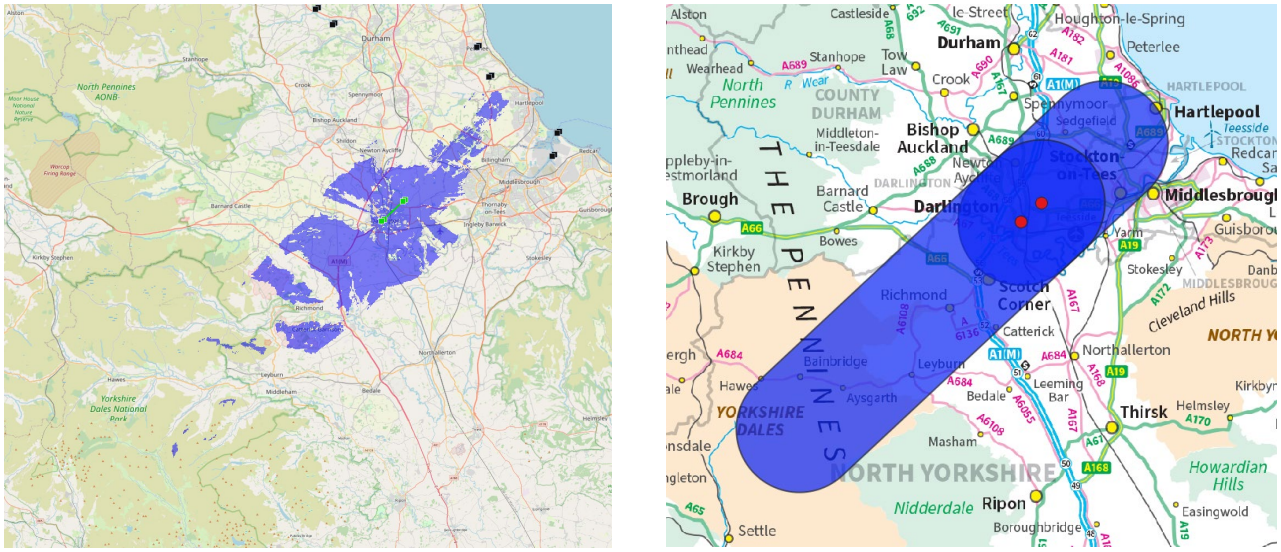
A2.7 In particular, each coordination zone map contains two types of coordination zone tubes:

- the “wide” coordination zone tubes are for coordination with fixed link receivers operating **co-channel** (i.e. in the same channel as the map’s channel); and
- the “thin matchstick” coordination zone tubes are for coordination with fixed link receivers operating in **adjacent channels**.

A2.8 Each coordination zone tube is a length with a buffer zone around it which approximates the shape of a fixed link receiver sterilisation area. The coordination zone tubes are a simplified representation of the area which could be sterilised by a fixed link receiver. We consider this simplification appropriate because any more detailed representation of the sterilisation area for each fixed link receiver would only be correct for a medium power base station deployed at a specific height and power level.

A2.9 The coordination requests made to Ofcom in relation to any medium power base station falling within the coordination zone tubes may be successful. This is because, as shown in Figure 3, there may be areas within each coordination zone tube where a medium power base station could still be deployed. In addition, as explained in the next section, licensees may be able to moderate their deployments to reduce the risk of interference to an incumbent fixed link, thereby increasing the likelihood that their coordination request is successful.

Figure 3: Two maps showing the sterilisation area and associated coordination zone tube for a pair of fixed links in north Yorkshire



The potential impact of mitigation techniques

A2.10 The area sterilised by a fixed link receiver operating in the 25.1-26.5 GHz band can be shrunk by a 26 GHz Spectrum Access Licensee by introducing isolation between any new medium power base station and the fixed link receiver.

A2.11 We studied how the coordination zone tubes shrink by reducing the EIRP of the medium power base station by 6 dB. In Table 9, we provide an indicative estimate of the footprint of the coordination zone tubes change if the EIRP of the medium power base station was reduced by 6 dB. We estimate that reducing the power by 6 dB would potentially increase the footprint of the areas outside of the coordination zone tubes by around 10 - 20% across the seven channels, as shown in the last column of Table 9.

A2.12 26 GHz Spectrum Access Licensees could achieve 6 dB of isolation between the medium power base station and fixed link receivers by a combination of mitigation techniques which might include reducing the EIRP as well as other techniques. Some of these other techniques include introducing antenna downtilt, reducing the antenna height, modifying the operating frequency and/or bandwidth.

A2.13 Given that the co-channel coordination zone tubes are significantly larger than the ones for adjacent channels, we have only estimated the impact of introducing an isolation of 6 dB on the size of the coordination zone tubes for co-channel operation. We have not studied the actual area sterilised by each fixed link receiver because, as we note in paragraph A2.8, this would only be valid for a single base station power level and base station height.

Table 9: Indicative estimate of the HDA footprint where 26 GHz Spectrum Access Licensees would not need to submit a coordination request to Ofcom if the power is reduced by 6 dB [12]

Freq Range (GHz)	Channel ID	Indicative % of HDA footprint outside of the coordination zone tubes	Indicative % of HDA footprint outside of the coordination zone tubes if the power is reduced by 6 dB	Indicative % point improvement if the power is reduced by 6 dB
25.1-25.3	1	55	70	15
25.3-25.5	2	57	70	13
25.5-25.7	3	5	15	10
25.7-25.9	4	29	47	18
25.9-26.1	5	26	46	20
26.1-26.3	6	56	69	13
26.3-26.5	7	63	77	14

[12] The data capture date was June 10, 2024. These figures will change as fixed links leave the band in the future.