Business Radio Technical Frequency Assignment Criteria

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Section 1

Foreword

1.1 The Wireless Telegraphy Act 2006 requires that only radio equipment that the Office of Communications (Ofcom) has granted a licence to, unless licence exempt, can be installed and used in the United Kingdom. This is under the condition that the radio equipment meets certain minimum requirements set in the Interface Requirement (IR 2044) which is available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0021/84630/ir2044.pdf

1.2 This document details the technical frequency assignment criteria and the principles that Ofcom will employ in the frequency bands for use by business radio.

1.3 This Technical Frequency Assignment Criteria (TFAC) is subject to revision.

1.4 Operators and manufacturers can obtain the latest copy of this document from the Ofcom website. If you do not have access to the internet, you can request a printed copy to be posted to you from Spectrum Licensing by telephoning the number below.

1.5 Please see below for full contact details:

Contact Details
Ofcom Spectrum Licensing
Phoenix House
Lakeside Drive
Centre Park
Warrington. WA1 1RX

Email	spectrum.licensing@ofcom.org.uk
Phone	020 7981 3131
Ofcom	http://www.ofcom.org.uk
Business Radio	https://www.ofcom.org.uk/manage-your-licence/radiocommunication-licences/business-radio
TFAC	https://www.ofcom.org.uk/__data/assets/pdf_file/0023/59432/ofw164.pdf

Section 2

Introduction

Licensee's Responsibility

2.1 The establishment use or installation of transmitting or receiving equipment is subject to the issue of the relevant licence by Ofcom. The licensee must comply with the licence terms and conditions and ensure that the equipment meets the requirements of UK Interface Requirement IR 2044. https://www.ofcom.org.uk/__data/assets/pdf_file/0021/84630/ir2044.pdf

Licence Types

2.2 There are five licence products or classes available:

- Business Radio (Simple UK)
- Business Radio (Simple Site)
- Business Radio (Suppliers Light)
- Business Radio (Technically Assigned)
- Business Radio (Area Defined)

2.3 For Technically Assigned or Area Defined you can apply online at: https://secure.ofcom.org.uk/busrad/. For Business Radio Light Licensing products stakeholders use the online licensing system to register and purchase a licence https://ofcom.force.com/licensingcomlogin.

2.4 For Business Radio (Area Defined) licences, Ofcom will issue a licence if spectrum is available within the geographical area requested. The licensee will have the freedom of deployment if the licence conditions are met and comply with any national and international coordination through the Post Issue Support process.

2.5 For Business Radio (Technically Assigned) licences, Ofcom will use its technical assignment algorithm, MASTS, to process the assignment request. If a suitable frequency is available, it will be granted.

Business Radio (Simple UK)

- This type of licence is for mobile-to-mobile communication anywhere in the UK. Use of base stations is not permitted
- The maximum permitted ERP power for mobile stations is five Watts.

Business Radio (Simple Site)

- This type of licence is for the use of base station systems that use a pre-packaged set of frequencies for applications such as paging

- The maximum permitted ERP power for base stations is two Watts with a maximum antenna height of 15m. The maximum permitted ERP power for mobile stations is two Watts, except for the 25 kHz bandwidth mobile channels where the maximum permitted ERP power is 0.02 Watts.

Business Radio (Suppliers Light)

- This type of licence is for use by radio suppliers and dealers only
- The maximum permitted ERP power for base stations is 10 Watts
- The maximum permitted ERP power for mobile stations is 25 Watts
- The maximum permitted base station antenna height above ground level is 20m.

2.6 More details on the technical assignment process for the Business Radio (Area Defined) and Business Radio (Technically Assigned) licence types are provided in Sections four and five respectively of this document.

Section 3

National and International Co-ordination

Introduction

3.1 There are several different types of co-ordination that may need to be undertaken as part of the frequency assignment process (this does not apply to the Light Licence classes). These different types of co-ordination are explained in more detail within this section.

Geo-limits

3.2 There are many other users (such as the Ministry of Defence (MoD), Programme Making and Special Events (PMSE), Maritime, etc) that share some of the Business Radio spectrum. To manage the co-existence between these users there are defined geographical areas where these users can operate. These geographical areas need to be protected and co-ordinated for Business Radio users and can be applied to either a whole band, or to a range of frequencies or a single frequency.

3.3 Currently UHF1 (425.00625 – 449.49375 MHz) is the only band that is impacted by geolimits within Business Radio spectrum, and these are listed in Annex 9

Exclusion Areas

3.4 These are areas that Ofcom must not allow any Business Radio UHF1 assignments, for example, within 40 kilometres of the Fylingdales Radar station.

Operation Areas

3.5 These are areas where Business Radio assignments can be assigned. For example, Ofcom is authorised to assign UHF1 spectrum in a radius within 56 kilometres of Charing Cross.

Co-ordination Areas

3.6 These are areas that Ofcom may be able to make Business Radio assignments, but direct co-ordination procedures will need to be undertaken with the users affected.

UHF1 band co-ordination

3.7 Business Radio shares the UHF1 band with the Ministry of Defence, all radio assignments in the UHF1 band must be co-ordinated with Ministry of Defence. This co-ordination does not permit an increase in the total received interference power at the radar site beyond a pre-specified limit and essentially means any new assignment must be considered against the interference level to ensure it does not cause an increase.

3.8 Any deployment and/or change to the characteristics of a radio system will need to be undertaken through the UHF1 co-ordination process. All potential technical changes to existing systems must be requested and these will be considered as part of the Ofcom validation process for any amendments within the UHF1 band.

International Coordination

3.9 Ofcom has a duty to coordinate all assignments with our neighbouring countries to manage the risk of interference to UK assignments and to neighbouring countries' assignments. This is either achieved through an agreed Memorandum of Understanding (MoU) or similar, or in the absence of a formal agreement the HCM Agreement is used (adhering to the general principals of CEPT Recommendation T/R 25-08 https://www.ecodocdb.dk/download/063e7311-fba7/TR2508.pdf).

3.10 If an assignment passes the requirements of an agreement, then it is deemed to have passed coordination. If it breaches the requirements of the MoU then the assignment may be sent for international coordination (not for Band III) with the country/countries affected. The affected country/countries will then let Ofcom know if the assignment can be made (antenna directivity, reduce ERP power etc) or will reject the assignment.

3.11 A summary of all the MoUs and Agreements applicable for Business Radio can be found in Annex 5.

FCS 1331

3.12 There is a code of practice detailing the way in which antennas should be used to prevent unnecessary interference to our International neighbours.

3.13 http://www.fcs.org.uk/image_upload/pdf/13-06-13-fcs1331-bs-cop-revision-2013-final-endorsed.pdf

Section 4

Business Radio (Area Defined) Licence Class

Introduction

4.1 A Business Radio (Area Defined) licence is suitable for users who operate networks on a national or wide area regional basis and require exclusive spectrum. Such networks are often of strategic and of national importance for rail networks, utilities, major distribution networks and for different types of transport. These licences will be issued, depending on spectrum availability, for geographical areas at national level (UK or nations) down to 50 km^2 national grid squares. Licensees will have the freedom to deploy their systems if they meet the licence terms and conditions. These include:

- Spectral boundaries: This will specify the frequencies on which the licensee can operate, the channel bandwidth, maximum operating power and the emission limits should meet those specified in the Interface Requirement (IR 2044).
- Geographical boundary: Geographical boundary: This will specify the area in which the licensee can operate, using the national grid reference system and national borders, and the predicted field strength density level of -116 dBm/12.5 kHz should not be exceeded at and beyond the boundary of adjacent geographical assignments. Special consideration has been given to assignments between 55.75 and 87.5 MHz, here the predicted field strength density level of -104 dBm/12.5 kHz should not be exceeded at and beyond the boundary of adjacent geographical assignments.
- The maximum ERP power for Base Stations is 100 Watts for >=25 kHz channel bandwidths, 50 Watts for 12.5 kHz channel bandwidths and 25 Watts for 6.25 kHz channel bandwidths.
- The maximum ERP power for Mobile Stations is 25 Watts regardless of the frequency width.
- Complying with relevant national and international coordination requirements such as UHF1 coordination and Band III MoUs/Agreements.

4.2 For a Business Radio (Area Defined) licence there are two processes:

- Frequency allocation: This is the main process for issuing a licence.
- Post issue support: This is the process for supporting/facilitating deployments after a licence has been issued. This is to support licensees complying with the licence terms and conditions.

4.3 These two processes are described in more detail below.

Frequency Allocation Process

4.4 This process is to identify a suitable frequency for the request. The test is to check whether there is/are assignments within the geographical area requested (this could be the UK, Nation(s) or 50 km^2 square grids or a combination where this is possible) for each channel (centre frequency and its associated bandwidth) within the selected band. Details of the available geographical areas can be found in Annex 8.

4.5 If a frequency has been identified, then a licence will be issued as shown in the following diagram

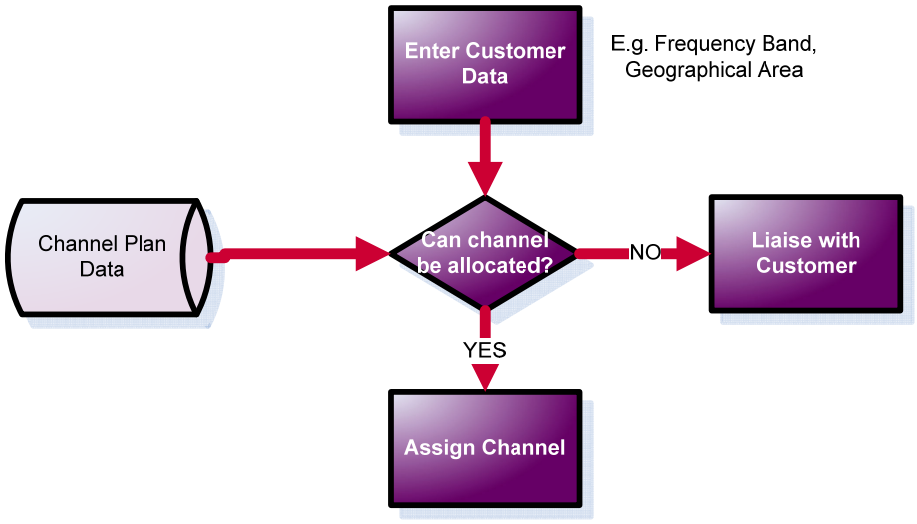


Figure 1 – High Level flow for Business Radio (Area Defined) Licence Frequency Allocation

Post Issue Support

4.6 It is a requirement from Ofcom that any deployments that may cause harmful interference to other services or neighbouring administrations are assessed to see if co-ordination is required.

4.7 A process has been devised to support deployment of assignments following licence issue. Post Issue Support is to enable licensees to comply with their licence terms and conditions (such as UHF-1 coordination, Band III co-ordination and international co-ordination). Figure 2 shows the Post Issue Support process.

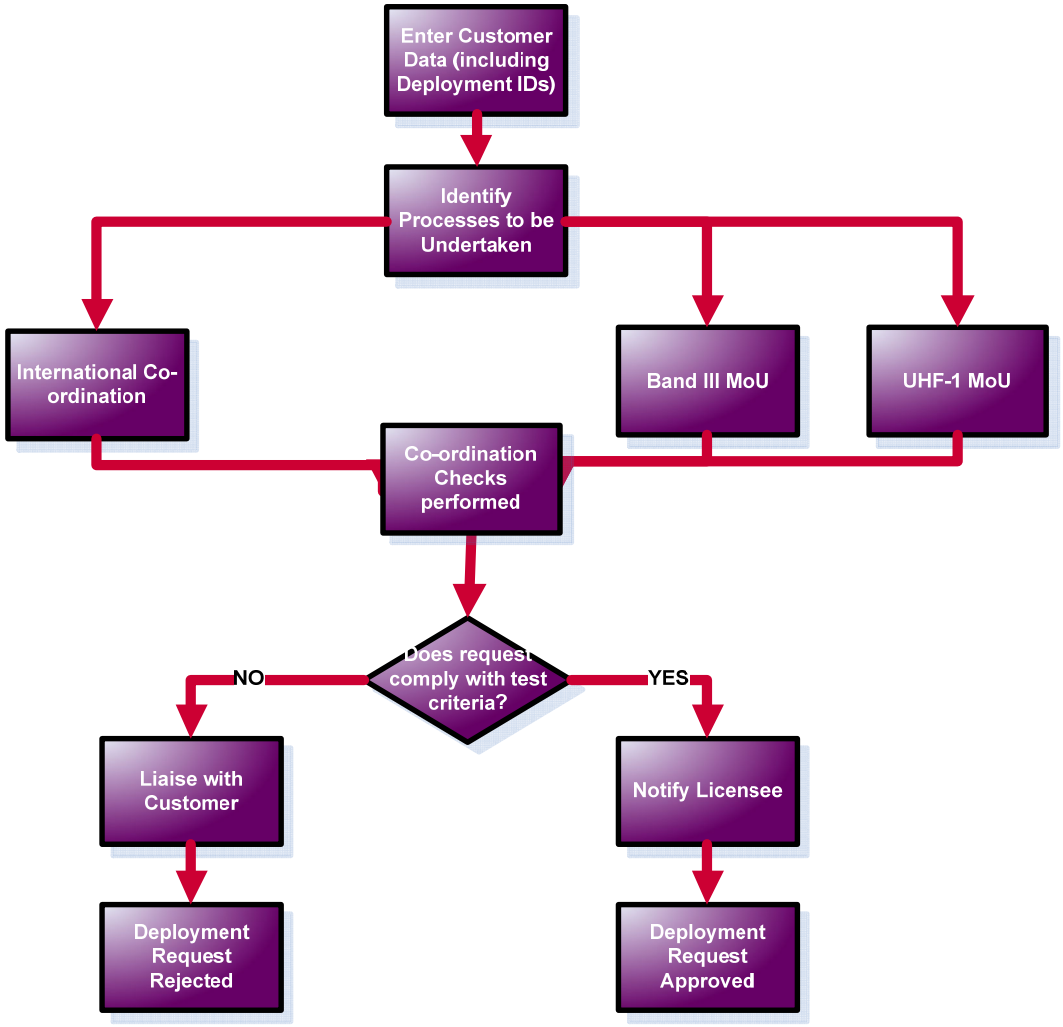


Figure 2 – High Level flow for Post Issue Support Process

Compliance with spectral power field strength density limit

4.8 For licensees to comply with the Business Radio (Area Defined) licence predicted power field strength density limit, licensees can either use the ITU standard propagation model (ITU-R P.1546-4) to model the field strength that Ofcom will use for the Business Radio (Technically Assigned) licence product or can ask Ofcom or a third party to undertake this check on their behalf.

4.9 Further details on the propagation model and configuration settings are in Annex 1. The full ITU Recommendation ITU-R P. 1546-4 can be found on the ITU website. https://www.itu.int/rec/R-REC-P.1546-4-200910-S/en

Co-ordination between adjacent channels

4.10 Business Radio (Area Defined) licensees operating on adjacent channels in the same geographical area need to carefully plan their deployments. Greater flexibility is provided by allowing up to 100 watts maximum ERP power for 25 kHz channel bandwidths (50 watts for 12.5 kHz channel bandwidths and 25 watts for 6.25 kHz channel bandwidths) but it is important that licensees take measures to minimise

the risk of interference. Ofcom recommends that licensees take special care with either some good site engineering or by having adequate separation distance from each site. Information on good site engineering can be found at: http://www.fcs.org.uk/image_upload/pdf/13-06-13-fcs1331-bs-cop-revision-2013-final-endorsed.pdf

4.11 If a Licensee/Applicant requests a higher maximum ERP power, then this request will require Ofcom consent and each request will be considered on a case-by-case basis.

Section 5

Business Radio (Technically Assigned) Licence Class

Introduction

5.1 The Business Radio (Technically Assigned) licence assignment process is made up of various key stages which are shown in figure 3. This licence product is suitable for users that require a degree of protection from other users. This is where Ofcom will undertake micro-management by employing the use of a scientific assignment process. The assignment process makes use of the MASTS algorithm and this is used for the analysis to identify if an assignment is acceptable on a given channel and geographical area or if the assignment should be rejected. More details regarding the MASTS process can be found in Section 6.

General Technical Parameters

5.2 Business Radio assigns its assignments using technical parameters and assumptions contained within this document. Details regarding the Business Radio licensing process can be found in the licensing procedures manual which is available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0017/74015/licensingpolicymanual.pdf

Effective Radiated Power (ERP)

5.3 The licence will state the assigned maximum ERP power which must not be exceeded. The maximum ERP power for each licence type is stated in the UK Interface Requirement 2044, which is available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0021/84630/ir2044.pdf

5.4 For Technically Assigned licences it is not required that the maximum ERP power level permitted meets the requested coverage area. A maximum ERP power may need to be limited, along with a reduced coverage area, so that a new system will not cause harmful interference to an existing system. As part of the application process, it is advisable that you request an ERP that provides radio coverage up to the edge of your requested service area.

Mandatory Required Inputs into the Technically Assigned Assignment Process

5.5 The following table summarises the key parameters that will be used to assess if an assignment can be made and will form part of the technically assigned licence parameters.

Parameter	Description	Examples
Type of Station	This describes whether it is a Base Station, Remote Control Point, or an Operational Area (Mobile to Mobile operation)	Base Station Remote Control Point[6.16] Operational Area[6.14]
Location	This is the location of the Base Station or centre of the Operational Area to a ten figure OS grid reference (1m accuracy) or you can specify the latitude / longitude	e.g. TQ 32284 80497 51.5079276440536,-0.0952792745694685
Customer Requested Service Area	This describes the area over which radio operation is desired. The resultant achievable coverage area is known as the designated service area and is calculated by the MASTS algorithm	Circle (radius km)
Assignment Type	This defines whether the required assignment is shared (where a level of blocking from/to other users is acceptable) or exclusive (for which no blocking from/to other users is allowed)	Exclusive (up to 100% of time) Shared (up to 33% of time)
Mobile ERP	This is the output power from the mobile antenna. This is used by the MASTS algorithm to determine the increase in the interference potential to other assignments (if applicable)	e.g. 25 Watts
Antenna Location	This identifies if the antenna is located within a building or underground. Adjustments to the coverage will be made depending on the location and associated propagation losses.	Indoor Outdoor Underground
Frequency Operation	This defines whether you require a different frequency for the Base and Mobile transmitter.	Single (Simplex) Dual (Duplex)
Frequency Band	This is used to identify the frequency to use for a coverage prediction and the choice of candidate channels for the assignment process.	Figures below in MHz **Band** **From** **To** Paging 26.225 49.49375 Band 1 55.75 68.0 Low 68.08125 87.49375 Mid 137.9625 165.04375 High 165.04375 173.09375 Band 3 177.20625 191.49375 UHF-1 425.00625 449.49375 UHF-2 450.00000 470.00000
Bandwidth	The amount of spectrum required for the channel, this will be considered in both the calculation of the coverage and when identifying assignments that may interfere with each other.	6.25 kHz 12.5 kHz 25.0 kHz Others will be considered on request.

Table 1 - Summary of Technical Data Inputs

Frequency Assignment Process

5.1 The frequency assignment process for the Business Radio (Technically Assigned) licence class is summarised in figure 3:

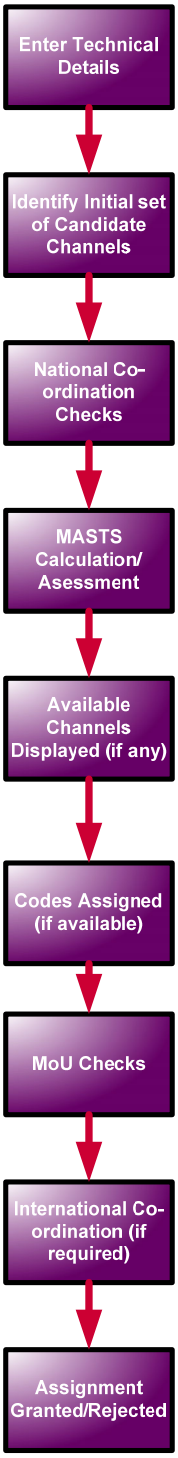


Figure 3 – High Level Flow for Technically Assigned Assignment Process

Description of the Technically Assigned Assignment Process

5.2 The following steps will form part of the technical assessment process for the Business Radio (Technically Assigned) licence. These steps are to identify a suitable channel, but if the request contains an applicant's preferred channel then the following steps will be carried out on this channel.

5.3 The technical details provided by the Customer include location information, type of station, frequency operation, area of desired operation, frequency band, antenna parameters and the assignment type.

5.3.1 An initial set of candidate channels will be identified based on the product Business Radio (Technically Assigned), the choice of frequency band and whether the request is for single or dual frequency operation.

5.3.2 The next step in the process is to carry out checks for National Co-ordination. These include geolimit checking and UHF-1 co-ordination. From the results of these checks the initial candidate channels may be reduced or even eliminated.

5.3.3 A proximity check calculation is undertaken to ensure that there are no existing assignments within 500m and 250m of the proposed location for either co-channel or the 1st adjacent channel respectively.

5.3.4 The MASTS calculations are then performed (more details can be found in Annex 3).

5.3.5 For each candidate channel all existing assignments within 120km are identified. The MASTS calculations are then performed on these assignments to identify which ones are affected.

5.3.6 The Signalling Codes (CTCSS. DCS) for analogue systems or timeslots or Channel Access Codes for digital systems will then be assigned (if possible). Channel Access Codes for TDMA or FDMA systems are not part of the assignment process as of September 2021. The applicant is required to notify Ofcom which codes they wish to use. The codes are displayed on the licence schedule.

5.3.7 If an assignment can be made it is provisionally granted at this stage.

5.3.8 MoU checks are then performed on the chosen candidate channel(s). If this check fails then the assignment must go for International Co-ordination (excluding Band III) whereby the neighbouring Countries affected will decide whether it can go ahead, if some concessions can be made (by varying technical parameters, e.g. antenna directivity), or if it must be rejected.

5.3.9 If a licence application requires Spectrum Licensing will contact the applicant to notify them that co-ordination is required. If the proposed assignment fails International Co-ordination, then the applicant will be notified accordingly.

5.3.10 Once all these processes have been performed successfully the assignment will be granted.

5.4 Ofcom will use a very similar process when a Customer variation is requested (technical changes to the licence, e.g. increase of power, concatenation of channels). This is undertaken to ensure that any change that is made is fully assessed regarding the impact to the existing co- and adjacent channel users.

Section 6

Mobile Assignment Technical System (MASTS)

Introduction

6.1 This section provides an overview of how the MASTS system is used with its various key components.

6.2 MASTS is a tool that is used to better quantify and manage the interference and blocking effects between users in the same spectrum. There are several concepts that MASTS uses, and these are detailed in this section.

6.3 Information on the configuration of the propagation model ITU-R P. 1546-4 and MASTS can be found in Annexes 1 and 3 respectively.

6.4 The following sections detail the main components that define the MASTS process.

Assignment Type

6.5 There are two types of assignments within the Business Radio (Technically Assigned) licence product; ***shared*** and ***exclusive***.

6.6 A shared assignment is an assignment that transmits no more than 33% of the time in its busiest hour. It is this parameter that determines the amount of time that an assignment may block another assignment from transmitting at that point in time. An exclusive assignment is one that either transmits up to 100%[1] of the time, more than 33% of the time in its busiest hour or requires extra protection because of either business or safety critical reasons. It is recommended that if you are using a data application then you apply for an exclusive assignment unless the radio transmits for less than twenty seconds in a minute.

With the nature of Business Radio in a shared environment there may be instances when a User exceeds the number of transmissions (as defined by their assignment type) over a short period. If there are continual breaches of the guideline criteria, then it may be necessary to liaise with the Users concerned and move them to Exclusive status or move them to a different channel (where possible).

Coverage Areas

6.7 The first step in the process is to take the ***Requested Service Area (RSA)*** which is defined at the application stage and represents the area (e.g., a radius from the base station) over which radio operation is desired. The coverage area is then calculated using the propagation model down to the service level field strength threshold.

[1] NB: stations operating continuously will be subject to more stringent international co-ordination requirements.

The intersection between the RSA and the filtered coverage area is then derived and is known as the ***Designated Service Area (DSA)***. This is the area the MASTS algorithm will use in terms of considering interference into that area from other users on the same channel.

The ***Blocking Area (BA)*** of the new application is then derived by utilising the original calculated coverage area and extending it down to the blocking field strength threshold level. This then identifies the area over which an assignment (base station and mobiles) would cause harmful interference or blocking.

If the trial assignment's blocking area intersects with an existing assignment's designated service area, then there is a potential to block that system. If there are channels that are adjacent, then these channels will be considered in the interference/blocking calculations.

Antenna Location

6.8 The antenna location is considered when calculating the predicted radio coverage area. If the antenna is located within a building (indoor) then an attenuation of 5 dB will be applied. Also, if the antenna is located underground (e.g., tunnel) then the coverage area will be limited to 1 km in radius. Interference is not considered between an underground system and a system above ground that use the same frequency within the same radius.

6.9 Both indoor and underground are difficult areas to model without the detailed characteristics of the clutter of the propagation model to calculate the coverage area of both indoor and underground areas. Therefore, we have defined a set of generic assumptions as stated above.

Quality of Service

6.10 The ***Quality of Service (QoS)*** is a measure of how good the channel is in the area where the proposed radio service could operate. This will consider all assignments within 25 kHz channel bandwidth (or the maximum used bandwidth by existing assignments) of the centre frequency and within a 120 km radius or 200 km radius for UHF and VHF bands respectively.

6.11 There are two elements of an “assignment” QoS. The first is self-inflicted, which is caused by transmissions (and associated traffic) from a system’s own network. The second is degradation and is caused by other services that provide significant interference or blocking. The following are the components considered on any given channel:

- Self-inflicted
    - Assignment Type (self-inflicted blocking)
- Degradation
    - Base to Base blocking
    - Mobile to Mobile blocking
    - Base to Mobile blocking
    - Mobile to Base blocking

6.12 The above factors considered will depend mainly on whether it is a single or dual frequency channel or if the frequencies being used have different base/mobile transmit/receive configurations.

The following table summarises how each of the factors are used.

Factor	Channel type affected	Description
Assignment Type	Single/Dual	This is self-inflicted blocking from own system.
Base to Base	Single only[2]	This is the potential blocking from "unwanted" base stations to the "wanted" base station. This is either present or not.
Mobile to Mobile	Single only[3]	This is the potential blocking from "unwanted" mobile stations to the "wanted" mobile station.
Base to Mobile	Single/Dual frequency	This is the potential blocking from "unwanted" base stations to the "wanted" mobile station.
Mobile to Base	Single/Dual frequency	This is the potential blocking from "unwanted" mobile stations to the "wanted" base station.

Table 2 - The MASTS QoS Components

6.13 Once all the above factors have been calculated they are summed up to define a Quality of Service (QoS) for the trial assignment and the existing affected assignments have their degradation updated in MASTS. A channel is suitable if its maximum QoS is not breached. This needs to be met in both directions considering both the trial assignment and the existing licensed assignments. The MASTS database will be updated with the new assignment and it's QoS and all affected existing assignments will also have their QoS updated.

Special Cases

Operational Areas

6.14 These are areas with a defined radius over which mobile to mobile communication is allowed in the absence of a base station. In MASTS these types of assignments are considered differently by assuming that the designated service areas are a direct translation from the requested service area.

[2] There may be cases where there is mixed configurations (i.e. both base transmit and receive on the same frequency) and in this case this component may apply.
[3] There may be cases where there is mixed (i.e. both mobile transmit and receive on the same frequency) configurations and in this case this component may apply.

Fill-in Stations

6.15 Fill-in stations are used for two reasons. Firstly, where coverage over a defined area cannot be achieved with a single base station and there are holes in the designated service area. Secondly, they are used for back-up or Emergency use only.

To make use of fill-in stations they must be engineered so that they are located within the designated service area of the main licensed Base Station and the resultant coverage area from them does not exceed the one for the main licensed base station.

Fill-in stations will undergo the same assignment process as the main base station. This will be considered on a case-by-case basis. Providing that the coverage area for fill-in stations does not exceed that of a licensed base station then they are recorded on the licence as non-chargeable and do not contribute to the licence fee.

Remote Control Points

6.16 Remote control points are used to enable communication through the base station to the mobile terminals at a different location. There are many different methods that could be used for Remote Control points. These include using landlines, fixed links and radio. For Business Radio assignment(s) we will only consider radio use.

6.17 Remote control point coverage will be treated in the same way as base stations (transmit and receive frequencies will be reversed). They will form part of a network and the interference between the base station and the remote-control points from the same system will be ignored. Remote control points must use directional antennas.

When you submit details of Remote-Control Points or trigger stations please ensure you provide an accurate antenna height and do not use the default mobile height of 1.5 metres. This is particularly important when systems are inspected by Ofcom for compliance with the published licence. As part of the assignment process you should include details of trigger stations in the application.

Linked Assignments

6.18 For assignments that form part of a system or network the interference effects between them will be ignored. A linked assignment is assumed to be any assignment that forms part of the same licence.

Section 7

CTCSS Tone Signalling

7.1 Analogue Signalling Codes

Signalling Type	Code	Frequency
C	1	67
C	2	69.3
C	3	71.9
C	4	74.4
C	5	77
C	6	79.7
C	7	82.5
C	8	85.4
C	9	88.5
C	10	91.5
C	11	94.8
C	12	97.4
C	13	103.5
C	14	107.2
C	15	110.9
C	16	114.8
C	17	118.8
C	18	123
C	19	127.3
C	20	131.8
C	21	136.5
C	22	141.3

C	23	146.2
C	24	151.4
C	25	156.7
C	26	162.2
C	27	167.9
C	28	173.8
C	29	179.9
C	30	186.2
C	31	192.8
C	32	198
C	33	203.5
C	34	206.5
C	35	210.7
C	36	218.1
C	37	225.7
C	38	229.1
C	39	233.6
C	40	241.8
C	41	250.3
C	42	254.1

7.2 Digital Signalling Codes (for analogue systems)

Signalling Type	Code	Frequency
D	23	0
D	43	0
D	114	0
D	115	0
D	212	0
D	25	0
D	53	0
D	122	0
D	125	0
D	26	0
D	54	0
D	131	0
D	132	0
D	246	0
D	31	0
D	65	0
D	134	0
D	143	0
D	252	0
D	71	0
D	72	0
D	145	0
D	155	0
D	255	0
D	73	0

D	74	0
D	156	0
D	162	0
D	266	0
D	116	0
D	165	0
D	205	0
D	311	0
D	315	0
D	226	0
D	261	0
D	325	0
D	331	0
D	332	0
D	32	0
D	343	0
D	346	0
D	371	0
D	432	0
D	466	0
D	36	0
D	431	0
D	565	0
D	606	0
D	624	0
D	654	0

7.3 Signalling Codes. CTCSS (Continuous Tone-Coded Squelch System) is one type of circuit that is used to reduce the annoyance of listening to other users on a shared two-way radio communications channel. It is sometimes referred to as tone squelch. It does this by adding a low frequency audio tone to the voice. Where more than one group of users is on the same radio frequency (called co-channel users), CTCSS circuitry mutes those users who are using a different CTCSS tone or no CTCSS.

Another type of circuit is DCS (Digitally Coded Squelch). DCS is a further development of the continuous tone-coded squelch system (or CTCSS) that uses a slow-speed, binary data stream passed as sub-audible data along with the transmission. Different DCS code or no DCS, the radio will not unmute the loudspeaker on the radio.

7.4 Please note that digital PMR technologies such as FDMA and TDMA use a different ETSI standard for channel access codes. In addition, the manufacturer of your radio may implement their own proprietary system as such Ofcom at time of publication does not consider channel access codes for digital PMR systems as part of the Technically Assigned assignment process.

7.4.1 FDMA (DPMR)
https://dpmrassociation.org/downloads/ETSI/ts_102658v020501p.pdf

7.4.2 TDMA (DMR)
https://www.dmrassociation.org/downloads/standards/ts_10236101v020501p.pdf

Annex 1

Recommendation ITU-R P.1546-4

High Level Process Flow

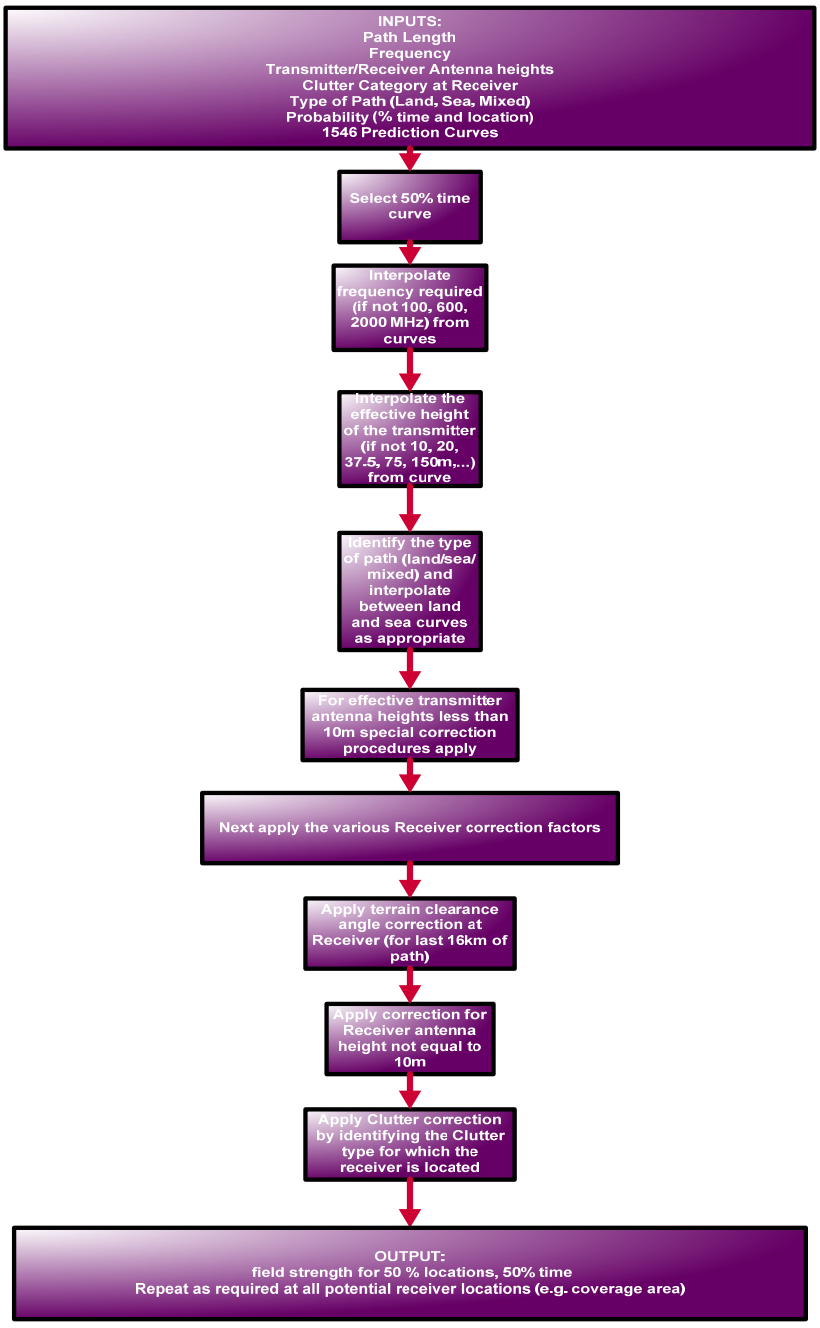


Figure 4 – High Level flow of ITU-R P.1546-4 Propagation Model

A1.1 Recommendations ITU-R P.1546 is an established ITU propagation model and utilises many years of real measurements. These measurements are for a receiver antenna at 10m high and assume different effective antenna heights (the difference between the antenna height and the mean terrain height of the path profile between 3 and 15km towards the direction of the receiver) of the transmitter at 10, 20, 37.5, 75m and higher. Curves are available for 100, 600 and 2000 MHz. Values for different frequencies and transmitter effective heights can be interpolated from the curves. The type of path must be determined land, sea or a mixture of the two paths.

A1.2 This is then followed by applying several receiver-related correction factors. The first is the terrain clearance angle at the receiver. The incoming ray angle incident on the receive antenna calculated from the tangent over the last 16km of the path between the transmitter and receiver. The second is if the mobile is located within the clutter (e.g. buildings). The final correction applied is for the receiver height not equating to 10m.

Configuration

A1.3 The following tables Table 3 and Table 4 provide the configurations of the propagation model that will be used by Ofcom to determine the wanted signal strength at the receiver.

Propagation model

Parameter	Value
Model	ITU-R P.1546-4 https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.1546-4-200910-S!!PDF-E.pdf
% Locations	50
% Time	50
Receiver Antenna Height	1.5m (for mobiles)
ERP (dBd)	Relative to a half wave dipole antenna

Table 3 - Propagation Model Settings

Digital mapping

Parameter	Resolution
Terrain data	200m
Clutter data	200m

Table 4 - Digital Mapping Data

Representative clutter heights

A1.4 The following Table 5 represents clutter height values used by Ofcom.

Classification	Clutter Height (metres)
Village	8
Suburban	8
Buildings	10
Urban	20
Dense Urban	30

Table 5 - Representative Clutter Heights

Annex 2

Technically Assigned Assignment Process

Detailed Assignment Process

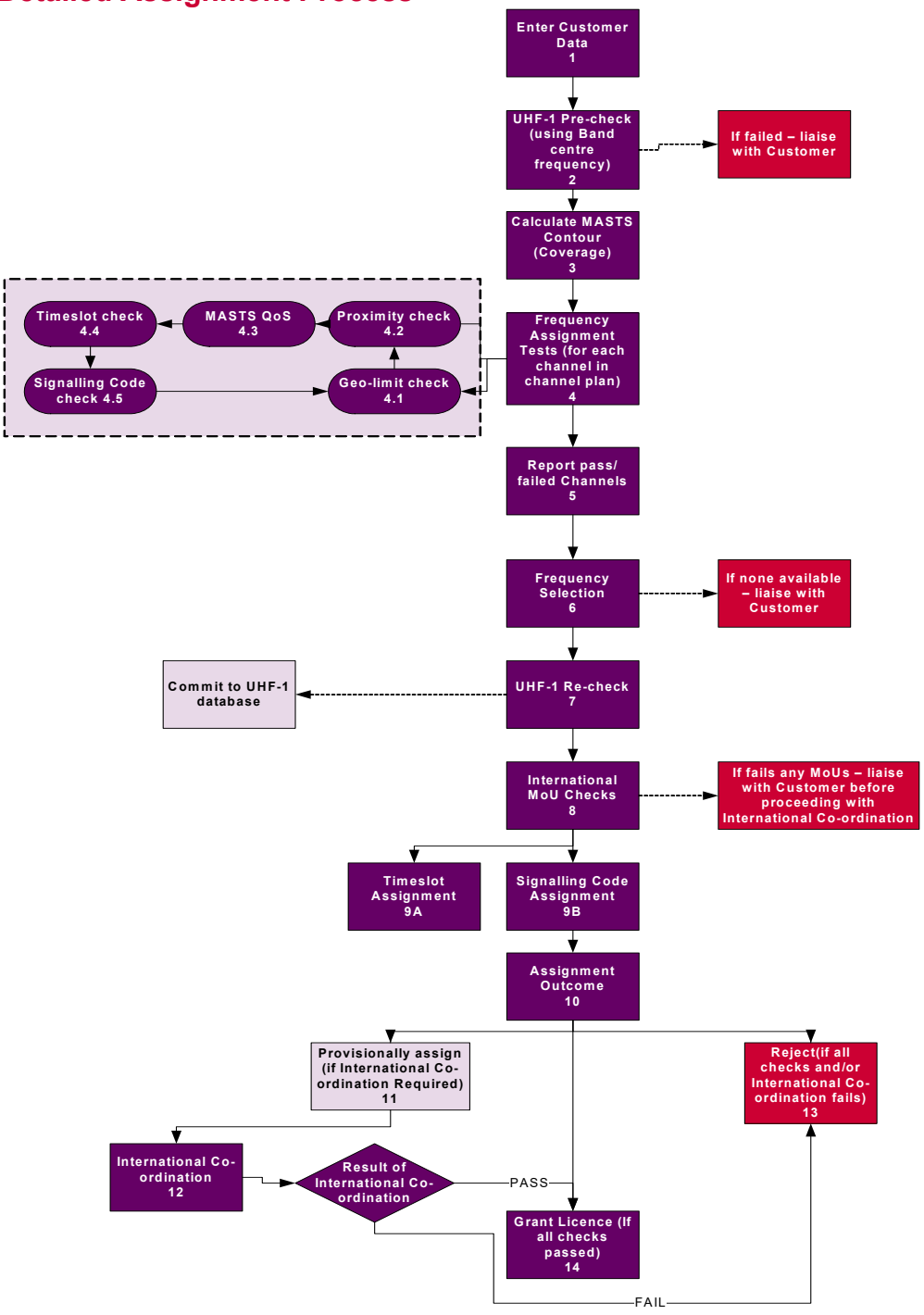


Figure 5 - Detailed Process Flow for the Technically Assigned Assignment Process

Enter Customer Details

A2.1 Firstly, the Customer technical details are entered in the licensing system. Any preferred data such as channels, signalling codes, timeslots will be used in the assignment process.

UHF1 Pre-check

A2.2 The Customer technical details are assessed for UHF1 frequencies. If this is the case, then a check with the applied technical parameters of the equipment will be processed (using the centre frequency of a channel in the UHF1 band). This will identify if the assignment is allowed in the band. In some circumstances, it may be possible to continue with a reduced power ERP in the direction of RAF Fylingdales allowing a 40-kilometre radius for protection.

Calculate MASTS Coverage

A2.3 The MASTS coverage is calculated using the technical parameters of the equipment using the propagation model. The wanted and unwanted coverage areas calculated are then derived.

Frequency Assignment Tests

A2.4 The initial set of candidate channels are identified based on the licence product and frequency band. Then proximity checks and geo-limit checks are carried out on these channels to reduce the number of candidate channels by ensuring channels that cannot be used are ruled out before the MASTS algorithm calculation is undertaken.

A2.5 The Quality of Service (QoS) is calculated using the MASTS algorithm for both the trial assignment and the existing assignments (and therefore passive and active interference are considered). The number of candidate channels is then reduced further by identifying channels that are suitable for assignment. A check on these channels is then undertaken to ensure that there are signalling codes or timeslots available (whichever is applicable) that can be used by the user that are suitable for use on the channels.

Final Checks

A2.6 A UHF1 coordination re-check is then undertaken (if applicable) using the selected frequency to ensure that it still meets the co-ordination criteria.

A2.7 The next process is to ensure that the trial assignment on the selected channel meets the criteria placed for International MoUs. If any of the MoUs are breached, it will be highlighted at this point. Depending on the outcome, these tests will determine if International Coordination is required.

A2.8 If an assignment requires International Coordination, it will be provisionally assigned until the outcome is known. If the results of the coordination tests fail, then the assignment will be rejected for a new assignment.

A2.9 If the assignment passes coordination, then it will be assigned to the user.

Code/Timeslot assignment

A2.10 Any signalling codes or timeslots will be assigned next by identifying which codes are available within a 120km search radius. Please note that as there are different colour code schemes available depending on whether the equipment uses the ETSI standard or another numbering scheme, Ofcom currently does not accommodate the use of colour codes as it does CTCSS/DCS due to the IS cost of catering for the different schemes.

When an industry standard is agreed on then this will become part of the technically assigned assignment process.

Assignment Result

A2.11 A licence will be issued at the end of the Technically Assigned assignment process showing the frequency(s) to be used by the applicant at the location specified in the application if the applicant has paid the requested licence fee.

Variation

A2.12 Licence variation is a request to change some of the technical parameters of the Business Radio (Technically Assigned) licence (such as increase in the antenna height or the ERP power). Ofcom will review the variation request for the licence through the Technically Assigned assignment process. This variation process will need to be repeated if a variation request for an existing assignment is to be changed for the Customer to ensure that the new parameters do not result in an unacceptable change to the Quality of Service (QoS).

A2.13 If an assignment is terminated (through either termination or revocation) then the QoS of all the neighbouring assignments will be updated accordingly.

Annex 3

MASTS

Introduction

A3.1 This section provides the MASTS configuration data that will be used throughout the assignment process.

Configuration

Service and Blocking Thresholds

A3.2 All figures are based on a receiver Service Threshold of -104 dBm/12.5kHz and a Blocking Threshold of -116 dBm/12.5kHz for assignments above 100 MHz and for Paging. For assignments between 55.75 MHz and 87.5 MHz the service threshold is -92 dBm/12.5kHz and the Blocking Threshold is -104 dBm/12.5 kHz.

Band	Centre Frequency	Bandwidth	Service Threshold (dBµ V/m)	Blocking Threshold (dBµV/m)
Paging	36 MHz	6.25 kHz	1	-11
		12.5 kHz	4	-8
		25.0 kHz	7	-5
Band1	61 MHz	6.25 kHz	18	6
		12.5 kHz	21	9
		25.0 kHz	24	12
Low	77 MHz	6.25kHz	20	8
		12.5kHz	23	11
		25.0kHz	26	14
Mid	151 MHz	6.25kHz	14	2
		12.5kHz	17	5
		25.0kHz	20	8
High	169 MHz	6.25kHz	15	3
		12.5kHz	18	6
		25.0kHz	21	9
Band III	191 MHz	6.25kHz	16	4

		12.5kHz	19	7
		25.0kHz	22	10
UHF 1	437 MHz	6.25kHz	23	11
		12.5kHz	26	14
		25.0kHz	29	17
UHF 2	459 MHz	6.25kHz	23	11
		12.5kHz	26	14
		25.0kHz	29	17

Figure 6 - Service and Blocking Thresholds

Proximity Check

Distance Clearance (m)	Comment
500	Co-channel
250	1st adjacent relative to bandwidth

Figure 7 - Proximity Check Criteria

Assignment type

There are two Assignment types; Shared or Exclusive. Each of these assignment types relates to an Activity Factor (AF - which is an input parameter to the MASTS algorithm). It represents the maximum percentage of time in the busy hour that a system will be transmitting. The value of Activity Factor (for the system) will be different depending on if it is used in a single or dual frequency mode of operation. The maximum value of QoS for any given frequency is 1. The maximum value of QoS for any given dual frequency will be the sum of two frequencies resulting in a value of 2.

Class of Station	Channel Operating Mode	Assignment Type	$AF_{B\ (BTS\text{-}TX)\ freq1}$	$AF_{M\ (MTS\text{-}TX)\ freq\ 2}$	QoS_{own}	QoS_{max}
Base Station	Dual Frequency	Exclusive	1	1	2	2
		Shared	0.33	0.33	0.66	2
	Single Frequency	Exclusive	0.5	0.5	1	1
		Shared	0.16	0.16	0.33	1
Operational Area	Single Frequency	Exclusive	N/A	1	1	1
		Shared	N/A	0.33	0.33	1

Table 6- Activity Factors and Maximum QoS for different Station configurations

Annex 4

Antennas

Introduction

A4.1 This section provides details of the types of antennas used for Business Radio systems.

A4.2 Ofcom would like to ensure that these antenna types represent the majority of those used in practice. If there are other general types of antennas that should be considered, then please contact us.

A4.3 The seven antenna types are:

Antenna Type	Code	Directivity
Omni	OM	Omni-directional
Down-fire	DF	Horizontal: Omni-directional Vertical: Directional
Yagi	DE	Directional
Cardioid	DC	Directional
Figure-of-Eight	D8	Directional
Off-set Omni	DO	Directional
Radiating Cable/Leaky Feeder	RC	Omni-directional

Table 7 - Summary of generic antennas available

A4.4 For each antenna the following additional information will be required:

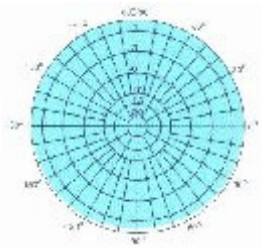
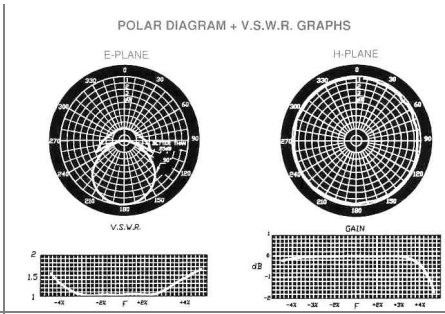
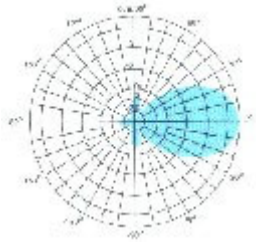
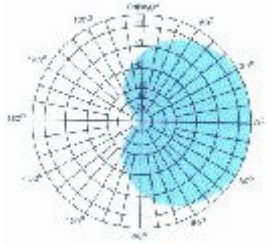
- Gain (dBd, gain with reference to a half-wave dipole);
- Tilt (electrical and/or mechanical, Degrees: – down, + up);
- For directional antennas the following additional information will also be required:
  - Half power beam width (degrees);
  - Front-to-back ratio (dB);
  - Requested azimuth (degrees clock-wise from True North);
- See example diagrams of the generic antenna coverage patterns in figure 8;
- See Table 8 for the list of generic HCM antenna codes and antenna gains.

A4.5 The generic antenna coverage pattern conversions are derived from the HCM Agreement Antenna Codes within Annex 6 of the HCM Agreement. See the following link for more information on the HCM Agreement Antenna Codes: http://hcm.bundesnetzagentur.de/http/englisch/verwaltung/index_berliner_vereinbarung.htm

Generic Antenna Coverage Patterns

A4.6 These diagrams show examples of the generic antenna coverage patterns.

Note: except for omni-directional antennas, the horizontal coverage pattern will change in proportion to a change in an antenna's gain.

	
Omni (OM), and Radiating cables (RC)	Down-fire (DF)
	
Elliptical (DE)	Cardioid (DC)

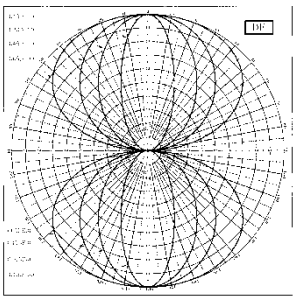
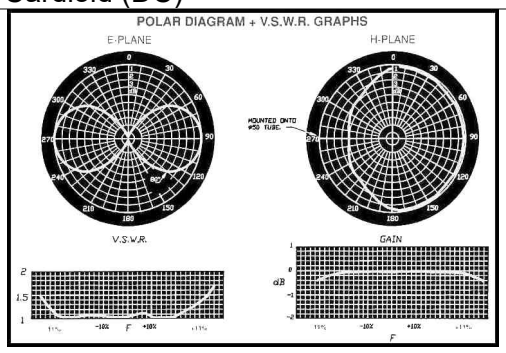

	

Figure-of-eight (D8)	Offset-omni (DO)

Figure 8 - Antenna Pattern diagrams

Ofcom will need to establish the antenna code before a system can be licensed. Table 8 shows examples of the antenna codes of common antennas. When the antenna code is known, perhaps by its being licensed already or being included within the manufacturer's datasheet, the applicant could input the exact antenna code.

Coverage	Gain	SMS antenna code	Typical antenna type	Horizontal	HCM	Code	Vertical	HCM	Code
Omni	0	OM_GAIN_0	Co-linear / end-fed vertical dipole	000	ND	00	450	TA	00
Omni	3	OM_GAIN_3	Co-linear	000	ND	00	160	TA	00
Omni	6	OM_GAIN_6	Co-linear	000	ND	00	100	TA	00
Down-fire	3	DF_GAIN_3	Down-fire #	000	ND	00	800	TA	05
Down-fire	6	DF_GAIN_6	Down-fire #	000	ND	00	400	TA	05
Offset-omni	0	DO_GAIN_0	Centre-fed vertical dipole	103	LA	60	040	DE	00
Elliptical	4	DE_GAIN_4	Yagi	065	EA	03	036	EA	03
Elliptical	8	DE_GAIN_8	Stacked array	103	EC	02	009	EA	02
Cardioid	3	DC_GAIN_3	Cardioid	090	LA	10	038	EA	10
Cardioid	6.6	DC_GAIN_6.6	Cardioid	090	LA	06	009	EA	06
Fig-of-8	0	D8_GAIN_0	Horizontal dipole	045	DE	00	000	ND	00
Omni	0	RC_GAIN_0	Radiating Cable	000	ND	00	000	ND	00

: Down-fire antennas point at the ground, i.e. a tilt of -90 degrees, not the horizon. The typical horizontal gain of a Down-fire antenna is ~-15dB.
Note 1: it is very important to note that Down-fire and Down-tilt antennas are not the same. Down-fire antennas have omni-directional horizontal coverage patterns whereas Down-tilt antennas usually have directional horizontal coverage patterns.
Note 2: omni-directional antennas should only have electrical down-tilt, e.g. -1 to -15 degrees.
Directional antennas usually only have mechanical down-tilt, e.g. -1 to -75 degrees, but may have both mechanical & electrical tilt.
Note 3: down-tilt is indicated by using a '-' sign. Up-tilt is indicated by using a '+' sign or no sign.

Table 8 - Summary of Antenna Types and their Equivalent HCM Code

Band III Antennas

A4.7 The Band III MoUs / Agreements are based on a power-sum process. This means that any change in an assignment's technical parameters may affect the overall available interference margin for other assignments.

A4.8 When performing international coordination calculations, the assignments made in Band III therefore need to have antenna pattern details that reflect the radio system's antenna coverage pattern more accurately.

A4.9 It is intended that suitably more accurate detailed antenna details will be available for selection for Band III assignment requests.

Antenna Directivity

A4.10 For systems with directional antennas, the vertical and horizontal radiation patterns (i.e. the gain in 5 degree increments) of the antenna are required. It is the responsibility of the applicant to either provide Ofcom with the antenna pattern or provide the accurate HCM Antenna Code. The azimuth, measured in degrees east of true north, is also required.

Antenna Tilt

A4.11 To adjust the coverage, or perhaps mitigate interference, antennas may include an angle of tilt (electrical and/or mechanical). The tilt is measured in degrees from the horizontal (– down, + up).

Down-Fire antennas and Leaky Feeders

A4.12 Down-fire antennas or leaky feeders are usually assigned where coverage is required to be limited within a building or tunnel.

Antenna Location

A4.13 The derivation of the coverage area is also dependent on where the antenna is located.

A4.14 If the antenna is located inside a building (indoor) then an attenuation of the field strength is reduced by 5dB. If the antenna is located underground such as an underground car park or tunnel, then the radio coverage is limited to 1km in radius for coordination purposes.

Annex 5

International Coordination

A5.1 The following table provides a summary of all the MoUs and Agreements that currently apply to Business Radio spectrum. The details of these agreements are reviewed periodically with the neighbouring Administrations concerned and may be subject to change.

A5.2 In the absence of a MoU or Agreement for any Business Radio spectrum then the HCM agreement is usually used.

Frequency band	MoU	Frequency Range Affected (MHz)	Countries Affected	Method
Band I	Memorandum of Understanding concluded between the administrations of France and the United Kingdom on coordination in the 47-68 MHz frequency band	47-68	France	Nuisance Field strength
Low Band	N/A	N/A	N/A	N/A
Mid Band	The Paris Agreement	138-144	France Belgium	Preferential Channels
Band III	GE06 G - F OPS Agreement on Band III*	175.8-209	France	Power sum
	GE06 G - HOL OPS Agreement on Band III*	175.8-209	Netherlands	Power sum
	GE06 G - BEL OPS Agreement on Band III*	175.8-209	Belgium	Power sum
UHF1	N/A			
UHF2	N/A			
ALL	Memorandum of Understanding on day to day cross border issues The frequency ranges in the next column are paired	85.0125 - 86.7 / 71.5125 - 72.7875 86.7125 - 86.70 / 76.7125 - 77.9875 81.7 - 83.5 / 68.2 - 70.0 162.05 - 169.0375 / 157.45 - 160.5375 165.05 - 169.8375 / 169.85 - 173.05 453.0125 - 456.9875 / 459.5625 - 462.4	Ireland	
ALL	HCM Agreement		France Belgium Netherlands Republic of Ireland	Nuisance Field strength

* These Band III Agreements will be replaced in 2009 (for Sub-band 1) and 2012 (for Sub-band 2).

Table 9 - Summary of MoUs

ITU notification requirements

A5.3 Business Radio assignments need to be internationally coordinated to pass the ITU notification process and, after which, be automatically entered in the Master International Frequency Register (MIFR) http://www.itu.int/ITU-R/terrestrial/broadcast/mifr/index.html;

A5.4 ITU Radio Regulation RR11.2 requires that any frequency assignment to a transmitting station and to its associated receiving stations shall be notified to the ITU Radiocommunications Bureau if the use of that assignment can cause harmful interference to any service of another administration (reference RR11.3a)

A5.5 Similar notifications shall be made for a frequency assignment to a receiving land station for reception from mobile stations if it is desired to obtain international recognition for that assignment (reference RR11.7e) to the receiving station (reference RR11.9)

A5.6 ITU Radio Regulation RR11.2 also requires that any frequency assignment to a transmitting station and to its associated receiving stations shall also be notified to the ITU Radiocommunications Bureau if it is desired to obtain international recognition for that assignment (reference RR11.7e)

A5.7 Ofcom uses RR11.7e to ensure that the use of spectrum within the UK by PMR assignments is internationally recognised. This recognition would ensure that these assignments would be taken into consideration when considering international changes to spectrum use, e.g., RRC-06 Band III

A5.8 Ofcom uses the following forms to notify Business Radio systems for the ITU:

- Terrestrial Transmitting Station T12
- Terrestrial Receiving Land Station T13

A5.9 Ofcom at times may use the notice form T14 for Terrestrial Typical Transmitting Station to notify some Simple Light Licensed systems

A5.10 Further information on the ITU Notification processes is available at http://www.itu.int/en/ITU-R/terrestrial/tpr/Pages/Notification.aspx

Annex 6

Frequency Bands available to Business Radio

Band	Frequency Band (MHz) unless stated	Single Frequency Channels Available	Dual Frequency Channels Available	Bandwidths Available	Dual Frequency splits available	CEPT Aligned? Yes/No
LF1	132.977 – 133.977 kHz	Yes	No	1 kHz	N/A	No
LF1A	146.205 – 147.205 kHz	Yes	No	1 kHz	N/A	No
Paging	26.225 – 49.49375	Yes	Yes	12.5 kHz 25.0 kHz	*(See Footnote 1)*	No
VHF Band I	55.75 - 68.0	Yes	Yes	12.5 kHz	7 MHz	Yes
VHF Low Band	68.08125 – 87.49375	Yes	Yes	6.25 kHz 12.5 kHz 25 kHz	8.7125 MHz 10.0 MHz 13.5 MHz	No
VHF Mid Band	137.9625 – 165.04375	Yes	Yes	6.25 kHz 12.5 kHz 25.0 kHz[2]	4.5 MHz 4.6 MHz 5.0 MHz 11.0 MHz	No
VHF High Band	165.04375 – 173.09375	Yes	Yes	6.25 kHz 12.5 kHz 25.0 kHz[2]	4.8 MHz	No
Band III	177.20625 – 191.49375[6]	Yes	Yes	12.5 kHz 25.0 kHz[2]	8.0 MHz	No
UHF Band 1 (UHF-1)	425.00625 – 449.49375	Yes	Yes	6.25 kHz 12.5 kHz 25.0 kHz	5.3875 MHz 14.5 MHz 17.0 MHz 17.15 MHz 17.41875 MHz 17.64375 MHz 17.65625 MHz 17.70625 MHz 17.71875 MHz 17.74375 MHz 17.78125 MHz 20.5 MHz *(See Footnote 3)*	No
UHF Band 2 (UHF-2)	450.0 – 470.0	Yes	Yes	6.25 kHz 12.5 kHz 25.0 kHz	5.3 MHz 5.5 MHz 5.65 MHz 6.5 MHz 7.0 MHz *(See Footnote 4)*	No

1) The dual frequency Channel Plans have 12.5 kHz return speech frequencies available at 161 MHz and 164 MHz.
2) Single frequency channels only
3) Most of the UHF1 dual frequency channels are on the 14.5 and 20.5 MHz duplex splits
4) Most of the UHF2 dual frequency channels are on the 5.5 and 6.5 MHz duplex splits
5) Any channels available for Technically Assigned can have a mixture of exclusive or shared use within a geographical area
6) The frequency range 193.2125 MHz to 207.49375 MHz is now allocated on a primary basis to broadcasting, any existing Business Radio use is expected to vacate the spectrum by 2020, there are no new Business Radio assignments within this spectrum

Annex 7

Special Services

Introduction

A7.1 This section summarises three special types of use of a radio system and provides references to other information sheets if more detail is required.

Trunked Systems

A7.2 We encourage the use of properly designed, trunked systems because it enables higher spectrum efficiency and can offer a better service than multiple single channels. The minimum frequency separation of trunked systems using 12.5 kHz width channels in bands below 191 MHz such as Mid Band or Band III will usually be 150 kHz between channels and for UHF systems 75 kHz between channels. For UHF systems using 25 kHz width channels then the minimum separation is 150 kHz between channels.

A7.3 Trunked systems will be considered as Exclusive use type systems due to the requirement to use a control channel.

A7.4 The analogue standard MPT1327 can be found here http://webarchive.nationalarchives.gov.uk/frame/20040104233440/http://www.ofcom.org.uk/static/archive/ra/publication/mpt/mpt_pdf/mpt1327.pdf

A7.5 The standard for DMR can be found here https://www.dmrassociation.org/downloads/standards/ts_10236101v020501p.pdf

A7.6 The standard for DPMR can be found here https://dpmrassociation.org/downloads/ETSI/ts_102658v020501p.pdf

IR 2008

A7.7 IR2008 is a radio channel access procedure using 250 or 500 millisecond timeslots for shared data services on a time domain basis.

A7.8 This is a Time Division Multiple Access (TDMA) protocol that requires the assignment of 250 ms (within a two-second frame) or 500 ms (within a four-second frame) timeslots for both the base and mobile frequencies.

A7.9 Apply for a licence using the Technically Assigned application form (OFW434)

A7.10 https://www.ofcom.org.uk/__data/assets/pdf_file/0025/28177/ofw434.pdf

Annex 8

Area Defined Geographical Areas

A8.1 There are three ways in which the geographical areas can be defined for the Business Radio (Area Defined) Licence.

A8.2 These are:

8.2.1 UK or;

8.2.2 The regions and nations, i.e. England, Scotland, Wales or Northern Ireland; or;

8.2.3 50km^2 units based on the grid squares of the 2nd series of Landranger maps published by Ordnance Survey (derived by splitting the UK extended grid squares equally into 4) e.g., TQ can be split into TQa, TQb, TQc, TQd;

a) Therefore, as an example TQa would be defined as located within the co-ordinates of TQ 000 500, TQ 999 999, TQ 500 999.

b) A UK map of the 50km^2 units grid squares is seen in Figure 9.

A8.3 This method of defining the geographical areas forms the basis for both the pricing and the tradable units for the Business Radio (Area Defined) licence product.

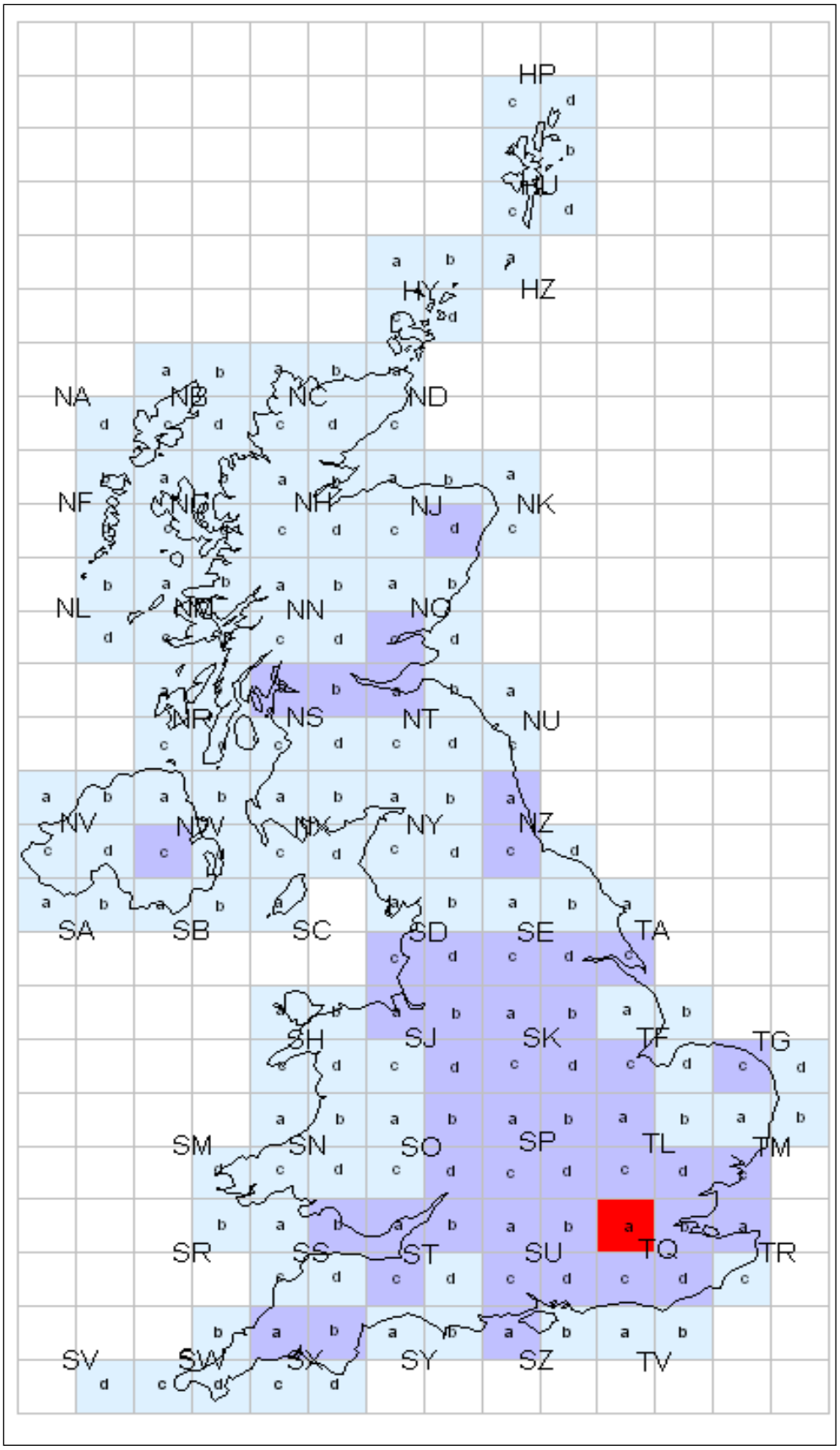


Figure 9 – Business Radio (Area Defined) geographical units

Annex 9

UHF1 Operational Areas

A9.1 Please note below the list of operational areas referenced in paragraph 3.3

		Permitted Area	
Place Name	**NGR**	**Latitude / Longitude**	**Radius (kms)**
Aberdeen	NJ 930 050	57.1358543001247, -2.11728363792833	32
Birmingham	SP 070 870	52.4808807528734, -1.89835789169247	40
Bradford	SE 160 330	53.7930694720459, -1.75860078807092	32
Bristol	ST 600 740	51.4635492664443, -2.57717989702412	10
Cardiff	ST 190 760	51.4771376968874, -3.1677243408331	10
Charing Cross	TQ 300 800	51.5039908428975,-0.128353978360336	56
Coventry	SP 330 790	52.4080158549712, -1.51632047513992	10
Derby	SK 340 350	52.9113578444353, -1.49586534059553	32
Edinburgh	NT 260 740	55.9533055995767, -3.18665411484455	32
Glasgow	NS 580 650	55.8572144261148, -4.27018331936896	40
Halifax	SE 080 250	53.7213481885523, -1.88024472515733	32
Leeds	SE 300 340	53.8014415487283, -1.54598920772812	32
Leicester	SK 590 040	52.630557274464, -1.12972526740951	32
Middlesbrough	NZ 490 200	54.5728510844113, -1.24355874664937	32
Newport	ST 310 880	51.5866117955489, -2.9973201510201	10
Nottingham	SK 570 410	52.9633449818824, -1.15283551546806	32
Preston	SD 530 290	53.7552302144211, -2.7143036440682	32
Sheffield	SK 350 870	53.3786995551667, -1.47533333709336	32
Swansea	SS 650 950	51.6375569707107, -3.95219236986501	10
Tyneside	NZ 270 620	54.9519222084252, -1.57996345613158	32
Warrington	SJ 600 880	53.3873164501046, -2.60287882258328	50

Note: Total exclusion for 40 kms from RAF Fylingdales for assignments in UHF1
National Grid Reference SE 86521 97072
Lat/Long 54.3618368547083, -0.669999808915801

Annex 10

Document History

Version	Published Date	Comments
Version 1.0	November 2004	
Version 2.5	November 2017	• Field strength density level of -104 dBm/12.5 kHz included for Band I and Low Band • Sharing percentage for Technically Assigned changed to 33%
Version 2.6	May 2018	• Amended proximity table • Included text for Band One and Low Band for thresholds table • Addition of spacing between channels for 25 kHz UHF channels • Changes to Glossary table
Version 2.7	March 2019	• Minor edits, no changes to policy
Version 2.8	October 2019	• Amendment to paragraph 7.3
Version 2.9	October 2020	• Update of links
Version 2.91	February 2021	• Update of Memorandum of Understanding table in Annex 5
Version 2.92	February 2022	• Minor edits, no changes to policy

Annex 11

Glossary

Term	Definition
Activity Factor	Maximum percentage of time in a busy hour that a base station will be transmitting
Antenna	Designed to emit radio waves and /or receive radio waves
Assigned Frequencies	Assigning frequencies for use in each network. For a network, assigning a frequency for multiple use in that network. For single usage, a frequency used for an individual assignment (see below)
Assignment	Authorisation given by a licensing authority for a radio station to use a specific radio frequency or channel under specified conditions
Band	A frequency range having a lower limit and an upper limit, usually specified by international agreement. Allocations of frequency ranges to bands are both national and international and is typically determined “for certain types of radio service”
Base Station	A fixed location at which transceivers and antennas are installed to offer a service to the surrounding area
Blocked	A call is blocked if the strength of an unwanted signal is sufficient to indicate that the channel is busy. This applies to both mobile and base station
Blocking	A blocking signal is an unwanted signal of such strength that it prevents initiation of a call
Blocking Signal Area	The area where the signal equals or exceeds that value (Blocking Signal Level) which causes blocking but does not reach that required for the raw coverage area
Blocking Threshold	The level at which (if breached) by an unwanted signal would result in a call being prevented, the transmission/call is then considered blocked
BSA	See Blocking Signal Area
CTCSS	Continuous Tone Controlled Signalling System
Channel	A carrier frequency used to transmit and receive radio signals
Channel Access Code	Is the equivalent of a CTCSS or DCS privacy tone for digital systems
Channel Plan	A set of adjacent channels often referred to as a channel raster when the frequency interval between adjacent carriers is the same
Clutter data	Is data for the propagation of a radio wave across land usage such as buildings, water and trees
Coordination Clearance	A procedure to check interference of unwanted signals on reception of wanted signals in a radio system, resulting in degradation of performance. This is required by international agreement to ensure that services assigned in the UK do not affect services in use in the Republic of Ireland and mainland Europe
Coverage Area	The geographical area in which a radio signal level from a base station transmitter is at or above a pre-defined threshold
Covered	A location within a coverage area
Cross-Talk Area	The area within the Protected Service Area within which an unwanted signal equal to or above the Interfering Signal level can occur

Term	Definition
CTA	See Cross-Talk Area
DCS	Digitally Coded Squelch
DMR	Digital Mobile Radio – uses two timeslots in 12.5 kHz
DPMR	Digital Private Mobile Radio – 6.25 kHz wide channel
ERP	Effective Radiated Power
FDMA	Frequency Division Multiple Access – as used by DPMR
Field Strength	The strength of a radio signal at a particular location
Frequency	A carrier frequency used to transmit and receive radio signals
Interference	An unwanted signal occurring at the time that a wanted signal is being received; it is a signal of such strength that it prevents initiation of a call
Interfering Signal Area	The area where the signal equals or exceeds that value (Interfering Signal Level) which causes crosstalk during a call but is not enough to prevent a call being made (Blocking Signal Level)
MASTS	Mobile Assignment Technical System. The frequency assignment algorithm for the Business Radio (Technically Assigned) Licence Class
MoU	Memorandum of Understanding: an agreement between two administrations setting out the areas / test points and the maximum tolerable interfering signal level therein/ thereat
National Grid Reference (NGR)	Ordnance Survey coordinates in the format two letters followed by Eastings (5 numerals) and Northings (5 numerals)
NGR	*See "National Grid Reference"*
Pixel	Geographic areas are represented by 'pixels' at regular intervals (typically 200m)
PMR	*See "Private Mobile Radio"*
Private Mobile Radio	It is a closed loop network that consists of users who operate their radios so that they would not interfere with each other or cause interference to other adjacent users
Propagation Model	The model which suitably defines how the transmitted signal is propagated
Protected Service Area	The intersection of the Requested Service Area and the Consolidated Coverage Area
PSA	See Protected Service Area
QoS	Quality of Service is the quantification of the level of service a system provides
Requested Service Area	The geographic area over which a radio service is desired
RSA	*See Requested Service Area*
Service Threshold	The workable signal level that a mobile is expected to receive a signal from the Base Station or Mobile transmitter
Site	The location details of where the base station will operate from
TDMA	Time Division Multiple Access – as used by DMR for timeslots in a channel
Topographical Data	Combined Terrain and Clutter data
Transmission Type	See Type of Service Transmission
Type of Service Transmission	How the service will be used i.e. Voice / Data / Both