



# Business Radio Technical Frequency Assignment Criteria

Version 2.1  
Issue date: November 2014

Page intentionally left blank



# Contents

Section		Page
1	Foreword	3
2	Introduction	4
3	National and International Co-ordination	6
4	Business Radio (Area Defined) Licence Class	8
5	Business Radio (Technically Assigned) Licence Class	12
6	Mobile ASsignment Technical System (MASTS)	17
Annex		Page
1	Recommendation ITU-R P.1546-4	21
2	Technically Assigned Assignment Process	24
3	MASTS	27
4	Antennas	30
5	International Co-ordination	35
6	Frequency Bands	37
7	Special Services	39
8	Area Defined Geographical Areas	40
9	Document History	42
10	Glossary	43

## 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:  
<http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/ir20441.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 being revised.
- 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 0300 123 1000.
- 1.5 Please see below for full contact details:

Ofcom website: <http://www.ofcom.org.uk>

TFAC location <http://licensing.ofcom.org.uk/radiocommunication-licences/business-radio/guidance-for-licensees/information/technical-information/tfac/>

**Spectrum Licensing**  
**Ofcom**  
**Riverside House**  
**2a Southwark Bridge Road**  
**London SE1 9HA**

**Email** [spectrum.licensing@ofcom.org.uk](mailto:spectrum.licensing@ofcom.org.uk)

**Tel: 0300 123 1000**

**Fax: 020 7981 3235**

## 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.  
<http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/ir20441.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 New applicants and existing licensees will be able to seek advice from Ofcom on the appropriate Business Radio licence class that will best suit them. The application forms can be downloaded from the Ofcom website at <http://licensing.ofcom.org.uk/radiocommunication-licences/business-radio/forms/> or you can apply online at: <https://secure.ofcom.org.uk/busrad/>.
- 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 as long as 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.
- 2.6 For Business Radio Light Licensing products, Ofcom will automatically issue a licence with the available frequencies that can be used with some technical restrictions applied such as a restriction on effective radiated power (ERP).

## 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 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.

2.7 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 coexistence 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.

## Exclusion Areas

- 3.3 These are areas that Ofcom must not allow any Business Radio assignments, for example, within 40 kms of the Fylingdales Radar station for frequencies between 420 MHz and 450 MHz

## Operation Areas

- 3.4 These are areas where Business Radio assignments can be assigned. For example, Ofcom is authorised to assign UHF1 spectrum within 56 kms of Charing Cross.

## Co-ordination Areas

- 3.5 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.
- 3.6 Currently UHF1 has the largest number of Geo-limits within Business Radio spectrum and these are listed in Annex 9

## UHF1 (420 – 450 MHz) 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 RAF Fylingdales. 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 has to 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).
- 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 in order 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](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

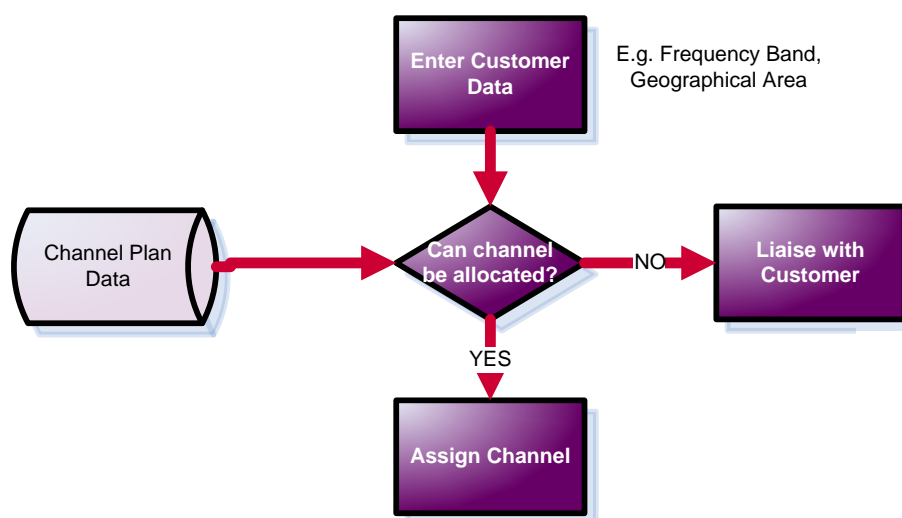
- 4.1 A Business Radio (Area Defined) licence is suitable for users who operate networks on a national or wide area regional basis and require exclusive spectrum. Such networks are often of strategic and of national importance for rail networks, utilities, major distribution networks and for different 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<sup>2</sup> national grid squares. Licensees will have the freedom to deploy their systems as long as 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: 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 regardless of the frequency width;
  - 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<sup>2</sup> 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.

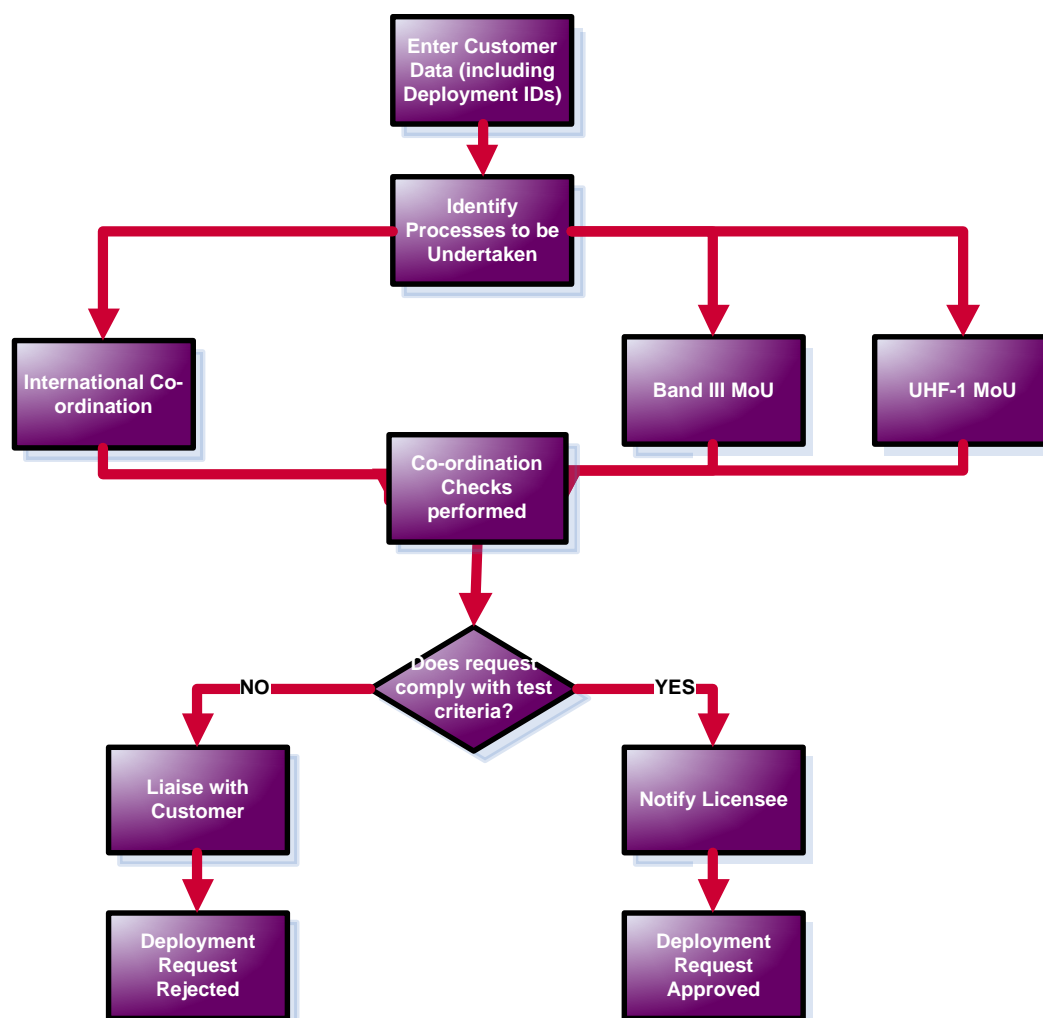


Figure 2 – High Level flow for Post Issue Support Process

### Compliance with spectral power field strength density limit

- 4.8 In order 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: <http://www.itu.int/rec/R-REC-P.1546-4-200711-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](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: <http://licensing.ofcom.org.uk/binaries/spectrum/business-radio/guidance-for-licensees/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 can be found at: <http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/ir20441.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.

<b>Parameter</b>	<b>Description</b>	<b>Examples</b>																											
Type of Station	This describes whether it is a Base Station, a Remote Control Point, or an Operational Area (Mobile to Mobile operation)	Base Station Remote Control Point <sup>6.16</sup> Operational Area <sup>6.14</sup>																											
Location	This is the location of the Base Station or centre of the Operational Area to a six figure OS grid reference (100m accuracy) or you can specify the latitude / longitude	e.g. TQ 322 804  51:30.42453N 0:5.79152W																											
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 (100% of time) Shared (50% 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  <table border="1"> <thead> <tr> <th>Band</th> <th>From</th> <th>To</th> </tr> </thead> <tbody> <tr> <td>Paging</td> <td>26.225</td> <td>49.49375</td> </tr> <tr> <td>Band 1</td> <td>55.75</td> <td>68.0</td> </tr> <tr> <td>Low</td> <td>68.08125</td> <td>87.49375</td> </tr> <tr> <td>Mid</td> <td>137.9625</td> <td>165.04375</td> </tr> <tr> <td>High</td> <td>165.04375</td> <td>173.09375</td> </tr> <tr> <td>Band 3</td> <td>177.20625</td> <td>207.49375</td> </tr> <tr> <td>UHF-1</td> <td>425.00625</td> <td>449.49375</td> </tr> <tr> <td>UHF-2</td> <td>453.00625</td> <td>466.08750</td> </tr> </tbody> </table>	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	207.49375	UHF-1	425.00625	449.49375	UHF-2	453.00625	466.08750
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	207.49375																											
UHF-1	425.00625	449.49375																											
UHF-2	453.00625	466.08750																											
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 of the proposed location on either co-channel or either of the first adjacent channels.
  - 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).
  - 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 will have to 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 Before International Co-ordination is undertaken the Customer should be contacted to advise them if they wish to proceed. If the proposed assignment fails International Co-ordination then the Customer 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 new concepts that MASTS introduces and these are detailed in this section. Also MASTS will introduce a Technically Assigned Assignment process for the new Business Radio (Technically Assigned) licence class.
- 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 50% 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%<sup>1</sup> of the time, more than 50% of the time in its busiest hour or requires extra protection because of either business or safety critical reasons

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 of time. 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. 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

---

<sup>1</sup> NB: stations operating continuously will be subject to more stringent international co-ordination requirements.

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 5dB will be applied. Also if the antenna is located underground (e.g. tunnel) then the coverage area will be limited to 1km in radius.
- 6.9 Both indoor and underground are difficult areas to model without the detailed characteristics of the clutter of the propagation model in order 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 take into account 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.
- 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 <sup>2</sup>	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 <sup>3</sup>	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 its QoS and also 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.

### 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

<sup>2</sup> 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.

<sup>3</sup> 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.

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 by request on a case by case basis.

### **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 exactly the same way as base stations (the 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.

### **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

Business Radio Technical Frequency Assignment Criteria

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

Business Radio Technical Frequency Assignment Criteria

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. There are two types CTCSS and DCS mainly used to identify a radio that identifies a code without the use of their own frequencies but frequencies assigned for their own use without interfering with each other. CTCSS codes are identified that they are never used in close proximity to the channel in use for transmission. DCS codes require the use of codes on a channel to differentiate between users on the same channel.

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

**7.4.1** FDMA

[http://www.etsi.org/deliver/etsi\\_tr/102800\\_102899/102884/01.01.01\\_60/tr\\_102884v010101p.pdf](http://www.etsi.org/deliver/etsi_tr/102800_102899/102884/01.01.01_60/tr_102884v010101p.pdf)

**7.4.2** TDMA

[http://www.etsi.org/deliver/etsi\\_tr/102300\\_102399/102398/01.01.02\\_60/tr\\_102398v010102p.pdf](http://www.etsi.org/deliver/etsi_tr/102300_102399/102398/01.01.02_60/tr_102398v010102p.pdf)

## Annex 1

# Recommendation ITU-R P.1546-4

## High Level Process Flow

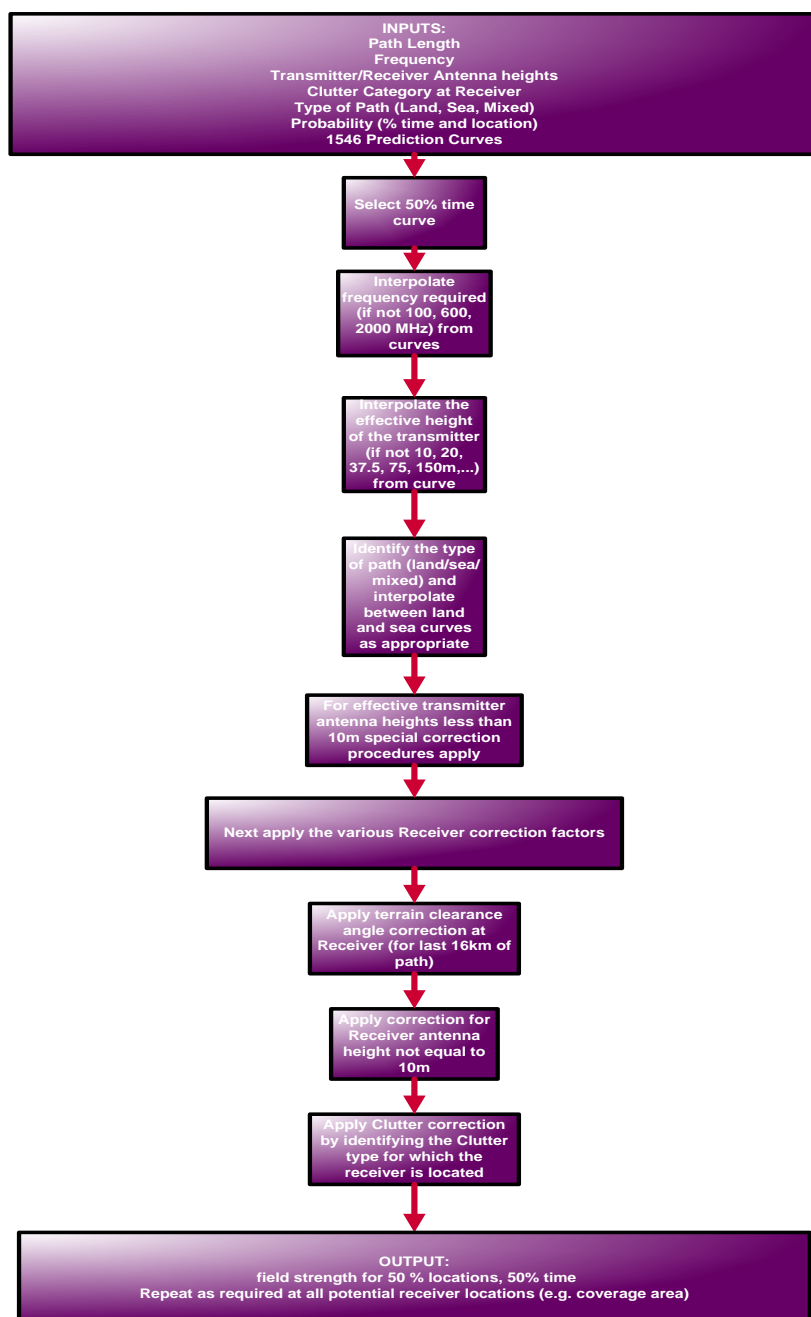


Figure 4 – High Level flow of ITU-R P.1546-4 Propagation Model

- 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
% 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 <sup>4</sup>
Terrain data	200m
Clutter data	200m

<sup>4</sup> Ofcom will consider in the near future the implementation of 50 m resolution for terrain and clutter data

### Table 4 - Digital Mapping Data

#### Representative clutter heights

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

<b>Classification</b>	<b>Clutter Height (metres)</b>
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

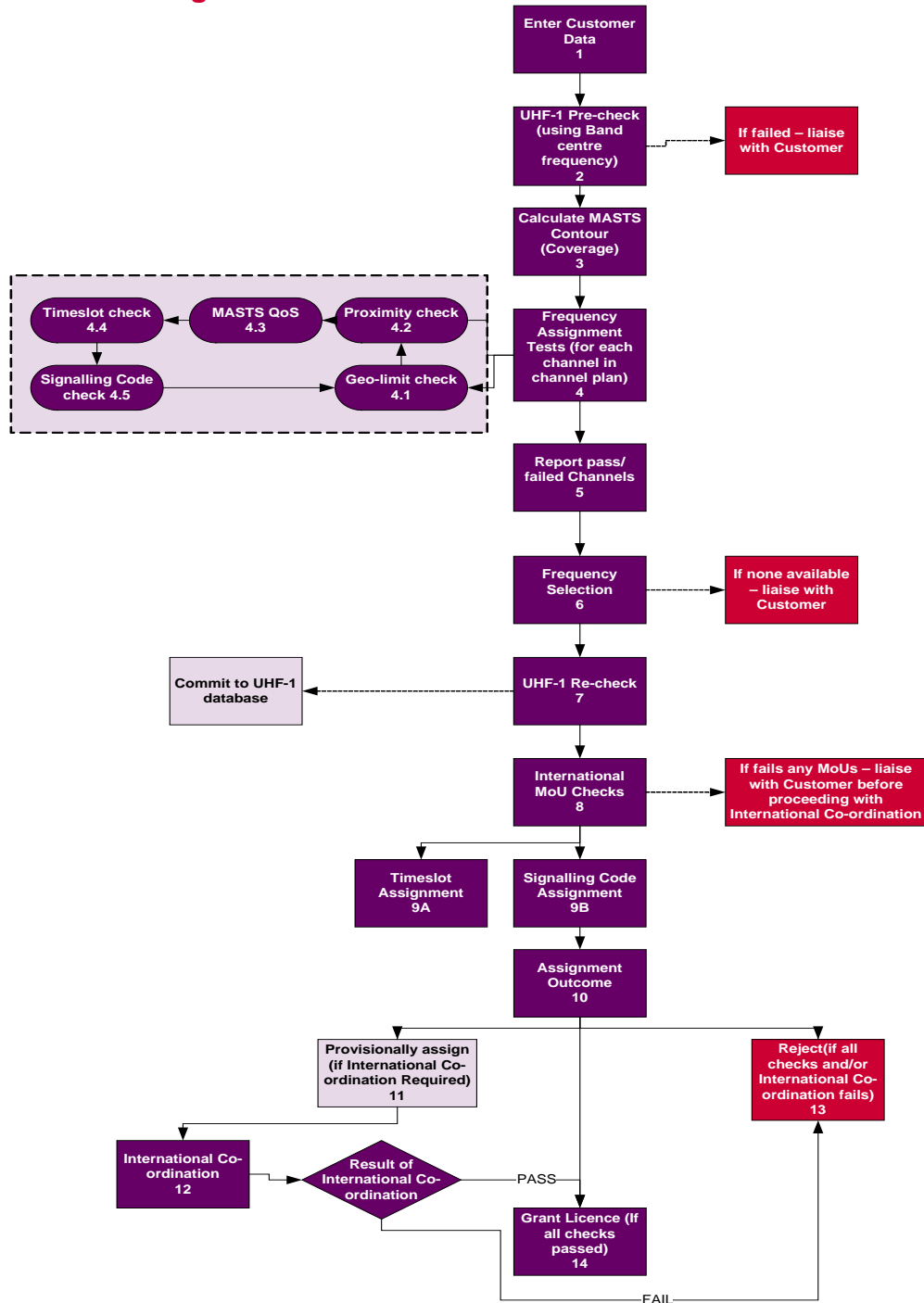


Figure 5 - Detailed Process Flow for the Technically Assigned Assignment Process

### Enter Customer Details

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

### UHF-1 Pre-check

- A2.2 The Customer technical details are assessed for UHF-1 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 UHF-1 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 in order 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 UHF-1 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 investigate 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 provided that 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.

Band	Centre Frequency	Bandwidth	Service Threshold (dB $\mu$ V/m)	Blocking Threshold (dB $\mu$ V/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	6	-6
		12.5 kHz	9	-3
		25.0 kHz	12	0
Low	77 MHz	6.25kHz	8	-4
		12.5kHz	11	-1
		25.0kHz	14	2
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**

Frequency Offset (kHz)	Distance Clearance (m)	Comment
0	2000	Co-channel
+/- 6.25	2000	6.25 kHz adjacent channel
+/- 12.5	500	12.5 kHz adjacent channel
+/- 25.0	500	25.0 kHz adjacent channel

**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 <sub>B</sub> (BTS-TX) freq1	AF <sub>M</sub> (MTS-TX) freq 2	QoS <sub>own</sub>	QoS <sub>max</sub>
<b>Base Station</b>	Dual Frequency	Exclusive	1	1	2	2
		Shared	0.5	0.5	1	2
	Single Frequency	Exclusive	0.5	0.5	1	1
		Shared	0.25	0.25	0.5	1
<b>Operational Area</b>	Single Frequency	Exclusive	N/A	1	1	1
		Shared	N/A	0.5	0.5	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
Elliptical	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](http://hcm.bundesnetzagentur.de/http/englisch/verwaltung/index_berliner_vereinbarung.htm)

## New 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.

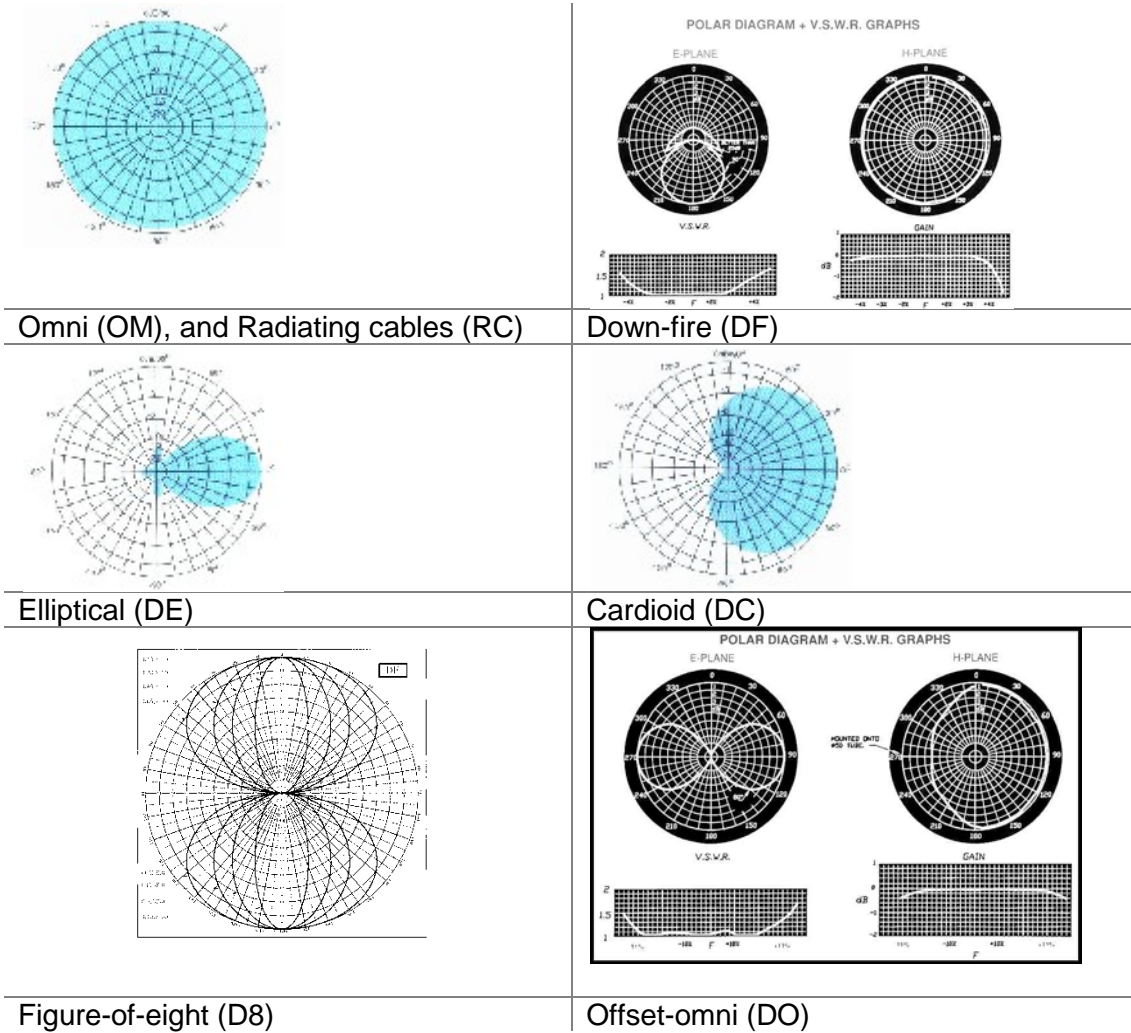


Figure 8 - Antenna Pattern diagrams

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.

Antenna coverage pattern	Gain (dBd)	Horizontal	HCM	Code	Vertical	HCM	Code	New code	Typical antenna type
Omni	0	000	ND	00	045	DE	00	OM	Co-linear and end-fed vertical dipole
Omni	3	000	ND	00	016	DE	00	OM	Co-linear
Omni	6	000	ND	00	010	DE	00	OM	Co-linear
Down-fire	3							DF	Down-fire #
Down-fire	6							DF	Down-fire #
Offset omni	0	103	LA	60	040	DE	00	DO	Centre-fed vertical dipole
Elliptical	4	074	EA	03	036	EA	03	DE	Yagi
Elliptical	8	103	EC	02	009	EA	02	DE	Stacked array
Cardioid	3	090	LA	10	038	EA	10	DC	Cardioid
Cardioid	6.6	090	LA	06	009	EA	06	DC	Cardioid
Fig-of-8	0	045	DE	00	045	ND	00	D8	Horizontal dipole
Fig-of-8	9	030	DE	05	025	DE	05	D8	Back-to-back pair
Omni	-30	000	ND	00	000	ND	00	RC	Leaky feeder / Radiating cable

# the +/- 45, +/- 30 degree beams, and 3, 6dBd gains, are pointing to the ground, not the horizon. The gains to the horizon of both antennas are <0dB.

**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 In order 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.

<b>Frequency band</b>	<b>MoU</b>	<b>Frequency Range Affected (MHz)</b>	<b>Countries Affected</b>	<b>Method</b>
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
High Band	Memorandum of Understanding (MoU) for day-to-day cross border issues	165-173	Republic of Ireland	Preferential Channels
Band III	MoU Band III (UK and France)*	177.2-207.5	France	Power sum
	MoU Band III (UK and Netherlands)*	177.2-207.5	Netherlands	Power sum
	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	HCM Agreement		France Belgium Netherlands Republic of Ireland	Nuisance Field strength

\* These Band III MoUs will be replaced in 2009 (for Sub-band 1) and 2012 (for Sub-band 2) for the corresponding RRC06 Agreements.

\*\* 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 in order 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 is capable of causing 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

Band	Frequency Band (MHz)	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	1kHz	N/A	No
LF1A	146.205 – 147.205 kHz	Yes	No	1kHz	N/A	No
Paging	26.225 – 49.49375	Yes	Yes	12.5 kHz 25.0 kHz	(See Footnote 1)	No
VHF Band I	55.750 -68.0	Yes	Yes	12.5 kHz	7 MHz	Yes
VHF Low Band	68.08125 – 87.49375	Yes	Yes	12.5 kHz	8.7125 MHz 10.0 MHz 13.5 MHz	No
VHF Mid Band	137.9625 – 165.04375	Yes	Yes	12.5 kHz 25.0 kHz <sup>2</sup>	4.5 MHz 4.6 MHz 8.5 MHz	No
VHF High Band	165.04375 – 173.09375	Yes	Yes	12.5 kHz 25.0 kHz <sup>2</sup>	4.8 MHz	No
Band III	177.20625 – 207.49375	Yes	Yes	12.5 kHz 25.0 kHz <sup>2</sup> 200 kHz <sup>2</sup>	8.0 MHz	No
UHF Band 1 (UHF-1)	425.00625 – 449.49375	Yes	Yes	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)	453.00625 – 466.0625	Yes	Yes	12.5 kHz 25.0 kHz	5.3 MHz 5.5 MHz 5.65 MHz 6.5 MHz 7.0 MHz (See Footnote	No

## Business Radio Technical Frequency Assignment Criteria

					4)	
--	--	--	--	--	----	--

- 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

### **Table 10 - Summary of Channel Plans available to Business Radio**

## 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 channel separation of trunked systems in bands below 209MHz such as Mid Band or Band III will usually be twelve channels and for UHF systems six channels.
- A7.3 Trunked systems will be considered as Exclusive use type systems due to the requirement to use a control channel. The standard for DMR can be found here [http://www.etsi.org/deliver/etsi\\_ts/102300\\_102399/10236104/01.02.01\\_60/ts\\_10236104v010201p.pdf](http://www.etsi.org/deliver/etsi_ts/102300_102399/10236104/01.02.01_60/ts_10236104v010201p.pdf)
- A7.4 The standard for DPMR can be found here [http://www.etsi.org/deliver/etsi\\_ts/102600\\_102699/102658/02.01.01\\_60/ts\\_102658v020101p.pdf](http://www.etsi.org/deliver/etsi_ts/102600_102699/102658/02.01.01_60/ts_102658v020101p.pdf)

### IR 2008

- A7.5 IR2008 is a radio channel access procedure through the use of 250 or 500 millisecond timeslots for shared data services on a time domain basis.
- A7.6 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.
- A7.7 More information can be found at:
- A7.8 <http://www.ofcom.org.uk/static/archive/ra/publication/interface/word-pdf/ir2008v1-2.pdf>

### Digital Mobile Radio

- A7.9 Digital Mobile Radio (DMR) is technology specific and can be accommodated within the Business Radio (Technically Assigned) Licence conditions.
- A7.10 Digital equipment will be subject to the same interference limitation requirements, e.g. coordination with other users, as with analogue equipment.

- A7.11 To aid the coordination of assignments, Ofcom will include the option to add Digital Access Codes to digital equipment systems.

## 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<sup>2</sup> units based on the grid squares of the 2<sup>nd</sup> 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<sup>2</sup> 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.

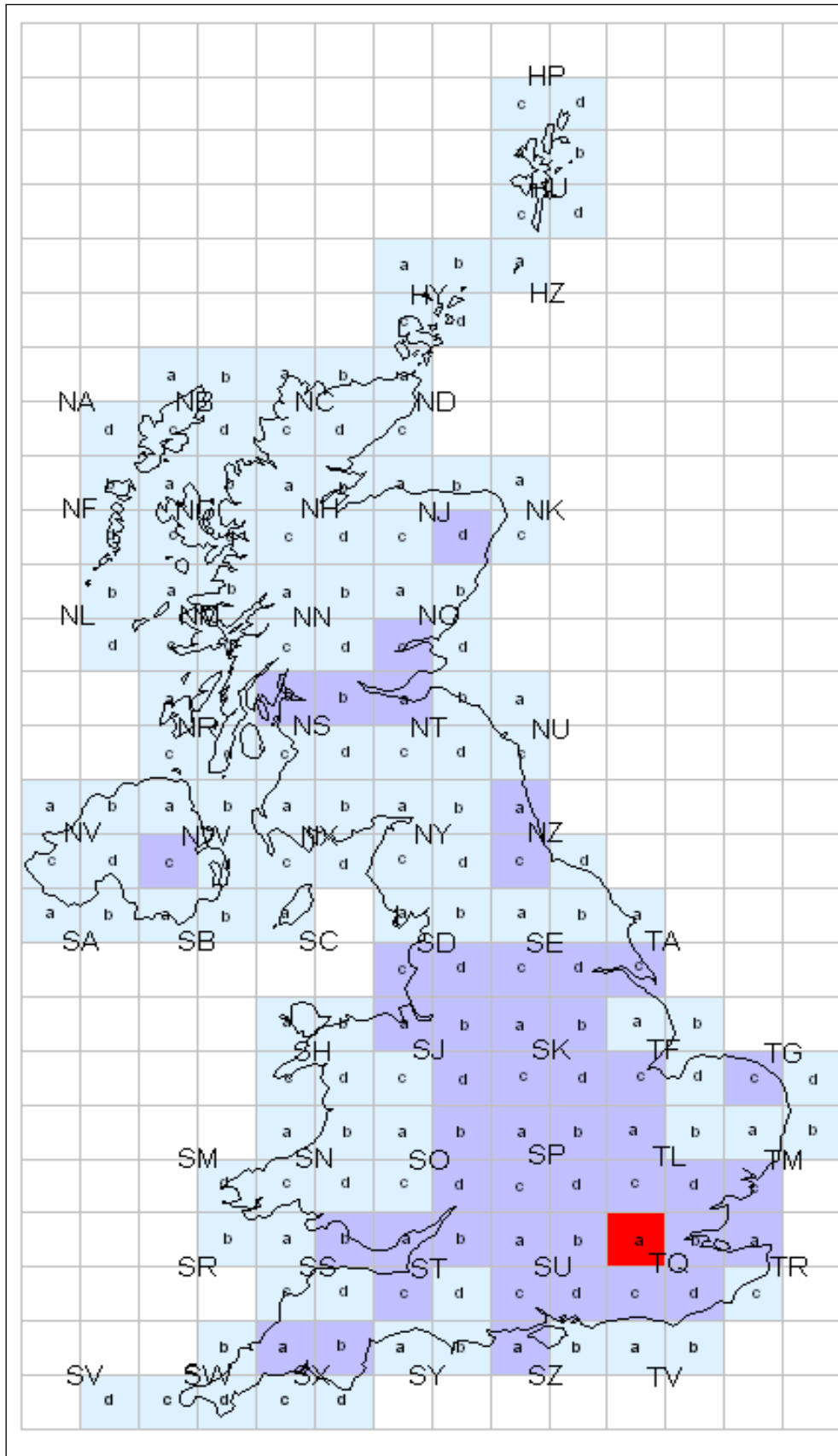


Figure 9 – Business Radio (Area Defined) geographical units



## Annex 9

# UHF1 Operational Areas

A9.1 Please note below the list of operational areas referenced in paragraph 3.6

Permitted Area		Radius (kms)
Place Name	NGR	
Charing Cross	TQ 300 800	56
Warrington	SJ 600 880	50
Birmingham	SP 070 870	40
Glasgow	NS 580 650	40
Aberdeen	NJ 930 050	32
Bradford	SE 160 330	32
Derby	SK 340 350	32
Edinburgh	NT 260 740	32
Halifax	SE 080 250	32
Leeds	SE 300 340	32
Leicester	SK 590 040	32
Middlesbrough	NZ 490 200	32
Nottingham	SK 570 410	32
Preston	SD 530 290	32
Sheffield	SK 350 870	32
Tyneside	NZ 270 620	32
Swansea	SS 650 950	10
Cardiff	ST 190 760	10
Newport	ST 310 880	10
Bristol	ST 600 740	10
Coventry	SP 330 790	10

Note: Total Exclusion for 40km from RAF Fylingdales  
 National Grid Reference SE 86521 97072  
 Lat/Long N54.361833 W0.669994

## Annex 10

# Document History

<b>Version</b>	<b>Published Date</b>	<b>Comments</b>
Version 1.0	November 2004	
Version 1.1	February 2005	
Version 2.0	November 2008	
Version 2.1	November 2014	Version number and issue date inserted on first page Update to links to documents and UHF1 geographical limitations Location details included for Fylingdales exclusion zone

## 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 incident thereon
Assigned Frequencies	Assigning frequencies for use in a given 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 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
CTA	See Cross-Talk Area
DCS	Digitally Coded Squelch

Term	Definition
ERP	Effective Radiated Power
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 cross-talk during a call but is not sufficient to prevent a call being made (Blocking Signal Level)
MASTS	Mobile Assignment Technical System. The new 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
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
Unify	An IS Programme in Ofcom which delivered a Licensing system which uses the MASTS algorithm as the basis for Business Radio assignments