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Notice of coordination procedures for MOD sites related to 2.3 GHz licences

Publication Date: 12 April 2018

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Section

1. Introduction

1.1 This Notice is notified to each 2.3 GHz Licensee under their respective 2.3 GHz licences.

1.2 MOD has a small amount of on-going use within the band at two locations, one in the Outer Hebrides and one in West Wales. It also requires protection around a number of other fixed receiver sites.

1.3 This Notice specifies the protection thresholds and coordination procedure necessary to ensure the protection of existing and continuing MOD usage in the 2310 to 2360 MHz band from potential harmful interference from the deployment of networks in the 2.3 GHz Band.

1.4 In this Notice:

- "2.3 GHz Band" means the following frequencies: 2350 MHz to 2390 MHz;
- "2.3 GHz Base Station" means a Base Station which is licensed to transmit using frequencies in the 2.3 GHz Band;
- "2.3 GHz Fixed or Installed Terminal Station" means a fixed or installed Terminal Station which is not exempt from licensing by the Wireless Telegraphy Act (Exemption) Regulations and which is licensed to transmit using frequencies in the 2.3 GHz Band;
- "2.3 GHz Licensee" means the licensee under a licence authorising use in the United Kingdom of frequencies in the 2.3 GHz Band;
- "Base Station" means radio equipment that transmits to a Terminal Station(s);
- "2.3 GHz Deployment" means a 2.3 GHz Base Station or a 2.3 GHz Fixed or Installed Terminal Station deployed by a 2.3 GHz Licensee. For the purposes of this Notice indoor femtocells and indoor smart/intelligent repeaters, as defined in Schedule 1 of the 2.3 GHz licence, are excluded from a 2.3 GHz Deployment;
- "MOD" means the Ministry of Defence;
- "Protected Site" means the list of sites set out in this Notice;
- "Signals" means the transmission in the 2350 to 2390 MHz band from the 2.3 GHz communications equipment;
- "Site Protection Threshold" means the threshold that the 2.3 GHz Licensee must comply with as specified in this Notice;
- "Terminal Station" means radio equipment that receives downlink transmissions from a Base Station.

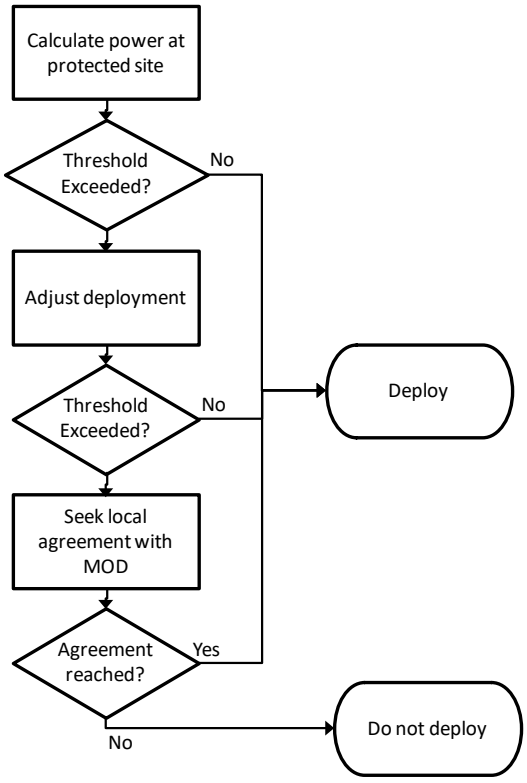
2. The procedure

Overview of coordination procedure

2.1 When planning its network deployment, the 2.3 GHz Licensee must check whether the protection thresholds set out in this document would be exceeded as a result of any proposed 2.3 GHz Deployment. To do so, the 2.3 GHz Licensee will need to calculate the communications signal at the relevant Protected Site location(s) (see Protection Thresholds section below). If these calculations show that the relevant threshold(s) will not be exceeded as a result of the planned deployment, then deployment can go ahead. If the calculations show that the relevant threshold(s) would be exceeded as a result of the planned deployment, the 2.3 GHz Licensee may consider adjusting the deployment.

2.2 If it is not possible to adjust the deployment so that the threshold(s) are not exceeded, the 2.3 GHz Licensee may only deploy if agreement is reached with the operator(s) of the relevant site(s). In the first instance, contact should be made via Ofcom who will facilitate a discussion between the licensee's appropriately security cleared personnel and the operator of the Protected Site.

Figure 2:1: Flowchart illustrating coordination procedures for deployments within the coordination zone



List of sites to be protected

2.3 The sites to which these coordination procedures apply are listed in Figure 2.2 below.

Figure 2.2: 2.3 GHz Band Protected Site Locations

Site	Location
Aberporth	SN 247 518
St Kilda	NF 094 987
Oakhanger	SU 776 357
Colerne	ST 808 717
Menwith Hill	SE 209 561
Boscombe Down	SU 178 392
Warton	SD 412 281
Portland Area	SY 836 593 SY 491 685
BUTEC Area	NG 635 490
Northern Ireland	At the coastline and within Northern Ireland

Protection thresholds

2.4 The 2.3 GHz Licensee must use the methodology in this Notice to ensure that emissions from each proposed 2.3 GHz Deployment in its licensed 2.3 GHz Band do not exceed the threshold for the in-band communications signal given in Figure 2.3.

Figure 2.3: Site Protection Thresholds

In-band communication signal		
	Aberporth	
Site Protection Thresholds	Threshold for Signals in the 2350 to 2360 MHz band [1]	-59 dBm /5 MHz
	Height	143m above mean sea level
	Area where calculation is to be performed	Within an area described by the following 10km grid squares (reference point is the lower left hand corner): SN15 (SN 1000 5000) SN25 (SN 2000 5000) SN35 (SN 3000 5000)

		SN36 (SN 3000 6000)
	St Kilda	
Site Protection thresholds	Threshold for Signals in the 2350 to 2360 MHz band [1]	-149 dBm / 5 MHz
	Height	370m above mean sea level
	Area where calculation is to be performed	Up to 225km from St Kilda
	Oakhanger, Colerne, Menwith Hill	
Site Protection thresholds	Threshold for Signals in the 2350 to 2390 MHz band [1]	-52 dBm / 5 MHz
	Height	14m above ground level
	Area where calculation is to be performed	Up to 5km from each site location
	Boscombe Down, Warton	
Site Protection thresholds	Threshold for Signals in the 2350 to 2390 MHz band [1]	-46dBm / 5 MHz
	Height	Boscombe Down: 15m above ground level Warton: 30m above ground level
	Area where calculation is to be performed	Up to 2.5km from each site location
	Portland Area – this requirement will cease on 31st December 2020	
Site Protection thresholds	Threshold for Signals in the 2350 to 2390 MHz band [1]	-103 dBm / 5 MHz
	Height	30m above sea level
	Area where calculation is to be performed Additionally, the 2.3 GHz Licensee cannot deploy Base Stations with an effective EIRP (including antenna pattern effects) of more than 56 dBm / 5 MHz in the direction of the Portland Area Protected Site location in the following grid squares without prior coordination and agreement from MOD. In this case, coordination will be required with a small number of additional locations within the sea around Portland ST90 ST91 ST92 SU00 SU01 SU02 SY99 SZ09	Within an area described by the following 10km grid squares (reference point is the lower left hand corner): ST10 (i.e. ST 1000 0000) ST20 SX57 SX83 SY07 SY66 SZ07 ST21 SX58 SX84 SY08 SY67 SZ08 ST30 SX65 SX85 SY18 SY68 SZ19 ST40 SX66 SX86 SY19 SY69 SZ28 ST50 SX67 SX87 SY28 SY77 SZ29 ST60 SX68 SX88 SY29 SY78 SZ38 ST70 SX69 SX89 SY38 SY79 SZ39 ST80 SX73 SX94 SY39 SY87 SZ47 ST81 SX74 SX95 SY48 SY88 SZ48 SU30 SX75 SX96 SY49 SY89 SZ49 SU40 SX76 SX97 SY58 SY97 SZ57 SU50 SX77 SX98 SY59 SY98 SZ58 SX78
	BUTEC Area – this requirement will cease on 31st December 2023	
Site Protection thresholds	Threshold for Signals in the 2350 to 2390 MHz band [1]	-100 dBm / 5 MHz
	Height	30m above sea level

	Area where calculation is to be performed	Within an area described by the following 10km grid squares (reference point is the lower left hand corner): NG 63 (i.e NG 6000 3000) NG54 NG78 NM78 NG81 NG55 NG66 NM79 NG82 NG74 NG70 NM68 NG86 NG64 NG75 NG72 NM69 NG87 NG65 NG76 NG56 NG73 NG53 NG77 NM77 NG79
	Northern Ireland	
Site Protection thresholds	Threshold for Signals in the 2350 to 2390 MHz band [1]	-125 dBm / 5 MHz
	Height	3m above ground level
Note [1]: The protection thresholds are defined during the 'on' period of the transmit signal and referenced to a 0dBi receive antenna		

Compliance with the thresholds

2.5 Prior to deployment, the 2.3 GHz Licensee must use the methodology in this Notice to assess whether the protection thresholds specified in Figure 2.3 will be exceeded as a result of its planned 2.3 GHz Deployment for any Protected Site. There is no requirement to undertake an assessment outside of the calculation areas given in Figure 2.3 except as described in paragraph 2.6 below.

2.6 The calculation areas in Figure 2.3 have been developed on the basis of Base Stations at 30m above ground level in order to constrain the area over which coordination must be undertaken. However, Licensees are advised that sites which are higher than this but located outside of the coordination area may still cause interference to MOD systems in certain circumstances. The 2.3 GHz Licensee must therefore consider whether any of its deployments which are greater than 30m above ground level are likely to cause any impact to the Protected Site and coordinate if it deems necessary.

2.7 In carrying out this assessment for deployments within the calculation areas described in Figure 2.3 the 2.3 GHz Licensee must use propagation models described below with the parameters given in Figure 2.4.

2.8 The 2.3 GHz Licensee must ensure that the protection thresholds for each 2.3 GHz Deployment are not exceeded at the Protected Site taking account of the relative horizontal antenna gain pattern described in Figure 2.6. The horizontal polar diagram will be used to calculate additional antenna discrimination loss in the direction of the 2.3 GHz Base Station. The antenna peak gain is accounted for in the protection thresholds and antenna polar diagrams provided are referenced to the maximum Protected Site antenna gain.

2.9 The 2.3 GHz Licensee must maintain records of its calculations and assessments and make these available to Ofcom if required.

Exceeding the threshold

2.10 The thresholds may only be exceeded in relation to a specific Protected Site if the 2.3 GHz Licensee has reached an agreement with the operator of that Protected Site (Ofcom will facilitate the necessary introductions). Any such agreement must be recorded in writing in a form agreed by both the 2.3 GHz Licensee and the site operator. The 2.3 GHz Licensee must maintain a record of all such agreements and make them available to Ofcom on request.

Propagation Model

2.11 The path loss will be calculated using ITU-R Recommendation P.452-16 "Prediction procedure for the evaluation of microwave interference between stations on the surface of the Earth at frequencies above 0.7 GHz"[1].

2.12 It predicts signal levels exceeded for a given percentage of time, the assessment will use a time percentage of 10% as included in Figure 2.4 below.

2.13 Predictions are based on the terrain profile and clutter along the path.

2.14 Additional losses due to protection from local clutter shall be applied at both the transmitter and receiver where they are on land. This is based on a nominal clutter height and nominal obstacle distance assigned to each clutter category. The required values are given in Figure 2.5.

Figure 2.4: ITU-R P.452 parameters

Time percentage	10%
Sea level surface refractivity, N_0 (N-units)	Aberporth: 326 St Kilda, BUTEC Area: 321 Oakhanger, Colerne, Boscombe Down: 327 Menwith Hill, Warton: 324 Portland Area: 327
The average radio-refractive index lapse-rate through the lowest 1km of the atmosphere, ΔN (N-units/km)	Aberporth: 42 St Kilda, BUTEC Area: 41 Oakhanger, Colerne, Boscombe Down: 42 Menwith Hill, Warton: 42 Portland Area: 42
Dry air pressure (hPa)	1013
Temperature (°C)	15.0
Nominal path centre latitude φ (°)	Aberporth: 52 St Kilda, BUTEC Area: 57

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

	Oakhanger, Colerne, Boscombe Down: 51 Menwith Hill, Warton: 54 Portland Area: 51
Clear-air propagation attenuation components included:	Line of sight/Diffraction - Diffraction - Multipath and focussing effects - Gaseous absorption Tropospheric scatter - Gaseous absorption Ducting/Layer reflection - Gaseous absorption
The path centre latitude φ may be selected on a case by case basis, in this case N_0 and ΔN should be calculated using the following equations: $N_0 = 328 - (\varphi - 50)$ $\Delta N = 42.5 - 0.25(\varphi - 50)$	

Terrain database

2.15 Digital terrain map data with 50m resolution shall be used. Examples include Ordnance Survey "Landform Panorama®" or "OS Terrain® 50" datasets[2].

Clutter database

2.16 A digital land classification ("clutter") dataset with 50m resolution such as "Infoterra 50m clutter"[3] or other equivalent shall be used.

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

2.18 The default parameters, given in Figure 2.5 for nominal clutter heights and nominal obstacle distances are as defined in ITU-R Recommendation P.452-16.

Figure 2.5: Infoterra clutter code mapping

Infoterra Clutter Code	Description	Nominal height (m)	Nominal distance (km)
1	Open	4	0.1
2	Suburban	9	0.025
3	Urban	20	0.02

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

4	Villages	5	0.07
5	Open in Urban	4	0.1
6	Forest	15	0.05
7	Water	Not applicable	Not applicable
8	Dense Urban	25	0.02
9	Park recreation	4	0.1
10	Industry	20	0.05

Horizontal antenna pattern

2.19 Figure 2.6 shows the horizontal antenna pattern that must be used for signal strength calculations.

Figure 2.6: Antenna pattern with reference to grid north

Angle from grid north (degrees)	Gain wrt to peak (dB) Aberporth	Gain wrt to peak (dB) All other sites
0	0	0
60	0	0
65	-8.3	0
70	-24	0
75	-30	0
80	-31	0
240	-31	0
245	-30.3	0
250	-24	0
255	-12.5	0
260	0	0
355	0	0