OfW 446: Technical Frequency Assignment Criteria for Fixed Point-to-Point Radio Services with Digital Modulation

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Overview

This document details the Technical Frequency Assignment Criteria employed in the point-to-point fixed links frequency bands managed by Ofcom. It is used as the basis for assessing both 1) new link applications and 2) Technical Reconfiguration of links (licence variation)

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1. Scope of the Technical Frequency Assignment Criteria

1.0 **Introduction**

Table 1 sets out the radio system types, channel plans and values for some key parameters used in the EIRP/frequency assignment process for the frequency bands managed by Ofcom and open to new frequency assignments.

1.1 **Radio System Types**

Ofcom provides an EIRP/frequency assignment service for the standard radio system types detailed in Table 1. Radio system type is defined by data rate and channel spacing (kbit/s in kHz or Mbit/s in MHz).

1.2 **Capacity**

The capacities given in Table 1 may be regarded as indicative of Spectral Efficiency Class and not a constraint on the actual data rate transmitted on the fixed link. Operators should specify the appropriate radio system type when submitting an application for frequency assignment.

Operators planning packet-data links should map the packet-data rate and channel spacing combination to a standard radio system type when submitting an application for frequency assignment.

1.3 **Channel Plans**

The channel plans used by Ofcom are specified in Table 1. Formulae for derivation of radio channel centre frequencies are given in Annex A.

1.4 **Antenna specification**

Where possible Ofcom uses antenna envelopes derived from information provided by link operators and based on the actual performance of antennas. Ofcom will accommodate antennas that comply with ETSI Class 2 (ETSI EN 302 217) co-polar and cross-polar Radiation Pattern Envelopes (RPEs) or better in all frequency bands.

1.5 **Signal polarisation**

Signal polarisation will be designated V, H or D where

V = Vertical Polarisation
H = Horizontal Polarisation
D = Dual Polarisation

The D designation is appropriate where Co-Channel-Dual-Polar (CCDP) technology is deployed. For CCDP links Ofcom will assess interference for vertically and horizontally polarised components of the CCDP signal. The EIRP assignment is based on calculations for the horizontally polarised component; this gives the ‘worst-case’ assessment for losses on the wanted path.

Table 1: Scope of the technical frequency assignment criteria

4 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
4 GHz band limits: 3.6 – 4.2 GHz	ITU-R Recommendation 635	10	ETSI SEC 4	16 QAM	34 in 15	-105.0	30
				16 QAM	2 x 34 in 30	-102.0	30
				32 QAM	100 in 30	-100.0	33
				64 QAM	51 in 15	-99.5	37
			ETSI SEC 5B	32 QAM	2 x 34 in 15	-103.0	33
				64 QAM	140/155 in 30	-97.0	37
				128 state	155/311 in 30	-97.0	36
			ETSI SEC 6A	512 state	200 in 30	-91.0	45

L6 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
L6 GHz band limits: 5.925 - 6.425 GHz	CEPT/ERC Recommendation 14-01	35	ETSI SEC 4L	16 QAM	64 in 29.65	-104.0	28
					128 in 59.3	-101.0	28
			ETSI SEC 4H	32 QAM	98 in 29.65	-101.0	31
					196 in 59.3	-98.0	31
			ETSI SEC 5LA	64 QAM	117 in 29.65	-98.0	34
			ETSI SEC 5LB		235 in 59.3	-95.0	34
			ETSI SEC 5HA	128 QAM	137 in 29.65	-97.0	37
			ETSI SEC 5HB		274 in 59.3	-94.0	37
			ETSI SEC 6LA	256 QAM	156 in 29.65	-93.0	40
			ETSI SEC 6LB		313 in 59.3	-90.0	40
			ETSI SEC 6HA	512 QAM	176 in 29.65	-88.5	43
			ETSI SEC 6HB		352 in 59.3	-86.0	43

U6 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
U6 GHz band limits: 6.425 - 7.125 GHz	CEPT/ERC Recommendation 14-02 E CEPT/ERC Recommendation 14-06 E	10	ETSI SEC 2	4 state	2 in 1.75	-123	24
					4 in 3.5	-120	24
			BT System	4 state	34 in 20	-103.0	27
			ETSI SEC 3	8PSK	3 in 1.75	-118	29
					6 in 3.5	-115	29
			BT System	16 QAM	140/155 in 40	-98.0	28
			ETSI SEC 4L	16 QAM	4 in 1.75	-116	31
					8 in 3.5	-113	31
					45 in 20	-106.0	28
					64 in 30	-104.0	28
					128 in 60	-101.0	28
			ETSI SEC 4H	32 QAM	98 in 30	-101.0	31
					196 in 60	-98.0	31
			ETSI SEC 5LA	64 QAM	117 in 30	-98.0	34
			ETSI SEC 5LB		235 in 60	-95.0	34

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
			ETSI SEC 5LB	64 QAM	168 in 40	-93.5	34
			ETSI SEC 5HA	128 QAM	137 in 30	-97.0	37
			ETSI SEC 5HB		274 in 60	-94.0	37
			ETSI SEC 5HB	128 QAM	196 in 40	-94.0	37
			ETSI SEC 6LA	256 QAM	156 in 30	-93.0	40
			ETSI SEC 6LB		313 in 60	-90.0	40
			ETSI SEC 6LB	256 QAM	224 in 40	-90.5	40
			ETSI SEC 6HA	512 QAM	176 in 30	-88.5	43
			ETSI SEC 6HB		352 in 60	-86.0	43
			ETSI SEC 6HB	512 QAM	252 in 40	-86.5	43

7.5 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
7.5 GHz band limits: 7.425 - 7.900 GHz	ITU-R Recommendation F.385-6	10	ETSI SEC 2	4 state	8 in 7	-117.0	26
					16 in 14	-114.0	26
					32 in 28	-111.0	26
					64 in 56	-108.0	26
			ETSI SEC 3	8 state	12 in 7	-112.0	32
					24 in 14	-109.0	32
					48 in 28	-106.0	32
					96 in 56	-103.0	32
			ETSI SEC 4L	16 QAM	16 in 7	-110.0	30
					32 in 14	-107.0	30
					64 in 28	-104.0	30
					128 in 56	-101.0	30
			ETSI SEC 4H	32 QAM	24 in 7	-107.0	33
					49 in 14	-104.0	33
					98 in 28	-101.0	33
					196 in 56	-98.0	33

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
			ETSI SEC 5L	64 QAM	29 in 7	-104.0	37
					58 in 14	-101.0	37
			ETSI SEC 5LA ETSI SEC 5LB	64 QAM	117 in 28	-98.0	37
					235 in 56	-95.0	37
			ETSI SEC 5H	128 QAM	34 in 7	-102.5	40
					68 in 14	-99.5	40
			ETSI SEC 5HA ETSI SEC 5HB	128 QAM	137 in 28	-97.0	40
					274 in 56	-94.0	40
			ETSI SEC 6L	256 QAM	39 in 7	-98.0	43
					78 in 14	-95.0	43
			ETSI SEC 6LA ETSI SEC 6LB	256 QAM	156 in 28	-93.0	43
					313 in 56	-90.0	43
			ETSI SEC 6H	512 QAM	88 in 14	-91.0	45
			ETSI SEC 6HA ETSI SEC 6HB	512 QAM	176 in 28	-88.5	45
					352 in 56	-86.0	45

8 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See section 1.2	Receiver Sensitivity Level (dBW)	W/U (dB)
8 GHz band limits: 7.900 – 8.500 GHz	ECC Recommendation (02)06 ITU-R Recommendation F.386-9	10	ETSI SEC 2	4 state	8 in 7	-117.0	26
					16 in 14	-114.0	26
					32 in 28	-111.0	26
			ETSI SEC 3	8 state	12 in 7	-112.0	32
					24 in 14	-109.0	32
					48 in 28	-106.0	32
			ETSI SEC 4L	16 QAM	16 in 7	-110.0	30
					32 in 14	-107.0	30
					64 in 28	-104.0	30
			ETSI SEC 4H	32 QAM	24 in 7	-107.0	33
					49 in 14	-104.0	33
					98 in 28	-101.0	33
			ETSI SEC 5L	64 QAM	29 in 7	-104.0	37

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See section 1.2	Receiver Sensitivity Level (dBW)	W/U (dB)
					58 in 14	-101.0	37
			ETSI SEC 5LA ETSI SEC 5LB	64 QAM	117 in 28	-98.0	37
			ETSI SEC 5H	128 QAM	34 in 7	-102.5	40
					68 in 14	-99.5	40
			ETSI SEC 5HA ETSI SEC 5HB	128 QAM	137 in 28	-97.0	40
			ETSI SEC 6L	256 QAM	39 in 7	-98.0	43
					78 in 14	-95.0	43
			ETSI SEC 6LA ETSI SEC 6LB	256 QAM	156 in 28	-93.0	43
			ETSI SEC 6H	512 QAM	88 in 14	-91.0	45
			ETSI SEC 6HA ETSI SEC 6HB	512 QAM	176 in 28	-88.5	45

13 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
13 GHz band limits: 12.75 - 13.25 GHz	CEPT/ERC Recommendation 12-02 E	15	ETSI SEC 2	4 state	2 in 1.75	-123.0	26
					4 in 3.5	-120.0	26
					8 in 7	-117.0	26
					16 in 14	-114.0	26
					32 in 28	-111.0	26
					64 in 56	-108.0	26
			ETSI SEC 3	8 state	3 in 1.75	-118.0	32
					6 in 3.5	-115.0	32
					12 in 7	-112.0	32
					24 in 14	-109.0	32
					48 in 28	-106.0	32
					96 in 56	-103.0	32
			ETSI SEC 4L	16 QAM	4 in 1.75	-116.0	30
					8 in 3.5	-113.0	30
					16 in 7	-110.0	30
					32 in 14	-107.0	30
					64 in 28	-104.0	30
					128 in 56	-101.0	30

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
			ETSI SEC 4H	32 QAM	24 in 7	-107.0	33
					49 in 14	-104.0	33
					98 in 28	-101.0	33
					196 in 56	-98.0	33
			ETSI SEC 5L	64 QAM	29 in 7	-104.0	37
					58 in 14	-101.0	37
			ETSI SEC 5LA ETSI SEC 5LB	64 QAM	117 in 28	-98.0	37
					235 in 56	-95.0	37
			ETSI SEC 5H	128 QAM	34 in 7	-101.5	40
					68 in 14	-98.5	40
			ETSI SEC 5HA ETSI SEC 5HB	128 QAM	137 in 28	-95.5	40
					274 in 56	-94.0	40
			ETSI SEC 6L	256 QAM	39 in 7	-97.5	43
					78 in 14	-94.5	43
			ETSI SEC 6LA ETSI SEC 6LB	256 QAM	156 in 28	-92.0	43
					313 in 56	-90.0	43
			ETSI SEC 6H	512 QAM	88 in 14	-91.0	45
			ETSI SEC 6HA ETSI SEC 6HB	512 QAM	176 in 28	-88.5	45
					352 in 56	-86.0	45

15 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
15 GHz band limits: 14.5 -15.35 GHz	CEPT/ERC Recommendation 12-07 E	10	ETSI SEC 2	4 state	2 in 1.75	-123.0	26
					4 in 3.5	-120.0	26
					8 in 7	-117.0	26
					16 in 14	-114.0	26
					32 in 28	-111.0	26
					64 in 56	-108.0	26
			ETSI SEC 3	8 state	3 in 1.75	-118.0	32
					6 in 3.5	-115.0	32
					12 in 7	-112.0	32
					24 in 14	-109.0	32
					48 in 28	-106.0	32
					96 in 56	-103.0	32
			ETSI SEC 4L	16 QAM	4 in 1.75	-116.0	30
					8 in 3.5	-113.0	30
					16 in 7	-110.0	30
					32 in 14	-107.0	30
					64 in 28	-104.0	30
					128 in 56	-101.0	30

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
			ETSI SEC 4H	32 QAM	24 in 7	-107.0	33
					49 in 14	-104.0	33
					98 in 28	-101.0	33
					196 in 56	-98.0	33
			ETSI SEC 5L	64 QAM	29 in 7	-104.0	37
					58 in 14	-101.0	37
			ETSI SEC 5LA ETSI SEC 5LB	64 QAM	117 in 28	-98.0	37
					235 in 56	-95.0	37
			ETSI SEC 5H	128 QAM	34 in 7	-101.5	40
					68 in 14	-98.5	40
			ETSI SEC 5HA ETSI SEC 5HB	128 QAM	137 in 28	-95.5	40
					274 in 56	-92.0	40
			ETSI SEC 6L	256 QAM	39 in 7	-97.5	43
					78 in 14	-94.5	43
			ETSI SEC 6LA ETSI SEC 6LB	256 QAM	156 in 28	-92.0	43
					313 in 56	-89.0	43
			ETSI SEC 6H	512 QAM	88 in 14	-91.0	45
			ETSI SEC 6HA ETSI SEC 6HB	512 QAM	176 in 28	-88.5	45
					352 in 56	-86.0	45

18 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
18 GHz band limits: 17.7 - 19.7 GHz	CEPT/ERC Recommendation 12-03 E (13.75, 27.5 and 55 MHz channel rasters). ITU-R Recommendation F.595 (3.5 and 7 MHz channel rasters).	10	ETSI SEC 2	4 state	4 in 3.5	-119.0	26
					8 in 7	-116.0	26
					16 in 13.75	-113.0	26
					32 in 27.5	-110.0	26
					64 in 55	-107.0	26
					128 in 110	-104.0	26
			ETSI SEC 3	8 state	6 in 3.5	-114.0	32
					12 in 7	-111.0	32
					24 in 13.75	-108.0	32
					48 in 27.5	-105.0	32
					96 in 55	-102.0	32
					191 in 110	-99.0	32
			ETSI SEC 4L	16 QAM	8 in 3.5	-112.0	30
					16 in 7	-109.0	30
					32 in 13.75	-106.0	30
					64 in 27.5	-103.0	30
					128 in 55	-100.0	30
					256 in 110	-97.0	30
			ETSI SEC 4H	32 QAM	24 in 7	-106.0	33
					49 in 13.75	-103.0	33

					98 in 27.5	-100.0	33
					196 in 55	-97.0	33
					392 in 110	-94.0	33
			ETSI SEC 5L	64 QAM	29 in 7	-103.0	37
					58 in 13.75	-100.0	37
			ETSI SEC 5LA ETSI SEC 5LB	64 QAM	117 in 27.5	-97.0	37
					235 in 55	-94.0	37
					470 in 110	-91.0	37
			ETSI SEC 5H	128 QAM	34 in 7	-100.0	40
					68 in 13.75	-97.0	40
			ETSI SEC 5HA ETSI SEC 5HB	128 QAM	137 in 27.5	-94.0	40
					274 in 55	-91.0	40
					548 in 110	-88.0	40
			ETSI SEC 6L	256 QAM	39 in 7	-96.0	43
					78 in 13.75	-93.5	43
			ETSI SEC 6LA ETSI SEC 6LB	256 QAM	156 in 27.5	-91.0	43
					313 in 55	-88.0	43
					627 in 110	-85.0	43
			ETSI SEC 6H	512 QAM	88 in 13.75	-90.0	45
			ETSI SEC 6HA ETSI SEC 6HB	512 QAM	176 in 27.5	-87.5	45
					352 in 55	-85.0	45
					705 in 110	-82.0	45

23 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
23 GHz band limits: 22 - 23.6 GHz	CEPT/ERC Recommendation 13-02 E	10	ETSI SEC 2	4 state	4 in 3.5	-119.0	26
					8 in 7	-116.0	26
					16 in 14	-113.0	26
					32 in 28	-110.0	26
					64 in 56	-107.0	26
					128 in 112	-104.0	26
			ETSI SEC 3	8 state	6 in 3.5	-114.0	32
					12 in 7	-111.0	32
					24 in 14	-108.0	32
					48 in 28	-105.0	32
					96 in 56	-102.0	32
					191 in 112	-99.0	32
			ETSI SEC 4L	16 QAM	8 in 3.5	-112.0	30
					16 in 7	-109.0	30
					32 in 14	-106.0	30
					64 in 28	-103.0	30
					128 in 56	-100.0	30
					256 in 112	-97.0	30

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
			ETSI SEC 4H	32 QAM	24 in 7	-106.0	33
					49 in 14	-103.0	33
					98 in 28	-100.0	33
					196 in 56	-97.0	33
					392 in 112	-94.0	33
			ETSI SEC 5L	64 QAM	29 in 7	-103.0	37
					58 in 14	-100.0	37
			ETSI SEC 5LA ETSI SEC 5LB	64 QAM	117 in 28	-97.0	37
					235 in 56	-94.0	37
					470 in 112	-91.0	37
			ETSI SEC 5H	128 QAM	34 in 7	-100.0	40
					68 in 14	-97.0	40
			ETSI SEC 5HA ETSI SEC 5HB	128 QAM	137 in 28	-94.0	40
					274 in 56	-91.0	40
					548 in 112	-88.0	40
			ETSI SEC 6L	256 QAM	39 in 7	-96.0	43
					78 in 14	-93.5	43
			ETSI SEC 6LA ETSI SEC 6LB	256 QAM	156 in 28	-91.0	43
					313 in 56	-85.0	43
					627 in 112	-85.0	43
			ETSI SEC 6H	512 QAM	88 in 14	-90.0	45

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
			ETSI SEC 6HA ETSI SEC 6HB	512 QAM	176 in 28	-87.5	45
					352 in 56	-85.0	45
					705 in 112	-82.0	45

38 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
38 GHz band limits: 37 - 39.5 GHz	CEPT/ERC Recommendation T/R 12-01	10	ETSI SEC 2	4-state	4 in 3.5	-117.0	26
					8 in 7	-114.0	26
					16 in 14	-111.0	26
					32 in 28	-108.0	26
					64 in 56	-105.0	26
					128 in 112	-102.0	26
			ETSI SEC 3	8 state	6 in 3.5	-112.0	32
					12 in 7	-109.0	32
					24 in 14	-106.0	32
					48 in 28	-103.0	32
					96 in 56	-100.0	32
					191 in 112	-97.0	32

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
			ETSI SEC 4L	16 QAM	8 in 3.5	-110.0	30
					16 in 7	-107.0	30
					32 in 14	-104.0	30
					64 in 28	-101.0	30
					128 in 56	-98.0	30
					256 in 112	-95.0	30
			ETSI SEC 4H	32 QAM	24 in 7	-104.0	33
					49 in 14	-101.0	33
					98 in 28	-98.0	33
					196 in 56	-95.0	33
					392 in 112	-92.0	33
			ETSI SEC 5L	64 QAM	29 in 7	-100.5	37
					58 in 14	-98.0	37
			ETSI SEC 5LA ETSI SEC 5LB	64 QAM	117 in 28	-95.0	37
					235 in 56	-92.0	37
					470 in 112	-89.0	37
			ETSI SEC 5H	128 QAM	34 in 7	-97.0	40
					68 in 14	-95.0	40
			ETSI SEC 5HA ETSI SEC 5HB	128 QAM	137 in 28	-92.0	40
					274 in 56	-89.0	40
					548 in 112	-86.0	40

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
			ETSI SEC 6L	256 QAM	39 in 7	-93.5	43
					78 in 14	-91.0	43
			ETSI SEC 6LA ETSI SEC 6LB	256 QAM	156 in 28	-88.5	43
					313 in 56	-86.0	43
					627 in 112	-83.0	43
			ETSI SEC 6H	512 QAM	88 in 14	-87.5	45
			ETSI SEC 6HA ETSI SEC 6HB	512 QAM	176 in 28	-85.0	45
					352 in 56	-82.5	45
					705 in 112	-80.0	45

52 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
52 GHz band limits: 51.4 - 52.6 GHz	CEPT/ERC Recommendation 12-11	10	ETSI SEC 2	4-state	2 in 3.5	-111.5	26
					2x2 in 3.5	-109.0	26
					8 in 7	-105.5	26
					2x8 in 14	-102.5	26

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
					34 in 28	-99.0	26
			ETSI SEC 3	16 QAM	51 in 28	-96.0	30
					8 in 3.5	-104.0	30
					2x8 in 7	-101.0	30
					34 in 14	-98.0	30
					155 in 56	-91.5	30
			ETSI SEC 4	32 QAM	51 in 14	-94.0	33

55 GHz frequency band

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
55 GHz band limits: 55.78 – 57.0 GHz	CEPT/ERC Recommendation 12-12	10	ETSI SEC 2	4-state	2 in 3.5	-111.5	26
					2x2 in 3.5	-109.0	26
					8 in 7	-105.5	26
					2x8 in 14	-102.5	26
					34 in 28	-99.0	26
			ETSI SEC 3	16 QAM	51 in 28	-96.0	30
					8 in 3.5	-104.0	30
					2x8 in 7	-101.0	30
					34 in 14	-98.0	30
					155 in 56	-91.5	30
			ETSI SEC 4	32 QAM	51 in 14	-94.0	33

71 – 76 GHz and 81 – 86 GHz frequency band (70/80 GHz band)

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
70/80 GHz band limits: 71.125 – 73.125 GHz and 81.125 – 83.125 GHz	ECC Recommendation (05)7	20	ETSI SEC 1	2 PSK	35 in 62.5	-102.0	23
					71 in 125	-99.0	23
					142 in 250	-96.0	23
					285 in 500	-93.0	23
					427 in 750	-91.0	23
					570 in 1000	-90.0	23
			ETSI SEC 2	4 PSK	71 in 62.5	-100.0	26
					142 in 125	-97.0	26
					285 in 250	-94.0	26
					570 in 500	-91.0	26
					855 in 750	-89.0	26
					1140 in 1000	-88.0	26
			ETSI SEC 3	8 PSK	106 in 62.5	-97.0	32
					212 in 125	-94.0	32
					425 in 250	-91.0	32
					850 in 500	-88.0	32
					1275 in 750	-86.0	32
					1700 in 1000	-85.0	32
			ETSI SEC 4L	16 QAM	142 in 62.5	-94.5	30
					285 in 125	-91.5	30

Frequency band and band limits (GHz)	Channel plan	Min fade Margin (dB)	ETSI Spectral Efficiency Class (SEC)/ alternative system	Modulation type assumed for planning	Capacity (Mbit/s in MHz) See page 2	Receiver Sensitivity Level (dBW)	W/U (dB)
					570 in 250	-88.5	30
					1140 in 500	-88.5	30
					1710 in 750	-83.5	30
					2280 in 1000	-82.5	30
			ETSI SEC 4H	32 QAM	219 in 62.5	-91.0	33
					438 in 125	-88.0	33
					875 in 250	-85.0	33
					1750 in 500	-82.0	33
					2625 in 750	-80.0	33
			ETSI SEC 5LA ETSI SEC 5LB	64 QAM	262 in 62.5	-87.5	37
					525 in 125	-84.5	37
					1050 in 250	-81.5	37
					2100 in 500	-78.5	37
					3150 in 750	-76.5	37
			ETSI SEC 5HA ETSI SEC 5HB	128 QAM	306 in 62.5	-84.0	40
					612 in 125	-81.0	40
					1225 in 250	-78.0	40
					2450 in 500	-75.0	40
			ETSI SEC 6LA ETSI SEC 6LB	256 QAM	350 in 62.5	-80.0	43
					700 in 125	-77.0	43
					1400 in 250	-74.0	43
					2800 in 500	-71.0	43

Table 2: Band specific issues

Frequency	Issue
4 GHz	1. The maximum *EIRP* assigned will be +50 dBW. 2. Channels within the frequency ranges 3.605 to 3.815 GHz paired with 3.925 to 4.135 GHz are not available for Point-to-Point fixed links. Please see the statement and consultation on improving consumer access to mobile services at 3.6GHz to 3.8GHz. 3. The 4 GHz band is shared with the Fixed Satellite Service (FSS). All applications for frequency assignment are co-ordinated with FSS.
L6 GHz	1. The maximum *EIRP* assigned will be +50 dBW 2. The L6 GHz band is shared with the Fixed Satellite Service (FSS). All applications for frequency assignment are co-ordinated with FSS. 3. A minimum fade margin of 35 dB applies to minimise the risk of undue interference from earth stations on board vessels.
U6 GHz	1. The maximum *EIRP* assigned will be +50 dBW 2. The U6 GHz band is shared with the Fixed Satellite Service (FSS). All applications for frequency assignment are co-ordinated with FSS.
7.5 GHz	1. The maximum *EIRP* assigned will be +40 dBW.
8 GHz	1. The maximum EIRP assigned will be +40 dBW. 2. This spectrum is shared with military uses. Only channels within the frequency range 8078–8162 MHz paired with 8286–8370 MHz are available for Point-to-Point fixed links. Three paired 28 MHz channels are available. 3. Spectrum is being made available initially in the South East of the UK. In this area, there will be full co-ordination with all fixed location military and civil operations. 4. The civil channels have been designated to minimise the risk of interference from other fixed location military systems, although temporary military operations may occur from time to time. When applying to use this band stakeholders should therefore note that whilst the co-ordination measures for this band have been designed to minimise the risk of interference, this is a shared band with military systems and like all licences issued, Ofcom cannot guarantee interference will not occur. It should also be noted that coordination with navel military systems for cross border links (across the Channel) will not apply.
13 GHz	1. The maximum *EIRP* assigned will be +45 dBW. 2. The 13 GHz band is shared with the Fixed Satellite Service (FSS). All applications for frequency assignment are co-ordinated with FSS.

15 GHz	1. The maximum *EIRP* assigned will be +50 dBW 2. All applications for frequency assignment are co-ordinated with the Fixed Satellite Service (FSS).
18 GHz	1. The maximum *EIRP* assigned will be +55 dBW. 2. The *Soft Boundary Frequency Assignment* methodology is used by Ofcom at 18 GHz. See Annex B for a detailed explanation of the methodology. 3. The 18 GHz band is shared with the Fixed Satellite Service (FSS). All applications for frequency assignment are co-ordinated with FSS.
23 GHz	1. The maximum *EIRP* assigned will be +55 dBW. 2. The 23 GHz band is shared with the Radio Astronomy Service (RAS). All applications for frequency assignment are co-ordinated with RAS.
38 GHz	1. The maximum *EIRP* assigned will be +55 dBW.
52 GHz	1. The maximum *EIRP* assigned will be +30 dBW. 2. Staged band release: lower third of band available.
55 GHz	1. The maximum *EIRP* assigned will be +30 dBW. 2. Staged band release: lower third of band available.
70/80 GHz	1. The maximum *EIRP* assigned will be +55 dBW. 2. The maximum transmitter power delivered to the antenna will be +30dBm. 3. In accordance with ETSI 302-217 the minimum antenna gain will be 38dBi.

2. Principles of EIRP and Channel Assignment

2.1 High-Low protocol

The technical procedures for channel assignment include a *High-Low protocol* ensuring that the candidate link respects High-Low designation at established sites. Sites are designated High or Low with reference to the High and Low duplex channel sets used for transmitting frequencies at the site. Requests for channel assignments in breach of this protocol are normally refused, except in very special circumstances, where established *dirty* sites are in play; that is sites where transmitting frequencies are sourced from both Low and High duplex channel sets. Dirty sites are discussed further in Annex E. Values for the *High-Low search radius* which define the site area are set out in Annex G.

2.2 **EIRP calculations**

Ofcom's frequency co-ordination process requires that *EIRP* values are calculated for the candidate link in advance of interference calculations. The minimum *EIRP* value required to resolve each direction on the candidate link is calculated using:

$$EIRP = RSL + L_{fixed} + M + FSPL + L_{atmos} - G_{Rx} \qquad (dBW) \qquad [1]$$

where

EIRP = Equivalent Isotropic Radiated Power	*(dBW)*
RSL = Receiver Sensitivity Level (distant-end)	*(dBW)*
L_{fixed} *= Fixed System Losses (distant-end)*	*(dB)*
M = Fade Margin	*(dB)*
FSPL = Free Space Path Loss	*(dB)*
L_{atmos} *= Atmospheric Loss*	*(dB)*
G_{Rx} *= Receiver Antenna Gain (distant-end)*	*(dBi)*

For new link applications, *EIRP* calculations assume use of channel 1 on the appropriate channel raster with a margin = 1 dB added to account for differences in path loss and Fade Margin requirement across the channel set, ensuring that the *EIRP* value is robust to the channel selection process. These values for *EIRP* are used in the channel selection process where the radios associated with the candidate link are characterised as interferers. If channel assignment is successful then *EIRP* values are re-calculated taking account of selected frequencies.

Fade Margin (FM) is calculated on the basis of the *propagation availability* requirement, in the range 99.9 to 99.999 % of time, specified by the link operator. Values are determined using the *"quick-all"* method specified in ITU-R P.530–10 taking account of fades attributable to rain and clear-air effects. A sleet model calculates a contribution to Fade Margin attributable to sleet. The rain-rate map used by Ofcom is reproduced in Annex H.

The frequency assignment software utilises equations for clear-air and combined rain/sleet fading to iterate for the value of fade. The fade value is the sum of the individual (clear-air and combined rain/sleet) unavailabilities.

A *Minimum Fade Margin (MFM)* is specified for each frequency band, taking account of performance requirements (beyond radio propagation availability) and in some cases accounting for inter-service interference issues. When the calculated *FM < MFM* then *MFM* is assigned to the link under consideration. *MFM* values are set out in Table 1.

It is understood that, due to practical antenna alignment problems in the field, operators may sometimes wish to uplift *EIRP* by up to 3 dB in order that the assigned *EIRP* value is evident on the wanted path. Requests for these uplifts are considered by Ofcom on a case-by-case basis.

EIRP uplifts of up to 6 dB are considered by Ofcom engineers on a case-by-case basis where obstacles are present on the wanted path. In these cases, consideration should be given to use of alternative routes or deployment of antennas at increased height as well as the impact of increased *EIRP* levels on the interference environment.

2.3 Interference calculations and channel assignment

In general, the channel assignment tool operates a *sequential algorithm* that assigns the first available channel working up-band from channel 1 taking account of the tuning range of the radio equipment on the candidate link and any preferences specified by the link operator (preferred channels). Special arrangements have been made for the 18 GHz frequency band where the *Soft Boundary Frequency Assignment methodology* is implemented (Annex B).

Interference radiating from, and incident to, the candidate fixed link is modelled in the channel assignment software using ITU-R Recommendation P.452-10. A band-specific frequency co-ordination zone is specified and interference calculations are performed for all links in the zone; Annex D, Table 1 sets out values for the radius of the frequency co-ordination zone in each frequency band.

We define the *like-to-like* interference as a scenario where interfering transmitter and victim receiver are of the same radio system type. *Like-to-unlike* interference is where interfering transmitter and victim receiver are alternative radio system types.

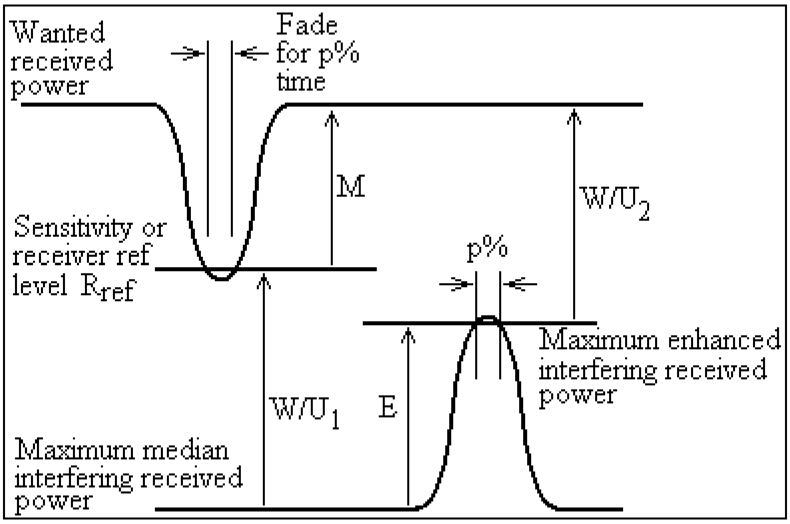
Wanted-to-Unwanted (W/U) ratios are evaluated at each receiver in the co-ordination zone for both like-to-like and like-to-unlike scenarios. Initially, simple calculations are performed in the database assuming free space path loss on interference paths (with a margin added to account for signal enhancement). Links are excluded from detailed technical analysis in cases where the *W/U* are satisfied using this approach; otherwise detailed calculations are performed in the channel assignment software as follows:

Two tests, described in **Figure 1,** are applied:

W/U Test 1: where *W/U* is applied to the *Receiver Sensitivity Level* (the fully faded wanted signal) and the median interfering signal level.

W/U Test 2: where *W/U* is applied to the median wanted signal level (*RSL + FM*) and an enhanced interfering signal level exceeded for *p*% of time where *p* = 100 – *availability* (associated with the victim receiver).

Figure 1: W/U tests



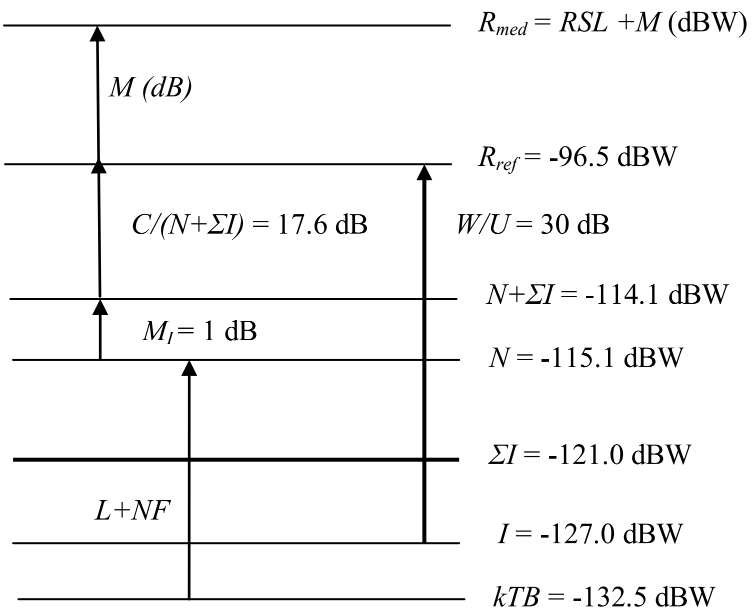
Both W/U tests must be satisfied at all receivers in the co-ordination zone in order for a channel to be selected for assignment. In practical terms this means that the *unwanted* signal level must be less than or equal to the interference threshold at the victim receiver. Interference calculations take account of antenna discrimination at both ends of the interference path, losses on the path and any Net Filter Discrimination available (see Section 2.4).

For the 70-80 GHz frequency band, Ofcom have taken some special measures with regard to the configuration of the radio propagation models in its assignment tool. These are mainly using a Minimum Fade of 20 dB Margin and free space model instead of the ITU Recommendation P.452.

2.4 W/U design

W/U ratios are designed according to Ofcom's *noise-limited* assignment methodology; that is a *noise-interference budget* is developed for each radio system as shown in Figure 2 which sets out an example budget for a 34 Mbit/s in 14 MHz radio system.

Figure 2: Noise-interference budget



R_{med} represents the *median wanted* signal level given by adding the fade margin *M* to the Receiver Sensitivity Level R_{ref} required to support a BER = 10^{-6}. In general, R_{ref} values are sourced directly from the ETSI point-to-point standard *EN 302 217.* Carrier-to-Noise plus aggregate interference, denoted *C/(N+ΣI)*, may be regarded as the core protection ratio associated with the modulation scheme assumed for planning purposes. These values are sourced from *Recommendation ITU-R F.1101*.

The total Noise allowance *N* accommodates the system *Noise Figure* as well as *fixed system losses*. Degradation of *N* is limited by an interference Margin M_I. In general M_I = 1 dB; setting the aggregate interference threshold *ΣI* at a level 5.9 dB below *N.* Note: in three frequency bands: L6, U6 and 26 GHz, M_I = 2 dB and *ΣI* is 2.3 dB below *N*.

The single-entry interference threshold, *I,* is determined using:

$$I = 10\,log\left(\frac{10^{\Sigma I/10}}{n}\right) \quad (dBW) \qquad [2]$$

Where *n* is the number of equal single-entry interferers accounted for; *n* = 4 in all cases.

Work was completed in 2011 on the rationalisation of noise-interference budgets in order that *n* = 4 in all cases. Earlier analysis had indicated that the number of equal single-entry interferers accounted for was not consistent.

The *W/U* value is given by:

$$W/U = R_{ref} - I \quad (dB) \qquad [3]$$

This (rounded) protection ratio is used in like-to-like and like-to-unlike scenarios.

Annex F sets out values associated with the noise-interference budgets for the radio system types currently assigned by Ofcom.

2.5 Net Filter Discrimination

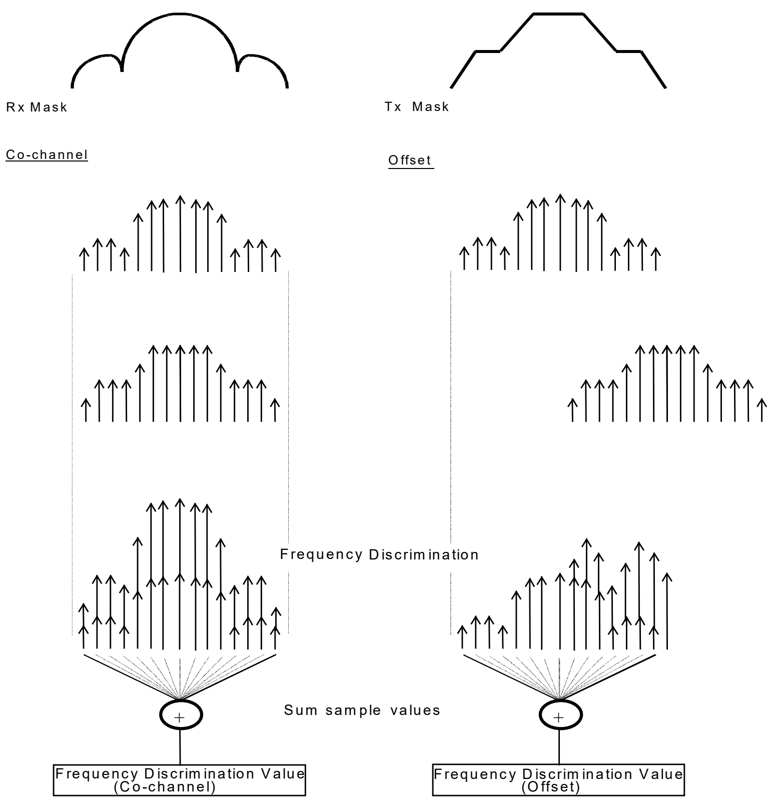
The *Net Filter Discrimination*, or *NFD,* available between victim and interfering stations is used to adjust the predicted interfering signal level incident to the victim receiver. ETSI *Out-of-Band* masks are used to characterise the unwanted signal and the wanted receiver mask is derived using the 'conservative' method set out in ETSI TR 101 854. Default masks are employed in cases where legacy equipment cannot be mapped to the modern ETSI Standard.

The two masks are sampled 'on the fly' and the *NFD* calculated using:

$$NFD = 10\,log\left[\frac{\sum_{i=0}^{i=n-1} 10^{(U_i + W_i)/10}}{\sum_{i=0}^{i=n-1} 10^{(U_{i(offset)} + W_i)/10}}\right] \quad (dB) \qquad [4]$$

Where U_i and W_i are values sampled from the unwanted and wanted signal masks set co-frequency, $U_{i(offset)}$ are samples from the unwanted mask offset in frequency from the victim receiver and n is the number of samples taken from the wanted and unwanted masks. The process is illustrated in Figure 3 below:

Figure 3: NFD concept



The maximum value for *NFD,* termed NFD_{max} is given by:

$$NFD_{\max} = W/U + 40 \qquad (dB) \qquad [5]$$

This facilitates a lower bound for *W/U* = - 40 dB. Calculations are performed up to the point where the wanted and unwanted masks are at the point of separation and the frequency offset between wanted and unwanted signal carriers, denoted f_w and f_u respectively, is given by:

$$|f_w - f_u| = 2.5 \cdot (B_w + B_u) \qquad (MHz) \qquad 6]$$

where B_w and B_u are the bandwidths of the wanted and unwanted signals expressed in MHz. $NFD_{\max}$ is used at this point; interference is not considered at frequency separations greater than that given by [6].

For a scenario where the wanted receiver under test is subject to interference from an unwanted signal that is operating on the same channel raster, the method results in evaluation of interference for co-channel and 1, …,5th adjacent channel interferers. *NFD* is calculated where the unwanted signal is in the 1,…,4th adjacent channels with $NFD_{\max}$ set as the upper bound. $NFD_{\max}$ is applied to scenarios where the unwanted signal is in the 5th adjacent channel.

A1. Derivation of radio channel centre frequencies

4 GHz Band

For the 3.6 to 4.2 GHz band, the 15 and 30 MHz channel rasters are in accordance with ITU-R Recommendation 635. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 3900 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn’ be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 30 MHz:

Lower half of the band:	fn = (f0 -310 + 30n) MHz	
Upper half of the band:	fn' = (f0 + 10 + 30n) MHz	where n = 8, 9

b) For systems with a carrier spacing of 15 MHz:

Lower half of the band:	fn = (f0 -302.5 + 15n) MHz	
Upper half of the band:	fn' = (f0 + 17.5 + 15n) MHz	where n = 15, ...18

L6 GHz

For the 5.925 to 6.425 GHz band, the 29.65 MHz channel raster is in accordance with the arrangements set out in CEPT/ERC Recommendation 14-01. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 6175 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn’ be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 59.3 MHz:

Lower half of the band: fn = (f0 – 244.625 + 29.65n) MHz

Upper half of the band: fn’ = (f0 + 7.415 + 29.65n) MHz where n = 1, …7.

b) For systems with a carrier spacing of 29.65 MHz:

Lower half of the band: fn = (f0 – 259.45 + 29.65n) MHz

Upper half of the band: fn’ = (f0 - 7.41 + 29.65n) MHz where n = 1, …8.

U6 GHz

For the 6.425 to 7.125 GHz band, the 20 and 40 MHz channel rasters are in accordance with the arrangements set out in CEPT/ERC Recommendation 14-02 E. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 6770 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn’ be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 40 MHz:

Lower half of the band: fn = (f0– 350 + 40n) MHz

Upper half of the band: fn’ = (f0– 10 + 40n) MHz where n = 1, ...8

b) For systems with a carrier spacing of 20 MHz:

Lower half of the band: fn = (f0– 350 + 20n) MHz

Upper half of the band: fn’ = (f0– 10 + 20n) MHz where n = 1, …16

The 30 MHz channel raster is in accordance with the arrangements set out in ITU-R Recommendation F.384-6. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 6770 MHz;

fn be the centre frequency (MHz) of a radio frequency channel in the Lower half of the band;

fn’ be the centre frequency (MHz) of a radio frequency channel in the Upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 60 MHz:

Lower half of the band: fn = (f0 - 325 + 30n) MHz

Upper half of the band: fn’ = (f0 + 15 + 30n) MHz where n = 1, ...9

b) For systems with a carrier spacing of 30 MHz:

Lower half of the band: fn = (f0- 340 + 30n) MHz;

Upper half of the band: fn’ = (f0+ 30n) MHz; where n = 1, ...10

The 3.5 MHz and 1.75 MHz channel rasters are in accordance with the arrangements of 2 X 14 MHz channel plan set out in CEPT/ERC Recommendation 14-06 E (Annex 2 , Table 1). Radio channel centre frequencies may be derived on the following basis:

Let

f_0 be the frequency (MHz) of the centre of the band of frequencies occupied, f_0 = 6 941.25 MHz;

fn be the centre frequency (MHz) of one radio-frequency channel in the lower half of the band;

fn' be the centre frequency (MHz) of one radio-frequency channel in the upper half of the band;

then the frequencies (MHz) of individual channels are expressed by the following relationships:

a) for systems with a carrier spacing of 3.5 MHz:

lower half of the band: fn = f_0 – 180 + 3.5 n

upper half of the band: fn' = f_0 + 162.5 + 3.5 n where n = 1, 2, 3, 4.

b) for systems with a carrier spacing of 1.75 MHz:

lower half of the band: fn = f_0 – 179.125 + 1.75 n

upper half of the band: fn' = f_0 + 163.375 + 1.75 n where n = 1, 2, ...7, 8.

7.5 GHz

For the 7.425 to 7.900 GHz band, the 7, 14, and 28 MHz channel rasters are in accordance with the arrangements set out in ITU-R Recommendation F.385-6, Annex 4. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 7662.5 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 56 MHz:

Lower half of the band: fn = (f0 – 234.5 + 28n) MHz

Upper half of the band: fn' = (f0 + 10.5 + 28n) MHz where n = 1, … 7

b) For systems with a carrier spacing of 28 MHz:

Lower half of the band: fn = (f0 – 248.5 + 28n) MHz

Upper half of the band: fn' = (f0 – 3.5 + 28n) MHz where n = 1, … 8

c) For systems with a carrier spacing of 14 MHz:

Lower half of the band: fn = (f0 – 241.5 + 14n) MHz

Upper half of the band: fn' = (f0 + 3.5 + 14n) MHz where n = 1, … 16

d) For systems with a carrier spacing of 7 MHz:

Lower half of the band: fn = (f0 – 238 + 7n) MHz

Upper half of the band: fn' = (f0 + 7 + 7n) MHz where n = 1, … 32

8 GHz

For the 7.900 to 8.500 GHz band, the 7, 14 and 28 MHz channel rasters are in accordance with the arrangements set out in ITU-R Recommendation F.385-9, Annex 5. Channel frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 8253MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn’ be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 28 MHz:

half of the band: fn = (f0 – 217 + 28n) MHz

Upper half of the band: fn’ = (f0 – 9 + 28n) MHz where n = 2, … 4

b) For systems with a carrier spacing of 14 MHz:

Lower half of the band: fn = (f0 – 210 + 14n) MHz

Upper half of the band: fn’ = (f0 – 2 + 14n) MHz where n = 3, … 8

c) For systems with a carrier spacing of 7 MHz:

half of the band: fn = (f0 – 206.5 + 7n) MHz

Upper half of the band: fn’ = (f0 + 1.5 + 7n) MHz where n = 5, … 16

13 GHz

For the 12.75 to 13.25 GHz band, the 1.75, 3.5, 7, 14, and 28 MHz channel rasters are in accordance with the arrangements set out in CEPT/ERC Recommendation 12-02 E. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 12,996 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn’ be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 56 MHz:

Lower half of the band: fn = (f0 - 245 + 28n) MHz;

Upper half of the band: fn’ = (f0 + 21 + 28n) MHz; where n = 1, …7

b) For systems with a carrier spacing of 28 MHz:

Lower half of the band: fn = (f0 - 259 + 28n) MHz;

Upper half of the band: fn’ = (f0 + 7 + 28n) MHz; where n = 1, …8

c) For systems with a carrier spacing of 14 MHz:

Lower half of the band: fn = (f0 - 252 + 14n) MHz;

Upper half of the band: fn’ = (f0 + 14 + 14n) MHz; where n = 1, …16

d) For systems with a carrier spacing of 7 MHz:

Lower half of the band: fn = (f0 – 248.5 + 7n) MHz;

Upper half of the band: fn’ = (f0 + 17.5 + 7n) MHz; where n = 1, …32

e) For systems with a carrier spacing of 3.5 MHz:

Lower half of the band: fn = (f0 – 246.75 + 3.5n) MHz;

Upper half of the band: fn’ = (f0 + 19.25 + 3.5n) MHz; where n = 1, …64

f) For systems with a carrier spacing of 1.75 MHz:

Lower half of the band: fn = (f0 – 245.875 + 1.75n) MHz;

Upper half of the band: fn’ = (f0 + 20.125 + 1.75n) MHz; where n = 1, …128

15 GHz

For the 14.5 to 15.35 GHz band, the 1.75, 3.5, 7, 14, 28 and 56 MHz channel rasters are in accordance with the arrangements set out in CEPT/ERC Recommendation 12-07 E. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 14,924 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 56 MHz:

Lower half of the band: fn = (f0 – 451 + 56n) MHz;

Upper half of the band: fn' = (f0 + 277 + 56n) MHz; where n = 1, 2

b) For systems with a carrier spacing of 28 MHz:

Lower half of the band: fn = (f0 – 437 + 28n) MHz;

Upper half of the band: fn' = (f0 + 291 + 28n) MHz; where n = 1, ...4

c) For systems with a carrier spacing of 14 MHz:

Lower half of the band: fn = (f0 – 423 + 14n) MHz;

Upper half of the band: fn' = (f0 + 305 + 14n) MHz; where n = 1, ...8

d) For systems with a carrier spacing of 7 MHz:

Lower half of the band: fn = (f0 – 426.5 + 7n) MHz;

Upper half of the band: fn' = (f0 + 301.5 + 7n) MHz; where n = 1, ...16

e) For systems with a carrier spacing of 3.5 MHz:

Lower half of the band: fn = (f0 – 424.75 + 3.5n) MHz;

Upper half of the band: fn' = (f0 + 303.25 + 3.5n) MHz; where n = 1, ...32

f) For systems with a carrier spacing of 1.75 MHz:

Lower half of the band: fn = (f0 – 423.875 + 1.75n) MHz;

Upper half of the band: fn' = (f0 + 304.125 + 1.75n) MHz; where n = 1, ...64

18 GHz

For the 17.7 to 19.7 GHz band, the 13.75, 27.5, 55 and 110 MHz channel rasters are in accordance with the arrangements set out in CEPT/ERC Recommendation 12-03 E. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 18,700 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 110 MHz:

Lower half of the band: fn = (f0 – 1000 + 110n) MHz;

Upper half of the band: fn' = (f0 + 10 + 110n) MHz; where n = 1, ...6

b) For systems with a carrier spacing of 55 MHz:

Lower half of the band: fn = (f0 – 1000 + 55n) MHz;

Upper half of the band: fn' = (f0 + 10 + 55n) MHz; where n = 1, ...13

c) For systems with a carrier spacing of 27.5 MHz:

Lower half of the band: fn = (f0 – 1000 + 27.5n) MHz;

Upper half of the band: fn' = (f0 + 10 + 27.5n) MHz; where n = 1, ...27

d) For systems with a carrier spacing of 13.75 MHz:

Lower half of the band: fn = (f0 – 1000 + 13.75n) MHz;

Upper half of the band: fn' = (f0 + 10 + 13.75n) MHz; where n = 1, ...54

The 3.75 and 7.0 MHz channel rasters are in accordance with the arrangements set out in ITU-R Recommendation F.595. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 18,700 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 3.5 MHz:

Lower half of the band: fn = (f0 – 981.25 + 3.5n) MHz;

Upper half of the band: fn' = (f0 + 26.75 + 3.5n) MHz; where n = 212, ...272

b) For systems with a carrier spacing of 7 MHz:

Lower half of the band: fn = (f0 – 983 + 7n) MHz;

Upper half of the band: fn' = (f0 + 25 + 7n) MHz; where n = 107, ...136

23 GHz

For the 22.0 to 23.6 GHz band, the 3.5, 7, 14, and 28 MHz channel rasters are in accordance with the arrangements set out in CEPT/ERC Recommendation 13-02 E.

The 56 MHz channel plan has been modified to give a sub-divided relationship between the 56 MHz plan and the 28 MHz plan. This gives 10 x 56 MHz channels (as opposed to 9 in the CEPT/ERC Recommendation).

Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 21,196 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 112 MHz:

Lower half of the band: fn = (f0 +770 +112n) MHz;

Upper half of the band: fn' = (f0 + 1778 + 112n) MHz; where n = 1, ...5

b) For systems with a carrier spacing of 56 MHz:

Lower half of the band: fn = (f0 +784 +56n) MHz;

Upper half of the band: fn' = (f0 + 1792 + 56n) MHz; where n = 1, ...10

c) For systems with a carrier spacing of 28 MHz:

Lower half of the band: fn = (f0 + 798 + 28n) MHz;

Upper half of the band: fn' = (f0 + 1806 + 28n) MHz; where n = 1, ...20

d) For systems with a carrier spacing of 14 MHz:

Lower half of the band: fn = (f0 + 805 +14n) MHz;

Upper half of the band: fn' = (f0 + 1813 + 14n) MHz; where n = 1, ...41

e) For systems with a carrier spacing of 7 MHz:

Lower half of the band: fn = (f0 + 808.5 + 7n) MHz;

Upper half of the band: fn' = (f0 + 1816.5 + 7n) MHz; where n = 1, ...83

f) For systems with a carrier spacing of 3.5 MHz:

Lower half of the band: fn = (f0 + 805 + 3.5n) MHz;

Upper half of the band: fn' = (f0 + 1813 + 3.5n) MHz; where n = 1, ...168

38 GHz

For the 37.0 to 39.5 GHz band, the 3.5, 7, 14, 28 and 56 MHz channel rasters are in accordance with the arrangements set out in CEPT/ERC Recommendation T/R 12-01. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 38,248 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships:

a) For systems with a carrier spacing of 112 MHz:

Lower half of the band: fn = (f0 – 1246 + 112n) MHz;

Upper half of the band: fn' = (f0 + 14 + 112n) MHz; where n = 1, ...10

b) For systems with a carrier spacing of 56 MHz:

Lower half of the band: fn = (f0 – 1218 + 56n) MHz;

Upper half of the band: fn' = (f0 + 42 + 56n) MHz; where n = 1, ...20

c) For systems with a carrier spacing of 28 MHz:

Lower half of the band: fn = (f0 – 1204 + 28n) MHz;

Upper half of the band: fn' = (f0 + 56 + 28n) MHz; where n = 1, ...40

d) For systems with a carrier spacing of 14 MHz:

Lower half of the band: fn = (f0 – 1197 + 14n) MHz;

Upper half of the band: fn' = (f0 + 63 + 14n) MHz; where n = 1, ...80

e) For systems with a carrier spacing of 7 MHz:

Lower half of the band: fn = (f0 – 1193.5 + 7n) MHz;

Upper half of the band: fn' = (f0 + 66.5 + 7n) MHz; where n = 1, ...160

f) For systems with a carrier spacing of 3.5 MHz:

Lower half of the band: fn = (f0 – 1191.75 + 3.5n) MHz;

Upper half of the band: fn' = (f0 + 68.25 + 3.5n) MHz; where n = 1, ...320

52 GHz

For the 51.4 to 52.6 GHz band, the 3.5, 7, 14, 28 and 56 MHz channel rasters are in accordance with the arrangements set out in CEPT/ERC Recommendation 12-11. Radio channel centre frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 51,412 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships with f0 and fn in MHz:

a) For systems with a carrier spacing of 56 MHz:

Lower half of the band: fn = (f0 + 56n) MHz;

Upper half of the band: fn' = (f0 + 616 + 56n) MHz; where n = 1, ...3

b) For systems with a carrier spacing of 28 MHz:

Lower half of the band: fn = (f0 + 14 + 28n) MHz;

Upper half of the band: fn' = (f0 + 630 + 28n) MHz; where n = 1, ...6

c) For systems with a carrier spacing of 14 MHz:

Lower half of the band: fn = (f0 + 21 + 14n) MHz;

Upper half of the band: fn' = (f0 + 637 + 14n) MHz; where n = 1, ...12

d) For systems with a carrier spacing of 7 MHz:

Lower half of the band: fn = (f0 + 24.5 + 7n) MHz;

Upper half of the band: fn' = (f0 + 640.5 + 7n) MHz; where n = 1, ...24

e) For systems with a carrier spacing of 3.5 MHz:

Lower half of the band: fn = (f0 + 26.25 + 3.5n) MHz;

Upper half of the band: fn' = (f0 + 642.25 + 3.5n) MHz; where n = 1, ...48

55 GHz

For the 55.78 to 57.0 GHz band, the 3.5, 7, 14, 28 and 56 MHz channel rasters are in accordance with the arrangements set out in CEPT/ERC Recommendation 12-12 . Channel frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 55,814 MHz;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships with f0 and fn in MHz:

a) For systems with a carrier spacing of 56 MHz:

Lower half of the band: fn = (f0 + 56n) MHz;

Upper half of the band: fn' = (f0 + 616 + 56n) MHz; where n = 1, ...3

b) For systems with a carrier spacing of 28 MHz:

Lower half of the band: fn = (f0 + 14 + 28n) MHz;

Upper half of the band: fn' = (f0 + 630 + 28n) MHz; where n = 1, ...6

c) For systems with a carrier spacing of 14 MHz:

Lower half of the band: fn = (f0 + 21 + 14n) MHz;

Upper half of the band: fn' = (f0 + 637 + 14n) MHz; where n = 1, ...12

d) For systems with a carrier spacing of 7 MHz:

Lower half of the band: fn = (f0 + 24.5 + 7n) MHz;

Upper half of the band: fn' = (f0 + 640.5 + 7n) MHz; where n = 1, ...24

e) For systems with a carrier spacing of 3.5 MHz:

Lower half of the band: fn = (f0 + 26.25 + 3.5n) MHz;

Upper half of the band: fn' = (f0 + 642.25 + 3.5n) MHz; where n = 1, ...48

70/80 GHz Ofcom co-ordinated band: 71.125-73.125 GHz and 81.125–83.125 GHz

For the 71.0 to 86.0 GHz band, the 250 and 500 MHz channel rasters are in accordance with the arrangements set out in ECC Recommendation (05)07. Channel frequencies may be derived on the following basis:

Let: f0 be the reference frequency of 71000 MHz for the lower band;

f0' be the reference frequency of 81000 MHz for the upper half of the band;

fn be the centre frequency (MHz) of a radio-frequency channel in the lower half of the band; and

fn' be the centre frequency (MHz) of a radio-frequency channel in the upper half of the band.

Individual channel frequencies are expressed by the following relationships with f0 and fn in MHz:

a) For systems with a carrier spacing of 62.5 MHz:

Lower half of the band: fn = (f0 + 93.75 + 62.5n) MHz;

Upper half of the band: fn' = (f0' + 93.75 + 62.5n) MHz; where n = 1, ...32

b) For systems with a carrier spacing of 125 MHz:

Lower half of the band: fn = (f0 + 62.5 +125n) MHz;

Upper half of the band: fn' = (f0' + 62.5 + 125n) MHz; where n = 1, ...16

c) For systems with a carrier spacing of 250 MHz:

Lower half of the band: fn = (f0 + 250n) MHz;

Upper half of the band: fn' = (f0' + 250n) MHz; where n = 1, ...8

d) For systems with a carrier spacing of 500 MHz:

Lower half of the band: fn = (f0 - 125 +500n) MHz;

Upper half of the band: fn' = (f0' -125 + 500n) MHz; where n = 1, ...4

e) For systems with a carrier spacing of 750 MHz:

Lower half of the band: fn = (f0 - 250 + 750 n) MHz;

Upper half of the band: fn' = (f0' – 250 + 750n) MHz; where n = 1,2

f) For systems with a carrier spacing of 1000 MHz:

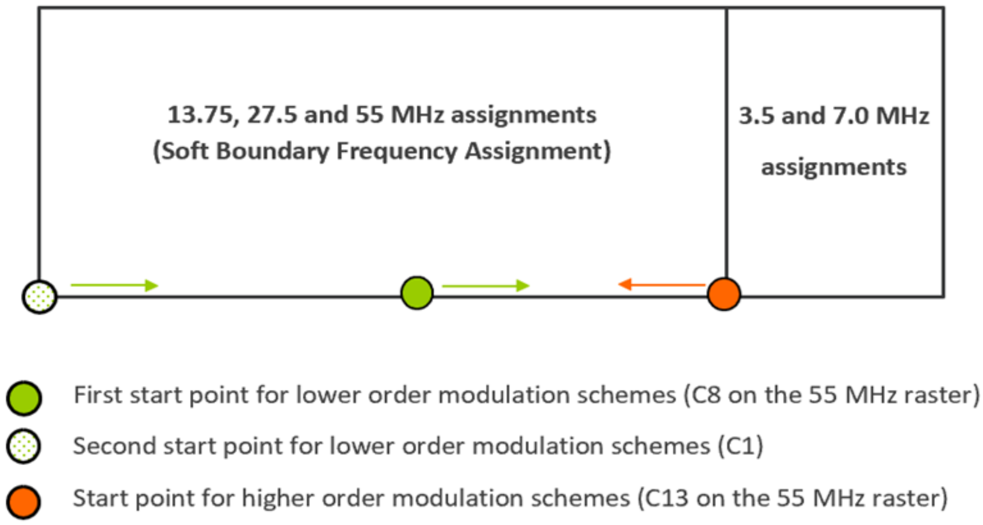
Lower half of the band: fn = (f0 - 375 +1000n) MHz;

Upper half of the band: fn' = (f0' -375 + 1000n) MHz; where n = 1,2

A2. Soft boundary Frequency Assignment

The *Soft Boundary Frequency Assignment (SBFA)* method is employed at 18 GHz. This approach encourages development of link communities on the basis of modulation order with the aim of reducing inequalities between link assignments. The original assignment strategy is shown conceptually in Figure B1 below.

Figure B1: Original SBFA strategy at 18 GHz

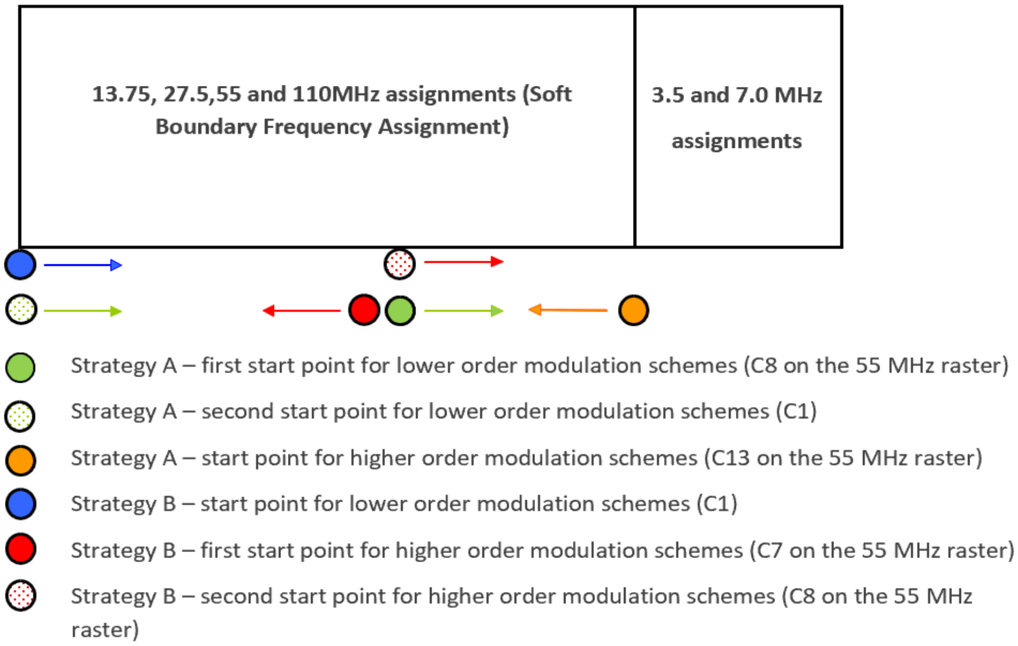


Higher order modulation communities are defined by systems using 32 state modulation and above and lower order by those using 16 QAM and below. In addition to the *SBFA* method being used, there is hard segmentation towards the upper frequency limit of the band where spectrum is reserved for 3.5 and 7 MHz assignments. The original strategy also allowed for co-ordination with FSS to be prioritised towards the lower limit of the band (in the lower duplex channel set).

The SBFA strategy has been refined in order that four, rather than two, distinct link communities are accommodated.

Figure B2 sets out two assignment strategies, A (the original strategy) and B (the new strategy). Users may indicate which strategy they are working to when making a link application. Co-ordination with FSS is no longer prioritised towards the lower limit of the band.

Figure B2: Revised SBFA strategy at 18 GHz



SBFA is flexible both conceptually and in practice. There is no formal segmentation between communities of links and eventually it is expected that communities will merge once significant numbers of assignments are made. Both SBFA strategies are open to all users of the band.

Table B1 sets out assignment strategies for the band in detail for the radio system types accommodated in the TFAC.

Table B1: SBFA strategies at 18 GHz

Assignment Strategy	Modulation category	System	Start Channel (for the assignment tool)	Direction	End Channel	If assignment not possible then jump to alternative start channel	Direction	End Channel
Strategy for 3.5/7 MHz band segment (See note 1)	**Lower order**	8 in 3.5	212	Up-band	272	n/a	n/a	n/a
		8 in 7	107	Up-band (See note 2)	136	n/a	n/a	n/a
Assignment Strategy A **Soft Boundary Frequency Assignment**	**Lower order**	2x8 in 13.75	30	Up-band	54	1	Up-band	29
		34 in 13.75	30	Up-band	54	1	Up-band	29
		34 in 27.5	16	Up-band	27	1	Up-band	15
		68 in 27.5	16	Up-band	27	1	Up-band	15
		155 in 55	8	Up-band	13	1	Up-band	7
		128 in 110	3	Up-band	6	1	Up-band	2
		191 in 110	3	Up-band	6	1	Up-band	2
		256 in 110	3	Up-band	6	1	Up-band	2
	Higher order	100 in 27.5	27	Down-band	1	n/a	n/a	n/a
		155/311 in 27.5	27	Down-band	1	n/a	n/a	n/a
		155/311 in 27.5 (SEC5B)	27	Down-band	1	n/a	n/a	n/a
		311/622 in 55	13	Down-band	1	n/a	n/a	n/a
		8 x STM-0 in 55 (SEC6A)	13	Down-band	1	n/a	n/a	n/a
		392 in 110	6	Down-band	1	n/a	n/a	n/a
		470 in 110	6	Down-band	1	n/a	n/a	n/a
		548 in 110	6	Down-band	1	n/a	n/a	n/a
		627 in 110	6	Down-band	1	n/a	n/a	n/a

		705 in 110	6	Down-band	1	n/a	n/a	n/a
Assignment Strategy B **Soft Boundary Frequency Assignment**	**Lower order**	2x8 in 13.75	1	Up-band	37	n/a	n/a	n/a
		34 in 13.75	1	Up-band	37	n/a	n/a	n/a
		34 in 27.5	1	Up-band	18	n/a	n/a	n/a
		68 in 27.5	1	Up-band	18	n/a	n/a	n/a
		155 in 55	1	Up-band	9	n/a	n/a	n/a
		128 in 110	1	Up-band	4	n/a	n/a	n/a
		191 in 110	1	Up-band	4	n/a	n/a	n/a
		256 in 110	1	Up-band	4	n/a	n/a	n/a
	Higher order	100 in 27.5	15	Down-band	1	16	Up-band	18
		155/311 in 27.5	15	Down-band	1	16	Up-band	18
		155/311 in 27.5 (SEC5B)	15	Down-band	1	16	Up-band	18
		311/622 in 55	7	Down-band	1	8	Up-band	9
		8 x STM-0 in 55 (SEC6A)	7	Down-band	1	8	Up-band	9
		392 in 110	2	Down-band	1	3	Up-band	4
		470 in 110	2	Down-band	1	3	Up-band	4
		548 in 110	2	Down-band	1	3	Up-band	4
		627 in 110	2	Down-band	1	3	Up-band	4
		705 in 110	2	Down-band	1	3	Up-band	4

Note 1: All users of the 3.5 and 7 MHz rasters are required to operate in the 3.5/7 MHz segment.

A3. Band Specific Frequency Co-ordination Zones

Table D1 sets out values for the radius of the frequency co-ordination zone in each frequency band.

Table D1: Coordination zone radius

Frequency band	Coordination Zone radius
4 GHz	250 km
Lower 6 GHz	250 km
Upper 6 GHz	250 km
7.5 GHz	200 km
8 GHz	200 km
13 GHz	200 km
15 GHz	200 km
18 GHz	200 km
23 GHz	200 km
38 GHz	70 km
52 GHz	70 km
55 GHz	70 km
70/80 GHz	70 km

A4. Supplementary notes

Adjacent Channel Alternate Polarisation (ACAP) working

Operators should note that there is no provision in the frequency assignment process to ensure alternate polarisation for links with ACAP equipment sharing a common route and using adjacent channels. Interference analysis is performed in accordance with the general methodology described in this document.

Adaptive coding & Modulation

For radio systems employing Adaptive Coding & Modulation (ACM), Ofcom's approach will be to assign radio channels and EIRPs using parameters associated with a reference radio system nominated by the Licensee. The reference radio system will be selected from one of the standard radio system types described in this document. Operators will be free to use ACM technology while respecting the channel assignment, the spectrum mask associated with the reference system and the *EIRP* values assigned by Ofcom. *EIRP* and interference calculations will be performed using parameters associated with the reference system.

Antenna space-diversity on the receive path

Operators deploying space-diversity antennas on receive paths should note that Ofcom’s procedures take account of one antenna only (the radiating antenna) at each end of the microwave link.

Changes to design of W/U

Here, we describe the design of *W/U* in the *legacy* frequency assignment tool, immediately prior to the commissioning of SPECTRAemc.

Historically, the noise-interference budget described in Figure *2* was used to derive the co-channel protection ratio W/U_{co}. This ratio was used for like-to-like scenarios and those like-to-unlike scenarios where the unwanted signal was of an alternative radio system type (i.e. sending an alternative data-rate and using alternative modulation) but operating co-channel on the same channel raster.

With reference to the legacy system, *W/U* for scenarios where the unwanted signal was offset in frequency from the victim carrier may be described using the term W/U_{off}. For like-to-like scenarios, with the interferer residing in the first adjacent channel, W/U_{off} was a value taken from the ETSI standard and modified to account for a specified number of equal single-entry interferers contributing to ΣI. These modified ETSI values were used for this scenario only. All other W/U_{off} were derived from W/U_{co} using *Net Filter Discrimination (NFD)* where:

$$W/U_{off} = W/U_{co} - NFD + 2 \qquad (dB) \qquad [1D]$$

where 2 dB is an extra contribution to *Multiple Exposure Allowance (MEA)*; that is an allowance to account for a number of equal interferers contributing to ΣI.

The rationalisation of noise-interference budgets in 2006 was a step towards a more coherent set of budgets but did not include a review of W/U_{off} for scenarios where the unwanted signal was a first adjacent channel interferer or the use of the extra 2 dB *MEA* for all other scenarios where W/U_{off} was applicable.

With implementation of the methodology in SPECTRAemc we have completed our tidy-up. We now specify a single W/U value per radio system type where a number of equal interferers are assumed as per the description in Section 2. NFD is used to attenuate the interfering signal level modelled at the victim receiver rather than to adjust W/U. ETSI *W/U* values are no longer referenced and no extra *MEA* is available for scenarios where the unwanted signal is offset in frequency.

High-Low protocol

Ofcom procedures are designed to support the High-Low protocol. That is to respect the designation of sites as transmitting High or transmitting Low; by which we mean that all transmit frequencies on a site are selected from either High or Low duplex channel sets. The protocol ensures that receivers are not at risk of harmful interference from co-sited transmitters operating in the same duplex channel set.

There are, however, some dirty sites where the High-Low protocol is not respected. In frequency bands below 38 GHz it is often the case that these sites had dirty status when returned to government administration (historically, some frequency bands were managed by fixed links operators; these were returned to government administration in 2003). It should be noted that Ofcom's High-Low protocol did not apply to these sites under the previous administrations.

Ofcom aim to achieve *clean* status at all of these sites and encourage operators to move towards clean sites whenever possible. In the meantime, Ofcom will not permit any new links to be deployed at dirty sites in bands below 38 GHz where a new assignment would place a third-party link at risk of harmful interference (*Technical Reconfiguration* of existing links may be permitted on a case-by-case basis). In cases where only 1 operator is active at a site and new links are proposed that improve the ratio of High/Low transmitters in favour of the majority designation then channel assignments will be considered on a case-by-case basis.

The 38 GHz band and 70/80 GHz Ofcom co-ordinated band may be regarded as a special cases where the frequency assignment culture has allowed for development of dirty sites. Here, Ofcom will permit new frequency assignments on dirty sites ensuring that new links are assigned frequencies that improve the majority High/Low designation and with adequate frequency separation between transmitters and receivers operating in the same duplex sub-band.

Note: given the reduced number of larger channels available at the 70/80 GHz band consideration of new 70/80 GHz assignments on dirty sites will be on case by case basis.

For a scenario where transmitters operating at L6 and U6 GHz are co-sited, Ofcom will aim to designate the site High for L6 GHz and Low for U6 GHz. This is to ensure adequate frequency separation between co-sited transmitters and receivers.

Minimum Path Length values

Previously, Ofcom's *Minimum Path Length (MPL)* policy set values for minimum path length in order to encourage use of the higher frequency bands for shorter link solutions. Divergence from policy was permitted on a case-by-case basis.

This approach has been superseded by use of a *Path Length Factor* in the fixed links fees algorithm which continues to encourage the use of the appropriate frequency band with respect to reference MPL values. Operators may now apply for links of any viable path length in any of the co-ordinated frequency bands but will incur an increased fee when diverging from reference values.

The formula for calculation of fixed links licence fees is set out in *Statutory Instrument 2005 No.1378 The Wireless Telegraphy (Licence Charges) Regulations 2005.*

Multi-channel working

In general operators are able to nominate the specific channels required for multi-channel links which we define here as a radio connection utilising numbers of radio channels working in parallel over the same path and with all signals at a node radiating via a single antenna.

On this basis, the multi-channel link will be regarded as a single object in the interference environment with no account taken of interference between signals on the multi-channel link. Interference is considered between the multi-channel link and distant links only.

Packet data

For radio systems sending packet data, Ofcom's approach will be to assign radio frequencies and *EIRP*s using parameters associated with the standard radio system types described in this document.

Passive repeaters

Ofcom does not have procedures in place that accommodate use of passive repeaters.

Legacy radio systems

Ofcom continue to co-ordinate established legacy radio systems; that is, active fixed links equipped with legacy radio systems. We define legacy radio systems as radio systems deployed in the past period but not used in new fixed link deployments (not listed in Table 1). New *EIRP*/frequency assignments for links using legacy equipment, including *Technical Reconfiguration* of links, is not possible.

Automatic Transmitter Power Control (ATPC)

Ofcom do not take account of ATPC use in the *EIRP*/frequency assignment process. Operators using ATPC should note that maximum *EIRP* is restricted to the value assigned by Ofcom and specified in the Licence.

A5. Noise-interference budgets

Note: The noise-interference budgets set out in this Annex show values used in the derivation of *W/U*. Here we employ W/U Test 1 in a co-channel scenario in order to calculate *W/U* such that the single-entry interference threshold *I*, associated with the median unwanted signal, is set at a level below aggregate interference *ΣI* taking account of a predetermined number of equal single-entry interferers *n*. The *W/U* derived here is used in all like-to-like and like-to-unlike interference scenarios with the interfering signal power adjusted to account for NFD.

4 GHz

Radio System Type *(Mbit/s in MHz)*	***RSL*** *(dBW)*	**Modulation type assumed for planning**	***C/(N+ΣI)*** *(dB)*	***N+ΣI*** *(dBW)*	M_I *(dB)*	***N*** *(dBW)*	***ΣI*** *(dBW)*	***n***	***I*** *(dBW)*	***W/U*** *(dB)*
34 in 15	-105.0	16 QAM	17.6	-122.6	1	-123.6	-129.5	4.0	-135.5	30
2 x 34 in 30	-102.0	16 QAM	17.6	-119.6	1	-120.6	-126.5	4.0	-132.5	30
2 x 34 in 15	-99.5	32 QAM	20.6	-120.1	1	-121.1	-127.0	4.0	-133.0	33
100 in 30	-100.0	32 QAM	20.6	-120.6	1	-121.6	-127.5	4.0	-133.5	33
51 in 15	-103.0	64 QAM	23.8	-126.8	1	-127.8	-133.7	4.0	-139.7	37
140/155 in 30	-97.0	64 QAM	23.8	-120.8	1	-121.8	-127.7	4.0	-133.7	37
155/311 in 30	-97.0	128 state	23.6	-120.6	1	-121.6	-127.5	4.0	-135.5	36
200 in 30	-91.0	512 state	32.4	-123.4	1	-124.4	-130.3	4.0	-136.3	45

L6 GHz

Radio System Type *(Mbit/s in MHz)*	*RSL* *(dBW)*	Modulation type assumed for planning	*C/(N+ΣI)* *(dB)*	*N+ΣI* *(dBW)*	M_I *(dB)*	*N* *(dBW)*	*ΣI* *(dBW)*	*n*	*I* *(dBW)*	*W/U* *(dB)*
64 in 29.65	-104.0	16 QAM	17.6	-121.6	2	-123.6	-125.9	4.0	-131.9	28
128 in 59.3	-101.0	16 QAM	17.6	-118.6	2	-120.6	-122.9	4.0	-128.9	28
98 in 29.65	-101.0	32 QAM	20.6	-121.6	2	-123.6	-125.9	4.0	-131.9	31
196 in 59.3	-98.0	32 QAM	20.6	-118.6	2	-120.6	-122.9	4.0	-128.9	31
117 in 29.65	-98.0	64 QAM	23.8	-121.8	2	-123.8	-126.1	4.0	-132.1	34
235 in 59.3	-95.0	64 QAM	23.8	-118.8	2	-120.8	-123.1	4.0	-129.1	34
137 in 29.65	-97.0	128 QAM	26.7	-123.7	2	-125.7	-128.0	4.0	-134.0	37
274 in 59.3	-94.0	128 QAM	26.7	-120.7	2	-122.7	-125.0	4.0	-131.0	37
156 in 29.65	-93.0	256 QAM	29.8	-122.8	2	-124.8	-127.1	4.0	-133.1	40
313 in 59.3	-90.0	256 QAM	29.8	-119.8	2	-121.8	-124.1	4.0	-130.1	40
176 in 29.65	-88.5	512 QAM	32.4	-120.9	2	122.9	-125.2	4.0	-131.2	43
352 in 59.3	-86.0	512 QAM	32.4	-118.4	2	-120.4	-122.7	4.0	-128.7	43

U6 GHz

Radio System Type *(Mbit/s in MHz)*	*RSL (dBW)*	Modulation type assumed for planning	*C/(N+ΣI) (dB)*	*N+ΣI (dBW)*	*M_I (dB)*	*N (dBW)*	*ΣI (dBW)*	*n*	*I (dBW)*	*W/U (dB)*
2 in 1.75	-123	4 state	13.5	-136.5	2	-138.5	-140.8	4.0	-146.8	24
4 in 3.5	-120	4 state	13.5	-133.5	2	-135.5	-137.8	4.0	-143.8	24
BT System 34 in 20	-103.0	4 state	13.5	-116.5	2	-118.5	-120.8	4.0	-126.8	24
3 in 1.75	-118	8PSK	18.8	-136.8	2	-138.8	-141.1	4.0	-147.1	29
6 in 3.5	-115	8PSK	18.8	-133.8	2	-135.8	-138.1	4.0	-144.1	29
4 in 1.75	-116	16 QAM	20.5	-136.5	2	-138.5	-140.8	4.0	-146.8	31
8 in 3.5	-113	16 QAM	20.5	-133.5	2	-135.5	-137.8	4.0	-143.8	31
BT System 140 in 40	-98.0	16 QAM	17.6	-115.6	2	-117.6	-119.9	4.0	-125.9	28
45 in 20	-106.0	16 QAM	17.6	-123.6	2	-125.6	-127.9	4.0	-133.9	28
64 in 30	-104.0	16 QAM	17.6	-121.6	2	-123.6	-125.9	4.0	-131.9	28
128 in 60	-101.0	16 QAM	17.6	-118.6	2	-120.6	-122.9	4.0	-128.9	28
98 in 30	-101.0	32 QAM	20.6	-121.6	2	-123.6	-125.9	4.0	-131.9	31
196 in 60	-98.0	32 QAM	20.6	-118.6	2	-120.6	-122.9	4.0	-128.9	31
117 in 30	-98.0	64 QAM	23.8	-121.8	2	-123.8	-126.1	4.0	-132.1	34
168 in 40	-93.5	64 QAM	23.8	-117.3	2	-119.3	-121.6	4.0	-127.6	34
235 in 60	-95.0	64 QAM	23.8	-118.8	2	-120.8	-123.1	4.0	-129.1	34
137 in 30	-97.0	128 QAM	26.7	-123.7	2	-125.7	-128.0	4.0	-134.0	37
196 in 40	-94.0	128 QAM	26.7	-120.7	2	-122.7	-125.0	4.0	-131.0	37
274 in 60	-94.0	128 QAM	26.7	-120.7	2	-122.7	-125.0	4.0	-131.0	37

156 in 30	-93.0	256 QAM	29.8	-122.8	2	-124.8	-127.1	4.0	-133.1	40
224 in 40	-90.5	256 QAM	29.8	-120.3	2	-122.3	-124.6	4.0	-130.6	40
313 in 60	-90.0	256 QAM	29.8	-119.8	2	-121.8	-124.1	4.0	-130.1	40
176 in 30	-88.5	512 QAM	32.4	-120.9	2	-122.9	-125.2	4.0	-131.2	43
252 in 40	-86.5	512 QAM	32,4	-118.9	2	-120.9	-123.2	4.0	-129.2	43
352 in 60	-86.0	512 QAM	32.4	-118.4	2	-120.4	-122.7	4.0	-128.7	43

7.5 GHz

Radio System Type (Mbit/s in MHz)	RSL (dBW)	Modulation type assumed for planning	C/(N+ΣI) (dB)	N+ΣI (dBW)	M_I (dB)	N (dBW)	ΣI (dBW)	n	I (dBW)	W/U (dB)
8 in 7	-117.0	4 state	13.5	-130.5	1	-130.5	-131.4	4.0	-143.4	26
16 in 14	-114.0	4 state	13.5	-127.5	1	-128.5	-134.4	4.0	-140.4	26
32 in 28	-111.0	4 state	13.5	-124.5	1	-125.5	-131.4	4.0	-137.4	26
64 in 56	-108.0	4 state	13.5	-121.5	1	-122.5	-128.4	4.0	-134.4	26
12 in 7	-112.0	8 state	18.8	-130.8	1	-131.8	137.7	4.0	-143.7	32
24 in 14	-109.0	8 state	18.8	-127.8	1	-128.8	134.7	4.0	-140.7	32
48 in 28	-106.0	8 state	18.8	-124.8	1	-125.8	131.7	4.0	-137.7	32
96 in 56	-103.0	8 state	18.8	-121.8	1	-122.8	-128.7	4.0	-134.7	32
16 in 7	-110.0	16 QAM	17.6	-127.6	1	-128.6	-134.5	4.0	-140.5	30
32 in 14	-107.0	16 QAM	17.6	-124.6	1	-125.6	-131.5	4.0	-137.5	30
64 in 28	-104.0	16 QAM	17.6	-121.6	1	-122.6	-128.5	4.0	-134.5	30
128 in 56	-101.0	16 QAM	17.6	-118.6	1	-119.6	-125.5	4.0	-131.5	30
24 in 7	-107.0	32 QAM	20.6	-127.6	1	-128.6	-134.5	4.0	-140.5	33
49 in 14	-104.0	32 QAM	20.6	-124.6	1	-125.6	-131.5	4.0	-137.5	33
98 in 28	-101.0	32 QAM	20.6	-121.6	1	-122.6	-128.5	4.0	-134.5	33
196 in 56	-98.0	32 QAM	20.6	-118.6	1	-119.6	-125.5	4.0	-131.5	33

Radio System Type *(Mbit/s in MHz)*	*RSL* *(dBW)*	Modulation type assumed for planning	*C/(N+ΣI)* *(dB)*	*N+ΣI* *(dBW)*	M_I *(dB)*	*N* *(dBW)*	*ΣI* *(dBW)*	*n*	*I* *(dBW)*	*W/U* *(dB)*
29 in 7	-104.0	64 QAM	23.8	-127.8	1	-128.8	-134.7	4.0	-140.7	37
58 in 14	-101.0	64 QAM	23.8	-124.8	1	-125.8	-131.7	4.0	-137.7	37
117 in 28	-98.0	64 QAM	23.8	-121.8	1	-122.8	-128.7	4.0	-134.7	37
235 in 56	-95.0	64 QAM	23.8	-118.8	1	-119.8	-125.7	4.0	-131.7	37
34 in 7	-102.5	128 QAM	26.7	-129.2	1	-130.2	-136.1	4.0	-142.1	40
68 in 14	-99.5	128 QAM	26.7	-126.2	1	-127.2	-133.1	4.0	-139.1	40
137 in 28	-97.0	128 QAM	26.7	-123.7	1	-124.7	-130.6	4.0	-136.6	40
274 in 56	-94.0	128 QAM	26.7	-120.7	1	-121.7	-127.6	4.0	-133.6	40
39 in 7	-98.0	256 QAM	29.8	-127.8	1	-128.8	-134.7	4.0	-140.7	43
78 in 14	-95.0	256 QAM	29.8	-124.8	1	-125.8	-131.7	4.0	-137.7	43
156 in 28	-93.0	256 QAM	29.8	-122.8	1	-123.8	-129.7	4.0	-135.7	43
313 in 56	-90.0	256 QAM	29.8	-119.8	1	-120.8	-126.7	4.0	-132.7	43
88 in 14	-91.0	512 QAM	32.4	-123.4	1	-124.4	-130.3	4.0	-136.3	45
176 in 28	-88.5	512 QAM	32.4	-120.9	1	-121.9	-127.8	4.0	-133.8	45
352 in 56	-86.0	512 QAM	32.4	-118.4	1	-119.4	-125.3	4.0	-131.3	45

8 GHz

Radio System Type (Mbit/s in MHz)	RSL (dBW)	Modulation type assumed for planning	C/(N+ΣI) (dB)	N+ΣI (dBW)	M_I (dB)	N (dBW)	ΣI (dBW)	n	I (dBW)	W/U (dB)
8 in 7	-117.0	4 state	13.5	-130.5	1	-130.5	-131.4	4.0	-143.4	26
16 in 14	-114.0	4 state	13.5	-127.5	1	-128.5	-134.4	4.0	-140.4	26
32 in 28	-111.0	4 state	13.5	-124.5	1	-125.5	-131.4	4.0	-137.4	26
12 in 7	-112.0	8 state	18.8	-130.8	1	-131.8	137.7	4.0	-143.7	32
24 in 14	-109.0	8 state	18.8	-127.8	1	-128.8	134.7	4.0	-140.7	32
48 in 28	-106.0	8 state	18.8	-124.8	1	-125.8	131.7	4.0	-137.7	32
16 in 7	-110.0	16 QAM	17.6	-127.6	1	-128.6	-134.5	4.0	-140.5	30
32 in 14	-107.0	16 QAM	17.6	-124.6	1	-125.6	-131.5	4.0	-137.5	30
64 in 28	-104.0	16 QAM	17.6	-121.6	1	-122.6	-128.5	4.0	-134.5	30
24 in 7	-107.0	32 QAM	20.6	-127.6	1	-128.6	-134.5	4.0	-140.5	33
49 in 14	-104.0	32 QAM	20.6	-124.6	1	-125.6	-131.5	4.0	-137.5	33
98 in 28	-101.0	32 QAM	20.6	-121.6	1	-122.6	-128.5	4.0	-134.5	33
29 in 7	-104.0	64 QAM	23.8	-127.8	1	-128.8	-134.7	4.0	-140.7	37
58 in 14	-101.0	64 QAM	23.8	-124.8	1	-125.8	-131.7	4.0	-137.7	37
117 in 28	-98.0	64 QAM	23.8	-121.8	1	-122.8	-128.7	4.0	-134.7	37
34 in 7	-102.5	128 QAM	26.7	-129.2	1	-130.2	-136.1	4.0	-142.1	40

68 in 14	-99.5	128 QAM	26.7	-126.2	1	-127.2	-133.1	4.0	-139.1	40
137 in 28	-97.0	128 QAM	26.7	-123.7	1	-124.7	-130.6	4.0	-136.6	40
39 in 7	-98.0	256 QAM	29.8	-127.8	1	-128.8	-134.7	4.0	-140.7	43
78 in 14	-95.0	256 QAM	29.8	-124.8	1	-125.8	-131.7	4.0	-137.7	43
156 in 28	-93.0	256 QAM	29.8	-122.8	1	-123.8	-129.7	4.0	-135.7	43
88 in 14	-91.0	512 QAM	32.4	-123.4	1	-124.4	-130.3	4.0	-136.3	45
176 in 28	-88.5	512 QAM	32.4	-120.9	1	-121.9	-127.8	4.0	-133.8	45

13 GHz

Radio System Type *(Mbit/s in MHz)*	*RSL* *(dBW)*	Modulation type assumed for planning	*C/(N+ΣI)* *(dB)*	*N+ΣI* *(dBW)*	M_I *(dB)*	*N* *(dBW)*	*ΣI* *(dBW)*	*n*	*I* *(dBW)*	*W/U* *(dB)*
2 in 1.75	-123.0	4 state	13.5	-136.5	1	-137.5	-143.4	4.0	-149.4	26
4in 3.5	-120.0	4 state	13.5	-133.5	1	-134.5	-140.4	4.0	-146.4	26
8 in 7	-117.0	4 state	13.5	-130.5	1	-131.5	-137.4	4.0	-143.4	26
16 in 14	-114.0	4 state	13.5	-127.5	1	-128.5	-134.4	4.0	-140.4	26
32 in 28	-111.0	4 state	13.5	-124.5	1	-125.5	-131.4	4.0	-137.4	26
64 in 56	-108.0	4 state	13.5	-121.5	1	-122.5	-128.4	4.0	-134.4	26
3 in 1.75	-118.0	8 state	18.8	-136.8	1	-137.8	-143.7	4.0	-149.7	32
6 in 3.5	-115.0	8 state	18.8	-133.8	1	-134.8	-140.7	4.0	-146.7	32
12 in 7	-112.0	8 state	18.8	-130.8	1	-131.8	-137.7	4.0	-143.7	32
24 in 14	-109.0	8 state	18.8	-127.8	1	-128.8	-134.7	4.0	-140.7	32
48 in 28	-106.0	8 state	18.8	-124.8	1	-125.8	-131.7	4.0	-137.7	32
96 in 56	-103.0	8 state	18.8	-121.8	1	-122.8	-128.7	4.0	-134.7	32
4 in 1.75	-116.0	16 QAM	17.6	-133.6	1	-134.6	-140.5	4.0	-146.5	30
8 in 3.5	-113.0	16 QAM	17.6	-130.6	1	-131.6	-137.5	4.0	-143.5	30
16 in 7	-110.0	16 QAM	17.6	-127.6	1	-128.6	-134.5	4.0	-140.5	30
32 in 14	-107.0	16 QAM	17.6	-124.6	1	-125.6	-131.5	4.0	-137.5	30
64 in 28	-104.0	16 QAM	17.6	-121.6	1	-122.6	-128.5	4.0	-134.5	30
128 in 56	-101.0	16 QAM	17.6	-118.6	1	-119.6	-125.5	4.0	-131.5	30
24 in 7	-107.0	32 QAM	20.6	-127.6	1	-128.6	-134.5	4.0	-140.5	33
49 in 14	-104.0	32 QAM	20.6	-124.6	1	-125.6	-131.5	4.0	-137.5	33

Radio System Type (Mbit/s in MHz)	*RSL* (dBW)	Modulation type assumed for planning	*C/(N+ΣI)* (dB)	*N+ΣI* (dBW)	M_I (dB)	*N* (dBW)	*ΣI* (dBW)	*n*	*I* (dBW)	*W/U* (dB)
98 in 28	-101.0	32 QAM	20.6	-121.6	1	-122.6	-128.5	4.0	-134.5	33
196 in 56	-98.0	32 QAM	20.6	-118.6	1	-119.6	-125.5	4.0	-131.5	33
29 in 7	-104.0	64 QAM	23.8	-127.8	1	-128.8	-134.7	4.0	-140.7	37
58 in 14	-101.0	64 QAM	23.8	-124.8	1	-125.8	-131.7	4.0	-137.7	37
117 in 28	-98.0	64 QAM	23.8	-121.8	1	-122.8	-128.7	4.0	-134.7	37
235 in 56	-95.0	64 QAM	23.8	-118.8	1	-119.8	-125.7	4.0	-131.7	37
34 in 7	-101.5	128 QAM	26.7	-128.2	1	-129.2	-135.1	4.0	-141.1	40
68 in 14	-98.5	128 QAM	26.7	-125.2	1	-126.2	-132.1	4.0	-138.1	40
137 in 28	-95.5	128 QAM	26.7	-122.2	1	-123.2	-129.1	4.0	-135.1	40
274 in 56	-94.0	128 QAM	26.7	-120.7	1	-121.7	-127.6	4.0	-133.6	40
39 in 7	-97.5	256 QAM	29.8	-127.3	1	-128.3	-134.2	4.0	-140.2	43
78 in 14	-94.5	256 QAM	29.8	-124.3	1	-125.3	-131.2	4.0	-137.2	43
156 in 28	-92.0	256 QAM	29.8	-121.8	1	-122.8	-128.7	4.0	-34.7	43
313 in 56	-90.0	256 QAM	29.8	-119.8	1	-120.8	-126.7	4.0	-132.7	43
88 in 14	-91.0	512 QAM	32.4	-123.4	1	-124.4	-130.3	4.0	-136.3	45
176 in 28	-88.5	512 QAM	32.4	-120.9	1	-121.9	-127.8	4.0	-133.8	45
352 in 56	-86.0	512 QAM	32.4	-118.4	1	-119.4	-125.3	4.0	-131.3	45

15 GHz

Radio System Type (Mbit/s in MHz)	RSL (dBW)	Modulation type assumed for planning	C/(N+ΣI) (dB)	N+ΣI (dBW)	M_I (dB)	N (dBW)	ΣI (dBW)	n	I (dBW)	W/U (dB)
2 in 1.75	-123.0	4 state	13.5	-136.5	1	-137.5	-143.4	4.0	-149.4	26
4 in 3.5	-120.0	4 state	13.5	-133.5	1	-134.5	-140.4	4.0	-146.4	26
8 in 7	-117.0	4 state	13.5	-130.5	1	-131.5	-137.4	4.0	-143.4	26
16 in 14	-114.0	4 state	13.5	-127.5	1	-128.5	-134.4	4.0	-140.4	26
32 in 28	-111.0	4 state	13.5	-124.5	1	-125.5	-131.4	4.0	-137.4	26
64 in 56	-108.0	4 state	13.5	-121.5	1	-122.5	-128.4	4.0	-134.4	26
3 in 1.75	-118.0	8 state	18.8	-136.8	1	-137.8	-143.7	4.0	-149.7	32
6 in 3.5	-115.0	8 state	18.8	-133.8	1	-134.8	-140.7	4.0	-146.7	32
12 in 7	-112.0	8 state	18.8	-130.8	1	131.8	-137.7	4.0	-143.7	32
24 in 14	-109.0	8 state	18.8	-127.8	1	-128.8	-134.7	4.0	-140.7	32
48 in 28	-106.0	8 state	18.8	-124.8	1	-125.8	-131.7	4.0	-137.7	32
96 in 56	-103.0	8 state	18.8	-121.8	1	-122.8	-128.7	4.0	-134.7	32
4 in 1.75	-116.0	16 QAM	17.6	-133.6	1	-134.6	-140.5	4.0	-146.5	30
8 in 3.5	-113.0	16 QAM	17.6	-130.6	1	-131.6	-137.5	4.0	-143.5	30
16 in 7	-110.0	16 QAM	17.6	-127.6	1	-128.6	-134.5	4.0	-140.5	30
32 in 14	-107.0	16 QAM	17.6	-124.6	1	-125.6	-131.5	4.0	-137.5	30
64 in 28	-104.0	16 QAM	17.6	-121.6	1	-122.6	-128.5	4.0	-134.5	30
128 in 56	-101.0	16 QAM	17.6	-118.6	1	-119.6	-125.5	4.0	-131.5	30
24 in 7	-107.0	32 QAM	20.6	-127.6	1	-128.6	-134.5	4.0	-140.5	34
49 in 14	-104.0	32 QAM	20.6	-124.6	1	-125.6	-131.5	4.0	-137.5	34

Radio System Type *(Mbit/s in MHz)*	*RSL* *(dBW)*	**Modulation type assumed for planning**	*C/(N+ΣI)* *(dB)*	*N+ΣI* *(dBW)*	M_I *(dB)*	*N* *(dBW)*	*ΣI* *(dBW)*	*n*	*I* *(dBW)*	*W/U* *(dB)*
98 in 28	-101.0	32 QAM	20.6	-121.6	1	-122.6	-128.5	4.0	-134.5	34
196 in 56	-98.0	32 QAM	20.6	-118.6	1	-119.6	-125.5	4.0	-131.5	34
29 in 7	-104.0	64 QAM	23.8	-127.8	1	-128.8	-134.7	4.0	-140.7	37
58 in 14	-101.0	64 QAM	23.8	-124.8	1	-125.8	-131.7	4.0	-137.7	37
117 in 28	-98.0	64 QAM	23.8	-121.8	1	-122.8	-128.7	4.0	-134.7	37
235 in 56	-95.0	64 QAM	23.8	-118.8	1	-119.8	-125.7	4.0	-131.7	37
34 in 7	-101.5	128 QAM	26.7	-128.2	1	-129.2	-135.1	4.0	-141.1	40
68 in 14	-98.5	128 QAM	26.7	-125.2	1	-126.2	-132.1	4.0	-138.1	40
137 in 28	-95.5	128 QAM	26.7	-122.2	1	-123.2	-129.1	4.0	-135.1	40
274 in 56	-92.0	128 QAM	26.7	-118.7	1	-119.7	-125.6	4.0	-131.6	40
39 in 7	-97.5	256 QAM	29.8	-127.3	1	-128.3	-134.2	4.0	-140.2	43
78 in 14	-94.5	256 QAM	29.8	-124.3	1	-125.3	-131.2	4.0	-137.2	43
156 in 28	-92.0	256 QAM	29.8	-121.8	1	-122.8	-128.7	4.0	-134.7	43
313 in 56	-89.0	256 QAM	29.8	-118.8	1	-119.8	-125.7	4.0	-131.7	43
88 in 14	-91.0	512 QAM	32.4	-123.4	1	-124.4	-130.3	4.0	-136.3	45
176 in 28	-88.5	512 QAM	32.4	-120.9	1	-121.9	-127.8	4.0	-133.8	45
352 in 56	-86.0	512 QAM	32.4	-118.4	1	-119.4	-125.3	4.0	-131.3	45

18 GHz

Radio System Type *(Mbit/s in MHz)*	*RSL (dBW)*	Modulation type assumed for planning	*C/(N+ΣI) (dB)*	*N+ΣI (dBW)*	*M_I (dB)*	*N (dBW)*	*ΣI (dBW)*	*n*	*I (dBW)*	*W/U (dB)*
4in 3.5	-119.0	4 state	13.5	-132.5	1	-133.5	-139.4	4.0	-145.4	26
8 in 7	-116.0	4 state	13.5	-129.5	1	-130.5	-136.4	4.0	-142.4	26
16in 13.75	-113.0	4 state	13.5	-126.5	1	-127.5	-133.4	4.0	-139.4	26
32in 27.5	-110.0	4 state	13.5	-123.5	1	-124.5	-130.4	4.0	-136.4	26
64 in 55	-107.0	4 state	13.5	-120.5	1	-121.5	-127.4		-133.4	26
128 in 110	-104.0	4 state	13.5	-117.5	1	-118.5	-124.4	4.0	-130.4	26
6 in 3.5	-114.0	8 state	18.8	-132.8	1	-133.8	-139.7	4,0	-145.7	32
12 in 7	-111.0	8 state	18.8	-129.8	1	-130.8	-136.7	4.0	-142.7	32
24 in 13.75	-108.0	8 state	18.8	-126.8	1	-127.8	-133.7	4.0	-139.7	32
48 in 27.5	-105.0	8 state	18.8	-123.8	1	-124.8	-130.7	4.0	-136.7	32
96 in 55	-102.0	8 state	18.8	-120.8	1	-121.8	-127.7	4.0	-133.7	32
191 in 110	-99.0	8 state	18.8	-117.8	1	-118.8	-124.7	4.0	-130.7	32
8 in 3.5	-112.0	16 QAM	17.6	-129.6	1	-130.6	-136.5	4.0	-142.5	30
16 in 7	-109.0	16 QAM	17.6	-126.6	1	-127.6	-133.5	4.0	-139.5	30
32 in 13.75	-106.0	16 QAM	17.6	-123.6	1	-124.6	-130.5	4.0	-136.5	30
64 in 27.5	-103.0	16 QAM	17.6	-120.6	1	-121.6	-127.5	4.0	-133.5	30
128 in 55	-100.0	16 QAM	17.6	-117.6	1	-118.6	-124.5	4.0	-130.5	30
256 in 110	-97.0	16 QAM	17.6	-114.6	1	-115.6	-121.5	4.0	-127.5	30
24 in 7	-106.0	32 QAM	20.6	-126.6	1	-127.6	-133.5	4.0	-139.5	33
49 in 13.75	-103.0	32 QAM	20.6	-123.6	1	-124.6	-130.5	4.0	-136.5	33

98 in 27.5	-100.0	32 QAM	20.6	-120.6	1	-121.6	-128.5	4.0	-133.5	33
196 in 55	-97.0	32 QAM	20.6	-117.6	1	-118.6	-124.5	4.0	-130.5	33
392 in 110	-94.0	32 QAM	20.6	-114.6	1	-115.6	-121.5	4.0	-127.5	33
29 in 7	-103.0	64 QAM	23.8	-126.8	1	-127.8	-133.7	4.0	-139.7	37
58 in 13.75	-100.0	64 QAM	23.8	-123.8	1	-124.8	-130.7	4.0	-136.7	37
117 in 27.5	-97.0	64 QAM	23.8	-120.8	1	-121.8	-127.7	4.0	-133.7	37
235 in 55	-94.0	64 QAM	23.8	-117.8	1	-118.8	-124.7	4.0	-130.7	37
470 in 110	-91.0	64 QAM	23.8	-114.8	1	-115.8	-121.7	4.0	-127.7	37
34 in 7	-100.0	128 QAM	26.7	-126.7	1	-127.7	-133.6	4.0	-139.6	40
68 in 13.75	-97.0	128 QAM	26.7	-123.7	1	-124.7	-130.6	4.0	-136.6	40
137 in 27.5	-94.0	128 QAM	26.7	-120.7	1	-121.7	-127.6	4.0	-133.6	40
274 in 55	-91.0	128 QAM	26.7	-117.7	1	-118.7	-124.6	4.0	-130.6	40
548 in 110	-88.0	128 QAM	26.7	-114.7	1	-115.7	-121.57	4.0	-127.6	40
39 in 7	-96.0	256 QAM	29.8	-125.8	1	-126.8	-132.7	4.0	-138.7	43
78 in 13.75	-93.5	256 QAM	29.8	-123.3	1	-124.3	-130.2	4.0	-136.2	43
156 in 27.5	-91.0	256 QAM	29.8	-120.8	1	-121.8	-127.7	4.0	-133.7	43
313 in 55	-88.0	256 QAM	29.8	-117.8	1	-118.8	-124.7	4.0	-130.7	43
627 in 110	-85.0	256 QAM	29.8	114.8	1	-115.8	-121.7	4.0	-127.7	43
88 in 13.75	-90.0	512 QAM	32.4	-122.4	1	-123.4	-129.3	4.0	-135.3	45
176 in 27.5	-87.5	512 QAM	32.4	-119.9	1	-120.9	-126.8	4.0	-132.8	45
352 in 55	-85.0	512 QAM	32.4	-117.4	1	-118.4	-124.3	4.0	-130.3	45
705 in 110	-82.0	512 QAM	32.4	-114.4	1	-115.4	-121.3	4.0	-127.3	45

23 GHz

Radio System Type *(Mbit/s in MHz)*	*RSL* *(dBW)*	Modulation type assumed for planning	*C/(N+ΣI)* *(dB)*	*N+ΣI* *(dBW)*	M_I *(dB)*	*N* *(dBW)*	*ΣI* *(dBW)*	*n*	*I* *(dBW)*	*W/U* *(dB)*
4 in 3.5	-119.0	4 state	13.5	-132.5	1	-133.5	-139.4	4.0	-145.4	26
8 in 7	-116.0	4 state	13.5	-129.5	1	-130.5	-136.4	4.0	-142.4	26
16 in 14	-113.0	4 state	13.5	-126.5	1	-127.5	-133.4	4.0	-139.4	26
32 in 28	-110.0	4 state	13.5	-123.5	1	-124.5	-130.4	4.0	-136.4	26
64 in 56	-107.0	4 state	13.5	-120.5	1	-121.5	-127.4	4.0	-133.4	26
128 in 112	-104.0	4 state	13.5	-117.5	1	-118.5	-124.4	4.0	-130.4	26
6 in 3.5	-114.0	8 state	18.8	-132.8	1	-133.8	-139.7	4.0	-145.7	32
12 in 7	-111.0	8 state	18.8	-129.8	1	-130.8	-136.7	4.0	-142.7	32
24 in 14	-108.0	8 state	18.8	-126.8	1	-127.8	-133.7	4.0	-139.7	32
48 in 28	-105.0	8 state	18.8	-123.8	1	-124.8	-130.7	4.0	-136.7	32
96 in 56	-102.0	8 state	18.8	-120.8	1	-121.8	-127.7	4.0	-133.7	32
191 in 112	-99.0	8 state	18.8	-117.8	1	-118.8	-124.7	4.0	-130.7	32
8 in 3.5	-112.0	16 QAM	17.6	-129.6	1	-130.6	-136.5	4.0	-142.5	30
16 in 7	-109.0	16 QAM	17.6	-126.6	1	-127.6	-133.5	4.0	-139.5	30
32 in 14	-106.0	16 QAM	17.6	-123.6	1	-124.6	-130.5	4.0	-136.5	30
64 in 28	-103.0	16 QAM	17.6	-120.6	1	-121.6	-127.5	4.0	-133.5	30
128 in 56	-100.0	16 QAM	17.6	-117.6	1	-118.6	-124.5	4.0	-130.5	30

Radio System Type (Mbit/s in MHz)	RSL (dBW)	Modulation type assumed for planning	C/(N+ΣI) (dB)	N+ΣI (dBW)	M_I (dB)	N (dBW)	ΣI (dBW)	n	I (dBW)	W/U (dB)
256 in 112	-97.0	16 QAM	17.6	-114.6	1	-115.6	-121.5	4.0	-127.5	30
24 in 7	-106.0	32 QAM	20.6	-126.6	1	-127.6	-133.5	4.0	-139.5	33
49 in 14	-103.0	32 QAM	20.6	-123.6	1	-124.6	-130.5	4.0	-136.5	33
98 in 28	-100.0	32 QAM	20.6	-120.6	1	-121.6	-127.5	4.0	-133.5	33
196 in 56	-97.0	32 QAM	20.6	-117.6	1	-118.6	-124.5	4.0	-130.5	33
392 in 112	-94.0	32 QAM	20.6	-114.6	1	-115.6	-121.5	4.0	-127.5	33
29 in 7	-103.0	64 QAM	23.8	-126.8	1	-127.8	-133.7	4.0	-139.7	37
58 in 14	-100.0	64 QAM	23.8	-123.8	1	-124.8	-130.7	4.0	-136.7	37
117 in 28	-97.0	64 QAM	23.8	-120.8	1	-121.8	-127.7	4.0	-133.7	37
235 in 56	-94.0	64 QAM	23.8	-117.8	1	-118.8	-124.7	4.0	-130.7	37
470 in 112	-91.0	64 QAM	23.8	-114.8	1	-115.8	-121.7	4.0	-127.7	37
34 in 7	-100.0	128 QAM	26.7	-126.7	1	-127.7	-133.6	4.0	-139.6	40
68 in 14	-97.0	128 QAM	26.7	-123.7	1	-124.7	-130.6	4.0	-136.6	40
137 in 28	-94.0	128 QAM	26.7	-120.7	1	-121.7	-127.6	4.0	-133.6	40
274 in 56	-91.0	128 QAM	26.7	-117.7	1	-118.7	-124.6	4.0	-130.6	40
548 in 112	-88.0	128 QAM	26.7	-114.7	1	-115.7	-121.6	4.0	-127.6	40
39 in 7	-96.0	256 QAM	29.8	-125.8	1	-126.8	-132.7	4.0	-138.7	43
78 in 14	-93.5	256 QAM	29.8	-123.3	1	-124.3	-130.2	4.0	-136.2	43

Radio System Type *(Mbit/s in MHz)*	*RSL* *(dBW)*	Modulation type assumed for planning	*C/(N+ΣI)* *(dB)*	*N+ΣI* *(dBW)*	M_I *(dB)*	*N* *(dBW)*	*ΣI* *(dBW)*	*n*	*I* *(dBW)*	*W/U* *(dB)*
156 in 28	-91.0	256 QAM	29.8	-120.8	1	-121.8	-127.7	4.0	-133.7	43
313 in 56	-88.0	256 QAM	29.8	-117.8	1	-118.8	-124.7	4.0	-130.7	43
627 in 112	-85.0	256 QAM	29.8	-114.8	1	-115.8	-121.7	4.0	-127.7	43
88 in 14	-90.0	512 QAM	32.4	-122.4	1	-123.4	-129.3	4.0	-135.3	45
176 in 28	-87.5	512 QAM	32.4	-119.9	1	-120.9	-126.8	4.0	-132.8	45
352 in 56	-85.0	512 QAM	32.4	-117.4	1	-118.4	-124.3	4.0	-130.3	45
705 in 112	-82.0	512 QAM	32.4	-114.4	1	-115.4	-121.3	4.0	-127.3	45

38 GHz

Radio System Type *(Mbit/s in MHz)*	*RSL (dBW)*	Modulation type assumed for planning	*C/(N+ΣI) (dB)*	*N+ΣI (dBW)*	*M_I (dB)*	*N (dBW)*	*ΣI (dBW)*	*n*	*I (dBW)*	*W/U (dB)*
4 in 3.5	-117.0	4 state	13.5	-130.5	1	-131.5	-137.4	4.0	-143.4	26
8 in 7	-114.0	4 state	13.5	-127.5	1	-128.5	-134.4	4.0	-140.4	26
16in 14	-111.0	4 state	13.5	-124.5	1	-125.5	-131.4	4.0	-137.4	26
32 in 28	-108.0	4 state	13.5	-121.5	1	-122.5	-128.4	4.0	-134.4	26
64 in 56	-105.0	4 state	13.5	-118.5	1	-119.5	-125.4	4.0	-131.4	26
128 in 112	-102.0	4 state	13.5	-115.5	1	-116.5	-122.4	4.0	-128.4	26
6 in 3.5	-112.0	8 state	18.8	-130.8	1	-131.8	-137.7	4.0	-143.7	32
12 in 7	-109.0	8 state	18.8	-127.8	1	-128.8	-134.7	4.0	-140.7	32
24 in 14	-106.0	8 state	18.8	-124.8	1	-125.8	-131.7	4.0	-137.7	32
48 in 28	-103.0	8 state	18.8	-121.8	1	-122.8	-128.7	4.0	-134.7	32
96 in 56	-100.0	8 state	18.8	-118.8	1	-119.8	-125.7	4.0	-131.7	32
191 in 112	-97.0	8 state	18.8	-115.8	1	-116.8	-122.7	4.0	-128.7	32
8 in 3.5	-110.0	16 QAM	17.6	-127.6	1	-128.6	-134.5	4.0	-140.5	30
16 in 7	-107.0	16 QAM	17.6	-124.6	1	-125.6	-131.5	4.0	-137.5	30
32 in 14	-104.0	16 QAM	17.6	-121.6	1	-122.6	-128.5	4.0	-134.5	30
64 in 28	-101.0	16 QAM	17.6	-118.6	1	-119.6	-125.5	4.0	-131.5	30
128 in 56	-98.0	16 QAM	17.6	-115.6	1	-116.6	-122.5	4.0	-128.5	30
256 in 112	-95.0	16 QAM	17.6	-112.6	1	-113.6	-119.5	4.0	-125.5	30
24 in 7	-104.0	32 QAM	20.6	-124.6	1	-125.6	-131.5	4.0	-137.5	33
49 in 14	-101.0	32 QAM	20.6	-121.6	1	-122.6	-128.5	4.0	-134.5	33

Radio System Type (Mbit/s in MHz)	RSL (dBW)	Modulation type assumed for planning	C/(N+ΣI) (dB)	N+ΣI (dBW)	M_I (dB)	N (dBW)	ΣI (dBW)	n	I (dBW)	W/U (dB)
98 in 28	-98.0	32 QAM	20.6	-118.6	1	-119.6	-125.5	4.0	-131.5	33
196 in 56	-95.0	32 QAM	20.6	-115.6	1	-116.6	-122.5	4.0	-128.5	33
392 in 112	-92.0	32 QAM	20.6	-112.6	1	-113.6	-119.5	4.0	-125.5	33
29 in 7	-100.5	64 QAM	23.8	-124.3	1	-125.3	-131.2	4.0	-137.2	37
58 in 14	-98.0	64 QAM	23.8	-121.8	1	-122.8	-128.7	4.0	-134.7	37
117 in 28	-95.0	64 QAM	23.8	-118.8	1	-119.8	-125.7	4.0	-131.7	37
235 in 56	-92.0	64 QAM	23.8	-115.8	1	-116.8	-122.7	4.0	-128.7	37
470 in 112	-89.0	64 QAM	23.8	-112.8	1	-113.8	-119.7	4.0	-125.7	37
34 in 7	-97.0	128 QAM	26.7	-123.7	1	-124.7	-130.6	4.0	-136.6	40
68 in 14	-95.0	128 QAM	26.7	-121.7	1	-122.7	-128.6	4.0	-134.6	40
137 in 28	-92.0	128 QAM	26.7	-118.7	1	-119.7	-125.6	4.0	-131.6	40
274 in 56	-89.0	128 QAM	26.7	-115.7	1	-116.7	-122.6	4.0	-128.6	40
548 in 112	-86.0	128 QAM	26.7	-112.7	1	-113.7	-119.6	4.0	-125.6	40
39 in 7	-93.5	256 QAM	29.8	-123.3	1	-124.3	-130.2	4.0	-136.2	43
78 in 14	-91.0	256 QAM	29.8	-120.8	1	-121.8	-127.7	4.0	-133.7	43
156 in 28	-88.5	256 QAM	29.8	-118.3	1	-119.3	-125.2	4.0	-131.2	43
313 in 56	-86.0	256 QAM	29.8	-115.8	1	-116.8	-122.7	4.0	-128.7	43
627 in 112	-83.0	256 QAM	29.8	-112.8	1	-113.8	-119.7	4.0	-125.7	43
88 in 14	-87.5	512 QAM	32.4	-119.9	1	-120.9	-126.8	4.0	-132.8	45
176 in 28	-85.0	512 QAM	32.4	-117.4	1	-118.4	-124.3	4.0	-130.3	45
352 in 56	-82.5	512 QAM	32.4	-114.9	1	-115.9	-121.8	4.0	-127.8	45
705 in 112	-80.0	512 QAM	32.4	-112.4	1	-113.4	-119.3	4.0	-125.3	45

52 GHz

Radio System Type (Mbit/s in MHz)	RSL (dBW)	Modulation type assumed for planning	C/(N+ΣI) (dB)	N+ΣI (dBW)	M_I (dB)	N (dBW)	ΣI (dBW)	n	I (dBW)	W/U (dB)
2 in 3.5	-111.5	4 state	13.5	-125.0	1	-126.0	-131.9	4.0	-137.9	26
2x2 in 3.5	-109.0	4 state	13.5	-122.5	1	-123.5	-129.4	4.0	-135.4	26
8 in 7	-105.5	4 state	13.5	-119.0	1	-120.0	-125.9	4.0	-131.9	26
2x8 in 14	-102.5	4 state	13.5	-116.0	1	-117.0	-122.9	4.0	-128.9	26
34 in 28	-99.0	4 state	13.5	-112.5	1	-113.5	-119.4	4.0	-125.4	26
51 in 28	-96.0	16 QAM	17.6	-113.6	1	-114.6	-120.5	4.0	-126.5	30
8 in 3.5	-104.0	16 QAM	17.6	-121.6	1	-122.6	-128.5	4.0	-134.5	30
2x8 in 7	-101.0	16 QAM	17.6	-118.6	1	-119.6	-125.5	4.0	-131.5	30
34 in 14	-98.0	16 QAM	17.6	-115.6	1	-116.6	-122.5	4.0	-128.5	30
51 in 14	-94.0	32 QAM	20.6	-114.6	1	-115.6	-121.5	4.0	-127.5	33
155 in 56	-91.5	16 QAM	17.6	-109.1	1	-110.1	-116.0	4.0	-122.0	30

55 GHz

Radio System Type (Mbit/s in MHz)	RSL (dBW)	Modulation type assumed for planning	C/(N+ΣI) (dB)	N+ΣI (dBW)	M_I (dB)	N (dBW)	ΣI (dBW)	n	I (dBW)	W/U (dB)
2 in 3.5	-111.5	4 state	13.5	-125.0	1	-126.0	-131.9	4.0	-137.9	26
2x2 in 3.5	-109.0	4 state	13.5	-122.5	1	-123.5	-129.4	4.0	-135.4	26
8 in 7	-105.5	4 state	13.5	-119.0	1	-120.0	-125.9	4.0	-131.9	26
2x8 in 14	-102.5	4 state	13.5	-116.0	1	-117.0	-122.9	4.0	-128.9	26
34 in 28	-99.0	4 state	13.5	-112.5	1	-113.5	-119.4	4.0	-125.4	26
51 in 28	-96.0	16 QAM	17.6	-113.6	1	-114.6	-120.5	4.0	-126.5	30
8 in 3.5	-104.0	16 QAM	17.6	-121.6	1	-122.6	-128.5	4.0	-134.5	30
2x8 in 7	-101.0	16 QAM	17.6	-118.6	1	-119.6	-125.5	4.0	-131.5	30
34 in 14	-98.0	16 QAM	17.6	-115.6	1	-116.6	-122.5	4.0	-128.5	30
51 in 14	-94.0	32 QAM	20.6	-114.6	1	-115.6	-121.5	4.0	-127.5	33
155 in 56	-91.5	16 QAM	17.6	-109.1	1	-110.1	-116.0	4.0	-122.0	30

70/80 GHz Ofcom co-ordinated band: 71.125 – 73.125 GHz and 81.125 – 83.125 GHz

Radio System Type *(Mbit/s in MHz)*	*RSL (dBW)*	Modulation type assumed for planning	*C/(N+ΣI) (dB)*	*N+ΣI (dBW)*	*M_I (dB)*	*N (dBW)*	*ΣI (dBW)*	*n*	*I (dBW)*	*W/U (dB)*
35 in 62.5	-102.0	2-PSK	10.5	-112.5	1	-113.5	-119.4	4.0	-125.4	23
71 in 125	-99.0	2-PSK	10.5	-109.5	1	-110.5	-116.4	4.0	-122.4	23
142 in 250	-96.0	2-PSK	10.5	-106.5	1	-107.5	-113.4	4.0	-119.4	23
285 in 500	-93.0	2-PSK	10.5	-103.5	1	-104.5	-110.4	4.0	-116.4	23
427 in 750	-91.0	2-PSK	10.5	-101.5	1	-102.5	-108.4	4.0	-114.4	23
570 in 1000	-90.0	2-PSK	10.5	-100.5	1	-101.5	-107.4	4.0	-113.4	23
71 in 62.5	-100.0	4-PSK	13.5	-113.5	1	-114.5	-120.4	4.0	-126.4	26
142 in 125	-97.0	4-PSK	13.5	-110.5	1	-111.5	-117.4	4.0	-123.4	26
285 in 250	-94.0	4-PSK	13.5	-107.5	1	-108.5	-114.4	4.0	-120.4	26
570 in 500	-91.0	4-PSK	13.5	-104.5	1	-105.5	-111.4	4.0	-117.4	26
855 in 750	-89.0	4-PSK	13.5	-102.5	1	-103.5	-109.4	4.0	-115.4	26
1140 in 1000	-88.0	4-PSK	13.5	-101.5	1	-102.5	-108.4	4.0	-114.4	26
106 in 62.5	-97.0	8-PSK	18.8	-115.8	1	-116.8	-122.7	4.0	-128.7	32
212 in 125	-94.0	8-PSK	18.8	-112.8	1	-113.8	-119.7	4.0	-125.7	32
425 in 250	-91.0	8-PSK	18.8	-109.8	1	-110.8	-116.7	4.0	-122.7	32
850 in 500	-88.0	8-PSK	18.8	-106.8	1	-107.8	-113.7	4.0	-119.7	32
1275 in 750	-86.0	8-PSK	18.8	-104.8	1	-105.8	-111.7	4.0	-117.7	32
1700 in 1000	-85.0	8-PSK	18.8	-103.8	1	-104.8	-110.7	4.0	-116.7	32
142 in 62.5	-94.5	16-QAM	17.6	-112.1	1	-113.1	-119.0	4.0	-125.0	30
285 in 125	-91.5	16-QAM	17.6	-109.1	1	-110.1	-116.0	4.0	-122.0	30

Radio System Type *(Mbit/s in MHz)*	*RSL* *(dBW)*	Modulation type assumed for planning	*C/(N+ΣI)* *(dB)*	*N+ΣI* *(dBW)*	M_I *(dB)*	*N* *(dBW)*	*ΣI* *(dBW)*	*n*	*I* *(dBW)*	*W/U* *(dB)*
570 in 250	-88.5	16-QAM	17.6	-106.1	1	-107.1	-113.0	4.0	-119.0	30
1140 in 500	-88.5	16-QAM	17.6	-103.1	1	-104.1	-110.0	4.0	-116.0	30
1710 in 750	-83.5	16-QAM	17.6	-101.1	1	-102.1	-108.0	4.0	-114.0	30
2280 in 1000	-82.5	16-QAM	17.6	-100.1	1	-101.1	-107.0	4.0	-113.0	30
219 in 62.5	-91.0	32-QAM	20.6	-111.6	1	-112.6	-118.5	4.0	-124.5	33
438 in 125	-88.0	32-QAM	20.6	-108.6	1	-109.6	-115.5	4.0	-121.5	33
875 in 250	-85.0	32-QAM	20.6	-105.6	1	-106.6	-112.5	4.0	-118.5	33
1750 in 500	-82.0	32-QAM	20.6	-102.6	1	-103.6	-109.5	4.0	-115.5	33
2625 in 750	-80.0	32-QAM	20.6	-100.6	1	-101.6	-107.5	4.0	-113.5	33
262 in 62.5	-87.5	64-QAM	23.8	-111.3	1	-112.3	-118.2	4.0	-124.2	37
525 in 125	-84.5	64-QAM	23.8	-108.3	1	-109.3	-115.2	4.0	-121.2	37
1050 in 250	-81.5	64-QAM	23.8	-105.3	1	-106.3	-112.2	4.0	-118.2	37
2100 in 500	-78.5	64-QAM	23.8	-102.3	1	-103.3	-109.2	4.0	-115.2	37
3150 in 750	-76.5	64-QAM	23.8	-100.3	1	-101.3	-107.2	4.0	-113.2	37
306 in 62.5	-84.0	128-QAM	26.7	-110.7	1	-111.7	-117.6	4.0	-123.6	40
612 in 125	-81.0	128-QAM	26.7	-107.7	1	-108.7	-114.6	4.0	-120.6	40
1225 in 250	-78.0	128-QAM	26.7	-104.7	1	-105.7	-111.6	4.0	-117.6	40
2450 in 500	-75.0	128-QAM	26.7	-101.7	1	-102.7	-108.6	4.0	-114.6	40
350 in 62.5	-80.0	256-QAM	29.8	-109.8	1	-110.8	-116.7	4.0	-122.7	43
700 in 125	-77.0	256-QAM	29.8	-106.8	1	-107.8	-113.7	4.0	-119.7	43
1400 in 250	-74.0	256-QAM	29.8	-103.8	1	-104.8	-110.7	4.0	-116.7	43
2800 in 500	-71.0	256-QAM	29.8	-100.8	1	-101.8	-107.7	4.0	-113.7	43

A6. High-Low search radius

Table G1 sets out the High-Low search radius used to check High-Low protocol in each of the frequency bands managed by Ofcom and open to new frequency assignments. The radius defines the fixed link site area. In cases where links are established at the site, the candidate link is normally required to transmit from the same duplex sub-band as established transmitters.

Table G1: High-Low search radius

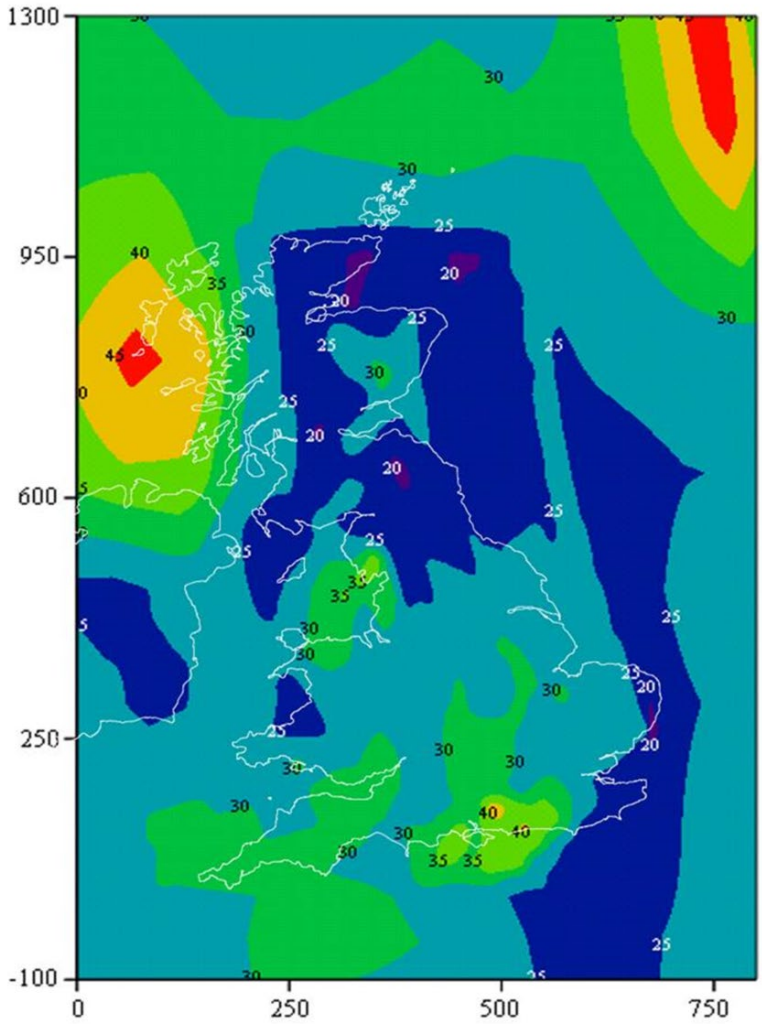
Frequency band (GHz)	High-Low search radius metres
4	500
L6	500
U6	500
7.5	500
8	500
13	500
15	500
18	300
23	200
38	100
52	100
55	100
70/80	100

A7. UK rain-rate map

The contours of the map are for rain-rate (mm/h) exceeded for 0.01% of time.

The map is positioned in relation to the UK according to the following co-ordinates:

Corner	E km	N km
NE	800	1300
SW	0	-100



The map is constructed from British Atmospheric Data Centre and ITU data. A full explanation is given in (legacy) paper RSSP(05-01)/42, available from Ofcom on request.

A8. Document history

Version	Published date	Comments
1.0	February 2009	Consolidation of frequency band-specific TFAC documents.
1.1	February 2009	Minor editorial corrections.
2.0	February 2010	Specification of 4500 kbit/s in 3500 kHz and 9100 kbit/s in 3500 kHz in the 1.4 GHz band. Specification of 155/311 Mbit/s in 27.5 MHz and 8 x STM-0 in 55 MHz in the 18 GHz band. High/Low search radius set to 500 m in the 1.4 and 4 GHz bands. Editorial effort/corrections.
2.1	April 2010	Corrections to RSL values for 2x34 Mbit/s in 27.5 MHz and 155 Mbit/s in 55 MHz in the 18 GHz band.
3.0	November 2010	Specification of 34 Mbit/s in 7 MHz in the 7.5, 13, 15, 18, 23, 26 and 38 GHz bands. Specification of 2x34 Mbit/s in 14 MHz in the 7.5, 13, 23, 26 and 38 GHz bands. Specification of 200 Mbit/s in 28 MHz in the 4, L6, U6, 7.5, 13, 15, 18, 23, 26 and 38 GHz bands. Specification of 155/311 Mbit/s in 28 MHz (SEC 5B) in the 4, L6, U6, 7.5, 13 and 15 GHz bands. Editorial effort/corrections.
3.1	November 2010	Corrections to RSL values for 34 Mbit/s in 7 MHz in the 26 GHz band. Corrections to RSL values for 2 x 34 in 14 MHz in the 26 GHz band. Corrections to RSL values for 155/311 Mbit/s in 30 MHz in the U6 GHz band Corrections to RSL values for 200Mbit/s in 29.65 MHz in the L6, U6 and 26 GHz bands. Removal of criteria for 2 x 34 Mbit/s in 14 MHz (64 QAM option) in the 7.5 GHz band. Minor editorial corrections
4.0	January 2012	Revision of frequency assignment criteria for radio systems using 16 or 128 state modulation. Editorial effort.

5.0	August 2012	Specification of 2 x 34 Mbit/s in 30 MHz in the 4 and U6 GHz bands. Specification of 100 Mbit/s in 30 MHz in the 4 and U6 GHz bands. Specification of 2 x 34 Mbit/s in 29.65 MHz in the L6 GHz band. Specification of 100 Mbit/s in 29.65 MHz in the L6 GHz band. Improved notes on High-Low protocol. Editorial effort.
5.1	August 2012	Editorial corrections.
6.0	December – 2013	Editorial corrections. Specification of frequency assignment criteria for the for 70/80 GHz Ofcom coordinated band: 71.125 – 73.125 GHz and 81.125 – 83.125 GHz. Specification of 51 Mbit/s in 20 MHz in the U6 GHz band. Specification of wider bandwidth channels. 59.3 MHz channel in the L6 GHz, 60 MHz channel in the U6 GHz, 56 MHz channel in 7.5 GHz and 13 GHz bands, 110 MHz channel in the 18 GHz band and 112 MHz channel in the 23 GHz, 26 GHz and 38 GHz bands. Improved guidance on antenna alignment problems.
7.0	December – 2014	Editorial corrections. Addition of new equipment profiles to align with EN 302 217-2-2 V2.2.1 (2014-04).
8.0	March – 2015	Changes to fixed links in the 1.4 GHz band due to the variation of spectrum access licence for 1452 – 1492 MHz
9.0	July – 2015	Addition of new equipment profiles to align with EN 302 217-2-2 V2.2.1 (2014-04) in bands L6GHz to 38GHz. Addition of 62.5 MHz and 125 MHz channels in 70/80 GHz band.
10.0	October – 2016	To reflect the changes in the 4GHz band following publication of the Ofcom 3.6-3.8 GHz consultation document.
11.0	July – 2017	Updating channels availability in the 4 GHz band to reflect changes to the 4 GHz band.
12.0	July – 2018	Updating availability of the 1.4 GHz band to start the process of implementing EC Decision 2018/661. Explanation of fade margin at L6 GHz.
13.0	September – 2019	Removes the 1.4 GHz band which was closed on 5 January 2019 for new applications and technical variations.

		Updates (increases) the number of channels available for assignment in the Ofcom Co-ordinated part of the 70 / 80 GHz band. The update makes the full 2 x 2 GHz available for assignment as part of Occom's channel assignment policy. Minor editorial corrections.
14.0	December - 2019	Addition of 8 GHz band to fixed link point to point product.
15.0	February - 2020	Addition of low capacity channels (1.75 MHz and 3.5 MHz) in the U6 GHz band in accordance with ECC Recommendation 14-06 E including the addition of new equipment profiles to align with EN 302 217 V3.1.1(2017-05).
16.0	May – 2020	Minor editorial, text alignment and formatting issues corrected including correction to the number of available channels in the 8 GHz band, on the 28, 14 and 7 MHz channel rasters.
17.0	August - 2022	Removal of the 26 GHz band which was closed on 18 July 2022 for new applications and technical variations.