



## Appendix 4 – Draft Technical Conditions

### Digital Video Broadcasting Hand Held (DVB-H) Network Technical Conditions under a Mobile TV Wireless Telegraphy Licence

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## 1.1 Purpose

This document specifies draft characteristics for the operation of a Digital Video Broadcasting Hand Held (DVB-H) transmission network under a Mobile TV Wireless Telegraphy Licence.

## 1.2 Definitions

ComReg

Commission for Communications Regulation.

Conditional Access Service Provider

A provider of conditional access services or operator of conditional access systems.

Conditional Access System/Service

A system or service or any part thereof controlling access to digital television services, so that only authorised subscribers receive such services. This includes *Encryption Services*, that is to say, any encryption of signals for digital television services; and the conveyance by such a system of encryption information.

Digital Multiplex

A signal (which in its baseband form is a DVB transport stream, but is a signal with a bandwidth of 8 MHz in UHF when modulated) containing more than one programme service, with associated and other data.

Digital Terrestrial Television System

A Digital Terrestrial Television System is a system used for the transmission of a modulated data stream containing Digital Terrestrial Television (DTT) Digital Multiplexes in the broadcasting bands IV and V intended for direct reception<sup>1</sup> by the general public.

Effective Radiated Power (e.r.p.) (in a given direction)

The product of the power supplied to the antenna and its gain in a given direction relative to a half-wave dipole. This is usually expressed in decibels relative to one watt (dBW).

Encryption

A method of encoding a Programme Service, such that it is only available to subscribers who are authorised to avail of such a service.

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<sup>1</sup> The technical conditions are premised on providing for mobile reception of multiplexes for Mobile TV.

European Standards Body

A body such as ETSI, the IEC or CENELEC, which sets standards for equipment or services.

Licensee

Means the holder of a Mobile TV Wireless Telegraphy Licence (or in the event of the benefits and obligations of the Licence are assigned to a third party – the third party).

Multiplex Contractor

Provider of Programme Service Multiplex, under a Broadcasting Commission of Ireland Multiplex Contract.

Omni directional Antenna

An antenna having a horizontal radiation pattern with variations of 2 dB, or less, over 360 degrees.

Other Service Providers

Operators providing additional Programme Services other than those provided by the licensee.

Programme Services

Programme content and programme-related content.

Programme Service Multiplex ("Multiplex")

A Digital Multiplex containing Programme Services, with associated and other data (which includes a programme service for up to four other providers of distribution services to end users).

Programme Service Provider

A compiler of programme content into a Programme Service.

DVB-H Receiver

Devices, which can receive, demodulate fully and display a Programme Service Multiplex which is either broadcast for general reception or encrypted.

Transmission Station

One or more transmitters or receivers, or a combination of transmitters and receivers, including the associated equipment necessary, at a location set down in the licence for implementing a digital terrestrial television system.

Subscriber Authorisation Services

Means:

- a) the means to actuate or control remotely or otherwise decoders or any other such device; or
- b) the initial transmission of messages connected with the aforesaid.

Subscriber Management Services

Means:

- a) the preparation and/or supply to subscribers of essential components; or
- b) the preparation from subscribers orders of instruction for authorisation signals, for transmission to decoders; or
- c) both.

Technical Services

Means:

- a) those detailed in the definitions for Subscriber Management Services or Subscriber Authorisation Services or
- b) any part thereof which is of a technical nature, which prevents the digitally transmitted services of the Programme Service provider, or the Programme Service Multiplex provider, being accessed by subscribers.

Trans-control

The means where, upon payment of any relevant charges, a Programme Redistribution Operator may access Programme Services and retransmit them, using their own Technical Services.

Transport Stream

A data stream corresponding to the relevant ETSI (DVB) standards carrying MPEG encoded video and associated or other data.

### 1.3 Summary Information

These conditions detail the characteristics of the equipment that need to be considered for the purposes of the provision of service to the subscriber and safety. They do not include detailed equipment specifications.

These conditions also detail those characteristics relevant for ensuring compatibility with other authorised users of the radio frequency spectrum.

The parameters specified in this document are based on harmonised European Standards as revised: including those given in ETSI and CENELEC documents: ISO/IEC 14496-1, 2, 3, 10 for coding standards, EN 301 192, EN 300 744, EN 302 304 and TR 101 190 for the transmission standards.

For conditions not referred to by this document, the licensee shall comply with standards set out in any relevant ETSI, IEC or CENELEC standard relating to DVB-H, which may also include standards relating to DVB-T, as appropriate.

The conditions specified in this document may be revised and/or added to from time to time.

### 1.4 System Engineering:-

#### 1.4.1 General

The mechanical and electrical construction of the installation shall be in accordance with best practice.

The practice of good system engineering is a necessary requirement to ensure the provision of a high quality service and the minimising of the potential for interference to, or from, radio communication services operating in accordance with the Irish Table of Frequency Allocations.

#### 1.4.2 Controls

Controls which, when wrongly adjusted, change the system parameters, increase the risk of interference or cause improper functioning of the transmitter and other appropriate equipment, shall be immediately accessible to qualified personnel only.

#### 1.4.3 Manufacturer's Identification.

The equipment shall be labelled with the manufacturer's trademark, type designation and serial number.

#### 1.4.4 Weather Protection.

All apparatus and cables exposed to weather, corrosive atmosphere, or other adverse conditions shall be so constructed, or protected, as may be necessary to prevent danger, or interference, arising from such exposure.

## 1.5 Installation Certification and Maintenance:-

### 1.5.1 Access and Personnel

The licensee shall, on a request made by an authorised officer of ComReg, facilitate that officer in the inspection<sup>2</sup> of any part of the Multiplex or Transmission Station installation.

Only authorised personnel shall have access to the Digital Multiplex and/or Digital Terrestrial Transmission System for the purpose of adjustment and/or maintenance of that or any associated equipment.

The licensee shall ensure that all authorised personnel are adequately trained for the functions they are to undertake.

### 1.5.2 Examination and Testing

When the installation of equipment is complete, the licensee shall examine the station and indicate to ComReg whether the installation is ready to commence operation in accordance with these conditions. Permission for on-air testing prior to the examination and commencement of regular service can be obtained.

On commencement of operation, the licensee shall inform ComReg of the date of commencement and provide certification indicating that the station is operating in accordance with the specified conditions and characteristics.

### 1.5.3 Maintenance

The Digital Multiplex and Digital Terrestrial Television installation shall be so maintained as to always comply with these conditions. The licensee shall ensure that a suitably qualified person has the necessary technical training, knowledge and practical experience so as to be able to certify that the installation and maintenance of the installation complies with these conditions. The licensee shall ensure that the installation is examined annually to ensure compliance and a log shall be kept indicating the dates and results of these examinations.

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<sup>2</sup> Inspection shall include the undertaking of measurements.

## 2 System Standards:-

### 2.1 Encryption:-

Encryption data may be included in the Transport Stream to enable only authorised subscribers to view certain programmes.

### 2.2 Additional Broadcasting Services:-

Additional Broadcasting Services are Permitted. Any data carried which is an integral part of the programme service shall conform to the methods described in EN 301 192 and observe the guidelines referenced in TR101 202 and TR 101 211.



## 2.3 Transmission characteristics

### 2.3.1 Transmission Standard

The Transmission Standard used shall be the DVB-H standard specified in EN 302 304 in conjunction with the DVB-T standard as specified in EN 300 744.

### 2.3.2 Summary List of Parameters: -

#### **MPEG 4 Encoding Standards**

System	ISO/IEC 14496-1
Video *	ISO/IEC 14496-10, MPEG4 Baseline Profile, Level 1.3.
Audio	ISO/IEC 14496-3, HE AAC
Data (Additional services for general reception)	EN 301 192
Data (Additional services for closed user groups)	EN 301 192
Technical Services (CA Message sections)	TR 101 289

#### **Other Video and Audio Parameters**

<b>SD Video Frame rate</b>	25 Hz
<b>Audio Sampling Frequency</b>	32kHz
<b>Emphasis</b>	None

### 2.3.3 Frequency Spacing and Bands of Operation

Nominal radio-frequency channel bandwidth occupied by a modulated Digital Multiplex for UHF:- Band IV and V	8MHz
Emission Designation; UHF Band IV and V (470 to 862MHz)	8M00X7FXF

## 2.3.4 Modulation

Modulation (COFDM)	X7F
Number of carriers <sup>3</sup>	6817
Carrier Modulation	QPSK or 16QAM
Guard Interval	1/4 to 1/32
Forward Error Correction (FEC) <sup>4</sup>	All

*\*Note: Where a station that is a member of an SFN loses synchronisation, then the output of that station should be reduced by 6dB, or the station should cease transmission, to avoid interference with the remaining synchronised stations.*

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<sup>3</sup> For reasons of spectrum efficiency and to allow for greater flexibility the use of the 2k and 4k DVB-T/H modes are not permitted.

<sup>4</sup> Multi-Protocol Encapsulation Further Error Correction (MPE-FEC) as specified in EN 301 192 is permitted.

### 3 System Performance:-

#### 3.1 Frequency Stability

The equipment shall be designed to operate on the assigned frequency in the frequency Bands, IV and V only.

The frequency tolerance shall be

$$F_s = 8 * 10^6 / 100N$$

$F_s$       Frequency Stability  
 $N$         No of carriers

Or

- $\pm 250$  Hz, for transmitters for which the licence characteristics do not require the use of offset and are part of a Multi Frequency Network.
- $\pm 1$  Hz, for transmitters for which the licence characteristics require the use of offset or are part of a single frequency network

The transmitter frequency adjustment control shall be accessible to qualified personnel only.

##### 3.1.1 Power

As the total effective radiated power is the sum of the transmitter output power (in dBW) and the gain of the antenna (in dB), the output power of transmitter shall be adjustable so that the value of the effective radiated power permitted for each station is not exceeded.

If the equipment is designed to operate with different levels of power, the rated output power for each power level must be declared by the manufacturer.

#### 3.2 Maximum Permitted Levels of Spurious Emissions

The maximum permitted level of spurious emission for a transmitting station shall be:-

- at least 40 dB below the transmitter e.r.p. and shall not in any case:-  
exceed -46 dBW for a transmitter e.r.p. less than, or equal to, 14dBW.
- at least 60dB below the transmitter e.r.p. and shall not in any case:-  
exceed -17 dBW for transmitter e.r.p. above 14 dBW.

### 3.3 Overview of National Band Plan:-

#### 3.3.1 Frequency Channels and Standard Groups

The applicable frequency bands for the broadcast of DVB-H signals are UHF bands IV and V.

Transmission station(s) may initially have coverage in excess of the planned service area (depending on whether the station is noise or interference limited, which may depend on the operation of other existing or planned stations e.g. for DTT or other services). With the introduction of additional stations, which may be used for other broadcasting or non-broadcasting services, it is to be expected that any extended service area will be reduced to an interference limited coverage area.

#### 3.3.2 Assignment List

A list of the Assignments, which constitute the national plan, will be maintained by ComReg.

#### 3.3.3 Planning Parameters

The planning parameters used by ComReg correspond to those set out in the Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Region 1 and 3, in the frequency band 470 – 862 MHz, Geneva 2006 (GE06). This was a conference convened by the ITU. A summary of these parameters is given in Appendix A

#### 3.3.4 Additional and Modified Assignments:-

##### 3.3.4.1 Requisite information

The licensee shall provide ComReg with all the necessary details in support of an application for an additional assignment, or a modification of an existing assignment.

##### 3.3.4.2 Examination

The licensee shall examine any proposal for an additional, or modified, assignment with regard to other persons having assignments in the same frequency segment.

##### 3.3.4.3 Field Strength Measurements

It may be necessary to supply field strength measurements in support of an application or an interference complaint.

##### 3.3.4.4 International Agreements

ComReg is bound by the provisions of the Radio Regulations and the Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Region 1 and 3, in the frequency bands 174 – 230 MHz and 470 – 862 MHz, Geneva 2006 (GE-06) in relation to aspects of UHF and VHF Band III broadcast television services. These agreements require ComReg to

undertake certain co-ordination and registration procedures when considering additions / modifications of the assignment plan.

A minimum of three months is allowed for co-ordination. However, co-ordination of additional or modified assignments cannot be guaranteed. The licensee shall allow adequate time in planning, and provide ComReg with the relevant information, to ensure compliance with these agreements.

3.3.5 Information to be submitted to ComReg: -

3.3.5.1 Update of System Information

The licensee shall, upon request from ComReg, submit in a format specified by ComReg:

- An up to date frequency plan indicating the Digital Multiplex on any given frequency channel;
- An updated network diagram/map of the Digital Television System, clearly indicating the most up to date geographical area of operation of the Digital Television System; and
- Any additional information required by ComReg within 21 days of the receipt of the request.

## 4 Conditions for the Operation of Conditional Access Systems:-

### 4.1 Condition 1; Conditional Access Standards:-

Licensees in the State, intending to use the above Conditional Access Systems as defined or part thereof, must use either of the systems referred to in subparagraph a) or b) below.

- a) Multicrypt technology, as specified in CENELEC standards EN50221 and R 206001.
- b) Simulcrypt technology, as specified in ETSI standards TS 101 197-1, 101 197-2.

Licensees must ensure that any DVB-H Handset offered for sale, lease or rent by them or their agents is fully labelled to indicate the equipment functionality and that all user manuals clearly document any limitations of the equipment.

### 4.2 Condition 2; Service Obligations for Conditional Access Service Providers:-

#### 4.2.1 Non Discrimination

Any Technical Services, in respect of the licensee's Conditional Access System, offered by the licensee to a programme service provider or a Multiplex Contractor shall be offered on a fair, reasonable and non-discriminatory basis.

#### 4.2.2 Co-operation

If any Technical Service is provided under subparagraph 5.3.1 the licensee shall co-operate with the programme service provider or Multiplex Contractor and do whatever is required, within reason, to ensure the interconnection and or interoperability of the relevant system and all associated apparatus for provision and maintenance of Technical Services.

#### 4.2.3 Proportionality of Incremental Expenditure

The licensee shall not cause the programme service provider or Multiplex Contractor to incur costs or incremental expenditure in interfacing with the licensee's apparatus or systems greater than the initial charge for the Technical Service or disproportionate to the benefit to be gained from the use of the Technical Services.

#### 4.3 Condition 3, Cost Effective Trans-control:-

##### 4.3.1 Effecting Trans-control

Where the licensee (or Multiplex Contractor) provides to a programme service provider any Technical Service in relation to the provision of digital video services; and the programme service provider's digital video services are provided to other service providers for the purpose of distribution;

The licensee shall co-operate with and assist other services providers, providing all information and assistance necessary to facilitate cost effective trans-control, whereby the other service providers can trans-control and distribute the digital video service using its own Technical Services.

##### 4.3.2 Licensees Responsibility for Third Party Services

The licensee shall be responsible for third party services where the licensee does not provide any Technical Services but contracts a Conditional Access Service Provider to provide Technical Services in relation to the provision of programme services, which programme services, are then provided to other service providers.

Furthermore the licensee shall make all reasonable efforts to ensure that the Conditional Access Service Provider co-operates and assists other service providers, providing all information and assistance necessary to facilitate cost-effective trans-control, whereby:- other service providers can trans-control and distribute the digital video service using its own Technical Services.

#### 4.4 Prohibition on Linked Sales:-

##### 4.4.1 Attachment of Conditions

The licensee or Conditional Access Service Provider shall not attach any condition on the provision of Technical Services where such condition requires the purchase of:-

- a) another service from the licensee, except where the service is essential for the operation of the Technical Service requested; or
- b) any apparatus or system, unless the requested Technical Service cannot be provide without such apparatus or system.

## Appendix A; Planning Parameters

**Note:** As a DVB-H signal uses the same modulation scheme as DVB-T: It is considered that the interference from a DVB-T signal into an analogue television<sup>5</sup> signal is the same as that from a DVB-H signal into an analogue television signal and vice versa.

Table 1.0

Parameter	Description	Value used
Propagation using terrain data	Wanted Signal: Unwanted Signal, Domestic: Unwanted Signal, DVB-T and RBL <sup>6</sup> :	50% location, 50% time 50% location, 5% time 50% location, 1% time
Quality of service	Continuous Interference: Tropospheric Interference:	Grade 4 <sup>7</sup> Grade 3 <sup>8</sup>
Polarisation Discrimination	Domestic: RBL:	15 dB 20 dB

Table 2.0

Parameter	Description	Value used
Maximum Receive antenna directivity	Domestic: RBL:	16 dB 20 dB

*Analogue television (for information)*

Table 3.0

Parameter	Description	Value used
Analogue Protection Ratios	Co-channel, continuous	52 dB, no offset
		40 dB, 3/12 line offset
	Co-channel, tropospheric	45 dB, no offset
		30 dB, 3/12 line offset
	Lower Adjacent Channel	-9 dB, tropospheric
	Upper Adjacent Channel	-12 dB, tropospheric
	Image channel	-10 dB, tropospheric
Local oscillator channel	-10 dB, tropospheric	
Analogue Protection Ratios, with precision offset	Continuous, no offset	36 dB
	Tropospheric, no offset	32 dB
	Continuous, 3/12 line offset	27 dB
	Tropospheric, 3/12 line offset	22 dB

Table 4.0

Parameter	Description	Value used
Analogue, PAL I interfered with by DVB-T 8 MHz.	Co-channel, continuous	40 dB
	Co-channel, tropospheric	34 dB
Analogue vision signal interfered with by a DVB-T 8 MHz channel.	Lower adjacent, continuous	-5 dB
	Lower adjacent, Tropospheric	-9 dB
	Upper adjacent, continuous	-5 dB

<sup>5</sup> Final Acts of the GE-06 Treaty – (Annex 3)

<sup>6</sup> Radio Broadcasting Link

<sup>7</sup> Grade 4: Perceptible, but not annoying

<sup>8</sup> Grade 3: Slightly annoying



	Upper adjacent, tropospheric	-8 dB
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*Digital Video Broadcasting – Terrestrial (DVB-T)*

Table 5.0

Parameter	Description	Value used
Protection ratios for co-channel DVB-T interfered with by DVB-T, for mobile reception.	QPSK 1/2	11.00 dB
	QPSK 2/3	14.00 dB
	QPSK 3/4	14.70 dB
	QPSK 5/6	16.00 dB
	QPSK 7/8	17.10 dB
	16-QAM 1/2	16.00 dB
	16-QAM 2/3	19.00 dB
	16-QAM 3/4	21.00 dB
	16-QAM 5/6	22.40 dB
	16-QAM 7/8	23.10 dB

Table 6.0

Parameter	Description	Value used
Protection ratios for co-channel DVB-T interfered with by DVB-T, for portable indoor reception.	QPSK 1/2	8.00 dB
	QPSK 2/3	11.00 dB
	QPSK 3/4	11.70 dB
	QPSK 5/6	13.00 dB
	QPSK 7/8	14.10 dB
	16-QAM 1/2	13.00 dB
	16-QAM 2/3	16.00 dB
	16-QAM 3/4	18.00 dB
	16-QAM 5/6	19.40 dB
	16-QAM 7/8	20.10 dB

Table 7.0

Parameter	Description	Value used
Protection ratios for DVB-T interfered with by DVB-T.	Lower adjacent	-30 dB
	Upper adjacent	-30 dB

Table 8.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, mobile reception, interfered with by co-channel analogue television.	QPSK 1/2	- 12.0 dB	- 9.0 dB
	QPSK 2/3	- 8.0 dB	- 5.0 dB
	QPSK 3/4	- 4.0 dB	2.6 dB
	QPSK 5/6	3.0 dB	9.8 dB
	QPSK 7/8	9.0 dB	16.0 dB
	16-QAM 1/2	- 8.0 dB	- 5.0 dB
	16-QAM 2/3	- 3.0 dB	6.0 dB
	16-QAM 3/4	0.0 dB	8.0 dB
	16-QAM 5/6	9.0 dB	15.8 dB
	16-QAM 7/8	16.0 dB	23.0 dB

Table 9.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, portable indoor reception, interfered with by co-channel analogue television.	QPSK 1/2	- 12.0 dB	- 12.0 dB
	QPSK 2/3	- 8.0 dB	- 8.0 dB
	QPSK 3/4	- 4.0 dB	- 0.4 dB
	QPSK 5/6	3.0 dB	6.8 dB
	QPSK 7/8	9.0 dB	13.0 dB
	16-QAM 1/2	- 8.0 dB	-8.0 dB
	16-QAM 2/3	- 3.0 dB	3.0 dB
	16-QAM 3/4	0.0 dB	5.0 dB
	16-QAM 5/6	9.0 dB	12.8 dB
	16-QAM 7/8	16.0 dB	20.0 dB

Table 10.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, mobile reception, interfered with by lower adjacent (N – 1) analogue television.	QPSK 1/2	- 44.0 dB	- 41.0 dB
	QPSK 2/3	- 44.0 dB	- 41.0 dB
	QPSK 3/4	- 42.9 dB	- 39.9 dB
	QPSK 5/6	- 41.8 dB	- 38.8 dB
	QPSK 7/8	- 40.9 dB	- 37.9 dB
	16-QAM 1/2	- 43.0 dB	- 40.0 dB
	16-QAM 2/3	- 42.0 dB	- 39.0 dB
	16-QAM 3/4	- 38.0 dB	- 35.0 dB
	16-QAM 5/6	- 39.4 dB	- 36.4 dB
	16-QAM 7/8	- 38.9 dB	- 35.9 dB

Table 11.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, portable indoor reception, interfered with by lower adjacent (N – 1) analogue television.	QPSK 1/2	- 44.0 dB	- 44.0 dB
	QPSK 2/3	- 44.0 dB	- 44.0 dB
	QPSK 3/4	- 42.9 dB	- 42.9 dB
	QPSK 5/6	- 41.8 dB	- 41.8 dB
	QPSK 7/8	- 40.9 dB	- 40.9 dB
	16-QAM 1/2	- 43.0 dB	- 43.0 dB
	16-QAM 2/3	- 42.0 dB	- 42.0 dB
	16-QAM 3/4	- 38.0 dB	- 38.0 dB
	16-QAM 5/6	- 39.4 dB	- 39.4 dB
	16-QAM 7/8	- 38.9 dB	- 38.9 dB

Table 12.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, mobile reception, interfered with by upper adjacent (N + 1) analogue television.	QPSK 1/2	- 48.9 dB	- 45.9 dB
	QPSK 2/3	- 47.0 dB	- 44.0 dB
	QPSK 3/4	- 45.9 dB	- 42.9 dB
	QPSK 5/6	- 44.8 dB	- 41.8 dB
	QPSK 7/8	- 43.9 dB	- 40.9 dB
	16-QAM 1/2	- 45.4 dB	- 42.4 dB
	16-QAM 2/3	- 43.0 dB	- 40.0 dB
	16-QAM 3/4	- 41.5 dB	- 38.5 dB
	16-QAM 5/6	- 40.4 dB	- 37.4 dB
	16-QAM 7/8	- 39.9 dB	- 36.9 dB

Table 13.0

Parameter	Description	Gauss	Value used
Protection ratios for DVB-T, portable indoor reception, interfered with by upper adjacent (N + 1) analogue television.	QPSK 1/2	- 48.9 dB	- 48.9 dB
	QPSK 2/3	- 47.0 dB	- 47.0 dB
	QPSK 3/4	- 45.9 dB	- 45.9 dB
	QPSK 5/6	- 44.8 dB	- 44.8 dB
	QPSK 7/8	- 43.9 dB	- 43.9 dB
	16-QAM 1/2	- 45.4 dB	- 45.4 dB
	16-QAM 2/3	- 43.0 dB	- 43.0 dB
	16-QAM 3/4	- 41.5 dB	- 41.5 dB
	16-QAM 5/6	- 40.4 dB	- 40.4 dB
	16-QAM 7/8	- 39.9 dB	- 39.9 dB

#### 4.4.2 Minimum Field Strength

The minimum field strengths used in planning are:-

*DVB-T, Band IV/V (470 - 862 MHz)*

Table 14.0

Parameter	Description	Value used
Minimum median field-strength values (dB( $\mu$ V/m)) for mobile reception at reference frequency 500 MHz.	QPSK 1/2	67.10
	QPSK 2/3	69.20
	QPSK 3/4	70.50
	QPSK 5/6	71.80
	QPSK 7/8	72.90
	16-QAM 1/2	72.80
	16-QAM 2/3	75.40
	16-QAM 3/4	77.10
	16-QAM 5/6	78.40
	16-QAM 7/8	79.10

Table 15.0

Parameter	Description	Value used
Minimum median field-strength values (dB( $\mu$ V/m)) for portable indoor reception at reference frequency 500 MHz.	QPSK 1/2	76.10
	QPSK 2/3	78.20
	QPSK 3/4	79.50
	QPSK 5/6	80.80
	QPSK 7/8	81.90
	16-QAM 1/2	81.80
	16-QAM 2/3	84.40
	16-QAM 3/4	86.10
	16-QAM 5/6	87.40
	16-QAM 7/8	88.10

The minimum median field-strengths given in the above tables 14 – 15 (above) are for reference frequency, 500 MHz (Band IV/V). For other frequencies, the following interpolation rule shall be used:-

$$E_{med(f)} = E_{med(fr)} + Corr$$

where:

$E_{med(fr)}$  The minimum median field strength at the reference frequency in dB $\mu$ V/m,  
 $E_{med(f)}$  The minimum median field strength at the actual frequency in dB $\mu$ V/m,

Mobile and Portable reception:-

$Corr = 30 \log_{10}(f/fr)$ ,  $f$  is the actual frequency,  $fr$  is the reference frequency.

The above values are for 1.5 metres above ground level for mobile and portable indoor reception.

Protection cannot be sought for locations with a field-strength below the values mentioned above.