



Commission for  
**Communications Regulation**

## Technical Conditions

### Appendix A Digital Sound Broadcasting Multiplex Licence - Technical Conditions

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## 1 Purpose

This document specifies the general conditions attached to a licence for Digital Sound Broadcasting Systems in LF, MF, VHF band III and L band; including Digital Audio Broadcasting (DAB), DAB+ and Digital Radio Mondial (DRM).

## 2 Summary Information

These conditions detail the characteristics of the equipment that need to be considered for the purposes of frequency spectrum management, safety and the provision of a satisfactory service to the subscriber. 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 mainly based on those given in European Telecommunications Standards Institute (ETSI) documents: EN 300-401, 300-797, 300-798, ETS 300-799, TS 102-563, 102-428 and ES 201-980.

For issues not referred to by this document, the licensee shall comply with standards set out in any relevant ETSI, International Electrotechnical Commission (IEC) or European Committee for Electrotechnical Standardization (CENELEC) standard relating to DAB, DAB+ or DRM.

The Commission for Communications Regulation does not require evidence of type approval of equipment. Instead a procedure of system audits will apply.

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

Nothing contained in these conditions shall absolve the licensee from any requirement in law to obtain whatever additional consents, permissions, authorisations, or licences that may be necessary for the exercise of entitlements under the licence.

### 3 Definitions

“Carrier to Noise ratio” means the difference in decibels between the carrier level at a given point in the system and the noise level at that point (measured within a bandwidth appropriate to the system in use).

“Commission” means the Commission for Communications Regulation.

“Digital Audio Broadcasting (DAB)” means a Digital Sound Broadcasting System in the broadcasting band III and L band in accordance with the relevant ETSI (DAB) standards and intended for direct reception by the general public.

“Digital Sound Broadcasting System” means a system used for the transmission of a modulated data stream containing Programme Services intended for direct reception by the general public.

“Digital Multimedia Broadcasting (DMB)” means a Digital Sound Broadcasting System in the broadcasting band III, in accordance with the relevant ETSI standards and intended for direct reception by the general public.

“Digital Radio Mondial (DRM)” means a Digital Sound Broadcasting System in the broadcasting bands LF, MF and HF, in accordance with the relevant ETSI standards and intended for direct reception by the general public.

“Effective Antenna Height (Eff. Ht.)” means the height in metres above the average level of the ground between distances of 3 and 15 km from the transmitter. This is calculated for each of 36 evenly spaced radials (10 degree separation) starting from true North<sup>1</sup>.

“Effective Radiated Power (ERP)” means 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).

“HE AAC” means High Efficiency Advanced Audio Coding, as specified in ISO/IEC 14496-3

“Ensemble” means a signal (which in its baseband form is a DAB Transport Stream, but is a signal with a bandwidth of 1.536 MHz when modulated) containing more than one programme service, with associated and other data.

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<sup>1</sup> Note: This takes into account both the height of the site (a.s.l) and the height of the mast (a.g.l). This can be calculated by the Commission using the national grid reference for the transmitting station, consisting of one letter and six digits, provided the site height above sea level and the antenna height above ground level are supplied.

“European Standards Body” means a body such as the European Telecommunications Standards Institute ETSI, International Electrotechnical Commission (IEC) or European Committee for Electrotechnical Standardization (CENELEC), which specifies standards for equipment or services.

“Interference” means interference with the working of, or interference which otherwise injuriously affects, any apparatus for wireless telegraphy in respect of which a licence has been granted under the Wireless Telegraphy Acts 1926 to 1988 and is in force, or any apparatus for wireless telegraphy lawfully maintained or worked without any such licence or any broadcasting station maintained under Part II of the Act of 1926 or under the Broadcasting Authority Act, 1960;

“Licence” means a licence in respect of the establishment, maintenance and operation of a sound broadcasting multiplex issued by the Commission under the Broadcasting (Amendment) Act 2007, Wireless Telegraphy Acts 1926 to 1988 and, where relevant, under the Broadcasting Authority Act 1960 to which these Technical Conditions apply.

“Licensee” Means the holder of a Digital Sound Broadcasting Multiplex licence or any party to whom the benefits and obligations of the Licence have been assigned to.

“Multiplex” means an electronic system which combines programme material and related and other data in a digital form and the transmission of that material and data so combined by means of wireless telegraphy directly or indirectly for reception by the general public.

“Omnidirectional Antenna” means an antenna having a horizontal radiation pattern with variations of 2 dB, or less, over 360 degrees.

“Programme Service Provider” means a provider of sound broadcasting programmes.

“Programme Service” means a sound broadcasting programme.

“Sound broadcasting multiplex” means a multiplex in which the programme material is predominantly sound.

“Station” means one or more transmitters or receivers, or a combination of transmitters and receivers, including necessary associated equipment, at one location implementing a Digital Sound Broadcasting System.

“Transport Stream” means a data stream corresponding to the relevant ETSI standards carrying digitally encoded audio, associated and other data.

## 4 System Engineering

### 4.1 System Transparency

Unless specifically excluded by the Licence, the Digital Sound Broadcasting System shall be designed in such a manner that it is capable of relaying all components within a Programme Service<sup>2</sup> intended for general reception<sup>3</sup>.

### 4.2 General

The mechanical and electrical construction of the Digital Sound Broadcasting System shall be in accordance with best practice.

Digital Sound Broadcasting System engineering and maintenance is necessary to ensure the provision of System Performance (see section 6) and to minimise the potential for interference to, or from, radio communication services operating in accordance with the Irish Table of Frequency Allocations

#### 4.2.1 Transmitter Construction

All controls, meters, indicators and terminals shall be clearly labelled. Details of the main and any auxiliary power supply from which the equipment is intended to operate shall be clearly indicated. The equipment should be housed in one complete unit.

Controls which, when wrongly adjusted, increase the risk of causing interference, or of improper functioning of the transmitter, shall be immediately accessible to qualified personnel only.

The transmitter and associated equipment shall be labelled with the manufacturer's trademark, type designation and serial number. The label shall be fitted on the outside of the transmitter and associated equipment, and shall be clearly readable, non-removable and indelible.

#### 4.2.2 Access and Personnel

The licensee shall, on a request made by an authorised officer of the Commission, facilitate that officer in the inspection<sup>4</sup> of any part of the Digital Sound Broadcasting System.

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<sup>2</sup> While not intended for reception by the general public, broadcast organisations include test signals in the Transport Stream. The Digital Sound Broadcasting System must be transparent to these signals so as to facilitate performance measurements.

<sup>3</sup> While the Digital Sound Broadcasting System shall be designed to relay all the components within an audio signal, the actual components relayed shall take account of the copyright arrangements between the licensee and the service provider.

<sup>4</sup> Inspection shall include the undertaking of measurements



Only authorised personnel shall have access to the Digital Sound Broadcasting Multiplex for the purpose of adjustment and maintenance. The licensee shall ensure that all authorised personnel are adequately trained for the functions they are to undertake.

#### 4.2.3 Examination, Testing and Maintenance

Adequate and accurately calibrated test equipment shall be made available to the Commission, for non-radiative measurements of transmitter power, modulation characteristics and spurious emissions whilst the station is undergoing initial alignment and regular maintenance.

Permission for installation and commissioning transmissions prior to the examination and commencement of regular service can be obtained from the Commission. On commencement of operation, the licensee shall inform the Commission of the date of commencement and provide certification indicating that the station is operating in accordance with the specified conditions and characteristics.

The transmission 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 station complies with these conditions. The licensee shall examine a station annually to ensure compliance and shall keep a log indicating the dates, and results, of these examinations.

A copy of any maintenance programme and the log shall be made available to an authorised officer of the Commission upon request.

#### 4.2.4 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.

## 5 System Standards

### 5.1 DAB Transmission Standard

The Transmission Standard used shall be the DAB (Eureka 147) standard as specified in EN 300-401.

#### 5.1.1 Frequency Spacing and Bands of Operation

Nominal radio-frequency channel bandwidth of an Ensemble	1.536MHz
Frequency Bands	III, and L

#### 5.1.2 Modulation (band III)

Modulation (COFDM)	X7E
Number of carriers	1536
Carrier Modulation	QPSK,
Guard Interval*	246µS

#### 5.1.3 Modulation (L band)

Modulation (COFDM)	X7E
Number of carriers	384
Carrier Modulation	QPSK,
Guard Interval*	62µS

*\*Note: Where a station is a member of a Single Frequency Network (SFN) and 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.*

#### 5.1.4 DAB Emission Designation

VHF Band III      1M54X7EXF  
 L Band            1M54X7EXF

## 5.2 DRM Transmission Standard

The Transmission Standard used shall be the DRM standard as specified in ES 201 980.

### 5.2.1 Frequency Spacing and Bands of Operation

Nominal radio-frequency channel bandwidth	9kHz
Frequency Bands	LF and MF

### 5.2.2 Modulation (LF)

Modulation (COFDM)	X7E
Number of carriers	204
Carrier Modulation	64QAM
Guard Interval	2.66mS

### 5.2.3 Modulation (MF)

Modulation (COFDM)	X7E
Number of carriers	204
Carrier Modulation	64QAM
Guard Interval	2.66mS

*\*Note: Where a station is a member of a Single Frequency Network (SFN) and 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.*

### 5.2.4 DRM Emission Designations

LF            9KX7EXF  
 MF            9KX7EXF

## 5.3 Additional Broadcast Services

### 5.3.1 Format of Additional Broadcast Services

Additional broadcast services may be provided by the licensee in accordance with ETSI TS 102 427.

### 5.3.2 Additional Broadcast Services Requiring Authorisation

Licensees must seek the express prior approval of the Commission to use the services detailed in ETSI TS 102 428.

## 6 System Performance

### 6.1 Impairment Quality

The performance limits set out in this section applies in the presence of all signals for which an Ensemble or Multiplex serves.

There are three main forms of audible interference to a Digital Sound Broadcasting service. These are exhibited by audible artefacts, such as an absence of service, distortion and stereo image shift.

The signal should be free from these or other audible degradation for 99% of the time at 99% of locations served

### 6.2 Frequency Offset and Stability

In all cases the transmitter frequency adjustment control shall be accessible to qualified personnel only.

#### 6.2.1 VHF Band III

A frequency offset of

$$f_c \pm 1/T_u$$

may be used, where;

$f_c$  is the centre frequency of the channel and

$T_u$  is the usable part of the OFDM symbol.

The equipment shall be designed to operate on the assigned frequency in the appropriate frequency band only.

The frequency tolerance shall be

$$F_s = Bw/100N$$

$F_s$	Frequency Stability
$Bw$	Bandwidth
$N$	No of carriers

#### 6.2.2 LF/MF

$$F_s \leq 10\text{Hz}$$

### 6.3 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.

### 6.4 Maximum Permitted Levels of Spurious Emissions

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

- LF/MF: 50dBc or not greater than 50mW;
- VHF Band III:  $46+10\log(P^5)$ , 60dBc or not greater than 1mW.

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<sup>5</sup> P = mean power of the device.

## 7 Safety

### 7.1 General Safety and Safety Controls.

The Station and its premises must comply with all relevant statutory safety regulations.

There shall be a single control to isolate power for the entire installation. If a form of auxiliary power (such as diesel generators or an un-interruptible power supply) is provided, then the same control should isolate these. The 'on' position of such a device must be clearly indicated. Guards or key switches may be fitted to the device to prevent accidental operation.

### 7.2 Safety Standards

The system must comply with I.S./EN 60215: 1990 *Safety Requirements for Radio Transmitting Equipment*.

This standard is available from the National Standards Authority of Ireland.<sup>6</sup>

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<sup>6</sup>Please note that the standard ENV 50166-2 is a European Pre standard and shall be replaced by the respective European Standard when it becomes available.

## 8 Information to be Submitted to the Commission

### 8.1 General

Upon receipt of a request from the Commission, the licensee shall provide the following:

- a complete and up-to-date frequency plan indicating, for each programme service in the Ensemble or Multiplex, the programme name, position and ID; and/or
- an updated network diagram or map of the Digital Sound Broadcasting System system, clearly indicating the most up to date geographical area of operation of it.

The licensee shall notify the Commission immediately following any change to the above.

### 8.2 Additional and Modified Assignments

#### 8.2.1 Requisite information

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

#### 8.2.2 Examination

The licensee shall examine an application for an additional, or modified, assignment with due regard to other spectrum users, nationally and internationally, having assignments in the same frequency segment.

#### 8.2.3 Field Strength Measurements

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

## 9 Annex 1: Planning Parameters

### 9.1 LF / MF

DRM is designed to operate in accordance with the Regional Agreement, Geneva 1975 (GE75); DRM is required to operate with 7dB less power than the analogue station under GE75 which it replaces.

### 9.2 VHF Band III

In accordance with GE06

#### 9.2.1 Protection ratio for DAB/DAB+ interfered with by DAB/DAB+

For DAB/DAB+ vis-à-vis DAB/DAB+, the protection ratio of 15dB shall be used.

#### 9.2.2 Protection Ratios for DAB/DAB+ interfered with by DVB-T 8 MHz system

Table A1: Protection Ratios for DAB/DAB+ interfered with by DVB-T 8 MHz system

$\Delta f$ (MHz)	-5	-4.2	-4	-3	0	3	4	4.2	5
PR (dB) Mobile and Portable reception	-43	6	7	8	8	8	7	6	-43
PR (dB) Gaussian Channel	-50	-1	0	1	1	1	0	-1	-50

**Note:** Frequency separation ( $\Delta f$ ): centre frequency of the DVB-T signal minus centre frequency of the T-DAB signal.

#### 9.2.3 Protection Ratios for DAB/DAB+ interfered with by DVB-T 7 MHz system

Table A2: Protection Ratios for DAB/DAB+ interfered with by DVB-T 7 MHz system

$\Delta f$ (MHz)	-4.5	-3.7	-3.5	-2.5	0	2.5	3.5	3.7	4.5
PR (dB) Mobile and Portable reception	-42	7	8	9	9	9	8	7	-42
PR (dB) Gaussian Channel	-49	0	1	2	2	2	1	0	-49

**Note:** Frequency separation ( $\Delta f$ ): Centre frequency of the DVB-T signal minus centre frequency of the DAB signal.



9.2.4 Protection ratios for DAB/DAB+ interfered with by analogue television system I/PAL (Band III)

Table A3: Protection ratios for DAB/DAB+ interfered with by analogue television system I/PAL (Band III)

$\Delta f$ (MHz)	-8	-7.5	-7	-6.5	-6	-5.5	-5	-4.5	-4
PR(dB)	-42	-23.5	-10	-3	-2	-3	-24	-21	-23
$\Delta f$ (MHz)	-3.5	-3	-2.5	-2	-1.5	-1	-0.9	-0.8	-0.7
PR(dB)	-31	-31.5	-30	-28.5	-25	-19.5	-17.5	-11	-7
$\Delta f$ (MHz)	-0.6	0	0.6	0.7	0.8	0.9	1	2	3
PR(dB)	-1.5	-1.5	-4	-5.5	-13.5	-17	-20	-33	-47.5

**Note:** Frequency separation ( $\Delta f$ ): Analogue system vision carrier frequency minus DAB centre frequency.

9.2.5 Protection ratios for analogue television (vision signals) interfered with by DAB/DAB+

Figure 1 and Table A4 give protection ratios for negative modulated vision signals interfered with by a 1.5 MHz wide COFDM signal according to the DAB/DAB+ system (see Recommendation ITU-R BS.1114). A reduction of 2 dB should be applied for positive modulated vision signal in the range from -1 MHz to 5 MHz.

Figure 1: Protection ratios for analogue television (vision signals) interfered with by DAB/DAB+

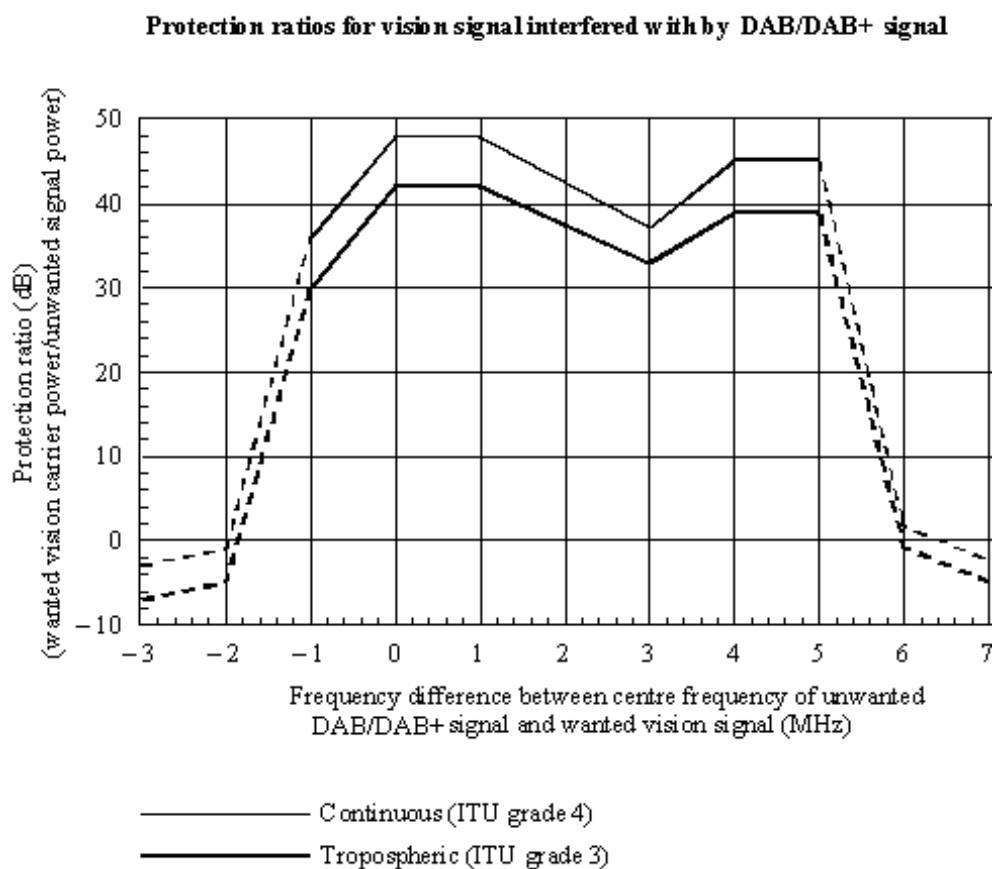


Table A4: Protection ratios for DAB/DAB+ interfered with by analogue television system I/PAL (Band III)

Protection Ratio (dB)	Frequency difference between unwanted and wanted carriers (MHz)													
	Luminance Range							Chrominance range						
	-3.0	-2.5	-2.0 <sup>(1)</sup>	-1.0	0.0	1.0	3.0	4.0	5.0	6.0 <sup>(2)</sup>	6.5 <sup>(3)</sup>	7.0 <sup>(4)</sup>	7.5 <sup>(5)</sup>	8.0
<b>Tropospheric interference (T)</b>	-7	-6	-5	30	42	42	33	39	39	-1	-3	-5	-7	-9
<b>Continuous interference</b>	-3	-2	-1	36	48	48	37	45	45	2	0	-2	-4	-6

(1) Only B/PAL, D1/PAL.  
 (2) Only B/PAL, D1/PAL.  
 (3) Only B/PAL, I/PAL.  
 (4) Only B/PAL, I/PAL, D/PAL, D1/PAL.  
 (5) B/PAL, I/PAL, D/PAL, D1/PAL.

### 9.3 L Band

In accordance with MA02revCO07

#### 9.3.1 Intra-service (DAB interfered with by DAB)

**Table A5:** Intra-service (DAB interfered with by DAB)

	Protection Ratio (dB)	Propagation Correction Factor to protect wanted T-DAB signals for 99% locations (dB)	Minimum median equivalent field strength (dBµV/m)	Maximum permissible field strength at contour of an allotment (dBµV/m)
<b>DAB interfered with by co-block DAB</b>	10	18	69	41* based on (69 -10 - 18)
<b>DAB interfered with by adjacent DAB block</b>	-30	18	69	81* based on (69 -(-30) - 18)

\* In the case of Reference Network 2 and Reference Network 3 this value should be increased by 2 and 4 dB respectively.