Annex to Information Notice

Digital Audio Broadcasting

Technical Conditions

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CONTENTS

TECHNICAL CONDITIONS RELATING TO THE ESTABLISHMENT AND OPERATION OF DIGITAL AUDIO BROADCASTING SYSTEMS IN THE BROADCASTING BAND III AND IN L BAND

1 Purpose

This document specifies the general conditions attached to a licence for a Digital Audio Broadcasting System.

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 ETSI documents: ETS 300-401, 300-797, 300-798, and ETS 300-799.

For issues not referred to by this document, the licensee shall comply with standards set out in any relevant ETSI, IEC or CENELEC standard relating to DAB.

The Director of Telecommunications 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 and Glossary of Terms

3.1 Digital Audio Broadcasting System
A Digital Audio Broadcasting System (DAB) is used for the transmission of a modulated data stream containing Programme Services in the broadcasting band III and L band intended for direct reception by the general public.

3.2 Station
One or more transmitters or receivers, or a combination of transmitters and receivers, including the associated equipment necessary, at one location implementing a Digital Audio Broadcasting System.

3.3 Effective Antenna Height (Eff. Ht.)
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[1].
Note: This takes into account both the height of the site (a.s.l) and the height of the mast (a.g.l).

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

3.5 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).

3.6 ODTR
Office of the Director of Telecommunications Regulation.

3.7 Director
The Director of Telecommunications Regulation.

3.8 Carrier to Noise ratio
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).

3.10 Programme Service Provider
A provider of sound broadcasting programmes.

[1]This can be calculated by the ODTR 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.

3.11 Ensemble

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.

3.12 Transport Stream

A data stream corresponding to the relevant ETSI (DAB) standards carrying digitally encoded Audio, associated and other data.

3.13 European Standards Body

A Body such as ETSI, IEC or CENELEC, who specify standards for equipment or services.

4. System Transparency

Unless specifically excluded by the licence, the Digital Audio Broadcasting System shall be designed in such a manner that it is capable of relaying all components within a Programme Service intended for general reception[2] [3].

5. System Engineering

5.1 General

The mechanical and electrical construction of the Digital Audio Broadcasting station 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, radiocommunication services operating in accordance with the Irish Table of Frequency Allocations

5.2 Transmitter Construction

5.2.1 General

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.

5.2.2 Controls

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.

5.2.3 Manufacturer's Identification

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.

5.3 Weather Protection

[2] While not intended for reception by the general public, the broadcast organisations include Test signals in the Transport Stream. The system must be transparent to these signals, so as to facilitate performance measurements.

[3] While the Digital Audio 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.

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.

6. System Standards

6.1 Transmission Standard

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

6.2 Summary List of System Parameters

6.2.1. Frequency Spacing and Bands of Operation

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

6.2.3 Modulation (band III)

Modulation (COFDM)	*X7F*
Number of carriers	1536
Carrier Modulation	QPSK,
Guard Interval*	246μS

Modulation (L band)

Modulation (COFDM)	X7F
Number of carriers	384
Carrier Modulation	QPSK,
Guard Interval*	62μS

**Note: Where a station is a member of an 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.*

6.2.4 Emission Designation

1M54X7EXF

6.3 Audio Encoding Parameters

Audio	MPEG Audio Layer II, ISO/IEC 11172-3
Minimum Sampling Rate	48kHz
Minimum Resolution	16 Bits
Minimum Stereo Music Bit Rate Minimum Stereo Speech Bit Rate Minimum Monaural Bit Rate	256kbps 128kbps 64kbps

Note: The use of 'Joint Stereo' encoding is not permitted

6.3.1 Multi-Channel Audio

Minimum bit rates do not apply to Multi Channel 'surround' or 'cinema' style sound.

6.4 Encryption Data

Encryption data may be included in the Ensemble to enable only authorised subscribers to access certain programmes.

6.5 Additional Broadcasting Services

6.5.1 Permitted Additional Broadcasting Services.

6.5.2 Additional Broadcasting Services Requiring Approval from the Director of Telecommunications Regulation

Prior approval must be obtained from the Director of Telecommunications Regulation for any additional services, other than those indicated in Section 6.5.1 that are included within an Ensemble.

7 System Performance

7.1 Impairment Quality

The performance limits set out in this section apply in the presence of all signals for which the Digital Audio Broadcasting System was designed.

There are three main forms of audible interference in a digital audio 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.

7.2 Frequency Offset

A frequency offset of

$$f_c \pm 1/T_u$$

may be used, where f_c is the centre frequency of the channel.

7.3 Frequency Stability

The equipment shall be designed to operate on the assigned frequency in the frequency band III and L band only.

The frequency tolerance shall be

$$Fs = Bw/100N$$

Fs	Frequency Stability
Bw	Bandwidth
N	No of carriers

The transmit frequency shall be derived from a crystal oscillator. If use is made of a synthesiser and/or a phase locked loop system, the transmitter shall be inhibited when synchronisation is absent. The transmitter frequency adjustment control shall be accessible to qualified personnel only.

7.3 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.

7.4 Maximum Permitted Levels of Spurious Emissions

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

For band III

- at least 71 dB below the transmitter e.r.p. at ±0.97MHz away from fc
  at least 106dB below the transmitter e.r.p. at ±1.75MHz away from fc

For L band

at least 56dB below the transmitter e.r.p. at ±0.97MHz away from fc
at least 106dB below the transmitter e.r.p. at ±3MHz away from fc

Where fc is the centre frequency of the channel in use taking into account of any frequency offset used.

8. OVERVIEW OF NATIONAL BAND PLAN.

8.1 Frequency Channels and Standard Groups

The frequency bands for broadcasting are band III and L band. These are based on the Final Acts of the CEPT T-DAB Planning Meeting, Wiesbaden, 1995.

Due to the phased development of the Digital Audio Broadcasting System, a station may initially have coverage in excess of the planned service area. With the introduction of additional stations, it is to be expected that this extended service area will be reduced.

8.2 Assignment List

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

8.3 Planning Parameters

The planning parameters used by the Director correspond to those recommended by the CEPT. A summary of these parameters is given below.

8.3.1 T-DAB interfering with Band III PAL-I TV

Protected Field Strength 55dBμV/m Receiver Height 10m

Δf (MHz)	-2.500	-2.000	-1.500	-1.000	0.000	1.000	2.000	3.000	4.000	5.000	5.630
PR (dB) 1%	-.01	3.8	21.0	32.0	39.8	43.0	39.5	37.3	39.3	38.0	24.5
PR (dB) 50%	5.9	10.3	25.5	38.0	46.8	48.3	44.3	41.8	45.5	42.5	30.0
dBμV/m 1%	55.1	51.2	34.0	23.0	15.2	12.0	15.5	17.7	15.7	17.0	30.5
dBμV/m 50%	49.1	44.7	29.5	17.0	8.2	6.7	10.7	13.2	9.5	12.5	25.0
Δf (MHz)	5.670	5.890	5.950	6.550	7.200	7.550	7.900				
PR (dB) 1%	25.5	29.7	31.0	31.0	31.0	19.0	-2.0				
PR (dB) 50%	29.1	29.7	31.0	31.0	31.0	19.0	-2.0				
dBμV/m 1%	29.5	25.3	24.0	24.0	24.0	36.0	57.0				
dBμV/m 50%	25.9	25.3	24.0	24.0	24.0	36.0	57.0				

8.3.2 T-DAB Interfering with the Aeronautical Safety Service (First Channel 230.05MHz)

Protected Field Strength 26dBμV/m, Receiver Height 10000m, Separation Distance 1000m

Δf (MHz)	-10.20	-6.550	-6.350	-6.150	-5.930	-5.770	0.000	10.000			
PR (dB) 1%	-56.0	-56.0	-54.0	-49.0	-33.0	6.0	6.0	6.0			
dBμV/m 1%	82.0	82.0	80.0	75.0	59.0	20.0	20.0	20.0			

8.3.3 T-DAB Interfering with T-DAB

Frequency Band	Minimum Wanted field strength dBμV/m (99% of Locations at 10 m height)	Protection Ratio (T-DAB to T-DAB (dB))
Band III	58	28
L Band	66	28

The Maximum interfering field strength $FS_{(max)}$ may be calculated as follows;

$FS_{(max)}$ =($FS_{(other\ services)}$-PR) dBμV/m

PR is the protection ratio required for the interfered with service.
Δf (MHz) Frequency difference in MHz
PR (dB)1% Protection ratio required for Tropospheric interference
PR (dB)50% Protection ratio required for continuous interference

8.4 Minimum Field Strength

The minimum field strengths used in planning are:

+58dB(μV/m) for band III

+66dB(μV/m) for L band

The above values are for 10 metres above ground level. Protection cannot be sought for locations with a field strength below these limits.

9. SAFETY

9.1 General Safety.

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

9.2 Safety Controls

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.

9.3 Safety Standards

The system must comply with the following requirements:

I.S./EN 60215 : 1990
Safety Requirements for Radio Transmitting Equipment.

ENV50166-2
Human exposure to electromagnetic fields
High frequency (10 kHz to 300GHz)

These standards are available from the National Standards Authority of Ireland[4].

[4]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.

10. STATION CERTIFICATION AND MAINTENANCE

10.1 Access and Personnel

The licensee shall, on a request made by an authorised officer of the Director of Telecommunications Regulation, facilitate that officer in the inspection[5] of any part of the Digital Audio Broadcasting System.

Only authorised personnel shall have access to the Transmission Equipment for the purpose of adjustment and/or maintenance of that equipment.

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

10.2 Examination and Testing

Adequate and accurately calibrated test equipment shall be made available 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. On commencement of operation, the licensee shall inform the Director of the date of commencement and provide certification indicating that the station is operating in accordance with the specified conditions and characteristics.

10.3 Maintenance

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 Director of Telecommunications Regulation on request.

[5] Inspection shall include the undertaking of measurements

11. Information to be submitted to the Director

11.1 Update of System Information

The licensee shall, upon request from the Director of Telecommunications Regulation, submit:

An up to date frequency plan indicating the programme name of each programme service and its position and ID in the Ensemble. The licensee shall notify the Director immediately any change occurs.

An updated network diagram/map of their system, clearly indicating the most up to date geographical area of operation of their Digital Audio Broadcasting System.

12 Additional and Modified Assignments

12.1 Requisite information

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

12.2 Examination

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

12.3 Field Strength Measurements

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

12.4 International Agreements

The Director is bound by both, the provisions of the Radio Regulations and the Final Acts of the CEPT T-DAB Planning Meeting Wiesbaden 95; in relation to aspects of band III and L band DAB services. These agreements require the Director 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 the Director with the relevant information, to ensure compliance with these agreements.