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**Transmitting equipment for the
Digital Audio Broadcasting (DAB) service;
Harmonised Standard for access to radio spectrum**

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.4] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

National transposition dates

Date of adoption of this EN:	4 June 2018
Date of latest announcement of this EN (doa):	30 September 2018
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 March 2019
Date of withdrawal of any conflicting National Standard (dow):	31 March 2020

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document specifies technical characteristics and methods of measurements for transmitter equipment for broadcast sound services using the Digital Audio Broadcast (DAB) modulation system operating in VHF band III (174 MHz to 240 MHz).

The present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.1] under the conditions identified in annex A.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.1] is given in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI EN 300 401 (V2.1.1) (01-2017): "Radio broadcasting systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".
- [2] ETSI ETS 300 799 (Edition 1) (09-1997): "Digital Audio Broadcasting (DAB); Distribution interfaces; Ensemble Transport Interface (ETI)".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.2] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.3] ETSI TR 100 028-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [i.4] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in Directive 2014/53/EU [i.1] and the following apply:

Adjacent Channel Leakage Ratio (ACLR): ratio of the mean power of the DAB signal in the OFDM block at f_L to the mean power of the unoccupied OFDM block within the MCOFDM group

antenna port: port of an apparatus which is designed, in normal operation, to be connected to an antenna using coaxial cable

broadcasting service: radiocommunication service in which the transmissions are intended for direct reception by the general public

NOTE: This service may include sound transmissions, television transmissions or other types of transmission.

class of emission: set of characteristics of an emission, designated by standard symbols, e.g. type of modulation of the main carrier, modulating signal, type of information to be transmitted, and also, if appropriate, any additional signal characteristics

DAB transmitter: device comprising a DAB exciter, RF amplifier and RF system filter

dBc: decibels relative to the unmodulated carrier power of the emission

NOTE: In the cases which do not have a carrier, for example in some digital modulation schemes where the carrier is not accessible for measurement, the reference level equivalent to dBc is decibels relative to the mean power P.

enclosure port: physical boundary of the apparatus through which electromagnetic fields may radiate or impinge

NOTE: In the case of integral antenna equipment, this port is inseparable from the antenna port.

exclusion band: band of radio frequencies where no measurements are made

harmonic: component of order greater than 1 of the Fourier series of a periodic quantity

high power transmitter: transmitter whose conducted output power is greater than 1 000 W per OFDM block

intermodulation products: unwanted frequencies resulting from intermodulation between carriers or harmonics of emission, or between any oscillations generated to produce the carrier

low power transmitter: transmitter whose conducted output power is less than or equal to 25 W per OFDM block

MCOFDM group: group of OFDM blocks generated by a MCOFDM system

MCOFDM system: low power transmitter system that generates more than one OFDM block with an overall RF system filter spanning all blocks

mean power: average power supplied to the antenna port by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation envelope taken under normal operating conditions

medium power transmitter: transmitter whose conducted output power is greater than 25 W and less than or equal to 1 000 W per OFDM block

necessary bandwidth: for a given class of emission, the width of the frequency band which is sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

OFDM block: group of digitally modulated carriers comprising a complete DAB ensemble

out-of-band emissions: emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions

rated output power: conducted power that the transmitter delivers at its output under specified conditions of operation

reference bandwidth: bandwidth in which the emission level is specified

RF system filter: filter connected to the output of the RF amplifier to control output spectrum

NOTE: The RF system filter may be internal or external to the transmitter casing.

RMS power: apparent power of an AC power that is calculated by multiplying root-mean-square (rms) current by the root mean square voltage

NOTE 1: In a purely resistive circuit this is held to be the equivalent heating effect of a DC power and can be deemed to be true power. In a circuit that consists of reactance as well as resistance the apparent power is greater than the true power (the vector difference between true power and apparent power is called reactive power).

$$\text{True Power} = V_{\text{rms}} \times (I_{\text{rms}} \Delta \cos \phi)$$

Where $\Delta \cos \phi$ is the phase difference between voltage and current introduced by the reactance of the load.

NOTE 2: From note 1 it becomes clear that unless any measuring system can be completely devoid of reactance then the measured power cannot be considered to be RMS power. It therefore becomes apparent that this parameter would be difficult to measure with any degree of accuracy at RF frequencies.

spurious emissions: emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information.

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of band emissions.

unwanted emissions: consist of spurious emissions and out-of-band emissions

3.2 Symbols

For the purposes of the present document, the following symbols apply:

"	inch
C/N	Carrier power to Noise power density
Hz	Hertz (cycles per second)
m	metre
μ	micro, 10^{-6}
V	Volt
W	Watt

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACLR	Adjacent Channel Leakage Ratio
BER	Bit Error Ratio
COFDM	Coded Orthogonal Frequency Division Multiplex
CRC	Cyclic Redundancy Check
CW	Continuous Wave
DAB	Digital Audio Broadcasting
EDI	Encapsulation of DAB Interfaces
EMC	ElectroMagnetic Compatibility
ETI	Ensemble Transport Interface
EUT	Equipment Under Test
MCOFDM	Multiple Coded Orthogonal Frequency Division Multiplex
MER	Modulation Error Ratio
N	Noise power

OFDM	Orthogonal Frequency Division Multiplex
PRBS	Pseudo Random Binary Sequence
RF	Radio Frequency
rms	root mean square
SFN	Single Frequency Network
TII	Transmitter Identification Information
Tx	Transmitter
VHF	Very High Frequency

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document which are identified as applicable in annex A at all times when operating within the boundary limits of the declared operational environmental profile.

4.2 Conformance requirements

4.2.1 Rated output power accuracy

4.2.1.1 Definition

The rated output power is the conducted power that the transmitter shall deliver at its antenna port under the manufacturers specified conditions of operation. It is, however, recommended that this parameter is not quoted as RMS power.

For MCOFDM systems, the rated output power is the conducted power of the highest powered OFDM block within the MCOFDM group.

Transmitters shall be categorized into one of three power classes, as follows:

- low power;
- medium power;
- high power.

4.2.1.2 Limit

The output power shall be within -0,5 dB of the rated output power under normal operating conditions as defined by the manufacturer.

4.2.1.3 Conformance

Conformance tests as defined in clause 5.3.1 shall be carried out.

4.2.2 Frequency stability

4.2.2.1 Definition

The frequency stability of an emission is the variation of frequency against a predetermined time scale.

4.2.2.2 Limit

The centre frequency of the RF signal shall not deviate more than 10 % of the relevant carrier spacing from its nominal value. In transmission mode I, the limit is 100 Hz.

The stability of the centre frequency shall not deviate more than 1 % of the relevant carrier spacing from its nominal value within a three month period when measured under identical operating conditions at the start and at the end of the period. In transmission mode I, the limit is 10 Hz.

4.2.2.3 Conformance

Conformance tests as defined in clause 5.3.2 shall be carried out.

4.2.3 Crest factor

4.2.3.1 Definition

Maximum ratio of peak power to mean power levels.

4.2.3.2 Limit

The peak level of the output RF power signal shall not exceed the mean power level by more than 13 dB.

4.2.3.3 Conformance

Conformance tests as defined in clause 5.3.3 shall be carried out.

4.2.4 Spurious emissions

4.2.4.1 Definition

Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out-of-band emissions.

For the purposes of the present document spurious emissions are emissions at frequencies below $f_L - 3$ MHz, where f_L is the centre frequency of the lowest frequency OFDM block, and above $f_H + 3$ MHz, where f_H is the centre frequency of the highest frequency OFDM block of the transmission, irrespective of the number of blocks employed. In the case of a single block transmitter, $f_L = f_H$.

4.2.4.2 Limits

Spurious emissions shall not exceed the values set out in table 1, shown additionally in figure 1 and figure 2, for the frequency range 9 kHz to 1 GHz at the output of the RF system filter.

Table 1: Spurious emissions limits

Frequency range of the spurious emission	Limits of the spurious emission	Reference bandwidth (kHz)	Figure
9 kHz to 174 MHz	-36 dBm (250 nW).	100	1
> 174 MHz to 400 MHz	-82 dBm for low power transmitters; -126 dBc for medium power transmitters; -66 dBm for high power transmitters.	4	2
> 400 MHz to 1 000 MHz	-36 dBm (250 nW).	100	1

NOTE: The power category of the transmitter is defined in clause 4.2.1.