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## Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.16] 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.12].

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.

The present document is part 2 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.17].

### Proposed national transposition dates

Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
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## 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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## Executive summary

With the introduction of Directive 2014/53/EU [i.12], the present multi-part deliverable has been reformatted into multiple parts to accommodate the different types of equipment represented, i.e. different receivers for audio Programme Making and Special Events (PMSE) and Assistive Listening Devices (ALD). Part 2 covers Class B receivers.

The present document seeks to improve spectrum efficiency and has introduced new technology to assist in maximizing the use of available spectrum.

The present document seeks to provide a platform for Wideband Multichannel Audio Systems (WMAS).

Although the present document covers spectrum up to 3 GHz, it should be emphasized that multi-channel audio PMSE systems used in professional productions are best suited to spectrum under 2 GHz for reasons of propagation and body interaction. Further information on audio PMSE is available in ECC Report 204 [i.13].

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## Introduction

With the introduction of Directive 2014/53/EU [i.12], receiver parameters are now included and the removal of the 9 kHz lower limit has brought inductive loop systems and receivers into this multi-part deliverable. Inductive loop transmitters are covered within ETSI EN 303 340 [i.18] along with test receivers; hearing aids containing inductive loop receivers (often referred to as T coil) are now covered in ETSI EN 300 422-4 [i.21]. The frequency range of the present document has been reduced to accommodate inductive loop receivers.

The present document is a testing standard based on spectrum utilization parameters and does not include performance characteristics that may be required by the user nor requirements for interfacing equipment.

This multi-part deliverable was originated in 1991 when Assistive Listening Devices (ALD) were a very small part of the Radio Microphone Industry; in recent years major advances in both the volume and functionality of ALDs has caused a rethink in how to best present the testing regime in a clear and concise manner. After a number of discussions the present document covers audio PMSE as Parts 1, 2, and 3, and ALDs as Part 4.

Systems including assistive listening devices (Aids for the handicapped) with analogue or digital modulations and operating in the range 863 MHz to 865 MHz may be tested to either the present document or to ETSI EN 301 357-1 [i.1] with due consideration of power and operating frequency.

ALDs may in some cases require stereo transmission to present both left and right audio information to the wearer. For that reason, devices that transmit information to the hearing impaired may require two channel operation. It is expected that two or more channel devices will be tested separately when determining bandwidth and associated measurements. Channels may involve the use of two separate frequencies or wider bandwidth.

Since the initial adoption of ETSI I-ETS 300 422 [i.2] there has been the introduction of further types of equipment into the market - cordless headphones/loudspeakers, Low power Band II and consumer in-ear monitoring. These are low power wideband systems that have some characteristics in common with radio microphones but are not compatible with multichannel radio microphones. This equipment is covered by ETSI EN 301 357-1 [i.1] and annex 10 of CEPT/ERC/REC 70-03 [i.6].

Additional standards or specifications may be required for equipment:

- 1) intended to interface to Public Networks, e.g. PSTN. This facility may be subjected to regulatory conditions;  
or
- 2) other relevant radio standards.



# 1 Scope

The present document covers the minimum characteristics considered necessary in order to make the best use of the available frequency spectrum for audio PMSE and ALDs.

The present document specifies the minimum performance requirements and the methods of measurement of Assistive Listening Devices, radio microphones and in-ear monitoring systems. It does not necessarily include all the characteristics that may be required by a user, nor does it necessarily represent the optimum performance achievable.

The present document applies to equipment operating on radio frequencies up to 3 GHz (as shown in table 1) using analogue, digital and hybrid (using both analogue and digital) modulation.

The maximum power recommended for equipment covered by this multi-part deliverable is 250 mW for radio microphones and 10 mW for ALDs.

An exception to this are the Public Hearing Aids defined in the CEPT Report 004 [i.7] and subsequent ECC [i.9] and EC Decisions [i.8] on the ex ERMES band (169,4 MHz to 169,8125 MHz) where 500 mW is defined.

The present document also covers radio microphones used in the 863 MHz to 865 MHz band, with a maximum power of 10 mW.

Electromagnetic Compatibility (EMC) requirements are covered by ETSI EN 301 489-9 [i.4].

National regulations on:

- 1) maximum power output;
- 2) licensing status;

will take precedence or those detailed in the latest version of:

- EC Decision 2005/928/EC [i.9];
- ECC/DEC/(05)02 [i.10];
- the EC SRD Decision [i.8]; or
- CEPT/ERC/REC 70-03 [i.6], annex 10 (see <http://www.ero-docdb.dk/>);
- EC Decision 2014/641/EU [i.11].

Unless otherwise stated in the EC SRD Decision, ECC Decision or National Interfaces, Radio Microphones can be subject to individual licence.

The types of equipment covered by the present document are as follows:

- in ear monitoring systems;
- radio microphones;
- WMAS (Wireless Multichannel Audio Systems);
- tour guide systems.

**Table 1: Radiocommunications service frequency bands**

	<b>Radiocommunications service frequency bands</b>
Transmit	up to 3 000 MHz
Receive	up to 3 000 MHz

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## 2 References

### 2.1 Normative 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.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

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 document is necessary for the application of the present document.

- [1] ETSI TR 100 028 (all parts) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [2] IEC 60244-13:1991: "Methods of measurement for radio transmitters - Part 13: Performance characteristics for FM sound broadcasting".

### 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] ETSI EN 301 357-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Cordless audio devices in the range 25 MHz to 2 000 MHz; Part 1: Technical characteristics and test methods".
- [i.2] ETSI I-ETS 300 422: "Radio Equipment and Systems (RES); Technical characteristics and test methods for wireless microphones in the 25 MHz to 3 GHz frequency range".
- [i.3] Recommendation ITU-R BS.559-2: "Objective measurement of radio-frequency protection ratios in LF, MF, and HF broadcasting".
- [i.4] ETSI EN 301 489-9: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 9: Specific conditions for wireless microphones, similar Radio Frequency (RF) audio link equipment, cordless audio and in-ear monitoring devices".
- [i.5] ETSI TR 102 273: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".
- [i.6] CEPT/ERC/REC 70-03: "Relating to the use of Short Range Devices (SRD)".
- [i.7] CEPT Report 004: "Report from CEPT to the European Commission in response to the Mandate to: Review the frequency band 169,4 - 169,8 MHz".
- [i.8] Commission Decision 2006/771/EC of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices.
- [i.9] EC Decision 2005/928/EC: "Commission Decision of 20 December 2005 on the harmonisation of the 169,4-169,8125 MHz frequency band in the Community", OJ L 344, 27.12.2005, p. 47-51.

- [i.10] ECC/DEC/(05)02: "ECC Decision of 18 March 2005 on the use of the Frequency Band 169,4-169,8125 MHz".
- [i.11] Commission Implementing Decision 2014/641/EU of 1 September 2014 on harmonised technical conditions of radio spectrum use by wireless audio programme making and special events equipment in the Union (notified under document C(2014) 6011) (Text with EEA relevance).
- [i.12] 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.13] ECC Report 204: "Spectrum Use and future requirements for PMSE".
- [i.14] Recommendation ITU-R SM.2152 (09-2009): "Definitions of Software Defined Radio (SDR) and Cognitive Radio System (CRS)".
- [i.15] ETSI EG 203 336: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.16] 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.
- [i.17] ETSI EN 300 422-1: "Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [i.18] ETSI EN 303 340: "Digital Terrestrial TV Broadcast Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [i.19] ETSI EN 300 422-3: "Wireless Microphones; Audio PMSE up to 3 GHz; Part 3: Class C Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [i.20] ANSI C63.5-2006: "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electro Magnetic Interference".
- [i.21] ETSI EN 300 422-4: "Assistive Listening Devices including personal sound amplifiers and inductive systems: Ear-level inductive receivers (T-coils)".

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**alignment range:** frequency range over which the receiver and the transmitter can be programmed and/or re-aligned to operate without any physical change of components other than programmable read only memories supplied by the manufacturer or the manufacturer's nominee, crystals, and frequency setting elements

**antenna port:** port, where a radio frequency antenna is connected to equipment

**audio limiting threshold:** audio input or output level at which the transmitter audio limiter action may be said to commence

NOTE: It is specified with any accessible variable gain controls set according to the manufacturer's instructions, with a sinusoidal input signal of 500 Hz.

**audio PMSE:** inclusive description consisting of radio microphones, in ear monitoring systems, audio links

**base station equipment:** radio and/or ancillary equipment intended for operation at a fixed location and powered directly or indirectly

**body worn transmitter:** radio microphone that can be attached to the human body

NOTE: The microphone is attached to the transmitter via cable; the antenna radiation characteristics are affected by the human body.

**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

**conducted measurements:** measurements that are made using a direct connection to the device under test (DUT)

**confidence level:** probability of the accumulated error of a measurement being within the stated range of uncertainty of measurement

**C-PMSE:** Cognitive Radio System (CRS) based on Recommendation ITU-R SM.2152 [i.14] and designed for the purpose and the specific requirements of PMSE applications

**C-PMSE system:** constituted out of information acquisition and C-PMSE

**digital modulation:** any modulation scheme with discrete constellation points (e.g. FSK, PSK)

**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.

**frequency stability:** spontaneous and/or environmentally caused frequency change within a given time interval

**hand held microphone:** radio microphone which can be held and operated in the human hand

NOTE: The microphone is directly attached to the transmitter; the antenna radiation characteristics are less affected by the human body than body worn equipment.

**hybrid systems:** combination of analogue and digital processing and modulation techniques

**in ear monitor (IEM):** body worn miniature receiver with earpieces for personal monitoring of single- or dual-channel sound

**integral antenna:** antenna, with or without a connector, designed as, and declared as by the manufacturer, an indispensable part of the equipment

**integral microphone:** microphone, designed as, and declared as by the manufacturer, an indispensable fixed part of the equipment

**mean power (of a radio transmitter):** average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions

**mobile equipment:** receiver, transmitter or transmitter/receiver (transceiver) intended for installation and use in a vehicle, and powered by the main battery of the vehicle

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

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

**personal hearing aid system:** radio communication system comprising of a transmitter, which can be handheld, on a table or around the neck of a hearing impaired person and one or more receivers, where each receiver can have wired or inductive connection to a hearing aid

**port:** any connection point on or within the device under test (DUT) intended for the connection of cables to or from that equipment

**portable equipment:** radio and/or ancillary equipment intended for portable (e.g. handheld) operation, powered by its own integral battery

**public hearing aid system:** broadcast radio communication system comprising one transmitter (up to 500 mW in the band 169,4 MHz to 169,8125 MHz), which is installed at a fixed location in a large auditorium, e.g. in a church or theatre and one or more receivers, where each receiver can have wired or inductive connection to a hearing aid

NOTE: May be subject to an individual licence.

**radiated measurements:** measurements that involve the absolute measurement of a radiated electromagnetic field

**Radio Frequency (RF) port:** any connection point on or within the DUT intended for the connection of RF cables

NOTE: RF ports are treated as 50  $\Omega$  connection points unless otherwise specified by the manufacturer.

**radio receiver:** item of electronic equipment designed to receive electromagnetic radio frequency emissions

**rated output power:** mean power which the transmitter delivers at its antenna port under the manufacturer's specified conditions of operation

NOTE: For the purposes of the present document this is quoted as erp below 1 GHz and eirp above 1 GHz.

**receiver adjacent channel selectivity:** measure of the capability of the receiver to operate satisfactorily in the presence of an unwanted signal, which differs in frequency from the wanted signal by an amount equal to the channel separation declared by the manufacturer

**receiver blocking:** measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or the adjacent channels or bands

**receiver co-channel rejection:** measure of the capability of a receiver to receive a wanted signal, without exceeding a given degradation, due to the presence of an unwanted signal, both signals being at the nominal frequency of the receiver

**receiver sensitivity:** ability to receive a wanted signal at low input power level while providing a pre-determined level of performance

**spurious emissions:** 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

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

**switching range:** the maximum frequency range over which the receiver or the transmitter can be operated without hardware or software modifications

**transmitter intermodulation distortion (IMD):** originates from non-linearities in electronic circuits when at least two signals on different frequencies are injected at transmitter side resulting in at least third order intermodulation products

**transmitter intermodulation performance:** measure of the capability of the transmitter to inhibit the generation of signals in its nonlinear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna

**transmitter intermodulation ratio:** the ratio of the power of the intermodulation product to the wanted signal, when an interference signal is injected into the antenna connector at a specific power level lower than that of the mean power of the wanted signal

**Wireless Multichannel Audio Systems (WMAS):** wireless audio transmission systems using broadband transmission technique for microphone and in-ear monitor systems, and other multichannel audio PMSE use

## 3.2 Symbols

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

$\lambda$	wavelength in metres
$\Omega$	ohm
$\mu\text{F}$	microfarad
$\mu\text{W}$	microwatt