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Wireless Microphones; Audio PMSE Equipment up to 3 GHz; Part 1: Audio PMSE Equipment up to 3 GHz; Harmonised Standard for access to radio spectrum

Reference

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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.18] 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.10].

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 1 of a multi-part deliverable covering Wireless Microphones, Audio PMSE Equipment up to 3 GHz, as identified below:

Part 1: "Audio PMSE Equipment up to 3 GHz";

Part 2: "Class B Receivers" (see note);

Part 3: "Class C Receivers"(see note);

Part 4: "Assistive Listening Devices including personal sound amplifiers and inductive systems up to 3 GHz".

NOTE: Since the present document now covers Class A, B, and C receivers for audio PMSE, ETSI EN 300 422-2 and ETSI EN 300 422-3 will no longer be maintained.

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
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Executive summary

This update includes changes requested by the EC for terminology in Harmonised Standards in addition to changes of the technical requirements.

Introduction

Audio Programme Making and Special Events (Audio PMSE) equipment up to 3 GHz are used in wireless applications for audio transmission purposes.

Following publication by ETSI of version 2.1.2 of ETSI EN 300 422-1 and its subsequent publication in the Official Journal, the present document has been revised with information gained from those using that version. The previous four-parts deliverable has been reformatted into two parts to accommodate the different types of equipment represented. The present document (Part 1) now covers Class A, B, and C receivers for audio PMSE. To avoid confusion, the numbering for ETSI EN 300 422-4 [i.4] (ALDs) has been retained.

Spectrum, power limits, and technical requirements for audio PMSE are shown in the latest version of:

- EC Decision on Short Range Devices [i.14];
- CEPT/ERC Recommendation 70-03 [i.12], annex 10;
- National Interface regulations; and
- compatibility studies.

Further information is given in CEPT/ERC Recommendation 25-10 [i.13], annexes 2 and 4. Further information is available via the ECO website:

https://cept.org/ecc/topics/programme-making-and-special-events-applications-pmse

and the EFIS database:

https://efis.cept.org/.

Unless otherwise stated in the EC SRD Decision [i.14], EC Decision 2014/641/EU [i.11] or national regulations, the use of audio PMSE equipment can be subject to an individual licensing regime.

Although the present document covers a spectrum up to 3 GHz, it should be emphasized that multi-channel audio PMSE systems used in professional productions are best suited to a spectrum under 2 GHz for reasons of propagation and body interaction. Further information on audio PMSE is available in ECC Report 204 [i.16].

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 specifies technical characteristics and methods of measurements for audio PMSE equipment operating with up to 250 mW output power on radio frequencies up to 3 GHz (see note 1).

NOTE 1: For RF power levels above this, refer to ETSI EN 300 454-1 [i.3].

Audio Programme Making and Special Events (PMSE) equipment within the scope of the present document is used in wireless applications for audio transmission purposes including, but not limited to equipment such as wireless microphones, in-ear monitoring systems, conference systems, talkback systems, tour guide systems, Cognitive PMSE (C-PMSE), Wireless Multichannel Audio Systems (WMAS), and assistive listening devices.

Table 1: Radiocommunications service frequency bands

	Radiocommunications service frequency bands
Transmit	up to 3 000 MHz
Receive	up to 3 000 MHz

NOTE 2: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.10] is given in annex A.

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 documents are necessary for the application of the present document.

[1] IEC 60244-13:1991: "Methods of measurement for radio transmitters - Part 13: Performance characteristics for FM sound broadcasting".

[2] ERC Recommendation 74-01 (May 2019): "Unwanted emissions in the spurious domain".

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.

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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 EG 203 336: "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.2] Void.

[i.3] ETSI EN 300 454-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Wide band audio links; Part 1: Technical characteristics and test methods".

[i.4] ETSI EN 300 422-4: "Wireless Microphones; Audio PMSE up to 3 GHz; Part 4: Assistive Listening Devices including personal sound amplifiers and inductive systems up to 3 GHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".

[i.5] Void.

[i.6] ETSI EG 203 367 (V1.1.1): "Guide to the application of harmonised standards covering articles 3.1b and 3.2 of the Directive 2014/53/EU (RED) to multi-radio and combined radio and non-radio equipment".

[i.7] ETSI TR 102 273 (V1.2.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".

[i.8] ETSI EN 301 489-9: "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; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU".

[i.9] Void.

[i.10] 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.11] Commission Implementing Decision 2014/641/EU of 01/09/2014 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] CEPT/ERC Recommendation 70-03: "Annex 10: Radio microphone applications including assistive listening devices (ALD), wireless audio and multimedia streaming systems".

[i.13] CEPT/ERC Recommendation 25-10: "Frequency Ranges for the Use of Terrestrial Audio and Video Programme Making and Special Events (PMSE) applications", Amended 18 October 2016.

[i.14] Commission Decision 2013/752/EC on harmonization of the radio spectrum for use by short-range devices as amended by subsequent Commission Decisions.

[i.15] Recommendation ITU-R BS.559-2: "Objective measurement of radio-frequency protection ratios in LF, MF, and HF broadcasting".

[i.16] ECC Report 204: "Spectrum Use and future requirements for PMSE".

NOTE: Available at https://docdb.cept.org/download/1f1d1819-5ca2/ECCREP204.PDF.

[i.17] Report Recommendation ITU-R SM.2152 (09/2009): "Definitions of Software Defined Radio (SDR) and Cognitive Radio System (CRS)".

[i.18] 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.19] ANSI C63.5: "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electro Magnetic Interference".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in Directive 2014/53/EU [i.10] and the following apply:

analogue modulation: modulation technique whereby message signal, which is the analogue of some physical quantity, is impressed on a carrier signal for transmission through a channel (e.g. FM)

antenna port: port, where a radio frequency antenna is connected to equipment or where a temporary antenna connector is provided

NOTE: 50 Ω connection points unless otherwise stated.

audio channel: monaural (mono) audio signal

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 published information relevant to the equipment, with a sinusoidal input signal of 500 Hz.

audio PMSE: inclusive description consisting of wireless microphones, in-ear monitoring systems, conference systems, talkback systems, tour guide systems, Cognitive PMSE (C-PMSE), Wireless Multichannel Audio Systems (WMAS), and assistive listening devices

bodypack transmitter: wireless microphone that can be attached to the human body, sometimes referred to as body worn transmitter

centre frequency: centre frequency of the operating channel

channel separation: minimum separation in frequency between the centre frequencies of two adjacent usable channels

conducted measurements: measurements that are made using a direct connection to the Device Under Test (DUT)

conducted output power: output power which the transmitter delivers at its antenna port into a 50 Ohm load

conference system: multiple microphone and sound reinforcement system

NOTE: A conference system comprises one control unit and a number of delegate units for discussion groups and face-to-face meetings as well as far end-to-far end (including video) conference events.

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

control data: data for controlling or managing a device or system; can be uni-directional or bi-directional communication

corresponding device: device required to initiate transmissions by the DUT

C-PMSE: Cognitive Radio System (CRS) based on Recommendation ITU-R SM.2152 [i.17] and designed for the purpose and the specific requirements of PMSE applications

C-PMSE system: cognitive PMSE with information acquisition

declared channel bandwidth: width of a band of frequencies assigned to a single channel

dedicated antenna: antenna physically external to the equipment, using an antenna connector with a cable or a wave-guide and which has been designed or developed for one or more specific types of equipment, and is as such assessed in combination with the equipment against the requirements in the present document

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.

error metric: measure for errors, which is typically formulated as relative value or rate in comparison to an error-free measure

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

handheld microphone: wireless microphone which is designed to be held and operated in the human hand

In-Ear Monitor (IEM) system: transmitter and one or more bodypack miniature receivers with earpieces for personal monitoring of single- or dual-channel sound

integral antenna: antenna designed as a fixed part of the equipment (without the use of an external connector) which cannot be disconnected from the equipment by a user with the intent to connect another antenna

NOTE: An integral antenna may be fitted internally or externally. In the case where the antenna is external, a non-detachable cable or wave-guide can be used.

occupied (channel) bandwidth: bandwidth containing 99 % of the total transmit power of the signal

operating channel: frequency range in which transmissions from the device occur during operation

operating frequency: actual transmitted frequency

operational mode: mode in which the equipment is operated

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

peak: spectrum analyser setting peak detection

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

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

radiated output power: mean output power of the transmitter measured as a radiated measurement

radio microphone: See wireless microphone.

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

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 category: set of relevant receiver requirements and minimum performance criteria

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

RF channel: specific amount of spectrum for transmission between at least two devices

spectrum scanning procedure: functionality that allows PMSE equipment to perform a scan in order to identify available frequencies within the tuning range of the equipment

spurious emissions: unwanted emissions in the spurious domain applying at frequencies beyond the limit of 250 % of the declared bandwidth above and below the centre frequency of the emission

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

tour guide system: equipment used for visitor guidance or interpreter or assistive listening applications

EXAMPLE: Tour guide systems are used for visitor guidance (such as factory or facility tours), and interpreter applications, but also can be used as assistive listening devices in theatres or opera houses. In some cases, hearing aids can be connected to the receivers. They can be permanently or temporarily installed in a wide variety of buildings or facilities. They are primarily designed for speech reproduction.

transmitter Inter Modulation Distortion (IMD): emission created by non-linearties in electronic circuits when at least two signals are mixed

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

transmitter intermodulation ratio: 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

tuning range: maximum frequency range over which the receiver or the transmitter can be operated without hardware or firmware modifications

wireless microphone: microphone combined with a radio transmitter as a handheld or bodypack device; sometimes referred to as radio microphone

Wireless Multichannel Audio Systems (WMAS): wireless audio transmission systems using digital broadband transmission techniques for microphone and in-ear monitor system applications, and other multichannel audio PMSE use, e.g. with the ability to support three or more audio channels per MHz

wireless talkback system: communication system used in a production

3.2 Symbols

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

λ	wavelength in metres
µF	microfarad
µW	microwatt
dB	decibel; logarithmic unit to express ratio between two quantities
dBA	A-weighted power quantity
dBc	power quantity relative to carrier power level
dBm	power quantity relative to 1 mW
f_{BLK}	frequency of blocker signal
B	declared channel bandwidth
f_c	centre frequency
f_{cm}	actual centre frequency
f_{INT}	frequency of interferer signal
f_{TOI}	frequency of third order intermodulation product
f_w	wanted frequency
GHz	gigahertz
kHz	kilohertz
MHz	megahertz
mW	milliwatt
nW	nanowatt
P_{min}	minimum RF power
R	distance
Ω	ohm

3.3 Abbreviations

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

AF	Audio Frequency
ALD	Assistive Listening Device
BER	Bit Error Rate
CEPT	European Conference of Postal and Telecommunications administrations
DUT	Device Under Test
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	effective radiated power
EC	European Commission
ECC	Electronic Communications Committee
ECO	European Communications Office
EFIS	ECO Frequency Information System
EFTA	European Free Trade Association
EMC	Electro Magnetic Compatibility
emf	electromagnetic field
ERC	former European Radio Committee in CEPT, now ECC
FM	Frequency Modulation
FSK	Frequency Shift Keying
IEC	International Electrotechnical Commission
IEM	In Ear Monitor system
IMD	Inter Modulation Distortion
ITU-R	International Telecommunication Union Radiocommunication sector
LF	Low Frequency
lim	limiting
NF	Noise Figure
OATS	Open Area Test Site
PER	Packet Error Rate
PMSE	Programme Making and Special Events
ppm	parts per million
PSK	Phase Shift Keying
PSTN	Public Switched Telephone Network
RBW	Resolution Bandwidth
RF	Radio Frequency
RMS	Root Mean Square
Rx	Receiver
SINAD	Ratio of (Signal + Noise + Distortion) to (Noise + Distortion)
SNR	Signal to Noise Ratio
SRD	Short Range Device
TOI	Third Order Intermodulation
Tx	Transmitter
Tx-IMD	Transmitter Inter Modulation Distortion
VBW	Video Bandwidth
VSWR	Voltage Standing Wave Ratio
WMAS	Wireless Multichannel Audio Systems

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for the operation of the equipment, which shall be in accordance with its intended use (product information, see clause 5.3.1). The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.