

# ETSI EN 300 422-4 V2.1.1 (2017-05)



**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**

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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.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.14].

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

- Part 1: "Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU";
- Part 2: "Class B Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU";
- Part 3: "Class C Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU";
- 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".**

### National transposition dates

Date of adoption of this EN:	25 April 2017
Date of latest announcement of this EN (doa):	31 July 2017
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 January 2018
Date of withdrawal of any conflicting National Standard (dow):	31 January 2019

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## Modal verbs terminology

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## Executive summary

With the introduction of Directive 2014/53/EU [i.14], 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 (ALDs). Part 4 covers Assistive Listening Devices including personal sound amplifiers and inductive systems with digital and analogue (FM) receivers. It is also applicable to accessories associated with ALDs. In addition, it covers ALDs with inductive receivers (T-coils).

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## Introduction

With the introduction of Directive 2014/53/EU [i.14], receiver parameters are now included and the removal of the 9 kHz lower limit has brought inductive loop systems and receivers into the present document. Inductive loop transmitters are covered within ETSI EN 303 348 [i.19] along with test receivers; hearing aids containing inductive loop receivers (often referred to as T coil) are now covered in clause 9.2 of the present document. 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.

ETSI EN 300 422 [i.2] 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 ETSI EN 300 422 family [i.2] covers audio PMSE as Parts 1 [i.20], 2 [i.21], and 3 [i.22]; and ALDs as Part 4 (the present document).

Systems including assistive listening devices (Aids for the handicapped) with 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 [i.1] with due consideration of power and operating frequency.

Ear worn hearing assistance devices 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.

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 Assistive Listening Devices (ALDs) comprising personal hearing aid systems including inductive systems, personal sound amplifiers, and associated accessories for ALDs, e.g. remote controls and audio streaming devices.

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 present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.14] under the conditions identified in annex A.

NOTE 1: The frequency bands for this equipment may differ from country to country as specified in their national regulations.

**Table 1: Radiocommunications service frequency bands**

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

NOTE 2: Power limits for different frequency bands can be found in ECC/DEC/(05)02 [i.11]; the EC SRD Decisions [i.9] and [i.16]; EC Decision 2014/641/EU [i.13]; or CEPT/ERC/REC 70-03 [i.7], annex 10 (or European or national regulations).

NOTE 3: Electromagnetic Compatibility (EMC) requirements are covered by ETSI EN 301 489-9 [i.4].

## 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] 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: "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Technical characteristics and test methods for analogue cordless wideband audio devices using integral antennas operating in the CEPT recommended 863 MHz to 865 MHz frequency range".
- [i.2] ETSI EN 300 422: "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); 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 (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.5] ETSI TR 102 273 (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.6] ANSI C63.5 (all parts): "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electro Magnetic Interference".
- [i.7] CEPT/ERC/REC 70-03: "Relating to the use of Short Range Devices (SRD)".
- [i.8] CEPT Report 04: "Report from CEPT to the European Commission in response to the Mandate to: Review the Frequency Band 169,4 - 169,8 MHz".
- [i.9] Commission Decision 2006/771/EC of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices.
- [i.10] ECC Report 230: "Harmonisation Possibilities for Assistive Listening Devices in the Band 174-216 MHz".
- [i.11] ECC/DEC/(05)02: "ECC Decision of 18 March 2005 on the use of the Frequency Band 169,4-169,8125 MHz".
- [i.12] CEPT Report 43: "To undertake technical studies on the efficient use of the harmonised 169.4-169.8125 MHz frequency band".
- [i.13] 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.14] 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.15] CEPT Report 44: "Annual update of the technical annex of the Commission Decision on the technical harmonisation of radio spectrum for use by SRD".
- [i.16] EC Decision 2013/752/EU: Commission Implementing Decision of 11 December 2013 amending Decision 2006/771/EC on harmonisation of the radio spectrum for use by short-range devices and repealing Decision 2005/928/EC.
- [i.17] 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.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] ETSI EN 303 348: "Induction loop systems intended to assist the hearing impaired in the frequency range 10 Hz to 9 kHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [i.20] 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.21] ETSI EN 300 422-2: "Wireless Microphones; Audio PMSE up to 3 GHz; Part 2: Class B Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [i.22] 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.23] CENELEC EN 62209-1: "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)".
- [i.24] CENELEC EN 62209-2: "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)".
- [i.25] ETSI TR 100 028 (all parts) (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

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## 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.14] and the following apply:

**aids for hearing impaired:** all types of hearing aids and their accessories as well as all types of assistive listening systems for hearing impaired people

**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

**Assistive Listening Device (ALD) for hearing impaired:** aid for a hearing impaired person, also known as a hearing aid

**Assistive Listening System (ALS) for hearing impaired:** systems utilizing electromagnetic, radio or light waves, or a combination of these, to transmit the acoustic signal from the source (e.g. a loudspeaker or a person talking) directly to the hearing impaired person

NOTE: Both aids for the hearing impaired and Assistive Listening devices would normally be prescribed by a hearing professional.

**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-Frequency Induction-Loop System (AFILS):** system including induction loop amplifier(s), microphones and/or other signal sources, in which magnetic fields are created by the flow of audio-frequency current in a conductor arranged in the form of a loop or coil

**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

**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.

**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.

**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

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

**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

**personal sound amplifier:** a body-worn device providing sound amplification

**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

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

## 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
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

$f_{\text{BLK}}$	frequency of blocker signal
$f_c$	centre frequency
$f_{\text{INT}}$	frequency of interferer signal
$f_w$	wanted frequency
GHz	gigahertz
kHz	kilohertz
MHz	megahertz
mW	milliwatt
nW	nanowatt

### 3.3 Abbreviations

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

ac	alternating current
AF	Audio Frequency
ALD	Assistive Listening Device
B	declared channel Bandwidth

NOTE: See table 2.

BER	Bit Error Rate
BN	Necessary Bandwidth
BW	BandWidth
CE	European Commission
CEPT	Commission of European Post and Telecommunications
CW	Continuous Wave
DAB	Digital Audio Broadcasting
dc	direct current
DUT	Device Under Test
EFIS	ECO (European Communications Office) Frequency Information System
EFTA	European Free Trade Area
eirp	equivalent isotropically radiated power
EMC	ElectroMagnetic Compatibility
emf	electromagnetic field
erp	effective radiated power
IEC	International Electrotechnical Commission
IEM	In Ear Monitor system
IMD	InterModulation Distortion
LF	Low Frequency
lim	limiting
NF	Noise Figure
OATS	Open Area Test Site
PER	Packet Error Rate
PMSE	Programme Making and Special Events
PSTN	Public Switched Telephone Network
R	distance
RBW	Resolution BandWidth
RF	Radio Frequency
RMS	Root Mean Square
Rx	Receiver
SINAD	Ratio of (Signal + Noise + Distortion) to (Noise + Distortion)
SPL	Sound Pressure Level
SRD	Short Range Device
T-coil	Inductive Loop Systems
Tx	Transmitter
UUT	Unit Under Test
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio