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ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Digital radio microphones operating in the CEPT Harmonized band 1 785 MHz to 1 800 MHz; Part 1: Technical characteristics and methods of measurement

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**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Digital radio microphones operating in the CEPT
Harmonized band 1 785 MHz to 1 800 MHz;
Part 1: Technical characteristics and
methods of measurement**

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Foreword

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

The present document is part 1 of a multi-part deliverable covering the Digital radio microphones operating in the CEPT Harmonized band 1 785 MHz to 1 800 MHz, as identified below:

Part 1: "Technical characteristics and methods of measurement";

Part 2: "Harmonized EN under article 3.2 of the R&TTE directive".

Every EN prepared by ETSI is a voluntary standard. The present document may contain text concerning conformance testing of the equipment to which it relates. This text should be considered as guidance only and does not make the present document mandatory.

Annex A provides normative specifications concerning radiated measurements.

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Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 March 2002
Date of withdrawal of any conflicting National Standard (dow):	31 March 2002

Introduction

The present document is the first stage of the introduction of digital radio microphones into the radio spectrum. The parameters are suitable for use on a wider range of spectrums when such spectrum is available and compatibility issues are considered.

The present document is based on EN 300 422 [1].

Since the adoption of EN 300 422 [1] for radio microphones, digital equipment has been introduced with different requirements for bandwidth and testing.

The present document is intended to specify the minimum performance and the methods for measurement of Digital Radio Microphones and In-ear monitoring systems as specified in the scope. In-ear monitoring systems may be tested to either the present document or to EN 301 357 [6] with due consideration of power and operating frequency.

The rapidly increasing quantities of wireless microphones (hereafter referred to as radio microphones) in operation, both legal and illegal, together with the greater mobility of the users, either professional or private, has led to a serious situation with many occurrences of interference and irregular operation. Legal radio microphones, being fundamentally low power devices, are interfered with more than the generators of the interference, and suffer primarily from this situation. The use of the CEPT harmonized band 1 785 to 1 800 MHz for digital devices detailed within the scope enables manufacturers to better meet the requirements of the market.

In preparing the present document, much attention has been given to assure a low interference probability, while at the same time allowing a maximum flexibility and service to the end-user.

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 or requirements for interfacing equipment.

Cordless headphones/loudspeakers and consumer In-ear monitoring are low power wideband systems that have some characteristics in common with radio microphones but are not compatible with multichannel radio microphones covered by the present document. This equipment is covered by EN 301 357 [6].

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1 Scope

The present document covers the minimum characteristics considered necessary in order to make the best use of the available frequencies. 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 digital equipment operating on radio frequencies between 1 785 MHz and 1 800 MHz. The present document does not preclude any digital FDMA modulation technique, provided that the modulation spectrum lies within the standardized spectral mask.

Analogue Frequency Modulation (FM) is at present used for the majority of radio microphones and other similar equipment and is not within the scope of this standard. The present document does not apply to radio microphones or in ear monitoring equipment employing Time Division Multiple Access (TDMA), frequency hopping and spread spectrum or similar forms of modulation.

Electromagnetic compatibility (EMC) requirements are covered by EN 301 489-9 [5].

Additional standards or specifications may be required for equipment intended to interface to the Public Switched Telephone Network (PSTN). This facility may be submitted to regulatory conditions.

The present document may be used by accredited test laboratories for testing of the equipment. The performance of the equipment submitted for testing should be representative of the performance of the corresponding production models.

The present document contains instructions for the presentation of equipment for testing purposes.

Power limits recommended in the present document have been chosen to allow maximum simultaneous reuse of frequency allocations. National regulations on power output may apply up to the limits quoted below.

NOTE: For higher power equipment reference should be made to ETS 300 454 [4] Wide band audio links.

Equipment	effective radiated power (erp) or conducted
Radio Microphones	50 mW
In ear monitoring	50 mW

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

- professional hand held radio microphones;
- professional body worn radio microphones;
- in ear monitoring systems.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1] 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".
- [2] ITU-R Recommendation BS.559-2: "Objective measurement of radio-frequency protection ratios in LF, MF and HF broadcasting".
- [3] ETSI ETR 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".
- [4] ETSI ETS 300 454 (including Amendment 1): "Radio Equipment and Systems (RES); Wide band audio links; Technical characteristics and test methods".
- [5] 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 and similar Radio Frequency (RF) audio link equipment".
- [6] 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".
- [7] ANSI C63.5: "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electromagnetic Interference (EMI) Control Calibration of Antennas (9 kHz to 40 GHz)".
- [8] ETSI ETR 273: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement of radiated methods of measurement (using test sites) and evaluation of the corresponding measurement uncertainties".
- [9] IEC 60489-3: "Methods of measurement for radio equipment used in the mobile services. Part 3: Receivers for A3E or F3E emissions".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

conducted measurements: measurements that are made using a direct 50 Ω connection to the EUT

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

limiter threshold: audio input or output level at which the transmitter audio limiter action may be said to commence (It is specified with any accessible variable gain controls set according to the manufacturer's instructions, with a sinusoidal input signal of 500 Hz)

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

carrier grid: evenly spaced raster in a given frequency band for the allocation of carrier frequencies

The minimum distance of two carriers in use is a multiple of the raster dependent on type and usage of the equipment

channel bandwidth: frequency band of defined width (as a multiple of the carrier grid) including safety margin for operation on adjacent channels, located symmetrically around carrier frequency in the carrier grid

port: any connection point on or within the Equipment Under Test (EUT) intended for the connection of cables to or from that equipment

Radio Frequency (RF) port: any connection point on or within the EUT intended for the connection of RF cables
RF ports are treated as 50 Ω connection points unless otherwise specified by the manufacturer.

3.2 Symbols

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

λ	wavelength in metres
μF	microFarad
μW	microWatt
dBc	dB relative to the carrier level
E	field strength
E _o	reference field strength (see annex A)
f _c	carrier frequency
f _o	operating frequency
GHz	gigaHertz
H	Henry
kHz	kiloHertz
lim	limiting
MHz	megaHertz
mW	milliWatt
nW	nanoWatt
R	distance (see annex A)
R _o	reference distance (see annex A)

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3.3 Abbreviations

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

ac	alternating current
AR1	Alignment Range 1
AR2	Alignment Range 2
B	declared channel Bandwidth (see table 1)
BN	Necessary Bandwidth
dc	direct current
erp	effective radiated power
EUT	Equipment Under Test
FDMA	Frequency Division Multiple Access
GMSK	Gaussian Filtered Minimum Shift Keying
GTFM	Generalized Tamed Frequency Modulation
LF	Low Frequency
PSTN	Public Switched Telephone Network
RBW	Resolution BandWidth
RF	Radio Frequency
TDMA	Time Division Multiple Access
Tx	Transmitter
VBW	Video BandWidth

4 Functional characteristics

4.1 Radio microphone descriptions

Radio microphones traditionally have used wide band analogue frequency modulation to achieve the necessary audio performance for professional use. For analogue applications the modulated transmitter signal requires a 200 kHz maximum channel bandwidth. For digital applications the required bandwidth is affected by the transmitted data rate, the pulse shaping filter and the applied modulation scheme. The required data rate will be determined primarily by the desired audio quality. Various combinations of the source coding, channel coding, spectrum shaping and modulation technique are applicable and may lead to more or less spectral bandwidth. In order to keep freedom in application and design different channel bandwidths are defined and can be declared by the manufacturer.

The radio part of the transmitter and receiver shall be made up exclusively from equipment that has been approved according to the present document.

Other equipment that may be connected to radio microphones shall fulfil the standards applicable to that equipment (if any).

4.2 In ear monitoring

In ear monitoring equipment is used by stage and studio performers to receive personal fold back (monitoring) of the performance. This can be just their own voice or a complex mix of sources. This equipment is usually stereo or 2 channel audio, however, the bandwidth requirement of professional in ear monitoring equipment is similar to those of radio microphones.

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The radio part of the transmitter and receiver shall be made up exclusively from equipment that has been approved according to the present document.

Other equipment that may be connected to in ear monitoring equipment shall fulfil the standards applicable to that equipment (if any).

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5 General

5.1 Presentation of equipment for testing purposes

Each equipment submitted for testing shall fulfil the requirements of the present document on all channels over which it is intended to operate.

The applicant shall complete the appropriate application form when submitting equipment for testing.

For radio microphones that may use a variety of audio capsules the manufacturer shall supply the test sample with an audio test fixture, to substitute the audio capsule, with suitable input and output impedance.

The applicant shall state the channel bandwidth(s) within which the equipment is designed to operate chosen from table 1.

Table 1: Channel bandwidth

Declared channel Bandwidth (B)	Designation
200 kHz	D2
300 kHz	D3
400 kHz	D4
500 kHz	D5
600 kHz	D6