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Land Mobile Service;
Radio equipment using integral antennas
intended primarily for analogue speech;
Harmonised Standard covering the essential requirements
of article 3.2 of the 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.9] 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.8].

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 C.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:	21 March 2016
Date of latest announcement of this EN (doa):	30 June 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 December 2016
Date of withdrawal of any conflicting National Standard (dow):	31 December 2017

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 covers the minimum characteristics considered necessary in order to avoid harmful interference and to make acceptable use of the available frequencies.

The present document applies to equipment with integral antennas, used in angle modulation systems in the land mobile service, operating on radio frequencies between 30 MHz and 1 000 MHz, with channel separations of 12,5 kHz, 20 kHz and 25 kHz, and is intended primarily for analogue speech.

In the present document different requirements are given for the different radio frequency bands, channel separations, environmental conditions and types of equipment, where appropriate.

The present document is complementary to ETSI EN 300 086 [i.6], which covers radio equipment with an internal or external RF connector, for use in the land mobile service.

The present document may apply to PMR446 equipment as defined in [i.7]. Note that PMR446 equipment has a requirement to incorporate a receiver and may have requirements for 180 s maximum transmission time and VOX.

Table 1: Radiocommunications service frequency bands

	Radiocommunications service frequency bands
Transmit	30 MHz to 1 000 MHz
Receive	30 MHz to 1 000 MHz

The present document contains requirements to demonstrate that "*... Radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference*" and that "*....radio equipment supports certain features ensuring access to emergency services*" [i.8].

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the Radio Equipment Directive [i.8] may apply to equipment within the scope of the present document.

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 http://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] ETSI TR 100 028 (V1.4.1) (12-2001) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[2] ANSI C63.5 (2006): "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electro Magnetic Interference".

[3] ETSI TR 100 028-2 (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".

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] CEPT/ERC/REC 74-01E: "Unwanted emissions in the spurious domain" (Siófok 1998, Nice 1999, Sesimbra 2002; Hradec Kralove 2005).

[i.2] ETSI EN 300 793 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Presentation of equipment for type testing".

[i.3] 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.4] IEC 60489-3 (1988): "Methods of measurement for radio equipment used in the mobile services; Part 3: Receivers for A3E or F3E emissions".

[i.5] Recommendation ITU-T O.41 (1994): "Psophometer for use on telephone-type circuits".

[i.6] ETSI EN 300 086: "Land Mobile Service; Radio equipment with an internal or external RF connector intended primarily for analogue speech; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.7] ECC/DEC/(15)05: "The harmonised frequency range 446.0-446.2 MHz, technical characteristics, exemption from individual licensing and free carriage and use of analogue and digital PMR 446 applications".

[i.8] 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.9] 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 following terms and definitions apply:

50 Ω: 50 ohm non-reactive impedance

adjacent and alternate channels:

- The adjacent channels are those two channels offset from the wanted channel by the channel spacing.
- The alternate channels are those two channels offset from the wanted channel by double the channel spacing.

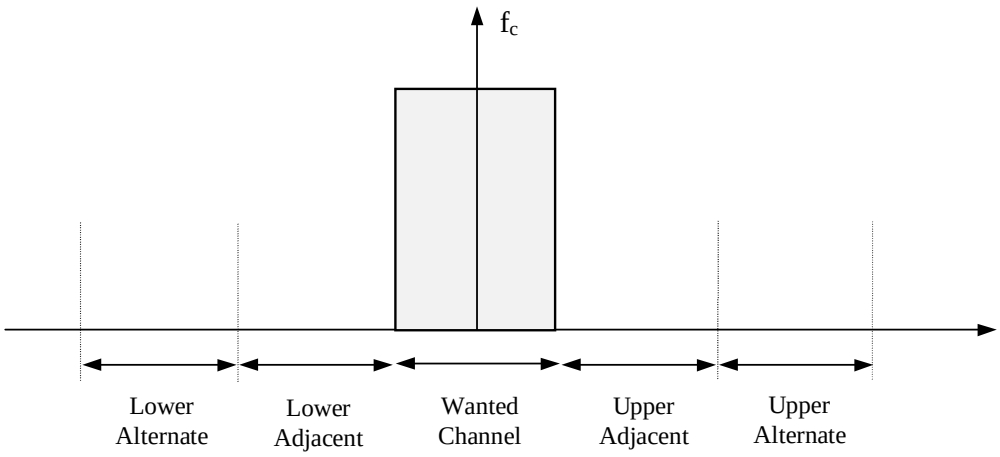

Figure 1: Adjacent and alternate channel definitions

angle modulation: either phase modulation or frequency modulation

audio frequency load: resistor, or suitable alternative, having a value equal to the impedance of the audio transducer at 1 000 Hz, as stated by the supplier, and of sufficient power rating to accept the maximum audio output power from the equipment under test

NOTE: In some cases it may be necessary to place an isolating transformer between the output terminals of the receiver under test and the load.

audio frequency termination: any connection other than the audio frequency load which may be required for the purpose of testing the receiver

NOTE: The termination device should be, as appropriate, either chosen by the supplier or agreed between the supplier and the testing laboratory and details included in test reports. If special equipment is required then it should be provided by the supplier.

conducted measurements: measurements which are made using a direct connection to the equipment under test

integral antenna: antenna designed to be connected to the equipment without the use of a 50 Ω external connector and considered to be part of the equipment

NOTE: An integral antenna may be fitted internally or externally to the equipment.

low power equipment: equipment that has a transmitter effective radiated power, as measured in clause 7.2, of not more than 500 mW

psophometric weighting network: psophometric weighting network is described in Recommendation ITU-T O.41 [i.5]

radiated measurements: measurements which involve the absolute measurement of a radiated field

SINAD Meter: measurement instrument used to measure SND/ND using a band-stop filter

switching range (sr): maximum frequency range, as specified by the supplier, over which the receiver or the transmitter can be operated within the alignment range without reprogramming or realignment

3.2 Symbols

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

dBc	dB relative to the carrier power
f_{I1}	1st intermediate frequency
f_{I2}	2nd intermediate frequency
f_{In}	nth intermediate frequency
f_l	frequency of the limited frequency range

f_{LO}	Local oscillator frequency
V_{min}	Minimum extreme test voltage
V_{max}	Maximum extreme test voltage
T_{min}	Minimum extreme test temperature
T_{max}	Maximum extreme test temperature

3.3 Abbreviations

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

AF	Audio Frequency
CEPT	Commission Européenne des Postes et Télécommunications
CSP	Channel SeParation
CTCSS	Continuous Tone Controlled Squelch System
CW	Continuous Wave
DC	Direct Current
DCS	Digital Controlled Squelch
EC	European Community
emf	electro-motive force
EUT	Equipment Under Test
IF	Intermediate Frequency
MPFD	Maximum Permissible Frequency Deviation
OATS	Open Area Test Site
PTT	Push To Talk
RBW	Resolution BandWidth
RF	Radio Frequency
rms	root mean squared
Rx	Receiver
SINAD	Received signal quality based on (Signal + Noise + Distortion) / (Noise + Distortion)
SND/ND	(signal + noise + distortion)/(noise + distortion)
sr	switching range
Tx	Transmitter
VOX	Voice Operated Transmitter
VSWR	Voltage Standing Wave Ratio

4 General and operational requirements

4.1 General

4.1.1 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 supplier, but as a minimum, shall be that specified in the test conditions contained in the present document.

4.1.2 Choice of model for testing

Stand-alone equipment should be complete with any ancillary equipment needed for testing.

If an equipment has several optional features, considered not to affect the RF parameters then the tests need only to be performed on the equipment configured with the combination of features considered to be the most complex.

Where practicable, equipment to be tested should provide a 50 Ω connector for conducted RF power level measurements.

In the case of integral antenna equipment, if the equipment does not have a internal permanent 50 Ω connector then it is permissible to use a second sample of the equipment with a temporary antenna connector fitted to facilitate testing. Any such modified samples shall not be used for any radiated measurements.

The performance of the equipment to be tested shall be representative of the performance of the corresponding production model.

NOTE: Guidance may be found in ETSI EN 300 793 [i.2].

4.1.3 Auxiliary test equipment

All necessary auxiliary test equipment, setting up instructions and other product information should be available.

4.2 Mechanical and electrical design

4.2.1 General

The equipment should be designed, constructed and manufactured in accordance with good engineering practice, and with the aim of minimizing harmful interference to other equipment and services.

4.2.2 Controls

Those controls, which if maladjusted, might increase the interfering potentialities of the equipment should not be accessible for adjustment by the user.

4.2.3 Transmitter shut-off facility

When a timer for an automatic shut-off facility is operative, at the moment of the time-out the transmitter should automatically be switched off (the re-activation of the transmitter shall reset the timer).

A shut-off facility should be inoperative for the duration of the measurements unless it has to remain operative to protect the equipment. If the shut-off facility is left operative the status of the equipment should be indicated.

4.3 Marking

The equipment shall be marked in a visible place. This marking shall be legible, tamperproof and durable.

5 Test conditions, power sources and ambient temperatures

5.1 Normal and extreme test conditions

Testing shall be performed under normal test conditions, and also, where stated, under extreme test conditions.

The test conditions and procedures shall be as specified in clauses 5.2 to 5.5.

5.2 Test power source

During testing the power source of the equipment shall be replaced by a test power source capable of producing normal and extreme test voltages as specified in clauses 5.3.2 and 5.4.2. The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the purpose of tests, the voltage of the power source shall be measured at the input terminals of the equipment.

For battery operated equipment the battery shall be removed and the test power source shall be applied as close to the battery terminals as practicable.

During tests of DC powered equipment the power source voltages shall be maintained within a tolerance of < ±1 % relative to the voltage at the beginning of each test. The value of this tolerance is critical for power measurements. Using a smaller tolerance will provide better measurement uncertainty values.

5.3 Normal test conditions

5.3.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- temperature: +15 °C to +35 °C;
- relative humidity: 20 % to 75 %.

When it is impracticable to carry out the tests under these conditions, a note to this effect, stating the ambient temperature and relative humidity during the tests, shall be added to the test report.

5.3.2 Normal test power source

5.3.2.1 Mains voltage

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of the test power source corresponding to the ac mains shall be between 49 Hz and 51 Hz.

5.3.2.2 Regulated lead-acid battery power sources used on vehicles

When the radio equipment is intended for operation from the usual types of regulated lead-acid battery power source used on vehicles the normal test voltage shall be 1,1 times the nominal voltage of the battery (for nominal voltages of 6 V and 12 V, these are 6,6 V and 13,2 V respectively).

5.3.2.3 Other power sources

For operation from other power sources or types of battery (primary or secondary), the normal test voltage shall be that declared by the equipment supplier.

5.4 Extreme test conditions

5.4.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with the procedures specified in clause 5.5, at the upper and lower temperatures of one of the following two ranges:

- -20 °C to +55 °C.
  All mobile and handportable equipment.
  Base stations for outdoor/uncontrolled climate conditions.
- 0 °C to +40 °C.
  Base stations for indoor/controlled climate conditions.

In the case of base station equipment, the supplier shall declare which conditions the equipment is intended to be installed in.

5.4.2 Extreme test source voltages

5.4.2.1 Mains voltage

The extreme test voltage for equipment to be connected to an ac mains source shall be the nominal mains voltage ±10 %.