SLOVENSKI STANDARD
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Elektromagnetna združljivost in zadeve v zvezi z radijskim spektrom (ERM) - Kopenska mobilna storitev - Komercialno dostopna amaterska radijska oprema - 1. del: Tehnične karakteristike in merilne metode

Electromagnetic compatibility and Radio spectrum Matters (ERM) - Land Mobile Service - Commercially available amateur radio equipment - 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 Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Commercially available amateur radio equipment, as identified below:

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

Part 2: "Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".

National transposition dates	
Date of adoption of this EN:	28 June 2010
Date of latest announcement of this EN (doa):	30 September 2010
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Date of withdrawal of any conflicting National Standard (dow):	31 March 2011

Introduction

The present document is the "radio product standard" corresponding to commercially available amateur radio equipment.

1 Scope

The present document applies to the following radio equipment types:

- Radio equipment intended to be used by radio amateurs within the meaning of article 1, definition 53, of the International Telecommunications Union (ITU) Radio Regulations [1] and which is available commercially.

NOTE: It is noted that this sort of equipment is traditionally supplied with an antenna connector.

2 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 reference 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.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

[1] ITU Radio Regulations (2008).

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

[3] IEC 60489-3 (Edition 2 - 1988): "Methods of measurement for radio equipment used in the mobile services. Part 3: Receivers for A3E or F3E emissions" (appendix F).

2.2 Informative references

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] ITU-R Recommendation SM.329-10 (2003): "Unwanted emissions in the spurious domain".

[i.2] CEPT/ERC/Recommendation 74-01 (2005): "Unwanted emissions in the spurious domain".

[i.3] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.4] 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".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Single SideBand (SSB): any emission using Single SideBand (SSB) suppressed carrier format

3.2 Symbols

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

Bn	Necessary bandwidth of an emission
PX	Maximum PEP

3.3 Abbreviations

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

AM	Amplitude Modulation
CBW	Channel BandWidth
CSP	Channel SPacing
DC	Direct Current
EUT	Equipment Under Test
FM	Frequency Modulation
HF	High Frequency
OATS	Open Area Test Site
PEP	Peak Envelope Power
RBW	Resolution BandWidth
SSB	Single SideBand
RF	Radio Frequency
SINAD	(Signal + Noise + Distortion) / (Noise + Distortion)
Tx	Transmit
UHF	Ultra High Frequency
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

4 Technical requirements specifications

4.1 Environmental profile

The environmental profile for operation of the equipment shall be declared by the supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the required operational environmental profile.

4.2 EUT test frequencies

Testing shall be performed with the EUT set to frequencies as follows:

- single-band equipment: test at the centre of the band;
- double-band equipment: test at the centre of both bands;
- HF multi-band equipment or VHF/UHF multi-band equipment: test at the centre of the lowest, the centre of the middle, and the centre of the highest band;

- HF/VHF, HF/UHF or HF/VHF/UHF combined equipment: test at the centre of the lowest HF band, the centre of the middle HF band, the centre of the highest HF band, the centre of the lowest VHF/UHF band, the centre of the middle VHF/UHF band, and the centre of the highest VHF/UHF band.

4.3 Test power source

During testing the power source of the equipment shall be replaced by a test power source capable of producing the nominal supply voltage for the equipment as declared by the manufacturer. 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.

4.3.1 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.

4.3.2 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).

4.3.3 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 manufacturer.

4.4 Testing of equipment that does not have an external 50 Ω RF connector (integral antenna equipment)

Where equipment has an internal 50 Ω connector it shall be permitted to perform the tests at this connector.

Equipment may also have a temporary internal 50 Ω connector installed for the purposes of testing.

No connection shall be made to any internal permanent or temporary antenna connector during the performance of radiated emissions measurements, unless such action forms an essential part of the normal intended operation of the equipment, as declared by the manufacturer.

4.5 Test load (artificial antenna)

For conducted measurements of the transmitter, a power attenuator ("artificial antenna") shall be used, exhibiting a substantially non-reactive, non-radiating load of 50 Ω to the antenna connector and capable of dissipating the transmitter output power.

4.6 PEP

The PEP is the average power in watts supplied to the artificial antenna by a transmitter during one RF cycle at the highest crest of the modulation envelope. For practical purposes the methods of measurements in clause 5.1 should be used.

4.7 Transmitter automatic shut-off facility

If the equipment is fitted with an automatic transmitter shut-off facility it shall be made inoperative for the duration of the type test, unless it has to be left operative to protect the equipment.

4.8 Arrangement for analogue test signals at the input of the transmitter

For the purpose of the present document, in the case of analogue equipment, the transmitter audio frequency modulation signal shall be applied to the terminals of the audio input connector with any microphone disconnected, unless otherwise stated.

4.9 Arrangement for test signals at the input of the receiver

RF test signal sources which are applied to the receiver shall present an impedance of 50 Ω to the receiver input. This requirement shall be met irrespective of whether one or more signals using a combining network are applied to the receiver simultaneously.

The levels of the test signals shall be expressed in terms of the emf at the receiver input connector.

The effects of any intermodulation products and noise produced in the test signal sources shall be negligible.

4.10 Characteristics of test signals at the input of the receiver

Wanted RF test signals applied to the receiver shall have the modulation characteristics as specified in table 1.

Table 1: Wanted test signal

Mode	Units	Modulation
AM	60	% AM (1 kHz)
FM	60	% of the maximum permissible frequency deviation (1 kHz)
SSB	1 kHz offset	None
Other modes	as declared by the manufacturer	as declared by the manufacturer

4.11 Characteristics of test signals at the input of the transmitter

The manufacturer shall declare details of the modulation scheme used and identify how the percentage modulation can be measured or specified.

Equipment capable of transmission of digital information shall be tested with modulation as specified in clause 4.11.2. Equipment using analogue transmission shall be tested with modulation as specified in clause 4.11.1. Equipment capable of both analogue and digital transmission shall be tested separately in each mode.

4.11.1 Analogue signals

For tests on analogue equipment via the audio input socket terminals, the test signal shall consist of two equal amplitude non harmonically related sinusoidal input signals selected to be in the range 500 Hz to 3 kHz with at least 500 Hz separation between them, each of which would independently drive the transmitter into its compression region. The composite signal level shall be 20 dB higher than the level which produces 60 % modulation unless the output power at this drive level is less than the highest Tx output power in which case the signal level shall be set to produce the highest possible Tx output power.

For tests via any facilities sockets this test signal shall be of the nature described by the manufacturer for the purpose of the socket , at a level which produces the largest value of output power (PEP) possible with analogue modulation.

4.11.2 Digital signals

For tests on digital equipment (including digital speech), the test signal be as declared by the manufacturer, at the appropriate data rate.

If the transmission of a continuous bit stream is not possible, the test signal shall be trains of correctly coded bits or messages.

For the purpose of testing PX in clause 5.1 the test signal shall produce the largest value of output power (PEP) possible with digital modulation. If this is not the case then a test signal that does produce the largest possible value of output power (PEP) with digital modulation should be used in the testing in clause 5.1.

For digital equipments that support adaptive rates, testing is only required at one bit rate. For transmitter tests in this clause this would normally be the highest bit-rate supported by the equipment.

4.12 Reference bandwidths for spurious measurements

The reference bandwidths applicable for all spurious measurement are given in table 2.

Table 2: Reference bandwidths to be used for the measurement of spurious emissions

Frequency range	RBW
9 to 150 kHz	1 kHz
150 kHz to 30 MHz	10 kHz
30 MHz to 1 GHz	100 kHz
Above 1 GHz	1 MHz

4.13 Transmit exclusion bandwidths for spurious measurements

When measuring transmit spurious emissions, an exclusion band centred on the wanted carrier is defined as 250 % of the CSP. The minimum values of necessary bandwidth (Bn) applicable depend on the operating frequency of the equipment as defined in CEPT/ERC/Recommendation 74-01 [i.2]. The combination of 250 % of the CSP and these necessary bandwidths result in the following transmit exclusion bands for spurious measurements in table 3.

Table 3: Transmit exclusion bands for the measurement of spurious emissions

Operating freq	Bn minimum	Tx exclusion band
Below 30 MHz	4 kHz	10 kHz
30 MHz to 1 GHz	25 kHz	62,5 kHz
1 GHz to 26 GHz	100 kHz	250 kHz
Above 26 GHz	1 MHz	2,5 MHz

Where the necessary bandwidth of the emission being measured is greater than the minimum values given in table 3, the transmit exclusion band shall be recalculated using the actual value of Bn.