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Electromagnetic compatibility and Radio spectrum Matters (ERM); Ground-based UHF radio transmitters, receivers and transceivers for the UHF aeronautical mobile service using amplitude modulation; Part 1: Technical characteristics and methods of measurement

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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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): Ground-based UHF radio transmitters, receivers and transceivers for the UHF aeronautical mobile service using amplitude modulation as identified below:

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

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

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Date of adoption of this EN:	19 January 2009
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1 Scope

The present document states the minimum performance requirements for radio transmitters receivers and transceivers at ground-based aeronautical stations operating in the UHF band (225 MHz to 399,975 MHz) allocated to the aeronautical mobile service.

The present document applies to DSB AM systems, with channel separations of 25 kHz intended for analogue speech.

The scope of the present document is limited to ground base stations.

2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
 - for informative references.

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 indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ITU-T Recommendation O.41: "Psophometer for use on telephone-type circuits".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.2] NATO STANAG 4205: "Technical Standards for Single Channel UHF Radio Equipment".
- [i.3] ETSI EN 300 113-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land mobile service; Radio equipment intended for the transmission of data (and/or speech) using constant or non-constant envelope modulation and having an antenna connector; Part 1: Technical characteristics and methods of measurement".

3 Definitions and abbreviations

3.1 Definitions

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

aeronautical mobile service: mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate

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

ground base station: aeronautical station equipment, in the aeronautical mobile service, for use with an external antenna and intended for use at a fixed location

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

3.2 Abbreviations

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

AF	Audio Frequency
AGC	Automatic Gain Control
AM	Amplitude Modulation
dBc	dB relative to the carrier power
DSB	Double Side Band
IF	Intermediate Frequency
ppm	parts per million
RF	Radio Frequency
rms	root mean square
SINAD	(Signal + Noise + Distortion)/(Noise + Distortion)
UHF	Ultra High Frequency
VSWR	Voltage Standing Wave Ratio

4 General requirements

25 kHz equipment shall be able to operate on the frequencies 225,000 MHz to 399,975 MHz.

It shall not be possible to transmit while any frequency synthesizer used within the transmitter is out of lock.

It shall not be possible to transmit during channel switching operations.

4.1 Controls and indicators

The equipment shall have the following controls and indicators as a minimum:

- a visual indication that the device is switched on;
- a facility to disable the squelch for test purposes (by local or remote control);
- a visual indication that the carrier is being produced.

The equipment shall also meet the following requirements:

- the user shall not have access to any control which, if unintentionally set, might impair the operating parameters of the equipment.

4.2 Class of emission and modulation characteristics

The equipment shall use Double Side Band (DSB) Amplitude Modulation (AM) full carrier, 6K80A3EJN with 25 kHz channel spacing.

4.3 Warm up

After being switched on the equipment shall meet the requirements of the present document within one minute under normal test conditions (see clause 5.3).

If the equipment includes parts which require to be heated in order to operate correctly (e.g. crystal ovens) a warming-up period of 10 minutes of those parts shall be allowed.

5 Test conditions, power sources and ambient temperatures

5.1 Normal and extreme test conditions

Measurements shall be made under normal test conditions (see clause 5.3) and also, where stated, under extreme test conditions (see clauses 5.4.1 and 5.4.2).

5.2 Test power source

During testing, the equipment shall be supplied from a test power source capable of producing normal and extreme test voltages.

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 testing the power source voltage shall be measured at the input terminals of the equipment.

During testing, the power source voltages shall be maintained within a tolerance of ± 3 % relative to the voltage level at the beginning of each test.

5.3 Normal test conditions

5.3.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be a 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 power sources

5.3.2.1 Mains voltage and frequency

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 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.

5.4 Extreme test conditions

5.4.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with clause 5.5, at a lower temperature of $-20\text{ }^{\circ}\text{C}$ and an upper temperature of $+55\text{ }^{\circ}\text{C}$. This test shall be performed at the nominal supply voltage as defined in clause 5.3.2.

5.4.2 Extreme values of test power sources

5.4.2.1 Mains voltage

The extreme test voltages shall be between 207 V and 253 V. This test shall be performed at the normal temperature and humidity as defined in clause 5.3.1.

The frequency of the test voltage shall be between 49 Hz and 51 Hz.

5.4.2.2 Other power sources

For equipment using other power sources, or capable of being operated from a variety of power sources, the extreme test voltages shall be those agreed between the equipment manufacturer and the testing laboratory and shall be recorded in the test report.

5.5 Performance test

For the purposes of the present document, the term "performance test" shall be taken to mean the following measurements and limits:

- for the transmitter:
 - frequency error:
with the transmitter connected to a coaxial termination (see clause 6.2.1), the frequency error shall be as in clause 7.2;
 - carrier power:
with the transmitter connected to a coaxial termination (see clause 6.2.1), the transmitter shall be keyed without modulation and the output power shall be as defined in clause 7.3;
 - modulation:
with the transmitter connected to a coaxial termination (see clause 6.2.1), the transmitter shall be keyed. The modulation distortion shall be as in clause 7.4.3.
- for the receiver:
 - sensitivity:
with the AGC operative, a normal test signal (see clause 6.1.3) shall be applied to the receiver. The sensitivity shall be as defined in clause 8.1.

5.6 Environmental tests

5.6.1 General

Environmental tests shall follow checking the protection of the transmitter (see clause 7.1) which follows the first application of the Performance test (see clause 5.5).

5.6.2 Procedure for tests at extreme temperatures

Before tests at the upper extreme temperature ($55\text{ °C} \pm 3\text{ °C}$), the equipment shall be placed in the test chamber and left until thermal balance is attained. The equipment shall then be switched on for 30 minutes. The transmitter shall then be keyed for 1 minute in the transmit condition, after which the equipment shall meet the specified requirements. Transmitters shall be operated in the highest rated power transmit condition.

For tests at the lower extreme temperature ($-20\text{ °C} \pm 3\text{ °C}$), the equipment shall be left in the test chamber until thermal balance is attained, then switched to the standby or receive condition for 1 minute after which the equipment shall meet the specified requirements.

NOTE: It is assumed that equipment intended for off-set carrier operation will be installed in a building with facilities suitable to provide protection from temperature extremes, therefore extreme temperature tests need not be applied to such equipment.

5.6.3 Temperature tests

The chamber must be able to maintain the required temperature value during the measurement.

5.6.3.1 High temperature

- Place the equipment in a chamber and heat to the required temperature value and allow to stabilize for 1 hour.
- Switch on the equipment.
- After 30 minutes carry out the performance test as detailed in clause 5.5.
- Switch off the equipment and allow the chamber to cool to room temperature over a 1 hour period.
- Allow time for the equipment to stabilize to normal room temperature and humidity before carrying out the next test.

5.6.3.2 Low temperature

- Place the equipment in a chamber and cool to the required temperature value for 2 hours.
- Switch on the equipment and maintain the chamber at the required operating temperature.
- After 10 minutes carry out the performance test as detailed in clause 5.5.
- Switch off the equipment and allow the chamber to rise to room temperature over a 1 hour period.
- Allow time for the equipment to stabilize to normal room temperature and for moisture to disperse before carrying out the next test.