

SLOVENSKI STANDARD
SIST EN 300 676-1 V1.4.1:2007

01-december-2007

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

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SIST EN 300 676-1 V1.4.1:2007
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Ta slovenski standard je istoveten z: EN 300 676-1 Version 1.4.1

ICS:

33.060.20	Sprejemna in oddajna oprema	Receiving and transmitting equipment
33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general
49.090	U] ^ { aš š • d` { ^ } cš : æ } aš š • [b \ aš cš @	On-board equipment and instruments

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ETSI EN 300 676-1 V1.4.1 (2007-04)

European Standard (Telecommunications series)

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

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Reference

REN/ERM-TG25-027-1

Keywords

aeronautical, AM, DSB, radio, testing, VHF

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Sous-Préfecture de Grasse (06) N° 7803/88

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Contents

Intellectual Property Rights	7
Foreword.....	7
Introduction	7
1 Scope	8
2 References	8
3 Definitions and abbreviations.....	8
3.1 Definitions	8
3.2 Abbreviations	9
4 General requirements	9
4.1 Controls and indicators.....	9
4.2 Class of emission and modulation characteristics	10
4.3 Warm up.....	10
5 Test conditions, power sources and ambient temperatures	10
5.1 Normal and extreme test conditions	10
5.2 Test power source.....	10
5.3 Normal test conditions.....	10
5.3.1 Normal temperature and humidity	10
5.3.2 Normal power sources	11
5.3.2.1 Mains voltage and frequency	11
5.3.2.2 Regulated lead-acid battery power sources used on vehicles	11
5.3.2.3 Other power sources.....	11
5.4 Extreme test conditions	11
5.4.1 Extreme temperatures	11
5.4.2 Extreme values of test power sources	11
5.4.2.1 Mains voltage.....	11
5.4.2.2 Other power sources.....	11
5.4.3 Extended temperatures.....	11
5.5 Performance test	12
5.6 Environmental tests	12
5.6.1 General.....	12
5.6.2 Procedure for tests at extreme temperatures	12
5.6.3 Temperature tests	13
5.6.3.1 High temperature.....	13
5.6.3.2 Low temperature	13
6 General conditions of measurement	13
6.1 Receiver test signal arrangement.....	13
6.1.1 Test signal sources	13
6.1.2 Nominal frequency	13
6.1.3 Normal test signal	13
6.1.4 Squelch	13
6.1.5 Normal audio output power	14
6.1.6 Audio AGC.....	14
6.2 Transmitter test signal arrangement	14
6.2.1 Coaxial termination.....	14
6.2.2 Signal sources	14
6.2.3 Normal test signal	14
6.3 Test channels.....	14
7 Transmitter	14
7.1 Protection of the transmitter	14
7.1.1 Definition.....	14
7.1.2 Method of measurement	14

7.1.3	Requirement.....	15
7.2	Frequency error	15
7.2.1	Definition.....	15
7.2.2	Method of measurement	15
7.2.3	Limits.....	15
7.3	Carrier power.....	15
7.3.1	Definitions	15
7.3.2	Method of measurement	16
7.3.3	Tolerances.....	16
7.3.3.1	Normal test conditions	16
7.3.3.2	Extreme test conditions	16
7.4	Amplitude modulation characteristic.....	16
7.4.1	Modulation depth (speech)	16
7.4.1.1	Definitions.....	16
7.4.1.2	Method of measurement.....	16
7.4.1.3	Limits	16
7.4.1.4	Modulation depth (analogue data mode).....	16
7.4.1.5	Method of measurement.....	16
7.4.1.6	Limits	17
7.4.2	Modulation compression (speech mode)	17
7.4.2.1	Definition	17
7.4.2.2	Method of measurement.....	17
7.4.2.3	Limits	17
7.4.3	Amplitude modulation distortion.....	17
7.4.3.1	Definition	17
7.4.3.2	Method of measurement.....	17
7.4.3.3	Limits	18
7.4.4	Audio frequency response	18
7.4.4.1	Definition	18
7.4.4.2	Method of measurement.....	18
7.4.4.3	Limits 8,33 kHz channel spacing	18
7.4.4.4	Limits 25 kHz channel spacing.....	18
7.4.4.5	Limits 25kHz/channel spacing (Data mode only).....	18
7.4.5	Group delay variation (data mode only).....	19
7.4.5.1	Definition	19
7.4.5.2	Transmitter method of measurement.....	19
7.4.5.3	Limits	19
7.5	Adjacent channel power	20
7.5.1	Definition.....	20
7.5.2	Measurement.....	20
7.5.3	Limits.....	20
7.6	Broadband noise measurement.....	21
7.6.1	Definition.....	21
7.6.2	Method of measurement	21
7.6.3	Limit	21
7.7	Conducted spurious emissions	22
7.7.1	Definition.....	22
7.7.2	Method of measurement	22
7.7.3	Limits.....	22
7.8	Intermodulation attenuation.....	23
7.8.1	Definition.....	23
7.8.2	Method of measurement	23
7.8.3	Limits.....	23
7.9	RF power attack time and release time.....	24
7.9.1	Definitions	24
7.9.2	Method of measurement	24
7.9.2.1	Attack time	24
7.9.2.2	Release time	25
7.9.3	Limits.....	25
7.10	Keying Transient frequency behaviour of the transmitter	25
7.10.1	Definitions	25
7.10.2	Method of measurement	26

7.10.3	Limits.....	26
7.11	Sidetone.....	26
7.11.1	Limits.....	26
8	Receiver.....	27
8.1	Sensitivity.....	27
8.1.1	Definition.....	27
8.1.2	Method of measurement.....	27
8.1.3	Limits.....	27
8.2	Harmonic distortion.....	27
8.2.1	Definition.....	27
8.2.2	Method of measurement.....	27
8.2.3	Limits.....	28
8.3	Audio frequency response.....	28
8.3.1	Definition.....	28
8.3.2	Method of measurement.....	28
8.3.3	Limits.....	28
8.3.4	Limit for DATA operation.....	28
8.4	Audio noise.....	28
8.4.1	Definition.....	28
8.4.2	Method of measurement.....	28
8.4.3	Limits.....	29
8.5	Effective acceptance bandwidth.....	29
8.5.1	Definition.....	29
8.5.2	Method of measurement.....	29
8.5.3	Limits.....	29
8.6	Adjacent channel rejection.....	29
8.6.1	Definition.....	29
8.6.2	Method of measurement.....	29
8.6.3	Limits.....	30
8.7	Spurious response rejection.....	30
8.7.1	Definition.....	30
8.7.2	Introduction to the method of measurement.....	30
8.7.3	Method of search of the limited frequency range.....	31
8.7.4	Method of measurement.....	31
8.7.5	Limit.....	31
8.8	Intermodulation response rejection.....	31
8.8.1	Definition.....	31
8.8.2	Method of measurement.....	32
8.8.3	Limit.....	32
8.9	Blocking or desensitization.....	32
8.9.1	Definition.....	32
8.9.2	Method of measurement.....	32
8.9.3	Limit.....	33
8.10	Conducted spurious emissions.....	33
8.10.1	Definition.....	33
8.10.2	Method of measuring the power level.....	33
8.10.3	Limits.....	33
8.11	Squelch operation.....	34
8.11.1	Definition.....	34
8.11.2	Method of measurement.....	34
8.11.3	Limits.....	34
8.12	Cross modulation rejection.....	35
8.12.1	Definition.....	35
8.12.2	Method of measurement.....	35
8.12.3	Limits.....	35
8.13	Receiver dynamic range.....	35
8.13.1	Definition.....	35
8.13.2	Method of measurement.....	35
8.13.3	Limit.....	36
8.14	AGC attack time and release time (data mode only).....	36
8.14.1	Definitions.....	36

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SIST EN 300 676-1 V1.4.1:2007

<https://standards.iteh.ai/catalog/standards/sist/9b4fbd35-4963-4f78-a82c-411551911118/sist-en-300-676-1-v1-4-1-2007>

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8.14.2	Method of measurement	36
8.14.2.1	Attack time	36
8.14.2.2	AGC Decay time	36
8.14.3	Limits	36
8.15	AF AGC	37
8.15.1	Definition	37
8.15.2	Method of measurement	37
8.15.3	Limit	37
8.16	Group delay variation (data mode only)	37
8.16.1	Definition	37
8.16.2	Receiver method of measurement	37
8.16.3	Limits	37
9	Measurement uncertainty and interpretation of the measured results	38
9.1	Maximum measurement uncertainties	38
9.2	Interpretation of the measurement results	39
Annex A (normative):	Auxiliary cables	40
Annex B (normative):	Specification for adjacent channel power measurement arrangements	41
B.1	Power measuring receiver specification	41
B.1.1	IF filter	41
B.1.2	Attenuation indicator	42
B.1.3	RMS value indicator	42
B.1.4	Oscillator and amplifier	42
Annex C (informative):	Bibliography	43
History		44

[SIST EN 300 676-1 V1.4.1:2007](https://standards.iteh.ai/catalog/standards/sist/9b4fd35-4963-4f78-a82c-a1133f5111fd/sist-en-300-676-1-v1-4-1-2007)
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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 Ground-based VHF hand-held, mobile and fixed radio transmitters, receivers and transceivers for the VHF 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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National transposition dates		
Date of adoption of this EN:	SIST EN 300 676-1 V1.4.1:2007	26 January 2007
Date of latest announcement of this EN (doa):	https://standards.iteh.ai/catalog/standards/sist/9b4fd35-4963-4f78-a82c-a1952f11fd/sist-en-300-676-1-v1-4-1-2007	30 April 2007
Date of latest publication of new National Standard or endorsement of this EN (dop/e):		31 October 2007
Date of withdrawal of any conflicting National Standard (dow):		31 October 2007

Introduction

The present document states the minimum performance requirements for ground based radio transmitters, transceivers and receivers for the aeronautical mobile service operating in the VHF band (118 MHz to 136,975 MHz), using Double Sideband Amplitude Modulation with 8,33 kHz or 25 kHz channel spacing.

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

The present document has been written on the assumption that:

- the type test measurements will be performed only once, in an accredited test laboratory and the measurements accepted by the various authorities in order to grant type approval;
- if equipment available on the market is required to be checked it will be tested in accordance with the methods of measurement specified in the present document.

1 Scope

The present document states the minimum performance requirements for radio transmitters receivers and transceivers at ground-based aeronautical stations operating in the VHF band (118 MHz to 136,975 MHz) allocated to the aeronautical mobile service.

The present document applies to DSB AM systems, with channel separations of 8,33 kHz or 25 kHz intended for analogue speech and ground base stations with a channel spacing of 25 kHz intended for ACARS data communication.

The scope of the present document is limited to ground base stations, ground mobile and hand held radios for ground use.

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.

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- [1] ETSI ETR 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".
 - [2] ICAO annex 10 volume V (1996): "Aeronautical Radio Frequency Spectrum Utilization".
 - [3] ITU-T Recommendation P.53: "Psophometer for use on telephone-type circuits".
 - [4] ISO 7637 (parts 1 and 2): "Road vehicles - Electrical disturbances from conduction and coupling".
 - [5] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

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

hand held: radio equipment with integral batteries, designed to be hand portable and operated hand held

integral antenna equipment: radio communications equipment with an antenna integrated into the equipment without the use of an external connector and considered to be part of the equipment

NOTE: An integral antenna may be internal or external to the equipment. In equipment of this type, a 50 Ω RF connection point shall be provided for test purposes. A connection point for an AF modulating input and for AF output measurements shall also be provided.

mobile station: radio equipment designed for permanent or temporary vehicle installation and operation, including provision for vehicle DC power supply, and connections for external antenna, PTT key, microphone, speaker and/or headphone

non-integral antenna equipment: radio communications equipment with a connector intended for connection to an antenna

portable station: radio equipment with integral battery for independent hand-carried use

NOTE: Provisions may be made for connections of an external antenna, PTT key, microphone, headphone and charger, but principally to be operated as a self contained unit.

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:

ACARS	Aircraft Communications Addressing and Reporting System
AF	Audio Frequency
AGC	Automatic Gain Control
AM	Amplitude Modulation
dBc	dB relative to the carrier power
DSB	Double Side Band
ICAO	International Civil Aviation Organization
IF	Intermediate Frequency
ppm	parts per million
RF	Radio Frequency
rms	root mean square
SINAD	(Signal + Noise + Distortion)/(Noise + Distortion)
VSWR	Voltage Standing Wave Ratio

4 General requirements

8,33 kHz equipment shall be able to operate on all channels in the List of Assignable Frequencies defined in Appendix 2, chapter 4, Group F (see clause 4.1.8.1.2) of the ICAO Annex 10 Volume V [2].

The channel labelling used for 8,33 kHz channel spacing is based on a frequency-channel pairing in accordance with table 4.1 (bis) of ICAO Annex 10 Volume V [2] clause 4.1.2.4.

25 kHz equipment shall be able to operate on the frequencies 118,0 MHz to 136,975 MHz in accordance with ICAO Annex 10 Volume V [2], Appendix to Chapter 4.

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;

- 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 wrongly set, might impair the technical characteristics 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 for 25 kHz, 5K00A3EJN for 8,33 kHz), for speech and 13k0A2D for data. The equipment shall be designed to operate satisfactorily with a channel separation of 8,33 kHz or 25 kHz.

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: $+15^{\circ}\text{C}$ to $+35^{\circ}\text{C}$;

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 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 (6 V, 12 V, etc.).

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 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°C and an upper temperature of $+55^{\circ}\text{C}$. 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. Equipment intended for vehicle installation shall meet the power supply requirements of ISO 7637 [4].

5.4.3 Extended temperatures

For tests at extended temperatures, measurements shall be made in accordance with clause 5.5, at a lower temperature of 0°C and an upper temperature of $+40^{\circ}\text{C}$. This test shall be performed at the nominal supply voltage as defined in clause 5.3.2.