SLOVENSKI STANDARD
SIST ETS 300 676 E1:2003

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Radijska oprema in sistemi (RES) – Radijski oddajniki in sprejemniki v aeronavtičnih postajah aeronavtične mobilne storitve, ki delujejo v pasu VHF (118 MHz–137 MHz) z uporabo amplitudne modulacije in s kanalskim razmikom 8,33 MHz – Tehnične karakteristike in merilne metode

Radio Equipment and Systems (RES); Radio transmitters and receivers at aeronautical stations of the aeronautical mobile service operating in the VHF band (118 MHz -137 MHz) using amplitude modulation and 8,33 kHz channel spacing; Technical characteristics and methods of measurement

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI).

Transposition dates	
Date of adoption:	28 February 1997
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Introduction

This ETS states the minimum performance requirements for radio transmitters and receivers at aeronautical stations of the aeronautical mobile service operating in the VHF band (118 MHz - 137 MHz), using Double Sideband Amplitude Modulation with 8,33 kHz channel spacing.

This ETS 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.

This ETS has been written on the assumption that:

- the type test measurements will be performed only once, in one of the accredited test laboratories 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 this ETS.

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1 Scope

This European Telecommunication Standard (ETS) states the minimum performance requirements for radio transmitters and receivers at ground-based aeronautical stations operating in the VHF band (118 MHz - 137 MHz) allocated to the aeronautical mobile service. The allotment of 8,33 kHz channels in the VHF band has been decided by the International Civil Aviation Organization (ICAO) and may be found in ICAO Annex 10 Volume V [3].

This ETS applies only to Double Side Band (DSB) Amplitude Modulation (AM) systems, with channel separations of 8,33 kHz intended for analogue speech. Offset carrier operation is not intended in a 8,33 kHz channel separation environment. A system can exist of a combination of the single transmitter or a single receiver or a transceiver. The scope of this ETS is limited to ground base stations, and excludes ground mobile and handportable stations.

2 Normative references

This ETS incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent references to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ICAO Annex 10 Volume III Part 2 (1996): "Voice Communication Systems".

[2] ETR 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".

[3] ICAO Annex 10 Volume V (1996): "Aeronautical Radio Frequency Spectrum Utilization".

[4] ITU-T Recommendation P.53: "Psophometer for use on telephone-type circuits".

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of this ETS, the following definitions apply:

Types of measurements:

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

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

aeronautical mobile service: A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate. Emergency position-indicating radio beacon stations may also participate in this service on designated distress and emergency frequencies.

Type of station:

aeronautical station: A land station in the aeronautical mobile service.

ground base station: Aeronautical station equipment fitted with an external 50 Ω antenna socket or connector, for use with an external antenna and intended for use at a fixed location.

3.2 Abbreviations

For the purposes of this ETS, 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
emf	electro-motive force
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

4.1 Construction

The mechanical and electrical construction and finish of the equipment shall conform in all respects to good engineering practice, and the equipment shall be suitable as part of a ground installation.

All controls shall enable the control functions to be easily performed and the number of controls should be the minimum necessary for simple and satisfactory operation.

All parts of the equipment to be checked during inspection or maintenance operations shall be readily accessible. Components shall be readily identifiable.

Technical documentation (e.g. operating instructions) shall be supplied with the equipment.

The VHF aeronautical mobile service uses only single-frequency channels with simplex operation.

The equipment shall be able to operate on all channels in the list of assignable frequencies defined in Group F (paragraph 4.1.8.1.2) of the ICAO Annex 10 Volume V [3] paragraph 4.1.2.4.

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 I Part II [1] paragraph 4.1.2.5.

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.

4.2 Controls and indicators

The equipment shall have the following controls and indicators:

- a visual indication that the installation is in operation;
- a squelch control including on/off switch and a squelch level adjustment;
- a visual indication that the carrier is being produced.

The equipment shall also meet the following requirements:

- the equipment shall be integrated in a system that shall be end-to-end compatible with the ICAO Annex 10 Volume III Parts 2 [1] characteristics of the aeronautical mobile service using 8,33 kHz channel spacing;

- the user shall not have access to any control which, if wrongly set, might impair the technical characteristics of the equipment;

- for Air Traffic Control purposes, the equipment shall provide a remote control capability.

4.3 Safety precautions

Measures shall be taken to protect the equipment against the effects of overcurrent or overvoltage.

4.4 Class of emission and modulation characteristics

The equipment shall use Double Side Band (DSB) Amplitude Modulation (AM), A3E, for speech.

The equipment shall be designed to operate satisfactorily with a channel separation of 8,33 kHz (25/3 kHz).

4.5 Warm up

After being switched on the equipment shall be operational within five seconds and shall meet the requirements of this ETS within one minute under normal conditions.

If the equipment includes parts which require to be heated in order to operate correctly (e.g. crystal ovens) a warming-up period of 30 minutes to 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 (subclause 5.3) and also, where stated, under extreme test conditions (subclauses 5.4.1 and 5.4.2 applied simultaneously).

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 as specified in subclauses 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 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 %.

5.3.2 Normal power sources

5.3.2.1 Mains voltage and frequency

The normal test voltage shall be the nominal mains voltage, 230 V +10 % / -6 % (253,0 V to 216,2 V).

The frequency of the test voltage shall be 50 Hz ± 1 Hz.

5.3.2.2 Battery power sources

When the radio equipment is intended for operation from the usual types of battery power source, the normal test voltage shall be the nominal voltage of the battery (e.g. 12 V, 24 V etc.).

5.3.2.3 Other power sources

For operation from other power sources, the normal test voltage shall be declared by the manufacturer.

5.4 Extreme test conditions

5.4.1 Extreme temperatures

For tests at extreme temperatures, measurements shall be made in accordance with subclause 5.5, at a lower temperature of -20°C and an upper temperature of +55°C.

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.

The frequency of the test voltage shall be 50 Hz ± 1 Hz.

5.4.2.2 Battery power sources

When the radio equipment is intended for operation from the usual types of battery power source, the extreme test voltages shall be 1,3 and 0,9 times the nominal voltage of the battery (for a nominal voltage of 24 V these are 31,2 V and 21,6 V respectively).

5.4.2.3 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 Procedure for tests at extreme temperatures

The equipment shall be switched off during the temperature stabilizing periods.

For tests at the upper temperature, the equipment shall be placed in the test chamber and left until thermal equilibrium is reached. The equipment shall then be switched on for 30 minutes in the highest power transmit condition before any measurements are made.

For tests at the lower temperature, the equipment shall be left in the test chamber until thermal equilibrium is reached. The equipment shall then be switched on for one minute in the stand-by or receive condition before any measurements are made.

5.6 Environmental tests

5.6.1 General

Environmental tests shall be carried out before any other tests. The protection of the transmitter (subclause 7.10) shall be checked before the environmental tests.

5.6.2 Performance check

For the purposes of this ETS, the term "performance check" shall be taken to mean the following measurements and limits:

- for the transmitter:
  - frequency error:

    with the transmitter connected to an artificial antenna (subclause 6.2.1), the frequency error (subclause 7.1) shall be within ±1,5 ppm;

  - carrier power:

    with the transmitter connected to an artificial antenna (subclause 6.2.1), the transmitter shall be keyed without modulation and the output power (subclause 7.2) shall be within +2 dB and -3 dB from the rated maximum output power;

- for the receiver:
  - maximum usable sensitivity:

    with the Automatic Gain Control (AGC) operative, a normal test signal (subclause 6.1.4) shall be applied to the receiver. The level of the input test signal shall be adjusted until the SINAD at the output of the receiver is 20 dB and the receiver output power is at least the normal audio output power (subclause 6.1.6). The level of the input signal shall be less than +26 dBμV emf.

5.6.3 Temperature tests

5.6.3.1 Dry heat

The equipment shall be placed in a chamber at normal room temperature. The temperature shall then be raised to, and maintained, at +70°C (±3°C) for a period of at least 10 hours.

The chamber shall then be cooled down to +55°C (±3°C). After temperature balance the equipment shall then be switched on and shall be kept operating continuously for two hours with a 50 % duty cycle period equal to 8 minutes. The temperature of the chamber shall be maintained at +55°C (±3°C) during the two hour period. During this period, the equipment shall be subjected to a performance check.

At the end of the test and with the equipment still in the chamber, the chamber temperature shall be brought to room temperature in not less than one hour. The equipment shall then be exposed to normal room temperature and humidity for not less than three hours before the next test is carried out.

5.6.3.2 Damp heat

The equipment shall be placed in a chamber at normal room temperature and humidity which shall be heated steadily over a period of three hours (±30 minutes), to +40°C (±3°C). During this period, the relative humidity shall be brought to 93 % (±2 %) so that excessive condensation is avoided.

The conditions shall be maintained for a period of at least 10 hours.

30 minutes later the equipment shall be switched on and shall be kept operating continuously for two hours. The equipment shall be subjected to a performance check during this two hour period.

The temperature and relative humidity of the chamber shall be maintained at +40°C (±3°C) and 93 % (±2 %) during the period of 2 hours and 30 minutes.

At the end of the test and with the equipment still in the chamber, the chamber shall be brought to room temperature in not less than one hour. The equipment shall then be exposed to normal room temperature and humidity for not less than three hours, or until moisture has dispersed, which ever is longer, before the next test is carried out.