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Meteorological Aids (Met Aids);
Radiosondes to be used in the 400,15 MHz to 406 MHz frequency range with power levels ranging up to 200 mW;
Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

Reference
REN/ERM-TGAERO-51

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.2] 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.1].

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 A.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.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
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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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Introduction

Meteorological aids, Radiosondes, are light weight, disposable precision measurement instruments mainly used for *in situ* upper air measurements of meteorological variables (pressure, temperature, relative humidity, wind speed and direction) in the atmosphere up to an altitude of 36 km. The measurements are vital to international weather forecasting capability (and hence severe weather warning services for the public involving protection of life and property). The Radiosonde systems provide simultaneous measurements of the vertical profile of temperature, relative humidity as well as wind speed and direction. The variation of these meteorological variables in the vertical contains the majority of the critical information for weather forecasting. These systems are the only meteorological observing systems able to regularly provide the vertical resolution that meteorologists need for all five variables (i.e. pressure, temperature, relative humidity, wind speed and direction).

Typically the Radiosonde observations are produced by Radiosondes measuring atmosphere for approximately 2 hours and carried by ascending balloons launched from land stations or ships. Radiosonde observations are carried out routinely by almost all countries, two to four times a day. The observation data is then circulated immediately to all other countries within a few hours via the WMO (World Meteorological Organization) Global Telecommunications System (GTS). The observing systems and data dissemination are all organized under the framework of the World Weather Watch Programme of WMO.

The observation stations are required, worldwide, at a horizontal spacing of less than or equal to 250 km with a frequency of observation from one to four times per day.

Remotely sensed measurements from satellites do not have the vertical resolution available from Radiosondes. Successful derivation of vertical temperature structure from these satellite measurements usually requires a computation initialized either directly from Radiosonde statistics or from the numerical weather forecast itself. In the latter case, the Radiosonde measurements ensure that the vertical structure in these forecasts remains accurate and stable with time. In addition, the Radiosonde measurements are used to calibrate satellite observations by a variety of techniques.

Radiosonde observations are thus seen to remain absolutely necessary for meteorological operations for the foreseeable future.

Other applications, independent of the main civilian meteorological organizations include environmental pollution, hydrology, radioactivity in the free atmosphere, significant weather phenomena (e.g. winter storms, thunderstorms, etc.) and investigation of a range of physical and chemical properties of the atmosphere.

About 150 000 Radiosondes are annually used in Europe, about 90 % of them are in 403 MHz band. This use is not decreasing with time, since with modern automation it is now much easier to successfully operate systems without highly skilled operators and a large amount of supporting equipment.

The Radiosondes use unidirectional transmission on two frequency bands: 403 MHz band covers primary and co-primary allocations from 400,15 MHz to 406 MHz and 1 680 MHz band from 1 668,4 MHz to 1 690 MHz. The 403 MHz Radiosonde technology applies GNSS (Global Navigation Satellite Systems) for wind measurement, whereas the 1 680 MHz systems may base the wind measurement on balloon tracking with a Radio Direction Finding antenna. Because the 403 MHz wind measurement depends on the availability of the GNSS signals, many operators do not consider this technology secure enough for critical applications (e.g. defence and national security), and consequently prefer 1 680 MHz systems.

National regulatory conditions (channel/frequency separations or the inclusion of an automatic transmitter shut-off feature) for an individual/general license or license exemption may apply.

1 Scope

The present document specifies technical characteristics and methods of measurements for digitally modulated radiosondes operating in the range from 400,15 MHz to 406 MHz and with power levels ranging up to 200 mW.

The present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.1] under the conditions identified in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

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

[1] CISPR 16-1-1 (Edition 4.0) (09-2015): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".

[2] ETSI TS 103 052 (V1.1.1) (03-2011): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".

[3] ETSI EN 300 220-1 (V3.1.1) (02-2017): "Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 1: Technical characteristics and methods of measurement".

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.

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 not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] 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.2] 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.

[i.3] ETSI TR 100 028 (all parts) (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.4] ETSI TR 100 028-2 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

conducted measurements: measurements which are made using a direct 50 Ω connection to the EUT

dedicated antenna: removable antenna supplied and tested with the radio equipment, designed as an indispensable part of the EUT

integral antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment

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

telemetry: use of radio communication for indicating or recording data at a distance

3.2 Symbols

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

dB	decibel
E	Field strength
˚C	Temperature in degrees Celsius
hPa	Atmospheric pressure in hecto Pascal
%RH	Air relative humidity in percentage
λ	Wavelength

3.3 Abbreviations

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

CISPR	International Special Committee on Radio Interference
DC	Direct Current
EU	European Union
EUT	Equipment Under Test
FAR	Fully Anechoic Room
GNSS	Global Navigation Satellite Systems
GTS	Global Telecommunications System
ICAO	International Civil Aviation Organization
RF	Radio Frequency
RH	Relative Humidity
RMS	Root Mean Square
VSWR	Voltage Standing Wave Ratio
WMO	World Meteorological Organization

4 Technical requirements specifications

4.1 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 manufacturer, but as a minimum, shall be that specified in the test conditions contained in the present document. The equipment shall comply with all the technical requirements of the present document which are identified as applicable in annex A at all times when operating within the boundary limits of the declared operational environmental profile.

4.2 Conformance requirements

4.2.1 General Requirements

Where the transmitter is designed with an adjustable carrier power, then all transmitter parameters shall be measured using the highest power level, as declared by the manufacturer.

If the EUT is supplied with both a permanent external 50 Ω RF connector and a dedicated or integral antenna, then full tests shall be carried out using the external connector. In addition, the following tests shall be carried out with the dedicated or integral antenna:

- effective radiated power (radiated) (see clause 4.2.4);
- spurious emissions (see clause 4.2.6).

The submitted EUT shall fulfil the requirements of the stated measurements.

4.2.2 Frequency error

4.2.2.1 Definition

The frequency error of the transmitter is the difference between the measured unmodulated carrier frequency and the nominal frequency as stated by the manufacturer under normal and extreme conditions (see clauses 5.3.3 and 5.3.4).

4.2.2.2 Limits

The frequency error or drift shall not exceed ±20 kHz (it corresponds to ±50 ppm @ 403 MHz).

4.2.2.3 Conformance

The conformance tests are specified in clause 6.3.1.

4.2.3 Carrier Power (conducted)

4.2.3.1 Definition

The carrier power is the average power delivered to the artificial antenna (see clause 5.2.2) during one radio frequency cycle in the absence of modulation.

4.2.3.2 Limits

Under normal and extreme test conditions, the carrier output power (conducted) shall not exceed 200 mW.

NOTE: It corresponds to 23 dBm.

4.2.3.3 Conformance

The conformance tests are specified in clause 6.3.2.

4.2.4 Effective Radiated Power

4.2.4.1 Definition

The effective radiated power is the power radiated in the direction of the maximum level under specified conditions of measurements in the absence of modulation.

4.2.4.2 Limits

The Effective Radiated Power (ERP) shall not exceed 200 mW.

NOTE: It corresponds to 23 dBm.

4.2.4.3 Conformance

The conformance tests are specified in clause 6.3.3.

4.2.5 Modulation bandwidth

4.2.5.1 Definition

The range of modulation bandwidth includes all associated side bands above the appropriate spurious level and the frequency error or drift under extreme test conditions. The requirement is that the emission limits are met under both normal and extreme conditions.

Radiosondes do not have channel assignments. Table 1 suggests that 200 kHz is required to provide needed protection from interference in the case another Radiosonde is in the vicinity of the receiver, and the Radiosonde to be received is at long distance (up to 350 km).

4.2.5.2 Limits

The permitted range of modulation bandwidth including the frequency error or drift as measured in clause 6.3.1 shall be within the limits shown in table 1.

Table 1: Maximum relative power density

Frequency relative to the nominal carrier	Maximum relative power in the 1 kHz bandwidth
±50 kHz to 100 kHz	-34 dBc/1 kHz
±100 kHz to 200 kHz	-40 dBc/1 kHz
±200 kHz to 300 kHz	-48 dBc/1 kHz

4.2.5.3 Conformance

The conformance tests are specified in clause 6.3.4.

4.2.6 Spurious emissions

4.2.6.1 Definition

Spurious emission: Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

4.2.6.2 Limits

The power of any spurious emission, conducted or radiated, shall not exceed the values given in table 2.