



**Satellite Earth Stations and Systems (SES);  
Satellite Earth Stations on board Vessels (ESVs)  
operating in the 11/12/14 GHz frequency bands  
allocated to the Fixed Satellite Service (FSS);  
Harmonised Standard for access to radio spectrum**

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# Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI Standardisation Request deliverable Approval Procedure (SRdAP).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.5] 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.8].

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.

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| 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

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# 1 Scope

The present document specifies technical characteristics and methods of measurements for Earth Stations located on board Vessels (ESVs) which have the following characteristics:

- The ESV is comprised of all the equipment, electrical and mechanical, from the antenna itself to the interface with other communications equipment on board (usually referred to as the terrestrial interface).
- The ESV transmits in the frequency range from 14,00 GHz to 14,50 GHz in the Fixed Satellite Services (FSS) (earth-to-space).
- The ESV receives in one or more frequencies within the range from 10,70 GHz to 12,75 GHz in the bands allocated to the Fixed Satellite Services (FSS) (space-to-earth), depending on the ITU Region where the ESV is located.
- The ESV uses linear polarization.
- The ESV operates through a geostationary satellite at least 2° to 3° away from any other geostationary satellite operating in the same frequency band and covering the same area.

NOTE 1: The satellite spacing is mainly equal to 3° in ITU Regions 1 and 3 and 2° in ITU Region 2.

- The ESV transmits at elevations greater or equal to the minimum elevation angle defined for its intended use.
- The ESV antenna diameter is not smaller than 0,6 m.

NOTE 2: Operation within 125 km of non-CEPT countries is subject to specific agreement with concerned administrations as stated in ITU-R Resolution 902 (Rev. WRC-23). Decision ECC(05)10 [i.9] applies for CEPT countries.

- The ESV is designed for transmission and reception of radio-communications signals in accordance with any of the frequency bands specified above.
- The ESV is usually designed for unattended operation.
- The ESV is operating as part of a satellite network (e.g. star, mesh or point-to-point) used for the distribution and/or exchange of information between users.
- The ESV is controlled and monitored by a Network Control Facility (NCF). The NCF is outside the scope of the present document.

The present document applies to the ESV with its ancillary equipment and its various telecommunication ports, and when operated within the boundary limits of the operational environmental profile defined for its intended use including all equipment as brought to the market.

The present document incorporates the technical limitations listed in annex 2 of ITU Radio Regulations Resolution 902 (Rev. WRC-23) [9].

NOTE 3: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.8] (RE Directive) is given in annex A.

---

## 2 References

### 2.1 Normative 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.

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

- [1] Void.
- [2] Void.
- [3] Void.
- [4] Void.
- [5] [CISPR 16-1 \(2019\)](#): "Specification for radio disturbance and immunity measuring apparatus and methods".
- [6] [CISPR 16-1-5:2014+AMD1:2016](#): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-5: Radio disturbance and immunity measuring apparatus - Antenna calibration sites and reference test sites for 5 MHz to 18 GHz".
- [7] [EN 60945:2002](#): "Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results", (produced by CEN).
- [8] [ITU Radio Regulations \(2024\)](#).
- [9] [ITU Radio Regulations Resolution 902 \(Rev. WRC-23\)](#): "Provisions relating to earth stations located on board vessels which operate in fixed-satellite service networks in the uplink frequency bands 5 925-6 425 MHz and 14-14.5 GHz".

### 2.2 Informative references

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- [i.1] Void.
- [i.2] Void.
- [i.3] ETSI TR 102 215: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Recommended approach, and possible limits for measurement uncertainty for the measurement of radiated electromagnetic fields above 1 GHz".

- [i.4] ETSI TR 102 375: "Satellite Earth Stations and Systems (SES); Guidelines for determining the parts of satellite earth station antenna radiation patterns concerned by the geostationary satellite orbit protection".
- [i.5] [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.6] ETSI EG 203 336: "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.7] ETSI TR 100 028-2: "Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics Part 2".
- [i.8] [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 (RE Directive).
- [i.9] [ECC/DEC/\(05\)10](#): "The free circulation and use of Earth Stations on board Vessels operating in fixed satellite service networks in the frequency bands 14-14.5 GHz".

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

For the purposes of the present document, the terms given in Directive 2014/53/EU [i.8] and the following apply:

**above-deck unit:** part of the ESV intended to be installed above deck, as defined for its intended use, and as indicated in the user documentation

NOTE 1: The above-deck unit usually comprises the following main parts:

- a) The antenna sub-system which converts the incident radiation field into a guided wave and vice versa.
- b) The Low Noise Block (LNB) down converter, which is a device that amplifies, with very low internal noise, the received signals in the Radio Frequency (RF) band and converts them to intermediate frequencies.
- c) The up-converter and the power amplifier which convert from the intermediate frequency to RF and amplify the low level RF signals for transmission through the antenna subsystem.
- d) The stabilization and tracking subsystems that ensure pointing of the antenna main beam towards the satellite within the required accuracy.

NOTE 2: The installation equipment (means of attachment) is outside the scope of the present document.

NOTE 3: The antenna structures and other components directly mounted on the antenna and forming an integral part of it, are subject to the specifications of the present document.

**ancillary equipment:** equipment used in connection with an ESV is considered as ancillary if the three following conditions are met:

- a) the equipment is intended for use in conjunction with the ESV to provide additional operational and/or control features (e.g. to extend control to another position or location);
- b) the equipment cannot be used on a stand alone basis, to provide user functions independently of the ESV; and
- c) the absence of the equipment does not inhibit the operation of the ESV

**below-deck unit:** part of the ESV equipment which is installed inside the vessel (i.e. below deck) and its connection cables with the above deck units

**carrier-off radio state:** radio state in which the ESV may transmit and does not transmit any carrier

NOTE 1: The phrase "the ESV may transmit" means that all the conditions for transmission are satisfied (e.g. in a state where transmissions are permitted, no failure detected, and the ESV is correctly pointed towards the satellite).

NOTE 2: The existence of a "Carrier-off" radio state depends on the system of transmission used. For ESVs designed for continuous transmission mode there may be no "Carrier-off" state.

**carrier-on radio state:** radio state in which the ESV may transmit and transmits a carrier

**Control Channel (CC):** channel or channels by which ESVs receive control information from the NCF

**EIRP<sub>max</sub>:** maximum e.i.r.p. capability of the ESV as defined for the intended use of the ESV

**EIRP<sub>nom</sub>:**

- i) either EIRP<sub>max</sub>;
- ii) or, when uplink power control is implemented, the maximum required e.i.r.p. of the ESV under clear sky condition as defined for the intended use of the ESV

**e.i.r.p density:** e.i.r.p. within a given frequency range

**emissions disabled radio state:** radio state in which the ESV does not emit

NOTE: Examples of cases where the ESV is in this radio state: before system monitoring pass, before the control channel is received, when a failure is detected, when an ESV is commanded to disable, and when the ESV is in a location requiring cessation of emissions.

**environmental profile:** range of environmental conditions under which equipment within the scope of ETSI EN 302 340 (the present document) is required to comply

**external control channel:** control channel which is either (i) carried by the ESV network via the same or another satellite, but not within the internal protocol of the ESV system, or (ii) carried by any other radio communication system

**external response channel:** response channel which is either (i) carried by the ESV network via the same or another satellite, but not within the internal protocol of the ESV system, or (ii) carried by any other radio communication system

**integral antenna:** antenna which may not be removed during the tests according to the documentation provided with the EUT

**internal control channel:** control channel which is carried by the ESV network via the same satellite as used for transmission of user data and within the internal protocol structure of the ESV system

**internal response channel:** response channel which is carried by the ESV network via the same satellite as used for transmission of user data and within the internal protocol structure of the ESV system

**network:** any network configuration including star, mesh and point-to-point configurations

**Network Control Facility (NCF):** set of functional entities that, at system level, monitor and control the correct operation of all ESVs in a network

**nominal antenna diameter:** antenna diameter as defined for the intended use of the ESV

NOTE 1: An antenna with a nominal antenna diameter D has the same technical characteristic as a circular aperture antenna of diameter D. For non circular aperture antenna, the nominal antenna diameter is defined for the intended use of the ESV.

NOTE 2: Network operators might request antennas of a certain diameter. Then an antenna that is compliant with the requirement for nominal antenna diameter equal to the requested antenna diameter can be used.

**nominated bandwidth:** bandwidth of the ESV radio frequency transmission nominated for the intended use of the ESV

NOTE 1: The nominated bandwidth is centred on the transmit frequency and does not exceed 5 times the occupied bandwidth.

NOTE 2: The nominated bandwidth is wide enough to encompass all spectral elements of the transmission which have a level greater than the specified spurious radiation limits. The nominated bandwidth is wide enough to take account of the transmit carrier frequency stability. This definition is chosen to allow flexibility regarding adjacent channel interference levels which will be taken into account by operational procedures depending on the exact transponder carrier assignment situation.

**off-axis angle:** angle between the direction of the axis of the antenna main beam and the considered direction

**removable antenna:** antenna which may be removed during the tests according to the intended use of the ESV and upon the EUT equipment capabilities

**Response Channel (RC):** channel by which ESV transmit monitoring information to the NCF

**spurious radiation:** any radiation outside the nominated bandwidth

**transmission disabled state:** state of the ESV when it is not authorized by the NCF to transmit

**transmission enabled state:** state of the ESV when it is authorized by the NCF to transmit

**wanted signal occupied Bandwidth (BW):** for a digital modulation scheme: width of the signal spectrum 10 dB below the maximum in-band density

## 3.2 Symbols

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

|              |                                                                                                                         |
|--------------|-------------------------------------------------------------------------------------------------------------------------|
| dBc          | Ratio expressed in decibels relative to the e.i.r.p. of the unmodulated carrier                                         |
| dBi          | Ratio of an antenna gain to the gain of an isotropic antenna, expressed in decibels                                     |
| dBsd         | Ratio expressed in decibels relative to the spectral density                                                            |
| dBW          | Ratio of a power to 1 watt, expressed in decibels                                                                       |
| dBpW         | Ratio of a power to 1 pico watt, expressed in decibels                                                                  |
| dB $\mu$ V/m | Ratio of an electric field to 1 $\mu$ V/m, expressed in decibels ( $20 \log(\text{electric field} / 1 \mu\text{V/m})$ ) |

## 3.3 Abbreviations

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

|          |                                                                                                                               |
|----------|-------------------------------------------------------------------------------------------------------------------------------|
| BDU      | Below Deck Unit                                                                                                               |
| BW       | Wanted signal occupied Bandwidth                                                                                              |
| CC       | Control Channel                                                                                                               |
| CCF      | Control Channel reception Failure                                                                                             |
| CCR      | Control Channel correctly Received                                                                                            |
| CENR     | Cessation of Emissions Not Requested                                                                                          |
| CEPT     | Conférence Européenne des Postes et Télécommunications (European Conference of Postal and Telecommunications Administrations) |
| CER      | Cessation of Emissions Requested                                                                                              |
| CISPR    | Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)       |
| CMF      | Control and Monitoring Functions                                                                                              |
| e.i.r.p. | equivalent isotropically radiated power                                                                                       |
| ECC      | Electronic Communications Committee (of CEPT)                                                                                 |
| EMC      | Electro-Magnetic Compatibility                                                                                                |
| EN       | European Standard                                                                                                             |
| ESV      | Earth Station on board a Vessel                                                                                               |
| EUT      | Equipment Under Test                                                                                                          |
| FEC      | Forward Error Correction                                                                                                      |
| FS       | Fixed Service                                                                                                                 |
| FSS      | Fixed Satellite Service                                                                                                       |
| GEUT     | Gain of EUT                                                                                                                   |
| GSO      | Geostationary Satellites Orbit                                                                                                |
| HPA      | High Power Amplifier                                                                                                          |
| IPR      | Intellectual Property Rights                                                                                                  |

|       |                                                                   |
|-------|-------------------------------------------------------------------|
| ITU   | International Telecommunication Union                             |
| ITU-R | International Telecommunication Union - Radiocommunication Sector |
| LNB   | Low Noise Block                                                   |
| LO    | Local Oscillator                                                  |
| LV    | Low Voltage                                                       |
| NCF   | Network Control Facility                                          |
| OATS  | Open Area Test Site                                               |
| RC    | Response Channel                                                  |
| RE    | Radio Equipment                                                   |
| RED   | RE Directive                                                      |
| RF    | Radio Frequency                                                   |
| SMF   | System Monitoring Fail                                            |
| SMP   | System Monitoring Pass                                            |
| STE   | Special Test Equipment                                            |
| TxD   | Transmission Disable command                                      |
| TxE   | Transmission Enable command                                       |
| WGSE  | Working Group Spectrum Engineering                                |
| WRC   | ITU World Radio Conference                                        |

## 4 Technical requirements specifications

### 4.1 General

#### 4.1.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

Before carrying out any other tests specified in the present document, survivability testing of the ESV shall be conducted under the following clauses of EN 60945 [7]:

- Clause 8.1 General
- Clause 8.3 Damp heat
- Clause 8.7 Vibration

The components of the ESV may be subject to different operational environmental conditions and shall maintain their performance in accordance with the present document under all environmental circumstances for the environmental classes applicable to them as defined in EN 60945 [7]. Specifically, the operational environmental conditions for:

- "protected" class shall apply to the below deck equipment; and
- "exposed" class shall apply to the above deck equipment.

#### 4.1.2 Operational configurations

Under operational conditions an ESV may dynamically change the occupied bandwidth and other transmission parameters (e.g. FEC, modulation, symbol rate) of the transmitted signal. For each occupied bandwidth an  $EIRP_{max}$ , an  $EIRP_{nom}$  and a nominated bandwidth shall be defined for the intended use of the ESV. The following specifications apply to the ESV for each occupied bandwidth and other transmission parameters.

### 4.1.3 ESV states and radio states

For the purpose of the present document the following four ESV states are defined, without presuming the effective implementation of the ESV state machine:

- "Non valid";
- "Initial phase";
- "Transmission disabled"; and
- "Transmission enabled".

The four ESV states are represented on figure 2 and are used in clause 4.2.9 for the specification of the Control and Monitoring Functions (CMFs).

In the "Non-valid" state and in the "Transmission disabled" state the ESV is not allowed to transmit. In the "Transmission-enabled" state the ESV is allowed to transmit. In the "Initial phase" state the ESV is only allowed to transmit initial bursts or is waiting for a transmit enable/disable command.

The "Initial phase" is divided into three radio states:

- "Initial phase-0" until the first initial burst is transmitted or when no initial bursts are transmitted;
- "Initial phase-1" during the transmission of the initial bursts;
- "Initial phase-2" between initial bursts.

NOTE: ESVs which do not transmit initial bursts have no "Initial phase-1" state and no "Initial phase-2" state.

The ESV "may transmit" when all the conditions for transmission are satisfied (e.g. in a state where transmissions are permitted, no failure detected, correctly pointed towards the satellite and there is no requirement for cessation of emissions).

The following radio states of the ESV are defined:

- "Emissions disabled" when the ESV does not transmit any carrier;
- "Carrier-off" when the ESV may transmit and does not transmit any carrier;
- "Carrier-on" when the ESV may transmit and transmits a carrier.

Table 1 gives the only possible combinations of the ESV states and radio states which shall apply, with some examples of associated events.

When the ESV transmits several carriers having different frequencies, an ESV state machine as described above may be associated with each carrier or each set of carriers.