



**Satellite Earth Stations and Systems (SES);
Satellite Earth Stations on board
Vessels (ESVs) operating in the 4/6 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.7] 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.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
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Modal verbs terminology

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Introduction

The determination of the parameters of the user earth stations using a given geo-stationary satellite for the protection of the spectrum allocated to that satellite, is considered to be under the responsibility of the satellite operator or the satellite network operators.

The present document is based on the application of ITU RR Resolution 902 (Rev WRC-23) [i.1]. The present document incorporates the technical limitations listed in annex 2 of ITU RR Resolution 902 (Rev. WRC-23) [i.1], ECC Report (05)69 [i.2], and ECC Report (06)91 [i.3].

NOTE: According to ITU RR Resolution 902 [i.1], any transmission from ESVs within the 300 km minimum distance of each country where the ESV transmit frequency band is used by the Fixed Service will be subject to the prior agreement of the concerned administration(s), which may specify additional operational requirements, or to ECC Decision. ECC/DEC/(05)09 [i.9]

The present document does not cover those cases where a potential source of interference which is producing individually repeated transient phenomena or a continuous phenomenon is present, e.g. a radar or broadcast site in the near vicinity. In such a case special protection applied to the source of interference, and the interfered part may be required.

The present document does not contain any requirement, recommendation or information about the installation of the ESV.

All parts of the below-deck unit related to reception, processing and presentation of the received information except the control channel are not within the scope of the present document. The syntax of the control channel messages is outside the scope of the present document.

The present document is based upon the standard for environmental conditions for marine navigational equipment, IEC EN 60945 [4]. In addition, attention should be paid to clause 11.1 (Acoustic noise and signals), and clause 11.2 (Compass safe distance) of IEC EN 60945 [4].

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 5 925 MHz to 6 425 MHz allocated to the Fixed Satellite Services (FSS) (Earth-to-space).
- The ESV receives one or more frequencies within the range from 3 700 MHz to 4 200 MHz allocated to the Fixed Satellite Services (FSS) (space-to-Earth).
- The ESV transmits a single carrier.
- The ESV uses linear or circular polarization.
- The ESV operates through a geostationary satellite at least 2° away from any other geostationary satellite operating in the same frequency band and covering the same area.

The ESV transmits at elevations greater or equal to the minimum elevation angle defined for the intended use of the ESV:

- The ESV antenna diameter is not smaller than 2,4 m.
- 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 designed for unattended operation.
- The ESV is operating within 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 specifications associated to the NCF are 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 as defined for the intended use of the ESV including all equipment as brought to the market defined for the intended use of the ESV.

The present document is intended to cover the provisions of Directive 2014/53/EU [i.8] (RE Directive) article 3.2.

NOTE: The relationship between the present document and essential requirements of article 3.2 of the Directive 2014/53/EU [i.8] 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.

Referenced documents which are not found to be publicly available in the expected location might be found in the [ETSI docbox](#).

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

- [1] Void.
- [2] Void.
- [3] Void.
- [4] [IEC EN 60945:2002](#): "Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results".
- [5] [ITU Radio Regulations \(edition of 2024\)](#).
- [6] Void.
- [7] [ERC/REC 74-01 \(1998\)](#): "Unwanted emissions in the spurious domain".

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 may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

- [i.1] ITU RR 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".
- [i.2] ECC Report 069 (2005): "Formats for submission of information from administrations to the Office on conditions for operation of earth stations aboard vessels within the separation distances identified in ITU RR Resolution 902".
- [i.3] ECC Report 091 (2006): "Compatibility of earth stations on board vessels transmitting within the gaps in the CEPT fixed service channel plan for the lower 6 GHz band (5 925-6 425 MHz)".
- [i.4] ETSI TR 102 375 (V1.2.1): "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] ETSI TR 102 215 (V1.3.1): "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.6] Void.
- [i.7] [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.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)09 of 24 June 2005 (Amended on 8 March 2019) on the free circulation and use of Earth Stations on board Vessels (ESV) operating in Fixed Satellite service networks in the frequency bands 5925-6425 MHz (Earth-to-space) and 3700-4200 MHz (space-to-Earth).
- [i.10] 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".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

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

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

- a) the antenna sub-system which converts the 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 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: The installation equipment (means of attachment) is outside the scope of the present document. However, 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
- 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" radio state.

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

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

EIRP_{max}: maximum e.i.r.p. capability of the ESV as defined for the intended use of the ESV

ESV: complete ESV equipment, comprising the outdoor unit and the indoor unit including the connection cable(s) between the units, as brought to the market

EIRP_{Aggregate}: is the maximum on axis aggregate e.i.r.p. (Watts) within the nominated bandwidth of the ESV system towards the satellite

emissions disabled radio state: radio state in which the ESV is not emitting

NOTE: Examples of cases where the ESV is in this radio state: before system monitoring pass, before information of the control channel is correctly received, when a failure is detected, when the 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 the present document is required to comply with the provisions of the present document

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

H (in dB): maximum number of ESVs transmitting towards the same satellite on the same frequency and polarization which may transmit at EIRP_{max} in the same 4 kHz band as defined for the intended use of the ESV

integral antenna: antenna which may not be removed during the tests according to the defined intended use of the ESV

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

Internally Mounted Equipment (IME): modules of the equipment which are not defined for the intended use of the ESV as EME are defined as IME

K: factor that accounts for a reduction on the on-axis spurious radiation level in case of multiple ESVs transmitting simultaneously towards the same satellite on the same frequency and polarization

network: network is any network configuration with any topology (including star, mesh and point-to-point configurations) allowing communication from ESV to satellite and satellite to ESV

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: diameter of the antenna 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 and which meets the following conditions of notes 1 and 2

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.

occupied bandwidth (BW): width of the signal spectrum between the points 10 dB below the maximum in-band density, for a digital modulation scheme

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 the ESV transmits 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

XPD_{ESV} : maximum cross polarization discrimination capability of the ESV antenna as defined for the intended use of the ESV

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 μ V/m	Ratio of an electric field to 1 μ 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	occupied BandWidth

NOTE: In the context of the present document.

CC	Control Channel
CCF	Control Channel reception Failure
CCR	Control Channel correctly Received

CENR	Cessation of Emissions Not Requested
CER	Cessation of Emissions Requested
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
CMF	Control and Monitoring Functions
CW	Continuous Wave
ECC	Electronic Communications Committee (of CEPT)
EIRP	Equivalent Isotropically Radiated Power
EMC	Electro-Magnetic Compatibility
EME	Externally Mounted Equipment
EN	European Standard
ESV	Earth Station on board Vessel
EUT	Equipment Under Test
FEC	Forward Error Correction
FSS	Fixed Satellite Service
GSO	Geostationary Satellites Orbit
IME	Internally Mounted Equipment
ITU	International Telecommunication Union
LHCP	Left Hand Circular Polarization
LNB	Low Noise Block
LO	Local Oscillator
NCF	Network Control Facility
OATS	Open Area Test Site
p.s.d	power spectral density
PSD	Power Spectral Density
RC	Response Channel
RE	Radio Equipment
RED	Radio Equipment Directive
RF	Radio Frequency
RHCP	Right Hand Circular Polarization
SMF	System Monitoring Fail
SMP	System Monitoring Pass
STE	Special Test Equipment
TDMA	Time Division Multiplex Access
TxD	Transmission Disable command
TxE	Transmission Enable command
WRC	ITU World Radio Conference
XPD	Cross-Polarization Discrimination

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.

The environmental profile for operation of the equipment shall include the ranges of humidity, temperature and supply voltage.

Before carrying out any other tests specified in the present document, survivability testing of the ESV shall be conducted under the following clauses of IEC EN 60945 [4]:

- 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 IEC EN 60945 [4]. 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 Control and Monitoring Functions (CMF)

The ESV shall comply with all the technical requirements of the CMF as described in clause 6.14.

4.1.3 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 $EIRP_{max}$ and a nominated bandwidth shall be defined for the intended use of the ESV. The nominated bandwidth shall be centred on the transmit frequency and does not exceed 5 times the occupied bandwidth.

The following specifications apply to the ESV for each occupied bandwidth and other transmission parameters.

4.1.4 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 1 and are used in clause 4.2.11 for the present document 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 sub-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;