



**Satellite Earth Stations and Systems (SES);
Fixed earth stations communicating with non-geostationary
satellite systems in the 20 GHz and 30 GHz FSS bands;
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.1] 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.2].

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	
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Modal verbs terminology

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Sample Document

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1 Scope

The present document specifies technical characteristics and methods for measurements for satellite communications Earth Stations (ES) with the following characteristics:

- The ES is designed for stationary operation.
- The ES 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.
- The transmit and receive frequencies are shown in Table 1.

Table 1: Frequency bands

	Frequency Bands/frequencies
Transmit (Earth-to-space) 1	27,5 GHz to 29,1 GHz
Transmit (Earth-to-space) 2	29,5 GHz to 30,0 GHz
Receive (space-to-Earth)	17,3 GHz to 20,2 GHz

- The ES transmits within the frequency range from 27,5 GHz to 29,1 GHz and 29,5 GHz to 30,0 GHz, which are bands allocated to the Fixed Satellite Services (FSS) (Earth-to-space) among other services.
- At the national level, terminals covered by the present document, might operate on a co-frequency basis, with stations of other FSS networks / systems or with stations of other services. The present document does not cover requirements for ensuring protection of such services.
- The ES receives within the range from 17,30 GHz to 20,20 GHz (FSS).
- The ES uses linear or circular polarization.
- The ES operates through non-geostationary satellites.
- The ES is designed for unattended operation and it does not address specifications or requirements for earth stations operating as gateways or master earth station.
- The ES is controlled and monitored by a Network Control Facility (NCF). This function may be performed centrally (e.g. for a network of ESs with a central hub) or it could be performed within the ES for autonomous control. The NCF is outside the scope of the present document.
- The ES has one or more directive antennas that track satellites.

The present document may also be applicable to the frequency bands 30,0 GHz to 31,0 GHz (Earth-to-space) and 20,2 GHz to 21,2 GHz (space-to-Earth) subject to national regulation.

The present document applies to the ES including its ancillary equipment and its various telecommunication ports, and when operated within the boundary limits of the operational environmental profile as defined by the intended use of the ES

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.1] 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] [CISPR 16-1-1:2019](#): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".
- [3] [CISPR 16-1-4:2025](#): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements".
- [4] Void.
- [5] [CISPR 32:2015/AMD1:2019](#): "Electromagnetic compatibility of multimedia equipment - Emission requirements".

2.2 Informative references

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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] [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.2] [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.3] Void.
- [i.4] Void.
- [i.5] IEC 60153 (all parts): "Hollow metallic waveguides".
- [i.6] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.7] Void.

- [i.8] ETSI EG 203 336 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); 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.9] ETSI TR 102 273 (all parts) (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".
- [i.10] ANSI C63.5 (2017): "American National Standard for Electromagnetic Compatibility - Radiated Emission Measurements in Electromagnetic Interference (EMI) Control - Calibration of Antennas (9 kHz to 40 GHz)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

ancillary equipment: equipment used in connection with an ES when the following conditions are met:

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

antenna controller: equipment used to maintain antenna stabilization and tracking accuracy based on inputs from the Control and Monitoring Function

bandwidth of the ideal signal: bandwidth of a theoretical signal that is defined by the modulation scheme of the actual signal and contains no unwanted signal components that would increase the bandwidth

NOTE: In case of amplitude or phase shift keying signals the bandwidth of an ideal signal is $B = R_s \times (1 + \alpha)$, where R_s is the symbol rate and α is the roll-off. (B in Hertz, R_s in symbol/s and α between 0 and 1)

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

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

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

desense: reduction in the sensitivity of a receiver due to the presence of high power signals in the adjacent channel(s)

EIRP_{Aggregate}: sum of the EIRP (Watts) within the reference bandwidth of the ES network (consistent with RR No. 22.5D)

EIRP_{max}: maximum EIRP capability of the ES

NOTE: EIRP_{term} is the on axis EIRP (Watts) of the ES within the nominated bandwidth.

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

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

equivalent power flux density uplink: sum of the power flux densities produced at a receive station in the geostationary orbit by all the transmit earth stations within a non-geostationary satellite system

external control channel: control channel which is either:

- i) carried by the ES network via the same or another satellite, but not within the internal protocol of the ES system; or
- ii) carried by any other radio communication system

external response channel: response channel which is either:

- i) generated by the ES network via the same or another satellite, but not within the internal protocol of the ES system; or
- ii) generated by any other radio communication system

integral antenna: antenna which cannot be removed during the tests according to the intended use

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

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

mobile platform: any non-stationary platform such as a train, a vessel, an aircraft or other vehicles

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

nominal antenna diameter: diameter of the antenna (in meters) for the intended use of the ES

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 ES.

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 ES radio frequency transmission nominated for the intended use of the ES and which meets the following conditions:

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

operating frequency band: frequency band the ES is intended to be operated

peak pointing accuracy: angular error of antenna pointing that is not exceeded during intended use of the ES

phased array antenna: assembly of several radiating elements, driven by adjustable phases and amplitudes, whose total radiation combine constructively in the wanted direction and destructively in the others, in such a way the wanted direction can be steered by the adjustment of the phases

NOTE: A narrow beam (or beams) can be created and pointed in different directions.

removable antenna: antenna which may be removed during the tests

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

spurious radiation: any radiation outside the nominated bandwidth

transmission disabled state: radio state in which the ES is not authorized to transmit by the NCF

transmission enabled state: radio state in which the ES is authorized to transmit by the NCF

wanted signal occupied bandwidth: width of the signal spectrum 10 dB below the total mean in-band power of the emission

NOTE: For a digital modulation scheme only.

3.2 Symbols

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

dBc	ratio expressed in decibels relative to the EIRP of the unmodulated carrier
dBi	ratio of an antenna gain to the gain of an isotropic antenna, expressed in decibels
dBW	ratio of a power to 1 watt, expressed in decibels
dBpW	ratio of a power to 1 picowatt, expressed in decibels
dB μ V/m	ratio of an electric field to 1 μ V/m, expressed in decibels ($20 \log(\text{electric field} / 1 \mu\text{V/m})$)
$G(\varphi)$	antenna gain at angle φ relative to antenna main axis $G_x(\varphi)$ cross-polarized antenna gain at angle φ
φ	angle relative to antenna main axis
$IT_{\max}$	maximum Inhibit Time
IT_{trans}	inhibit Time to transition from "Carrier off" to "Carrier on" radio state
N	maximum number of earth stations expected to transmit simultaneously
K	factor that accounts for a reduction on the on axis spurious radiation level in case of multiple earth stations operating on the same frequency
T_{trans}	time to transition from "Carrier off" to "Carrier on" radio state

3.3 Abbreviations

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

BER	Bit Error Rate
BW	BandWidth
CC	Control Channel
CCF	Control Channel reception Failure
CCR	Control Channel correctly Received
CENR	Cessation of Emissions Not Required
CEPT	Conférence Européenne des Postes et Télécommunications (European Conference of Post and Telecommunications)
CER	Cessation of Emissions Required
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
CMF	Control and Monitoring Functions
CTR	Common Technical Regulation
CW	Continuous Wave
DC	Direct Current
EIRP	Equivalent Isotropically Radiated Power
EMC	Electro-Magnetic Compatibility
EN	European Norm
epfd	equivalent power flux-density
ES	Earth Station
EUT	Equipment Under Test
FEC	Forward Error Correction
FSS	Fixed Satellite Service
GSO	Geostationary Satellite Orbit
hEN	harmonised European Norm
HPA	High Power Amplifier
IDU	Indoor Unit
IEC	International Electrotechnical Commission
IP	Internet Protocol
KA	Ka band

LNB	Low Noise Block downconverter
LO	Local Oscillator
LV	Low Voltage
NCF	Network Control Facility
NGSO	Non Geostationary Satellite Orbit
OATS	Open Area Test Site
OFDM	Orthogonal Frequency Division Multiplexing
RBW	Reference BandWidth
RC	Response Channel
RE	Radio Equipment
RED	Radio Equipment Directive
RF	Radio Frequency
RMS	Root Mean Square
RR	Radio Regulations
SMA	SubMiniature version A
SMF	System Monitoring Fail
SMP	System Monitoring Pass
SNR	Signal to Noise Ratio
STE	Special Test Equipment
TxD	Transmission Disable command
TxE	Transmission Enable command
VSWR	Voltage Standing Wave Ratio
WG	WaveGuide
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.

4.1.2 Operational configurations

Under operational conditions an Earth Station (ES) 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 specified for the intended use of the ES. For the purposes of verifying that the ES complies with these specifications, the combination of transmission parameters for the intended use shall be defined and provided with the EUT documentation. The following specifications apply to the ES for each occupied bandwidth and other transmission parameters.

In the present document, ESs that use OFDM modulation shall be considered as transmitting a single carrier.

All operational parameters including EIRP, modulation and occupied bandwidth shall be provided for the testing.

The ES documentation shall include the number of emitters of the ES that may be used simultaneously for the intended use. The specifications in clause 4 shall be applied to such a configuration of simultaneously transmitting emitters.

4.1.3 $EIRP_{Aggregate}$ for networks of ESs

For ESs designed to operate in an FSS network where the EIRP of each ES is determined by the NCF, the ES shall be capable to set the EIRP as defined by the NCF. The method(s) used to maintain compliance of the EIRP shall be defined for the intended use and provided with the EUT documentation.

4.1.4 Void

4.1.5 Void

4.1.6 Void

4.1.7 Peak pointing accuracy

The peak pointing accuracy ($\delta\phi$) within which the antenna needs to be maintained whilst transmissions are enabled shall be provided.

4.2 Conformance requirements

4.2.1 Off-axis spurious radiation

4.2.1.1 Justification

To limit the level of interference to terrestrial and satellite radio services.

4.2.1.2 Specification

The following specifications apply to the ES transmitting at Equivalent Isotropically Radiated Power (EIRP) values up to and including $EIRP_{max}$:

- 1) The electric field strength level of any radiation from the ES in the frequency range from 30 MHz to 1 GHz shall not exceed the limits specified in CISPR 32 [5], annex A.

Table 2: Void

- 2) When the ES is in the "Emissions disabled" radio state, the off-axis spurious EIRP from the ES shall not exceed the limits in Table 3, for all off-axis angles greater than 7° or greater than the minimum elevation angle, whichever is lower.

Table 3: Limits of spurious EIRP - "Emissions disabled" radio state

Frequency band	EIRP limit	Measurement bandwidth
1,0 GHz to 2,0 GHz	52 dBpW	1 MHz
2,0 GHz to 10,7 GHz	58 dBpW	1 MHz
10,7 GHz to 21,2 GHz	64 dBpW	1 MHz
21,2 GHz to 60,0 GHz	70 dBpW	1 MHz

The lower limits shall apply at the transition frequency.

- 3) In the "Carrier-on" and "Carrier-off" radio states, the off-axis spurious EIRP density from the ES, shall not exceed the limits in Table 4, for all off-axis angles greater than 7° or greater than the minimum elevation angle, whichever is lower. Coherently with the definition of spurious radiation, these limits apply only for frequencies that fall outside the nominated bandwidth of the signal.