ETSI EN 302 186 V2.1.1 (2016-05)

**Satellite Earth Stations and Systems (SES);
Harmonised Standard for satellite mobile
Aircraft Earth Stations (AESs)
operating in the 11/12/14 GHz frequency bands
covering the essential requirements
of article 3.2 of the Directive 2014/53/EU**

Reference
REN/SES-00392

Keywords
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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

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 [6].

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.

National transposition dates	
Date of adoption of this EN:	16 May 2016
Date of latest announcement of this EN (doa):	31 August 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	28 February 2017
Date of withdrawal of any conflicting National Standard (dow):	28 February 2018

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

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio equipment within the scope of the Directive 2014/53/EU [6]. Each standard is a module in the structure. The modular structure is shown in ETSI EG 201 399 [i.1].

The requirements have been selected to ensure an adequate level of compatibility with other radio services.

The present document may 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 it may be necessary to use special protection applied to either the source of interference, or the interfered part or both.

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

The determination of the parameters of the AES using a given GeoStationary Orbiting (GSO) 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.

1 Scope

The present document specifies certain minimum technical performance requirements of Aircraft Earth Station (AES) equipment with both transmit and receive capabilities for provision of aeronautical mobile satellite service, in the frequency bands given in table 1.

Table 1: Frequency bands for the AES equipment specified in the present document

Mode of Operation	Frequency Band
AES transmit	14,00 GHz to 14,50 GHz
AES receive	10,70 GHz to 11,70 GHz
AES receive	12,50 GHz to 12,75 GHz
NOTE: The AESs are operating in one or more frequency ranges of the Fixed and Mobile-Satellite Services.	

The AES has the following characteristics:

- These AESs are equipment for installation on aircraft.
- The AES could consist of a number of modules from the antenna subsystem to the user interfaces.
- The AES uses linear polarization.
- The AES system uses digital modulation.
- The AES operates through a GSO satellite at least 3° away from any other geostationary satellite operating in the same frequency band and covering the same area.
- The antenna of the AES is directional, with means of tracking the satellites, which can be achieved by using either an active phase array or reflective type configuration.
- These AESs are operating as part of a satellite network used for the distribution and/or exchange of information between users.
- These AESs are controlled and monitored by a Network Control Facility (NCF). The NCF is outside the scope of the present document.
- When on the ground, the AES does not transmit at elevation angles below 7º with respect to the local horizontal plane, except at locations where transmissions below 7º are permitted by the local Administration; (the minimum elevation angle is also limited as per clause 4.2).

The technical requirements in the present document are in two major categories:

- **emission limits:** to protect other radio services and systems from harmful interference generated by the AES in normal use;
- **AES Control and Monitoring Functions (CMF):** to protect other radio services and systems from unwanted transmissions from the AES. The CMF in each AES is capable of answering to commands from the Network Control Facility (NCF) for its supporting satellite network.

The present document applies to the AESs with their ancillary equipment and its various ports, and when operated within the boundary limits of the operational environmental profile declared by the manufacturer.

The technical requirements for the AES in regard to the Power Flux Density (PFD) limits to protect Fixed Service (FS) and Radio Astronomy Service (RAS) are based on annexes B and C of Recommendation ITU-R M.1643 [5] and ECC Report 26 [i.4]. Furthermore, in relation to the protection of the Fixed Satellite Service (FSS) the technical requirements of the AES take into account annex A of Recommendation ITU-R M.1643 [5].

The present document is intended to cover the provisions of Directive 2014/53/EU [6] (RE Directive) article 3.2, which states that "*… radio equipment shall be so constructed that it both effectively and supports the use of radio spectrum allocated in order to avoid harmful interference*".

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements of other parts of article 3 of the RE Directive [6] may apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site at: http:\\www.newapproach.org.

The present document does not cover equipment compliance with relevant civil aviation regulations. In this respect, an AES, for its installation and operation on board an aircraft is subject to additional national or international civil aviation airworthiness certification requirements, for example to EUROCAE ED-14D [4].

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 at http://docbox.etsi.org/Reference.

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 necessary for the application of the present document.

[1] Void.

[2] CISPR 16-1 (2003) (all sub-parts): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".

[3] IEEE STD 149™ (1979): "IEEE Standard Test Procedures for Antennas".

[4] EUROCAE ED-14D (1997) Change 1 (2000), Change 2 (2001) and Change 3 (2002) (Equivalent to RTCA DO-160D): "Environmental Conditions and Test Procedures for Airborne Equipment".

[5] Recommendation ITU-R M.1643 (2003): "Technical and operational requirements for aircraft earth stations of aeronautical mobile-satellite service including those using fixed-satellite service network transponders in the band 14-14.5 GHz (Earth-to-space)".

[6] 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).

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] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the Radio & Telecommunication Terminal Equipment Directive 1999/5/EC (R&TTE) and a first guide on the impact of the Radio Equipment Directive 2014/53/EU (RED) on Harmonized Standards".

[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] Recommendation ITU-R S.524-7: "Maximum permissible levels of off-axis e.i.r.p. density from earth stations in geostationary-satellite orbit networks operating in the fixed-satellite service transmitting in the 6 GHz, 14 GHz and 30 GHz frequency bands".

[i.4] ECC Report 26: "The compatibility & sharing of the aeronautical mobile satellite service with existing services in the band 14,00 to 14,50 GHZ Molde", February 2003.

[i.5] ITU Radio Regulations articles (2012).

[i.6] ISO 7137 (1995): "Aircraft - Environmental conditions and test procedures for airborne equipment".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the Directive 2014/53/EU [6] and the following apply:

Figure 1a: Void

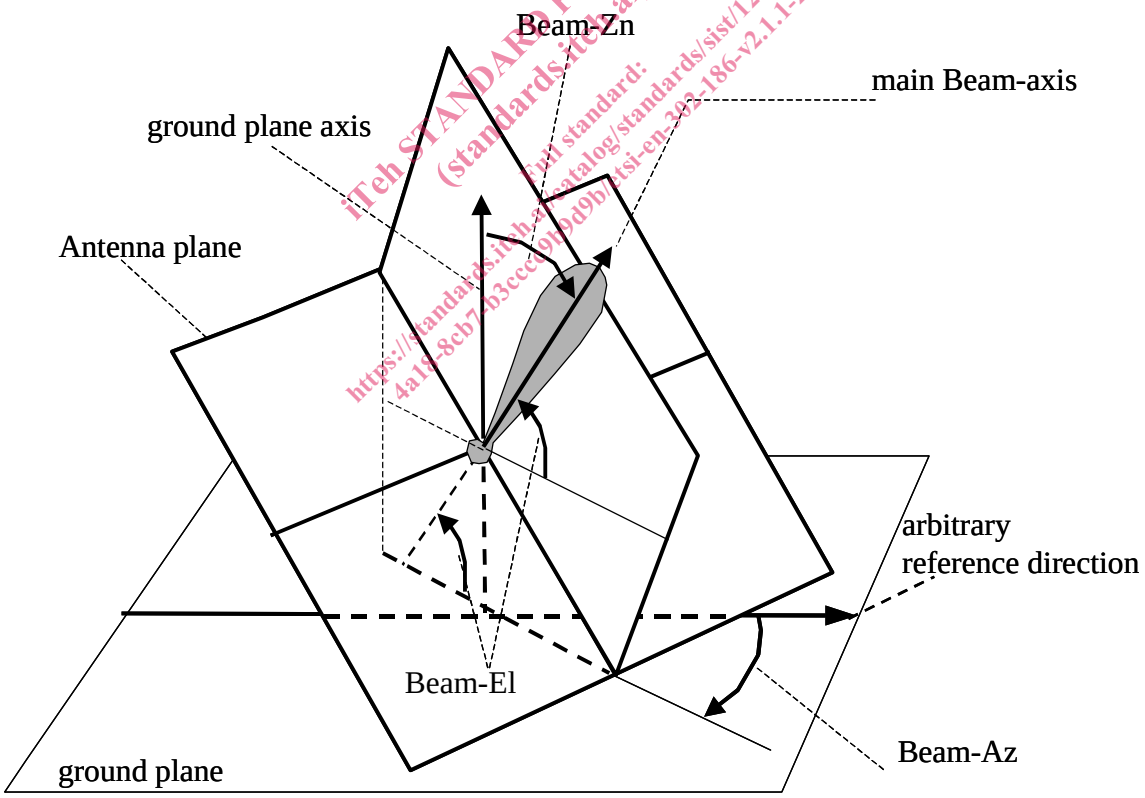

Figure 1b: Reference angles and planes for a passive (e.g. reflector) antenna

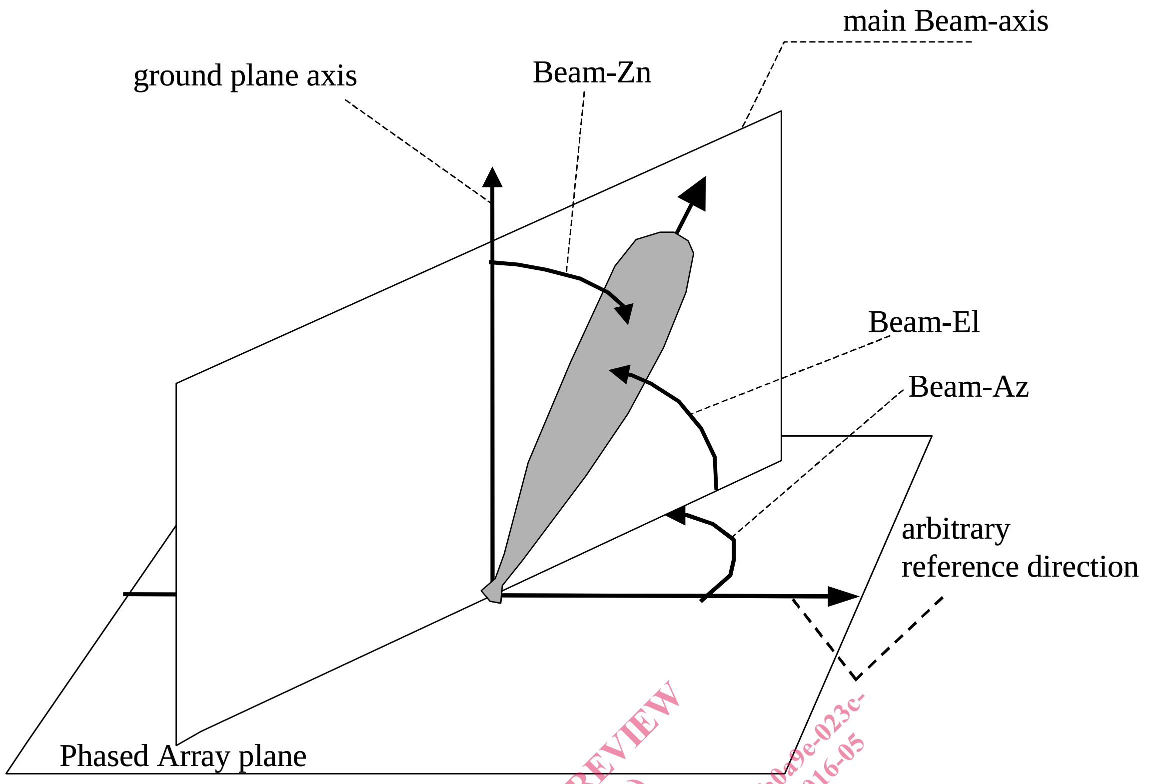

Figure 1c: Reference angles and planes for an active (e.g. phased array) antenna

AMSS network: comprises the AESs, geostationary satellite, LES and NCF

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

a) the equipment is intended for use in conjunction with the AES to provide additional operational and/or control features (e.g. to extend control to another position or location); and

b) the equipment cannot be used on a stand alone basis, to provide user functions independently of the AES; and

c) the absence of the equipment does not inhibit the operation of the AES.

antenna plane: for a passive antenna, plane orthogonal to the main beam axis direction. For a phased array antenna, the antenna plane is the phase array plane

NOTE: See figure 1b.

applicant: manufacturer or his authorized representative within the European Community or the person responsible for placing the apparatus on the market

beam Az angle: angle between an arbitrary reference direction (declared by the manufacturer) within the ground plane and the orthogonal projection of the main beam axis within that plane

NOTE 1: See figures 1b and 1c.

NOTE 2: In case of a rectangular phased array antenna such reference direction may be taken, for example, as the direction parallel to the longer of the two sides.

NOTE 3: When the ground plane axis is vertical and the reference direction oriented towards the north or the south, then the beam Az angle is the main beam azimuth angle.

beam El angle: angle between the ground plane and the main beam axis

NOTE: See figures 1b and 1c.

beam Zn angle: angle between the ground plane axis and the antenna main beam axis

NOTE: See figures 1b and 1c.

carrier-off state: state in which AES is when either it is authorized by the Network Control Facility (NCF) to transmit but when it does not transmit any signal, or when it is not authorized by the NCF to transmit

carrier-on state: state in which AES is when it is authorized by the NCF to transmit and when it transmits a signal

Control Channel (CC): channel or channels by which AES receive control information from the NCF of their network

NOTE: The CCs are not necessarily on separate RF channels from the RF channels carrying the user data streams.

$EIRP_{max}$: maximum EIRP capability of the AES as declared by the applicant

environmental profile: range of environmental conditions

Externally Mounted Equipment (EME): those of the modules of the Installable Equipment (IE) which are intended to be mounted externally to the aircraft as stated by the manufacturer

ground plane: for a passive antenna, the plane over which the antenna is mounted

NOTE: This plane can be specified by the manufacturer. For a phased array antenna, the ground plane is the phase array plane (see figure 1b).

ground plane axis: direction orthogonal to the ground plane

NOTE: See figures 1b and 1c.

Installable Equipment (IE): equipment which is intended to be fitted to an aircraft

NOTE: An IE may consist of one or several interconnected modules.

integral antenna: antenna which may not be removed during the tests according to the applicant's statement

Internally Mounted Equipment (IME): those of the modules of the IE which are not declared by the manufacturer as EME are defined as IME

Land Earth Station (LES): earth station in the FSS or, in some cases, in the MSS, located at a specified fixed point or within a specified area on land to provide a feeder-link for the MSS

main beam axis: direction where the antenna gain is maximum

NOTE: See figures 1b and 1c.

manufacturer: authorized representative within the Community or the person responsible for placing the apparatus on the market

nominal antenna diameter: antenna diameter declared by the manufacturer that is a parameter in performance characteristics and that allows reference to a certain performance

NOTE: An antenna with circular aperture of diameter equal to the nominal diameter does typically have the performance specified.

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. Manufacturers can mark their equipment with antenna diameters used in the requirements during compliance test.

nominated Bandwidth (Bn): bandwidth of the AES radio frequency transmission nominated by the applicant

NOTE 1: The nominated bandwidth is centred on the transmit frequency and does not exceed 5 times the occupied Bandwidth (Bo). The nominated bandwidth is within the 14,00 GHz to 14,50 GHz transmit frequency band.