# EUROPEAN TELECOMMUNICATION STANDARD

**ETS 300 456**

**November 1995**

Source: ETSI TC-SES

Reference: DE/SES-02008

ICS: 33.060.30

**Key words:** VSAT, testing

# Satellite Earth Stations and Systems (SES); Test methods for Very Small Aperture Terminals (VSATs) operating in the 11/12/14 GHz frequency bands

**ETSI**

European Telecommunications Standards Institute

**ETSI Secretariat**

**Postal address:** F-06921 Sophia Antipolis CEDEX - FRANCE
**Office address:** 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
**X.400:** c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

# Contents

Blank page

## Foreword

This European Telecommunication Standard (ETS) has been produced by the Satellite Earth Stations and Systems (SES) Technical Committee of the European Telecommunications Standards Institute (ETSI).

| **Transposition dates** | |
|---|---|
| Date of adoption of this ETS: | 15 September 1995 |
| Date of latest announcement of this ETS (doa): | 28 February 1996 |
| Date of latest publication of new National Standard or endorsement of this ETS (dop/e): | 31 August 1996 |
| Date of withdrawal of any conflicting National Standard (dow): | 31 August 1996 |

Blank page

# 1 Scope

This European Telecommunication Standard (ETS) covers the test methods for both transmit/receive and receive only Very Small Aperture Terminals (VSAT) used for digital communications within the 11/12/14 GHz frequency bands of the Fixed Satellite Service (FSS) utilising satellites spaced three degrees (3°) apart. These VSATs are defined and their basic characteristics are specified in the referenced ETSs, ETS 300 159 [1] and ETS 300 157 [2]. This ETS specifies the test methods for demonstration of compliance with the specifications of the reference ETS, and also with those for which the reference ETS allows verification at the manufacturer's discretion.

# 2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 159: "Satellite Earth Stations and Systems (SES); Transmit/receive Very Small Aperture Terminals (VSATs) used for data communications operating in the Fixed Satellite Service (FSS) 11/12/14 GHz frequency bands".

[2] ETS 300 157: "Satellite Earth Stations and Systems (SES); Receive-only Very Small Aperture Terminals (VSATs) used for data distribution operating in the 11/12 GHz frequency bands".

[3] IEC 510-1 (1975): "Methods of measurement for radio equipment used in satellite earth stations; Part 1: General".

[4] CISPR 16-1 (1993): "Specification for radio disturbance and immunity measuring apparatus and methods: Part 1: Radio disturbance and immunity measuring apparatus".

[5] EN 50083-1 (1993): "Cabled distribution systems for television and sound signals. Part 1: Safety requirements".

[6] ITU-R Recommendation S.732 (1990): "Method for statistical processing of Earth station antenna side-lobe peaks".

[7] EN 50081-1 (1991): "Electromagnetic compatibility - Generic emission standard. Part 1: residential, commercial and light industry".

[8] EN 55022 (1993): "Limits and methods of measurement of radio interference characteristics of information technology equipment".

[9] EN 50082-1 (1991): "Electromagnetic compatibility - Generic immunity standard. Part 1: residential, commercial and light industry".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of this ETS the following definitions apply:

Definitions are generally included in the subclause in which they occur. The definitions have been taken, where possible, from "International Electrotechnical Vocabulary (2nd Edition), Group 60, Radiocommunications" published by the International Electrotechnical Commission. Other sources include, but are not limited to, documentation produced by IEC, ETSI and CISPR.

The definitions below are of a general nature and apply throughout this ETS.

**indoor unit:** That part of the equipment which does not form part of the outdoor unit. It is generally installed inside the buildings and is connected to the outdoor unit. The connection cable between the outdoor and indoor units belongs to the indoor unit.

**Ku-band:** That part of the frequency spectrum which occupies the frequency band 10,7 GHz to 18 GHz.

**nominated bandwidth:** The bandwidth of the VSAT radio frequency transmission nominated by the manufacturer. The nominated bandwidth is wide enough to encompass all spectral elements of the transmission which have a density greater than the specified spurious levels, and to take into account the transmit carrier frequency stability.

NOTE: 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 assignment situation.

**outdoor unit:** That part of the terminal installed in a position within line of sight to the satellite and which is intended to be operated in outdoor environment conditions.

**spurious radiation:** Any radiation outside the nominated bandwidth.

**transmissions disabled state:** A VSAT is in the transmissions disabled state when it is not authorised by the Centralised Control and Monitoring Functions (CCMF) to transmit.

**transmissions enabled state:** A VSAT is in the transmissions enabled state when it is authorised by the CCMF to transmit.

### 3.2 Abbreviations

For the purposes of this ETS the following abbreviations apply:

| | |
|---|---|
| CCMF | Centralised Control and Monitoring Functions |
| EIRP | Equivalent Isotropically Radiated Power |
| EMC | Electro-Magnetic Compatibility |
| EUT | Equipment Under Test |
| HPA | High Power Amplifier |
| LNB | Low Noise Block (low noise amplifier and down-converter) |
| QTMA | Quality of Transmission Measurement Apparatus |
| RF | Radio Frequency |
| VSAT | Very Small Aperture Terminal |

## 4 General test arrangements

### 4.1 General

Five possible test sites are described in this clause: outdoor far-field test sites, anechoic chambers, open area test sites, compact antenna test ranges and semi-anechoic chambers. The test sites used for the measurements shall be validated and, where appropriate, calibrated, to reduce measurement uncertainty and the probability of measurement error. Other test sites may be used providing that they are proven to produce results consistent with those produced by the appropriate test site described in this clause.

Any measurement involving either antenna gain patterns or polarisation measurements shall be performed in the far field obtainable on an outdoor far-field test site, through a compact antenna test range or by any other recognised method that can be proved to give the same results over the concerned frequency range.

The test site shall be on a reasonable level surface or ground and it shall be free from reflecting objects so that the measurement results are not unduly affected. Sufficient precautions shall be taken to ensure that reflections from objects adjacent to the test site do not degrade the measurement methods.

Any measurement involving system radiation and electromagnetic immunity shall be performed with the VSAT in a continuous transmission mode. Any facilities necessary shall be provided by the manufacturer and shall be described in the test report.

The ambient noise of the test site shall be at least 6 dB lower than the lowest limit to which the measurements have to be compared. All test cables shall be as short as possible and shall be adequately screened.

In the case where the outdoor unit is manufactured without an accessible interface between the antenna subsystem and the Low Noise Block (LNB), it is impossible to carry out the tests to verify compliance with the specifications. In this case the manufacturer shall provide suitable fixtures.

## 4.2 Outdoor far-field test site

### 4.2.1 General

This test site shall be such that any covering or environmental protection as well as the site itself shall be transparent to electromagnetic waves at the frequencies under consideration. The distance between the measuring and measured antennas shall be such that they are each in the far-field region of the other antenna. Reflections from both natural and artificial objects shall be at a minimum and of known amplitude and effect.

### 4.2.2 Description

The far-field distance of an antenna is defined as:

$$R > 2D^2 / \lambda$$

where:

R is the far-field distance;
D is the largest dimension of the antenna under test;
$\lambda$ is the free space wavelength at the test frequency.

Even at this distance, the path difference between the ray from the source to the centre of the aperture and the ray from the source to the edge of the aperture is at the most $\lambda/16$ and the resulting phase deviation of the incident wavefront is at the most 22,5° which corresponds to an error of about 0,1 dB in antenna gain.

The structure supporting the Equipment Under Test (EUT) shall have means of adjustment in polarity, elevation angle and azimuth angle so that the received signal can be maximised.

To eliminate errors caused by reflection coefficient variation from one measurement geometry to another, the ground reflections shall be minimised. Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site do not degrade the measurement results and that all test cables are as short as possible and adequately screened.

If the near-field scanner technology to convert near-field measurements to far-field results is proven and sufficiently accurate by reference to tests taken in both regions then antenna measurements may be taken in the near field.

## 4.3 Anechoic chamber

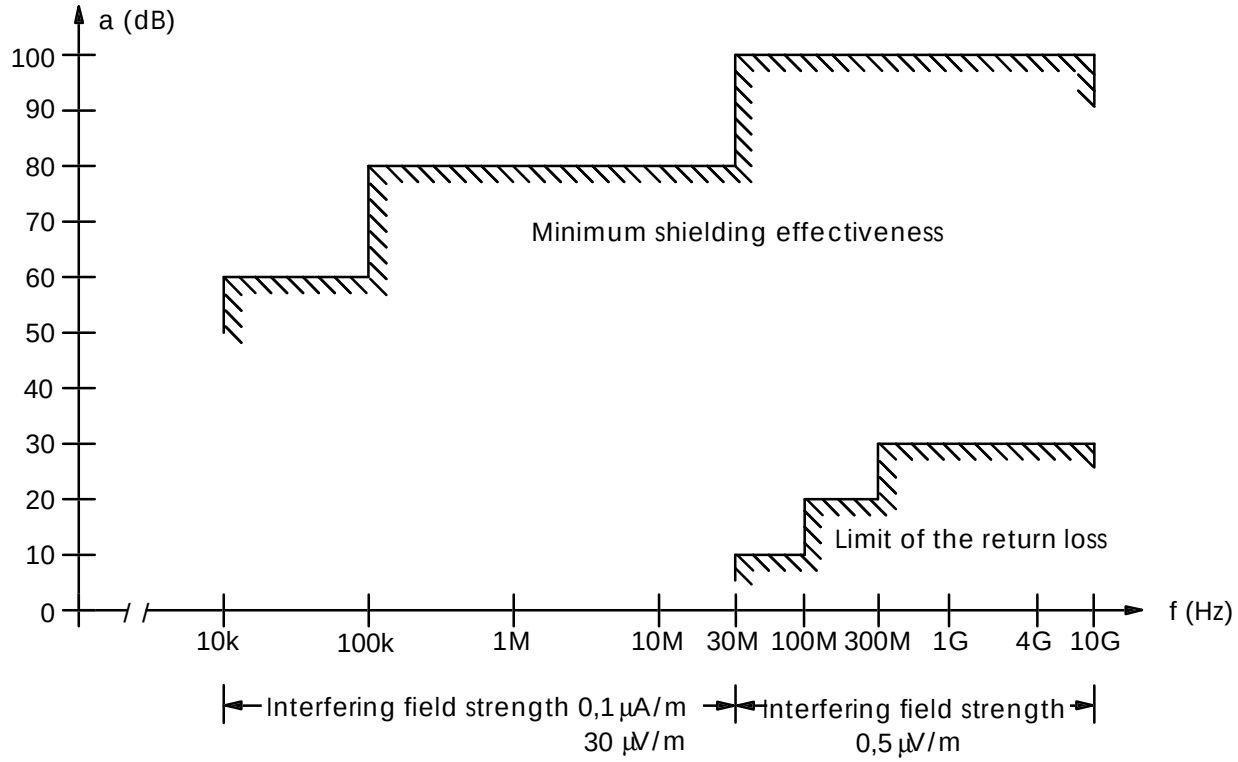
### 4.3.1 General

An anechoic chamber is a well shielded chamber covered inside with radio frequency absorbing material and simulating a free space environment. Absolute or relative measurements can be performed. Absolute measurements of field strength require the anechoic chamber to be calibrated. This is the type of chamber often used for immunity measurements.

### 4.3.2 Description

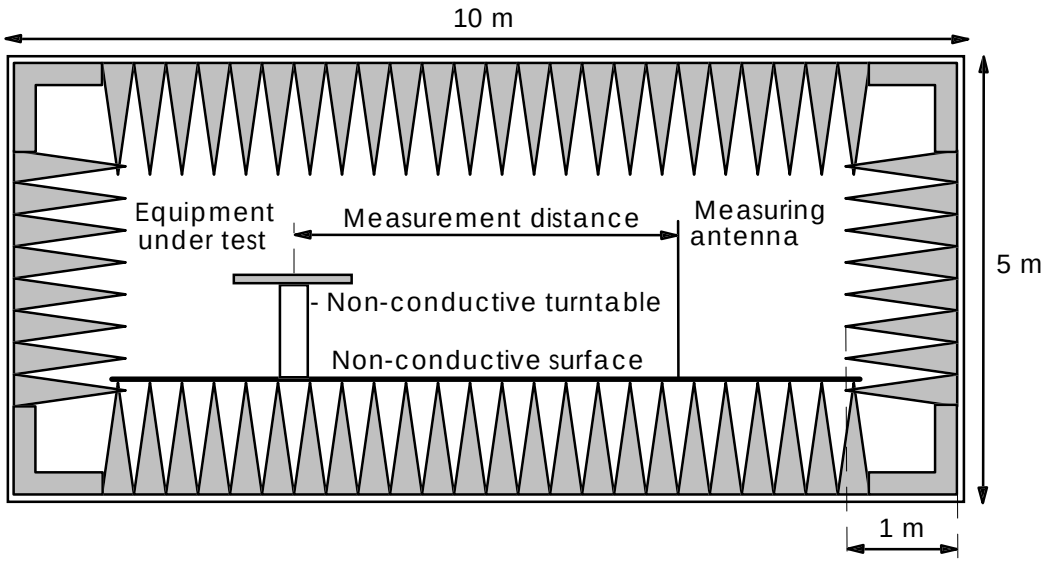
An anechoic chamber shall meet appropriate requirements for shielding effectiveness and wall return loss. Figure 1 shows an example of such requirements. Figure 2 shows an example of the construction of an anechoic chamber having a base area of 5 m by 10 m and a height of 5 m, usually used for Electro Magnetic Compatibility (EMC) measurements. The ceiling and walls are coated with pyramidal-formed absorbers approximately 1 m high. The base is covered with special absorbers which form the floor. The

available internal dimensions of the chamber are 3 m by 8 m by 3 m, so that a maximum measuring distance of 5 m in the middle axis of this chamber is available. The floor absorbers reject floor reflections so that the test antenna height need not be changed during the calibration procedures. Figure 3 shows an example of a chamber that can be used for higher frequencies. Anechoic chambers of other dimensions may be used.




where: a is attenuation;
f is frequency.

**Figure 1: Example of an anechoic shielded chamber for simulated free-space measurements**




Ground plan

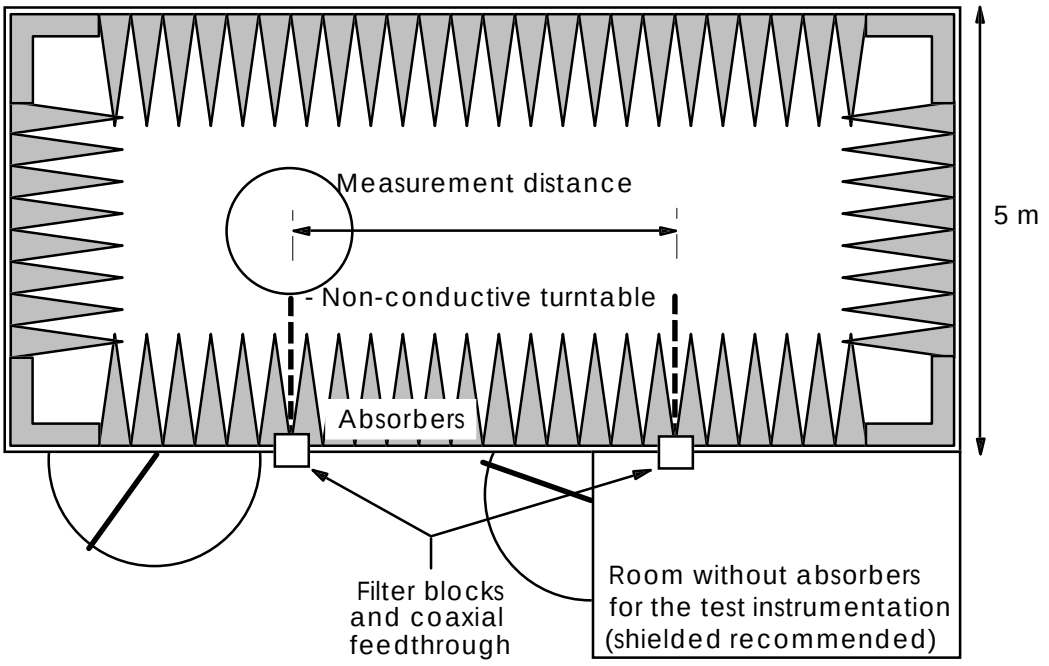
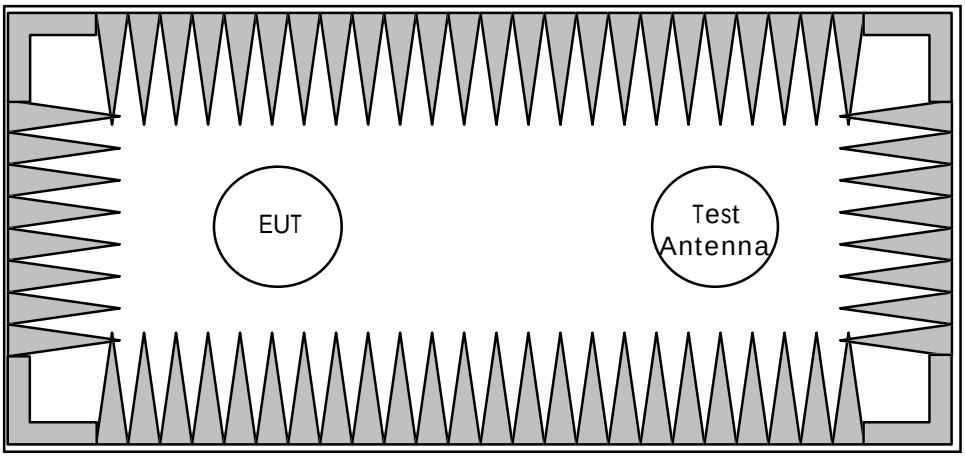



**Figure 2: Example of an anechoic shielded chamber for simulated free-space measurements below 3 GHz**




Ground plan

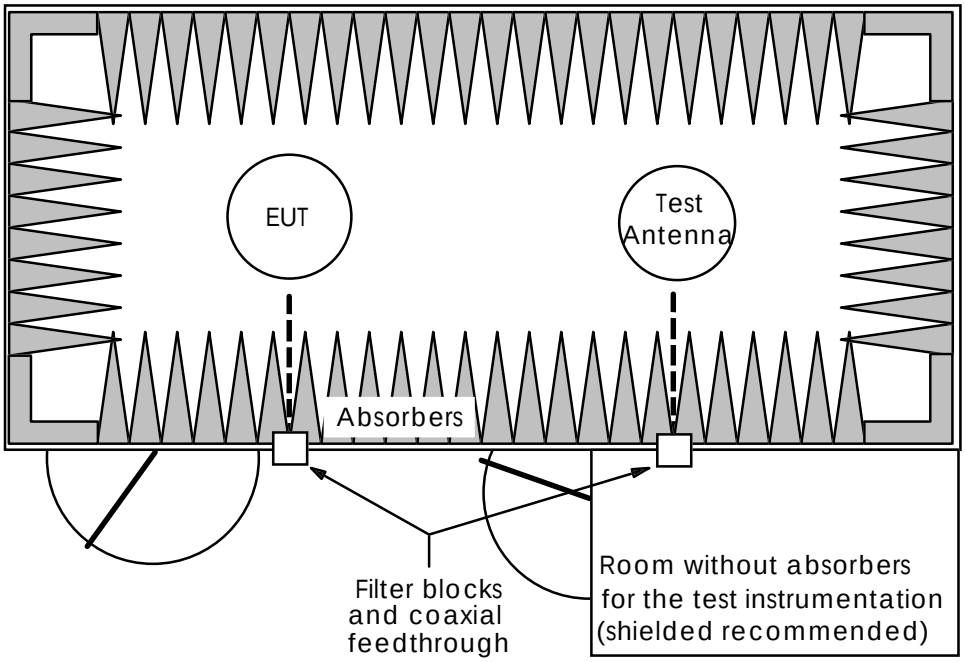



**Figure 3: Example of an anechoic shielded chamber for simulated free-space measurements above 3 GHz**

### 4.3.3 Parasitic reflections

For free-space propagation in the far field the relationship between the field strength and the distance is given by:

$$X = X_0 \times (R_0/R),$$

where:

X is the field strength;
$X_0$ is the reference field strength;
$R_0$ is the reference distance;
R is the distance.

This relationship allows relative measurements to be made as all constants are eliminated within the ratio and neither cable attenuation nor antenna mismatch or antenna dimensions are of importance.

If the logarithm of the foregoing equation is used, the deviation from the ideal curve can be easily seen because the ideal correlation of field strength and distance appears as a straight line. The deviations occurring in practice are then clearly visible. This indirect method shows quickly and easily any disturbances due to reflections and is far less difficult than the direct measurement of reflection attenuation.

With an anechoic chamber of the dimensions given in figure 2 at frequencies below 100 MHz there are no far field conditions, but the wall reflections are stronger, so that careful calibration is necessary. In the frequency range from 100 MHz to 1 GHz the dependence of the field strength to the distance meets expectations very well. Above 1 GHz, because more reflections will occur, the dependence of the field strength to the distance will not correlate so closely.

It is for this reason that the size of the anechoic chamber in relation to the required frequency range and the physical size of the equipment to be tested are of importance.

### 4.4 Open area test site

#### 4.4.1 General

This test site shall be such that any covering or environmental protection as well as the site itself shall be transparent to electromagnetic waves at the frequencies under consideration. Absolute or relative measurements can be performed. Absolute measurements of field strength require the open area test site to be calibrated.

#### 4.4.2 Description

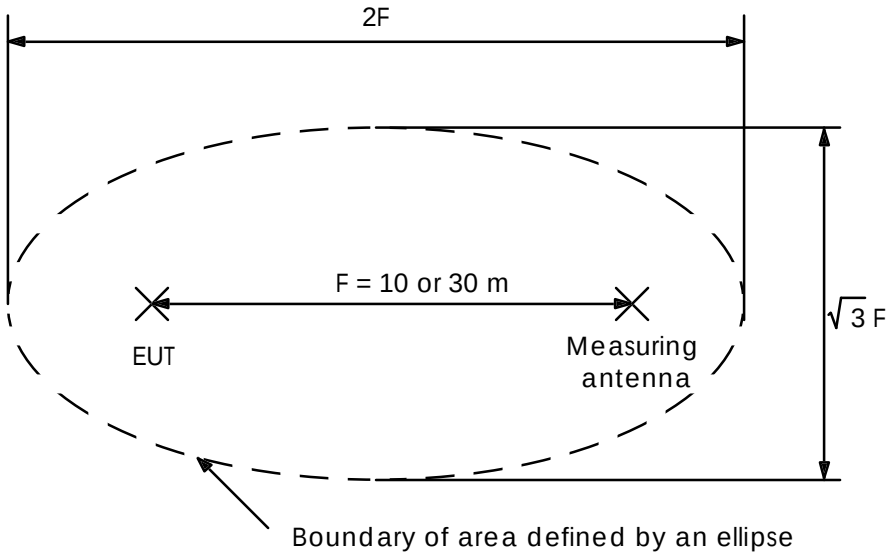



**Figure 4: Open area test site arrangement**

Figure 4 shows the arrangement of the test site which shall be void of buildings, electric lines, fences, trees etc. and be level. A reflecting ground plane shall be installed, if required to assist the reflectivity of the natural terrain and to avoid reflectivity changes due to environmental conditions or time. If an open area test site is constructed of wire mesh or aluminium mesh then a solid metal ground plane of total width at least 3 m and length 6 m towards the measuring antenna shall be placed from the centre of the turntable for the measurement of frequencies above 1 GHz. The site shall have an obstruction free area surrounding it. This obstruction free area shall be large enough so that scatterers from outside the obstruction-free area will have little effect on the fields measured by the measuring antenna.

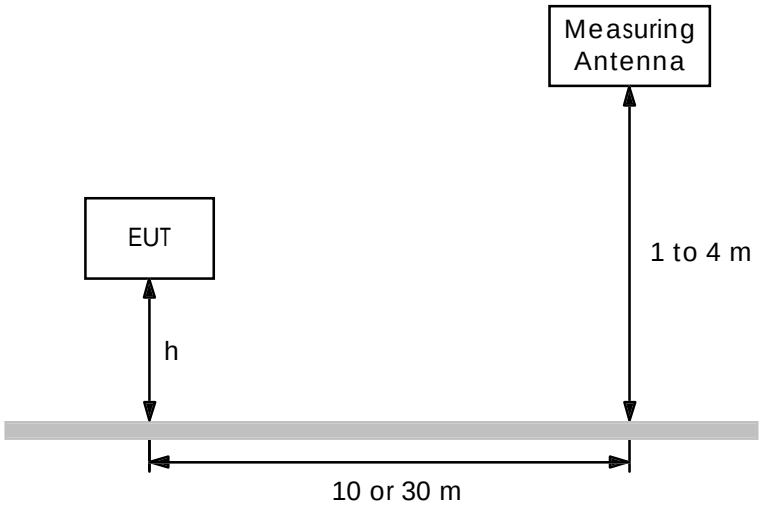



**Figure 5: Schematic of equipment in relation to ground plane**

Figure 5 shows the location of the equipment and ground plane. The height of the EUT (h) shall be as specified for each test. The height of the measuring antenna can be changed to allow both the direct and reflected waves to be combined.

### 4.5 Compact antenna test range

#### 4.5.1 General

A compact test range is a large anechoic chamber in which, with the use of reflectors, it is possible to simulate the far field obtainable on an outdoor far-field test site. These reflectors are very accurately profiled large metal plates which are optically aligned with each other.

#### 4.5.2 Description

Figure 6 shows the general arrangement of the test range which is one in which the receiving antenna is illuminated by the collimated energy in the aperture of a larger point or line focus antenna. The linear dimensions of the reflectors are usually chosen to be at least three times that of the antenna that they are illuminating, or are being illuminated by, so that the illumination sufficiently approximates a plane wave. To suppress any direct radiation from the feed antenna in the direction of the test region the reflectors are designed with long focal lengths. The use of relatively long focal length reflectors has the additional advantage that for a given size reflector the depolarisation effect associated with curved reflectors is reduced. Diffraction from the edges of the reflectors is reduced by designing the reflectors with serration around the edges. High quality absorbing material is placed between the two antennas to absorb the unwanted radiation. The structure holding the test antenna can be moved both sideways and forwards and backwards in order to further reduce any direct coupling between the antennas.

In order to obtain good results with a compact range the reflectors should be constructed with sufficient accuracy. Small deviations in the fabricated reflector surface can result in significant variations in the amplitude and phase distribution of the incident field at the receiving antenna. To assess the effect of surface deviations not only their shapes and maximum deviations should be noted but, also very importantly, their areas. For example, if the reflector has small deviations that do not exceed $\lambda/100$ and their individual sizes are also small (less than one square wavelength), then the integrated effect of all the deviations over the entire reflector will be quite small, and hence a fairly uniform amplitude distribution of the incident field over the receiving antenna will be obtained. On the other hand, suppose that a reflector had a single surface deviation near the centre of the reflector, extending over an area comparable to 1 Fresnel zone. In this case a very significant change in the incident field would occur. It is obvious therefore that the reflectors should be fabricated with great care.

The compact test range can be evaluated in the same manner as conventional ranges by the use of field probing techniques. Since the illuminating field is obtained by the reflection from curved surfaces some depolarisation is to be expected. The field probing should, therefore, include measurements of polarisation as well as amplitude and phase, especially if the measurements to be made depend upon the polarisation characteristics of the illuminating field.

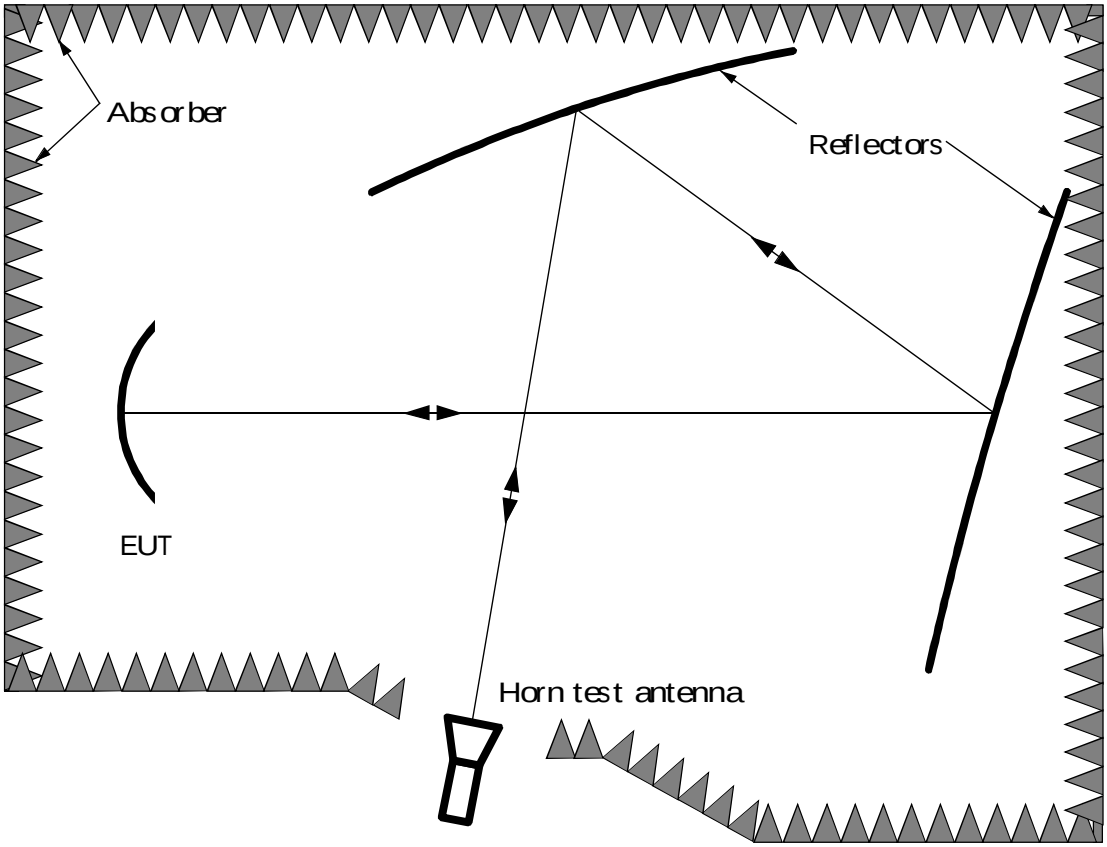



**Figure 6: Compact antenna test range**

### 4.6 Semi-anechoic chamber

A semi-anechoic chamber has one difference to an anechoic chamber as described in subclause 4.3. This difference is that the absorbers and any non-conductive surfaces are removed from the floor. The floor of a semi-anechoic chamber shall consist of a reflective ground plane.

### 4.7 Power supplies

During the test period the power supplies used shall not exceed the limits stated in table 1 (see also IEC 510-1 [3], clauses 5 and 6). The harmonic components are those components that deviate from the instantaneous value of the fundamental wave, the limit quoted is in respect of the difference in the amplitude of those components and the amplitude of the fundamental wave.

**Table 1: Power supply limits**

| Parameter | Limit |
|---|---|
| Voltage | ± 2 % |
| Frequency | ± 2 % |
| Harmonic components | 5 % |

### 4.8 Test equipment

#### 4.8.1 General

All test equipment utilised for any test shall be within its stated calibration period and be operated within the test equipment manufacturer's declared operating conditions and procedures.

#### 4.8.2 Measuring and test antenna

When the test site is used for radiation measurements the measuring antenna is used to detect the field from both the EUT and the substitution antenna when called for in the relevant test method.

When the test site is used for the measurement of receiver characteristics and, possibly, antenna measurements, the test antenna is used for transmission.

For frequencies between 80 MHz and 1 GHz the measuring antenna shall be a balanced dipole which shall be resonant in length. For frequencies below 80 MHz it shall have a length equal to the 80 MHz resonant length and shall be tuned and matched to the feeder by a suitable transforming device. For frequencies above 1 GHz the antenna shall be a horn radiator of known gain/frequency characteristics. When used for reception the antenna and any associated amplification system shall have an amplitude/frequency response within ± 2 dB of the combined calibration curves across the measurement frequency range considered for the antenna. The antenna is mounted on a support capable of allowing the antenna to be used in either horizontal or vertical polarisation and at the specified height.

#### 4.8.3 Substitution antenna

The substitution antenna is used to replace the EUT when called for in the relevant test method. For measurements below 1 GHz the substitution antenna shall be a half wavelength dipole resonant at the frequency under consideration, or a shortened dipole, calibrated to the half wavelength dipole. For measurements above 1 GHz a calibrated horn radiator shall be used. The centre of this antenna shall coincide with the centre of the smallest circular cylinder encompassing the EUT it has replaced.

#### 4.8.4 Test load

The test load is used to terminate the High Power Amplifier (HPA) when called for in the relevant test methods, and shall be capable of absorbing the maximum power produced by the HPA without measurable radiation. It shall be of sufficient size and have enough cooling capacity to satisfy this requirement.

#### 4.8.5 Measuring receiver/Spectrum analyser

For measurements below 1 GHz the measuring receiver shall conform to the following characteristics:

- the response to a constant amplitude sine wave signal shall remain within ± 1 dB across the frequency range of interest;

- quasi-peak detection shall be used in a - 6 dB bandwidth of 120 kHz;

- the receiver shall be operated at more than 1 dB below the compression point during tests/measurements.

For measurements above 1 GHz the spectrum analyser shall conform to the following characteristics:

- the response to a constant amplitude sine wave signal shall remain within ± 4 dB across the frequency range of interest;

The spectrum analyser shall conform to the following characteristics:

- the sweep time shall be capable of being varied between 0,1 s and 10 s;

- the resolution filter shall have a - 3 dB bandwidth of 100 kHz and a - 60 dB/- 3 dB shape factor of ≤ 15:1;

- screening effectiveness shall be at least 60 dB;

- the spectrum analyser shall be operated at more than 1 dB below the compression point during tests/measurements.

#### 4.8.6 Input filter

A suitable filter should be provided in order to protect the input circuitry of the spectrum analyser and/or selective voltmeter from damage or overloading due to the presence of the strong fundamental produced by the EUT transmitter. The filter should not reduce the dynamic range of the protected test equipment.

#### 4.8.7 Screening

The screening performance of all measuring equipment and interconnecting cables shall be in conformity with CISPR 16-1 [4], section one, subclause 2.8 over the frequency range of operation of that piece of test equipment.

### 4.9 Environmental conditions

All tests shall be performed under environmental conditions within those which the indoor unit and outdoor unit of the EUT are designed to operate.

### 4.10 Test results and test report

#### 4.10.1 Test results

The test results shall be classified on the basis of the specification for the EUT as either:

a) normal performance within the specified limits;
b) temporary degradation or loss of function or performance which is self-recoverable;
c) temporary degradation or loss of function or performance which requires operator intervention or system reset;
d) degradation or loss of function which is not recoverable due to damage to equipment or software, or loss of data.

The measurement value related to the corresponding limit shall be used to decide whether an equipment meets the requirements of the relevant standard.

#### 4.10.2 Measurement uncertainty

The values of measurement uncertainty associated with each measurement parameter apply to all of the test cases described in this ETS. The measurement uncertainties shall not exceed the values shown in table 2.

**Table 2: Measurement uncertainty**

| Measurement parameter | Uncertainty |
|---|---|
| RF frequency | ± 10 kHz |
| RF power | ± 0,75 dB |
| Conducted spurious | ± 4 dB |
| Radiated spurious | ± 4 dB |
| Antenna gain | ± 2 dB |
| Polarisation discrimination | ± 2 dB |

#### 4.10.3 Test report

A test report containing details of the environmental and test conditions and the test results shall be produced.

The measurement uncertainty value for the measurement of each parameter shall be included in the test report.

A test report summary is provided in annex A which shall be incorporated into the test report.

Annex B is composed of test report result forms which shall be used in the test report. These forms contain the minimum amount of information that is required to show compliance with the specification. Any graphically presented results shall be included in the test report following the appropriate test result.

The test report form shall contain the nominated bandwidth declared by the manufacturer.

These forms and pro-forma cover tests which, if performed, shall be included in the report.

The test results shall be presented in the manner described in this ETS, whatever the method of measurement used.

# 5 Safety

## 5.1 Mechanical construction

### 5.1.1 Specification

The outdoor unit, including mounted structural components (but excluding the means of attachment), shall be designed as specified in ETS 300 159 [1] and ETS 300 157 [2].

### 5.1.2 Test method - wind speed

#### 5.1.2.1 General

The numerical analysis tests are performed in two stages.

In the first stage the effects of maximum wind speed shall be computed on the overall outdoor unit using a numerical analysis method (finite elements method by computer) taking into account the intrinsic properties of the materials. In the second stage the computed loads shall be applied to the structure.

The purpose of the numerical analysis is twofold:

1) to show that the fields of force and torque applied to the outdoor unit structure under nominated conditions do not reach the breakpoint limit of any element of the structure;

2) to compute equivalent static loads (force and torque) applied to the critical attachment points of the structures, e.g.:
   - reflector - mounting legs fixing point;
   - reflector - struts;
   - LNB - struts.

#### 5.1.2.2 Numerical analysis and load applications

a) The air related parameters, namely the cinematic viscosity used to calculate drags at the rims of the structure shall be calculated with the standard atmospheric environmental conditions (temperature = 293 K, air pressure = 1,013 x $10^5$ Pascal).

b) The computations needed to derive the field of force and torque and the equivalent static stresses shall be carried out for each of the following variables:
   - elevation angle: maximum and minimum;
   - wind direction: in steps of 45° around the outdoor unit;
   - wind speed: 180 km/h.

c) It shall be verified with the simulated results that break point limits are not exceeded for any self-contained element.

d) The calculated equivalent static loads shall be applied at any critical fixing point of the assembly.

e) Whilst the loads are applied the outdoor unit shall be observed and any distortion noted.

f) The test report shall contain the following information:
   - the computation method used;
   - description of the test equipment;
   - description of the tests performed;
   - results of the safety margin test;
   - any signs of distortion observed.

   For the pointing stability, see subclause 7.4 the test report shall contain the following additional information:
   - results of the measurements of the deviation of the antenna position;
   - component deviation with respect to each other.

#### 5.1.3 Test method - interface loads

This test shall be performed in conjunction with that detailed in subclause 5.1.

The wind load (W) is given by the formula:

$$W = c \times p \times A,$$

where:

W is the wind load in Newton (N);
c is the area correction coefficient and is equal to 1,2;
p is the wind pressure (Pa);
A is the component area ($m^2$).

For the purposes of establishing outdoor unit loading, the following wind pressure value corresponding to the required wind speed shall be used:

- a wind pressure of 1570 Pa, corresponding to a wind speed of 180 km/h.

The test report shall contain the following information:

- results of the measurements or calculations on the mechanical loads transmitted at the interface of the outdoor unit and the attachment devices.

### 5.2 Lightning protection

#### 5.2.1 Specification

Means shall be provided to permit the attachment of bonding conductors of dimensions indicated in EN 50083-1 [5], subclause 10.2.3.

#### 5.2.2 Test method

a) The dimensions of the attachment point shall be measured.

b) The dimensions of any restrictive area shall be measured.

c) The measurements obtained in a) and b) above shall be compared to the required minimum cross-sections given in table 3 to ascertain compliance.

**Table 3: Earthing conductors**

| Material | Cross section ($mm^2$) |
|---|---|
| Cu | 16 |
| Al | 25 |
| Fe | 50 |

## 6 Radio frequency

### 6.1 Off-axis EIRP emission density

#### 6.1.1 General

The requirements of this subclause shall only apply to equipment with transmit capability.

For the purposes of this subclause, off-axis Equivalent Isotropically Radiated Power (EIRP) emission density is defined as the EIRP in any 40 kHz band within the nominated bandwidth transmitted through the antenna in an unwanted direction in any polarisation plane.

The Radio Frequency (RF) port of the outdoor unit is often directly fitted with the antenna feed horn. In this case, it is necessary to separate the antenna feed horn from the outdoor unit according to manufacturer's instructions to enable the measurements of the antenna parameters and the RF parameters at this

interface point. Sometimes it may be necessary to use appropriate waveguide adapters and/or transducers to connect the measuring equipment with this interface point. In such a case, the performance of such adapters and/or transducers shall be calibrated.

Since the control function inside the VSAT usually inhibits emission of the RF signal when the VSAT in the star network does not receive appropriate signals from the hub station, it may be necessary to follow the manufacturer's instructions to force the VSAT to emit the signal by disabling such control function or by using the Hub Simulator (HS) with Network Control and Monitoring (NCM) computer or its emulator which generates the control signal.

### 6.1.2 Specification

The maximum EIRP in any 40 kHz band within the nominated bandwidth of the co-polarised component in any direction $\phi$ degrees from the antenna main beam axis shall not exceed the limits and ranges specified in ETS 300 159 [1].

In addition the cross-polarised component in any direction $\phi$ degrees from the antenna main beam axis shall not exceed the limits and ranges specified in ETS 300 159 [1].

### 6.1.3 Test method

To ascertain the off-axis EIRP it is necessary to know the transmit power density and antenna transmit radiation pattern. To ascertain the radiation pattern it is necessary to know the antenna transmit gain.

The following three measurement procedures shall, therefore, be performed:

a) transmitter output power density (dBW/40 kHz);
b) antenna transmit gain (dBi);
c) antenna transmit radiation patterns (dBi).

#### 6.1.3.1 Transmitter output power density

For the purposes of this ETS, transmitter output power is defined as the maximum power delivered continuously by the transmitting equipment to the antenna flange.

For the purposes of this test the EUT is defined as the indoor unit and that part of the outdoor unit up to the antenna flange.

##### 6.1.3.1.1 Test site

There are no requirements for the test site to be used for this test.

##### 6.1.3.1.2 Method of measurement

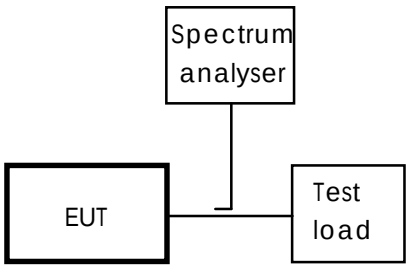



**Figure 7: Test arrangement - transmit output power density measurement**

a) The EUT shall be connected to a test load as shown in figure 7.

b) With the carrier being modulated by a pseudo random bit sequence, the maximum power supplied to the antenna flange shall be measured in dBW/40 kHz. The coupling factor of the test coupler at the test frequency and the attenuation of any necessary waveguide adapter shall be taken into account. The resolution bandwidth of the spectrum analyser shall be set as close as possible to the

specified measuring bandwidth. If the resolution bandwidth is different from the specified bandwidth then bandwidth correction shall be performed.

#### 6.1.3.2 Antenna transmit gain

##### 6.1.3.2.1 General

For the purposes of this ETS, the antenna transmit gain is defined as the ratio, expressed in decibels, of the power that would have to be supplied to the reference antenna, i.e. an isotropic radiator isolated in space, to the power supplied to the antenna being considered, so that they produce the same field strength at the same distance in the same direction. Unless otherwise specified the gain is for the direction of maximum radiation.

NOTE: At a given frequency the antenna transmit gain is identical to the antenna receive gain which is defined in subclause 6.2.3.3.

For the purposes of this test the EUT is defined as that part of the outdoor unit which comprises the antenna and its flange. The antenna includes the parabolic reflector, feed, support struts and an enclosure of equal weight/distribution to any electrical equipment normally housed with the feed at the antenna focal point.

##### 6.1.3.2.2 Test site

This test shall be performed on either an outdoor far-field test site or compact test range (however, see the last paragraph of subclause 4.2.2).

##### 6.1.3.2.3 Method of measurement

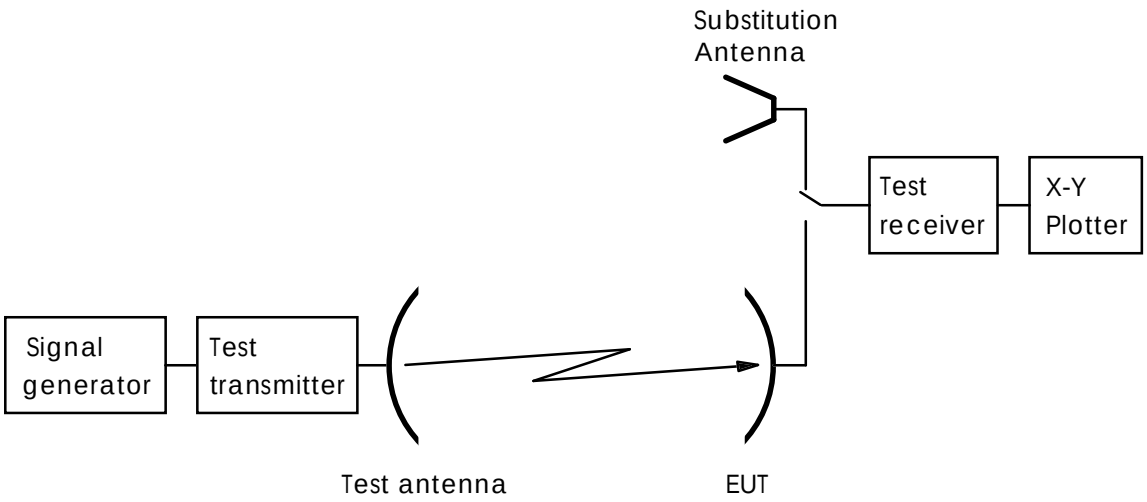



**Figure 8: Test arrangement - antenna transmit gain measurement**

a) The test arrangement shall be as shown in figure 8 with the EUT connected to the test receiver. A signal proportional to the angular position from the servo mechanism shall be applied to the X-axis and the signal level from the test receiver shall be applied to the Y-axis of the plotter.

b) A test signal at 14,005 GHz shall be transmitted in the E-plane by the test transmitter through the test antenna. The E-plane shall be vertical.

c) The EUT shall be aligned to maximise the received signal and the X-Y plotter adjusted to give the maximum reading on the chart.

d) The EUT shall be driven in azimuth in one direction through 10°.

e) The pattern measurement is then obtained by driving the EUT in azimuth back through boresight to 10° the other side with the plotter recording the results.

f) The EUT shall be replaced by the substitution antenna and the received signal level maximised.

g) This level shall be recorded on the X-Y plotter.

h) The substitution antenna shall be driven in azimuth as in d) and e).

j) The gain of the EUT shall be calculated from:

$$G_{EUT} = L_1 - L_2 + C$$

where:

$G_{EUT}$ is the gain of the EUT (dBi);
$L_1$ is the level obtained with the EUT (dB);
$L_2$ is the level obtained with the substitution antenna (dB);
C is the calibrated gain of the substituted antenna at the test frequency (dBi).

k) The tests in b) to j) shall be repeated with the frequency changed to 14,250 GHz.

l) The tests in b) to j) shall be repeated with the frequency changed to 14,495 GHz.

n) The tests in b) to l) shall be repeated with the test signal being transmitted in the H-plane instead of the E-plane.

p) The tests in b) to l) shall be repeated with the test signal being transmitted in a plane at + 45° to the H-plane.

q) The tests in b) to l) shall be repeated with the test signal being transmitted in a plane at - 45° to the H-plane.

#### 6.1.3.3 Antenna transmit radiation patterns

##### 6.1.3.3.1 General

For the purposes of this ETS, the antenna transmit radiation patterns are diagrams relating field strength to direction relative to the pointing angle of the antenna at a constant large distance from the antenna.

For the purposes of this test, the EUT is defined as that part of the outdoor unit which comprises the antenna and its flange. The antenna includes the parabolic reflector, feed, support struts and an enclosure of equal weight/distribution to any electrical equipment normally housed with the feed at the antenna focal point.

##### 6.1.3.3.2 Test site

This test shall be performed on either an outdoor far-field test site or compact test range (however, see the last paragraph of subclause 4.2.2).

##### 6.1.3.3.3 Method of measurement


**Figure 9: Test arrangement - antenna transmit radiation pattern measurement**

a) The test arrangement shall be as shown in figure 9 with the EUT connected to the test receiver. A signal proportional to the angular position from the servo mechanism shall be applied to the X-axis and the signal level from the test receiver shall be applied to the Y-axis of the plotter.

b) A test signal at 14,005 GHz shall be transmitted in the E-plane by the test transmitter through the test antenna. The E-plane shall be vertical.

c) The EUT shall be aligned to maximise the received signal and the X-Y plotter adjusted to give the maximum reading on the chart.

d) The EUT shall be driven in azimuth through 180°.

e) The transmit pattern measurement is then obtained by driving the EUT in azimuth through 360° with the plotter recording the results.

f) The tests in b) to e) shall be repeated with the frequency changed to 14,250 GHz.

g) The tests in b) to e) shall be repeated with the frequency changed to 14,495 GHz.

h) The tests in b) to g) shall be repeated with the test signal being transmitted in the H-plane instead of the E-plane.

j) The tests in b) to g) shall be repeated with the test signal being transmitted in a plane at + 45° to the H-plane.

k) The tests in b) to g) shall be repeated with the test signal being transmitted in a plane at - 45° to the H-plane.

l) The tests in b) to k) shall be repeated between the angles of 2,5° and 9,2° either with the EUT rotated through 90°, or the test antenna or the polarisation subsystem of the EUT rotated by 90° to give the cross-polar measurement.

#### 6.1.4 Computation of results

The results shall be computed by producing a "mask" to the specified limits with the reference level being equal to the sum of the transmitter output power density and the gain of the antenna. This reference shall then be placed on the maximum point of the plot obtained from the transmit radiation pattern measurement, so as to ascertain that the off-axis EIRP density is within the mask, and thus conforming to the specification.

### 6.2 Antenna transmit and receive radiation patterns

#### 6.2.1 General

If the tests are required, then in the case of the transmit patterns the test shall only consist of comparing the plots obtained in subclauses 6.1.3.2 and 6.1.3.3 with the specification and computation of results in subclause 6.2.2. In the case of the receive patterns the full test shall be performed.

For the purposes of this ETS antenna receive radiation patterns are defined as diagrams relating received signal strength to direction relative to the pointing angle of the antenna, at a constant large distance from the antenna. The transmit antenna gain definition is in subclause 6.1.3.3.1.

For the purposes of this subclause the receive EUT is defined as that part of the outdoor unit which comprises the antenna and its flange. The antenna includes the parabolic reflector, feed, support struts and an enclosure of equal weight/distribution to any electrical equipment normally housed with the feed at the antenna focal point. If there is no facility for directly taking a signal at 11/12 GHz from the focal point of the antenna then the EUT shall include an LNB of known characteristics including non-linear amplification of small signals. These characteristics shall be taken into account when evaluating the resultant patterns.

### 6.2.2 Transmit radiation pattern

#### 6.2.2.1 Specification

The gain G ($\phi$) in dB relative to an isotropic antenna of the main lobe and at least 90 % of the side-lobe peaks should not exceed the limits and ranges specified in ETS 300 159 [1]

Additionally, the cross-polar gain G ($\phi$) in dB relative to an isotropic antenna at least 90 % of the peaks should not exceed the limits and ranges specified in ETS 300 159 [1].

The method of statistical processing of side-lobe peaks and the definition of a peak is described in ITU-R Recommendation S.732 [6], annex II.

#### 6.2.2.2 Presentation of results

The presentation of results shall be carried out by producing a "mask" with the specified limits and with a reference level indicated and equal to the measured on-axis gain of the antenna.

For the comparison of the results with the mask, the maximum point of the plot obtained from the pattern measurements shall be set to the reference level. The plot and the mask shall be presented together on the same figure.

### 6.2.3 Receive radiation pattern

#### 6.2.3.1 Specification

The gain G ($\phi$) in dB relative to an isotropic antenna of the main lobe and at least 90 % of the side-lobe peaks should not exceed the limits and ranges specified in ETS 300 159 [1] and ETS 300 157 [2].

Additionally, the cross-polar gain G ($\phi$) in dB relative to an isotropic antenna at least 90 % of the peaks should not exceed the limits and ranges specified in ETS 300 159 [1] and ETS 300 157 [2].

The method of statistical processing of side-lobe peaks and the definition of a peak is described in ITU-R Recommendation S.732 [6], annex II.

#### 6.2.3.2 Test site

These tests shall be performed on either an outdoor far-field test site or compact test range (however, see the last paragraph of subclause 4.2.2).

#### 6.2.3.3 Method of measurement

To align the specified absolute receive gain patterns criteria to a measured value it is necessary to know the actual gain of the antenna. For the purposes of this test, the antenna receive gain is defined as the ratio, expressed in decibels, of the power that is received by the antenna being considered as the power received by the reference antenna, i.e. an isotropic radiator isolated in space, when receiving the same signal from the same source. Unless otherwise specified the gain is for the direction of maximum reception.

#### 6.2.3.4 Measurement of receive gain

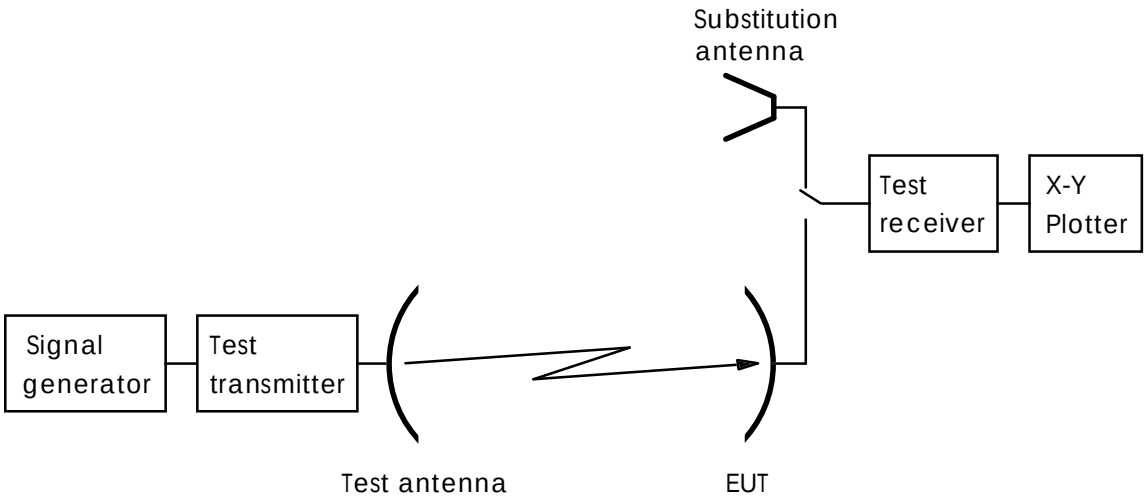



**Figure 10: Test arrangement - antenna receive gain measurement**

a) The test arrangement shall be as shown in figure 10 with the EUT connected to the test receiver. A signal proportional to the angular position from the servo mechanism shall be applied to the X-axis and the signal level from the test receiver shall be applied to the Y-axis of the plotter.

b) A test signal at either 12,505 GHz or 10,705 GHz shall be transmitted by the test transmitter through the test antenna in the E-plane. (The frequency is dependent upon the designed receive frequency band.) The E-plane shall be vertical.

c) The EUT shall be aligned so that maximum deflection is obtained on the X-Y plotter.

d) This deflection shall be adjusted to the maximum reading on the chart.

e) The EUT shall be driven in azimuth in one direction through 10°.

f) The pattern measurement is then obtained by driving the EUT in azimuth back through boresight to 10° the other side with the plotter recording the results.

g) The EUT shall be replaced by the substitution antenna and the received signal level maximised.

h) This level shall be recorded on the X-Y plotter.

j) The substitution antenna shall be driven in azimuth as in e) and f).

k) The gain of the EUT is calculated from:

$$G_{EUT} = L_1 - L_2 + C,$$

where:

$G_{EUT}$ is the gain of the EUT (dBi);
$L_1$ is the level obtained with the EUT (dB);
$L_2$ is the level obtained with the substitution antenna (dB);
C is the calibrated gain of the substituted antenna at the test frequency (dBi).

l) The tests in b) to k) shall be repeated with the frequency changed to 12,625 GHz or 11,200 GHz as appropriate.

m) The tests in b) to k) shall be repeated with the frequency changed to 12,745 GHz or 11,695 GHz as appropriate.

n) The tests in b) to m) shall be repeated with the frequencies changed to the others specified if the design of the equipment is such that operation is possible, but not necessarily simultaneously, in both bands.

p) The tests in b) to n) shall be repeated with the test signal being transmitted in the H-plane instead of the E-plane.

#### 6.2.3.5 Measurement of receive radiation patterns

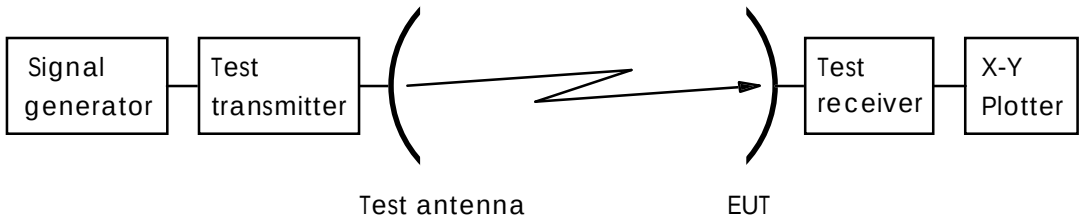



**Figure 11: Test arrangement - antenna receive radiation patterns measurement**

a) The test arrangement shall be as shown in figure 11 with the EUT connected to the test receiver. A signal proportional to the angular position from the servo mechanism shall be applied to the X-axis and the signal level from the test receiver shall be applied to the Y-axis of the plotter.

b) A test signal at either 12,505 GHz or 10,705 GHz shall be transmitted by the test transmitter through the test antenna in the E-plane. (The frequency is dependent upon the designed receive frequency band.) The E-plane shall be vertical.

c) The EUT is aligned to maximise the received signal level and the X-Y plotter adjusted to give the maximum reading on the chart.

d) The EUT shall be driven in azimuth through 180°.

e) The pattern measurement is then obtained by driving the EUT in azimuth through 360° with the plotter recording the results.

f) The tests in b) to e) shall be repeated with the frequency changed to 12,625 GHz or 11,200 GHz as appropriate.

g) The tests in b) to e) shall be repeated with the frequency changed to 12,745 GHz or 11,695 GHz as appropriate.

h) The tests in b) to g) shall be repeated with the frequencies changed to the others specified if the design of the equipment is such that operation is possible, but not necessarily simultaneously, in both bands.

j) The tests in b) to h) shall be repeated with the test signal being transmitted in the H-plane instead of the E-plane.

j) The tests in b) to h) shall be repeated with the test signal being transmitted in a plane at + 45° to the H-plane.

k) The tests in b) to h) shall be repeated with the test signal being transmitted in a plane at - 45° to the H-plane.

l) The tests in b) to k) shall be repeated between the angles of 2,5° and 9,2° with the EUT rotated through 90°, or the test antenna or the polarisation subsystem of the EUT rotated by 90° to give the cross-polar measurement.

#### 6.2.3.6 Presentation of results

The presentation of results shall be carried out by producing a "mask" with the specified limits and with a reference level indicated and equal to the measured on-axis gain of the antenna.

For the comparison of the results with the mask, the maximum point of the plot obtained from the pattern measurements shall be set to the reference level. The plot and the mask shall be presented together on the same figure.

### 6.3 Transmit polarisation discrimination

#### 6.3.1 General

The requirements of this subclause only apply to equipment with transmit capability.

#### 6.3.2 Definitions

For the purposes of this ETS, transmit polarisation discrimination is defined as the ratio of the power transmitted in the direction of maximum antenna gain in the intended polarisation (co-polarisation) to the power transmitted in a given direction in the polarisation which is orthogonal to the intended polarisation (cross-polarisation).

For the purposes of this subclause, EUT is defined as that part of the outdoor unit which comprises the antenna and its flange. The antenna includes the parabolic reflector, feed, support struts and an enclosure of equal weight/distribution to any electrical equipment normally housed with the feed at the antenna focal point.

#### 6.3.3 Specification

The polarisation discrimination of the antenna system in the transmit frequency band shall exceed that specified in ETS 300 159 [1].

#### 6.3.4 Test site

This test shall be performed on either an outdoor far-field test site or compact test range (however, see the last paragraph of subclause 4.2.2).

#### 6.3.5 Method of measurement

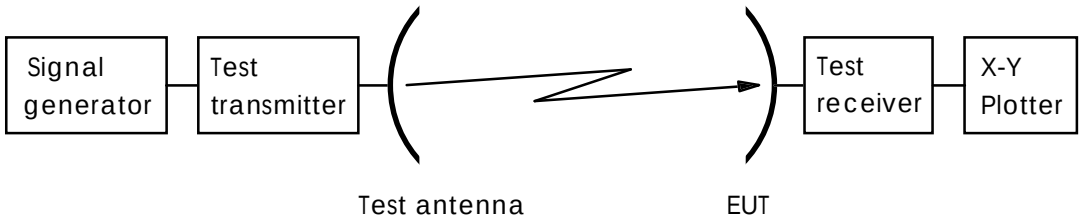



**Figure 12: Test arrangement - transmit polarisation discrimination**

a) The test arrangement shall be as shown in figure 12 with the EUT connected to the test receiver. A signal proportional to the angular position from the servo mechanism shall be applied to the X-axis and the signal level from the test receiver shall be applied to the Y-axis of the plotter.

b) A test signal at 14,005 GHz shall be transmitted in the E-plane by the test transmitter through the test antenna in the E-plane. The E-plane shall be vertical.

c) The EUT shall be aligned so that maximum deflection is obtained on the X-Y plotter.

d) This deflection shall be adjusted to the maximum reading on the chart.

e) The EUT shall be driven in azimuth until the level has dropped by 10 dB.

f) The EUT shall then be driven in azimuth through boresight to a corresponding offset on the other side with the X-Y plotter recording the level.

g) The EUT shall be returned to boresight.

h) The test antenna shall be aligned with the on-axis cross-polar component of the EUT.

j) The test shall be repeated between the same two angles used for the co-polar trace.

k) The plot obtained should show both co-polar and cross-polar traces.

l) The minimum transmit polarisation discrimination is the difference between the peak co-polar gain and the peak cross-polar gain between the points on the co-polar plot as stated in the specifications in ETS 300 159 [1].

m) The tests in b) and d) to l) shall be repeated with the frequency changed to 14,250 GHz.

n) The tests in b) and d) to l) shall be repeated with the frequency changed to 14,495 GHz.

p) The tests in b) to n) shall be repeated with the test signal being transmitted in the H-plane instead of the E-plane.

q) The tests in b) to n) shall be repeated with the test signal being transmitted in a plane at + 45° to the H-plane.

r) The tests in b) to n) shall be repeated with the test signal being transmitted in a plane at - 45° to the H-plane.

## 6.4 Receive polarisation discrimination

### 6.4.1 General

The tests in this subclause may be performed if required by the manufacturer.

For the purposes of this ETS, receive polarisation discrimination is defined as the ratio of the power received by the antenna in the direction of maximum antenna gain in the polarisation of intended maximum power transfer (co-polarisation) to the power received from a given direction from an identical far-field source of equal power but of orthogonal polarisation (cross-polarisation).

For the purposes of this subclause, EUT is defined as that part of the outdoor unit which comprises the antenna and its flange. The antenna includes the parabolic reflector, feed, support struts and an enclosure of equal weight/distribution to any electrical equipment normally housed with the feed at the antenna focal point.

NOTE: If there is no facility for directly taking a signal at 11/12 GHz from the focal point of the antenna then the EUT may include an LNB of known characteristics including non-linear amplification of small signals. These characteristics should be taken into account when evaluating the resultant patterns.

### 6.4.2 Specification

The polarisation discrimination of the antenna system in the receive frequency bands shall exceed the limit and range specified in ETS 300 159 [1] and ETS 300 157 [2].

### 6.4.3 Test site

This test shall be performed on either an outdoor far-field test site or compact test range (however, see the last paragraph of subclause 4.2.2).

### 6.4.4 Method of measurement

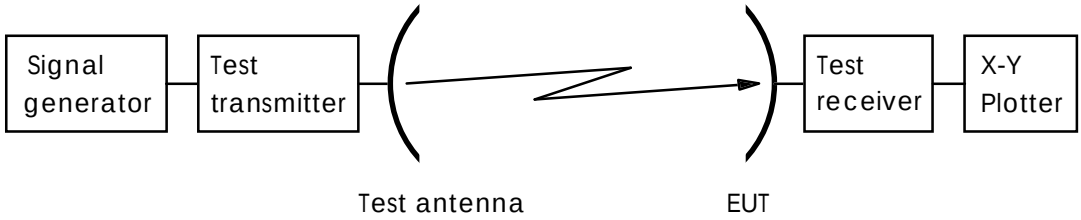



**Figure 13: Test arrangement - receive polarisation discrimination**

a) The test arrangement shall be as shown in figure 13 with the EUT connected to the test receiver. A signal proportional to the angular position from the servo mechanism shall be applied to the X-axis and the signal level from the test receiver shall be applied to the Y-axis of the plotter.

b) A test signal at either 12,505 GHz or 10,705 GHz shall be transmitted by the test transmitter through the test antenna in the E-plane (the frequency is dependent upon the designed receive frequency band). The E-plane shall be vertical.

c) The EUT shall be aligned so that maximum deflection is obtained on the X-Y plotter.

d) This deflection shall be adjusted to the maximum reading on the chart.

e) The EUT shall be driven in azimuth until the level has dropped by 10 dB.

f) The EUT shall then be driven in azimuth through boresight to a corresponding offset on the other side with the X-Y plotter recording the level.

g) The EUT shall be returned to boresight.

h) The test antenna shall be aligned with the on-axis cross-polar component of the EUT.

j) The test shall be repeated between the same two angles used for the co-polar trace.

k) The plot obtained should show both co-polar and cross-polar traces.

l) The receive polarisation discrimination corresponding to the specification is the difference between the peak co-polar gain and the peak cross-polar gain between the - 1 dB points on the co-polar plot.

m) The tests in b) to l) shall be repeated with the frequency changed to 12,625 GHz or 11,200 GHz.

n) The tests in b) to l) shall be repeated with the frequency changed to 12,745 GHz or 11,695 GHz.

p) The tests in b) to n) shall be repeated with the frequencies changed to the others specified if the design of the equipment is such that operation is possible, but not necessarily simultaneously, in both bands.

q) The tests in b) to p) shall be repeated with the test signal being transmitted in the H-plane instead of the E-plane.

r) The tests in b) to q) shall be repeated with the test signal being transmitted in a plane at + 45° to the H-plane.

s) The tests in b) to q) shall be repeated with the test signal being transmitted in a plane at - 45° to the H-plane.

## 6.5 Transmit carrier centre frequency stability

### 6.5.1 General

The requirements of this subclause only apply to equipment with transmit capability.

For the purposes of this ETS, transmit carrier centre frequency stability is defined as the amount by which the carrier centre frequency drifts from its nominal value during the switch-on sequence and whilst in use.

For the purposes of this subclause the EUT is defined as the indoor unit and that part of the outdoor unit up to the antenna flange.

### 6.5.2 Specification

As stated in ETS 300 159 [1] the transmitted carrier centre frequency shall not deviate from its nominal value by more than an amount which allows the carrier, and its spectral components which have a spectral power density greater than the specified spurious levels, to remain within its nominated bandwidth. This frequency tolerance refers to the initial frequency adjustment plus long-term drift. Long-term drift shall be assumed to be at least one month.

### 6.5.3 Test site

There are no requirements for the test site to be used for this test.

### 6.5.4 Verification

This shall be performed by a declaration from the manufacturer, supported by full documentary evidence, that the specification has been met.

## 6.6 Spurious radiation

### 6.6.1 General

A general emission standard for EMC has been produced in EN 50081-1 [7].

Until such time as a specific product or family ETS is produced covering EMC requirements for VSAT equipment the contents of this ETS shall be used.

### 6.6.2 Below 960 MHz

#### 6.6.2.1 Specification

As specified in ETS 300 159 [1] and ETS 300 157 [2] the VSAT shall satisfy the limits for radiated interference field strength below 960 MHz specified in EN 55022 [8].

The applicable class A (test distance 30 m) or class B (test distance 10 m) shall be designated by the manufacturer and indicated in the data sheet of the test report.

#### 6.6.2.2 Method of measurement

The method of measurement given in EN 55022 [8] shall apply.

### 6.6.3 Above 960 MHz

#### 6.6.3.1 Specifications

##### 6.6.3.1.1 Carrier-off state

For the carrier-off case and receive-only equipment the off-axis spurious EIRP from the VSAT for all off-axis angles greater than 7° shall be within the limits and ranges specified in ETS 300 157 [2] and ETS 300 159 [1] respectively.

#### 6.6.3.1.2 Carrier-on state

For the carrier-on case, the off-axis spurious EIRP from the VSAT for all off-axis angles greater than 7°, shall be within the limits and ranges as specified in ETS 300 159 [1].

### 6.6.3.2 Method of measurement

#### 6.6.3.2.1 Test method

The test shall be performed either with a EUT comprising both the indoor and outdoor units interconnected by 10 m of cable, or with the EUT defined as both the indoor unit and that part of the outdoor unit up to the antenna flange interconnected by 10 m of cable. The connecting cable between the indoor and the outdoor units shall be the same types as recommended by the manufacturer in the installation manual. The type of cable used shall be entered in the test report.

The indoor unit shall be terminated with matched impedance at the terrestrial ports.

The spectrum analyser resolution bandwidth shall be set to the specified measuring bandwidth or as close as possible. If the resolution bandwidth is different from the specified measuring bandwidth, bandwidth correction shall be performed for the noise-like wideband spurious.

The test shall be performed in three stages for both the carrier-off and carrier-on states:

Stage A: Identification of significant frequencies of spurious radiation;
Stage B: Measurement of radiated power levels of identified spurious radiation;
Stage C: Measurement of conducted spurious radiation radiated through the antenna flange.

#### 6.6.3.2.2 Identification of significant frequencies of spurious radiation

##### 6.6.3.2.2.1 Test site

The identification of frequencies emitting from the EUT shall be performed in an anechoic chamber with the test antenna close to the EUT and at the same height as the volume centre of the EUT.

##### 6.6.3.2.2.2 Procedure

a) The EUT shall be in the carrier-off condition (receive-only terminals shall be in the normal operating condition).

b) The main beam of the antenna shall have an angle of elevation of 7°, or, if the EUT is without the antenna, it shall be terminated by a dummy load.

c) The receivers shall scan the frequency band whilst the EUT revolves.

d) The EUT shall be rotated though 360° and the frequency of any spurious signals noted for further investigation.

e) The test shall be repeated with the test antenna being in the opposite polarisation.

f) The test shall be repeated, for transmit capable equipment, in the carrier-on condition whilst transmitting maximum power.

#### 6.6.3.2.3 Measurement of radiated power levels of identified spurious radiation

##### 6.6.3.2.3.1 Test site

The measurement of each spurious radiation noted during stage A of the test shall be performed on a test site that is free from reflecting objects, i.e. either an open-area test site or a semi-anechoic chamber.

**6.6.3.2.3.2 Procedure**

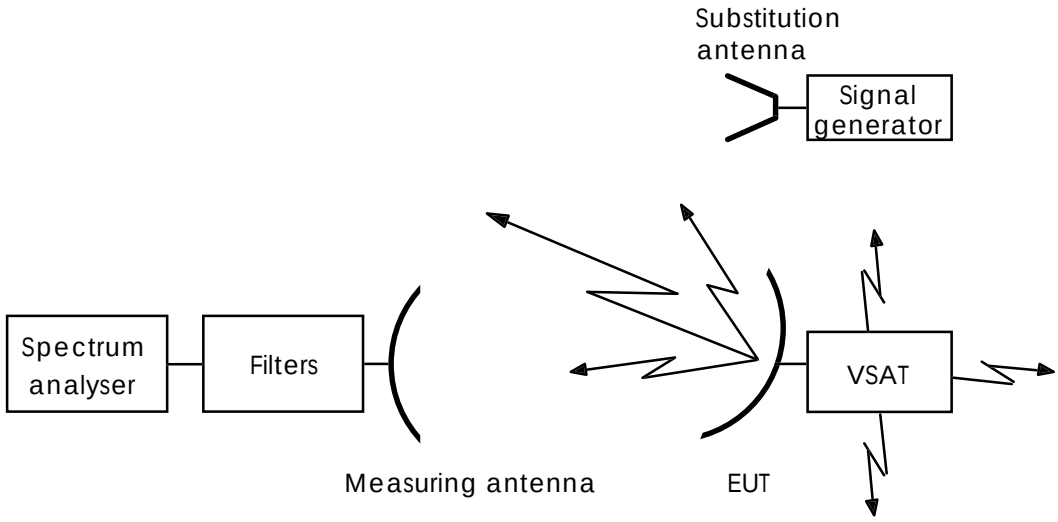



**Figure 14: Test arrangement - Spurious radiation measurement above 1 GHz, EUT inclusive of antenna**

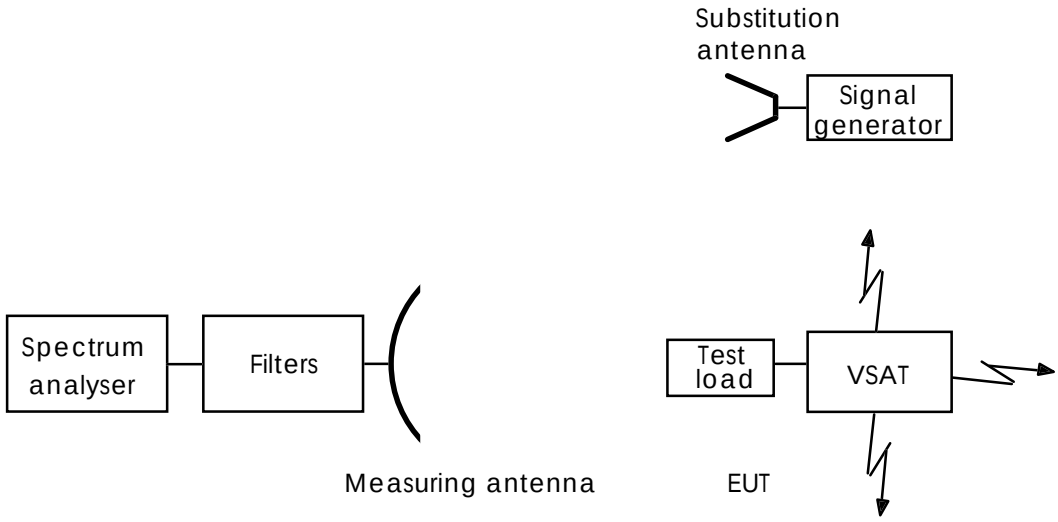



**Figure 15: Test arrangement - spurious radiation measurements above 1 GHz, EUT terminated at the antenna flange**

a) The test arrangement shall be as shown in figure 14 or figure 15.

b) The EUT shall be installed such that the units are separated by about 1 to 2 m with the indoor unit at a height between 0,5 m and 1,0 m on a turntable. The interconnection cable shall be maintained by non-metallic means at a height between 0,5 m and 1,0 m. For the test arrangement shown in figure 14 the main beam of the antenna shall have an angle of elevation of 7° and be oriented away from the geostationary orbit, or be inhibited by placing RF absorbing panels in that direction.

c) The measuring antenna shall be positioned at a distance of 10 m from the EUT. The measuring antenna shall be adjusted in height and the EUT rotated for a maximum response on the associated spectrum analyser at each spurious frequency previously identified, this response level shall be noted. The measuring antenna shall never enter the 7° off-axis cone around the main beam direction.

d) The investigation shall be repeated with the measuring antenna in the opposite polarisation and the response level similarly noted.

e) The EUT shall be replaced by the substitution antenna to which is connected a signal generator. The main beam axes of the test and substitution antennas shall be aligned and the distance between them shall be 10 m.

f) The substitution and measuring antennas shall be aligned in the polarisation which produced the larger response between the EUT and the test antenna.

g) The output of the generator shall be adjusted so that the received level is identical to that of the previously noted largest spurious radiation.

h) The output level of the signal generator shall be noted. The EIRP of the spurious radiation is the sum, in dB, of the signal generator output plus the substitution antenna isotropic gain minus the interconnection cable loss.

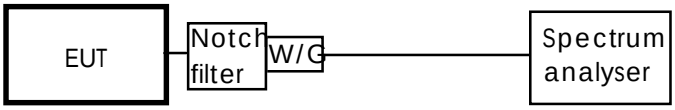
#### 6.6.3.2.4 Measurement of conducted spurious radiation at the antenna flange

The measurement of conducted spurious radiation for a VSAT, to which access to the antenna flange is impossible, shall be performed in association with the tests in stage B. The test shall then be performed over the entire band of 1 GHz to 40 GHz and every spurious radiation measured in frequency and power. Due allowance shall be made for the effect of the near field measurement.

##### 6.6.3.2.4.1 Test site

There are no requirements for the test site to be used for this test.

##### 6.6.3.2.4.2 Procedure




W/G = Waveguide Transition
Notch Filter is for suppression of the carrier

**Figure 16: Test arrangement - conducted spurious radiation**

a) The test arrangement shall be as shown in figure 16.

b) The frequency range 960 MHz to 40 GHz shall be investigated for spurious radiation, excluding intermodulation products.

c) To obtain the off-axis spurious EIRP the maximum measured antenna transmit gain for off-axis angles greater than 7°, or its worst case assumed (i.e. 8 dBi for off-axis angles greater than 7°), shall be added to any figure obtained in the above measurement and any correction or calibration factors summated with the result.

d) The test shall be repeated, for transmit capable equipment, in the carrier-on condition.

### 6.7 On-axis spurious radiation

#### 6.7.1 General

The requirements of this subclause only apply to equipment having transmit capability.

For the purposes of this subclause the EUT is defined as the indoor unit and that part of the outdoor unit up to the antenna flange and 10 m of interconnecting cable.

### 6.7.2 Specification

In the 14,0 GHz to 14,5 GHz frequency band the EIRP spectral density of the spurious radiation, excluding intermodulation products and the nominated bandwidth, shall not exceed the limits specified in ETS 300 159 [1].

### 6.7.3 Test site

There are no requirements for the test site to be used for this test.

### 6.7.4 Method of measurement

#### 6.7.4.1 General

For VSAT equipment for which measurements at the antenna flange are not possible or not agreed by the manufacturer, the measurements shall be performed with a test antenna.

For VSAT equipment for which measurements at the antenna flange are possible and agreed by the manufacturer, the measurements shall be performed at the antenna flange.

#### 6.7.4.2 Method of measurement at the antenna flange

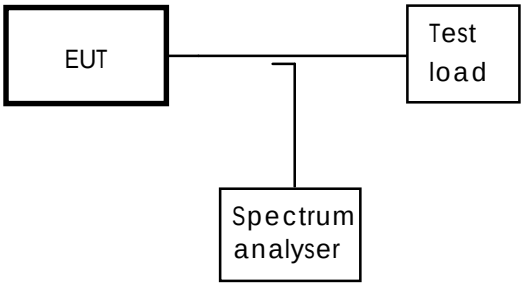



**Figure 17: Test arrangement - on-axis spurious radiation measurements at the antenna flange**

a) The EUT shall be connected to a test load as shown in figure 17.

b) Whilst continuously transmitting a modulated carrier at maximum power the frequency range 14,00 GHz to 14,50 GHz shall be investigated.

c) The spectrum analyser resolution bandwidth shall be set to the appropriate measuring bandwidth or as close as possible. If the resolution bandwidth is different from the specified measuring bandwidth, bandwidth correction shall be performed for noise-like wideband spurious radiation.

d) To obtain the on-axis spurious power level that would be transmitted, the antenna isotropic transmit gain shall be added to any figure obtained in the above measurement and any correction or calibration factor summated with the result.

e) The antenna gain shall be as measured in subclause 6.1.3.2.

f) The test shall be repeated in the carrier off condition but additionally noting any signals within the nominated bandwidth for use in the test described in subclause 6.8.

#### 6.7.4.3 Method of measurement with a test antenna

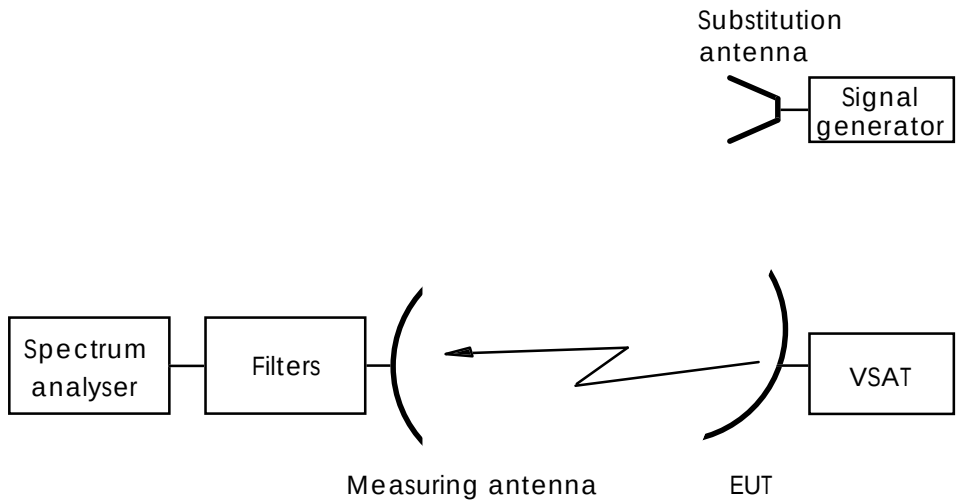



**Figure 18: Test arrangement - on-axis spurious radiation measurements with a measuring antenna**

a) The test arrangement shall be as shown in figure 18.

b) The EUT shall be installed such that the units are separated by about 1 to 2 m with the indoor unit at a height between 0,5 m and 1,0 m on a turntable. The interconnection cable shall be maintained by non-metallic means at a height between 0,5 m and 1,0 m. The elevation angle shall be 7°.

c) The spectrum analyser resolution bandwidth shall be set to the appropriate measuring bandwidth or as close as possible. If the resolution bandwidth is different from the specified measuring bandwidth, bandwidth correction shall be performed for noise-like wideband spurious radiation.

d) The measuring antenna shall be positioned at a distance of 10 m from the EUT. The measuring antenna shall be adjusted in height and polarisation and the EUT rotated for a maximum response on the associated spectrum analyser at each spurious frequency previously identified, this response level shall be noted. The measuring antenna shall never enter the 7° off-axis cone around the main beam direction.

e) The EUT shall be replaced by the substitution antenna to which is connected a signal generator. The main beam axes of the measuring and substitution antennas shall be aligned and the distance between them shall be 10 m.

f) The substitution and measuring antennas shall be aligned in the polarisation which produced the larger response between the EUT and the test antenna.

g) The output of the generator shall be adjusted so that the received level is identical to that of the previously noted largest spurious radiation.

h) The output level of the signal generator shall be noted. The EIRP of the on-axis spurious radiation is the sum, in dB, of the signal generator output plus the substitution antenna isotropic gain minus the interconnection cable loss.

j) The test shall be repeated in the carrier off condition but additionally noting any signals within the nominated bandwidth for use in the test described in subclause 6.8.

## 6.8 Carrier off state

### 6.8.1 General

The requirements of this subclause only apply to equipment with transmit capability.

#### 6.8.2 Specification

When the VSAT terminal is in suppressed transmission mode it shall transmit an EIRP density within the limits specified in ETS 300 159 [1].

#### 6.8.3 Method of measurement

This measurement shall be carried out in conjunction with that for on-axis spurious radiation, subclause 6.7.

### 6.9 Electromagnetic immunity

#### 6.9.1 General

A generic immunity standard for EMC has been produced as EN 50082-1 [9].

Until such time as a specific product or family ETS is produced covering immunity requirements for VSAT equipment the contents of this ETS shall be used.

For the purposes of this subclause, EUT is defined as both the indoor and outdoor units interconnected by at least 10 m of connecting cable. The EUT when in the carrier-on state, shall continuously transmit at a level dependant upon the HPA operating point, stated by the manufacturer, as follows:

| | |
|---|---|
| Single operating point not adjustable: | Transmission at that power level; |
| Single operating point adjustable: | Transmission at a power level 3 dB below maximum if possible; |
| A restricted range of output level: | Transmission at a power level in mid-range; |
| Unrestricted range of output level: | Transmission at a power level 3 dB below maximum possible. |

#### 6.9.2 Below 1 GHz

##### 6.9.2.1 Specification

The VSAT shall have an adequate level of intrinsic immunity to enable it to operate as intended, when it is exposed to the electrical field strengths as specified in ETS 300 159 [1] and ETS 300 157 [2].

##### 6.9.2.2 Method of measurement

The method of measurement given in EN 50082-1 [9] shall apply.

#### 6.9.3 Above 1 GHz

##### 6.9.3.1 Specification

The VSAT shall have an adequate level of intrinsic immunity to enable it to operate as intended, when it is exposed to the electrical field strengths specified in ETS 300 159 [1] and ETS 300 157 [2].

##### 6.9.3.2 Test site

The test site shall be one in which the EUT can be placed in a uniform electric field of stated strength, amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 kHz, the frequency of the electric field shall be changed by increments between the limits specified.

A field is considered uniform if its magnitude does not vary by greater than - 0 dB, + 6 dB of nominal value over 75% of the surface of the defined area.

#### 6.9.3.3 Method of measurement

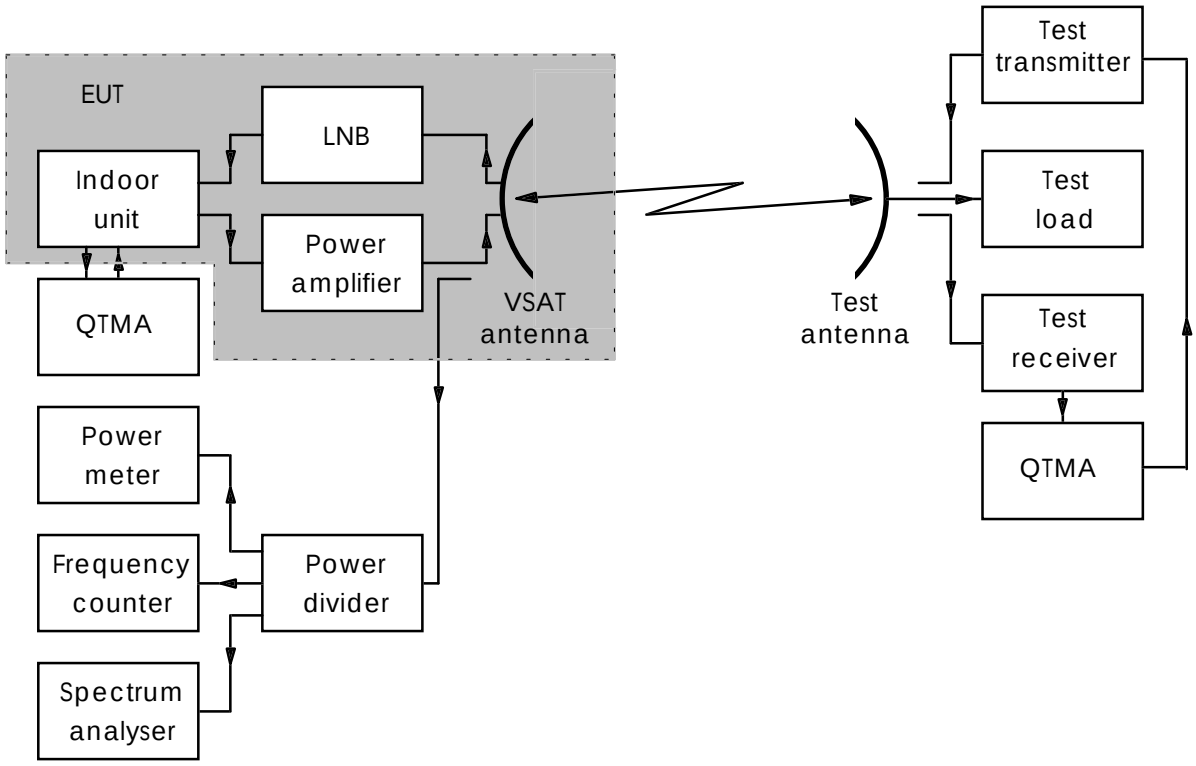



**Figure 19: Test arrangement - electromagnetic immunity measurement**

a) The equipment shall be configured as shown in figure 19 for a transmit/receive VSAT.

b) Provision shall be made for the EUT to be switched between the carrier-on and carrier-off states, possibly through the test transmitter, whilst the test is in progress, unless the EUT is receive only.

c) The test equipment shall be the means whereby the correct operation of the EUT is verified.

1) The power meter measures the output power and will confirm both the carrier-on and carrier-off switching and output power level consistency.

2) The frequency counter measures the centre frequency of the radiated carrier in the absence of modulation.

3) The spectrum analyser measures the bandwidth of the transmission.

4) The test receiver is used to demodulate the transmitted signal.

5) The two Quality of Transmission Measurement Apparatus (QTMA) are used in conjunction with each other to assess the quality of transmission to verify that there is no degradation.

6) The test transmitter is used to control the switching between carrier-on and carrier-off states by transmitting the CCMF.

d) The readings on the various measuring test equipment shall be taken in the absence of the uniform electric field for both carrier-on and carrier-off states. These readings shall be recorded.

e) The same measurements shall be taken in the presence of the uniform electric field at each of the stepped frequencies and the EUT shall be rotated. These readings shall be recorded.

f) The two sets of measurements shall be compared to ascertain any difference in operability of the EUT when under the influence of the uniform field.

g) The results obtained above shall be compared with the criteria shown below:

1) the quality of transmission observed shall not be worse than the lowest acceptable quality of transmission declared by the manufacturer;

2) under these conditions the VSAT transmission shall be able to be suppressed by the CCMF or any CCMF simulator and it shall not restart without being enabled by the CCMF;

3) when the VSAT is in the carrier-off state there shall be no change in the signal level;

4) when the VSAT is in the carrier-on state there shall be no change in either the signal level or frequency.

# 7 Mechanical requirements

## 7.1 General

Transmit capable VSAT equipment shall be verified in accordance with this clause. Receive-only equipment may be verified, if required by the manufacturer, in accordance with this clause.

## 7.2 Definition

For the purposes of this clause EUT is defined as the outdoor unit.

## 7.3 Antenna pointing accuracy

### 7.3.1 Specification

The antenna mount shall allow the position of the antenna transmit main beam axis to be fixed with an accuracy as specified in ETS 300 159 [1].

### 7.3.2 Test site

There are no requirements for the test site for this test.

### 7.3.3 Method of verification

a) The EUT shall be inspected to ascertain whether fine adjustment facilities are available for the azimuth axis (coarse adjustment is usually provided by the positioning of the means of attachment).

b) The adjustment facilities shall be examined to determine both the angular movement possible and the means of arresting that movement.

c) The arresting facility shall be examined to determine its permanency.

d) The test shall be repeated for the elevation axis.

## 7.4 Pointing stability

### 7.4.1 Specification

Under the wind speed and gusts stated in ETS 300 159 [1] and ETS 300 157 [2] the installation shall behave as specified in those ETSs.

### 7.4.2 Method of verification

The verification shall be carried out at the same time as the tests in subclause 5.1.2.

## 7.5 Polarisation angle alignment capability

### 7.5.1 Specification

The polarisation angle shall be continuously adjustable over the stated range and it shall be possible to fix the transmit antenna polarisation angle with an accuracy specified in ETS 300 159 [1] and ETS 300 157 [2].

### 7.5.2 Test site

There are no requirements for the test site for this test.

### 7.5.3 Method of verification

a) The adjustment facilities shall be examined to determine both the angular movement possible and the means of arresting that movement.

b) The arresting facility shall be examined to determine its permanency.

## Annex A (normative): Test report summary

**Table A.1: Test report summary**

| Test number | Specification title | Status | Test Conducted Y/N | Pass or fail | Comments and/or measured value |
|---|---|---|---|---|---|
| 5.1 | Mechanical construction | | | | |
| 5.2 | Lightning protection | | | | |
| 6.1 | Off-axis EIRP radiation density | | | | |
| 6.2.2 | Antenna transmit radiation patterns | | | | |
| 6.2.3 | Antenna receive radiation patterns | | | | |
| 6.3 | Transmit polarisation discrimination | | | | |
| 6.4 | Receive polarisation discrimination | | | | |
| 6.5 | Transmit carrier centre frequency stability | | | | |
| 6.6 | Spurious radiation | | | | |
| 6.7 | On-axis spurious radiation | | | | |
| 6.8 | Carrier on-off | | | | |
| 6.9.2 | Electromagnetic immunity (below 1 GHz) | | | | |
| 6.9.3 | Electromagnetic immunity above 1 GHz | | | | |
| 7.3 | Pointing accuracy | | | | |
| 7.4 | Pointing stability | | | | |
| 7.5 | Polarisation angle alignment | | | | |

## Annex B (normative): Test report result forms



The following forms shall be used as a minimum requirement to record the results of the tests carried out. Where a graphical representation is required the graph shall be included immediately after the test result.

TEST REPORT REFERENCE

MECHANICAL CONSTRUCTION SUBCLAUSE 5.1

Test results:

Safety margin test:
.....
.....

| | Yes | No |
|---|---|---|
| Any signs of distortion observed | ☐ | ☐ |

Comments:
.....
.....
.....
.....
.....
.....
.....
.....

LIMITS: Subclause 5.1.1

The outdoor unit, including mounted structural components (but excluding the means of attachment), shall be designed as specified in ETS 300 159 [1] or ETS 300 157 [2].

TEST EQUIPMENT USED:

.....

.....

NOTE: Indicate the computation method used.

TEST REPORT REFERENCE .....

MECHANICAL CONSTRUCTION - INTERFACE LOADS SUBCLAUSE 5.1

NOTE: The test to be reported on this form forms part of the tests covered by subclause 5.1. There is, however, no definitive specification for this test.

| Interface description | Load value (N) | Measurement uncertainty |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Comments:
.....
.....
.....
.....
.....
.....
.....
.....

LIMITS: Subclause 5.1.1

The outdoor unit, including mounted structural components (but excluding the means of attachment), shall be designed as specified in ETS 300 159 [1] or ETS 300 157 [2].

TEST EQUIPMENT USED:

.....

.....

NOTE: Indicate the computation method used.

TEST REPORT REFERENCE .....

LIGHTNING PROTECTION SUBCLAUSE 5.2

Dimensions of the attachment point: .....

Dimensions of restrictive area: .....

Attachment suitable for conductor made of: Cu ☐

Al ☐

Fe ☐

None ☐

Comments:
.....
.....
.....
.....
.....
.....
.....
.....

SPECIFICATION: Subclause 5.2.1

Means shall be provided to permit the attachment of bonding conductors of dimensions indicated in EN 50083-1 [5], subclause 10.2.3.

**Earthing conductors**

| **Material** | **Cross section ($mm^2$)** |
|---|---|
| Cu | 16 |
| Al | 25 |
| Fe | 50 |

TEST REPORT REFERENCE .....

OFF-AXIS EIRP EMISSION DENSITY SUBCLAUSE 6.1

Ambient temperature .....°C Relative humidity ..... %

Number of VSATs transmitting in the same carrier frequency band, N: .....

Nominated Bandwidth:.....

Test frequency: ..... GHz Test polarisation: .....

| Test | Measured value | Unit of measurement | Measurement uncertainty |
|---|---|---|---|
| Transmitter output power | | dBW/40 kHz | |
| Antenna transmit gain | | dBi | |
| Antenna transmit radiation pattern | See Graphs | dB | |

NOTE: Measurement results are presented in a graphic form following this result sheet.

SPECIFICATION: Subclause 6.1.2

The maximum EIRP in any 40 kHz band within the nominated bandwidth of the co-polarised component in any direction $\phi$ degrees from the antenna main beam axis shall not exceed the limits and ranges specified in ETS 300 159 [1].

In addition the cross-polarised component in any direction $\phi$ degrees from the antenna main beam axis shall not exceed the limits and ranges specified in ETS 300 159 [1].

COMPUTATION OF RESULTS

As indicated in subclause 6.1.4.

Results are presented in a graphic form following this result sheet.

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

ANTENNA TRANSMIT RADIATION PATTERNS SUBCLAUSE 6.2.2

Ambient temperature .....°C Relative humidity ..... %

Test frequency: ..... GHz

Test polarisation: .....

| Test | Measured value | Unit of measurement | Measurement uncertainty |
|---|---|---|---|
| Antenna transmit gain | | dBi | |
| Antenna transmit radiation pattern | See Graphs. | dB | |

NOTE: Measurement results are presented in a graphic form following this result sheet.

SPECIFICATION: Subclause 6.2.2.1

The gain G ($\phi$) in dB relative to an isotropic antenna of the main lobe and at least 90 % of the side-lobe peaks should not exceed the limits and ranges specified in ETS 300 159 [1]

Additionally, the cross-polar gain G ($\phi$) in dB relative to an isotropic antenna at least 90 % of the peaks should not exceed the limits and ranges specified in ETS 300 159 [1].

The method of statistical processing of side-lobe peaks and the definition of a peak is described in ITU-R 732 Recommendation, annex II [6].

PRESENTATION OF RESULTS

As indicated in subclause 6.2.2.2.

Results are presented in a graphic form following this result sheet.

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

ANTENNA RECEIVE RADIATION PATTERNS SUBCLAUSE 6.2.3

Ambient temperature .....°C Relative humidity ..... %

Test frequency: ..... GHz

Test polarisation: .....

| Test | Measured value | Unit of measurement | Measurement uncertainty |
|---|---|---|---|
| Antenna receive gain | | dBi | |
| Antenna receive radiation pattern | See Graphs. | dB | |

NOTE: Measurement results are presented in a graphic form following this result sheet.

SPECIFICATION: Subclause 6.2.3.1

The gain G ($\phi$) in dB relative to an isotropic antenna of the main lobe and at least 90 % of the side-lobe peaks should not exceed the limits and ranges specified in ETS 300 159 [1] and ETS 300 157 [2]

Additionally, the cross-polar gain G ($\phi$) in dB relative to an isotropic antenna at least 90 % of the peaks should not exceed the limits and ranges specified in ETS 300 159 [1] and ETS 300 157 [2].

The method of statistical processing of side-lobe peaks and the definition of a peak is described in ITU-R 732 Recommendation, annex II [6].

PRESENTATION OF RESULTS

As indicated in subclause 6.2.3.6.

Results are presented in a graphic form following this result sheet.

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

TRANSMIT POLARISATION DISCRIMINATION SUBCLAUSE 6.3

Ambient temperature .....°C Relative humidity ..... %

Test frequency: ..... GHz

Test polarisation: .....

| Test | Measured value | Unit of measurement | Measurement uncertainty |
|---|---|---|---|
| Transmit polarisation discrimination: | See Graphs | | |
| - essential test | | dB | |
| - optional test | | dB | |

NOTE: Measurement results are presented in a graphic form following this result sheet.

SPECIFICATION: Subclause 6.3.3

The polarisation discrimination of the antenna system in the transmit frequency band shall exceed that specified in ETS 300 159 [1].

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

RECEIVE POLARISATION DISCRIMINATION SUBCLAUSE 6.4

Ambient temperature .....°C Relative humidity ..... %

Test frequency: ..... GHz

Test polarisation: .....

| Test | Measured value | Unit of measurement | Measurement uncertainty |
|---|---|---|---|
| Receive polarisation discrimination | See Graphs. | dB | |

NOTE: Measurement results are presented in a graphic form following this result sheet.

SPECIFICATION: Subclause 6.4.2

The polarisation discrimination of the antenna system in the receive frequency bands shall exceed the limit and range specified in ETS 300 159 [1] and ETS 300 157 [2].

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

TRANSMIT CARRIER CENTRE FREQUENCY STABILITY SUBCLAUSE 6.5

Ambient temperature .....°C Relative humidity ..... %

SPECIFICATION: Subclause 6.5.2

As stated in ETS 300 159 [1] the transmitted carrier centre frequency shall not deviate from its nominal value by more than an amount which allows the carrier, and its close-in spectral components which have a spectral power density greater than the specified spurious levels, to remain within its nominated bandwidth. This frequency tolerance refers to the initial frequency adjustment plus long-term drift. Long-term drift shall be assumed to be at least one month.

VERIFICATION OF SPECIFICATION

As indicated in subclause 6.5.4.

| | |
|---|---|
| Declaration from manufacturer | |
| Full documentary evidence | |
| Specification verified | |

TEST REPORT REFERENCE .....

SPURIOUS RADIATION BELOW 960 MHz SUBCLAUSE 6.6.2

Ambient temperature .....°C Relative humidity ..... %

| Frequency of spurious signal (GHz) | Level of spurious signal (dBµV/m) | Measurement uncertainty |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

SPECIFICATION: Subclause 6.6.2.1

As specified in ETS 300 159 [1] and ETS 300 157 [2] the VSAT shall satisfy the limits for radiated interference field strength below 960 MHz specified in EN 55022 [8].

The applicable class A (test distance 30 m) or class B (test distance 10 m) shall be designated by the manufacturer and indicated in the data sheet of the test report.

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

SPURIOUS RADIATION ABOVE 960 MHz - CARRIER-OFF STATE SUBCLAUSE 6.6.3

Ambient temperature .....°C Relative humidity ..... %

| **Frequency of spurious signal (GHz)** | **Level of spurious signal (dBpW)** | **Measurement uncertainty** |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| **Frequency of spurious signal (GHz)** | **Level of spurious signal radiated through the antenna (dBpW)** | **Measurement uncertainty** |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

NOTE: All results are obtained by measuring in any 100 kHz.

SPECIFICATION: Subclause 6.6.3.1.1

For the carrier-off case and receive-only equipment the off-axis spurious EIRP from the VSAT for all off-axis angles greater than 7° shall be within the limits and ranges specified in ETS 300 157 [2] and ETS 300 159 [1] respectively.

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

SPURIOUS RADIATION ABOVE 960 MHz - CARRIER-ON STATE SUBCLAUSE 6.6.3

Ambient temperature .....°C Relative humidity ..... %

| Frequency of spurious signal (GHz) | Level of spurious signal (dBpW) | Measurement uncertainty |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| Frequency of spurious signal (GHz) | Level of spurious signal radiated through the antenna (dBpW) | Measurement uncertainty |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

NOTE: All results are obtained by measuring in any 100 kHz.

SPECIFICATION: Subclause 6.6.3.1.2

For the carrier-on case, the off-axis spurious EIRP from the VSAT for all off-axis angles greater than 7°, shall be within the limits and ranges as specified in ETS 300 159 [1].

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

ON-AXIS SPURIOUS RADIATION - CARRIER-ON STATE SUBCLAUSE 6.7

Ambient temperature .....°C Relative humidity ..... %

Number of VSATs transmitting in the same carrier frequency band, N: .....

| **Maximum EIRP in any 100 kHz band (dBW)** | **Measurement uncertainty** |
|---|---|
| | |

SPECIFICATION Subclause 6.7.2

In the 14,0 GHz to 14,5 GHz frequency band the EIRP spectral density of the spurious radiation, excluding intermodulation products and the nominated bandwidth, shall not exceed the limits specified in ETS 300 159 [1].

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

ON-AXIS SPURIOUS RADIATION - CARRIER-OFF STATE SUBCLAUSE 6.7

Ambient temperature .....°C Relative humidity ..... %

| **Maximum EIRP in any 100 kHz band (dBW)** | **Measurement uncertainty** |
|---|---|
| | |

SPECIFICATION Subclause 6.7.2

In the 14,0 GHz to 14,5 GHz frequency band the EIRP spectral density of the spurious radiation, excluding intermodulation products and the nominated bandwidth, shall not exceed the limits specified in ETS 300 159 [1].

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

CARRIER OFF STATE SUBCLAUSE 6.8

Ambient temperature .....°C Relative humidity ..... %

| **Maximum EIRP in any 4 kHz band (dBW)** | **Measurement uncertainty** |
|---|---|
| | |

LIMITS Subclause 6.8.2

When the VSAT terminal is in suppressed transmission mode it shall transmit an EIRP density within the limits specified in ETS 300 157 [2].

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

ELECTROMAGNETIC IMMUNITY SUBCLAUSE 6.9

Ambient temperature .....°C Relative humidity ..... %

| Feature tested | Pass/Fail | Frequency range in which failures occurred |
|---|---|---|
| Quality of transmission | | |
| Transmission suppression by the CCMF [1)] | | |
| Signal level change in the carrier-off state [1)] | | |
| Signal level change in the carrier-on state [1)] | | |
| Frequency change in the carrier-on state [1)] | | |

[1)] this applies to equipment with transmit capability

SPECIFICATION: Subclauses 6.9.2.1 and 6.9.3.1

The VSAT shall have an adequate level of intrinsic immunity to enable it to operate as intended, when it is exposed to the electrical field strengths specified in ETS 300 159 [1] and ETS 300 157 [2].

TEST EQUIPMENT USED:

.....

.....

TEST REPORT REFERENCE .....

POINTING ACCURACY SUBCLAUSE 7.3

| **Pointing accuracy** | **Azimuth axis** | | **Elevation axis** | |
|---|---|---|---|---|
| | Yes | No | Yes | No |
| Adjustments available | ☐ | ☐ | ☐ | ☐ |
| Angular movement possible | ☐ | ☐ | ☐ | ☐ |
| Means of arresting available | ☐ | ☐ | ☐ | ☐ |
| Arresting facility permanent | ☐ | ☐ | ☐ | ☐ |

Comments:
.....
.....
.....
.....
.....
.....
.....
.....

SPECIFICATION: Subclause 7.3.1

The antenna mount shall allow the position of the antenna transmit main beam axis to be fixed with an accuracy as specified in ETS 300 157 [2].

TEST REPORT REFERENCE

POINTING STABILITY SUBCLAUSE 7.4

| | | | | |
|---|---|---|---|---|
| Permanent distortion | Yes | | No | |
| Repointing required | Yes | | No | |

COMMENTS:.....
.....
.....
.....
.....
.....
.....

SPECIFICATION: Subclause 7.4.1

Under the wind speed and gusts stated in ETS 300 159 [1] and ETS 300 157 [2] the installation shall behave as specified in those ETSs.

TEST REPORT REFERENCE .....

POLARISATION ANGLE ALIGNMENT CAPABILITY SUBCLAUSE 7.5

| **Polarisation angle** | **Examination** | |
|---|---|---|
| | Yes | No |
| Adjustments available | ☐ | ☐ |
| Angular movement possible | ☐ | ☐ |
| Means of arresting available | ☐ | ☐ |
| Arresting facility permanent | ☐ | ☐ |

Comments:
.....
.....
.....
.....
.....
.....
.....
.....

SPECIFICATION: Subclause 7.5.1

The polarisation angle shall be continuously adjustable over the stated range and it shall be possible to fix the transmit antenna polarisation with an accuracy specified in ETS 300 159 [1] and ETS 300 157 [2].

## History

| Document history | | | |
|---|---|---|---|
| September 1994 | Public Enquiry | PE 71: | 1994-09-19 to 1995-01-13 |
| June 1995 | Vote | V 82: | 1995-06-26 to 1995-09-01 |
| November 1995 | First Edition | | |
| February 1996 | Converted into Adobe Acrobat Portable Document Format (PDF) | | |
| | | | |

ISBN 2-7437-0308-3
Dépôt légal : Novembre 1995