

ETSI EN 300 487 V2.1.2 (2016-11)

**Satellite Earth Stations and Systems (SES);
Harmonised Standard for Receive-Only Mobile
Earth Stations (ROMES) providing data communications
operating in the 1,5 GHz frequency band;
Radio Frequency (RF) specifications covering the essential
requirements of article 3.2 of the Directive 2014/53/EU**

Reference

REN/SES-00377

Keywords

data, earth station, LMSS, MES, mobile, RO,
satellite

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.

All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.
3GPP™ and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and
of the 3GPP Organizational Partners.
GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Contents

Intellectual Property Rights	5
Foreword.....	5
Modal verbs terminology.....	5
Introduction	6
1 Scope	7
2 References	7
2.1 Normative references	7
2.2 Informative references.....	7
3 Definitions and abbreviations.....	8
3.1 Definitions	8
3.2 Abbreviations	8
4 Test conditions	8
4.1 Test voltages.....	8
4.2 Test report	8
4.3 Special Test Equipment (STE)	9
4.4 Equipment Under Test (EUT)	9
5 RF emission limits.....	9
6 Receiver Performance Requirements	9
6.1 General	9
6.2 Receiver Adjacent Channel Selectivity	10
6.2.1 Purpose	10
6.2.2 Technical requirements.....	10
6.2.3 Conformance test	10
6.3 Receiver Blocking Characteristics	10
6.3.1 Purpose	10
6.3.2 Technical requirements.....	10
6.3.3 Conformance test	11
7 Method of Testing for Receiver Performance	11
7.1 General	11
7.2 Receiver Adjacent Channel Selectivity	11
7.2.1 General.....	11
7.2.2 Test arrangement	11
7.2.3 Test Procedures.....	11
7.3 Receiver Blocking Characteristics	12
7.3.1 General.....	12
7.3.2 Test arrangement	12
7.3.3 Test procedures.....	12
Annex A (normative): Environmental test conditions	13
Annex B (normative): RF emissions - test procedure	14
B.1 Introduction	14
B.2 Measuring apparatus.....	14
B.3 Equipment Under Test (EUT)	14
B.4 Special Test Equipment (STE)	14
B.5 Measurement procedure	14
Annex C (normative): Relationship between the present document and the essential requirements of Directive 2014/53/EU	17

Annex D (informative): Bibliography.....18
History19

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

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

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.1] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.2].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table C.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

National transposition dates	
Date of adoption of this EN:	12 September 2016
Date of latest announcement of this EN (doa):	31 December 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2017
Date of withdrawal of any conflicting National Standard (dow):	30 June 2018

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document is intended to cover the provisions of Directive 2014/53/EU [i.2] (RE Directive) article 3.2 which states that "*...radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference*".

Recital 10 of Directive 2014/53/EU [i.2] states that "*in order to ensure that radio equipment uses the radio spectrum effectively and supports the efficient use of radio spectrum, radio equipment should be constructed so that: in the case of a transmitter, when the transmitter is properly installed, maintained and used for its intended purpose it generates radio waves emissions that do not create harmful interference, while unwanted radio waves emissions generated by the transmitter (e.g. in adjacent channels) with a potential negative impact on the goals of radio spectrum policy should be limited to such a level that, according to the state of the art, harmful interference is avoided; and, in the case of a receiver, it has a level of performance that allows it to operate as intended and protects it against the risk of harmful interference, in particular from shared or adjacent channels, and, in so doing, supports improvements in the efficient use of shared or adjacent channel*".

Recital 11 of Directive 2014/53/EU [i.2] states that "*although receivers do not themselves cause harmful interference, reception capabilities are an increasingly important factor in ensuring the efficient use of radio spectrum by way of an increased resilience of receivers against harmful interference and unwanted signals on the basis of the relevant essential requirements of Union harmonisation legislation*".

As a consequence, the present document includes both transmitting and receiving parameters aiming to maximize the efficient use of radio spectrum.

1 Scope

The present document applies to the Receive-Only Mobile Earth Stations (ROMES) radio equipment operating under the Land Mobile Satellite Service (LMSS), in the frequency band 1 518 MHz to 1 559 MHz (space-to-earth bands).

The ROMESs operate as part of a satellite system providing one-way data communications.

ROMESs could have several configurations, including:

- either Portable Equipment (PE) or vehicle Installed Equipment (IE);
- a number of modules including a display/control interface to the user.

The present document is intended to cover the provisions of Directive 2014/53/EU [i.2] (RE Directive) article 3.2 which states that "*...radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference*".

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the Directive 2014/53/EU [i.2] may apply to equipment within the scope of the present document.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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

- | | |
|-----|---|
| [1] | Void. |
| [2] | ETSI ETS 300 133-5 (Edition 1) (07-1992): "Paging Systems (PS); Enhanced Radio MESSage System (ERMES); Part 5: Receiver conformance specification". |

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- | | |
|-------|---|
| [i.1] | Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council. |
|-------|---|

- [i.2] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

3 Definitions and abbreviations

3.1 Definitions

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

in-band signals: signals which are located in the operating band plus an offset of 10 MHz outside this operating band

operating frequency band: frequency band over which the ROMES is capable of operation

3.2 Abbreviations

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

BW	BandWith
CW	Continuous Wave
EC	European Commission
EFTA	European Free Trade Association
EIRP	Equivalent Isotropically Radiated Power
ETS	European Telecommunication Standard
EUT	Equipment Under Test
IE	Installed Equipment
LMSS	Land Mobile Satellite Service
LTE	Long Term Evolution
MSS	Mobile Satellite Service
PE	Portable Equipment
RF	Radio Frequency
ROMES	Receive-Only Mobile Earth Station
SNR	Signal to Noise Ratio
STE	Special Test Equipment

4 Test conditions

4.1 Test voltages

The nominal and extreme operational power supply voltages shall be stated by the manufacturer.

4.2 Test report

The test report shall contain:

- the results of the tests;
- all parameters and operational conditions;
- the value of the highest frequency conversion oscillator.

4.3 Special Test Equipment (STE)

To enable the tests specified in the present document to be carried out, the use of STE, supplied by the manufacturer or system provider, may be necessary. Since the STE will be specific for the particular equipment, it is not possible to provide detailed specifications in the present document. However, the following baseline is provided:

- the STE shall enable the ROMES to tune to every channel in the operating frequency band, to enable spurious emissions to be measured;
- if the connection of the STE affects any of the parameters specified in the present document then the effects shall clearly be stated by the manufacturer.

4.4 Equipment Under Test (EUT)

The EUT shall include all units necessary for the intended operation.

5 RF emission limits

Purpose:

To protect terrestrial and satellite radio services from emissions caused by ROMESs to which the present document applies.

Specification:

The radiated power from the equipment, including its antenna, shall not exceed the limits in table 1.

Table 1

Frequency range (MHz) (see note 1)	EIRP limit (dBpW) (see note 1)	Measurement bandwidth (kHz)
30,0 - 1 000,0	33	100
1 000,0 - 1 518,0	43 (see note 2)	100
1 518,0 - 1 559,0	17	3
1 559,0 - 12 750,0	43 (see note 2)	100
12 750,0 - 21 200,0	48 (see note 3)	100
21 200,0 - 40 000,0	60	100

NOTE 1: The lower limits shall apply at the transition frequency.
 NOTE 2: These figures shall be 48 dBpW prior to 1st January 1997.
 NOTE 3: This figure shall be 54 dBpW prior to 1st January 1997.

Verification:

All RF tests in this clause shall be carried out with the test conditions given in annex A.

The equipment shall be tested according to the test procedure given in annex B. The upper frequency to which tests shall be performed shall be at least the 10th harmonic of the highest frequency conversion oscillator or ten times the highest operational frequency, whichever is greater.

6 Receiver Performance Requirements

6.1 General

This clause shall apply for all ROMES.

6.2 Receiver Adjacent Channel Selectivity

6.2.1 Purpose

To enable reception of a wanted signal in the presence of other signals in the adjacent channel.

Adjacent channel selectivity is a measure of a receiver's ability to receive a signal at its assigned channel frequency in the presence of a signal in the adjacent channel at a given frequency offset from the centre frequency of the assigned channel.

6.2.2 Technical requirements

The frequency offset and relative power level of the adjacent signal compared to the wanted signal shall take the values given in table 2. The adjacent signal shall occupy the same bandwidth as the wanted signal where BW is the wanted signal occupied bandwidth. There shall be no more than 0,5 dB degradation in the receiver signal to noise ratio under these conditions.

Table 2: Adjacent Channel frequency and power level

Signal	Centre frequency offset from wanted signal	Power level relative to wanted signal
Adjacent signal	BW	12 dB

6.2.3 Conformance test

Conformance tests shall be carried out in accordance with clause 7.2.

6.3 Receiver Blocking Characteristics

6.3.1 Purpose

To prevent high power signals outside the receive frequency band from blocking the reception of signals inside the receive frequency band.

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. Receiver blocking is specified for in-band signals. In-band signals are signals in the 1 508 MHz to 1 569 MHz band.

6.3.2 Technical requirements

The receiver performance degradation, in terms of signal to noise ratio, shall not exceed 1 dB when the unwanted signal as specified in table 3 is present.

Table 3: Test parameters for in-band blocking characteristics

Interfering Signal	In-band Frequency Range (MHz)	Frequency offset from wanted carrier (MHz)	Level (dBm)
CW	1 508 to 1 569	5	-40 (see note)
NOTE:	The -40 dBm level is set based on the performance of the design of MSS terminals. For ease of laboratory testing, the interfering signal is specified as a CW signal. Receiver blocking performance specification against a broadband signal blocking interferer, such as LTE, is under study.		

6.3.3 Conformance test

Conformance tests shall be carried out in accordance with clause 7.3.

7 Method of Testing for Receiver Performance

7.1 General

These test methods apply to all requirements in clause 6.

7.2 Receiver Adjacent Channel Selectivity

7.2.1 General

If the EUT is a ROMES that has been modified by the applicant for these tests then full documentation of such modification(s) shall be provided to prove that the modification(s) will simulate the required test condition.

For the purpose of this test, the EUT is the ROMES without its antenna connected.

7.2.2 Test arrangement

The equipment should be set-up as shown in figure 1.

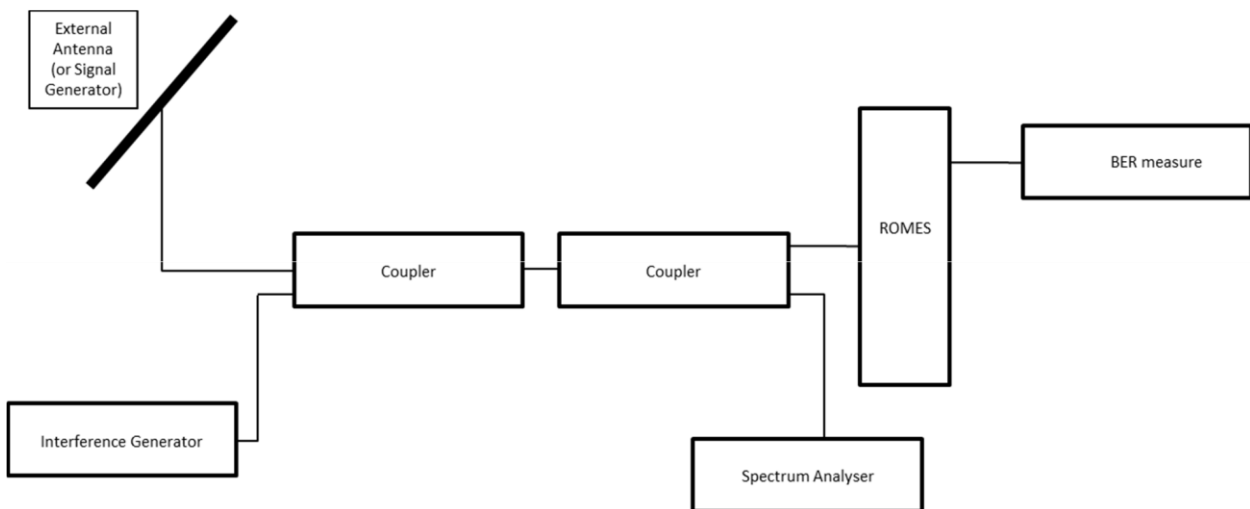


Figure 1: Measuring system set-up for Adjacent Channel Selectivity and Blocking Characteristics

7.2.3 Test Procedures

The procedure basics are illustrated below:

- 1) The wanted signal power is adjusted such that the SNR (at the receiver input) is set to the reference level plus 1 dB. The reference level is the minimum SNR required to achieve the target performance level for a given bearer type.
- 2) Measure the SNR of the receiver, where SNR of the receiver means the SNR determined by the receiver demodulator.
- 3) Set the parameters of the interference signal generator as shown in table 2 in clause 6.2.2.
- 4) Add the interference signal and measure the SNR of the receiver.

- 5) The SNR achieved in step 4 shall not exceed 0,5 dB degradation compared to the SNR measured in step 2.

7.3 Receiver Blocking Characteristics

7.3.1 General

If the EUT is a ROMES that has been modified by the applicant for these tests then full documentation of such modification(s) shall be provided to prove that the modification(s) will simulate the required test condition.

For the purpose of this test, the EUT is the ROMES without its antenna connected.

7.3.2 Test arrangement

The equipment should be set-up as shown in figure 1.

7.3.3 Test procedures

The procedure basics are illustrated below:

- 1) The wanted signal power is adjusted such that the SNR (at the receiver input) is set to the reference level plus 2 dB. The reference level is the minimum SNR required to achieve the target performance level for a given bearer type.
- 2) Measure the SNR of the receiver, where SNR of the receiver means the SNR determined by the receiver demodulator.
- 3) Generate CW with the parameters as shown in table 3 in clause 6.3.2.
- 4) Apply the interference CW and measure the receiver SNR.
- 5) The SNR achieved in step 4 shall not exceed 1 dB degradation compared to the SNR measured in step 2.

Annex A (normative): Environmental test conditions

The temperature range shall be $-10\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$ and relative humidity from 20 % to 70 % non-condensing. The test voltages shall be the extreme operational power supply voltages declared by the manufacturer.

Annex B (normative): RF emissions - test procedure

B.1 Introduction

This annex, based on procedures described in ETSI ETS 300 133-5 [2], describes the method of measurement of unwanted emissions generated by a ROMES terminal.

B.2 Measuring apparatus

In order to carry out the test, the following elements are required, as a minimum:

- a set of substitution antennas covering the frequency range of interest calibrated at 1,5 m above the ground plane;
- a set of test antennas covering the frequency range of interest;
- the necessary post test antenna amplification devices;
- spectrum analyser(s) covering the frequency range of interest.

For the apparatus utilized, it shall be verified that the response of the apparatus, including any antenna and associated amplification system, to a constant amplitude sine wave signal remains within ± 1 dB of calibration across the frequency range of interest.

B.3 Equipment Under Test (EUT)

For the purpose of the test, the ROMES terminal comprises:

- the IE or PE with any deployable parts in their normal operating configuration;
- any externally mounted accessories;
- any necessary power supply cables or other cable to ensure proper functioning of the terminal.

B.4 Special Test Equipment (STE)

In order to measure the system radiation under operational conditions, proper arrangement shall be made available (by the manufacturer) to put the ROMES terminal in its normal operating mode and tuned to any channel within its operating frequency band. This may require the use of STE provided by the manufacturer (see clause 4.3).

B.5 Measurement procedure

- a) The test site shall be such that its level of spurious radiation, in the directions of measurement to be used, over the frequency range of measurements, is at least 10 dB lower than the limits of spurious radiation for the EUT to be measured. The measurement antenna shall be oriented for vertical polarization and connected to a spectrum analyser. The bandwidth of the spectrum analyser shall be between 3 kHz and 100 kHz. The specified height range of the centre of the measurement antenna shall be between 1 m and 3 m.

- b) Using the measurement arrangement shown in figure B.1, the EUT shall be placed on a non-conducting support in its standard position. The EUT shall be tuned to the lowest frequency in the operating frequency band and shall be operated under normal transmission conditions with data received. The measuring antenna shall then be placed such that each antenna is positioned outside the near field of the other antenna.

The minimum far-field distance is defined as:

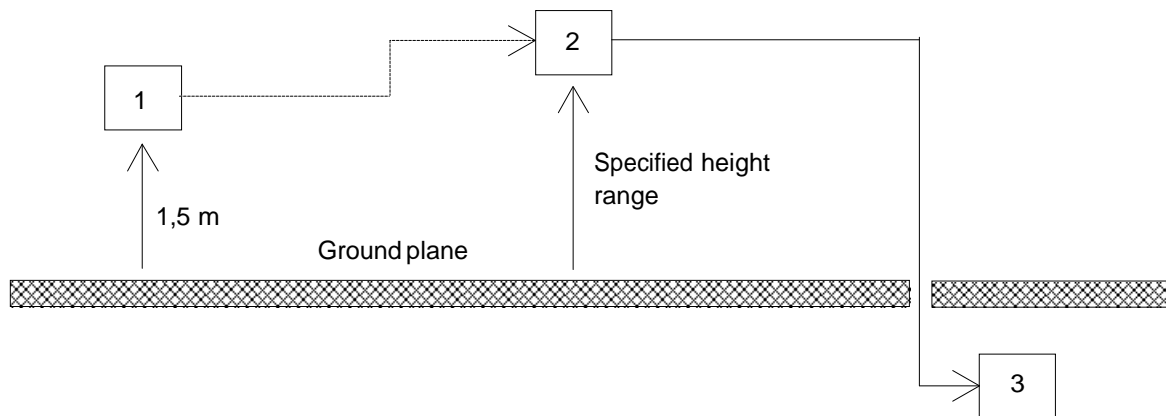
$$R > 2 \times D^2/\lambda$$

where:

R is the minimum far-field distance;

D is the largest dimension of the antenna;

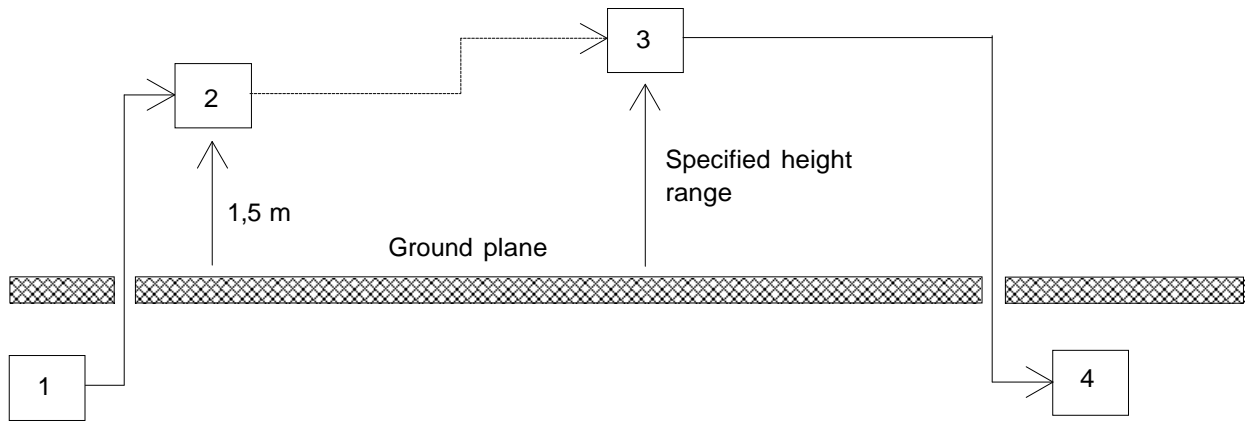
λ is the free space wavelength at the test frequency.



- 1) EUT
- 2) Measurement antenna
- 3) Spectrum analyzer

Figure B.1: Measurement arrangement number 1

- c) The radiation of any spurious component shall be detected by the measurement antenna and spectrum analyser over the specified frequency range. The frequency of each component shall be recorded. If the test site is disturbed by radiation coming from outside, this qualitative search may be performed in a screened room with temporarily reduced distance between the EUT and the measurement antenna.
- d) At each frequency at which a component has been detected, the measurement antenna height shall be adjusted through the range until the maximum signal level is detected on the spectrum analyser.
- e) The EUT shall be rotated up to 360° around a vertical axis to further maximize the signal level detected on the spectrum analyser.
- f) The measurement antenna height shall again be adjusted through the range until the maximum signal level is detected on the spectrum analyser. This level shall be recorded.
- g) Using the measurement arrangement shown in figure B.2, the substitution antenna shall replace the receiver antenna in the same position and in vertical polarization. It shall be connected to the signal generator.



- 1) Signal generator
- 2) Substitution antenna
- 3) Measurement antenna
- 4) Spectrum analyzer

Figure B.2: Measurement arrangement number 2

- h) For each frequency at which an emission has been detected, the signal generator and spectrum analyser shall be tuned and the measurement antenna shall be raised or lowered throughout the specified height range until the maximum signal level is detected. The level of the signal generator shall be adjusted to give the same level as previously recorded. This value, after correction due to the gain of the substitution antenna and the loss of the interconnecting cable, is the EIRP at this frequency and this shall be recorded.
- i) All of the tests a) to h) shall be repeated with the test and substitution antennas oriented for horizontal polarization and with the EUT tuned to the centre and highest frequency in the operating frequency band.

Annex C (normative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.1] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.2].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table C.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table C.1: Relationship between the present document and the essential requirements of Directive 2014/53/EU

Harmonised Standard ETSI EN 300 487				
The following requirements are relevant to the presumption of conformity under the article 3.2 of Directive 2014/53/EU [i.2]				
Requirement			Requirement Conditionality	
No	Description	Reference: Clause No	U/C	Condition
1	RF emission limits	5	U	
2	Receiver Adjacent Channel Selectivity	6.2	U	
3	Receiver Blocking Characteristics	6.3	U	

Key to columns:

Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement.

Description A textual reference to the requirement.

Clause Number Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement shall be unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement shall or shall not be applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex D (informative): Bibliography

- ITU Radio Regulations.

History

Document history		
Edition 1	June 1996	Publication as ETSI ETS 300 487
Amendment 1	November 1997	Amendment 1 to 1 st Edition of ETSI ETS 300 487
V2.1.0	February 2016	EN Approval Procedure AP 20160515: 2016-02-15 to 2016-05-16
V2.1.1	July 2016	Vote V 20160911: 2016-07-13 to 2016-09-12
V2.1.2	November 2016	Publication