



**Amplifiers and active antennas for TV broadcast reception  
in domestic premises;  
Harmonised Standard covering the essential requirements  
of article 3.2 of Directive 2014/53/EU**

*Standard for Review*  
*Full name: ETSI EN 303 354 V1.0.2 (2016-06)*  
*URL: https://standards.iteh.ai/catalog/standards/sis/474a-8af9-4bcea4abce4e/etsi-en-303-354-v1-0-2-2016-06*

---

**Reference**

DEN/ERM-TG17-16

---

**Keywords**

amplification, antenna, broadcasting, harmonised standard

**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/CommitteeSupportStaff.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 .....	5
1 Scope .....	7
2 References .....	7
2.1 Normative references .....	7
2.2 Informative references.....	8
3 Definitions, symbols and abbreviations .....	8
3.1 Definitions.....	8
3.2 Symbols.....	9
3.3 Abbreviations .....	9
4 Technical requirements specifications .....	9
4.1 Environmental profile.....	9
4.2 General conditions of measurement .....	10
4.2.1 General.....	10
4.2.2 Equipment configuration .....	10
4.2.3 Test conditions.....	10
4.2.3.1 General .....	10
4.2.3.2 Normal test conditions .....	10
4.2.3.2.1 Normal temperature and humidity.....	10
4.2.3.2.2 Extreme temperatures.....	10
4.3 General assessment.....	10
4.4 Conformance requirements .....	11
4.4.1 Gain .....	11
4.4.1.1 Definition .....	11
4.4.1.2 Limits .....	11
4.4.1.3 Conformance.....	11
4.4.2 Noise figure .....	11
4.4.2.1 Definition .....	11
4.4.2.2 Limits .....	12
4.4.2.3 Conformance.....	12
4.4.3 Amplifier intermodulation.....	12
4.4.3.1 Definition .....	12
4.4.3.2 Limits .....	12
4.4.3.3 Conformance.....	13
4.4.4 Return loss .....	13
4.4.4.1 Definition .....	13
4.4.4.2 Limits .....	13
4.4.4.3 Conformance.....	14
4.4.5 Selectivity .....	14
4.4.5.1 Definition .....	14
4.4.5.2 Classification 1.....	14
4.4.5.3 Classification 2.....	15
4.4.5.4 Conformance.....	15
4.4.6 Active antenna gain .....	15
4.4.6.1 Definition .....	15
4.4.6.2 Limits .....	15
4.4.6.3 Conformance.....	16
4.4.7 Active antenna figure of merit .....	16
4.4.7.1 Definition .....	16
4.4.7.2 Limits .....	16
4.4.7.3 Conformance.....	16
4.4.8 Active antenna intermodulation.....	16

4.4.8.1	Definition .....	16
4.4.8.2	Limits .....	17
4.4.7.3	Conformance.....	17
4.4.9	Internal immunity .....	17
4.4.9.1	Definition .....	17
4.4.9.2	Limits .....	17
4.4.10	Unwanted emissions in the spurious domain .....	17
4.4.10.1	Definition .....	17
4.4.10.2	Limits .....	17
4.4.11	RF Connectors .....	17
5	Testing for compliance with technical requirements.....	17
5.1	Environmental conditions for testing .....	17
5.2	Interpretation of the measurement results .....	18
5.3	Methods of measurement .....	18
5.3.1	Amplifier gain.....	18
5.3.2	Noise figure .....	19
5.3.3	Amplifier intermodulation .....	20
5.3.4	Return loss .....	21
5.3.5	Selectivity .....	22
5.3.6	Active antenna gain .....	22
5.3.7	Active antenna figure of merit.....	23
5.3.8	Active antenna intermodulation.....	23
5.3.9	Internal immunity .....	24
5.3.9.1	Method of measurement.....	24
5.3.10	Unwanted emissions in the spurious domain.....	24
5.3.10.1	Methods of measurement .....	24
<b>Annex A (normative):</b>	<b>Relationship between the present document and the essential requirements of Directive 2014/53/EU .....</b>	<b>25</b>
<b>Annex B (informative):</b>	<b>Active Antenna Theory .....</b>	<b>26</b>
<b>Annex C (informative):</b>	<b>Change History .....</b>	<b>28</b>
History .....		29

---

## 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 draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.4] 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.1].

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

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

National transposition dates	
Date of adoption of this EN:	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

---

## 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 a Harmonised Standard for amplifiers and active antennas used for broadcast TV reception from 470 MHz to 790 MHz and VHF (174 MHz to 230 MHz).

The primary purpose of the present document is to specify technical parameters to limit the interfering effects caused by unwanted signals on TV reception.

**ITeH STANDARD PREVIEW**  
**(standards.iteh.ai)**

Full standard:  
<https://standards.iteh.ai/catalog/standards/sist/a3644e8e-568f-474a-8af9-4bcea4abce4e/etsi-en-303-354-v1.1.1-2017-03>

# 1 Scope

The present document covers amplifiers and active antennas used for broadcast TV and sound reception at UHF (470 MHz to 790 MHz) and at VHF (174 MHz to 230 MHz).

The present document applies to the domestic equipment types defined in table 1.

**Table 1: Equipment type definitions**

Equipment Type	Description	Notes
P	Preamplifiers	Low noise amplifiers with one or more outputs.
D	Domestic amplifiers	Amplifiers with one or more outputs not intended for low noise applications.
L	Launch amplifiers	High output level amplifiers used for MATV systems.
A	Active antennas	Amplified domestic antenna for indoor use.

The selectivity classifications and associated RF environments are defined in table 2.

**Table 2: RF environment and selectivity classification**

Selectivity Classification	Intended RF environment	Notes
0	IMT is not deployed in the range from 694 MHz to 790 MHz. Devices have wideband response, with no selectivity.	This classification is expected to have a limited lifetime and may be withdrawn subject to European decisions relating to the band 694 MHz to 790 MHz. Wideband components (e.g. launch amplifiers) may still be appropriate where filters are included elsewhere in the system.
1	IMT is deployed above 700 MHz (E-UTRA band 28 and band 20). Devices have selectivity to reject IMT signals above 700 MHz.	Provides selectivity to reject LTE-700 (E-UTRA band 28) and LTE-800 (E-UTRA band 20) signals.
2	IMT is deployed above 700 MHz or below 470 MHz. Devices have selectivity to reject IMT signals below 470 MHz and above 700 MHz.	Provides selectivity to reject LTE-700 (E-UTRA band 28), LTE-800 (E-UTRA band 20) and IMT signals below 470 MHz.

The equipment type and selectivity classification appropriate for the RF environment are combined to define an equipment category. For example, equipment type P and selectivity classification 0 denotes a wideband preamplifier (equipment category P0) intended for use where IMT is not deployed in the range from 694 MHz to 790 MHz.

The present document contains requirements to demonstrate that radio equipment both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference.

## 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] CENELEC EN 50083-2:2012: "Cable networks for television signals, sound signals and interactive services - Part 2: Electromagnetic compatibility for equipment".
- [2] CENELEC EN 55032:2015: "Electromagnetic compatibility of multimedia equipment. Emission requirements".

## 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] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.2] Rohde & Schwarz Application Note 1MA78-0E: "The Y Factor Technique for Noise Figure Measurements", May 2012.
- [i.3] Agilent Technologies Application note 1439 5988-8571EN: "Measuring Noise Figure with a Spectrum Analyzer", 2003.
- [i.4] 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.5] Kraus, J. D., Antennas, second edition, McGraw-Hill International 1988.
- [i.6] ETSI TR 100 028 all parts (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.7] CEPT/ERC/Recommendation 74-01E (01-2011): "Unwanted Emissions In The Spurious Domain".
- [i.8] IEC 61169-24:2009: "Radio-frequency connectors - Part 24: Sectional specification - Radio frequency coaxial connectors with screw coupling, typically for use in 75  $\Omega$  cable networks (type F)".
- [i.9] IEC-61169-2:2007: "Radio-frequency connectors - Part 2: Sectional specification - Radio frequency coaxial connectors of type 9,52".

---

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

**amplifier:** indoor or outdoor equipment intended to amplify broadcast signals

**active antenna:** antenna equipped with an integrated low noise amplifier for indoor use



**domestic amplifier:** general purpose amplifier for use in domestic premises

**launch amplifier:** high output level amplifier used to distribute broadcast signals to multiple receivers

**preamplifier:** low noise amplifier with one or more outputs typically used immediately after the receive antenna

**UHF (Ultra High Frequency) band:** broadcast band from 470 MHz to 790 MHz divided into 40 channels, each 8 MHz wide, numbered from 21 to 60

**VHF (Very High Frequency) band:** broadcast band from 174 MHz to 230 MHz divided into 8 channels, each 7 MHz wide, numbered from 5 to 12

## 3.2 Symbols

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

<i>nf</i>	Noise Figure, expressed in dB
F	Noise Factor
IM3	3rd order intercept

## 3.3 Abbreviations

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

AAUT	Active Antenna Under Test
AC	Alternating Current
AUT	Amplifier Under Test
CW	Carrier Wave
DC	Direct Current
ENR	Excess Noise Ratio
E-UTRA	Evolved Universal Terrestrial Radio Access
GTEM	Gigahertz Transverse ElectroMagnetic
IMD	Intermodulation Distortion
IMT	International Mobile Telecommunication
MATV	Master Antenna Television
RF	Radio Frequency
RL	Return Loss
SNR	Signal to Noise Ratio
SWR	Standing Wave Ratio
TOI	Third Order Intercept
TV	TeleVision
UHF	Ultra High Frequency
VHF	Very High Frequency

---

# 4 Technical requirements specifications

## 4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

## 4.2 General conditions of measurement

### 4.2.1 General

This clause gives the general operational conditions. The product-specific operating conditions will be derived from the product description and documentation and stated in the test report.

The levels of the test signals shall be expressed either in terms of the power relative to 1 mW (dBm) for amplifiers or the field strength relative to 1  $\mu$ V/m (dB $\mu$ V/m) for antennas.

### 4.2.2 Equipment configuration

Power and signal distribution, grounding, interconnecting cabling and physical placement of equipment of a test system shall simulate the typical application and usage in so far as is practicable, and shall be in accordance with the relevant product specifications.

Only configurations within the range of setting likely to occur in normal use need be considered.

### 4.2.3 Test conditions

#### 4.2.3.1 General

The equipment shall be tested under normal test conditions according to the relevant product and basic standards or to the information accompanying the equipment, which shall be within the manufacturers declared range of humidity, temperature and supply voltage. The test conditions shall be recorded in the test report.

The test configuration and mode of operation shall be representative of the intended use and shall be recorded in the test report.

Typical test equipment will usually have a characteristic impedance of 50  $\Omega$  and antennas or amplifiers typically have a characteristic impedance of 75  $\Omega$ . In such cases, impedance matching attenuators or transformers should be used to interface to the equipment under test.

The equipment under test should be fed by the intended power supply supplied by the manufacturer or a suitable equivalent.

#### 4.2.3.2 Normal test conditions

##### 4.2.3.2.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be a combination of temperature and humidity within the following ranges:

- temperature: +15 °C to +35 °C;
- relative humidity: 20 % to 95 %, non-condensing.

##### 4.2.3.2.2 Extreme temperatures

For tests at extreme temperatures, measurements shall be made at a lower temperature of -10 °C and an upper temperature of +55 °C.

## 4.3 General assessment

The manufacturer shall at the time of submission of the equipment for test, supply the following information to be recorded in the test report:

- the intended functions of the equipment which shall be in accordance with the documentation accompanying the equipment;