



**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**

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Foreword

This final 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 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.

Proposed national transposition dates	
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).

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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.

1 Scope

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

The present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.1] under the conditions identified in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version 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".

2.2 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] IEC 61169-24:2009: "Radio-frequency connectors - Part 24: Sectional specification - Radio frequency coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F)".
- [i.8] 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 terrestrial broadcast signals

active antenna: antenna equipped with an integrated low noise amplifier for indoor use (equipment type A)

category: method of classifying equipment according to its type {P,D,L} and selectivity class {0,1,2,3,4}

Digital Terrestrial Television (DTT): platform for the delivery of digital TV content via terrestrial broadcasting

domestic amplifier: general purpose amplifier for use in domestic premises intended to amplify terrestrial broadcast signals (equipment type D)

internal immunity: ability of a device, equipment or system to perform without degradation in the presence of electromagnetic disturbances appearing at its normal input terminals or antennas

launch amplifier: high output level amplifier used to distribute terrestrial broadcast signals to multiple receivers (equipment type L)

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

NOTE: A masthead amplifier is a preamplifier for outdoor use with terrestrial broadcast signals (equipment type P).

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 which are identified as applicable in annex A 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 $\mu\text{V}/\text{m}$ (dB $\mu\text{V}/\text{m}$) 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 Ω and antennas or amplifiers typically have a characteristic impedance of 75 Ω . 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.

For amplifiers with multiple inputs or multiple outputs, any ports that would otherwise be unconnected shall be terminated in a well-matched load. For devices with multiple outputs, all outputs should be tested.

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;
- the equipment category, as defined in clause 4.4;
- the ancillary equipment (power supply for example) to be supplied with the equipment for testing (where applicable);
- an exhaustive list of ports, classified as either power or signal. Power ports shall further be classified as AC or DC power;
- the operating frequency ranges over which the equipment is intended to operate;
- the environment(s) in which the equipment is intended to be used.

4.4 Equipment categorization

The equipment covered by the present document is classified according to table 1 and table 2. The equipment type and selectivity classification appropriate for the RF environment are combined to describe an equipment category.

Table 1: Equipment types

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.

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 862 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.
3	IMT is deployed above 790 MHz (E-UTRA band 20). Devices have selectivity to reject IMT signals above 790 MHz. DTT is not deployed in channel 60 (782 MHz to 790 MHz).	Provides selectivity to reject LTE-800 (E-UTRA band 20). Filter rolls off in DTT channel 60.
4	IMT is deployed above 790 MHz (E-UTRA band 20). Devices have selectivity to reject IMT signals above 790 MHz. DTT is deployed in channel 60 (782 MHz to 790 MHz).	Provides selectivity to reject LTE-800 (E-UTRA band 20). DTT channel 60 preserved.

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 862 MHz.

4.5 Conformance requirements

4.5.1 Gain

4.5.1.1 Definition

This is the ratio of the power at the output of an amplifier to the power at the input expressed in dB.

4.5.1.2 Limits

The permitted gain variation with frequency shall be as shown in table 3.

Table 3: Amplifier gain variation

Test number	Test description	Frequency Range			Category {P,D,L}{0}
		Start (MHz)	Stop (MHz)	Step (MHz)	Maximum gain variation (dB)
1	UHF amplifier gain variation	470	790	≤ 2	4
2	VHF amplifier gain variation	174	230	≤ 1	4
NOTE 1: The gain variation is the difference between the maximum gain and the minimum gain over the specified test frequency range.					
NOTE 2: For amplifiers operating over a reduced frequency band, the start and stop frequencies shall be chosen to match the stated operating frequency range.					
NOTE 3: The maximum gain measured over the specified test frequencies shall be equal to or greater than the gain stated by the manufacturer.					
NOTE 4: For frequency selective equipment (selectivity classification 1–4), limits in clause 4.5.5 shall apply.					