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Amplifiers and active antennas for TV broadcast reception in domestic premises; Harmonised standard for access to radio spectrum

Reference
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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 Standardisation Request deliverable 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).

"**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 in the UHF band from 470 MHz to 694 MHz and the VHF band from 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 specifies technical characteristics and methods of measurements for:

1) Indoor and outdoor amplifiers for broadcast TV and sound reception at UHF (470 MHz to 694 MHz) and at VHF (174 MHz to 230 MHz).

2) Indoor active antennas for broadcast TV and sound reception at UHF (470 MHz to 694 MHz) and at VHF (174 MHz to 230 MHz).

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU is given in annex A.

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 https://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.

2.2 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] Void.

[i.3] Void.

[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] Void.

[i.6] ETSI TR 100 028 all parts (V1.4.1) (2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.7] Void.

[i.8] Void.

3 Definitions of terms, symbols and abbreviations

3.1 Terms

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

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

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

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

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 (equipment type P)

NOTE: A masthead amplifier is a preamplifier for outdoor use with terrestrial broadcast signals.

UHF band: broadcast band from 470 MHz to 694 MHz divided into 28 channels, each 8 MHz wide, numbered from 21 to 48

VHF 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:

nf	Noise Figure, expressed in dB
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
F	Frequency
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
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 in accordance with its intended use. 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 operational environmental profile defined by its intended use.

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 µV/m (dBµV/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.

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 including the information accompanying the equipment, and shall be within the range of humidity, temperature and supply voltage for the intended use. 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 has a characteristic impedance of 50 Ω whilst antennas and amplifiers typically have a characteristic impedance of 75 Ω. Impedance matching shall be used to interface to the equipment under test.

The equipment under test shall be fed by the power adaptor supplied by the manufacturer or, for products supplied without a power adaptor, by 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 inputs and outputs, all inputs and outputs shall be tested.

4.2.3.2 Normal test conditions

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.

4.3 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 Tables 1 and 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
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 and/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.

For example, equipment type P and selectivity classification 1 denotes a wideband preamplifier (equipment category P1) intended for use where IMT is deployed in the range from 694 MHz to 862 MHz.

4.5 Conformance requirements

4.5.1 Void

Table 3: Void

4.5.2 Noise figure

4.5.2.1 Definition

The noise figure, *nf*, is defined as the degradation of the Signal-to-Noise Ratio (SNR) resulting from noise generated by the amplifier expressed in decibel notation:

$$nf = 10 \times log_{10} \frac{C_1/N_1}{C_2/N_2}$$

where: C_1 = power of input signal;

C_2 = power of output signal;

N_1 = power of noise at input (thermal noise at 290 K);

N_2 = power of noise at output (thermal noise at 290 K).

The noise figure (*nf*) is defined at the standard noise temperature (290 K) over the bandwidth of interest.

4.5.2.2 Limits

The maximum noise figure shall be less than or equal to the values specified in Table 4.

Table 4: Amplifier noise figure

Test number	Test description	Test Frequencies (MHz)	Maximum noise figure (dB)		
				Category {P,D}{1,2}	Category {L}{1,2}
1	Noise figure UHF amplifiers	F_0		4	7
		F_1			
		F_2			
2	Noise figure VHF amplifiers	205,5		4	7
NOTE: The test frequencies F_0, F_1, F_2 are defined in Table 5.					

Table 5: Test frequencies

Test Frequencies (MHz)		Category {P,D,L}{1}	Category {P,D,L}{2}		
F_0		470	478		
F_1		586	586		
F_2		686	686		
NOTE: For amplifiers operating over a reduced frequency band, the test frequencies shall be as follows: F_0 = minimum frequency + 8 MHz, F_1 = centre frequency and F_2 = maximum frequency - 8 MHz of the stated band of operation.					

4.5.2.3 Conformance

The conformance tests for this requirement shall be as described in clause 5.3.2.