

ETSI EN 301 489-53 V1.1.1 (2019-04)



**ElectroMagnetic Compatibility (EMC)
standard for radio equipment and services;
Part 53: Specific conditions for terrestrial sound broadcasting
and digital TV broadcasting service transmitters
and associated ancillary equipment;
Harmonised standard covering the essential requirements
of article 3.1(b) of Directive 2014/53/EU**

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

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.

The present document is part 53 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

National transposition dates	
Date of adoption of this EN:	20 June 2017
Date of latest announcement of this EN (doa):	31 July 2019
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 January 2020
Date of withdrawal of any conflicting National Standard (dow):	31 January 2021

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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1 Scope

The present document specifies technical characteristic and methods of measurements for terrestrial sound broadcasting and digital TV broadcasting service transmitters, exciters, repeaters, active deflectors, On-Channel repeaters and any associated ancillary equipment.

The present document covers the essential requirements of article 3.1(b) of Directive 2014/53/EU [i.1] under the conditions identified in annex A.

Technical specifications related to the antenna port emissions are not included in the present document. Such technical specifications are found in the relevant product standards of ETSI for the effective use of the radio spectrum.

In case of differences (for instance concerning special conditions, definitions, abbreviations) between the present document and ETSI EN 301 489-1 [1], the provisions of the present document take precedence.

The present document may not cover those cases where a potential source of interference which is producing individually repeated transient phenomena or continuous phenomena is permanently present, e.g. a radar site in the near vicinity. In such a case it may be necessary to use special protection applied to either the source of interference or the interfered part or both.

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 <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] ETSI EN 301 489-1 (V2.2.0) (03-2017): "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU".
- [2] CENELEC EN 55011 (2007): "Industrial, scientific and medical (ISM) radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement".
- [3] CENELEC EN 55016-1-1 (2010): "Specification for radio disturbance and immunity measuring apparatus and methods. Radio disturbance and immunity measuring apparatus.
- [4] ETSI TS 102 820 (V4.1.1) (03-2016): "Digital Radio Mondiale (DRM); Multiplex Distribution Interface (MDI)".
- [5] ETSI EN 300 799 (edition 1) (09-1997): "Digital Audio Broadcasting (DAB); Distribution interfaces; Ensemble Transport Interface (ETI)".
- [6] ETSI EN 300 744 (V1.6.2) (10-2015): "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television".

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.

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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] Recommendation ITU-R SM.329-10: "Unwanted emissions in the spurious domain".
- [i.3] Recommendation ITU-R BT.500-13 (01/2012): "Methodology for the subjective assessment of the quality of television pictures".
- [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.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the definitions given in ETSI EN 301 489-1 [1] and the following apply:

active deflector: simple low power RF amplifier which receives an input signal off-air, and then directly amplifies and re-broadcasts the same signal on the same frequency

broadcasting service: radiocommunication service in which the transmissions are intended for direct reception by the general public

NOTE: This service may include sound transmission, television transmission, or other types of transmission.

broadcast service transmitter: device used to transmit the broadcast service

NOTE: It may or may not be fitted with an integral band pass filter.

enclosure port: also known as cabinet radiation

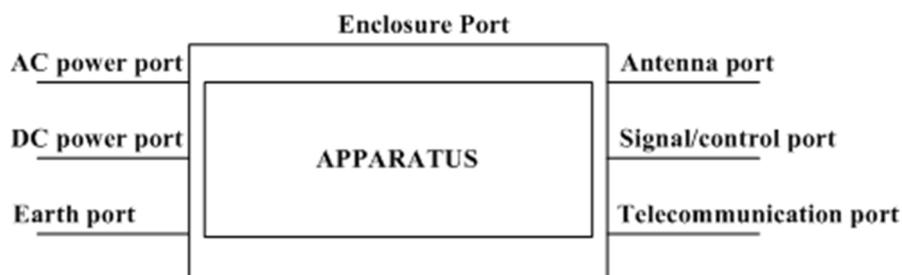


Figure 3.1

exciter/modulator: low level encoding and RF power stage of a broadcasting transmitter

modulation error ratio: single "figure of merit" analysis of the transmitted signal

Multi-channel COFDM (MCOFDM): transmission system that generates more than one OFDM block with an overall system filter spanning all blocks

necessary bandwidth: As defined in Recommendation ITU-R SM.329-10 [i.2].

on-channel repeater: complex low to medium power transmitter which receives an input signal off-air, then using echo-cancellation techniques (designed to minimize parasitic feedback between the input and output), amplifies and re-broadcasts the reconstructed signal on the same frequency

rated output power: conducted power that the broadcast service transmitter delivers at its final output under specific conditions of operation into the antenna

re-transmitter: transmitter which receives an input signal off air, demodulates the signal into baseband, re-encodes the signal, then re-broadcasts the signal on another channel

RF power amplifier: transmitter which comprises an amplifier, declared by the manufacturer to be capable of being connected to a terrestrial broadcasting antenna system via a RF band pass filter

transmitter: device which comprises an integral RF exciter and RF amplifier stage. It may or may not be fitted with an integral band pass filter

transposer: Tx/Rx which receives an broadcast signal off-air, and re-broadcast on a different frequency

NOTE: The incoming off-air signal is not decoded or regenerated in this system.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 301 489-1 [1] and the following apply:

%	percent
μ	micro, 10 ⁻⁶
A	Ampere
Hz	Hertz (cycles per second)
M	Mega (i.e. 10 ⁶)
m	metre
W	Watt

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 301 489-1 [1] and the following apply:

AC	Alternating Current
AM	Amplitude Modulation
BER	Bit Error Ratio
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee On Radio Interference)
COFDM	Coded Orthogonal Frequency Division Multiplex
CT	Continuous phenomena applied to Transmitters
DC	Direct Current
DRM	Digital Radio Mondiale
DVB	Digital Video Broadcasting
DVB-T2	Second generation Digital Video Broadcasting
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
ETI	Ensemble Transport Interface
FM	Frequency Modulation
HF	High Frequency
IF	Intermediate Frequency
LF	Low Frequency
MCOFDM	Multi-channel Coded Orthogonal Frequency Division Multiplex
MER	Modulation Error Ratio
MF	Medium Frequency

OFDM	Orthogonal Frequency Division Multiplex
QAM	Quadrature Amplitude Modulation
RDS	Radio Data System
RF	Radio Frequency
rms	root mean square
Rx	Receiver
SNR	Signal to Noise Ratio
T-DAB	Terrestrial-Digital Audio Broadcast
TS	Transport Stream
TT	Transient phenomena applied to Transmitters
TV	Television
Tx	Transmitter
UHF	Ultra High Frequency
VA	Volt Amperes
VHF	Very High Frequency

4 Test conditions

4.1 General

For the purposes of the present document, the test conditions of ETSI EN 301 489-1 [1], clause 4, shall apply as appropriate. Further provisions related to test conditions for broadcasting service transmitters are specified in the present document.

For emission and immunity tests the test modulation, test arrangements, etc., as specified in the present document, clauses 4.1 to 4.5, shall apply.

For immunity tests, the output of the broadcast service transmitter shall be monitored as specified in the present document, clause 4.2.2.

4.2 Arrangements for test signals

4.2.0 General

The provisions of ETSI EN 301 489-1 [1], clause 4.2 shall apply with the following modifications.

Typical test arrangements to assess the performance of the broadcast service transmitter are shown in figure 4.1 for all transmitter equipment types.

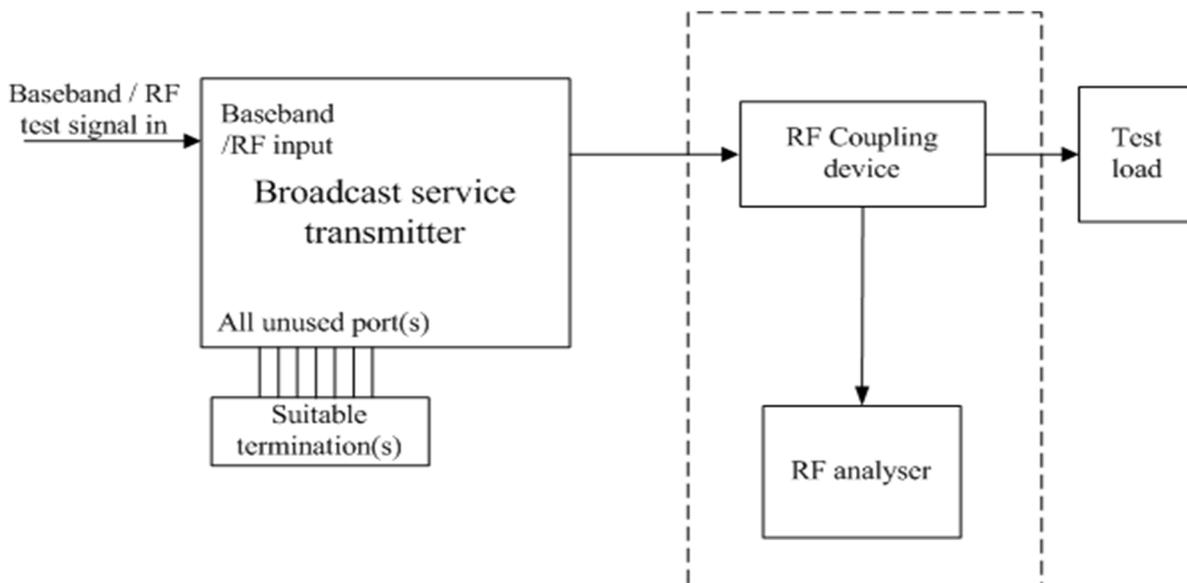


Figure 4.1: Typical test arrangement for the performance assessment of broadcast service transmitters

4.2.1 Arrangements for test signals at the input of the broadcast service transmitter

The provisions of ETSI EN 301 489-1 [1], clause 4.2.1 shall apply, with the following modifications.

If the EUT incorporates base-band processing and/or coding equipment (e.g. a RDS encoder for a FM transmitter, or a COFDM encoder for a digital television transmitter), then this equipment shall be active as in normal operation. The manufacturer shall provide reference encoders and the tests shall be carried out with these in operational mode.

If the EUT does not include integrated base-band processing and/or coding equipment, the manufacturer shall declare whether the transmitter is designed for operation with or without encoder(s). The manufacturer shall clearly state this in the product documentation.

If the EUT is designed for operation with externally fitted encoder(s), then it is left to the decision of the manufacturer whether the transmitter shall be tested with such encoder(s). Depending on the manufacturer's decision, the manufacturer may have to provide reference encoders and the tests shall be carried out with these in operational mode.

In case of transposers, re-transmitters, on-channel repeaters and active deflectors, the wanted RF input signal, at a frequency determined from the manufacturer's specification, shall be set to 3 dB above the EUT minimum input signal level, as declared by the manufacturer.

In case of RF amplifiers, the wanted RF input signal at a level equal to the mid-point of the range declared by the manufacturer shall be delivered from an adequate external modulator provided by the manufacturer. The modulator shall be placed outside the test environment or be included in the system under test, whichever is applicable.

A broadcasting transmission shall be established at the start of the test and maintained during the test.

Any unused port of the EUT shall be terminated according to the manufacturer's instructions.

4.2.2 Arrangements for test signals at the output of broadcast service transmitters

The provisions of ETSI EN 301 489-1 [1], clause 4.2.2 shall apply.

Suitable precautions should be taken to ensure test equipment input levels are not exceeded (e.g. transmitters with high conducted powers may use a suitable coupler to assess the output of the EUT).

4.3 RF exclusion bands

4.3.1 Introduction

The provisions of ETSI EN 301 489-1 [1], clause 4.3 shall apply with the modifications set out in the clauses 4.3.2.

4.3.2 Broadcast service transmitter exclusion bands

The exclusion bands for all broadcast technologies and transmitter types are provided in table 4.1.

Table 4.1: Broadcast Service Transmitter exclusion bands

Technology and transmitter class	Exclusion band
AM: Transmitter	The exclusion band for AM broadcasting transmitters shall be ± 500 % of the necessary bandwidth
DRM: Transmitter	The exclusion band for AM broadcasting transmitters shall be ± 500 % of the necessary bandwidth
FM: Transmitter and power amplifier	The exclusion band for FM broadcasting transmitters and/or power amplifiers extends from $f_c - 300$ kHz to $f_c + 300$ kHz, where f_c is the operating frequency
T-DAB/DMB: Transmitter, RF Power Amplifier, MCOFDM, On-Channel Repeater	The exclusion band extends from ± 250 % of the necessary bandwidth
DVB-T/T2: Transmitter and RF power amplifier	The exclusion band extends from ± 250 % of the necessary bandwidth
DVB-T/T2: Active deflector, On-Channel Repeater, Transposer	The exclusion band extends from ± 250 % of the necessary bandwidth
NOTE 1: For DVB-T/T2 active deflectors and On-Channel Repeaters, Special precautions shall be taken to avoid the wanted RF output of the active deflector from disturbing the signal at the RF input port.	
NOTE 2: For emission measurements, the transposer exclusion band shall comprise the exclusion band of the transmitting element of the equipment under test only. For immunity tests with continuous phenomena, the transposer exclusion bands shall comprise both the exclusion bands of the transmitting and receiving elements of the equipment under test. For the receiver part of the transposer, the exclusion band takes into account the blocking effect that may occur due to the high level of the immunity test field strength (10 V/m) in regard to the RF input level of that receiver part (which is usually less than 1 mV).	

4.4 Narrow band responses of receivers

The provisions of ETSI EN 301 489-1 [1], clause 4.4 shall apply during the immunity tests of On-Channel Repeaters, transposers and active deflectors to continuous phenomena.

4.5 Normal test modulation

For the purpose of EMC tests, the transmitter under test shall be modulated according to the normal test modulation as specified in table 4.2.

Table 4.2: Test Signal configuration for the Broadcast Service Transmitter

AM		
Audio Tone	1 kHz, sufficient amplitude to achieve 80 % modulation depth	
DRM		
Data Stream	Confirming to ETSI TS 102 820 [4]	
FM		
Audio Tone	1 kHz, sufficient amplitude to achieve ± 50 kHz deviation	
T-DAB/DMB		
Data Stream	Confirming to EN 300 799 [5]	
DVB-T		
Data Stream	Conforming to EN 300 744 [6], clause 4.3	
Channel bandwidth	7 MHz	8 MHz
Receiver bandwidth	6,7 MHz	7,6 MHz
Modulation scheme	64-QAM	64-QAM
FFT size	8 k	8 k
DVB-T2		
Data Stream	Conforming to EN 300 744 [6], clause 4.3	
Channel bandwidth	7 MHz	8 MHz
Receiver bandwidth	6,8 MHz	7,8 MHz
Modulation scheme	256-QAM	256-QAM
FFT size	32 k	32 k
Carrier mode	Extended	Extended

The characteristics of the wanted RF and modulation test signal used shall be recorded in the test report.

5 Performance assessment

5.1 General

The provisions of ETSI EN 301 489-1 [1], clause 5.1 shall apply.

In addition, the manufacturer shall, at the time of submission of the equipment for testing, declare the following information, also to be recorded in the test report, as appropriate:

- the frequencies as used in the transmitter for oscillators, clocks and intermediate frequencies;
- the bandwidth of the IF filter, or the bandwidth of the RF filter if no IF signal processing is used;
- for RF amplifiers, the nominal level of the wanted RF input signal to be used for the EMC tests.

For transmitters supplied for testing, which do not include integrated base-band processing and/or coding equipment, the manufacturer shall declare whether the transmitter is designed for operation with or without encoder(s), for inclusion in the product documentation. The manufacturer shall declare whether the EMC tests shall be performed with external encoder(s) fitted to the transmitter.

5.2 Equipment which can provide a continuous communication link as a broadcasting transmission

The provisions of ETSI EN 301 489-1 [1], clause 5.2 shall apply.

5.3 Equipment which does not provide a continuous communication link as a broadcasting transmission

Not applicable.

5.4 Ancillary equipment

The provisions of ETSI EN 301 489-1 [1], clause 5.4 shall apply.

5.5 Equipment classification

Unless specified otherwise in clauses 7.1 and/or 7.2 of the present document, broadcasting service transmitters and associated ancillary equipment in the scope of the present document shall meet the requirements for base station and ancillary equipment set out in ETSI EN 301 489-1 [1], clauses 7.8 and 9.

6 Performance criteria

6.0 Introduction

The provisions of ETSI EN 301 489-1 [1], clause 6 shall apply.

6.1 Performance criteria for continuous phenomena applied to transmitters (CT)

The provisions of ETSI EN 301 489-1 [1], clause 6.1 shall apply with the following modifications.

A broadcasting transmission link shall be established between the EUT and the monitoring equipment at the start of the test, and maintained during the test.

The parameters specified in table 6.1 shall be used to assess the performance of the Tx under test for continuous phenomena. During each individual exposure in the test sequence, it shall be verified that the characteristics of the wanted output signals remain within the permitted value ranges listed in table 6.1.

The performance of the Tx under test shall be assessed during the exposure with error correction activated and/or pre-emphasis and de-emphasis inserted into the transmission line, if appropriate.

Table 6.1: Performance criteria for continuous phenomena

Type of Equipment	Parameters	Reference values measured during pre-tests	Permitted values during immunity tests
LF, MF, and HF transmitters	RF power variation Audio SNR	RF power Manufacturers declared audio SNR	RF Power $\pm 0,5$ dB Manufacturers declared minimum audio SNR
FM equipment	RF power variation RF frequency variation Audio SNR BER from RDS	RF power RF frequency SNR ≥ 72 dB (unweighted) BER $\leq 10^{-6}$	RF power $\pm 0,5$ dB RF frequency ± 2 kHz SNR ≥ 60 dB (unweighted) BER $\leq 10^{-5}$
DRM	RF power variation MER Sound subjective quality (see note 2)	RF power Manufacturers declared MER No degradation to sound quality	RF power $\pm 0,5$ dB Declared MER -2 dB No degradation to sound quality
T-DAB / T-DMB	RF power variation MER Sound subjective quality (see note 2)	RF power Manufacturers declared MER No degradation to sound quality	RF power $\pm 0,5$ dB Declared MER -2 dB No degradation to sound quality

Type of Equipment	Parameters	Reference values measured during pre-tests	Permitted values during immunity tests
DVB-T/T2 equipment	MER:	Manufacturers declared MER	Declared MER -2 dB
	Picture and sound subjective quality (see note 2)	No degradation to picture or sound quality	No degradation to picture or sound quality
	RF power variation	RF Power	RF power $\pm 0,5$ dB
NOTE 1: According to: <ul style="list-style-type: none"> - Recommendation ITU-R BT.500-13, annex 1 [i.3]; - the subjective assessment of the picture quality may be carried out directly by the operator. NOTE 2: The subjective assessment of quality may be carried out with a picture/sound quality analyser, or directly by the operator.			

During the test the readings of the parameters monitored by the test instrumentation shall remain within the permitted value ranges during the immunity tests, specified in table 6.1.

At the conclusion of the total test, the EUT shall operate as intended, with no loss of control functions or stored data, as declared by the manufacturer, and the broadcasting transmission link shall have been maintained. The readings of the parameters monitored by the test instrumentation shall regain their reference values measured during the pre-test.

No false alarms or abnormal commands shall be generated as a result of the electromagnetic stress. Alarms indicating well-defined incidents due to the electromagnetic stress affecting the general performance of the transmitter under test may however occur. It shall be possible to reset these alarms by manual operation of controls.

Where the EUT provides a stand-by mode, the exposure shall be repeated in this mode to ensure that no unintentional transmission occurs.

6.2 Performance criteria for transient phenomena applied to Transmitters (TT)

The provisions of ETSI EN 301 489-1 [1], clause 6.2 shall apply with the following modifications:

- A broadcasting transmission link shall be established between the EUT and the monitoring equipment at the start of the test.
- During the tests, no assessment of the actual performance applies.
- The broadcasting transmission link shall be automatically regained at the conclusion of each individual test exposure.

At the conclusion of the total test, the EUT shall operate as intended, with no loss of control functions or stored data, as declared by the manufacturer, and the broadcasting transmission link shall have been maintained, or regained. The readings of the parameters monitored by the test instrumentation shall regain their nominal values measured during the pre-test.

No false alarms or abnormal commands shall be generated as a result of the electromagnetic stress. Alarms indicating well-defined incidents due to the electromagnetic stress temporarily affecting the general performance of the transmitter under test may however occur. It shall be possible to reset these alarms by manual operation of controls.

Where the EUT provides a stand-by mode, the test shall be repeated in this mode to ensure that no unintentional transmission occurs.

7 Applicability overview

7.1 Emission

7.1.1 General

Table 1 in ETSI EN 301 489-1 [1] contains the applicability of emission measurements to the relevant ports of radio and/or associated ancillary equipment.

Table 1 in ETSI EN 301 489-1 [1] shall apply.

7.1.2 Special conditions

The following special conditions set out in table 7.1 of the present document relate to the method of measurement and limits for EMC emissions used in ETSI EN 301 489-1 [1], clause 8.

Table 7.1: Special conditions for EMC emission measurements

Reference to clauses in ETSI EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions and limits in ETSI EN 301 489-1 [1]			
8.2.3 Limits; Enclosure of ancillary equipment measured on a stand-alone basis	The radiated emissions from the enclosure of the radio equipment shall meet the limits specified in clause 7.1.3 (Cabinet Radiation) of the present document. The relevant exclusion band specified in clause 4.3 shall apply. Broadcast transmission equipment < 240 MHz testing is only required to 1 GHz.			
8.3.2 Test method; DC power input/output ports and 8.4.2 Test method; AC mains power input/output ports	For ports of transmitters drawing a power of greater than 200 W (DC) or greater than 200 VA (AC) respectively, the test method shall be in accordance with CENELEC EN 55011 [2], clause 6. For ports of transmitters drawing a power of less than or equal to 200 W (DC) or less than or equal to 200 VA (AC) respectively, the test method specified in ETSI EN 301 489-1 [1] clauses 8.3.2, and 8.4.2 shall be applied as appropriate.			
8.3.3 Limits; DC power input/output ports and 8.4.3 Limits; AC mains power input/output ports	Limits for conducted emissions on AC and DC ports of transmitters			
	AC Power (kVA) DC Power (kW)	Limits (dBµV)		Frequency range (MHz)
Quasi-peak		Average		
> 0 to 2		79	66	0,15 to 0,5
		73	60	> 0,5 to 30
> 2 to 10		89	76	0,15 to 0,5
		83	70	> 0,5 to 30
> 10 to 75		100 (see note 2)	90 (see note 2)	0,15 to 0,5
		86 (see note 2)	76 (see note 2)	> 0,5 to 5
		90 to 70 (see note 2)	80 to 60 (see note 2)	5 to 30
> 75		130 (see note 2)	120 (see note 2)	0,15 to 0,5
		125 (see note 2)	115 (see note 2)	> 0,5 to 5
		115 (see note 2)	105 (see note 2)	5 to 30

NOTE 1: Limits decreasing linearly with the logarithm of frequency.

NOTE 2: Measured with CISPR voltage probe, see CENELEC EN 55011 [2], figure 4.

7.1.3 Enclosure Port (Cabinet Radiation)

7.1.3.1 Radiated emissions below 1 GHz

Radiated emissions below 1 GHz shall not exceed the values set out in table 7.2.

This test shall be performed at a distance of 10 m, where feasible. When size and/or power requirements necessitate testing in a manufacturing facility, other distances may be used (see notes 1, 2 and 3).

NOTE 1: The measurements can be carried out at other distances. In that case limits are modified according to the relation:

$$L(x) = L(10\text{m}) + 20 \log(10/x) \quad \text{where } x = \text{distance in metre (m)}.$$

NOTE 2: Care should be taken if measuring at test distances below 10 m as this may be in the near field.

NOTE 3: In cases of dispute the measurement distance of 10 m should take precedence.

Table 7.2: Cabinet radiation limits below 1 GHz

Frequency range	Quasi-peak limits (dB μ V/m) at 10 m
30 MHz to 230 MHz	$40 \text{ dB}\mu\text{V/m} \leq 60 + 10 \log_{10}(P/2\,000) \leq 70 \text{ dB}\mu\text{V/m}$
> 230 MHz to 1 GHz	$47 \text{ dB}\mu\text{V/m} \leq 67 + 10 \log_{10}(P/2\,000) \leq 77 \text{ dB}\mu\text{V/m}$
NOTE: P = Rated output power in W.	

7.1.3.2 Radiated emissions above 1 GHz

Radiated emissions above 1 GHz shall not exceed the values set out in table 7.3.

Alternatively the limits in table 7.4 may be used.

NOTE: The measurements can be carried out at other distances. In that case limits are modified according to the relation:

$$L(x) = L(3\text{m}) + 20 \log(3/x) \quad \text{where } x = \text{distance in metre (m)}.$$

In cases of dispute the measurement distance of 3 m shall take precedence.

Table 7.3: Cabinet radiation limits above 1 GHz

Frequency range	Average limits (dB μ V/m) at 3 m	Peak limits (dB μ V/m) at 3 m
1 GHz to 3 GHz	$56 \text{ dB}\mu\text{V/m} \leq 86 + 10 \log_{10}(P/2\,000) \leq 96 \text{ dB}\mu\text{V/m}$	$76 \text{ dB}\mu\text{V/m} \leq 106 + 10 \log_{10}(P/2\,000) \leq 116 \text{ dB}\mu\text{V/m}$
3 GHz to 6 GHz	$60 \text{ dB}\mu\text{V/m} \leq 90 + 10 \log_{10}(P/2\,000) \leq 100 \text{ dB}\mu\text{V/m}$	$80 \text{ dB}\mu\text{V/m} \leq 110 + 10 \log_{10}(P/2\,000) \leq 120 \text{ dB}\mu\text{V/m}$
NOTE: P = Rated output power in W.		

Table 7.4: Cabinet radiation limits above 1 GHz

Frequency range	RMS-Average limits (dB μ V/m) at 3 m (see notes 1 and 2)
1 GHz to 3 GHz	$60 \text{ dB}\mu\text{V/m} \leq 90 + 10 \log_{10}(P/2\,000) \leq 100 \text{ dB}\mu\text{V/m}$
3 GHz to 6 GHz	$64 \text{ dB}\mu\text{V/m} \leq 94 + 10 \log_{10}(P/2\,000) \leq 104 \text{ dB}\mu\text{V/m}$
NOTE 1: P = Rated output power in W.	
NOTE 2: For RMS-Average detector, please refer to CENELEC EN 55016-1-1 [3], clause 7.	

7.2 Immunity

7.2.1 General

Table 2 in ETSI EN 301 489-1 [1] contains the applicability of immunity measurements to the relevant ports of transmitters and/or associated ancillary equipment.

Table 2 in ETSI EN 301 489-1 [1] shall apply with the test signal levels set out in the present document.

7.2.2 Special conditions

The following special conditions set out in table 7.5 relate to the immunity test methods and levels used in ETSI EN 301 489-1 [1] clause 9.

Table 7.5: Special conditions for EMC immunity tests

Reference to clauses in ETSI EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions and limits in ETSI EN 301 489-1 [1]
9.2.2 Test method; Radio frequency electromagnetic field	The level of the immunity RF test signal shall be 10 V/m (measured unmodulated). RF immunity testing need not be carried out under the following conditions: <ul style="list-style-type: none"> • where for AC powered equipment, the input current exceeds 16 A per phase (at 230 V); or the RF output power is greater than 5 kW; • where for DC powered equipment the input power exceeds 2 kW.
9.4.2 Test method; Fast transients, common mode	The following immunity test levels shall be applied: <ul style="list-style-type: none"> • on AC mains power input ports: ± 2 kV; • on DC power input, modulation input, and data cable ports: ± 1 kV, only if intended for connection to cables longer than 3 m. If the current consumption of the transmitter exceeds the capability of the test equipment then where possible sensitive electronics (exciters, etc.) may be tested separately.
9.5.2 Test method; RF common mode	The level of the immunity RF test signal shall be 10 V rms (measured unmodulated). RF immunity testing need not be carried out under the following conditions: <ul style="list-style-type: none"> • where for AC powered equipment, the input current exceeds 16 A per phase (at 230 V), or the RF output power is greater than 5 kW; • where for DC powered equipment the input power exceeds 2 kW. Under these conditions the conducted RF immunity test described in ETSI EN 301 489-1 [1], clause 9.5 shall be used only, with the test frequency range extended up to 230 MHz and the test level set to 10 V rms (measured unmodulated).
9.7 Voltage dips and interruptions	If the current consumption of the transmitter exceeds the capability of the test equipment then where possible sensitive electronics (exciters, etc.) may be tested separately.
9.8 Surges	If the current consumption of the transmitter exceeds the capability of the test equipment then where possible sensitive electronics (exciters, etc.) may be tested separately.
9.8.2 Test method; Surges	The following immunity test levels and performance criteria shall be applied: <p>AC mains power input ports:</p> <ul style="list-style-type: none"> • line to line mode: ± 1 kV; • line to ground mode: ± 2 kV. If the current consumption of the transmitter exceeds the capability of the test equipment then where possible sensitive electronics (exciters, etc.) may be tested separately. <p>Telecommunication ports:</p> <ul style="list-style-type: none"> • line to ground mode: ± 2 kV.

Annex A (informative): 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.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.

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

Harmonised Standard ETSI EN 301 489-53				
Requirement			Requirement Conditionality	
No	Description	Reference: Clause No	U/C	Condition
1	Emissions: Enclosure port (Cabinet radiation)	7.1.3	U	
2	Emissions: DC power input/output ports	7.1.2 and 8.3.2 of ETSI EN 301 489-1 [1]	C	Only where equipment has DC power input and/or output ports
3	Emissions: AC mains power input/output ports	7.1.2 and 8.4.2 of ETSI EN 301 489-1 [1]	C	Only where equipment has AC mains power input and/or output ports
4	Emissions: Harmonic current emission (AC mains input port)	8.5 of ETSI EN 301 489-1 [1]	C	Only where equipment has AC mains power input ports
5	Emissions: Voltage fluctuations and flicker (AC mains input ports)	8.6 of ETSI EN 301 489-1 [1]	C	Only where equipment has AC mains power input ports
6	Emissions: Wired network ports	8.7 of ETSI EN 301 489-1 [1]	C	Only where equipment has wired network ports
7	Immunity: Radio frequency electromagnetic field (80 MHz to 6 000 MHz)	7.2.2	U	
8	Immunity: Electrostatic discharge	9.3 of ETSI EN 301 489-1 [1]	U	
9	Immunity: Fast transients common mode	7.2.2	U	
10	Immunity: Radio frequency common mode	7.2.2	U	
11	Immunity: Transients and surges in the vehicular environment	9.6 of ETSI EN 301 489-1 [1]	C	Only where equipment is fitted to a vehicle power supply
12	Immunity: Voltage dips and interruptions	7.2.2	C	Only where equipment has AC mains power input ports
13	Immunity: Surges, line to line and line to ground	7.2.2	C	Only where equipment has AC mains power input ports and/or wired network ports

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 is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement is or is not 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 B (informative): Types of broadcasting service equipment covered by the present document

B.1 AM sound broadcasting transmitters

Double side band AM sound broadcasting transmitters operating in the LF, MF and HF bands.

B.2 FM sound broadcasting transmitters and power amplifiers

Monophonic FM sound broadcasting transmitters operating in the frequency range 68 MHz to 108 MHz.

Stereophonic FM sound broadcasting transmitters operating in the frequency range 68 MHz to 108 MHz.

Active deflectors operating in the band 68 MHz to 108 MHz.

Transposers operating in the band 68 MHz to 108 MHz.

B.3 DRM sound broadcasting transmitters

DRM transmitters operating in the harmonized LF, MF and HF terrestrial sound broadcast bands.

- 47 MHz to 108 MHz.
- 174 MHz to 240 MHz.

B.4 T-DAB/T-DMB sound broadcasting transmitters, power amplifiers, and On-Channel repeaters

DAB transmitters operating in the following frequency bands:

- 47 MHz to 68 MHz.
- 174 MHz to 240 MHz.

B.5 Digital television transmitters, power amplifiers, active deflectors, transposers, and on-channel repeaters

DVB-T/T2 TV transmitters operating in the frequency range 174 MHz to 230 MHz.

DVB-T/T2 TV active deflector operating in the frequency range 174 MHz to 230 MHz.

DVB-T/T2 TV transposer operating in the frequency range 174 MHz to 230 MHz.

DVB-T/T2 TV re-transmitter operating in the frequency range 174 MHz to 230 MHz.

DVB-T/T2 TV on-channel repeater operating in the frequency range 174 MHz to 230 MHz.

DVB-T/T2 TV transmitters operating in the frequency range 470 MHz to 694 MHz.

DVB-T/T2 TV active deflectors operating in the frequency range 470 MHz to 694 MHz.

DVB-T/T2 TV transposer operating in the frequency range 470 MHz to 694 MHz.

DVB-T/T2 Re-Transmitter operating in the frequency range 470 MHz to 694 MHz.

DVB-T/T2 on-channel repeater operating in the frequency range 470 MHz to 694 MHz.

Annex C (informative): Bibliography

- CENELEC EN 50067 (1998): "Specification of the radio data system (RDS) for VHF/FM sound broadcasting in the frequency range from 87,5 to 108,0 MHz".
- IEC 60244-1 (1999): "Methods of measurement for radio transmitters - Part 1: General characteristics for broadcast transmitters"
- IEC 60244-13: "Methods of measurement for radio transmitters; Part 13: Performance characteristics for FM sound broadcasting".
- IEC 60244-15 (1999): "Methods of measurement for radio transmitters - Part 15: Amplitude-modulated transmitters for sound broadcasting".
- Recommendation ITU-T O.151: "Error performance measuring equipment operating at the primary rate and above".
- Recommendation ITU-R BS.468-4 (1990): "Measurement of audio-frequency noise voltage level in sound broadcasting".
- The Chester 1997 Multilateral Coordination Agreement relating to Technical Criteria, Coordination Principles and Procedures for the introduction of Terrestrial Digital Video Broadcasting (DVB-T), Chester, 25 July 1997.
- ETSI ETR 290 (1997): "Digital Video Broadcasting (DVB); Measurement guidelines for DVB systems".
- Recommendation ITU-T O.151: "Error performance measuring equipment operating at the primary rate and above".
- Recommendation ITU-R BT.1368-1: "Planning criteria for digital terrestrial television services in the VHF/UHF bands".
- IEC EN 60244-1 (1999): "Methods of measurement for radio transmitters - Part 1: General characteristics for broadcast transmitters".
- IEC EN 60244-5 (1992): "Methods of measurement for radio transmitters - Part 5: Performance characteristics of television transmitters".
- Recommendation ITU-R BT.470-6: "Conventional television systems".
- Recommendation ITU-R BS 1116-1: "Methods for the subjective assessment of small impairments in audio systems including multichannel sound systems".
- ETSI ETR 273-4 (1998): "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Improvement of radiated methods of measurement (using test sites) and evaluation of the corresponding measurement uncertainties; Part 4: Open area test site".
- Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.
- ETSI ETS 300 799: "Digital Audio Broadcasting (DAB) distribution interfaces; Ensemble Transport Interface (ETI)".
- ETSI TS 102 820: "Digital Radio Mondiale (DRM) Multiplex Distribution Interface (MDI)".
- ETSI EN 300 744 "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television".

Annex D (informative): Change history

Version	Information about changes
Draft v.0.0.1	First draft combining ETSI EN 301 489-11 and ETSI EN 301 489-14
Draft v.0.0.2	Second draft incorporating changes made to ETSI EN 301 489-1
Draft v.0.0.3	First draft submission to ETSI WGEMC

History

Document history		
V1.1.0	March 2017	EN Approval Procedure AP 20170620: 2017-03-22 to 2017-06-20
V1.1.1	April 2019	Publication