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*Candidate Harmonized European Standard (Telecommunications series)*

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
ElectroMagnetic Compatibility (EMC) standard  
for radio equipment and services;  
Part 11: Specific conditions for terrestrial sound  
broadcasting service transmitters**

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Reference

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broadcast, EMC, radio, regulation, testing, VHF

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## Foreword

This Candidate Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility ("the EMC Directive") (89/336/EEC [2] as amended) and Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive" [3]).

The present document is part 11 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

<b>National transposition dates</b>	
Date of adoption of this EN:	8 November 2002
Date of latest announcement of this EN (doa):	28 February 2003
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# 1 Scope

The present document, together with EN 301 489-1 [1], covers the assessment of transmitters, excitors, and any associated ancillary equipment dedicated for radio broadcasting services, in respect of ElectroMagnetic Compatibility (EMC).

Technical specifications related to the antenna port emissions and cabinet radiation 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.

The present document specifies the applicable test conditions, performance assessment and performance criteria for terrestrial sound broadcasting transmitters and their associated ancillary equipment.

Definitions of the type of broadcast transmitters and excitors covered by the present document are given in annex A.

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

The environmental classification and the emission and immunity requirements used in the present document are as stated in EN 301 489-1 [1], except for any specific conditions included in the present document, under which broadcast service transmitters are typically used.

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.

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [2] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive).
- [3] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [4] EN 55011 (1998): "Industrial, scientific and medical (ISM) radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement".
- [5] EN 61000-4-3/A1 (1998): "Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test".

## 3 Definitions symbols and abbreviations

### 3.1 Definitions

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

**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.

**transposer:** Tx/Rx (transceiver), which receives an input signal off-air, and re-broadcasts the same signal on a different frequency

**active deflector:** Tx/Rx (transceiver, repeater, gap filler), which receives an input signal off-air, and re-broadcasts the same signal on the same frequency

**RF power amplifier:** Tx, which comprises an amplifier, declared by the manufacturer to be capable of being connected to a terrestrial broadcasting antenna system

**Exciter/Modulator:** low level RF power stage of a broadcasting transmitter

### 3.2 Symbols

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

%	percent
A	Ampere
Hz	Hertz (cycles per second)
M	Mega (i.e. 10 <sup>6</sup> )
m	metre
VA	Volt Amperes
W	Watt

### 3.3 Abbreviations

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

AC	Alternating Current
AM	Amplitude Modulation
BER	Bit Error Ratio
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee On Radio Interference)
DAB-T	Digital Audio Broadcast - Terrestrial
DC	Direct Current
DRM	Digital Radio Mondiale
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
FM	Frequency Modulation
HF	High Frequency
IF	Intermediate Frequency
LF	Low Frequency
MF	Medium Frequency
RDS	Radio Data System
RF	Radio Frequency
Rx	Receiver
SNR	Signal to Noise Ratio
Tx	Transmitter
VHF	Very High Frequency

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## 4 Test conditions

For the purposes of the present document, the test conditions of 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.

### 4.1 General

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 Tx shall be monitored as specified in the present document, clause 4.2.3.

### 4.2 Arrangements for test signals

The provisions of EN 301 489-1 [1], clause 4.2 shall apply.

#### 4.2.1 Arrangements for test signals at the input of transmitters

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

If the transmitter under test incorporates base-band processing and/or coding equipment (e.g. a RDS encoder for a FM 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 transmitter under test 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 transmitter under test is designed for operation with externally fitted encoder(s), then it is left to the decision of the manufacturer whether the transmitter under test 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.

Any unused input port of the transmitter under test shall be terminated according to the manufacturer's instructions.

#### 4.2.2 Arrangements for test signals at the input of transposers, active deflectors, or RF power amplifiers

The provisions of EN 301 489-1 [1], clause 4.2.2 shall apply with the following modifications.

In case of transposers and active deflectors, the wanted RF input signal, at a frequency determined from the manufacturer's specification, shall be set to a level equal to the mid point of the range 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.

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



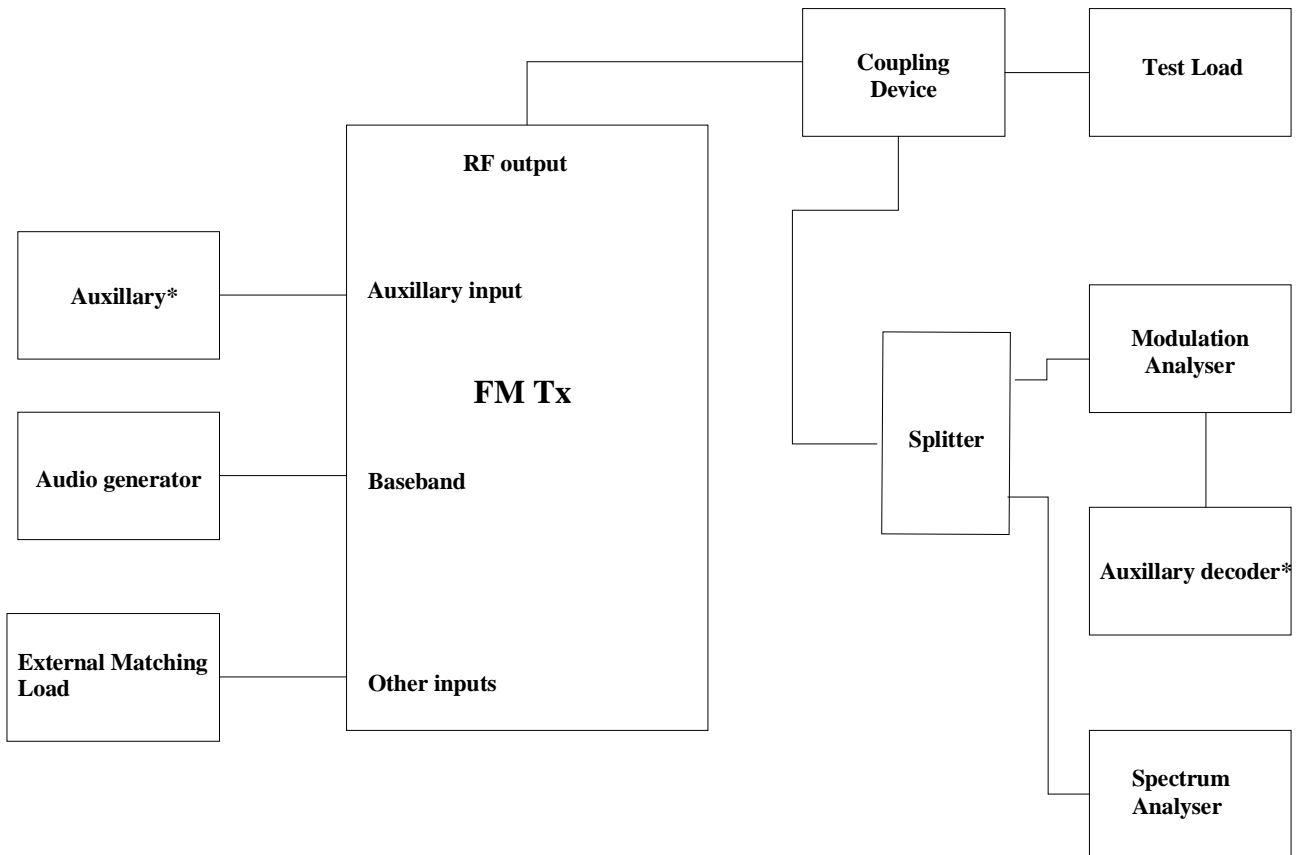
### 4.2.3 Arrangements for test signals at the output of transmitters, transposers, active deflectors or RF power amplifiers

The provisions of EN 301 489-1 [1], clause 4.2.3 shall apply with the following modifications.

Typical test arrangements to assess the performance of the EUT are shown in:

- figure 1 for VHF FM transmitters;
- figure 2 for LF, MF and HF AM transmitters.
- figure 3 for DAB-T and DRM transmitters

NOTE: In practice it is not necessary to use all the individual instrumentation shown in the figures. For specific measurement requirements refer to table 1.



NOTE: \*: For FM transmitters which use Auxiliary encoder e.g. RDS, data radio channel, etc.

**Figure 1: Typical test arrangement for the performance assessment of an FM transmitter**

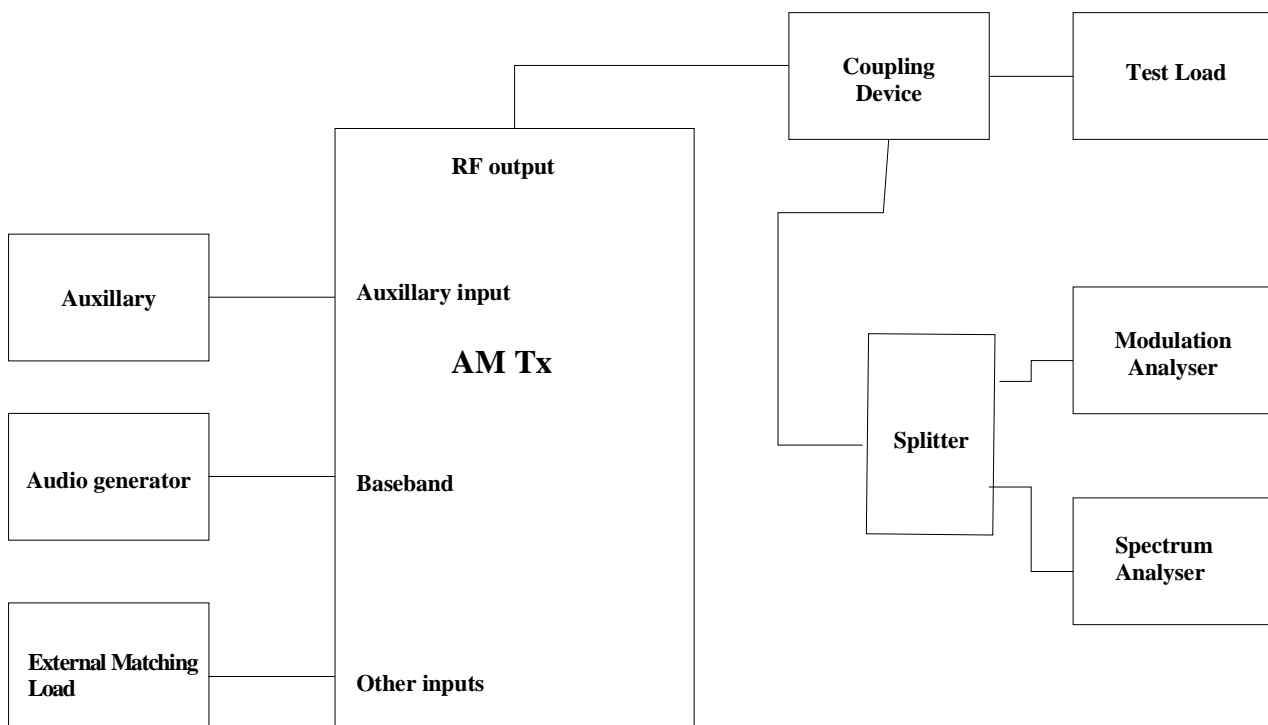


Figure 2: Typical test arrangement for the performance assessment of an LF, MF, or HF AM transmitter

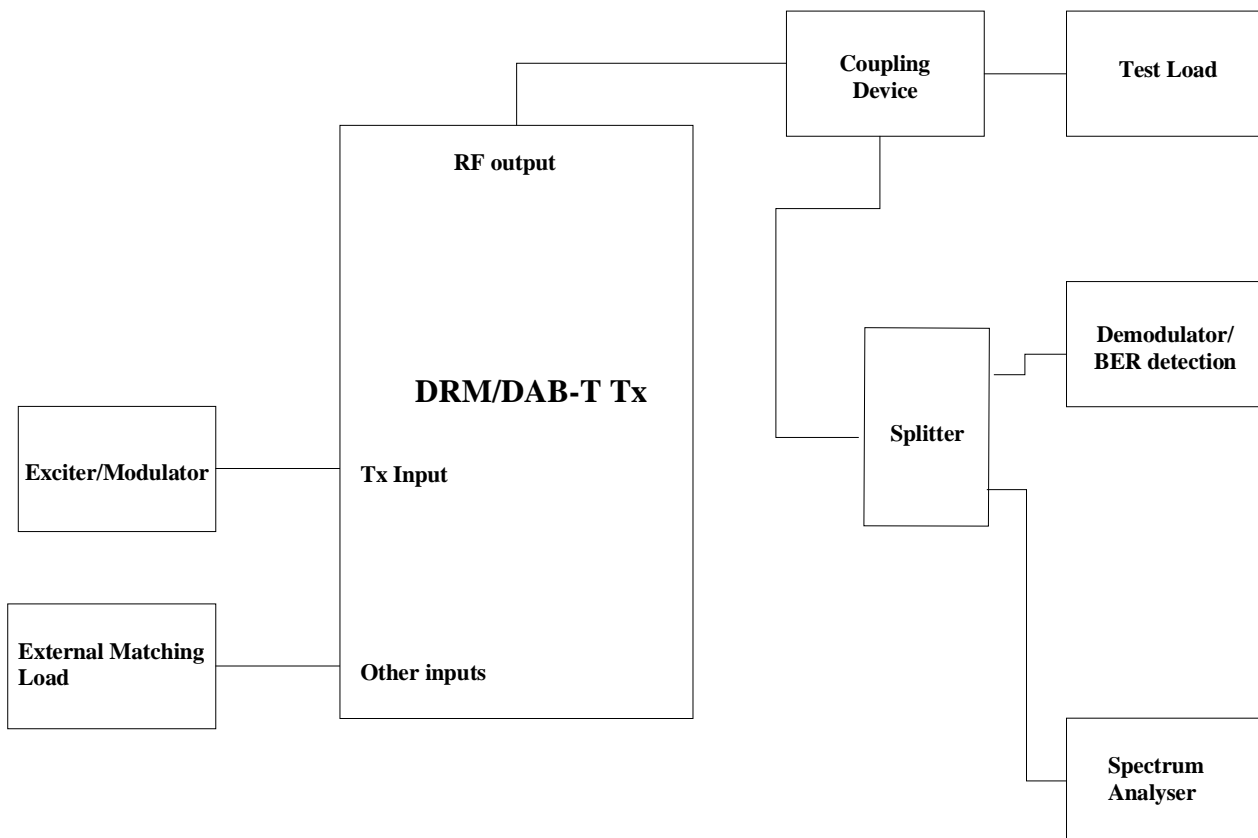


Figure 3: Typical test arrangement for the performance assessment of a DAB-T/DRM transmitter

## 4.3 RF exclusion bands

The provisions of EN 301 489-1 [1], clause 4.3 shall apply with the modifications set out in the clauses 4.3.1, 4.3.2 and 4.3.3 of the present document.

### 4.3.1 Transmitter and RF power amplifier exclusion band

#### 4.3.1.1 Transmitter and RF power amplifier exclusion band for FM

The exclusion band for the transmitter and/or power amplifier extends from  $F_c - 300$  kHz to  $F_c + 300$  kHz, where  $F_c$  is the operating frequency.

#### 4.3.1.2 Transmitter exclusion band for AM

The exclusion band for AM broadcasting transmitters shall be  $\pm 250$  % of the necessary bandwidth.

#### 4.3.1.3 Transmitter exclusion band for DRM

The exclusion band for DRM broadcasting transmitters shall be  $\pm 250$  % of the necessary bandwidth.

#### 4.3.1.4 Transmitter and RF power amplifier exclusion band for DAB-T

The exclusion band for the transmitter and/or power amplifier extends from  $F_c - 3$  MHz to  $F_c + 3$  MHz, where  $F_c$  is the operating frequency.

### 4.3.2 Active deflector exclusion band

The exclusion band for the active deflector (transmitting and receiving elements) is equal to the channel centre frequency  $-5$  % to  $+5$  %.

Special precautions shall be taken to avoid the wanted RF output of the active deflector from disturbing the signal at the RF input port.

### 4.3.3 Transposer exclusion bands

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.

The exclusion band for the transposer (transmitting and receiving elements) is equal to the channel centre frequency for each element  $-5$  % to  $+5$  %.

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 fieldstrength (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 EN 301 489-1 [1], clause 4.4 shall apply during the immunity tests of 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 below:

- FM: 1 kHz audio tone of sufficient amplitude to achieve  $\pm 50$  kHz deviation;
- AM: 1 kHz audio tone of sufficient amplitude to achieve 80 % modulation depth.
- DAB-T and DRM the modulation input port should be terminated (i.e. no modulating signal).

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

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## 5 Performance assessment

### 5.1 General

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

### 5.5 Equipment classification

Unless specified otherwise in clause 7.1.2 and/or 7.2.2 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 EN 301 489-1 [1], clauses 7, 8 and 9.

## 6 Performance criteria

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

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

The provisions of 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 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 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 1: Performance criteria for continuous phenomena**

Type of Equipment	Parameters	Reference values measured during pre-tests	Permitted values during immunity tests
FM equipment	RF power variation RF frequency variation Audio SNR BER from RDS	RF power RF frequency Manufacturers declared audio SNR $\leq 10^{-6}$	RF power $\pm 5\%$ RF frequency $\pm 2$ kHz Manufacturers declared minimum audio SNR $\leq 10^{-5}$
LF, MF, and HF transmitters	RF power variation Audio SNR	RF power Manufacturers declared audio SNR	RF Power $\pm 5\%$ Manufacturers declared minimum audio SNR
DAB-T/DRM equipment	RF power variation  BER measured after error correction	RF power  $\leq 10^{-6}$	RF power $\pm 5\%$  $\leq 10^{-4}$

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 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 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.

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## 7 Applicability overview

### 7.1 Emission

#### 7.1.1 General

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

Table 2 in EN 301 489-1 [1] shall apply.

## 7.1.2 Special conditions

The following special conditions set out in table 2 of the present document relate to the method of measurement and limits for EMC emissions used in EN 301 489-1 [1] clause 8.

**Table 2: Special conditions for EMC emission measurements**

Reference to clauses in EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions and limits in EN 301 489-1 [1]			
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 EN 55011 [4].			
8.3.3 Limits; DC power input/output ports and 8.4.3 Limits; AC mains power input/output ports	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 emission limits specified in EN 301 489-1 [1] clauses 8.3.3 and 8.4.3 shall be applied as appropriate. For transmitters drawing a DC power greater than 200 W or an AC power of greater than 200 VA the following limits shall be applied.			
	<b>Limits for conducted emissions on AC and DC ports of transmitters</b>			
	<b>AC Power (kVA) DC Power (kW)</b>	<b>Limits (dBµV)</b>		<b>Frequency range (MHz)</b>
		Quasi-peak	Average	
	> 0,2 to 2	79 73	66 60	0,15 to 0,5 > 0,5 to 30
	> 2 to 10	89 83	76 70	0,15 to 0,5 > 0,5 to 30
	> 10 to 75	100 86 90 to 70 (see note 1)	90 76 80 to 60 (see note 1)	0,15 to 0,5 > 0,5 to 5 5 to 30
	> 75	130 (see note 2) 125 (see note 2) 115 (see note 2)	120 (see note 2) 115 (see note 2) 105 (see note 2)	0,15 to 0,5 > 0,5 to 5 5 to 30

NOTE 1: Limits decreasing linearly with the logarithm of frequency.  
NOTE 2: Measured with CISPR voltage probe, see EN 55011 [4] figure 4.

## 7.2 Immunity

### 7.2.1 General

Table 3 in EN 301 489-1 [1] contains the applicability of immunity measurements to the relevant ports of transmitters and/or associated ancillary equipment.

Table 3 in 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 3 relate to the immunity test methods and levels used in EN 301 489-1 [1] clause 9.

**Table 3: Special conditions for EMC immunity tests**

Reference to clauses in EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions and limits in EN 301 489-1 [1]
<b>9.2.2 Test method; Radio frequency electromagnetic field</b>	The test method is described in EN 61000-4-3/A1 [5]. The level of the immunity RF test signal shall be 10V/m (measured unmodulated). The tests shall be performed over the total frequency range 80 MHz to 2 000 MHz (including the frequency range 1 000 MHz to 1 400 MHz) RF immunity testing need not be carried out under the following conditions: Where for AC powered equipment, the input current exceeds 16A 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.
<b>9.4.2 Test method; Fast transients, common mode</b>	The following immunity test levels shall be applied: on AC mains power input ports: $\pm 2$ kV; on DC power input, modulation input, and data cable ports: $\pm 1$ 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.
<b>9.5.2 Test method; RF common mode</b>	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: 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 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).
<b>9.7 Voltage dips and interruptions</b>	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.
<b>9.8 Surges</b>	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.
<b>9.8.2 Test method; Surges</b>	The following immunity test levels and performance criteria shall be applied: <b>AC mains power input ports:</b> - line to line mode: $\pm 1$ kV; - line to ground mode: $\pm 2$ 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. <b>Telecommunication ports:</b> - line to ground mode $\pm 2$ kV.



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## Annex A (informative): Types of broadcasting service equipment covered by the present document

### A.1 AM sound broadcasting transmitters

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

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### A.2 FM sound broadcasting transmitters

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.

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### A.3 DRM sound broadcasting transmitters

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

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### A.4 DAB-T sound broadcasting transmitters

DAB-T transmitters used in the sound broadcasting service operating in the following frequency bands:

- 47 MHz to 68 MHz.
- 174 MHz to 240 MHz.
- 1 452 MHz to 1 492 MHz.

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## Annex B (informative): Bibliography

- 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 (1999-12): '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"
- ITU-T Recommendation O.151: "Error performance measuring equipment operating at the primary rate and above".
- ITU-R Recommendation BS.468-4 (1990): "Measurement of audio-frequency noise voltage level in sound broadcasting".

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## History

Document history		
V1.1.1	May 2002	Publication
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