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*Candidate Harmonized European Standard (Telecommunications series)*

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Transmitting equipment for the  
Frequency Modulated (FM)  
sound broadcasting service;  
Part 2: Harmonized EN under article 3.2  
of the R&TTE Directive**

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Reference

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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), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

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 Directive 1999/5/EC [2] 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").

The present document is part 2 of a multi-part deliverable covering transmitting equipment for the Frequency Modulated (FM) sound broadcasting service, as identified below:

**Part 1:** "Technical characteristics and test methods";

**Part 2:** "**Harmonized EN under article 3.2 of the R&TTE Directive**".

<b>Proposed national transposition dates</b>	
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

## Introduction

The present document is part of a set of standards designed to fit in a modular structure to cover all radio and telecommunications terminal equipment under the R&TTE Directive [2]. Each standard is a module in the structure. The modular structure is shown in figure 1.

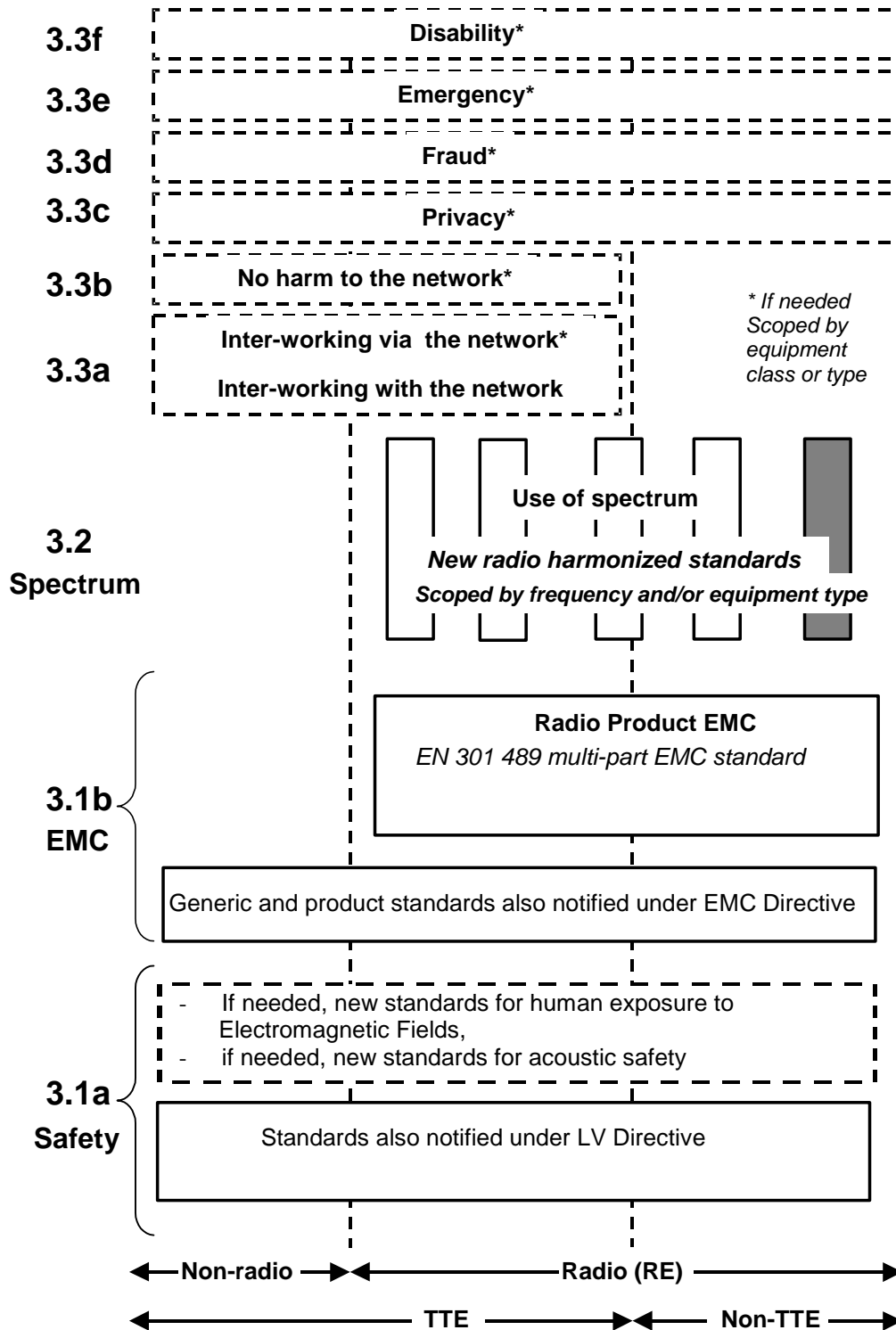


Figure 1: Modular structure for the various standards used under the R&TTE Directive [2]

The left hand edge of figure 1 shows the different clauses of article 3 of the R&TTE Directive [2].

For article 3.3 various horizontal boxes are shown. Dotted lines indicate that at the time of publication of the present document essential requirements in these areas have to be adopted by the Commission. If such essential requirements are adopted, and as far and as long as they are applicable, they will justify individual standards whose scope is likely to be specified by function or interface type.

The vertical boxes show the standards under article 3.2 for the use of the radio spectrum by radio equipment. The scopes of these standards are specified either by frequency (normally in the case where frequency bands are harmonized) or by radio equipment type.

For article 3.1b the diagram shows EN 301 489, the multi-part product EMC standard for radio used under the EMC Directive [3].

For article 3.1a the diagram shows the existing safety standards currently used under the LV Directive [4] and new standards covering human exposure to electromagnetic fields. New standards covering acoustic safety may also be required.

The bottom of the figure shows the relationship of the standards to radio equipment and telecommunications terminal equipment. A particular equipment may be radio equipment, telecommunications terminal equipment or both. A radio spectrum standard will apply if it is radio equipment. An article 3.3 standard will apply as well only if the relevant essential requirement under the R&TTE Directive is adopted by the Commission and if the equipment in question is covered by the scope of the corresponding standard. Thus, depending on the nature of the equipment, the essential requirements under the R&TTE Directive may be covered in a set of standards.

The modularity principle has been taken because:

- it minimizes the number of standards needed. Because equipment may, in fact, have multiple interfaces and functions it is not practicable to produce a single standard for each possible combination of functions that may occur in an equipment;
- it provides scope for standards to be added:
  - under article 3.2 when new frequency bands are agreed; or
  - under article 3.3 should the Commission take the necessary decisions without requiring alteration of standards that are already published;
- it clarifies, simplifies and promotes the usage of Harmonized Standards as the relevant means of conformity assessment.

Other documents directly associated with the present document:

- EN 302 018-1 [5];
- EN 301 489-11 [6].

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# 1 Scope

The present document applies to Transmitting equipment for the frequency-modulated sound broadcasting service.

The types of equipment covered by the present document are as follows:

- Transmitting equipment for frequency modulated sound broadcasting service operating in both Monophonic and Stereophonic operating in the frequency range 68 MHz to 108 MHz.

The present document is intended to cover the provisions of article 3.2, of Directive 1999/5/EC [2] (R&TTE Directive), which states that "... radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference."

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the R&TTE Directive [2] apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site <http://www.newapproach.org>.

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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.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

- [1] Council 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.
- [2] 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).
- [3] 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).
- [4] Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).
- [5] ETSI EN 302 018-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Transmitting equipment for the Frequency Modulated (FM) sound broadcasting service; Part 1: Technical characteristics and test methods".
- [6] ETSI EN 301 489-11: "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".
- [7] CENELEC EN 55011: "Industrial, scientific and medical (ISM) radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement".
- [8] IEC 60489-1: "Methods of measurements for radio equipment used in the mobile services; Part 1: General definitions and standard conditions of measurement".



- [9] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [10] ITU-R Recommendation SM.329: "Spurious emissions".
- [11] ITU-R Recommendation BS.412: "Planning standards for terrestrial FM sound broadcasting at VHF".
- [12] ITU-R Recommendation BS.641: "Determination of radio-frequency protection ratios for frequency-modulated sound broadcasting".

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

**antenna port:** port of an apparatus which is designed, in normal operation, to be connected to an antenna using coaxial cable

**broadcasting service:** radio communication service in which the transmissions are intended for direct reception by the general public

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

**cabinet radiation:** radiation from an enclosure containing, equipment, excluding radiation from connected antennas or cables

**carrier power:** average power supplied to the antenna transmission line by a transmitter during one cycle taken under the condition of no modulation

**channel L:** left hand channel of a stereophonic signal

**channel R:** right hand channel of a stereophonic signal

**class of emission:** set of characteristics of an emission, designated by standard symbols, e.g. type of modulation of the main carrier, modulating signal, type of information to be transmitted, and also, if appropriate, any additional signal characteristics

**composite:** See "Multiplex (MPX) signal".

**dBc:** decibels relative to the unmodulated carrier power of the emission

NOTE: In the cases which do not have a carrier, for example in some digital modulation schemes where the carrier is not accessible for measurement, the reference level equivalent to dBc is decibels relative to the mean power P.

**difference signal:** signal (S) theoretically equal to half the difference between the left (L) and right (R) stereophonic signals, and in practice proportional to this difference.  $S=(L-R)/2$

**enclosure port:** physical boundary of the apparatus through which electromagnetic fields may radiate or impinge

NOTE: In the case of integral antenna equipment, this port is inseparable from the antenna port.

**environmental profile:** range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document

**exclusion band:** band of radio frequencies where no measurements are made

**harmonic:** component of order greater than 1 of the Fourier series of a periodic quantity

**harmonic number:** integral number given by the ratio of the frequency of a harmonic to the fundamental frequency (2 harmonic = 2 x fundamental frequency)

**MultiPlex (MPX) signal:** contains all information, including the pilot tone and any supplementary signal which is used to frequency modulate the VHF FM transmitter

**mean power:** average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation envelope taken under normal operating conditions

**necessary bandwidth:** for a given class of emission, the width of the frequency band which is sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

**out-of-band emissions:** emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions

**reference bandwidth:** bandwidth in which the spurious emission level is specified

**signal L:** corresponds to the information in the left channel of the stereophonic signal

**signal R:** corresponds to the information in the right channel of the stereophonic signal

**spurious emissions:** emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of band emissions.

**stereo subcarrier:** 38 kHz subcarrier used to carry the difference signal

**sum signal:** signal(M) theoretically equal to half of the sum of the left (L) and right (R) stereophonic signals, and in practice proportional to this sum.  $M=(L+R)/2$

**unwanted emissions:** consist of spurious emissions and out of band emissions

## 3.2 Symbols

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

$\mu$  micro,  $10^{-6}$

## 3.3 Abbreviations

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

AF	Audio Frequency
dB	deciBel, logarithmic ratio (tenths of a "Bel")
dBm	dB relative to one milliwatt
EMC	Electro-Magnetic Compatibility
EUT	Equipment Under Test
FM	Frequency Modulation
LV	Low Voltage
R&TTE	Radio equipment and Telecommunications Terminal Equipment
rms	root mean square
VHF	Very High Frequency
W	Watt

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## 4 Technical requirements specifications

### 4.1 Environmental profile

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

### 4.2 Antenna port measurements

#### 4.2.1 Spurious emissions

##### 4.2.1.1 Definition

Emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out of band emissions.

##### 4.2.1.2 Method of measurement (essential test suite)

###### 4.2.1.2.1 Initial conditions

Test environment:

- the normal operating environment, as declared by the equipment manufacturer.

Test frequencies:

- a) the lowest operating frequency of the EUT;
- b) the highest operating frequency of the EUT;
- c) a frequency mid-way between a) and b) above.

Test arrangement (see figure A.1):

- 1) connect the AF Signal Generator to the EUT;
- 2) connect the EUT to the Test Load, via the Coupling Device;
- 3) connect the Spectrum Analyser to the Coupling Device.

###### 4.2.1.2.2 Procedure

- 1) measure the peak power of the unmodulated carrier on the Spectrum Analyser and set its value as a reference;
- 2) operate the EUT at each of the test frequencies as defined in clause 4.2.1.2.1;
- 3) measure the peak power of harmonic emissions on the Spectrum Analyser;
- 4) set the AF Signal Generator to deliver a test signal as defined in clause A.1.4;
- 5) measure the peak power of the modulated carrier on the Spectrum Analyser and set its value as a reference;
- 6) operate the EUT at each of the test frequencies as defined in clause 4.2.1.2.1;
- 7) measure the results on the Spectrum Analyser.

NOTE: measurements shall be made in the operational mode producing the largest emission in the frequency band.

#### 4.2.1.2.3 Test requirements

The results obtained shall be compared to the limits in clause 4.2.1.3 in order to demonstrate compliance.

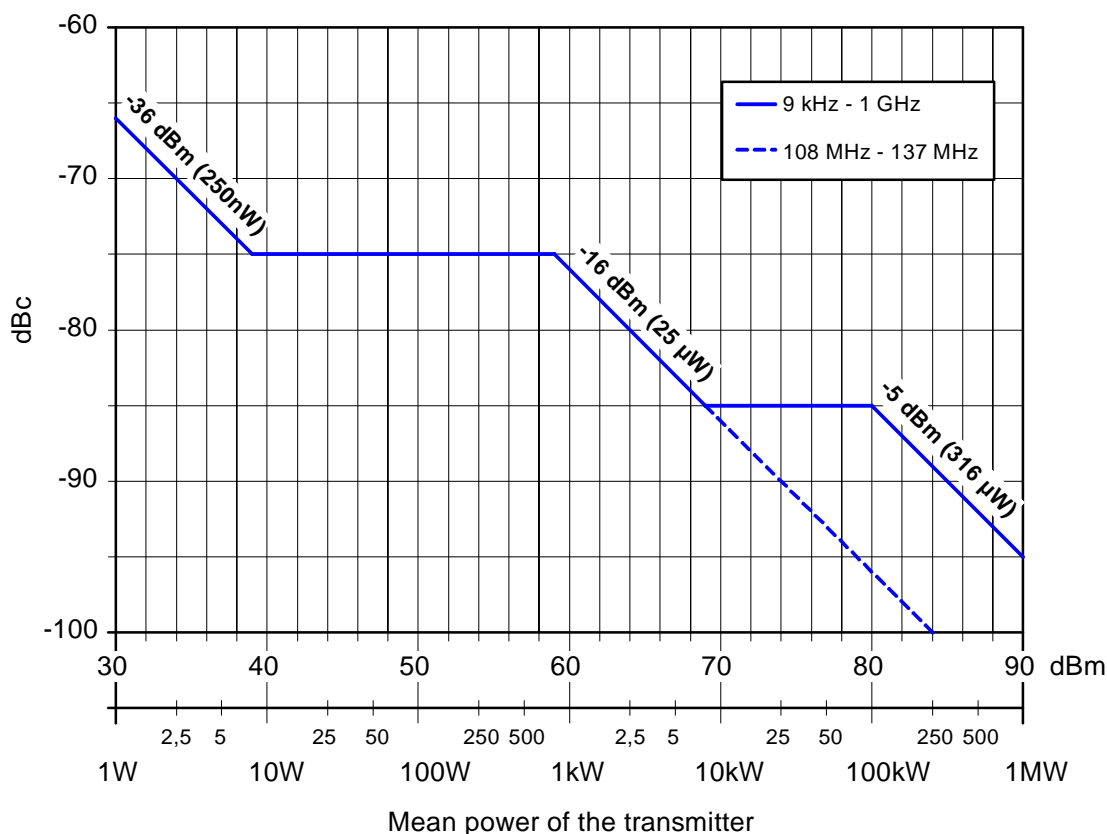
#### 4.2.1.3 Limit

Spurious emissions shall not exceed the values set out in table 4.1, shown additionally in figure 4.1 for the frequency range 9 kHz to 1 GHz.

**Table 4.1: Spurious emission limits**

Mean power of the transmitter	Limits Mean power absolute levels (dBm) or relative levels (dBc) below the power supplied to the antenna port in the reference bandwidth (see annex A)
$P < 9 \text{ dBW}$	-36 dBm
$9 \text{ dBW} \leq P < 29 \text{ dBW}$	75 dBc
$29 \text{ dBW} \leq P < 39 \text{ dBW}$	-16 dBm
$39 \text{ dBW} \leq P < 50 \text{ dBW}$	85 dBc
$50 \text{ dBW} \leq P$	-5 dBm

NOTE: Within the band 108 MHz to 137 MHz the limits above apply without exceeding the absolute limit of 25  $\mu\text{W}$  (-16 dBm).



**Figure 4.1: Spurious Emission limits for FM sound broadcasting transmitters**

## 4.2.2 Transmitter muting during frequency shift

### 4.2.2.1 Definition

The suppression of emissions during the retuning of transmitters, or the loss of carrier frequency control. This is particularly relevant to frequency agile transmitters incorporating frequency control loops.

### 4.2.2.2 Method of measurement (essential test suite)

#### 4.2.2.2.1 Initial conditions

Test environment:

- the normal operating environment, as declared by the equipment manufacturer.

Test frequencies;

- a) The lowest operating frequency of the EUT;
- b) The highest operating frequency of the EUT.

Test arrangement (see figure A.1.):

- 1) connect the EUT to the Test Load, via the Coupling Device;
- 2) connect the Spectrum Analyser to the Coupling Device;
- 3) set reference bandwidth as per clause A.1.3;
- 4) set span to correspond to the tunable frequency range shown at clause 4.2.2.2.1 points "a" and "b";
- 5) sweep time of the Spectrum Analyser should be no greater than 1/10 the frequency switching period of the EUT.

NOTE: AF Signal Generator and Voltage measuring equipment are not required for this test.

#### 4.2.2.2.2 Procedure

- 1) operate the EUT at the present frequency as defined in clause 4.2.2.2.1 point "a";
- 2) initiate frequency change to frequency defined in clause 4.2.2.2.1 point "b";
- 3) to measure the results set the Spectrum Analyser to "MAX HOLD" and retune the EUT at least 5 times between points "a" and "b".

#### 4.2.2.2.3 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.3 in order to demonstrate compliance.

### 4.2.2.3 Limit

The muting shall be as defined in table 4.1 and additionally shown in figure 4.1.

## 4.2.3 Out-of-band emissions

### 4.2.3.1 Definition

Emission on a frequency or frequencies immediately outside the necessary bandwidth, which results from the modulation process, but excludes spurious emissions.

### 4.2.3.2 Method of measurement (essential test suite)

#### 4.2.3.2.1 Initial conditions

Test environment:

- the normal operating environment, as declared by the equipment manufacturer.

Test frequencies:

- a) the lowest operating frequency of the EUT; the highest operating frequency of the EUT;
- b) a frequency mid-way between a) and b) above.

Test arrangement (see figure A.1):

- 1) connect the AF Signal Generator to the EUT;
- 2) connect the EUT to the Test Load, via the Coupling Device;
- 3) connect the Spectrum Analyser to the Coupling Device.

#### 4.2.3.2.2 Procedure

For monophonic operation:

- The test arrangement in clause A.1.1 shall be used.

One generator shall be a AF Signal Generator. The other generator shall deliver standardized coloured noise described in clause A.1.4. This can be obtained from a "white-noise" generator after a passive filter, as shown in figure A.4, and a low-pass filter of 15 kHz with a slope of 60 dB per octave.

A second output from a Directional Coupler is connected to a RF Spectrum Analyser.

- 1) check that the pre- and de-emphasis filters are in circuit;
- 2) adjust the output of the AF Generator at  $\leq 1$  kHz to a level which corresponds to a frequency deviation 7,4 dB below rated deviation. That is  $\pm 32$  kHz for  $\pm 75$  kHz rated deviation;
- 3) measure the effective value by means of the Noise Meter (see note) at the input of the EUT modulator (i.e. in general channel A);
- 4) switch the AF Generator out of circuit and the Noise Generator in circuit and adjust the output of the Noise Generator, so that the noise meter gives the same reading (the peak-deviation is now correct).
- 5) switch the analyser to a bandwidth of 1 kHz;
- 6) adjust the Spectrum Analyser with the unmodulated FM carrier to 0 dB as reference level;
- 7) modulate the transmitter with the coloured noise;
- 8) tune the Analyser to frequencies between the carrier frequency and  $\pm 100$  kHz to  $\pm 500$  kHz i.e. to all frequencies required in the out of band emission mask;
- 9) determine the rms value of the noise corresponding to power density, relative to the unmodulated carrier level;
- 10) operate the EUT at each of the test frequencies as defined in clause 4.2.3.2.1.

For stereophonic operation:

- The test arrangement in clause A.1.2 shall be used.

The AF Signal Generator has to be replaced during the measurement by the standard Coloured Noise Generator. Both channels L and R shall be fed simultaneously with an AF signal or with white noise in the ratio  $L = R - 6$  dB.

- 1) check that the appropriate pre- and de-emphasis filters are in circuit;

- 2) adjust the output of the AF Generator at  $\leq 1$  kHz to a level which corresponds to a frequency deviation 7,4 dB below maximum rated deviation and additionally include pilot tone. That is  $= \pm 40$  kHz for  $\pm 75$  kHz rated deviation;
- 3) measure the effective power value by means of the Noise Meter (see note) at the input of the EUT Stereo Modulator in channel B;
- 4) for the remaining procedure, see the method used for monophonic operation.

NOTE: The Noise Meter has to be applicable to determine a true effective value (rms) of power or voltage of a stochastic noise probe. Suit instruments are bolometric Power Meters or psophometric Voltage Meters. All and any weighting networks have to be disconnected.

#### 4.2.3.2.3 Test requirements

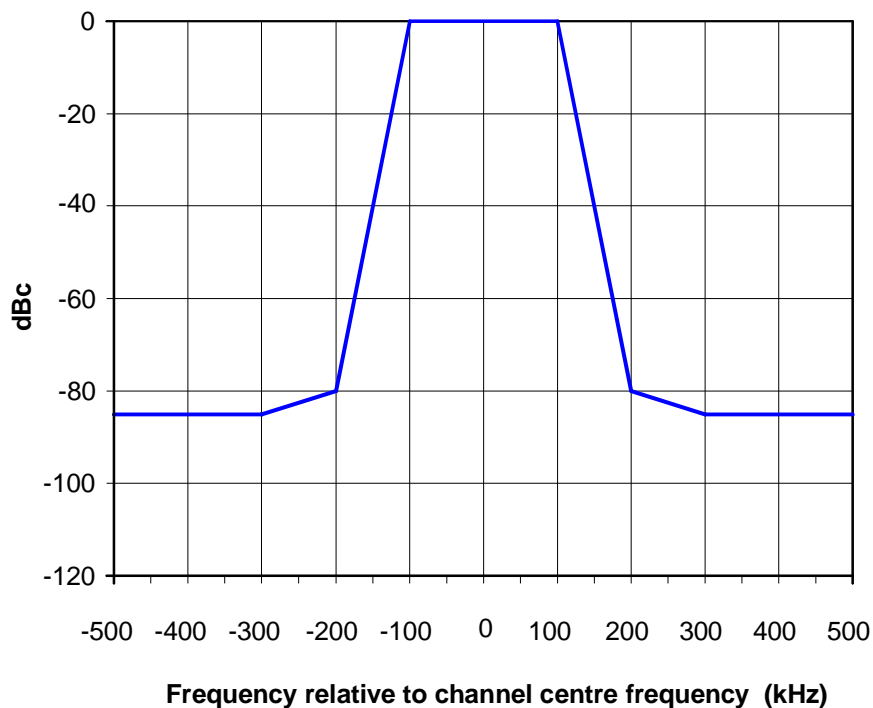
The results obtained shall be compared to the limits in clause 4.2.3.3 in order to demonstrate compliance.

#### 4.2.3.3 Limit

Out of band emissions shall not exceed the values set out in table 4.2 and additionally shown in figure 4.2.

**Table 4.2: Break points of spectrum limit mask for VHF FM sound broadcasting**

Frequency relative to the centre of the channel (kHz)	Relative level (dBc)
-500	-85
-300	-85
-200	-80
-100	0
100	0
200	-80
300	-85
500	-85



**Figure 4.2: Out-of-band emission limits for FM sound broadcasting transmitters**

## 4.3 Enclosure port measurements (radiated emissions)

### 4.3.1 Cabinet radiation

#### 4.3.1.1 Definition

Emissions from the equipment, radiated from the enclosure port, other than those present at the antenna port.

#### 4.3.1.2 Method of measurement (essential test suite)

##### 4.3.1.2.1 Initial conditions

Test environment:

- the normal operating environment, as declared by the equipment manufacturer.

Test frequencies:

- a) the lowest operating frequency of the EUT;
- b) the highest operating frequency of the EUT;
- c) a frequency mid-way between a) and b) above.

Test arrangement (see figure A.5):

- 1) connect the AF Signal Generator to the EUT;
- 2) connect the EUT to the Test Load, via the Test Load;
- 3) connect the measuring device to the measuring antenna.

##### 4.3.1.2.2 Procedure

- 1) operate the EUT without any modulation at each of the test frequencies as defined in clause 4.3.1.2.1;
- 2) measure the results on the measuring device (using a Quasi Peak Detector);
- 3) set the AF Signal Generator to deliver a test signal as defined in clause A.1.4;
- 4) operate the EUT at each of the test frequencies as defined in clause 4.3.1.2.1;
- 5) measure the results on the measuring device (using a Quasi Peak Detector).

NOTE: Testing shall be carried out at a suitably calibrated test site, unless physical size is a restriction, in which case the test method shall be in accordance with EN 55011 [7]:

- measurements shall be made outside the exclusion band (see table 4.3);
- measurements shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications;
- the equipment shall be configured in a manner which is representative of a normal/typical operation, where practical;
- an attempt shall be made to maximize the detected radiated emission, e.g. by moving the cables of the equipment;
- the configuration and mode of operation during measurements shall be precisely noted in the test report;
- RF input/output ports shall be correctly terminated;
- the tests shall be carried out at a point within the specified normal operating environmental range and at the rated supply voltage for the equipment.



### 4.3.1.2.3 Test requirements

The results obtained shall be compared to the limits in clause 4.3.1.3 in order to demonstrate compliance.

### 4.3.1.3 Limit

Radiated emissions shall not exceed the values set out in table 4.3, shown additionally in figure 4.3, for the frequency range 30 MHz to 1GHz.

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 to 3). Tests shall not be carried out in the exclusion band (see note 2 in table 4.3).

**Table 4.3: Limits for radiated unwanted emissions**

Quasi-peak limits (dB $\mu$ V/m) at 10 m (see notes 1 and 2)	Frequency range
$30 \text{ dB}\mu\text{V/m} \leq 60 + 10 \log_{10} (P_0/2\ 000) \leq 70 \text{ dB}\mu\text{V/m}$	30 MHz - 230 MHz
$37 \text{ dB}\mu\text{V/m} \leq 67 + 10 \log_{10} (P_0/2\ 000) \leq 77 \text{ dB}\mu\text{V/m}$	> 230 MHz - 1 GHz
NOTE 1: $P_0$ = RF output power in W.	
NOTE 2: The exclusion band for the transmitter extends from $F_c - 300 \text{ kHz}$ to $F_c + 300 \text{ kHz}$ , where $F_c$ is the operating frequency in MHz.	

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

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

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 shall take precedence.

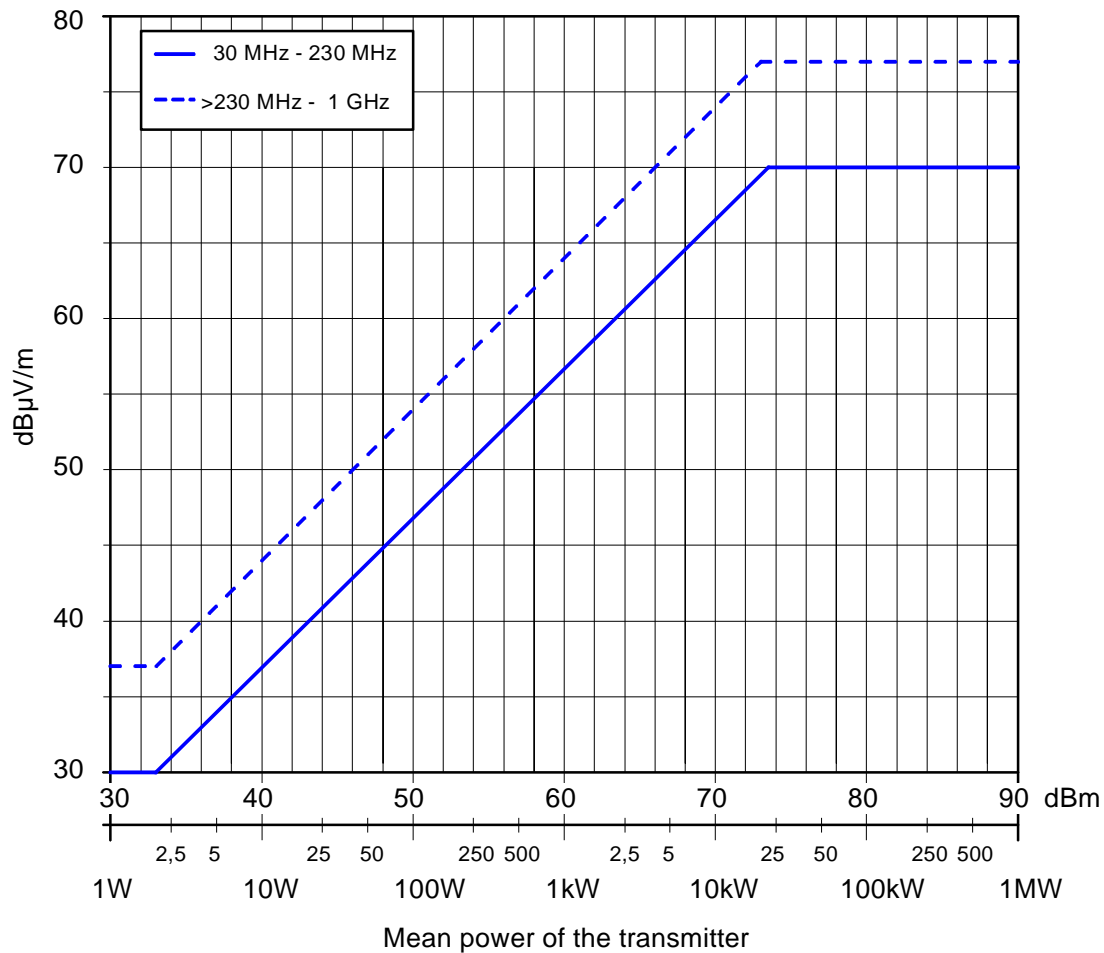


Figure 4.3: Cabinet radiation limits for FM sound broadcasting transmitters

## 4.4 Measurement Uncertainties

Measurement uncertainty should be calculated and techniques employed to minimize its range. This uncertainty should be applied to the limit and any measurement falling below the range is deemed acceptable [9].

## Annex A (normative): General measuring arrangements

### A.1 Testing arrangements for antenna port measurements

#### A.1.1 Testing arrangement for monophonic transmitters

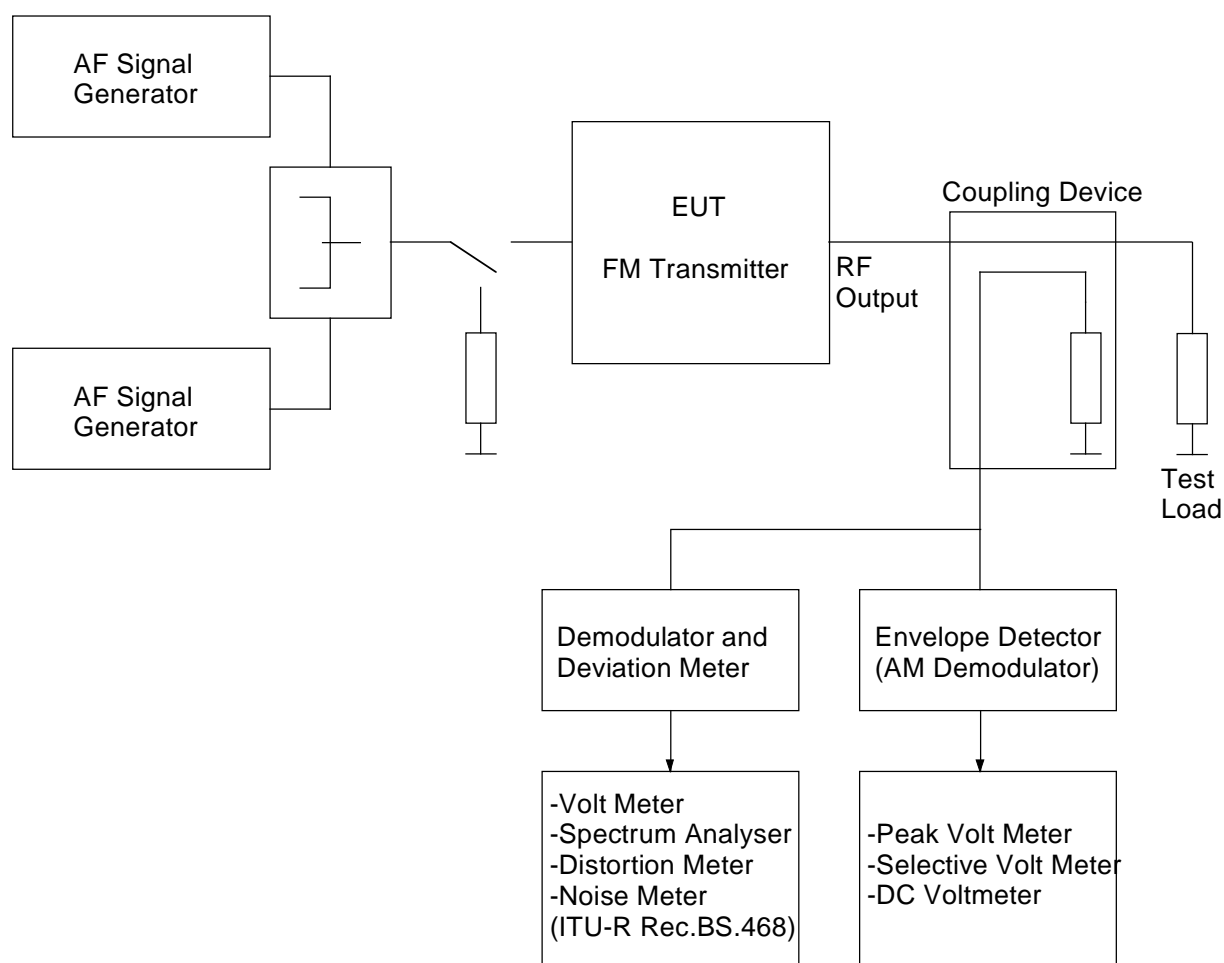


Figure A.1: Testing arrangement for Monophonic Transmitters

## A.1.2 Testing arrangement stereophonic transmitters

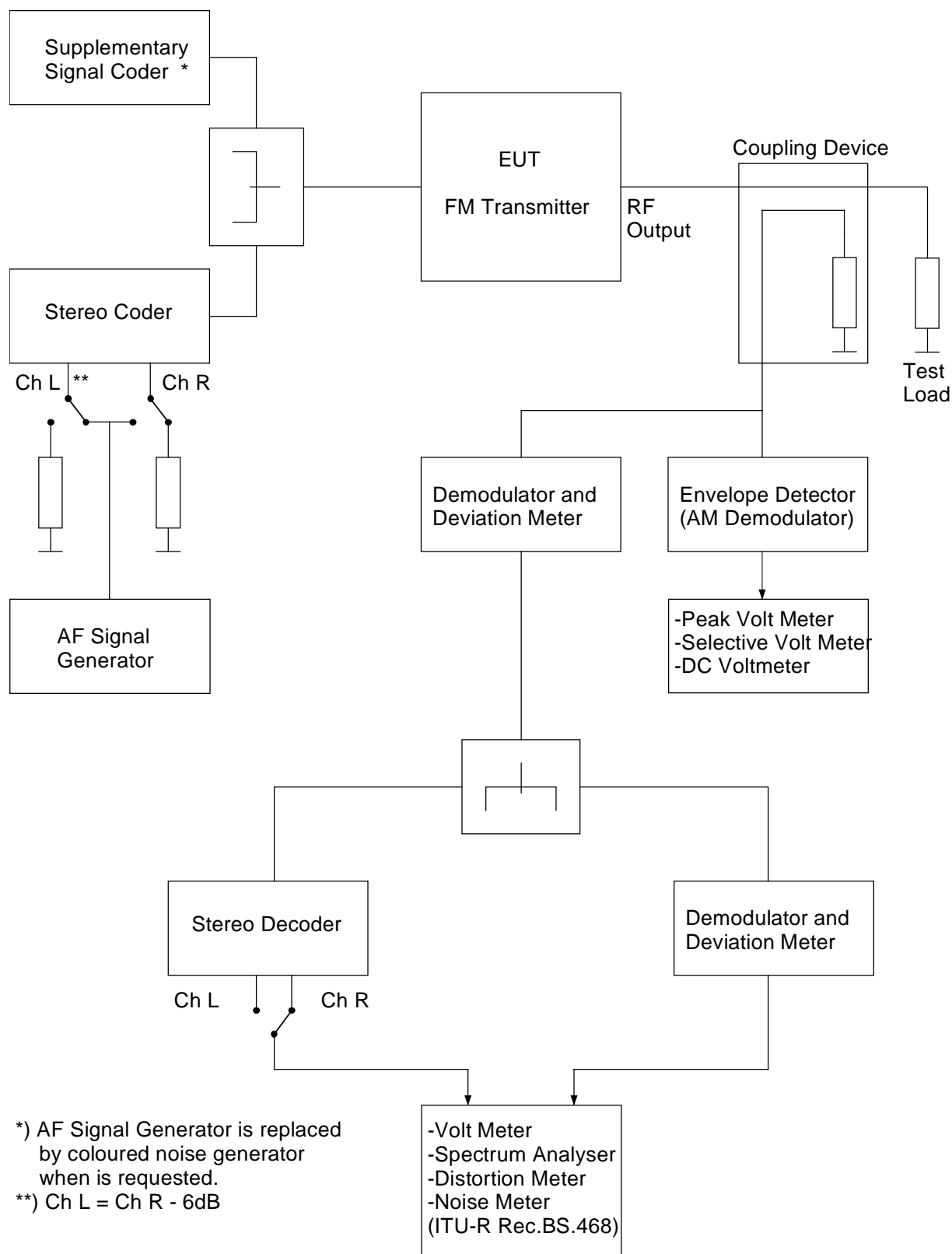


Figure A.2: Testing arrangement for Stereophonic Transmitters

## A.1.3 Test frequency range

Limits on unwanted emissions for radio equipments are considered to be applicable to the range 9 kHz to 300 GHz. However, for practical measurement purposes, the frequency range of spurious emissions may be restricted. As guidance for practical purposes, the following measurement parameters in table A.1 are recommended.

**Table A.1: Test frequency range**

Transmitter fundamental frequency range	Unwanted emission frequency measurement range	
	lower frequency	upper frequency
68 MHz to 108 MHz	9 kHz	1 GHz

The following reference bandwidths are to be used:

For spurious emissions:

- 1 kHz between 9 kHz and 150 kHz;
- 10 kHz between 150 kHz and 30 MHz;
- 100 kHz between 30 MHz and 1 GHz.

For out of band emissions:

- 1 kHz.

For definition of reference bandwidth, see ITU-R Recommendation SM.329 [10].

## A.1.4 Test modulating signal

### A.1.4.1 Introduction

The allocation of radio frequencies and the place of operation for broadcasting transmitters is planned such that mutual interferences as far as possible are avoided. Basis for frequency planning are the protection margin curves and the curves about propagation of RF signals in the relevant frequency range. The curves on protection margin were specified and internationally approved by ITU-R in its ITU-R Recommendation BS.412 [11].

For these radio-frequency protection ratios it is assumed that the maximum peak deviation of  $\pm 75$  kHz is not exceeded. Moreover, it is assumed that the power of the complete multiplex signal (including-tone and additional signals) integrated over any interval of 60 s is not higher than the power of a multiplex signal containing a single sinusoidal tone which causes a peak deviation of  $\pm 19$  kHz.

The power of a sinusoidal tone causing a peak deviation of  $\pm 19$  kHz is equal to the power of the coloured noise modulation signal according to ITU-R Recommendation BS.641 [12], i.e. a coloured noise signal causing a quasi peak deviation of  $\pm 32$  kHz.

### A.1.4.2 Noise signal for modulating the signal generator

The noise is weighted in accordance with the curves shown in figure A.3.

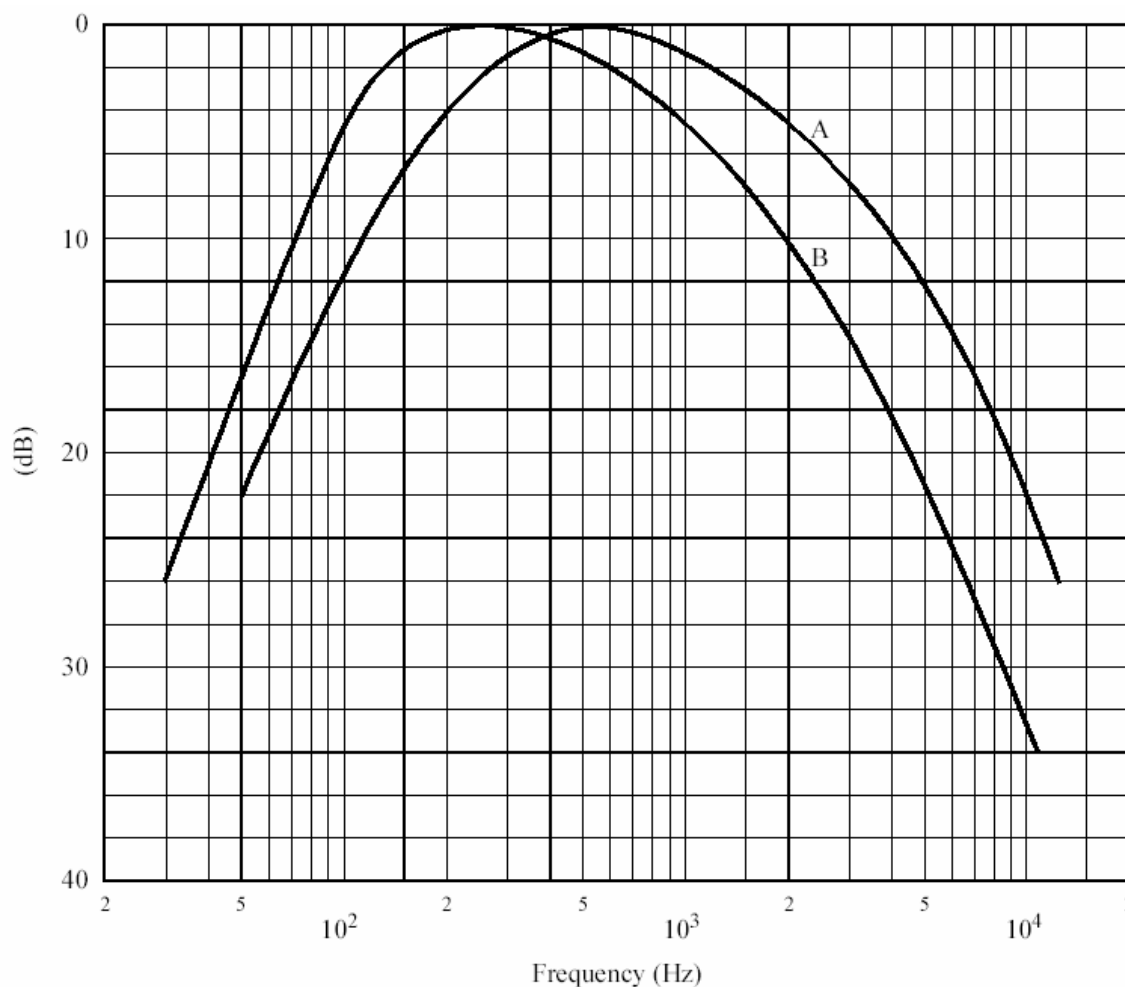
Two conditions should be fulfilled by the standardized signal to simulate programme modulation:

- its spectral constitution must correspond to that of a representative broadcast programme;
- its dynamic range must be small enough to result in a constant and steady reading on the measuring instrument.

The amplitude distribution of modern dance music was taken as a basis, as it is a type of programme with a considerable proportion of high audio-frequencies, which occur most frequently. However, the dynamic range of this type of programme is too wide and does not fulfill, therefore, the second requirement mentioned above. A signal which is appropriate for this purpose is a standardized coloured noise signal, the spectral amplitude distribution of which is fairly close to that of modern dance music (see curve A of figure A.3, which is measured using one-third octave filters).

This standardized coloured noise signal may be obtained from a white-noise generator by means of a passive filter circuit as shown in figure A.4. The frequency-response characteristic of this filter is reproduced as curve B of figure A.3. (It should be noted that the difference between curves A and B of figure A.3 is due to the fact that curve A is based on measurements with one-third octave filters which pass greater amounts of energy as the bandwidth of the filter increases with frequency).

The spectrum beyond the required bandwidth of the standardized coloured noise should be restricted by a low-pass filter having a cut-off frequency and a slope such that the bandwidth of the modulating signal is approximately equal to half the standardized bandwidth of emission. The audio-frequency amplitude/frequency characteristic of the modulating stage of the signal generator shall not vary by more than 2 dB up to the cut-off frequency of the low-pass filter.



Curves A: frequency spectrum of standardized noise (measured with one-third octave filters)  
 B: frequency response characteristic of filter-circuit

**Figure A.3: Coloured noise modulation**

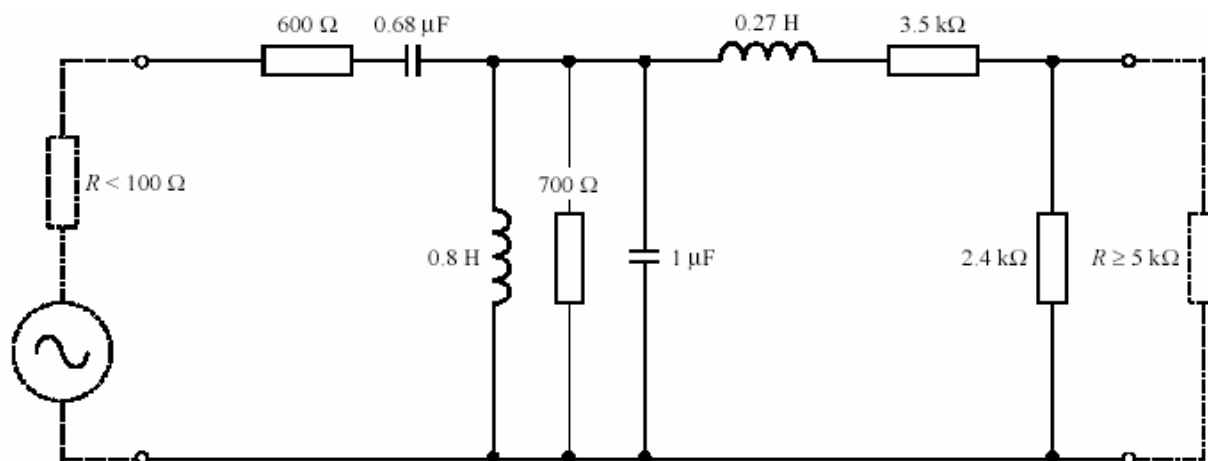


Figure A.4: Filter circuit

## A.2 Testing arrangements for enclosure port (radiated emissions) measurements

Guidance on methods of measurement can be found in IEC 60489-1 [8].

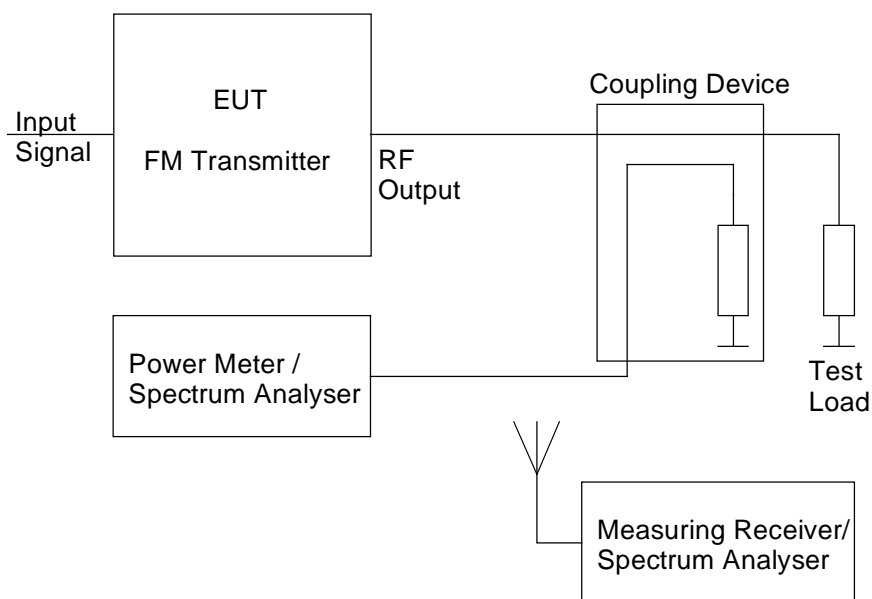


Figure A.5: Testing arrangement for cabinet radiation

## A.3 Test load characteristics

The transmitter may be required to operate into a precision load with return loss of  $> 26$  dB in the frequency band in which the transmitter is designed to operate.

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## Annex B (informative): Bibliography

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ITU-R Recommendation BS.559: "Objective measurement radio-frequency protection ratios in LF, MF and HF broadcasting"

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ITU-R Recommendation SM.328: "Spectra and bandwidth of emission".

ERC Recommendation 74-01: "Spurious emissions".

ITU-R Recommendation SM.1541 "Unwanted emissions in the Out-of-band domain".

CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity test".

CISPR 16-2: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Method of measurement of disturbance and immunity".

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CENELEC EN 60244-1 (2000): "Methods of measurements for radio transmitters - Part 1: General characteristics for broadcast transmitters".

CENELEC EN 60244-12-1 (1993): "Methods of measurements for transmitters - Part 12-1: Guideline for drawing up descriptive leaflets for transmitters and transposers for sound and television broadcasting - Characteristics to be specified".

CENELEC EN 60244-12-2 (1993): "Methods of measurements for transmitters - Part 12-2: Guideline for drawing up descriptive leaflets for transmitters and transposers for sound and television broadcasting - Specification sheets".

CENELEC EN 60244-13 (1993): "Methods of measurement for radio transmitters. Part 13: Performance characteristics for FM sound broadcasting".



## Annex C (informative): The EN title in the official languages

Language	EN title
Czech	Elektromagnetická kompatibilita a rádiové spektrum (ERM); Vysílací zařízení rozhlasové služby s kmitočtovou modulací (FM); Část 2: Harmonizovaná norma podle článku 3.2 Směrnice R&TTE
Danish	Frekvensmoduleret radiosendeudstyr for FM-radiofoni, Del 2: Harmoniseret EN, der dækker de væsentlige krav i R&TTE Direktivets artikel 3.2
Dutch	Funksendeanlagen für frequenzmodulierte Audioprogramme (FM); Teil 2: Harmonisierte EN nach Artikel 3.2 der R&TTE Richtlinie
English	Transmitting equipment for the Frequency Modulated (FM) sound broadcasting service; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive
Estonian	Elektromagnetilise ühilduvuse ja raadiospektri küsimused (ERM); Sagedusmoduleeritud (FM) raadioringhäälingusaatjad; Osa 2: Harmineeritud EN R&TTE direktiivi artikli 3.2 alusel
Finnish	Taajuusmodulaatiota käytävät ääniyleisradiotoiminnan ULA-lähettimet; Osa 2: R&TTE-direktiivin artiklaan 3.2 perustuva harmonisoitu standardi (EN)
French	Équipement émetteur pour le service de radiodiffusion sonore en Modulation de fréquence (FM); Partie 2: EN Harmonisée sous l'article 3.2 de la Directive R&TTE
German	Sendertechnische Einrichtungen für den frequenzmodulierten Ton-Rundfunkdienst(FM); Teil 2: Harmonisierte EN nach Artikel 3.2 der R&TTE -Richtlinie
Greek	Εξοπλισμός εκπομπής με Διαμόρφωση Συχνότητας (FM) για την υπηρεσία ραδιο-ευρεκπομπής. Μέρος 2: Εναρμονισμένο EN σύμφωνα με το άρθρο 3.2 της R&TTE οδηγίας
Hungarian	Elektromágneses összeférhetőségi és rádióspektrumügyek (ERM). A frekvenciamodulált (FM) hangműsorszóró szolgálat adóberendezései. 2. rész: Az R&TTE-irányelv 3.2. cikkelye alá tartozó harmonizált európai szabvány
Icelandic	Þættir sem varða rafsegulsviðssamhæfi og fjarskiptatíðni (ERM); Sendibúnaður til nota í tíðnimótaðri (FM) útvarpsþjónustu; 2. hluti: Samræmdur evrópustaðall skv. 2. mgr. 3. gr. í tilskipun 1999/5/EC um fjarskiptabúnað og endabúnað til fjarskipta
Italian	Apparati trasmettenti per servizi di radio diffusione a Modulazione di Frequenza (FM); Parte 2: Standard armonizzato per l'articolo 3.2 della direttiva R&TTE
Latvian	Elektromagnētiskā saderība un radiofrekvenču spektra jautājumi (ERM) - Lavīnu bākas - Raidītāju-uztvērēju sistēmas - 2.daļa: Harmonizēts Eiropas standarts (EN), kas atbilst R&TTE Direktīvas 3.2.punkta būtiskām prasībām
Lithuanian	Elektromagnetinio suderinamumo ir radijo dažnių spektro dalykai. Garso transliavimo tarnybos perdavimo įrenginiai su dažnio moduliacija (FM). 2 dalis. Darnusis Europos standartas pagal 1999/5/EC* direktyvos 3.2 straipsnį
Maltese	Kompatibilità elettromanjetika u materji relatati ma' spettru radjofoniku (ERM); Tagħmir li jittrasmetti għal servizz ta' xandir bil-ħoss fuq Frekwenza Modulata (FM); Parti 2: EN armonizzata taħt l-artiklu 3.2 tad-Direttiva R&TTE Tagħmir li jittrasmetti għal servizz ta' xandir bir-radju fuq frekwenza modulate
Norwegian	Elektromagnetisk kompatibilitet og radiospektrumspørsmål (ERM); Senderutstyr for den frekvensmodulerete (FM) radiokringkastingstjeneste; Del 2: Harmonisert EN under artikkel 3.2 i R&TTE-direktivet
Polish	Kompatybilność Elektromagnetyczna i Zagadnienia Widma Radiowego (ERM) - Urządzenia nadawcze dla służby radiofonicznej wykorzystującej modulację częstotliwości (FM) - Część 2: Zharmonizowana norma EN zgodna z artykułem 3.2 dyrektywy R&TTE
Portuguese	Transmissores para o serviço de radiodifusão sonora em modulação de frequência (FM); Parte 2 :EN harmonizada cobrindo os requisitos essenciais no âmbito do artigo 3º do nº2 da Directiva R&TTE
Slovak	Elektromagnetická kompatibilita a závislosti rádiového spektra (ERM). Vysielacie zariadenia pre frekvenčne modulované (FM) rozhlasové vysielanie. Časť 2: Harmonizovaná EN podľa článku 3.2 smernice R&TTE
Slovenian	Elektromagnetna združljivost (EMC) in zadeve v zvezi z radijskim spektrom (ERM); Oddajniška oprema za radiodifuzijske storitve s frekvenčno modulacijo (FM); 2. del: Harmonizirani evropski standard EN v skladu s členom 3.2 direktive R&TTE
Spanish	Equipos transmisores para el servicio de radiodifusión en Modulación de Frecuencia(FM); Parte 2 : EN armonizada cubriendo los requisitos esenciales según el artículo 3.2 de la directiva de R&TTE
Swedish	Utrustning för frekvensmodulerad (FM) radiosändareservice; Del 2: Harmoniserade i enlighet med EN artikel 3.2 i R&TTE direktivet

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## History

<b>Document history</b>		
V1.1.1	October 2002	Publication
V1.2.1	June 2005	Public Enquiry PE 20051007: 2005-06-08 to 2005-10-07