

# INTERNATIONAL STANDARD

# IEC 60244-1

Second edition  
1999-12

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## Methods of measurement for radio transmitters –

### Part 1: General characteristics for broadcast transmitters

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*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



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International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland  
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: [inmail@iec.ch](mailto:inmail@iec.ch) Web: [www.iec.ch](http://www.iec.ch)



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**METHODS OF MEASUREMENT FOR RADIO TRANSMITTERS –  
Part 1: General characteristics for broadcast transmitters**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 60244-1 has been prepared by IEC technical committee 103: Transmitting equipment for radiocommunication.

This International Standard is one of a series of parts of IEC 60244, describing recommended methods of assessing the performance of radio broadcast transmitters. Several existing parts of IEC 60244 are currently under review and some of the older parts will be revised or withdrawn. When this process is completed, the overall standard will comprise part 1 which deals with general characteristics including cross-references to International Radio Regulations and relevant ITU-R\* publications, and a number of parts dedicated to particular types of equipment.

This second edition of IEC 60244-1 cancels and replaces the first edition published in 1968, the first supplement (1968) and its amendment 1 (1973), and amendment 2 (1989). This second edition constitutes a technical revision.

This standard shall be used in conjunction with the various parts of IEC 60244.

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\* Formerly CCIR.

The text of this standard is based on the following documents:

FDIS	Report on voting
103/14/FDIS	103/16/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes C and D form an integral part of this standard.

Annexes A, B and E are for information only.

The committee has decided that this publication remains valid until 2009.

At this date, in accordance with the committee's decision, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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## METHODS OF MEASUREMENT FOR RADIO TRANSMITTERS –

### Part 1: General characteristics for broadcast transmitters

#### 1 Scope

This part of IEC 60244 defines the general characteristics of broadcast transmitters and standardizes the conditions and methods of measurement to be used to ascertain the performance of a broadcast transmitter and to make possible the comparison of the results of measurements made by different observers.

The methods of measurement detailed in this standard are intended for type tests and may also be used for acceptance tests and factory tests (see clause 3).

This part of IEC 60244 does not specify limiting values of the various quantities for acceptable performance, as these should be given in the relevant equipment specification, preferably in the form laid down in an appropriate IEC recommendation.

#### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60244. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on part of IEC 60244 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60244-5:1992, *Methods of measurement for radio transmitters – Part 5: Performance characteristics of television transmitters*

IEC 60244-13:1991, *Methods of measurement for radio transmitters – Part 13: Performance characteristics for FM sound broadcasting transmitters*

IEC 60244-15:—, *Methods of measurement for radio transmitters – Part 15: Amplitude-modulated transmitters for sound broadcasting<sup>1)</sup>*

IEC 600651:1979, *Sound level meters*

ISO 3744:1994, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane*

ISO 3745:1977, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision methods for anechoic and semi-anechoic rooms*

ITU-R Recommendation 328-7 – *Bandwidth*

ITU-R Recommendation 559 – *Standard coloured noise signal*

ITU-R Report 275 – *Bandwidth*

ITU-R Report 324 – *Bandwidth*

Radio Regulations and appendices: Geneva, 1990

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<sup>1)</sup> To be published.

### 3 Definitions

For the purposes of this part of IEC 60244, the following definitions apply.

#### 3.1

##### **broadcast transmitter**

equipment producing radiofrequency energy for the purpose of terrestrial broadcasting

NOTE For the purpose of this standard, such auxiliary equipment as is necessary to maintain the transmitter in normal operation, together with any device to match the impedance of the antenna (or the antenna transmission line) to the transmitter, including harmonic or other filters, are to be considered as part of the transmitter.

#### 3.2

##### **broadcast transmitting system**

equipment comprising a broadcast transmitter connected to its antenna or antennas, or several transmitters connected to a common antenna

NOTE Unless specifically indicated, this standard refers only to single broadcast transmitters.

#### 3.3

##### **type tests**

series of tests including a design evaluation carried out on a representative sample of the transmitting equipment, with the object of determining that a particular manufacturer can be considered capable of producing products meeting the specification

#### 3.4

##### **factory tests**

tests carried out by the manufacturer to verify that his products meet the specification

#### 3.5

##### **acceptance tests**

tests to determine the acceptability of a consignment of transmitting equipment, carried out in the factory, or on site after commissioning the equipment, on the basis of an agreement between customer and manufacturer

The agreement shall cover

- a) the sample size;
- b) the selection of the tests;
- c) the extent to which the results of the selected tests should conform to the specification.

NOTE In the event of divergent test results, IEC standard test methods should be employed.

### 4 General conditions of measurement and operation

The operating conditions given in column a) shall apply during the measurements to confirm that the equipment meets the performance specification.

Outside the operating conditions in column a) but within the extended limits of column b), the performance specification limits may be relaxed, subject to acceptable transmission performance and conformity with the requirements of the Radio Regulations. It is desirable that the limits for such relaxed performance should be given in the specification.



	a)	b)
4.1 Temperature in the operating room	5 °C to 35 °C	1 °C to 45 °C
4.2 Relative humidity in the operating room	up to 75 %	up to 90 % (maximum temperature 26 °C)
4.3 Cooling air temperature*		
– entering the cooling system	–20 °C to +35 °C	–25 °C to +40 °C
– entering the transmitter	15 °C to 35 °C	–20 °C to +45 °C
4.4 Relative humidity of the cooling air entering the cooling system up to 25 °C	up to 95 %	up to 95 %
4.5 Air pressure	720 hPa to 1 060 hPa	720 hPa to 1 060 hPa
4.6 Immunity against mechanical vibrations airborne or air pressure related to $2 \times 10^{-5}$ Pa	up to 80 dB	up to 100 dB
4.7 Immunity against RF fields within the broadcasting bands		
– electric field strength, minimum	up to 10 V/m	up to 10 V/m
– for special requirements	up to 100 V/m	up to 100 V/m
4.8 Immunity against magnetic fields	up to 4 A/m	up to 4 A/m
4.9 Mains voltage**	+6 % to –10 %	sudden change of $\pm 10$ % of nominal value
4.10 Mains frequency	$\pm 2$ %	$\pm 5$ %

NOTE For transmitters of power above 100 kW, where compliance with these conditions is problematical, the manufacturer should stipulate the alternative limits he finds acceptable.

## 5 General performance characteristics

### 5.1 Transmission systems

(article 4.2 of the Radio Regulations)

The Radio Regulations designate emissions by a combination of numerals and letters according to their necessary bandwidth and classification. The designation for the necessary bandwidth always precedes the designation for the class of emission.

#### 5.1.1 Designation of necessary bandwidth

(article 4.2 of the Radio Regulations)

The necessary bandwidth, rounded to three significant figures, is expressed by three numerals with a letter in the position of the decimal point to represent the unit of bandwidth. H, K, M or G, respectively, are used for Hz, kHz, MHz and GHz.

\* For liquid cooled transmitters, special agreements are to be applied.

\*\* The output power of transmitters may vary dependent on the variation of the mains voltage.

### 5.1.2 Designation of class of emission (article 4.2 of the Radio Regulations)

<b>First symbol – Type of modulation of the main carrier</b>	<b>Symbol</b>
Emission of an unmodulated carrier	N
Double sideband	A
Single sideband, full carrier	H
Single sideband, reduced or variable level carrier	R
Single sideband, suppressed carrier	J
Independent sidebands	B
Vestigial sideband	C
Frequency modulation	F
Phase modulation	G
 <b>Second symbol – Nature of signal(s) modulating the main carrier</b>	
No modulation signal	0
A single channel containing quantized or digital information without the use of a modulating subcarrier	1
A single channel containing quantized or digital information with the use of a modulating subcarrier	2
A single channel containing analogue information	3
Two or more channels containing quantized or digital information	7
Two or more channels containing analogue information	8
Composite system with one or more channels containing quantized or digital information, together with one or more channels containing analogue information	9
 <b>Third symbol – Type of information to be transmitted</b>	
No information transmitted	N
Telegraphy for aural reception	A
Telegraphy for automatic reception	B
Data transmission, telemetry, telecommand	D
Telephony (including sound broadcasting)	E
Television (video)	F
Combination of above	W
 <b>Additional characteristics</b> (appendix 6 of the Radio Regulations)	
 <b>Fourth symbol – Details of signal(s)</b>	
Two-condition mode	A
Sound of broadcasting quality (monophonic)	G
Sound of broadcasting quality (stereophonic)	H
Monochrome	M
Combination of above	W
Colour	N
 <b>Fifth symbol – Nature of multiplexing</b>	
None	N
Frequency-division multiplex	F
Time-division multiplex	T

### 5.1.3 Examples

Example 1: 6M 25 C3FNF is the designation for a vestigial sideband, single-channel analogue television (video) emission in colour without any multiplexing. The necessary bandwidth is 6,25 MHz.

Example 2: 750 K F8EHN is the designation for an FM two-channel television sound broadcasting emission in stereo, without any multiplexing. The necessary bandwidth is 750 kHz.

## 5.2 Frequency (range, stability, etc.)

### 5.2.1 General

In order to achieve effective use of the radiofrequency spectrum and limit mutual interference caused by radio services occupying adjacent channels, any departure from the frequency assigned to a transmitter shall be kept within strictly observed limits. These are defined by the International Telecommunications Union and are laid down in the Radio Regulations (see annex C).

### 5.2.2 Characteristic frequency

A frequency which can easily be identified and measured in the occupied band of an emission.

The term "characteristic frequency" is used in this standard to denote the actual frequency of that component of the emission, the nominal value of which is the assigned frequency.

### 5.2.3 Frequency tolerance

The frequency tolerance is the maximum permissible departure of the characteristic frequency of an emission from the assigned frequency. The frequency tolerance is expressed in parts per  $10^6$  or in hertz.

### 5.2.4 Frequency stability

The frequency stability is the extent to which an emission maintains its assigned frequency within frequency tolerances.

A random departure from the assigned frequency is expressed as frequency error.

### 5.2.5 Frequency error

The frequency error is the difference between the assigned frequency and the characteristic frequency, and shall not exceed the specified frequency tolerance.

The maximum frequency error is expressed in hertz and shall be compared with the frequency tolerance in the Radio Regulations or with the relevant statement in the equipment specification.

### 5.2.6 Frequency drift

The frequency drift of an emission is the uncontrolled continuous and irreversible variation of frequency against a predetermined timescale.

The latter should be chosen to identify either short-term or long-term frequency variations, expressed in hertz against a defined timescale (see figure 1).

The frequency drift can also be expressed in  $10^6 (\Delta f/f_0)$ .

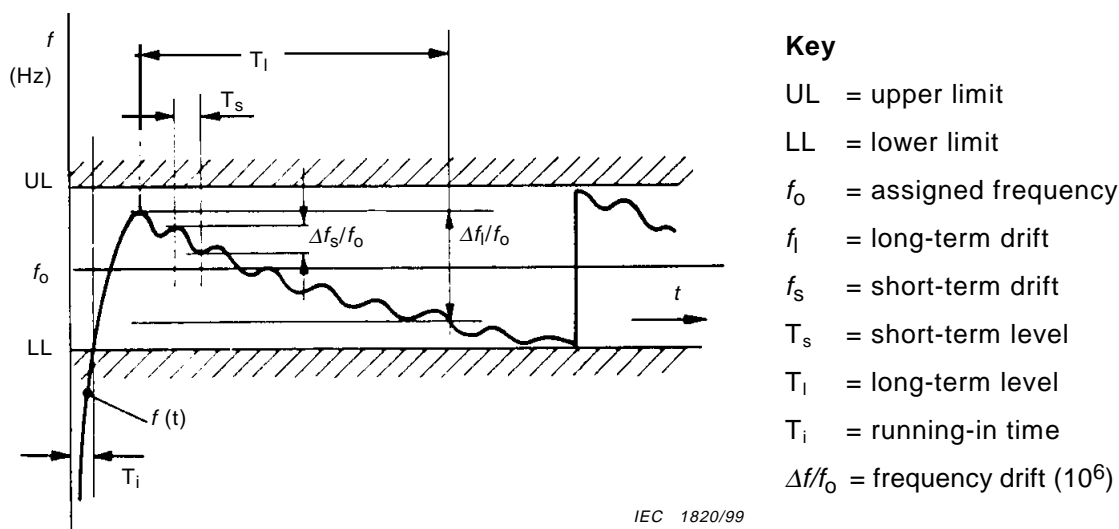


Figure 1 – Example of frequency drift as a function of time  $f(t)$

### 5.2.7 Frequency setting error

When a transmitter is set to a particular frequency, the characteristic frequency obtained will generally differ from the assigned frequency. This is the frequency setting error.

### 5.2.8 Conditions of operation

The transmitter shall be operated under the conditions given in clause 4. These conditions shall be clearly stated together with the conditions of modulation.

### 5.2.9 Methods of measurement of the characteristic frequency of an emission

The characteristic frequency may be measured with any suitable measuring device, provided that the accuracy attained during the measurement is better than approximately 10 % of the frequency tolerance or the frequency stability given in the relevant equipment specification of the transmitter.

For a tight frequency tolerance or a high degree of frequency stability, the measuring accuracy stated above puts higher demands on the accuracy of the measuring equipment.

Other methods of great precision use a standard reference frequency, the frequency of which is known with high accuracy. With such methods, the reception of a standard frequency transmission may be used to advantage.

When the frequency is to be measured as a function of time, measurements shall be made at intervals which are short enough to reveal the presence of superimposed periodical variations. In this case, the measurements shall preferably be made with a recording instrument.