

Methods of measurement for radio transmitters —

Part 13: Performance characteristics for FM sound broadcasting

The European Standard EN 60244-13:1993 has the status of a
British Standard

UDC 621.396.61:621.396.93:620.1.083:621.317.083

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This British Standard, having been prepared under the direction of the Electronic Equipment Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 December 1993

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The following BSI references relate to the work on this standard:
Committee reference EEL/25
Special announcement in *BSI News*, September 1993

ISBN 0 580 22647 6

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Cooperating organizations	Inside front cover
National foreword	ii
Foreword	2
Text of EN 60244-13	3
National annex NA (informative) Committees responsible	Inside back cover
National annex NB (informative) Cross-references	Inside back cover

National foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Policy Committee and is the English language version of EN 60244-13:1993, *Methods of measurement for radio transmitters —*

Part 13: Performance characteristics for FM sound broadcasting, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 244-13:1991, published by the International Electrotechnical Commission (IEC) and is part of a multi-part series describing recommended methods of measurement for assessing the performance of radio transmitters.

This Part of BS EN 60244 covers the method of measurement to assess the performance characteristics of frequency modulated transmitters for sound broadcasting and is intended to be used for type tests and acceptance or factory tests.

It is also intended to be used in conjunction with Parts 1 and 12-1 and 12-2¹⁾ of EN 60244, as well as with the CCIR Recommendations and Reports listed.

It is anticipated that the other Parts of IEC Publication 244 will be published as identical British Standards, subject to their harmonization by CENELEC. For ease of publication, some of the figures also include the French text.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 22, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ In preparation. It is envisaged that identical British Standards, designated BS EN 60244-1, BS EN 60244-12-1 and BS EN 60244-12-2, will be published in due course.

UDC 621.396.61:621.396.93:620.1.083:621.317.083

Descriptors: Radio equipment, transmitter, sound broadcasting, frequency modulation, operating characteristics, quality

English version

Methods of measurement for radio transmitters Part 13: Performance characteristics for FM sound broadcasting

(IEC 244-13:1991)

Méthodes de mesure applicables aux émetteurs
radioélectriques
Partie 13: Qualités de fonctionnement des
émetteurs de radiodiffusion sonore à
modulation de fréquence
(CEI 244-13:1991)

Meßverfahren für Funksender
Teil 13: Übertragungseigenschaften für
FM-Tonrundfunk
(IEC 244-13:1991)

This European Standard was approved by CENELEC on 1993-03-09. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 244-13:1991 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as European Standard.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as EN 60244-13 on 9 March 1993.

The following dates were fixed:

- latest date of publication
of an identical national
standard (dop) 1994-03-01
- latest date of withdrawal
of conflicting national
standards (dow) 1994-03-01

Annexes designated “normative” are part of the body of the standard. In this standard, Annex A, Annex B and Annex ZA are normative.

Contents

	Page
Foreword	2
Introduction	3
1 Scope	3
2 Normative references	3
3 General terms and definitions	3
4 General conditions of operation	4
5 General conditions of measurement	4
6 General characteristics	4
7 Transmission performance characteristics	4
8 Unwanted modulation	8
9 Out-of-band emission (Occasional measurement)	11
10 Assessment for transmitter equipped with limiters (Under consideration)	11
11 Special measurement for supplementary signals (Under consideration)	12
Measuring arrangement I	12
Measuring arrangement II	13
Annex A (normative) CCIR Recommendation 468-4	14
Annex B (normative) Extract from CCIR Recommendation 559	21
Annex ZA (normative) Other international publications quoted in this standard with the references of the relevant European publications	22
Figure 1a — Weighting network, simple form	14
Figure 1b — Frequency response of the weighting network shown in Figure 1a	15
Figure 2 — Maximum tolerances for the frequency response of the weighting network and the amplifier	16
Figure 3 — Constant resistance realization of weighting network	19
Figure 4	20
Figure 2	21
Figure 3 — Filter-circuit	21
Table I	15
Table II	17
Table III	17

Introduction

This International Standard is one of a series of parts of IEC 244.

A number of existing parts of IEC 244 are currently under review and several of these will be revised or withdrawn. When this process is complete, this series of publications will comprise one part dealing with general characteristics, with cross-references to relevant CCIR publications²⁾ and the Radio Regulations, and a number of specialized parts, each dealing with particular types of transmitter.

1 Scope

This International Standard contains the method of measurement to assess the performance characteristics of frequency modulated transmitters for sound broadcasting. To assess all other characteristics, this standard needs to be used in conjunction with the publications quoted in clause 2.

This standard is intended to be used for type tests and acceptance or factory tests.

It is not mandatory to measure all the described characteristics. Additional measurements may be carried out as an agreement between customer and manufacturer.

The performance characteristics measured in accordance with this standard makes possible the comparison of the results of measurements made by different observers.

Limiting values for acceptable performance are not covered by this standard but, in connection with the presentation of measured characteristics, some data are given for clarity.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

2.1 IEC publications

215:1987, *Safety requirements for radio transmitting equipment*.

Amendment No. 1 (1990).

244-1:1968, *Methods of measurement for radio transmitters — Part 1: General conditions of measurement, frequency, output power and power consumption (under revision)*.

Amendment No. 2 (1989) to IEC 244-1A (1968), *Methods of measurement for radio transmitters — Part 1: General conditions of measurement, frequency, output power and power consumption — First supplement: Appendices*.

244-12-1:1989, *Methods of measurement for radio transmitters — Part 12: Guideline for drawing up descriptive leaflets for transmitters and transposers for sound and television broadcasting — Characteristics to be specified*.

244-12-2:1989, *Methods of measurement for radio transmitters — Part 12: Guideline for drawing up descriptive leaflets for transmitters and transposers for sound and television broadcasting — Specification sheets*.

864-1:1986, *Standardization of interconnections between broadcasting transmitters or transmitter systems and supervisory equipment — Part 1: Interface standards for systems using dedicated interconnections*.

2.2 CCIR publications

Recommendation 450, *Transmission standards for FM sound broadcasting at VHF*.

Recommendation 468-4:1990, *Measurement of audio-frequency noise voltage level in sound broadcasting*.

Recommendation 559, *Objective measurement of radio-frequency protection ratios in LF, MF and HF broadcasting*.

Recommendation 643, *System for automatic tuning and other applications in FM radio receivers for use with the pilot-tone system*.

Report 463, *Transmission of several sound programmes or other signals with a single transmitter in frequency-modulation sound broadcasting*.

3 General terms and definitions

3.1 Frequency modulated sound transmitter

The term “frequency modulated sound transmitter” is used in this standard to denote equipment with a FM radio-frequency output and a baseband frequency input which can accept monophonic, stereophonic and supplementary service multiplexed signals.

²⁾ In most cases references to CCIR publications deliberately omit the revision number: it is assumed that reference will always be made to the later revision of CCIR publications. An exception is made here for Recommendation 468-4, whose text is reproduced in full in this publication.

3.2 Description of the transmission systems for FM sound broadcasting

The transmission systems for FM sound broadcasting are laid down in CCIR Recommendation 450.

Supplementary services are described in CCIR Report 463 and CCIR Recommendation 643.

3.3 Definitions of performance characteristics

These definitions are given in the clauses describing the method of measurement and are in line with those given in IEC 244-12-1 and IEC 244-12-2.

4 General conditions of operation

- The FM sound transmitter shall be tested under normal operating conditions at its rated output power.
- The mains supply and the environmental conditions shall be stated with the measurement results.
- The FM sound transmitter shall be connected to a test load which has an impedance expressed in terms of return-loss relative to the nominal load impedance of the transmitter of not less than 26 dB at frequencies within the FM broadcasting band and 16 dB at frequencies of any measured unwanted frequency outside this band.

5 General conditions of measurement

5.1 Input and output signal arrangements

- For the purposes of measurement, the input and output signal arrangements are shown in the form of diagrams given on pages 12 and 13.
- The impedance of the test equipment, the test object and all connections between them shall be accurately matched.
- The performance characteristics shall be measured via a directional coupler.

5.2 Measuring equipment

At the input:

- The modulating signals for the transmitter under test shall be provided by one or two baseband low distortion generators covering the frequencies up to 100 kHz.
- For stereophony, a stereo coder shall be used. If the transmitter does not incorporate a stereo coder, an external test stereo coder shall be used.
- If required auxiliary equipment for generating, supplementary signals will be used (e.g. RDS coder).

At the output:

- All measurements concerning the transmission performances shall be carried out at baseband signals, at the output of a test demodulator.
- For stereophony, the signals at the output of a test stereo decoder shall be measured.
- For supplementary signals, a test decoder shall be used (e.g. RDS decoder).

NOTE Because the results of these measurements are critically dependent on the performance of the test equipment, it is necessary to check first the overall performance of the test equipment in the absence of the transmitter under test.

5.3 Modulation and output power conditions

- The modulation conditions for each measurement are given in the clauses describing the method of measurement.
- The output power is the power of the unmodulated carrier.
- All measurements shall be carried out at rated output power.

5.4 Units used

As needed, results may either be given in decibels or as percentages.

6 General characteristics

The method of measurement of the general characteristics of the transmitter such as input impedance, output power and frequency stability will be described in IEC 244-1 (under revision).

7 Transmission performance characteristics

Measurement can be performed on baseband signals (at frequencies up to a maximum of 100 kHz) and/or audio-frequency signals (at frequencies up to 15 kHz).

The baseband measurements are made at the multiplex input of the transmitter. The audio band limiting and pre-emphasis in the transmitter and the de-emphasis in the demodulator are not in circuit, unless otherwise stated.

The audio-frequency measurements are made at the audio input of the transmitter. The audio band limiting and pre-emphasis in the transmitter or stereo coder and the de-emphasis in the demodulator or in the stereo decoder are in circuit, unless otherwise stated.

7.1 Amplitude/baseband-frequency characteristic

7.1.1 Definition

The amplitude/baseband-frequency characteristic is the variation of the amplitude of the demodulated signal with frequency for a constant value of the demodulating input signal voltage, relative to the amplitude at a certain reference frequency.

7.1.2 Measuring arrangement

Measuring arrangement I, page 12, with one signal generator at the input shall be used. The test demodulator output shall be connected to a spectrum analyser or voltage measuring equipment.

7.1.3 Measurement procedure

- Check that the pre- and de-emphasis filters and band-limiting filters are *out* of circuit.
- Adjust the input signal to a specified reference frequency.
- Adjust the input level so that the frequency deviation of the transmitter has a specified value.
- Vary the frequency of the modulating signal either manually or continuously by sweeping up to 76 kHz (some specifications ask for up to 100 kHz).
- Keep the input level constant.
- Measure the level of the demodulator output signal as a function of the modulation frequency.
- If required, repeat the procedure for other values of frequency deviation.

7.1.4 Presentation of the results

- The results may be presented as a table or a graph relative to the amplitude of the output at reference frequency. The frequency deviation at reference frequency shall be stated.

7.2 Baseband-frequency demodulation

7.2.1 Introduction

The method of intermodulation measuring is based on the method using two signals with frequencies f_1 and f_2 and equal amplitudes with a frequency difference $f_2 - f_1 = 1$ kHz. The products of interest are the difference tone of 1 kHz and $(f_1 + f_2)$ as the second order products and the tones 1 kHz below f_1 , $(f_1 - 1$ kHz), and 1 kHz above f_2 ($f_2 + 1$ kHz), as the third order products. The lowest frequency for f_1 shall be 3 kHz.

7.2.2 Definition

The second order (third order) intermodulation level is the ratio, expressed as a percentage or in decibels, between 1) the arithmetic sum of the r.m.s. values of the second order (third order) intermodulation component and 2) the arithmetic sum of the r.m.s. values of the wanted components at the demodulator output, for a modulation signal consisting of two tones of equal amplitude, generated within the baseband and spaced 1 kHz apart.

7.2.3 Measuring arrangement

Measuring arrangement I, page 12, shall be used. Two baseband generators are connected to the input of the transmitter. The isolation between the output of the generators shall be at least 40 dB. The spectrum analyser is connected to the output of the demodulator.

7.2.4 Measuring procedure

- Check that the pre- and de-emphasis filters and band-limiting filters are *out* of circuit.
- Adjust one input signal to frequency f_1 .
- Adjust the other input signal f_2 to a frequency 1 kHz higher.
- Adjust both input signals to the same level, so that one modulating signal gives 50 % of the specified deviation value of the transmitter under test.
- Vary the input frequencies up to 76 kHz keeping the input frequency spacing at 1 kHz and the frequency deviation constant (some specifications ask for measurements up to 100 kHz).
- Measure for a number of discrete frequencies the r.m.s. values of the second order and third order intermodulation components and the r.m.s. values of the wanted components at the output of the demodulator from the spectrum analyser.
- If required, repeat this procedure for other values of the frequency deviation.

NOTE Another value other than 1 kHz may be used for the frequency difference $f_2 - f_1$.

7.2.5 Presentation of the results

Components falling outside the frequency range shall not be taken into account.

The values of levels of each intermodulation component shall be given as a percentage or in decibels relative to the arithmetic sum of the wanted components. The results shall be presented in the form of tables or graphs as a function of the highest f_2 frequency. The frequency deviation shall also be stated with the results.