

Methods of measurement for radio transmitters —

Part 14: External intermodulation products caused by two or more transmitters using the same or adjacent antennas

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British Standard

ICS 33.060.20

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 20 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.

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English version

Methods of measurement for radio transmitters Part 14: External intermodulation products caused by two or more transmitters using the same or adjacent antennas

(IEC 60244-14:1997)

Méthodes de mesure applicables aux émetteurs
radioélectriques
Partie 14: Produits d'intermodulation à
l'extérieur du canal provoqués par deux
émetteurs ou plus utilisant la même antenne ou
des antennes adjacentes
(CEI 60244-14:1997)

Meßverfahren für Funksender
Teil 14: Externe Intermodulationsprodukte,
verursacht durch zwei oder mehr Sender,
welche gleiche oder benachbarte Antennen
benutzen
(IEC 60244-14:1997)

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

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Foreword

The text of document 103/2/FDIS, future edition 1 of IEC 60244-14, prepared by SC 12C (transformed into IEC TC 103, Transmitting equipment for radiocommunication), was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60244-14 on 1997-07-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-04-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1998-04-01

Endorsement notice

The text of the International Standard IEC 60244-14:1997 was approved by CENELEC as a European Standard without any modification.

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Introduction

Following the decision of the World Administrative Radio Conference held at Geneva in 1979 to extend the VHF/FM broadcast band to 108 MHz, the ITU-R¹⁾ has recommended more stringent limits on spurious emissions in some circumstances than those called for by the ITU Radio Regulations, in order to avoid interference to the aeronautical services.

Annex C, reproduced from CCIR Recommendation 329-6, summarizes in the form of a graph the requirements given in Provision 304 and Appendix 8 of the Radio Regulations, Geneva 1990 (see also Provisions 138, 139, 146 and 163 of the Radio Regulations, RR1-18/19/20/23, Sec. VI and VII).

1 Scope

This part of IEC 60244 details a measurement method for external intermodulation products (intermodulation components) caused by two or more transmitters using the same or adjacent antennas. It describes recommended methods of assessing the performance of radio broadcast transmitters.

The purpose of the measurements described in clauses 4 and 5 of this part is to prove, as far as possible, that the requirements of the Radio Regulations with respect to maximum permissible radiated levels of intermodulation products from LF, MF, HF, VHF, UHF and SHF transmitters will be fulfilled when two or more transmitters use the same or nearby antennas.

The method of measurement given in this part is not appropriate for type tests and IT SHOULD BE NOTED THAT THE MEASUREMENTS ARE TO BE CARRIED OUT ONLY WHEN MUTUALLY AGREED between the purchaser and supplier of the equipment.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60244. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60244 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ITU-R¹⁾ Recommendation 329-6:1994, *Spurious emissions (Fasc. I)*.

Radio Regulations and Appendices: Geneva 1990

3 Definitions

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

3.1

external intermodulation products and spurious emission

intermodulation products are classified by the Radio Regulations as spurious emissions, i.e., emissions on frequencies outside the necessary bandwidth, the levels of which may be reduced without affecting the corresponding transmission of information. In addition to intermodulation products, spurious emissions include harmonic emissions, parasitic emissions and frequency conversion products, but exclude out-of-band emissions

external intermodulation products result from intermodulation between the various transmissions when different transmitters make use of antennas located close together, or share the same antenna the external intermodulation products (components) may be caused by non-linearity in the output stage of a transmitter if the transmission from another transmitter is superimposed on its own. Such intermodulation may result from coupling between open transmission lines, switching units, nearby antennas (see Figure 6) or imperfect separation in the combining network between transmitters sharing the same antenna. External intermodulation products may also be produced if an interfering transmission penetrates the driver stages of a transmitter

3.2

out-of-band emission

emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions

3.3

harmful interference

interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with the Radio Regulations

¹⁾ Formerly CCIR.

3.4 necessary bandwidth

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

3.5 type A-mode interference (applies to VHF/FM broadcast services only)

type A-mode interference relates to interference radiated from VHF/FM broadcast transmitters at or near the frequency of aeronautical services in the adjacent band from 108 MHz to 137 MHz

the ITU-R subdivides type A-mode interference into type A1-mode and type A2-mode

— Type A1-mode interference comprises radiated intermodulation products from broadcast transmitters generated in the aeronautical band from 108 MHz to 137 MHz.

It is generally a low-level effect but may be of significance at – 100 dB, or lower, relative to the transmitter carrier reference level. It is a form of spurious emission and can be regarded as harmful interference as defined in the Radio Regulations.

— Type A2-mode interference relates to out-of-band emissions from broadcast transmitters on frequencies just below 108 MHz to aeronautical services just above 108 MHz.

4 General measuring procedure

4.1 Introduction

The following procedures assume the measurements are made manually using readily available test equipment and components. However, the precautions which need to be observed to avoid errors also apply to automatic measurements using specially designed equipment for the continuous monitoring of critical transmitter installations.

The methods described are suitable for measurements of type A1-mode interference down to at least – 100 dB relative to the reference carrier level. Theoretical considerations, including nomenclature used in all formulae in this standard, are detailed in Annex A.

Procedures are given for on-site measurements of signals derived from directional couplers in the feeders between the transmitters and the antennas and also for off-air measurements.

4.2 Measurements in transmitter feeders

a) The test equipment is connected to the transmitter system which is to be measured as shown in Figure 1.

b) With the stop filters (one for each transmission) switched out of circuit, measure the levels of the unmodulated carrier frequencies to establish a reference level against which intermodulation products (hereinafter “IPs”) can be measured. If the transmitter powers are not equal, the lowest power transmission should be used as the reference.

c) Switch in all the stop filters and tune each to give maximum attenuation at the appropriate carrier frequency so that each of the carriers is attenuated by approximately 55 dB, for example. (The attenuation is to be determined by the dynamic range of the spectrum analyzer.)

d) Calculate the frequencies at which IPs can be expected to occur using the formulae given in clause A.2, and measure the level of each of these IPs relative to the reference carrier, using the spectrum analyzer.

4.3 Precautions to be observed when making measurements

a) Ensure that levels into the spectrum analyzer are sufficiently low to avoid IP generation within the analyzer itself. This may be checked simply by attenuating the input to the spectrum analyzer by 3 dB and noting that all IPs are also reduced by 3 dB.

b) Verify that signals identified as IPs are generated in the transmitter system by switching off the transmitters in turn.

c) Correct the measured values of the IPs to allow for any differences in performance at the carrier frequencies and IP frequencies of the following:

- directional coupler;
- stop filter insertion loss (this is particularly important for any IP close to a carrier frequency);
- main transmitting feeder loss.

NOTE The measurement described in 4.2 does not represent the actual radiated level from the antenna. To obtain the radiated level, correct the results as described in 4.3 c), taking into account the frequency response and/or VSWR of the antenna.

4.4 Off-air measurements

a) Connect the test equipment to a calibrated broad-band receiving antenna at the location where the measurements are to be made, as shown in Figure 2.

b) Carry out the tests described in 4.2 b), 4.2 c), and 4.2 d).