
Methods of

Measuring and expressing the performance of radio receivers for sound broadcasting

Part 3. Radio-frequency measurements on receivers for amplitude-modulated emissions

[IEC title : Methods of measurement on radio receivers for various classes of emission
Part 3 : Radio-frequency measurements on receivers for amplitude – modulated emissions]

Méthodes de mesurage et d'expression des performances des récepteurs radioélectriques
pour la radiodiffusion sonore

Partie 3. Mesures aux fréquences radioélectriques sur les récepteurs
pour émissions à modulation d'amplitude

Verfahren zur Messung und Bezeichnung der Leistung von Radioempfängern für Hörfunk
Teil 3. Radiofrequenzmessungen auf Empfängern für Sendungen mit Amplitudenmodulation

National foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Committee and is Part 3 of a revision of BS 4054 which was first published in 1966. It is identical with IEC Publication 315-3 'Methods of measurement on radio receivers for various classes of emission Part 3 : Radio-frequency measurements on receivers for amplitude-modulated emissions', published by the International Electrotechnical Commission (IEC).

This British Standard is divided into five Parts of which this is Part 3. The other Parts are as follows :

- Part 1. General conditions
- Part 2. Measurements related to the audio-frequency part of the receiver
- Part 4. Radio-frequency measurements on receivers for frequency-modulated emissions (In course of preparation)
- Part 5. Measurements on frequency-modulated receivers of the response to impulsive interference.

Discussions are taking place within IEC on the preparation of an international standard that will form the basis of Part 4. Until international agreement is reached, BS 4054 : 1966, with amendments AMD 1451 and AMD 3288, will be retained for r.f. measurements on f.m. receivers.

Terminology and conventions. The text of the international standard has been approved as suitable for publication, without deviation, as a British Standard. Some terminology and certain conventions are not identical with those used in British Standards ; attention is especially drawn to the following.

Wherever the word 'Recommendation' appears, referring to this standard, it should be read as 'British Standard'.

NOTE. References to page numbers relate to the IEC page numbers given in brackets at the bottom of each page.

Cross-references

International standard	Corresponding British Standard
IEC 315	BS 4054 Methods of measuring and expressing the performance of radio receivers for sound broadcasting
Part 1 : 1970	Part 1 : 1980 General conditions (Identical)
Part 2 : 1971	Part 2 : 1980 Measurements related to the audio-frequency part of the receiver (Technically equivalent)

At present there is no corresponding British Standard to CISPR Publication 1 but the reference is for information only. The references made to CCIR publications are for information only.

The related British Standard for IEC 106 : 1974 is BS 905 : 1969.

NOTE. *Textual errors.* When the text of the international standard was adopted, the errors listed below were noticed. They have been reported to IEC in a proposal to amend the text of the international standard.

Clause 4, line 1 (IEC page 15). 'distortion' should be inserted after 'overall harmonic'.

Clause 8. The last three paragraphs should have been printed in text-size type and not in smaller type, as they are part of the requirements of the clause and not a continuation of the note.

Clause 20, line 3 (IEC page 31). 'Part 1' should be deleted and replaced by 'Part 2'.

Clause 21, lines 3 and 4 (IEC page 35). 'Part 1' should be deleted and replaced by 'Part 2'.

Clause 22, line 2 (IEC page 35). 'Part 1' should be deleted and replaced by 'Part 2'.

Clause 38, line 2 (IEC page 55). 'Clause 31' should be deleted and replaced by 'Clause 32'.

Clause 44, paragraph 2 of paragraph a), line 1 (IEC page 61). 'Clause 41' should be deleted and replaced by 'Clause 37'.

Clause 49, paragraph 2 (IEC page 69). 'Clause 48' should be deleted and replaced by 'Clause 47'.

Clause 51, paragraphs 1 and 4, line 1 (IEC page 71). 'Part 1' should be deleted and replaced by 'Part 2'.

Clause 59, line 5 (IEC page 81). 'Part 1' should be deleted and replaced by 'Part 2'.

Clause 60, penultimate line (IEC page 83). A comma should be inserted after 'sensitivity'.

Clause 79, paragraph 3 of paragraph b) (IEC page 97). The second sentence 'The signal to noise ratio used for determining the noise-limited sensitivity shall be stated' should be deleted.

Clause 83, line 9 (IEC page 99). In the definition of the Boltzmann constant, the symbol for the unit 'kelvin' should be 'K'.

In tables I, II, IIA and III, the symbol ' μ ' should be printed thus, i.e. in upright, not sloping type.

Clarification of intention. When this British Standard is used, the following points should be noted.

In clause 8, paragraph 10 (IEC page 17), the second sentence should be read as : 'If the audio-frequency part of the receiver cannot be considered to give negligible distortion at the chosen standard output power for these frequencies, the measurements shall be carried out using the arrangement given in Figure 1'.

In clause 66 (IEC page 87) the note should be read as though the words 'with an accuracy of 1 %' were deleted.

In clause 80 (IEC page 97) the definition should be read as :

'The gain limited sensitivity of the receiver is equal to the minimum level of the radio-frequency input signal, expressed in dB(μ V), dB(pW) or dB(μ V/m) depending on the type of the receiver, applied according to Chapter III of Part 1, and modulated 30 % at the standard reference frequency, which produces the reference output power (see clause 29 of Part 2 : 1980)'.

IMPORTANT NOTE. It is essential that this Part be read, where applicable, in conjunction with Part 1 of this British Standard.

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British Standard Methods of

Measuring and expressing the performance of radio receivers for sound broadcasting

Part 3. Radio-frequency measurements on receivers for amplitude-modulated emissions

CHAPTER I: GENERAL

SECTION ONE — INTRODUCTION

1. Object

This recommendation forms Part 3 of a series of recommendations which are intended to standardize the conditions and methods of measurement to be used to determine the characteristics of a radio receiver, so as to make possible the comparison of results of measurements made by different observers. Limiting values of the various quantities for acceptable performance are not specified.

These parts constitute a catalogue of selected measurements, recommended for assessing the essential properties of radio receivers. They are neither mandatory nor limiting, a choice of measurements being made in each particular case. If necessary, additional measurements may be carried out, if applicable, in accordance with recommendations laid down by other IEC Technical Committees or Sub-Committees or by other international bodies.

The methods of measurement are generally conceived to permit analysing the overall performance of the receiver, considered as a quadripole (two-port), without endeavouring to study its elements separately.

However, depending on the characteristic to be measured and the type of the receiver, it may be practicable, for experimental simplification or other reasons, to carry out measurements on parts of the receiver by injection or extraction of signals at appropriate places in its circuits.

2. Scope

This part describes various methods of measurement for assessing those radio-frequency properties of radio receivers for amplitude-modulated emissions, including particularly those for sound broadcast emissions of the full-carrier double-sideband type, which are not dealt with in other parts of this publication.

Methods of measurement of the susceptibility to interference acting through ways other than the normal aerial input circuit, and more particularly applicable to receivers for sound broadcast emissions, are included but are restricted to the frequency range of 150 kHz to 30 MHz.

This part is intended to be used with the following parts of IEC Publication 315: Methods of measurement on radio receivers for various classes of emission:

Part I (IEC Publication 315-1): General conditions for measurements and measuring methods applying to several types of receivers;

Part II (IEC Publication 315-2): Measurements particularly related to the audio-frequency part of a receiver.

These parts include general conditions and methods of measurement for various properties, including radio-frequency and audio-frequency properties, which are deemed to be applicable to all types of receivers.

This part does not deal with radiation from radio receivers. For this subject reference is made to IEC Publication 106: Recommended methods of measurement of radiation from receivers for amplitude-modulation, frequency-modulation and television broadcast transmissions.

3. General notes on measurements

As the results of various measurements described in this part may be influenced by other properties of the receiver, it is recommended that the various related measurements, given in Part 1 and Part 2 of this publication shall be carried out first.

Attention is drawn to the fact that it is considered advantageous to combine certain measurements e.g. those related to automatic gain control (Section Twenty-four) and the measurement of the operating frequency as a function of the input signal level (Clause 70 of Part 1). Unless otherwise specified, all measurements shall be carried out under the conditions as specified in Part 1 of this publication.

In general, where the term “radio-frequency” is used, intermediate frequency is deemed to be included, unless specifically excluded.

CHAPTER II: DISTORTION

SECTION TWO — OVERALL HARMONIC DISTORTION AND OVERALL MAXIMUM USEFUL OUTPUT POWER

* 4. Introduction

The overall harmonic is determined as the total harmonic distortion in the electrical audio-frequency output power, measured at a specified radio-frequency input signal level.

5. Method of measurement

Since the maximum useful output power obtainable when actually receiving radio-frequency emissions may not be equal to that measured on the equipment used as an audio-frequency amplifier, the measurement according to Clause 9 of Part 2 shall be repeated using the indirect method according to Clause 10 of Part 2, with a 30% modulated radio-frequency signal in accordance with Chapter IV of Part 1, with a specified input level, the output being adjusted by varying the volume control setting.

This measurement shall be repeated, applying an 80% modulated radio-frequency signal.

Unless otherwise specified, and depending on the type of receiver, the following radio-frequency input levels shall be applied:

- 80 dB (μV) for open aerial receivers;
- 40 dB (pW) for input circuits for specified source impedances or the relevant corresponding voltage E' , expressed in dB (μV), for the specified source impedance;
- 80 dB ($\mu\text{V}/\text{m}$) for magnetic aerials.

The audio-frequency output power is measured and the distortion is recorded as a function of this output power.

The measurement shall be repeated at all output terminals.

6. Presentation of the results

The curves resulting from the measurements, take the same form as that given in Figure 4 of Part 2. From each curve a maximum useful output power (see Clause 29 of Part 2) is derived corresponding to the overall harmonic distortion of the receiver at the specified input level and the specified modulation factor. The lower of these values of maximum useful output power is the overall maximum useful output power, from which the overall reference output power, 10 dB less, can be derived.

SECTION THREE — DISTORTION CAUSED BY THE RADIO-FREQUENCY, INTERMEDIATE-FREQUENCY AND DETECTOR STAGES

7. Introduction

When, according to Chapter II of Part 2, the distortion in the audio-frequency stages and the maximum useful output power have been measured, the influence of the radio-frequency stages, the intermediate-frequency stages and the detector stage on the total distortion remains to be assessed.

In general, this influence can be determined by measuring the overall distortion of a radio receiver under such conditions that the distortion in the audio-frequency stages is negligible.

Also the distortion arising from inaccuracy of tuning may be assessed (see Clause 10).

* See national foreword regarding textual error.

*** 8. Method of measurement with correct tuning**

A signal at a preferred measuring frequency, 80% amplitude modulated at the standard reference frequency, is applied to the receiver, which shall be tuned for minimum distortion (see Clause 55c of Part 1).

The input signal level shall be equal to the noise-limited sensitivity (see Section Twenty) for a chosen value of signal-to-noise ratio (e.g. 20 dB).

With the selectivity controls set to give the widest possible radio-frequency pass-band and with normal setting of the tone controls (see Clauses 27, 28 and 29 of Part 1), the volume control shall be adjusted to obtain a value of standard output power (Clause 36 of Part 1) for which the distortion is negligible and which is at least 20 dB below the overall maximum useful output power, as determined according to Clause 5, for 80% modulation.

The input signal is then increased, adjusting each time both the tuning for minimum distortion and the volume control so as to keep the output power constant and equal to the chosen value. The value of the harmonic distortion in the output circuit as a function of the signal level is noted.

The automatic gain control shall be on and off in turn if a switch is provided. If a local-distant switch is incorporated in the receiver, the measurement shall be carried out for each position of the switch. The measurement may be repeated with other modulation factors, 30% for example.

The measurement shall be repeated, applying a fixed input signal level of a suitable recommended value, according to Clause 51 of Part 1 varying the modulation factor, recording the harmonic distortion in the output power as function of the modulation factor.

For these measurements, the signal generator used shall have a modulation distortion very low compared with the distortion to be measured.

If a distortion meter of very high input impedance and adequate sensitivity is available, the preceding measurement may be made by connecting the distortion meter to the terminals of the load impedance of the detector through a suitable capacitor.

As the ratio between the d.c. load and the a.c. load of a detector circuit practically never equals unity, clipping distortion may occur above a certain modulation factor, depending on the value of the modulation frequency.

Therefore the measurement of the harmonic distortion as a function of the modulation factor shall be repeated at modulation frequencies below and above 1 kHz, chosen from Table II of Clause 31 of Part 1. These measurements shall preferably be carried out using the arrangement given in Figure 1, page 19, unless the audio-frequency part can be considered to give negligible distortion at the chosen standard output power.

These measurements may be repeated with other positions of the radio-frequency and/or intermediate-frequency gain control and with various positions of the selectivity control, from which the most unfavourable condition may be found.

Note. — The form of the pass-band (see Section Five) may affect distortion by giving rise to either a decrease or an increase of the modulation factor of the signal at the detector.

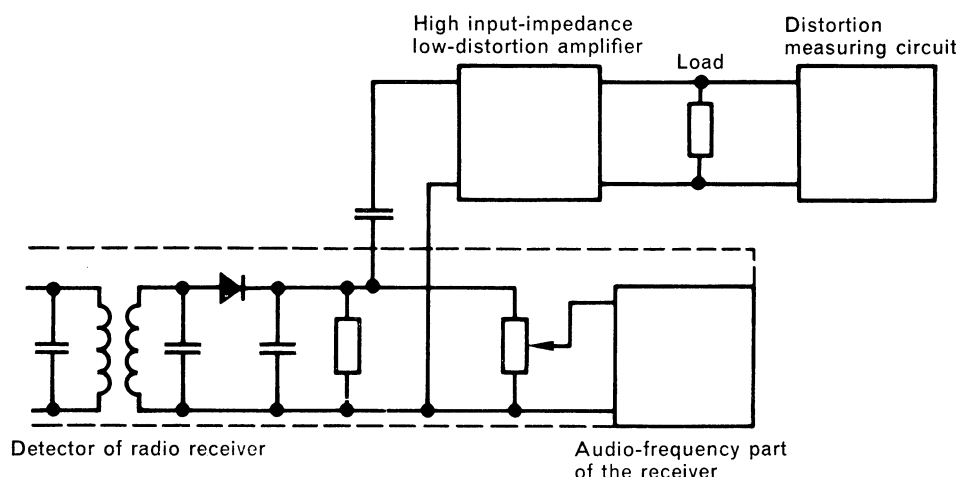


FIG. 1. — Example of the connection of an amplifier for the measurement of distortion caused by the radio-frequency, intermediate-frequency and detector stages of a receiver.

The measurements shall be repeated at all available output terminals and may be repeated at other operating frequencies.

The measurements may also be performed directly after the detector stage by connecting an amplifier, via a suitable capacitor, to the load circuit of the detector, the input impedance of this amplifier being sufficiently high in relation to the load circuit. The amplifier shall not introduce distortion influencing the accuracy of the measurement over the envisaged range of input levels (see Figure 1 above).

After establishing the initial level of the input signal of the receiver according to the first method, the volume control is set at zero position and the distortion measurements are performed at the suitably loaded output circuit of the amplifier.

9. Presentation of the results

Curves showing harmonic distortion as a function of the input signal level are plotted with the input signal level as abscissa and the distortion as ordinate.

The input level is expressed in dB (μV), with a reference to the specified source impedance, in dB (pW) or in dB ($\mu\text{V/m}$), whichever is applicable, and a linear scale is used for both abscissa and ordinate (see Figure 2, page 21).

Curves showing harmonic distortion as a function of the modulation factor are plotted with the modulation factor as abscissa and the distortion as ordinate, both on a linear scale and expressed as percentages, indicating the modulation frequency as the relevant parameter (see Figure 3, page 21).

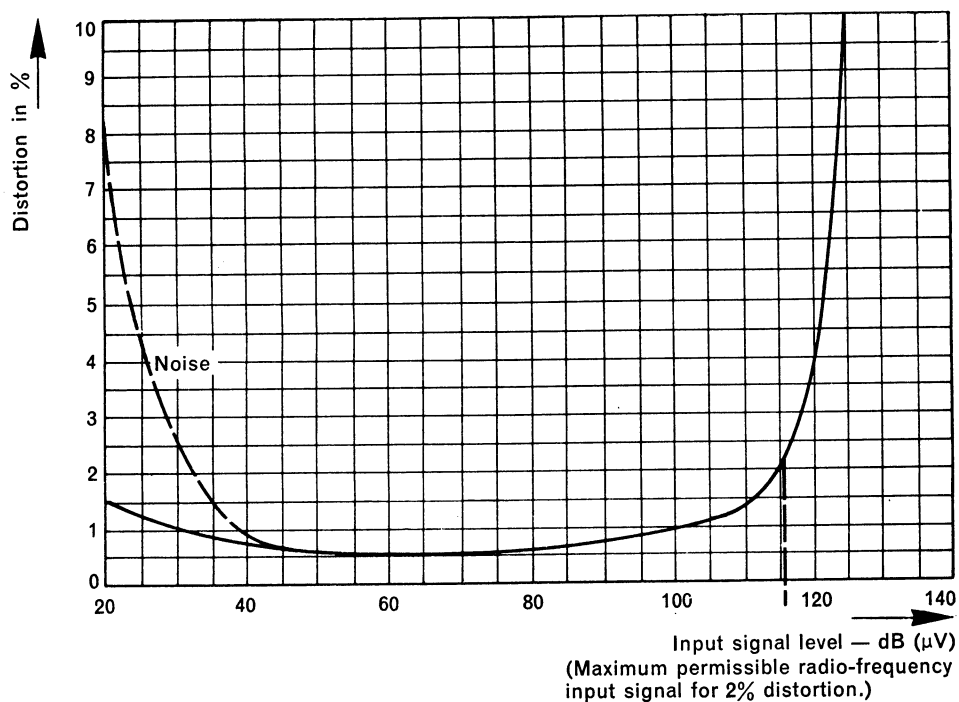


FIG. 2. — Harmonic distortion as a function of the radio-frequency input signal level, with a modulation frequency of 1 000 Hz, at 80% modulation, measured for a standard output power of 50 mW.

Note. — The curve marked “ noise ” shows the apparent distortion due to noise when a distortion factor meter is used.

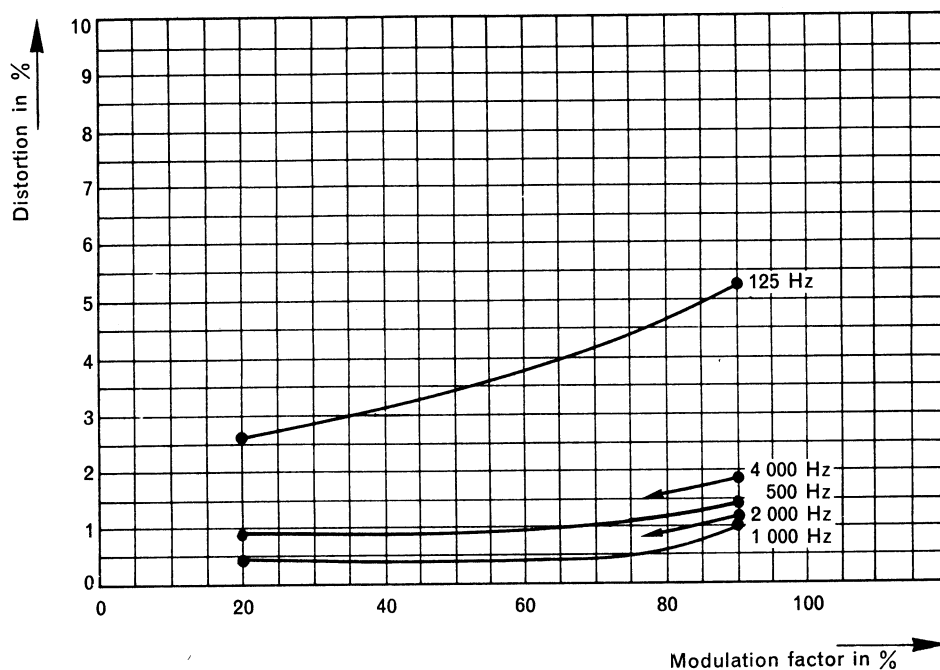


FIG. 3. — Harmonic distortion as a function of the modulation factor for an output power of 50 mW, with an input signal level of 80 dB (μ V) and various modulation frequencies.

Figures 2 and 3 show respectively an example of a curve for the distortion as a function of the radio-frequency input signal level and an example for the same distortion as a function of the modulation factor.

10. Distortion arising from inaccuracy of tuning

The method of measurement of distortion given in Clause 8 uses the tuning position of minimum distortion and this may not coincide with the tuning position for maximum audio-frequency output power (see Clause 55b of Part 1). In addition, the tuning position may vary according to the input signal level and/or the modulation factor of the signal. In order to assess these properties, the distortion caused by the radio-frequency, intermediate-frequency and detector stages is measured at several frequencies within the passband of the receiver. As regards distortion, the permissible departure of the various tuning positions in receivers with push-button or automatic search systems (see Clauses 77, 78, 79, 80, 81 and 82 of Part 1) from the frequency corresponding to minimum non-linearity distortion of the radio-frequency, intermediate-frequency and detector stages is determined by setting a limit to the non-linearity distortion as measured at the frequencies within the passband.

11. Method of measurement

The receiver is tuned for maximum audio-frequency output power (see Clause 55b of Part 1) at a preferred measuring frequency 30% amplitude modulated at the standard reference frequency, and at the lowest recommended input signal level at which measurements are taken.

With the selectivity controls set to give the widest possible radio-frequency pass-band and with normal setting of the tone control (see Clauses 27, 28 and 29 of Part 1), the volume control shall be adjusted to obtain a value of standard output power (see Clause 36 of Part 1) for which distortion is negligible, and which is at least 20 dB below the overall maximum useful output power, as determined according to Clause 5, for 80% modulation (alternatively, see Clause 8 for measurements at the detector stage). This standard output power is used for all measurements of this Clause.

The harmonic distortion is measured for 30% modulation and the measurement is repeated with the input signal frequency varied in convenient steps within the passband of the receiver, with the volume control adjusted to give the chosen value of the standard output power.

The measurements are repeated at other recommended input signal levels and with 80% modulation.

The method shall be used for all spot frequencies which are preselected in a push-button system and may be repeated at other preferred measuring frequencies.

At each of the input signal levels and modulation factors used, the relevant tuning positions shall be determined by tuning the signal generator until the conditions *a)*, *b)* and *c)*, as given in Clause 55 of Part 1 are met. The relevant frequencies shall be noted.

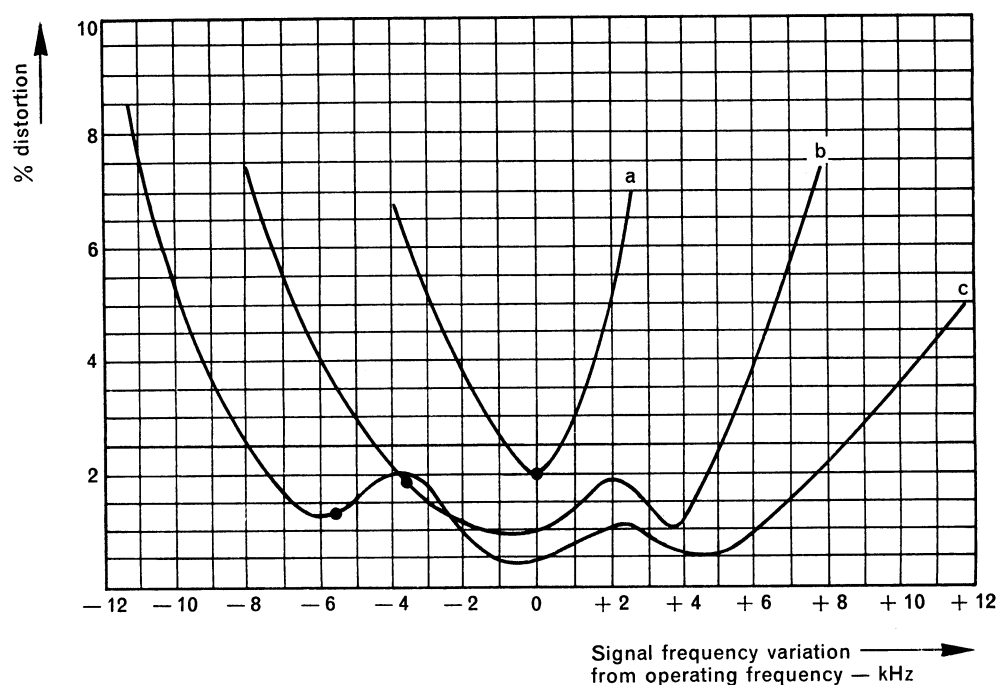
12. Presentation of the results

Curves showing non-linearity distortion are plotted with signal-frequency variation as abscissa and distortion as ordinate, both on a linear scale.

The tuning positions for maximum audio-frequency output are indicated by dots on the graph.

For push-button systems, the chosen limit of the non-linearity distortion is indicated and the permissible frequency variations from the appropriate tuning positions are determined.

An example of curves showing non-linearity distortion as a function of signal-frequency variation is shown in Figure 4.



Radio-frequency input signal level for a, b and c is 60 dB ($\mu\text{V/m}$), 80 dB ($\mu\text{V/m}$), 100 dB ($\mu\text{V/m}$), respectively, at 1 MHz, with 30% modulation. Tuning positions for maximum output power are indicated. Audio-frequency output power: 50 mW.

FIG. 4. — Non-linearity distortion as function of signal-frequency variation.

13. Maximum permissible radio-frequency input signal

The maximum permissible radio-frequency input signal is the highest level of the input signal, modulated 80%, for which the distortion, as measured in accordance with Clause 8, reaches the value specified for determining the overall maximum useful output power (see Clause 6).

It is expressed in dB (μV), with a reference to the specified source impedance, dB (pW) or dB ($\mu\text{V/m}$), depending on the type of the receiver and its value can be derived from the presentation of results as indicated on Figure 2, page 21.

CHAPTER III: RADIO-FREQUENCY SELECTIVITY

SECTION FOUR — INTRODUCTION

14. General notes on selectivity

The selectivity of a receiver is a measure of its ability to discriminate between a wanted signal to which the receiver is tuned (operating frequency, see Clause 61 of Part 1) and unwanted signals entering through the normal aerial circuit. For measurements relating to signals acting on the receiver through other ways than the normal aerial circuit, see Chapter IV.

Single-signal selectivity measurements mainly assess the characteristics of the receiver when operating in a linear mode, while multiple-signal selectivity measurement assess also the effects of non-linearity. In most cases, the latter will consist of two-signal methods.

15. Single-signal selectivity measuring method

The single-signal selectivity measuring method is used to express the performance of a limited number of characteristics of the receiver. The measurements are made at sufficiently low levels of radio-frequency input signals, to avoid non-linearity (e.g. overloading) affecting the results; the automatic gain control, automatic frequency control, etc., being rendered inoperative during the measurements.

16. Multiple-signal selectivity measuring method

The measurement of selectivity with more than one signal shall be the general method for measuring selectivity. Sometimes the non-linear effects are numerous, and then it will be necessary to select the most representative cases in order to simplify the measurements.

SECTION FIVE — PASS-BAND AND ATTENUATION SLOPE

17. Definitions

The *pass-band* B_a , is the band of radio-frequencies or intermediate frequencies limited by the two frequencies for which the attenuation exceeds that at the most favoured frequency by some agreed value (a) dB (see Clause 19).

Note. — The CCIR suggests that this value in general be 6 dB, except for high-quality radio telephony receivers, where this value is 2 dB (Rec. 332-1).

The *attenuation slope* on each side of the pass-band is the ratio of the difference in the attenuations corresponding to two different frequencies beyond the pass-band, to the difference between these frequencies. It is expressed in dB/Hz or dB/kHz (see Clause 19).

Notes 1. — This property is important in those cases where an excessively large attenuation slope may lead to serious distortion of the phase/frequency characteristics in the pass-band.

2. — The CCIR suggests that sufficient indication of single-signal selectivity is obtained by considering the frequency differences corresponding to attenuations of 20 dB, 40 dB, 60 dB and, if possible, 80 dB, reckoned from the limit frequencies of the pass-band. These differences are indicated as B_{a+20} , B_{a+40} , B_{a+60} and B_{a+80} , respectively. If the values thus obtained are essentially equal for the two sides of the pass-band, it is sufficient to give mean values.

3. — An alternative method of obtaining sufficient indication of single-signal selectivity is to consider the frequency difference corresponding to attenuations of 20 dB, 40 dB, 60 dB and if possible, 80 dB, higher than that at the actual operating frequency. These differences are indicated as B_{20} , B_{40} , B_{60} and B_{80} respectively.

18. Method of measurement

An unmodulated radio-frequency signal with a recommended frequency and a recommended level shall be applied according to Chapter IV of Part 1. The input level shall be low enough to avoid non-linearity, yet be high enough to ensure that the detector is deemed to function reasonably linearly. The receiver shall be tuned for maximum direct current or voltage of the detector, this value being noted.

If applicable, the voltage produced by the automatic gain control for the chosen value of radio-frequency input level shall be measured and replaced by a fixed bias of the same value, the automatic gain control, the automatic frequency control, etc., being rendered inoperative.

If a selectivity control is incorporated in the receiver, the measurement shall be made at least at the extreme positions of this control and may be repeated at other well-defined positions.

By varying the tuning of the signal generator, a determination shall be made of the frequencies on either side of the operating frequency for which the signal level has to be increased by each of a range of values including those shown hereafter, in order to keep the direct current or voltage of the final detector at the noted level.

- a) The specified value (a) dB, which determines the pass-band B_a , and
- b) the values $(a + 20)$ dB, $(a + 40)$ dB, $(a + 60)$ dB and if possible also $(a + 80)$ dB, necessary to determine the attenuation slopes, or
- c) the values 20 dB, 40 dB, 60 dB and if possible also 80 dB. The chosen values shall be indicated with the results.

Note. — In certain cases, where insufficient measuring equipment is available or where the d.c. output of the detector is inaccessible, a less accurate method can be used, applying a 30% modulated radio-frequency input signal, with a low modulation frequency (125 Hz or lower), measuring and keeping constant a chosen standard output power (Clause 36 of Part 1). Attention is drawn to the fact that the slope of the pass-band curve may give rise to apparent asymmetric modulation effects, affecting the results of the measurement.

19. Presentation of the results

Curves showing the pass-band and values of the attenuation slope of a receiver are plotted with the frequency difference in Hz or kHz as abscissa and the change of the signal level in dB as ordinate, both on a linear scale, the value of the originally chosen radio-frequency input level for the operating frequency of the receiver being considered as the zero-reference level. If the frequency-difference values obtained from the measurement are essentially equal for the two sides of the pass-band, it is deemed sufficient to give mean values. An example of such a curve is given in Figure 5, page 31. For the purpose of statistical comparison, these results may also be shown in the form of Table I, in which a reference coding is given in order to define the type of the measurement.

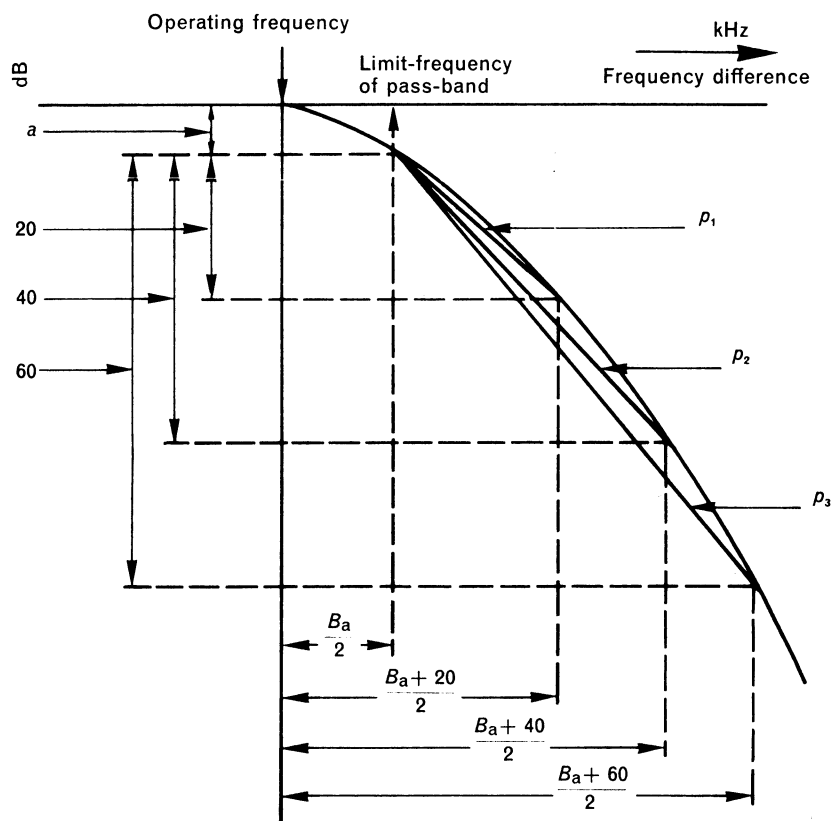


FIG. 5. — Example of an attenuation curve of a radio-receiver, indicating the pass-band and various attenuation slopes (mean values reduced to pseudo-symmetrical case).

The bandwidth at a specified level can be calculated from the formula:

$$B_{a+20n} = B_a + 20 (2n/p_n)$$

- where: a = the attenuation at the limit frequency of the pass-band;
 B_a = the pass-band, as defined in Clause 17;
 B_{a+20n} = the bandwidth at a level $(a + 20n)$ dB below the level at the operating frequency;
 p_n = the attenuation slope in dB/kHz as defined in Clause 17;
 n = an integer (1, 2, 3 or 4).

SECTION SIX — FIDELITY

* 20. Overall audio-frequency response/frequency characteristics

The pass-band and attenuation slope may have a limiting influence on the overall audio-response/frequency characteristics, as compared to the characteristics obtained by the measurements given in Clause 50 and Clause 56 of Part 1, if for these measurements an audio-frequency signal has been applied directly to the audio-frequency part.

TABLE I

Single-signal selectivity of sound-broadcast receivers (Sections Five and Seven)
(Derived from CCIR Rec. 332-1, Table III)

Type of equipment	Frequency range (MHz)	Coding of measurement	R.F. and I.F. pass-band B_a (kHz)	Attenuation slope from limit-frequency of pass-band B_a in dB/kHz				Image-rejection ratio dB	I.F.-rejection ratio dB	Spurious-response rejection ratio dB	Remarks
				$a + 20$ dB	$a + 40$ dB	$a + 60$ dB	$a + 80$ dB				
AM sound broadcast receivers	0.5-30		315-3-IEC -18 B_a	315-3-IEC -18 p_1	315-3-IEC -18 p_2	315-3-IEC -18 p_3	315-3-IEC -18 p_4	315-3-IEC -25a)	315-3-IEC -25b)	315-3-IEC -25c)	3 receivers of different types tested
			Maximum Mean Minimum	15.0 7.3 4.0	8.9 3.3 1.2	6.7 3.4 1.8	6.3 3.1 2.0	— — —	78 28 22	100 96 68	$a = 6$ dB 169 receivers of about 20 types tested

Two-signal selectivity of sound-broadcast receivers (Clauses 29, 30 and 31)
(Derived from CCIR Rec. 332-1, Table VI/1)

Type of equipment	Frequency range (MHz)	Signal separation $F_d - F_n$ (kHz)	Coding of measurement	Blocking Level of unwanted signal in dB (μ V) for level of wanted signal of:				Adjacent-signal selectivity Level of unwanted signal in dB (μ V) for level of wanted signal of:				Remarks
				20 dB (μ V)	40 dB (μ V)	60 dB (μ V)	80 dB (μ V)	20 dB (μ V)	40 dB (μ V)	60 dB (μ V)	80 dB (μ V)	
AM sound-broadcast receivers	0.5-30	10		315-3-IEC -30B20	315-3-IEC -30B40	315-3-IEC -30B60	315-3-IEC -30B80	315-3-IEC -30Ass20	315-3-IEC -30Ass40	315-3-IEC -30Ass60	315-3-IEC -30Ass80	3 receivers tested of different types at 3 frequencies; output level of unwanted signal 20 dB less than level of wanted signal
				Maximum Mean Minimum	— — —	79 64 50	96 83 68	114 102 85	— — —	76 68 54	99 86 72	

Multiple-signal selectivity of sound-broadcast receivers (Clauses 32, 33 and 34)
(Derived from CCIR Rec. 332-1, Table VI/2)

Type of equipment	Frequency range (MHz)	F_d (MHz)	Coding of measurement	Intermodulation Level of unwanted signals in dB (μV) for the level of the wanted signal, as indicated below:								Remarks
AM sound-broadcast receivers	0.5-30	1		case a) : $F_n' + F_n'' \approx F_{if}$		case b) : $F_n' - F_n'' \approx F_{if}$		case c) : $F_n' + F_n'' \approx F_d$		case d) : $F_n' - F_n'' \approx F_d$		3 receivers tested
				+ 20 dB (μV)	+ 40 dB (μV)	+ 20 dB (μV)	+ 40 dB (μV)	+ 20 dB (μV)	+ 40 dB (μV)	+ 20 dB (μV)	+ 40 dB (μV)	
				315-3-IEC -33a20	315-3-IEC -33a40	315-3-IEC -33b20	315-3-IEC -33b40	315-3-IEC -33c20	315-3-IEC -33c40	315-3-IEC -33d20	315-3-IEC -33d40	
			Maximum	—	—	90	—	90	—	78	—	
			Mean	—	—	70	—	82	—	70	—	
Minimum	—	—	51	—	70	—	63	—				

*** 21. Method of measurement**

Depending on whether the overall audio-frequency response/frequency characteristic or the overall electrical response/frequency characteristic is to be measured, the method of measuring as laid down in Clause 51 or in Clause 57 of Part 1, respectively, shall be used. In these cases the input signal shall be applied according to Clause 10 of Part 1.

*** 22. Presentation of the results**

According to the chosen method, the results shall be given in the way indicated either in Clause 52 or in Clause 58 of Part 1.

SECTION SEVEN — REJECTION OF UNWANTED SIGNALS ENTERING THROUGH THE NORMAL AERIAL CIRCUIT

23. Introduction

Signals may enter the receiver through the normal aerial circuit and give rise to an output response in the absence of a wanted signal at its operating frequency.

Such signals are at image and intermediate frequencies and at frequencies producing spurious responses in the receiver. Their effect can be assessed with a single-signal method or with a two-signal method, the latter giving a better impression of the effect under normal operating conditions. The results of the two methods are closely correlated unless blocking occurs when applying the two-signal method.

24. Definitions

The *image rejection ratio* is the ratio of the radio-frequency input signal level at an image frequency, required to produce a specified output power from the receiver, to the level of the wanted radio-frequency signal required to produce the same output power.

Notes 1. — An image frequency is the wanted signal frequency plus or minus twice the value of an intermediate frequency of the receiver, according to whether the frequency-change oscillator is, respectively, higher or lower in frequency than the wanted signal frequency.

2. — If the receiver incorporates more than one frequency changer, there will be more than one image frequency, and for each of these there will be a corresponding image rejection ratio.

The *intermediate-frequency rejection ratio* is the ratio of the level of a signal at any intermediate-frequency used in the receiver, applied to the radio-frequency input terminals of the receiver and which produces a specified output power from the receiver, to the level of the wanted radio-frequency signal required to produce the same output power.

The *spurious-response rejection ratio* is the ratio of the radio-frequency input signal level at the interfering frequency, required to produce a specified output power from the receiver, to the level of the wanted radio-frequency signal required to produce the same output power.

Note 3. — If F_{osc} is the frequency of the local oscillator, F_{if} the intermediate frequency and n an integer, spurious responses can occur from unwanted signals at the following frequencies:

$$F = F_{osc} \pm \frac{F_{if}}{2}, F = n F_{osc} \pm F_{if}, \text{ etc.}$$

* See national foreword regarding textual error.