

Methods of measurement on radio receivers for various classes of emission —

Part 3: Receivers for amplitude-modulated sound-broadcasting emissions

The European Standard EN 60315-3:1999, with the incorporation of amendment A1:1999, has the status of a British Standard.

ICS 33.160.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee EPL/100, Audio, video and multimedia systems and equipment, to Subcommittee EPL/100/1, Radio receivers, upon which the following bodies were represented:

- British Broadcasting Corporation
- British Educational Equipment Association
- British Radio and Electronic Equipment Manufacturers' Association
- British Telecommunications plc
- Consumers' Association
- Institution of Electrical Engineers
- Radio, Electrical and Television Retailers' Association
- Radiocommunications Agency

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 August 1996

© BSI 04-2000

Amendments issued since publication

The following BSI references relate to the work on this standard:
Committee reference EPL/100/1
Draft announced in *BSI News Update* May 1996

Amd. No.	Date	Comments
10596	April 2000	Renumbers BS 4054-3:1996 as BS EN 60315-3:2000 and implements amendment No. 1 to the BS EN (see national foreword)

ISBN 0 580 26018 6

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	2
Text of EN 60315-3	5

National foreword

This British Standard has been prepared by Subcommittee EPL/100/1. It is the English language version of EN 60315-3:1999, including amendment A1:1999. It was renumbered by amendment from BS 4054-3:1996. It is identical with IEC 60315-3:1989, *Methods of measurement on radio receivers for various classes of emission — Part 3: Receivers for amplitude-modulated sound-broadcasting emissions*, including corrigendum March 1994 and including amendment 1:1999, published by the International Electrotechnical Commission (IEC).

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

Other parts in this series published to date include:

- BS 4054-1:1995, *General considerations and methods of measurement including audio-frequency measurements*;
- BS EN 60315-4:1998, *Receivers for frequency-modulated sound broadcasting emissions*;
- BS 4054-5:1980, *Measurement on frequency-modulated receivers of the response to impulsive interference*;
- BS EN 60315-7:1966, *Methods of measurement on digital satellite (DSR) receivers*;
- BS EN 60315-9:1997, *Measurement of the characteristics relevant to radio data system (RDS) reception*.

It is envisaged that other parts will be published in due course.

References in the text to IEC page numbers should be ignored.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index” or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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 37 and back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

English version

Methods of measurement on radio receivers for various
classes of emission
Part 3: Receivers for amplitude-modulated
sound-broadcasting emissions

(includes amendment A1:1999)
(IEC 60315-3:1989 + corrigendum 1994 + A1:1999)

Méthodes de mesure applicables aux récepteurs
radioélectriques pour diverses classes
d'émission
Partie 3: Récepteurs pour émissions de
radiodiffusion à modulation d'amplitude
(inclut l'amendement A1:1999)
(CEI 60315-3:1989 + corrigendum 1994
+ A1:1999)

Meßverfahren für Funkempfänger für
verschiedene Sendearten
Teil 3: Radiofrequenzmessungen an
Empfängern für amplitudenmodulierte
Sendungen
(enthält Änderung A1:1999)
(IEC 60315-3:1989 + corrigendum 1994
+ A1:1999)

This European Standard, including amendment A1:1999, was approved by CENELEC on 1999-04-01. 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, Czech Republic, 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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of the International Standard IEC 60315-3:1989 and its corrigendum March 1994, prepared by SC 12A (transformed into SC 100A, Multimedia end-user equipment, of IEC TC 100, Audio, video and multimedia systems and equipment), was approved by CENELEC as HD 560.3 S1 on 1992-09-15.

This Harmonization Document was submitted to the formal vote for conversion into a European Standard and was approved by CENELEC as EN 60315-3 on 1999-04-01.

The following date was 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) 2000-04-01

Annexes designated “normative” are part of the body of the standard. In this standard, Annex ZA is normative. Annex ZA has been added by CENELEC.

Foreword to amendment A1

The text of document 100A/110/FDIS, future amendment 1 to IEC 60315-3:1989, prepared by SC 100A, Multimedia end-user equipment, of IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60315-3:1999 on 1999-04-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2000-04-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2002-04-01

Contents

	Page
Foreword	2
Section 1. General	
1 Scope	5
2 Conditions for measurement	5
2.1 Standard measuring conditions	5
2.2 Tuning and automatic frequency control	5
2.3 Precautions	6
Section 2. Sensitivity and internal noise	
3 Output/input characteristics	6
3.1 Introduction	6
3.2 Method of measurement	6
3.3 Presentation of results	7
3.4 Characteristics related to the output/input and noise output/input characteristics	7
Section 3. Selectivity and immunity	
4 Explanation of terms	8
4.1 Selectivity	8
4.2 Immunity	8
4.3 Single-signal method	8
4.4 Two-signal method	8
4.5 Audio-frequency signal-to-interference ratio	8
4.6 Audio-frequency protection ratio	8
4.7 Radio-frequency wanted-to-interfering signal ratio	8
4.8 Radio-frequency protection ratio	8
4.9 Desensitization (blocking)	9
4.10 Cross-modulation	9
4.11 Intermodulation	9
4.12 Adjacent-channel and alternate-channel selectivity	9
4.13 Image rejection ratio	9
4.14 Intermediate-frequency rejection ratio	9
4.15 Spurious-response rejection ratio	9
4.16 Pass-band or X dB bandwidth	9
4.17 Attenuation slope	9
5 Single-signal selectivity	9
5.1 Introduction	9
5.2 Method of measurement	10
5.3 Presentation of results	10
6 Two-signal selectivity using sinusoidal modulation of the unwanted signal	10
6.1 Introduction	10

	Page		Page
6.2 Method of measurement	10	Section 4. Interference due to internal sources	
6.3 Presentation of results	10	15 Single-signal beat-notes	17
7 Two-signal selectivity using noise modulation	11	15.1 Introduction	17
7.1 Introduction	11	15.2 Method of measurement	18
7.2 Output measurement	11	15.3 Presentation of results	18
7.3 Noise signal for modulating the signal generators	11	16 Acoustic effects	19
7.4 Measuring arrangements	11	17 Unwanted oscillations	19
7.5 Depth of modulation of the signal generators	12	18 Interference at the power-supply frequency and its harmonics (hum)	19
7.6 Frequency separation of the sources	12	18.1 Introduction	19
7.7 Audio-frequency signal-to-interference ratio	12	18.2 Method of measurement	19
7.8 Measurements	12	18.3 Presentation of results	19
7.9 Presentation of results	12	Section 5. Distortion	
7.10 Influence of non-linear distortion in the signal generators	12	19 Introduction	20
7.11 Accuracy	12	20 Overall harmonic distortion, distortion-limited a.f. output and distortion-limited input level	20
8 Desensitization (blocking)	13	20.1 Method of measurement	20
8.1 Method of measurement	13	20.2 Presentation of results	20
8.2 Presentation of results	13	21 Distortion due to inaccuracy of tuning	20
9 Intermodulation	13	21.1 Method of measurement	20
9.1 Introduction	13	Section 6. Miscellaneous	
9.2 Method of measurement	13	22 Tuning and automatic frequency-control characteristics	21
9.3 Presentation of results	14	22.1 Introduction	21
9.4 Precautions	14	22.2 Method of measurement	21
10 Rejection of unwanted signals entering through the antenna	14	22.3 Presentation of results	21
10.1 Introduction	14	Figures	22
10.2 Single-signal method of measurement	15	Annex ZA (normative) Other international publications quoted in this standard with the references of the relevant European publications	37
10.3 Presentation of results	16		
10.4 Two-signal method of measurement	16		
10.5 Presentation of results	16		
11 Overall audio-frequency response	16		
11.1 Introduction	16		
11.2 Method of measurement	16		
11.3 Presentation of results	16		
12 Pass-band and attenuation slope	17		
12.1 Introduction	17		
12.2 Modulation frequency and modulation factor	17		
12.3 Method of measurement	17		
12.4 Presentation of results	17		
13 Selectivity controls	17		
14 Immunity	17		

Section 1. General

1 Scope

This standard applies to radio receivers for the reception of amplitude-modulated sound-broadcasting emissions. It deals mainly with measurements using radio-frequency signals applied to the antenna terminals of the receiver, or induced in a magnetic antenna.

This part is intended to be read in conjunction with Part 1 (IEC 60335-1, Second edition).

Immunity is not covered, except for an explanation with cross-reference to C.I.S.P.R. publications. For radiation from receivers, reference is required to C.I.S.P.R. Publication 13.

NOTE 1 Receivers without volume controls or a.f. power output stages ("tuners") are included.

NOTE 2 Receivers for single-sideband and independent-sideband emissions are not included, nor are receivers for stereophonic emissions as far as characteristics involving the encoding system are concerned.

2 Conditions for measurement

2.1 Standard measuring conditions

A receiver is operating under standard measuring conditions when:

- a) the power supply voltage and frequency are equal to the rated values;
- b) the standard radio-frequency input signal is applied via the appropriate antenna simulation network to the antenna terminals of the receiver (see Table III and Figure 5 of Part 1) or applied to a standard magnetic field generator to induce the signal into the magnetic antenna of the receiver;
- c) the audio-frequency output terminals for connection to loudspeakers (if any) are connected to audio-frequency substitute loads, as are any other audio-frequency output terminals, if measurements are to be made at those terminals;
- d) the receiver is tuned to the applied signal in accordance with sub-clause 2.2;
- e) the volume control (if any) is adjusted so that the output voltage at the main audio-frequency output terminals is 10 dB below the rated distortion-limited output voltage, or corresponds to a preferred reference value (see Part 1, sub-clause 15.1);
- f) the environmental conditions are within the rated ranges;
- g) for stereo receivers, the balance control or its equivalent (if any) is adjusted so that output voltages of the two channels are equal;
- h) the tone controls (if any) are adjusted for the flattest possible audio-frequency response (e.g. for equal response at 100 Hz, 1 kHz and 10 kHz). This shall be carried out using an a.f. input signal if a.f. input terminals are available, otherwise the frequency of 10 kHz given above should be reduced to 2 kHz;
- i) the automatic frequency control is inoperative, if this can be achieved by means of a user control (see note).

NOTE Where a user control for automatic frequency control is provided, measurements should in general be made both with automatic frequency control off (which will allow easy analysis of the results), and with automatic frequency control on (which represents the situation when the receiver is in normal use). The two sets of results should be clearly identified.

If the automatic frequency control cannot be made inoperative by means of a user control, it may nevertheless be necessary (or desirable) for the automatic frequency control to be disabled for certain measurements. In this case the automatic frequency control should be disabled by temporarily modifying the receiver, the action taken being detailed with the results (see sub-clause 2.2);

- j) the muting control (if any) is in the "muting off" position.

2.2 Tuning and automatic frequency control

2.2.1 Preferred tuning method

If the manufacturer gives instructions on tuning the receiver, such as the use of a tuning indicator, these instructions shall be followed. In the absence of instructions or of a tuning indicator, the receiver shall be tuned for maximum output voltage at the main audio-frequency terminals under the conditions [with exception of Item d)] given in sub-clause 2.1, care being taken to avoid overloading the audio-frequency part of the receiver.

2.2.2 Effect of automatic frequency control

All tuning operations shall be made with arrangements for automatic frequency control inoperative, if this is possible, except when the performance of the automatic frequency control is being investigated.

When provision is made for the user to render the automatic frequency control inoperative, measurements may be made both with the automatic frequency control in operation, and with it disabled. The results shall clearly show whether the automatic frequency control was in operation or not (see also Section 6).

2.3 Precautions

Many of the measurements described in this part are likely to be adversely affected by interfering emissions and radio-frequency noise. It is usually essential that a screened room or screened enclosure is available in which to carry out these measurements. It is also highly desirable to monitor the audio-frequency output signal continuously with a loudspeaker or headphones in order to detect any interference or spurious output signals due to unwanted signals from the test equipment or elsewhere, or spurious responses of the receiver.

Measurement accuracy is also affected by inadequate signal-to-noise ratio. When the noise output is independent of the modulation factor (which is not always so), the output with zero modulation should be checked and if it is larger than -10 dB (unless otherwise stated in this part) with respect to the output with modulation, the result of the measurement shall be rejected and measurement made using an a.f. band-pass filter to improve the signal-to-noise ratio sufficiently to restore accuracy.

Section 2. Sensitivity and internal noise

3 Output/input characteristics

3.1 Introduction

Virtually all commercially-available receivers for amplitude-modulated sound-broadcasting emissions use some form of automatic gain control (a.g.c.). To investigate the sensitivity and noise characteristics of such receivers, it is useful to measure the a.f. output with a fixed modulation factor, and the noise output with zero modulation factor, as functions of the r.f. input signal level and to plot the curves on the same graph.

An example of such a graph is given in Figure 1, which also shows the characteristics whose values may be determined from the curves or the tabulated results of the measurements.

3.2 Method of measurement

- a) The receiver is brought under standard measuring conditions (see sub-clause 2.1). An a.f. voltmeter (preferably a true r.m.s. meter) and a noise weighting filter and quasi-peak meter (see Part 1, sub-clause 6.2.2) are connected across the audio-frequency substitute load at the terminals where a.f. output measurements are to be made.

A₁

NOTE 1 Unweighted noise measurements using a wide-band filter or A-weighting noise measurements may be made if required (see clause 6 of IEC 60315-1). In these methods, noise is measured with an r.m.s. meter (preferably a true r.m.s. meter). The method used should be clearly stated with the results. **A₁**

NOTE 2 If ultrasonic components within the bandwidth of the a.f. voltmeter may be present in the a.f. output voltage, the voltmeter should be preceded by a band-limiting filter in accordance with sub-clause 6.1 of Part 1.

- b) The a.f. output voltage on the a.f. voltmeter is noted. The modulation factor is then reduced to zero and the noise output voltage on the noise meter is noted.

- c) The measurements are then repeated for different values of r.f. input signal level, measurements being made at signal levels low enough to give very low signal-to-noise ratios and high enough (if possible) to explore the overloading of the r.f. part of the receiver (see clause 20).

If overloading of the a.f. part of the receiver occurs at high r.f. input signal levels, the volume control attenuation is increased by a known amount to eliminate the overloading, and measurements are continued. This increased attenuation is taken into account in presenting the results. If no volume control is fitted, the onset of a.f. overload sets a limit to the permissible r.f. input signal level and measurements should be discontinued.

- d) Particularly at high input signal levels, the receiver tuning should be checked by adjusting the carrier frequency of the signal source before each result is recorded, since the receiver may detune. The extent of any detuning shall be recorded in terms of frequency at each input signal level during this measurement sequence, as the results are of value for the measurement of variation of operating frequency with r.f. input signal level (see Part 1, clause 3).

NOTE It should be decided whether to record the results of the output/input characteristic measurement with or without retuning. Unless the tuning variations are large, it is usual to record the result obtained without retuning. If retuning is carried out, this should be noted with the results.

- e) The measurements may be repeated with other values of modulation factor, such as 80 % (see Part 1, clause 17 and Table III).

3.3 Presentation of results

The results of the measurement of the output/input characteristic and the noise output/input characteristic may be tabulated but are usually presented graphically, with input signal level in dB(fW) or dB(μ V/m) as abscissa and output or noise output level in dB as ordinate with respect to a stated reference [usually rated (distortion-limited) output voltage]. An example is shown in Figure 1.

3.4 Characteristics related to the output/input and noise output/input characteristics

3.4.1 Amplification reserve

The amplification reserve is 10.5 dB greater than the difference between the a.f. output level measured with a high level or r.f. input signal, which shall be 90 dB(fW) or 94 dB(μ V/m), unless otherwise stated and the rated (distortion-limited) a.f. output level, allowance being made for any attenuation introduced by the volume control (if any) to avoid a.f. overloading. The r.f. input signal shall be the standard input signal except in respect of level.

NOTE The factor 10.5 dB is introduced to allow for the modulation factor of the standard input signal being 30 %. The amplification reserve is thus related to 100 % modulation.

3.4.2 Gain-limited sensitivity

The gain-limited sensitivity is the r.f. input signal level at which the a.f. output is equal to the rated a.f. output with any volume controls set at maximum gain.

The r.f. input signal shall be the standard input signal except in respect of level.

3.4.3 Noise-limited sensitivity

The noise-limited sensitivity is the r.f. input signal level required to achieve a specified signal-to-noise ratio, which shall be 26 dB unless otherwise stated, referred to a signal with 30 % modulation (36.5 dB referred to 100 % modulation). The r.f. input signal shall be the standard input signal except in respect of level, so that the signal level in the signal-to-noise ratio calculation is that produced by 30 % modulation. The noise output of the receiver shall be measured with the psophometric weighting and quasi-peak meter (see Part 1, sub-clause 6.2.2) unless otherwise stated (see also sub-clause 3.4.8).

A₁

NOTE The unweighted noise measurement may be used if required. The method used should be clearly stated with the results. **A₁**

3.4.4 Noise factor

The noise factor of a receiver is the ratio of the noise output voltage under specified conditions to the noise output voltage produced by the thermal noise of the resistive part of the source impedance.

Although it is theoretically possible to calculate the latter output, in practice it is easier and more accurate to determine the noise factor directly by using a noise generator whose output level is calibrated directly in terms of noise factor expressed in decibels. To do this, the receiver is brought under the required conditions for measuring noise factor, with the noise generator connected to the antenna terminals through the appropriate antenna substitution network. The output of the noise generator is set to zero and the noise output measured with the wide-band filter and true r.m.s. meter (see Part 1, sub-clause 6.1). The noise generator output is then increased until the noise output level has risen by 3 dB. The noise factor can then be read from the output indicator of the noise generator.

3.4.5 A.G.C. figure-of-merit

The performance of the automatic gain control is indicated in detail by the output/input characteristic curve, but for specification purposes a numerical figure-of-merit is useful. The a.g.c. figure-of-merit is the range of r.f. input signal levels over which the a.f. output level changes by 10 dB, the r.f. input signal level corresponding to the upper limit of the range being stated [for example a.g.c. figure-of-merit 65 dB relative to 100 dB(fW)]. This level should be 100 dB(fW) or 104 dB(μ V/m) unless there is a good reason to choose a different value.

NOTE Former definitions have specified the upper limit of r.f. input signal level, giving different values for different types of receiver. Since it is difficult to assign appropriate values for the many different types of receiver, and different classes of performance within each type, it is considered more logical to require the manufacturer to specify this level.

3.4.6 Dynamic range (of the r.f. input signal level)

The dynamic range of the r.f. input signal level is the difference in level between the distortion-limited input signal level (see sub-clause 20.1) and the input signal level required, either to achieve a specified signal-to-noise ratio (which shall be 26 dB unless otherwise stated), or to achieve rated (distortion-limited) output voltage, whichever (input signal level) is the greater.

3.4.7 Distortion

It is often convenient to combine the measurement of the output/input characteristics with measurements of distortion (see sub-clause 20.1 and Figure 1).

3.4.8 SINAD (signal to noise and distortion)

SINAD measurements treat distortion and noise together as degradations of the output signal [see sub-clause 20.1, Item b) 4)].

Section 3. Selectivity and immunity

4 Explanation of terms

4.1 The *selectivity* of a receiver is a measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals entering through the antenna circuit.

Selectivity may be measured in several ways, but only the rather complex method using simulated interference mentioned below correlates well with the performance of the receiver when in use. Two aspects of receiver performance are included in the concept of selectivity. One is the discrimination against signals whose frequencies are relatively close to that of the wanted signal and is controlled by the performance of the r.f. and i.f. tuned circuits or their equivalent, while the other is the discrimination against signals whose frequencies are such that they may produce spurious responses; for example, the image frequency of a superhet receiver.

4.2 The *immunity* of a receiver is a measure of its rejection of unwanted signals, entering otherwise than through the normal antenna circuit (e.g. through the power supply or through an antenna system intended for another frequency range).

4.3 A *single-signal method* of measurement measures the response of the receiver to an unwanted signal in the absence of the wanted signal. The results of such a measurement are meaningful only if the receiver is operating in a linear mode both during the measurement and in the condition to which the measurement results are to be applied.

4.4 A *two-signal method* of measurement measures the response of the receiver to an unwanted signal in the presence of the wanted signal. The receiver operating mode may be non-linear provided that the results are applied only to conditions where only one strong unwanted signal is present.

A *two-signal measurement used sinusoidal modulation* of the unwanted signal is fairly simple to perform, but the results do not correlate well with the performance of the receiver when in use.

A *two-signal measurement using simulated interference* gives results which are a good measure of the true performance of the receiver.

Measurements using three signals are required for some purposes (see sub-clause 9.2).

4.5 The *audio-frequency (a.f.) signal-to-interference ratio* is the ratio (expressed in dB) between the values of the voltage of the wanted signal and voltage of the interference, measured under specified conditions, at the audio-frequency output of the receiver.

This ratio corresponds closely to the difference in sound pressure level between the wanted programme and the interference.

4.6 The *audio-frequency (a.f.) protection ratio* is the minimum value of the audio-frequency signal-to-interference ratio considered necessary to achieve a subjectively defined reception quality.

This ratio may have different values according to the type of service desired.

4.7 The *radio-frequency (r.f.) wanted-to-interfering signal ratio* is the ratio (expressed in dB) between the appropriate values of the radio-frequency voltage or power of the wanted signal and the interfering signal, measured at the input of the receiver under specified conditions.

For example, in the case of amplitude-modulation wanted and interfering transmissions (carrier with double sideband), the appropriate values will be the available powers or e.m.f. of the wanted and interfering carriers.

4.8 The *radio-frequency (r.f.) protection ratio* is the value of the radio-frequency wanted-to-interfering signal ratio that enables, under specified conditions, the audio-frequency protection ratio to be obtained at the output of the receiver.

The specified conditions include such diverse parameters as: spacing of the wanted and interfering carrier, emission characteristics (type of modulation, modulation factor), a.f. signal characteristics (bandwidth, dynamic compression, etc.), receiver input level as well as the receiver characteristics (selectivity and cross-modulation, etc.).

4.9 Desensitization (blocking) is an effect, resulting in a given change (generally a reduction) in the a.f. output of a receiver from a wanted modulated radio-frequency input signal of a specified level, caused by an unwanted unmodulated signal on a nearby frequency (see clause 8). The change in a.f. output shall be a reduction of 3 dB unless there is a good reason to use another value.

4.10 Cross-modulation is an effect, due to non-linearity in a pre-detector stage or stages, that produces an a.f. output from a receiver, receiving an unmodulated wanted signal of a specified level, resulting from the modulation of an unwanted signal on a nearby frequency, and is one of the factors affecting adjacent-signal selectivity (see below).

4.11 Intermodulation is an effect producing an a.f. output from a receiver receiving an unmodulated wanted signal of a specified radio-frequency input level, resulting from two simultaneously present unmodulated unwanted signals, at specified frequencies (see clause 9).

4.12 For receivers intended for use with emissions planned with regular channelling, the *adjacent-channel selectivity* is the selectivity measured by one of the methods given in this part, when the unwanted signal frequency is separated by one channel spacing from the wanted signal frequency. The *alternate-channel selectivity* is the selectivity measured by one of the methods given in this part, when the unwanted signal frequency is separated by two channel spacings from the wanted signal frequency.

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

NOTE 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.

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.

NOTE 2 The automatic frequency control (if any) will not function correctly with an input signal at image frequency.

4.14 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 which produces a specified a.f. output level from the receiver, to the level of the wanted radio-frequency signal required to produce the same output level.

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

NOTE If f_o is the frequency of the local oscillator, f_i the intermediate frequency and n an integer, spurious responses can occur from unwanted signals at the following frequencies:

$$f = f_o \pm f_i/2 \text{ and } f = nf_o \pm f_i$$

where n is a positive integer.

4.16 The *pass-band* or *X dB bandwidth* is the range of input signal frequencies over which the a.f. output level of the receiver, with an input signal having a specified low modulation frequency and modulation factor exceeds -X dB with respect to that at the operating frequency (see sub-clause 2.2).

The bandwidth or pass-band may also be defined for other specified values of response variation. In this part, X is assumed to be equal to 6 unless otherwise stated.

4.17 The *attenuation slope* is the slope of the graph of a.f. output level as a function of input signal frequency difference from the operating frequency, with an input signal having a specified low modulation frequency and modulation factor.

5 Single-signal selectivity

5.1 Introduction

The single-signal selectivity is the ratio of the r.f. input signal level, at a frequency whose difference from the operating frequency is specified, required to produce a reference value of audio-frequency output level, to the r.f. input signal level at the operating frequency required to produce *the same* output level, the receiver being otherwise under standard measuring conditions.