

Specification for radio disturbance and immunity measuring apparatus and methods —

Part 1-1: Radio disturbance and immunity measuring apparatus — Measuring apparatus

ICS 33.100.10; 33.100.20

National foreword

This British Standard is the UK implementation of EN 55016-1-1:2007+A2:2008. It is identical with CISPR 16-1-1:2006, incorporating amendments 1:2006 and 2:2007. It supersedes BS EN 55016-1-1:2007+A1:2007, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. 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.

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English version

**Specification for radio disturbance
and immunity measuring apparatus and methods -
Part 1-1: Radio disturbance and immunity measuring apparatus -
Measuring apparatus
(CISPR 16-1-1:2006)**

Spécifications des méthodes
et des appareils de mesure
des perturbations radioélectriques
et de l'immunité aux perturbations
radioélectriques -
Partie 1-1: Appareils de mesure
des perturbations radioélectriques
et de l'immunité aux perturbations
radioélectriques -
Appareils de mesure
(CISPR 16-1-1:2006)

Anforderungen an Geräte
und Einrichtungen sowie Festlegung
der Verfahren zur Messung
der hochfrequenten Störaussendung
(Funkstörungen) und Störfestigkeit -
Teil 1-1: Geräte und Einrichtungen
zur Messung der hochfrequenten
Störaussendung (Funkstörungen)
und Störfestigkeit -
Messgeräte
(CISPR 16-1-1:2006)

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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 document CISPR/A/642/FDIS, future edition 2 of CISPR 16-1-1, prepared by CISPR SC A, Radio-interference measurements and statistical methods, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 55016-1-1 on 2006-11-01.

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Foreword to amendment A1

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Foreword to amendment A2

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SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus

1 Scope

This part of CISPR 16 is designated a basic standard, which specifies the characteristics and performance of equipment for the measurement of radio disturbance voltages, currents and fields in the frequency range 9 kHz to 18 GHz. In addition, requirements are specified for specialized equipment for discontinuous disturbance measurements. The requirements include the measurement of broadband and narrowband types of radio disturbance.

The receiver types covered include the following:

- a) the quasi-peak measuring receiver,
- b) the peak measuring receiver,
- c) the average measuring receiver,
-  d) the rms-average measuring receiver. 

The requirements of this publication shall be complied with at all frequencies and for all levels of radio disturbance voltages, currents, power or field strengths within the CISPR indicating range of the measuring equipment.

Methods of measurement are covered in Part 2, and further information on radio disturbance is given in Part 3 of CISPR 16. Uncertainties, statistics and limit modelling are covered in Part 4 of CISPR 16.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*
Amendment 1 (1997)
Amendment 2 (1998)

CISPR 11:2003, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*

CISPR 14-1:2005, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

CISPR 16-3:2003, *Specification for radio disturbance and Immunity measuring apparatus and methods – Part 3: CISPR technical reports*

BIPM / IEC / IFCC / ISO / IUPAC / IUPAP / OIML:1993, *International vocabulary of basic and general terms in metrology*

3 Terms and definitions

For the purpose of this document, the following definitions apply. Also see IEC 60050(161) and the *International vocabulary of basic and general terms in metrology*.

3.1

bandwidth

B_n

the width of the overall selectivity curve of the receiver between two points at a stated attenuation, below the midband response. The bandwidth is represented by the symbol B_n , where n is the stated attenuation in decibels.

3.2

impulse bandwidth

B_{imp}

$$B_{\text{imp}} = A(t)_{\text{max}} / (2 G_o \times IS)$$

where

$A(t)_{\text{max}}$ is the peak of the envelope at the IF output of the receiver with an impulse area IS applied at the receiver input;

G_o is the gain of the circuit at the centre frequency.

Specifically for two critically-coupled tuned transformers,

$$B_{\text{imp}} = 1,05 \times B_6 = 1,31 \times B_3$$

where

B_6 and B_3 are respectively the bandwidths at the –6 dB and –3 dB points (see Clause A.2 for further information).

3.3

impulse area

IS

the impulse area (sometimes called impulse strength, IS) is the voltage-time area of a pulse defined by the integral:

$$IS = \int_{-\infty}^{+\infty} V(t) dt \text{ (expressed in } \mu\text{Vs or dB}(\mu\text{Vs))}$$

NOTE Spectral density (D) is related to impulse area and expressed in $\mu\text{V/MHz}$ or $\text{dB}(\mu\text{V/MHz})$. For rectangular impulses of pulse duration T at frequencies $f \ll 1/T$, the relationship $D (\mu\text{V/MHz}) = \sqrt{2} \times 10^6 IS (\mu\text{Vs})$ applies.

3.4

electrical charge time constant

T_c

the time needed after the instantaneous application of a constant sine-wave voltage to the stage immediately preceding the input of the detector for the output voltage of the detector to reach 63 % of its final value

NOTE This time constant is determined as follows: A sine-wave signal of constant amplitude and having a frequency equal to the mid-band frequency of the i.f. amplifier is applied to the input of the stage immediately preceding the detector. The indication, D , of an instrument having no inertia (e.g., a cathode-ray oscilloscope) connected to a terminal in the d.c. amplifier circuit so as not to affect the behaviour of the detector, is noted. The level of the signal is chosen such that the response of the stages concerned remains within the linear operating range. A sine-wave signal of this level, applied for a limited time only and having a wave train of rectangular envelope is gated such that the deflection registered is $0,63 D$. The duration of this signal is equal to the charge time of the detector.

3.5 electrical discharge time constant

T_D

the time needed after the instantaneous removal of a constant sine-wave voltage applied to the stage immediately preceding the input of the detector for the output of the detector to fall to 37 % of its initial value

NOTE The method of measurement is analogous to that for the charge time constant, but instead of a signal being applied for a limited time, the signal is interrupted for a definite time. The time taken for the deflection to fall to $0,37 D$ is the discharge time constant of the detector.

3.6 mechanical time constant of a critically damped indicating instrument

T_M

$$T_M = T_L / 2\pi$$

where

T_L is the period of free oscillation of the instrument with all damping removed.

NOTE 1 For a critically damped instrument, the equation of motion of the system may be written as:

$$T_M^2 (d^2\alpha / dt^2) + 2T_M (d\alpha / dt) + \alpha = ki$$

where

α is the deflection;

i is the current through the instrument;

k is a constant.

It can be deduced from this relation that this time constant is also equal to the duration of a rectangular pulse (of constant amplitude) that produces a deflection equal to 35 % of the steady deflection produced by a continuous current having the same amplitude as that of the rectangular pulse.

NOTE 2 The methods of measurement and adjustment are deduced from one of the following:

- The period of free oscillation having been adjusted to $2\pi T_M$, damping is added so that $\alpha T = 0,35\alpha_{\max}$.
- When the period of oscillation cannot be measured, the damping is adjusted to be just below critical such that the overshoot is not greater than 5 % and the moment of inertia of the movement is such that $\alpha T = 0,35\alpha_{\max}$.

3.7 overload factor

the ratio of the level that corresponds to the range of practical linear function of a circuit (or a group of circuits) to the level that corresponds to full-scale deflection of the indicating instrument

The maximum level at which the steady-state response of a circuit (or group of circuits) does not depart by more than 1 dB from ideal linearity defines the range of practical linear function of the circuit (or group of circuits).

3.8 symmetric voltage

in a two-wire circuit, such as a single-phase mains supply, the symmetric voltage is the radio-frequency disturbance voltage appearing between the two wires. This is sometimes called the differential mode voltage. If V_a is the vector voltage between one of the mains terminals and earth and V_b is the vector voltage between the other mains terminal and earth, the symmetric voltage is the vector difference ($V_a - V_b$)

3.9

CISPR indicating range

it is the range specified by the manufacturer which gives the maximum and the minimum meter indications within which the receiver meets the requirements of this section of CISPR 16

A₂ 3.10

weighting (of e.g. impulsive disturbance)

the pulse-repetition-frequency (PRF) dependent conversion (mostly reduction) of a peak-detected impulse voltage level to an indication that corresponds to the interference effect on radio reception

- For the analogue receiver, the psychophysical annoyance of the interference is a subjective quantity (audible or visual, usually not a certain number of misunderstandings of a spoken text).
- For the digital receiver, the interference effect is an objective quantity that may be defined by the critical bit error ratio (BER) (or bit error probability (BEP)) for which perfect error correction can still occur or by another, objective and reproducible parameter.

3.10.1

weighting characteristic

the peak voltage level as a function of PRF for a constant effect on a specific radiocommunication system, i.e., the disturbance is weighted by the radiocommunication system itself

3.10.2

weighting function or weighting curve

the relationship between input peak voltage level and PRF for constant level indication of a measuring receiver with a weighting detector, i.e. the curve of response of a measuring receiver to repeated pulses

3.10.3

weighting factor

the value in dB of the weighting function relative to a reference PRF or relative to the peak value

3.10.4

weighting detector

detector which provides an agreed weighting function

3.10.5

weighted disturbance measurement

measurement of disturbance using a weighting detector **A₂**

4 Quasi-peak measuring receivers for the frequency range 9 kHz to 1 000 MHz

The receiver specification depends on the frequency of operation. There is one receiver specification covering the frequency range 9 kHz to 150 kHz (band A), one covering 150 kHz to 30 MHz (band B), one covering 30 MHz to 300 MHz (band C), and one covering 300 MHz to 1 000 MHz (band D).

4.1 Input impedance

The input circuit of measuring receivers shall be unbalanced. For receiver control settings within the CISPR indicating range, the input impedance shall be nominally 50 Ω with a v.s.w.r. not to exceed 2,0 to 1 when the RF attenuation is 0 and 1,2 to 1 when the RF attenuation is 10 dB or greater.

Symmetric input impedance in the frequency range 9 kHz to 30 MHz: to permit symmetrical measurements a balanced input transformer is used. The preferred input impedance for the frequency range 9 kHz to 150 kHz is 600 Ω . This symmetric input impedance may be incorporated either in the relevant symmetrical artificial network necessary to couple to the receiver or optionally in the measuring receiver.

4.2 Fundamental characteristics

The responses to pulses as specified in 4.4 are calculated on the basis of the measuring receivers having the following fundamental characteristics.

Table 1 – Fundamental characteristics of quasi-peak receivers

Characteristics	Frequency band		
	Band A 9 kHz to 150 kHz	Band B 0,15 MHz to 30 MHz	Bands C and D 30 MHz to 1 000 MHz
Bandwidth at the –6 dB points, B_6 in kHz	0,20	9	120
Detector electrical charge time constant, in ms	45	1	1
Detector electrical discharge time constant, in ms	500	160	550
Mechanical time constant of critically damped indicating instrument, in ms	160	160	100
Overload factor of circuits preceding the detector, in dB	24	30	43,5
Overload factor of the d.c. amplifier between detector and indicating instrument, in dB	6	12	6
NOTE 1 The definition of mechanical time constant (see 3.6) assumes that the indicating instrument is linear, i.e., equal increments of current produce equal increments of deflection. An indicating instrument having a different relation between current and deflection may be used provided that the instrument satisfies the requirements of this subclause. In an electronic instrument, the mechanical time-constant may be simulated by a circuit.			
NOTE 2 No tolerance is given for the electrical and mechanical time constants. The actual values used in a specific receiver will be determined by the design to meet the requirements in 4.4			

4.3 Sine-wave voltage accuracy

The accuracy of measurement of sine-wave voltages shall be better than ± 2 dB when supplied with a sine-wave signal at 50 Ω resistance source impedance.

4.4 Response to pulses

NOTE Annexes B and C describe methods for determining the output characteristics of a pulse generator for use in testing the requirements of this subclause.

4.4.1 Amplitude relationship (absolute calibration)

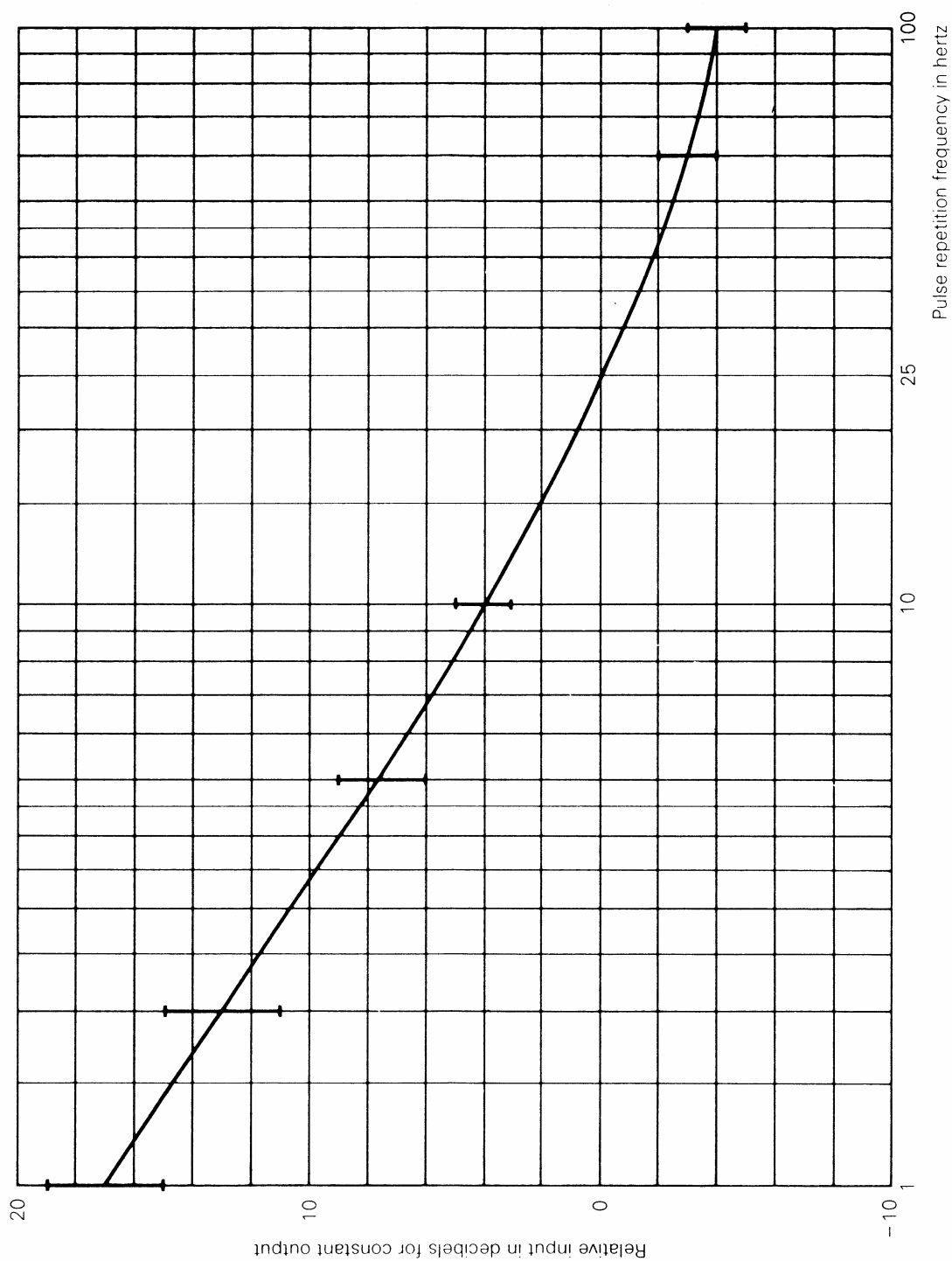
The response of the measuring receiver to pulses of impulse area of a) μ Vs (microvolt second) e.m.f. at 50 Ω source impedance, having a uniform spectrum up to at least b) MHz, repeated at a frequency of c) Hz shall, for all frequencies of tuning, be equal to the response to an unmodulated sine-wave signal at the tuned frequency having an e.m.f. of r.m.s. value 2 mV (66 dB(μ V)). The source impedances of the pulse generator and the signal generator shall both be the same. A tolerance of $\pm 1,5$ dB shall be permitted on the sine-wave voltage level.

Table 2 – Test pulse characteristics for quasi-peak measuring receivers

Frequency range	a) μ Vs	b) MHz	c) Hz
9 kHz to 150 kHz	13,5	0,15	25
0,15 MHz to 30 MHz	0,316	30	100
30 MHz to 300 MHz	0,044	300	100
300 MHz to 1 000 MHz	0,044	1 000	100

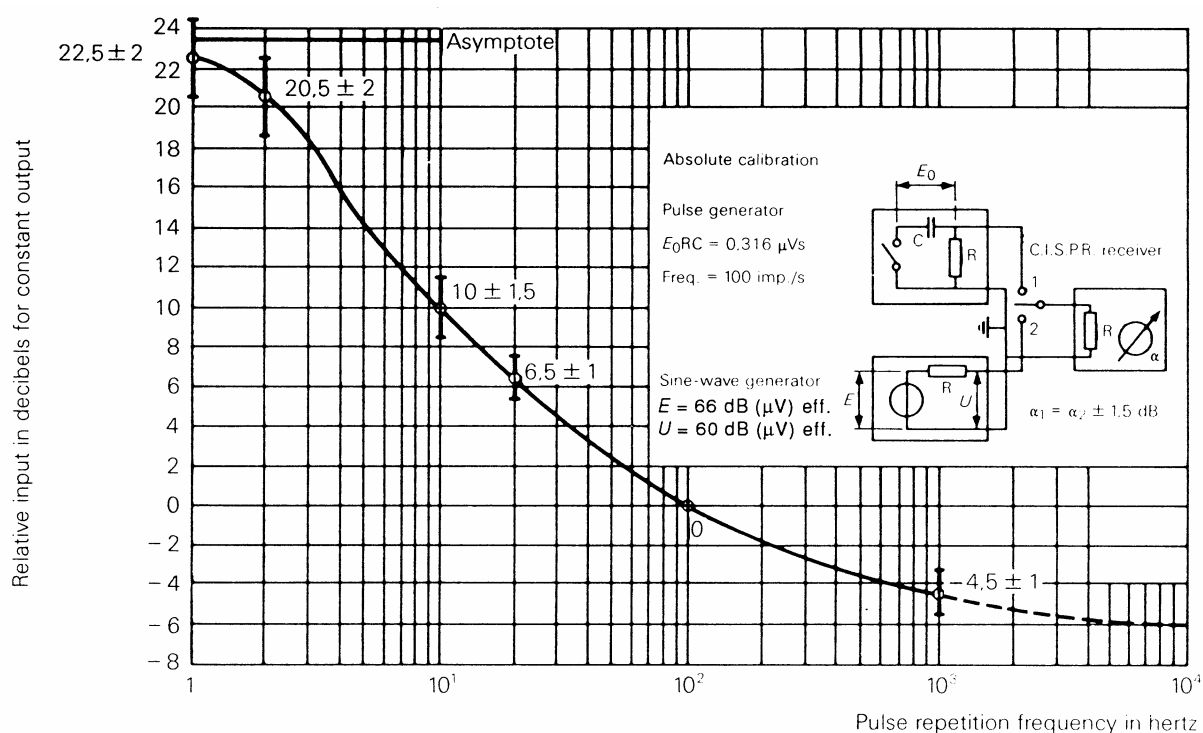
4.4.2 Variation with repetition frequency (relative calibration)

The response of the measuring receiver to repeated pulses shall be such that for a constant indication on the measuring receiver, the relationship between amplitude and repetition frequency is in accordance with Figures 1a, 1b or 1c.



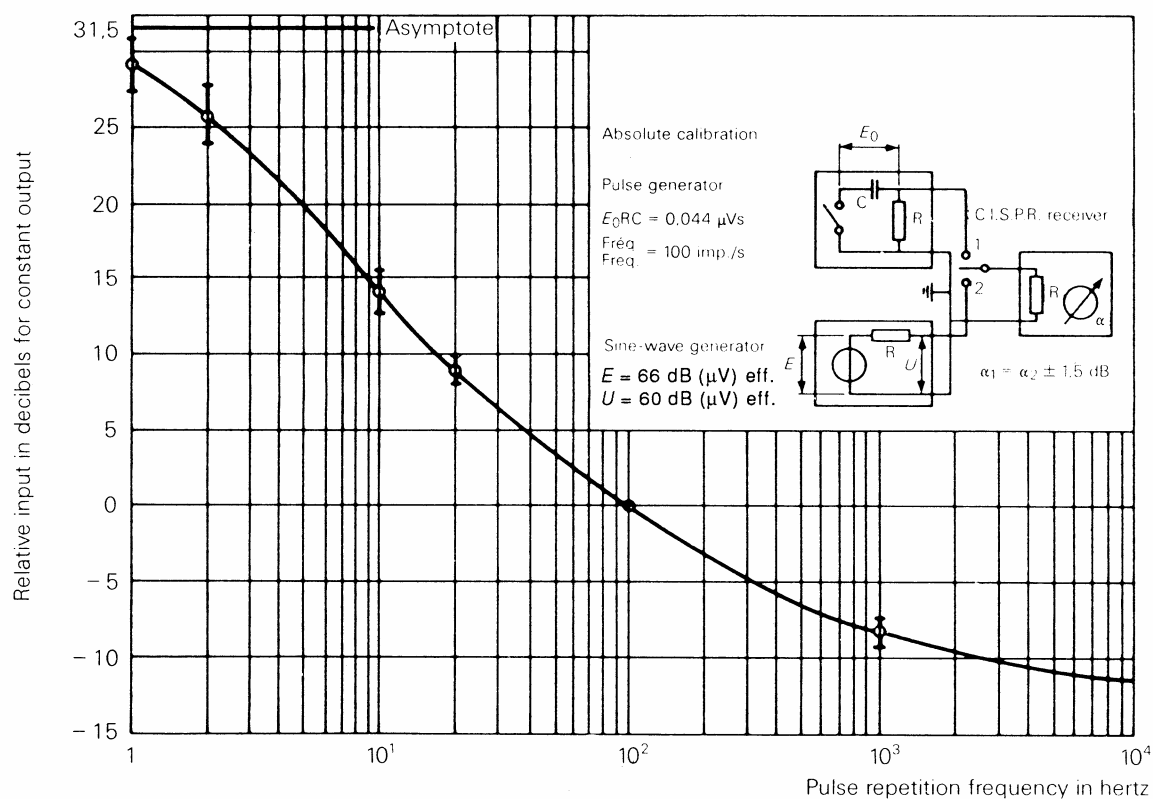
IEC 1290/99

Figure 1a – Pulse response curve (Band A)



IEC 1291/99

Figure 1b – Pulse response curve (Band B)



IEC 1292/99

Figure 1c – Pulse response curve (Bands C and D)

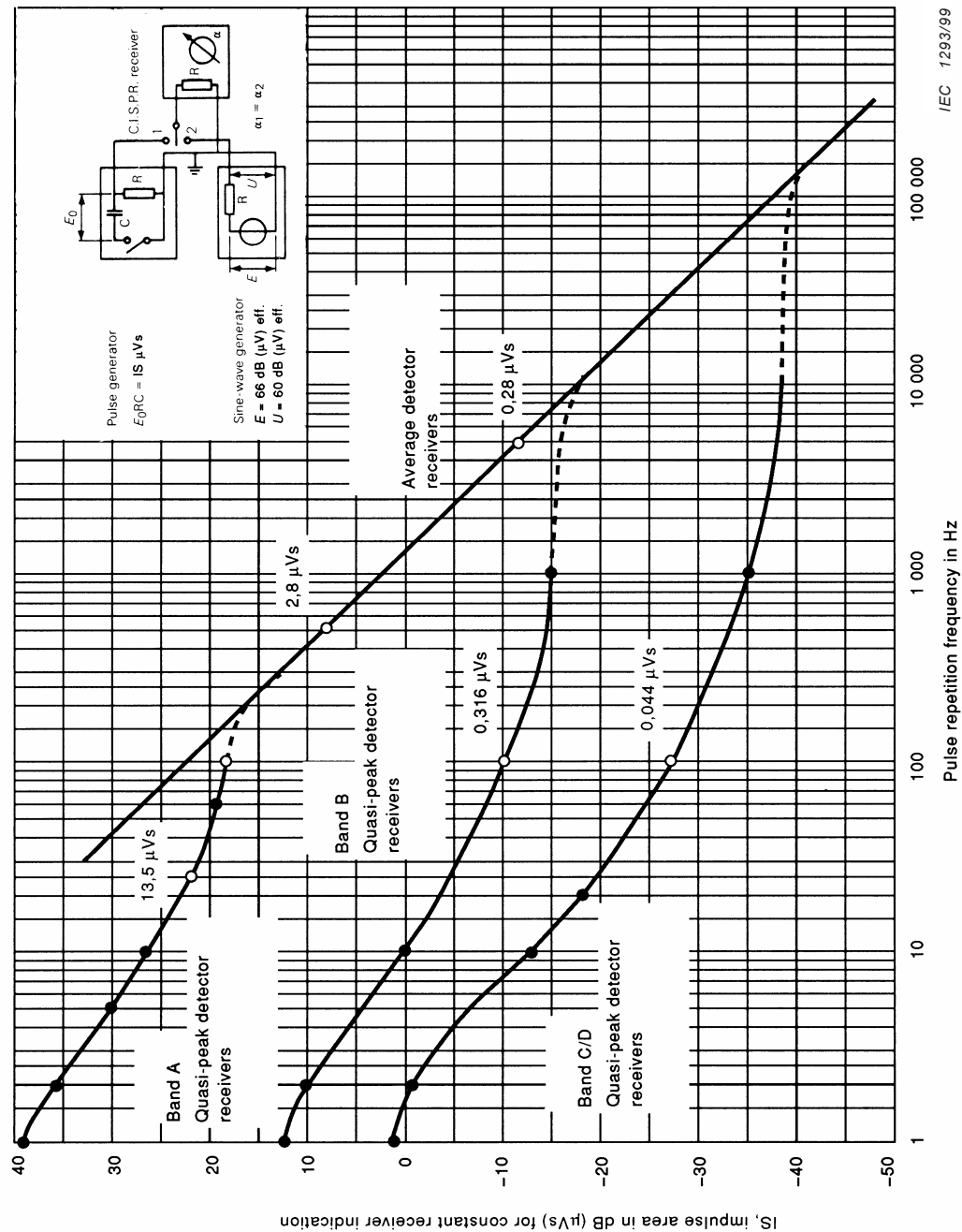


Figure 1d – Theoretical pulse response curve of quasi-peak detector receivers and average detector receiver (see 6.4.2)

Figure 1 – Pulse response curves

The response curve for a particular measuring receiver shall lie between the limits defined in the appropriate figure and quantified in Table 3.

Table 3 – Pulse response of quasi-peak receivers

Repetition frequency Hz	Relative equivalent level in dB of pulse for stated band			
	Band A 9 kHz to 150 kHz	Band B 0,15 MHz to 30 MHz	Band C 30 MHz to 300 MHz	Band D 300 MHz to 1 000 MHz
1 000	Note 4	$-4,5 \pm 1,0$	$-8,0 \pm 1,0$	$-8,0 \pm 1,0$
100	$-4,0 \pm 1,0$	0 (ref.)	0 (ref.)	0 (ref.)
60	$-3,0 \pm 1,0$	–	–	–
25	0 (ref.)	–	–	–
20	–	$+6,5 \pm 1,0$	$+9,0 \pm 1,0$	$+9,0 \pm 1,0$
10	$+4,0 \pm 1,0$	$+10,0 \pm 1,5$	$+14,0 \pm 1,5$	$+14,0 \pm 1,5$
5	$+7,5 \pm 1,0$	–	–	–
2	$+13,0 \pm 2,0$	$+20,5 \pm 2,0$	$+26,0 \pm 2,0$	$+26,0 \pm 2,0^*$
1	$+17,0 \pm 2,0$	$+22,5 \pm 2,0$	$+28,5 \pm 2,0$	$+28,5 \pm 2,0^*$
Isolated pulse	$+19,0 \pm 2,0$	$+23,5 \pm 2,0$	$+31,5 \pm 2,0$	$+31,5 \pm 2,0^*$

NOTE 1 The influence of the receiver characteristics upon its pulse response is considered in Annex D.

NOTE 2 The relationships between the pulse responses of a quasi-peak receiver and receivers with other detector types are given in 5.4, 6.4.1 and 7.4.1.

NOTE 3 The theoretical pulse response curves of quasi-peak and average detector receivers combined on an absolute scale are shown in Figure 1d. The ordinate of Figure 1d shows the open-circuit impulse areas in dB(μ Vs) corresponding to the open-circuit sine-wave voltage of 66 dB(μ V) r.m.s. The indication on a measuring receiver with an input matched to the calibrating generators will then be 60 dB(μ V). Where the measuring bandwidth is less than the pulse repetition frequency, the curves of Figure 1d are valid when the receiver is tuned to a discrete line of the spectrum.

NOTE 4 It is not possible to specify a response above 100 Hz in the frequency range 9 kHz to 150 kHz because of the overlapping of pulses in the i.f. amplifier.

NOTE 5 Annex A deals with the determination of the curve of response to repeated pulses.

NOTE 6 The pulse response is restricted due to overload at the input to the receiver at frequencies above 300 MHz. The values marked with an asterisk (*) in the table are optional and are not essential.

4.5 Selectivity

4.5.1 Overall selectivity (passband)

The curve representing the overall selectivity of the measuring receiver shall lie within the limits shown in Figures 2a, 2b or 2c.

Selectivity shall be described by the variation with frequency of the amplitude of the input sine-wave voltage that produces a constant indication on the measuring receiver.

NOTE For the measurement of equipment that requires higher selectivity at the transition between 130 kHz and 150 kHz (e.g. mains signalling equipment as defined in EN 50065-1/A2), a highpass filter may be added in front of the measuring receiver to achieve the following combined selectivity of CISPR measuring receiver and highpass filter:

Frequency kHz	Relative attenuation dB
150	≤ 1
146	≤ 6
145	≥ 6
140	≥ 34
130	≥ 81

The measuring receiver in conjunction with the highpass filter should fulfil the requirements of this standard.

4.5.2 Intermediate frequency rejection ratio

The ratio of the input sine-wave voltage at the intermediate frequency to that at the tuned frequency that produces the same indication of the measuring receiver shall be not less than 40 dB. Where more than one intermediate frequency is used, this requirement shall be met at each intermediate frequency.

4.5.3 Image frequency rejection ratio

The ratio of the input sine-wave voltage at the image frequency to that at the tuned frequency that produces the same indication on the measuring receiver shall be not less than 40 dB. Where more than one intermediate frequency is used, this requirement shall be met at the image frequencies corresponding to each intermediate frequency.

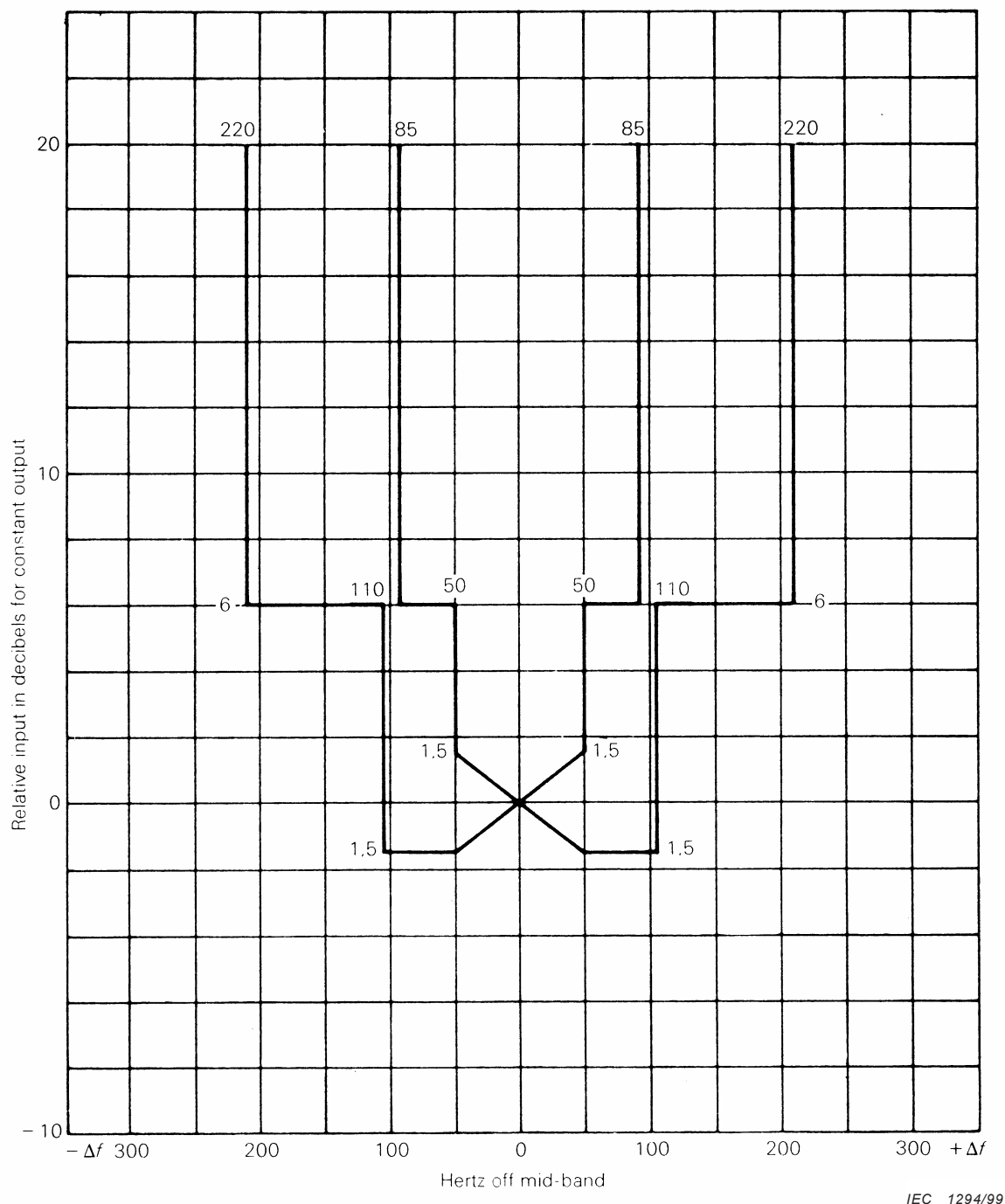


Figure 2a – Limits of overall selectivity – pass-band
(see 4.5.1, 5.5, 6.5, 7.5) (Band A)

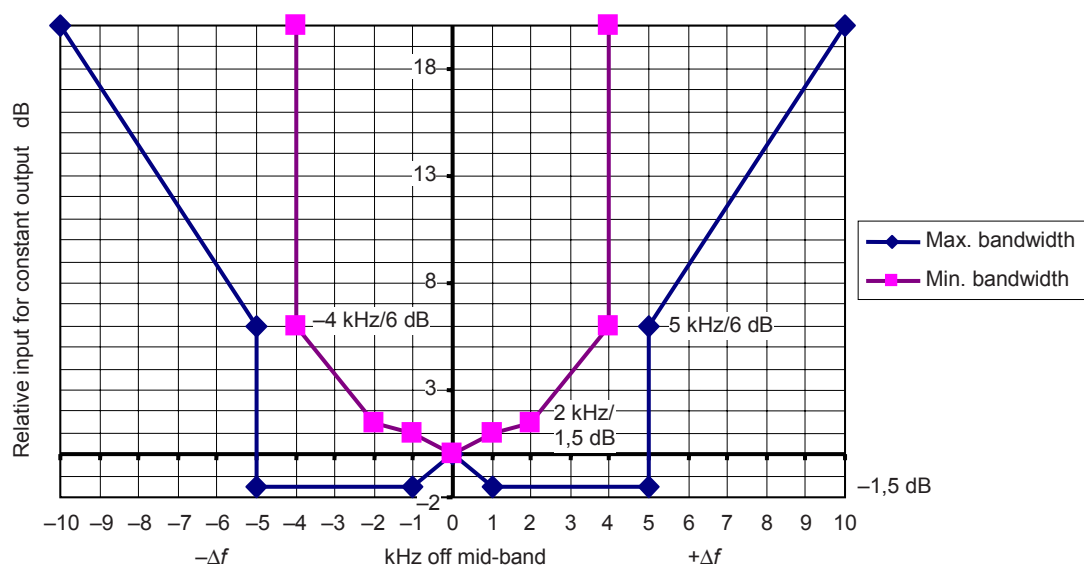
A₁

Figure 2b – Limits of overall selectivity – pass band (see 4.5.1, 5.5, 6.5, 7.5) (Band B)

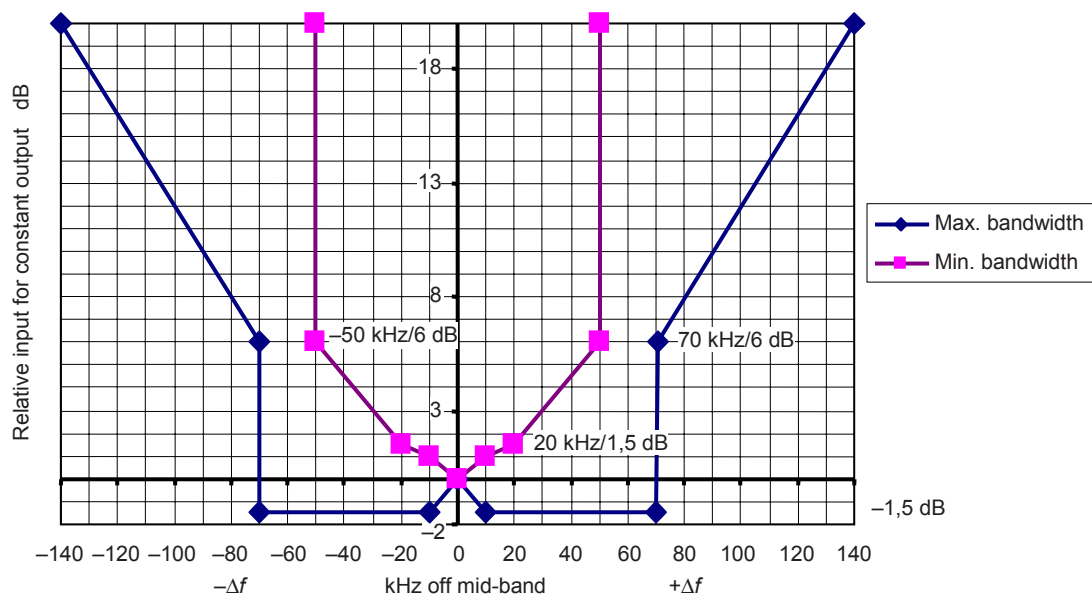


Figure 2c – Limits of overall selectivity – passband (see 4.5.1, 5.5, 6.5, 7.5) Bands (C and D)

Figure 2 – Limits of overall selectivity

A₁

4.5.4 Other spurious responses

The ratio of the input sine-wave voltage at frequencies other than those specified in 4.5.2 and 4.5.3 to that at the tuned frequency that produces the same indication on the measuring receiver shall be not less than 40 dB. Examples of the frequencies from which such spurious responses may occur are as follows:

$$(1/m) (nf_L \pm f_i) \text{ and } (1/k) (f_o)$$

where

m, n, k are integers;

f_L is the local oscillator frequency;

f_i is the intermediate frequency;

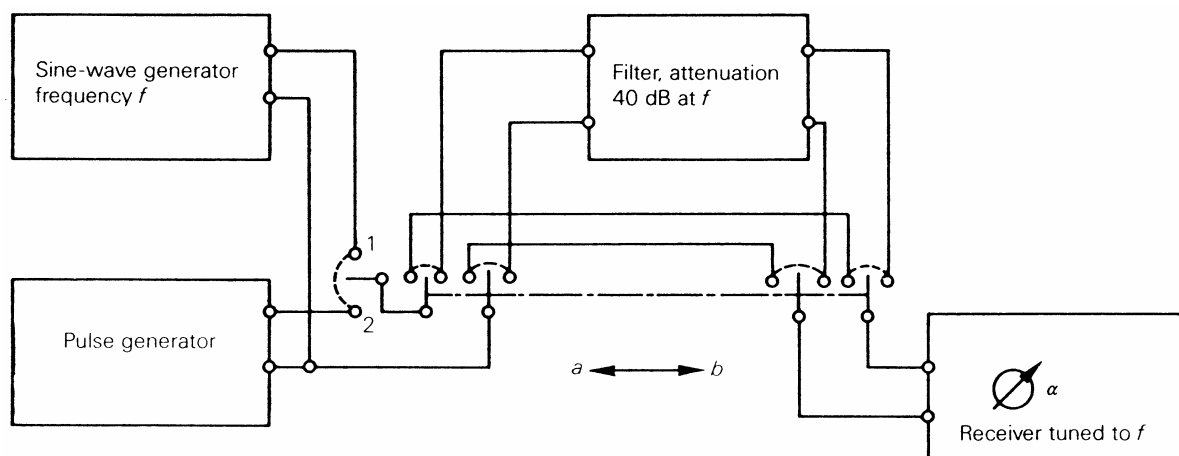
f_o is the tuned frequency.

NOTE Where more than one intermediate frequency is used, the frequencies f_L and f_i may refer to each of the local oscillator and intermediate frequencies used. In addition, spurious responses may occur when no input signal is applied to the measuring receiver; for example, when harmonics of the local oscillators differ in frequency by one of the intermediate frequencies. The requirements under this heading therefore cannot apply in these latter cases. The effect of these spurious responses is dealt with in 4.7.2.

4.6 Limitation of intermodulation effects

The response of the measuring receiver shall not be influenced by intermodulation effects when tested as follows.

Arrange the apparatus as shown in Figure 3. The pulse generator has a spectrum substantially uniform up to frequency 3) but at least 10 dB down at frequency 4) of the frequencies given in Table 4. The band-stop filter has an attenuation at the test frequency of at least 40 dB. Its bandwidth, B_6 , relative to the maximum attenuation of the filter shall lie between the frequencies 1) and 2) given in Table 4.



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Responses:

$$\alpha_{1a} = \alpha_{2a}$$

$$\alpha_{1b} = \alpha_{1a} - 40 \text{ dB}$$

$$\alpha_{2b} = \alpha_{2a} - 36 \text{ dB}$$

Figure 3 – Arrangement for testing intermodulation effects

Table 4 – Bandwidth characteristics for intermodulation test of quasi-peak measuring receivers

Frequency range	1) kHz	2) kHz	3) MHz	4) MHz
9 kHz to 150 kHz (band A)	0,4	4	0,15	0,3
0,15 MHz to 30 MHz (band B)	20	200	30	60
30 MHz to 300 MHz (band C)	500	2 000	300	600
300 MHz to 1 000 MHz (band D)	500	6 000	1 000	2 000

Connect the sine-wave generator output direct to the measuring receiver input and adjust for a convenient reading. Substitute the pulse generator for the sine-wave generator and adjust for the same reading. The pulse repetition frequency shall be 100 Hz for band A and 1 000 Hz for the other bands.

With the pulse generator connected as described above, switching the filter into circuit shall introduce attenuation of not less than 36 dB.

4.7 Limitation of receiver noise and internally generated spurious signals

4.7.1 Random noise

The background noise shall not introduce an error in excess of 1 dB.

NOTE The point where the background noise causes an error of 1 dB can be found by applying a signal, S , such that the meter indication is much larger (e.g. 40 dB) than the noise level N . By reducing the signal level S , the meter indication will reach a point, S_1 , where $(S_1 + N)$ deviates by 1 dB from the linear characteristic.

4.7.2 Continuous wave

Where more than one intermediate frequency is used, the existence of spurious responses as described in the note to 4.5.4 shall not introduce a measurement error in excess of 1 dB for any signal input to the measuring receiver. For a measuring receiver incorporating attenuation in the i.f. amplifier, this requirement shall be regarded as satisfied if the receiver complies with 4.7.1 when tested as described in 4.7.1, except that the attenuation in the intermediate stages shall be introduced after the last mixer stage.

4.8 Screening effectiveness

Screening effectiveness is a measure of the ability of the measuring receiver to operate in an electromagnetic field without degradation. The requirement applies to receivers operating within the "CISPR indication range" specified by the manufacturer as described in 3.9.

The screening of the receiver shall be such that when it is immersed in an ambient electromagnetic field of 3 V/m (unmodulated) at any frequency in the range 9 kHz to 1 000 MHz, an error of not greater than 1 dB is produced at the maximum and minimum of the CISPR indicating range as specified by the manufacturer of the receiver. In cases where a measuring receiver is not immune to the requirement of 3 V/m, the field strength and frequency at which the error exceeds 1 dB shall be stated by the manufacturer. The test shall be performed as described below.

The receiver is placed inside a screened enclosure. An input signal is applied to the receiver via a 2 m long well-screened cable (e.g. semi-rigid), through a feedthrough in the enclosure wall, to a signal generator placed outside the enclosure. The level of the input signal shall be at the maximum and the minimum of the CISPR indication range as specified by the manufacturer of the receiver. All other coaxial terminals of the receiver shall be terminated in their characteristic impedance.

Only essential leads (e.g. mains and input cables) for the normal use of the measuring receiver in its minimum configuration (excluding options such as headphones) shall be connected during the test. The leads shall have the lengths and be arranged as in typical use.

The strength of the ambient field in the vicinity of the measuring receiver shall be measured by a field strength monitor.

The receiver meter indication in the presence of the ambient electromagnetic field shall differ by not more than 1 dB from the meter indication when the field is absent.

4.8.1 Limitation of radio-frequency emissions from the measuring receiver

4.8.1.1 Conducted emissions

The radio disturbance voltage at any connecting pin of external lines (not only the mains terminals) shall not exceed the limits for class B equipment given in 5.1 of CISPR 11. The measurement of the radio disturbance voltage is however not required on the inner conductors of screened connections to screened equipment. The local oscillator injection power at the measuring receiver input terminated with its characteristic impedance shall not exceed 34 dB(pW) which is equivalent to 50 μ V across 50 Ω .

4.8.1.2 Radiated emissions

The radio disturbance field strength emitted by the measuring receiver shall not exceed the limits for class B equipment given in 5.2 of CISPR 11, for the frequency range of 9 kHz to 1 000 MHz. The limits shall also apply for frequency bands (ISM frequencies) listed in Table 1 of the same publication. In the frequency range of 1 GHz to 18 GHz, a limit of 45 dB(pW) shall apply.

Before performing radiated and conducted emission measurements, it is essential that the noise contributions of the test equipment do not affect the measured results (e.g. computer control).

4.9 Facilities for connection to a discontinuous disturbance analyzer

For all bands the disturbance measuring receiver shall have both an intermediate-frequency output and an output from the quasi-peak detector for the measurement of discontinuous disturbance. The loading of these outputs shall have no influence on the indicating instrument.

5 Measuring receivers with peak detector for the frequency range 9 kHz to 18 GHz

This clause specifies requirements for measuring receivers employing a peak detector when used for the measurement of impulsive or pulse-modulated disturbance.

Spectrum analyzers, that meet the requirements of this clause can be used for compliance measurements.

5.1 Input impedance

The input port of the measuring receivers shall be unbalanced. For receiver control settings within the CISPR indicating range, the nominal input impedance shall be 50 Ω with a VSWR not to exceed the values in Table 5.

Table 5 – VSWR requirements for receiver input impedance

Frequency range	RF attenuation dB	VSWR
9 kHz to 1 GHz	0	2,0 to 1
9 kHz to 1 GHz	≥ 10	1,2 to 1
1 GHz to 18 GHz	0	3,0 to 1
1 GHz to 18 GHz	≥ 10	2,0 to 1

Symmetric input impedance in the frequency range 9 kHz to 30 MHz: a balanced input transformer is to be used for symmetric (that is, ungrounded) measurements. (The preferred input impedance is 600 Ω for the frequency range 9 kHz to 150 kHz.) Symmetric input impedance may be incorporated either in the relevant symmetrical artificial network required to couple to the receiver or, optionally, in the measuring receiver itself.

5.2 Fundamental characteristics

5.2.1 Bandwidth

For all types of broadband disturbance, the actual value of the bandwidth shall be stated when the disturbance level is quoted and the bandwidth is within the values in Table 6.

Table 6 – Bandwidth requirements

Frequency range	Bandwidth B_6	Reference BW
9 kHz to 150 kHz (Band A)	100 Hz to 300 Hz ^a	200 Hz (B_6)
0,15 MHz to 30 MHz (Band B)	8 kHz to 10 kHz ^a	9 kHz (B_6)
30 MHz to 1000 MHz (Bands C and D)	100 kHz to 500 kHz ^a	120 kHz (B_6)
1 GHz to 18 GHz (Band E)	300 kHz to 2 MHz ^a	1 MHz ^b (B_{imp})
^a Since the response of a peak measuring receiver to non-overlapping pulses is proportional to its impulse bandwidth, either the actual bandwidth is quoted in the result or the level may be quoted as "in a 1 MHz bandwidth", calculated by dividing the measured value by the impulse bandwidth in MHz (see 3.2). For other types of broadband disturbance, this procedure may introduce an error. In case of dispute, data measured with the reference bandwidth shall take precedence.		
^b The bandwidth selected shall be defined as the impulse bandwidth of the measuring receiver with a tolerance of $\pm 10\%$.		

5.2.2 Charge and discharge time constants ratio

In order to achieve a meter reading within 10% of the true value of the peak at a repetition rate of 1 Hz, the ratio of discharge time constant to charge time constant shall be equal to or greater than the following values:

- a) $1,89 \times 10^4$ in the frequency range 9 kHz to 150 kHz
- b) $1,25 \times 10^6$ in the frequency range 150 kHz to 30 MHz
- c) $1,67 \times 10^7$ in the frequency range 30 MHz to 1 000 MHz
- d) $1,34 \times 10^8$ in the frequency range 1 GHz to 18 GHz

If the test receiver has a peak-hold capability, the hold time shall be adjustable to values between 30 ms and 3 s.

NOTE For receivers that use peak hold (and forced discharge after the hold time) or digital peak detection techniques, the requirement on the charge/discharge time constants ratio is not relevant. A maximum-hold function of the display may be used for signals with time-varying amplitudes.

If a spectrum analyzer is used for peak measurements, the video bandwidth (B_{video}) shall be set to a value greater than or equal to the resolution bandwidth (B_{resol}). For peak measurements, the result can be read from the spectrum analyzer display with the detector operating either in the linear or logarithmic mode.

5.2.3 Overload factor

For peak measuring receivers, the overload factor does not need to be as high as it is for other types of measuring receivers. For most direct-reading detectors, the overload factor need be only a little larger than unity. The overload factor shall be adequate for the time-constants used (see 5.2.2).

5.3 Sine-wave voltage accuracy

The accuracy of sine-wave voltage measurement shall be better than ± 2 dB ($\pm 2,5$ dB above 1 GHz) when fed with a sine-wave signal at a 50 Ω resistive source impedance.

5.4 Response to pulses

Up to 1 000 MHz, the response of the measuring receiver to pulses with impulse area $1,4/B_{\text{imp}}$ mVs (where B_{imp} is in hertz) emf at 50 Ω source impedance shall be equal to the response to an unmodulated sine-wave signal at the tuned frequency having an emf with rms value of 2 mV [66 dB(μ V)]. The source impedances of both the pulse generator and the signal generator shall be the same. The pulses shall have a uniform spectrum according to Table 2. A tolerance of $\pm 1,5$ dB is permitted in the sine-wave voltage level, and this is a requirement for all pulse repetition frequencies for which no overlapping pulses occur at the output of the IF amplifier.

NOTE 1 Annexes B and C describe methods for determining the output characteristics of pulse generators for use in testing for the requirements of this subclause.

NOTE 2 At a repetition rate of 25 Hz for Band A and 100 Hz for the other bands, the relationship between the indications of a peak measuring receiver and a quasi-peak measuring receiver with the preferred bandwidth are given in Table 7.