IEC®

CISPR 16-1-1

Edition 3.1 2010-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE
COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

Specification for radio disturbance and immunity measuring apparatus and methods –
Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus

**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 16-1-1:2010+A1:2010

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:
Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,…). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:
Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

IEC®

CISPR 16-1-1

Edition 3.1 2010-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE
COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

Specification for radio disturbance and immunity measuring apparatus and methods –
Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX CQ

ICS 33.100.10 ISBN 978-2-88912-193-9

CONTENTS

FOREWORD 6
INTRODUCTION 8
INTRODUCTION (to amendment 1) 8

1 Scope 9
2 Normative references 9
3 Terms and definitions 10
4 Quasi-peak measuring receivers for the frequency range 9 kHz to 1 000 MHz 13
4.1 General 13
4.2 Input impedance 13
4.3 Sine-wave voltage accuracy 13
4.4 Response to pulses 14
4.4.1 Amplitude relationship (absolute calibration) 14
4.4.2 Variation with repetition frequency (relative calibration) 14
4.5 Selectivity 19
4.5.1 Overall selectivity (passband) 19
4.5.2 Intermediate frequency rejection ratio 19
4.5.3 Image frequency rejection ratio 19
4.5.4 Other spurious responses 21
4.6 Limitation of intermodulation effects 22
4.7 Limitation of receiver noise and internally generated spurious signals 23
4.7.1 Random noise 23
4.7.2 Continuous wave 23
4.8 Screening effectiveness 23
4.8.1 General 23
4.8.2 Limitation of radio-frequency emissions from the measuring receiver 24
4.9 Facilities for connection to a discontinuous disturbance analyzer 24
5 Measuring receivers with peak detector for the frequency range 9 kHz to 18 GHz 24
5.1 General 24
5.2 Input impedance 24
5.3 Fundamental characteristics 25
5.3.1 Bandwidth 25
5.3.2 Charge and discharge time constants ratio 25
5.3.3 Overload factor 26
5.4 Sine-wave voltage accuracy 26
5.5 Response to pulses 26
5.6 Selectivity 26
5.7 Intermodulation effects, receiver noise, and screening 27
6 Measuring receivers with average detector for the frequency range 9 kHz to 18 GHz 28
6.1 General 28
6.2 Input impedance 28
6.3 Fundamental characteristics 28
6.3.1 Bandwidth 28
6.3.2 Overload factor 28

6.4 Sine-wave voltage accuracy 29
6.5 Response to pulses 29
6.5.1 General 29
6.5.2 Amplitude relationship 29
6.5.3 Variation with repetition frequency 30
6.5.4 Response to intermittent, unsteady and drifting narrowband disturbances 30
6.6 Selectivity 32
6.7 Intermodulation effects, receiver noise, and screening 32
7 Measuring receivers with rms-average detector for the frequency range 9 kHz to 18 GHz 32
7.1 General 32
7.2 Input impedance 32
7.3 Fundamental characteristics 33
7.3.1 Bandwidth 33
7.3.2 Overload factor 33
7.4 Sine-wave voltage accuracy 34
7.5 Response to pulses 34
7.5.1 Construction details 34
7.5.2 Amplitude relationship 34
7.5.3 Variation with repetition frequency 35
7.5.4 Response to intermittent, unsteady and drifting narrowband disturbances 35
7.6 Selectivity 36
7.7 Intermodulation effects, receiver noise, and screening 36
8 Measuring receivers for the frequency range 1 GHz to 18 GHz with amplitude probability distribution (APD) measuring function 36
9 Disturbance analyzers 37
9.1 General 37
9.2 Fundamental characteristics 38
9.3 Test method for the validation of the performance check for the click analyzer 44
9.3.1 Basic requirements 44
9.3.2 Additional requirements 45
Annex A (normative) Determination of response to repeated pulses of quasi-peak and rms-average measuring receivers (See 3.6, 4.4.2, 7.3.2 and 7.5.1) 46
Annex B (normative) Determination of pulse generator spectrum (See 4.4, 5.5, 6.5, 7.5) 52
Annex C (normative) Accurate measurements of the output of nanosecond pulse generators (See 4.4, 5.5, 6.5, 7.5) 54
Annex D (normative) Influence of the quasi-peak measuring receiver characteristics on its pulse response (See 4.4.2) 56
Annex E (normative) Response of average and peak measuring receivers (See 6.3.1) 57
Annex F (normative) Performance check of the exceptions from the definitions of a click according to 4.2.3 of CISPR 14-1 66
Annex G (informative) Rationale for the specifications of the APD measuring function 73
Annex H (informative) Characteristics of a quasi-peak measuring receiver 76
Annex I (informative) Example of EMI receiver and swept spectrum analyzer architecture 77

Bibliography...79

Figure 1 – Pulse response curves 17
Figure 2 – Limits of overall selectivity 21
Figure 3 – Arrangement for testing intermodulation effects 22
Figure 4 – Limits for the overall selectivity – pass band (Band E).............................27
Figure 5 – Block diagram of an average detector. 31
Figure 6 – Screenshot showing response of the meter-simulating network to an intermittent narrowband signal 31
Figure 7 – Example of a disturbance analyzer..39
Figure 8 – A graphical presentation of test signals used in the test of the analyzer for the performance check against the definition of a click according to Table 14 40
Figure E.1 – Correction factor for estimating the ratio B_{imp}/B_6 for other tuned circuits..........58
Figure E.2 – Pulse rectification coefficient P 60
Figure E.3 – Example (spectrum screenshot) of a pulse-modulated signal with a pulse width of 200 ns 61
Figure E.4 – Pulse-modulated RF signal applied to a measuring receiver 62
Figure E.5 – Filtering with a B_{imp} much smaller than the prf 62
Figure E.6 – Filtering with a B_{imp} much wider than the prf.......................................63
Figure E.7 – Calculation of the impulse bandwidth 63
Figure E.8 – Example of a normalized linear selectivity function 65
Figure F.1 – A graphical presentation of the test signals used for the performance check of the analyzer with the additional requirements according to Table F.1.....................72
Figure G.1 – Block diagram of APD measurement circuit without A/D converter..................74
Figure G.2 – Block diagram of APD measurement circuit with A/D converter........................74
Figure G.3 – Example of display of APD measurement 75
Figure I.1 – Example block diagram of EMI receiver consisting of swept spectrum analyzer with added preselector, preamplifier and quasi-peak/average detector 77

Table 1 – Test pulse characteristics for quasi-peak measuring receivers (see 4.4.1) 14
Table 2 – Pulse response of quasi-peak measuring receivers 18
Table 3 – Combined selectivity of CISPR measuring receiver and high-pass filter................19
Table 4 – Bandwidth characteristics for intermodulation test of quasi-peak measuring receivers (see 4.6)...22
Table 5 – VSWR requirements for receiver input impedance...25
Table 6 – Bandwidth requirements for measuring receivers with peak detector 25
Table 7 – Relative pulse response of peak and quasi-peak measuring receivers for the same bandwidth (frequency range 9 kHz to 1 000 MHz)..26
Table 8 – Bandwidth requirements for measuring receivers with average detector 28
Table 9 – Relative pulse response of average and quasi-peak measuring receivers for the same bandwidth (frequency range 9 kHz to 1 GHz)...29
Table 10 – Maximum reading of average measuring receivers for a pulse-modulated sine-wave input in comparison with the response to a continuous sine wave having the same amplitude 31
Table 11 – VSWR requirements of input impedance...33
Table 12 – Bandwidth requirements for measuring receivers with rms-average detector 33

Table 13 – Minimum pulse repetition rate without overload 33
Table 14 – Relative pulse response of rms-average and quasi-peak measuring receivers 34
Table 15 – Pulse response of rms-average measuring receiver 35
Table 16 – Maximum reading of rms-average measuring receivers for a pulse-modulated sine-wave input in comparison with the response to a continuous sine wave having the same amplitude 36
Table 17 – Disturbance analyzer performance test – Test signals used for the check against the definition of a click 41
Table B.1 – Pulse generator characteristics 52
Table E.1 – B_{imp} and A_{imp} values for a peak measuring receiver 59
Table E.2 – Carrier level for pulse-modulated signal of 1,4 nVs 61
Table F.1 – Disturbance analyzer test signals [a] 67
Table H.1 – Characteristics of quasi-peak measuring receivers 76

INTERNATIONAL ELECTROTECHNICAL COMMISSION
INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

____

SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

This consolidated version of CISPR 16-1-1 consists of the third edition (2010) [documents CISPR/A/867/FDIS and CISPR/A/881/RVD], its amendment 1 (2010) [documents CISPR/A/876/CDV and CISPR/A/893/RVC] and its corrigenda of October 2010 and October 2011. It bears the edition number 3.1.

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.

International Standard CISPR 16-1-1 has been prepared by CISPR subcommittee A: Radio-interference measurements and statistical methods.

This main technical change with respect to the previous edition consists of the addition of new provisions for the use of spectrum analyzers for compliance measurements.

It has the status of a basic EMC publication in accordance with IEC Guide 107, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the CISPR 16 series can be found, under the general title *Specification for radio disturbance and immunity measuring apparatus and methods*, on the IEC website.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the corrigenda 1 (October 2010) and 2 (October 2011) have been included in this copy.

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

The CISPR 16 series, published under the general title *Specification for radio disturbance and immunity measuring apparatus and methods,* is comprised of the following sets of standards and reports:

- CISPR 16-1 – five parts covering measurement instrumentation specifications;
- CISPR 16-2 – five parts covering methods of measurement;
- CISPR 16-3 – a single publication containing various technical reports (TRs) with further information and background on CISPR and radio disturbances in general;
- CISPR 16-4 – five parts covering uncertainties, statistics and limit modelling.

CISPR 16-1 consists of the following parts, under the general title *Specification for radio disturbance and immunity measuring apparatus and methods – Radio disturbance and immunity measuring apparatus:*

– Part 1-1: Measuring apparatus
– Part 1-2: Ancillary equipment – Conducted disturbances
– Part 1-3: Ancillary equipment – Disturbance power
– Part 1-4: Ancillary equipment – Radiated disturbances
– Part 1-5: Antenna calibration test sites for 30 MHz to 1 000 MHz

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning the measuring receiver with rms-average detector (patent no DE 10126830) given in Clause 7.

IEC takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured the IEC that he/she is willing to negotiate licences either free of charge or under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from:

Rohde & Schwarz GmbH & Co. KG
Muehldorfstrasse 15
81671 Muenchen
Germany

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. IEC shall not be held responsible for identifying any or all such patent rights.

ISO (www.iso.org/patents) and IEC (http://www.iec.ch/tctools/patent_decl.htm) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

INTRODUCTION
(to amendment 1)

CISPR 16-1-1 uses a "black box" approach to define specifications for test instrumentation. All stated specifications in CISPR 16-1-1 are met by an instrument independent of the selected implementation or technology in order to be considered suitable for measurements in accordance with CISPR standards. The addition of FFT-based measuring instrumentation requires further specifications as addressed in this amendment.

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 specifies the characteristics and performance of equipment for the measurement of radio disturbance in the frequency range 9 kHz to 18 GHz. In addition, requirements are provided for specialized equipment for discontinuous disturbance measurements.

NOTE In accordance with IEC Guide 107, CISPR 16-1-1 is a basic EMC standard for use by product committees of the IEC. As stated in Guide 107, product committees are responsible for determining the applicability of the EMC standard. CISPR and its sub-committees are prepared to co-operate with product committees in the evaluation of the value of particular EMC tests for specific products.

The specifications in this standard apply to EMI receivers and spectrum analyzers. The term “measuring receiver” used in this standard refers to both EMI receivers and spectrum analyzers.

Further guidance on the use of use of spectrum analyzers and scanning receivers can be found in Annex B of any one of the following standards: CISPR 16-2-1, CISPR 16-2-2 or CISPR 16-2-3.

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.

CISPR 11:2009, *Industrial, scientific and medical equipment – Radio-frequency 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*
Amendment 1 (2008)

CISPR 16-2-1:2008, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*

CISPR 16-2-2:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-2: Methods of measurement of disturbances and immunity – Measurement of disturbance power*
Amendment 1 (2004)
Amendment 2 (2005)

CISPR 16-2-3:2006, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

CISPR/TR 16-3:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 3: CISPR technical reports*
Amendment 1 (2005)
Amendment 2 (2006)

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161, and the following apply.

3.1
bandwidth
B_n
width of the overall selectivity curve of the receiver between two points at a stated attenuation, below the midband response

NOTE n is the stated attenuation in dB.

3.2
CISPR indication range
range specified by the manufacturer which gives the maximum and the minimum meter indications within which the measuring receiver meets the requirements of this part of CISPR 16

3.3
electrical charge time constant
T_C
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 IF amplifier is applied to the input of the stage immediately preceding the detector. The indication, D, of an instrument having no inertia (e.g. an 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.

3.4
electrical discharge time constant
T_D
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.

3.5
impulse area
A_{imp}
voltage-time area of a pulse defined by the integral:

$$A_{imp} = \int_{-\infty}^{+\infty} V(t)\,dt \qquad (1)$$

NOTE 1 Impulse area, sometimes referred to as impulse strength, is typically expressed in µVs or dB(µVs).

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

3.6
impulse bandwidth

B_{imp}

$$B_{imp} = \frac{A(t)_{max}}{2G_0 \times A_{imp}} \qquad (2)$$

where

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

G_0 is the gain of the circuit at the centre frequency.

Specifically for two critically-coupled tuned transformers,

$$B_{imp} = 1{,}05 \times B_6 = 1{,}31 \times B_3 \qquad (3)$$

where B_6 and B_3 are respectively the bandwidths at the –6 dB and –3 dB points

NOTE See A.2 for further information.

3.7
measuring receiver

~~instrument, such as a tunable voltmeter, an EMI receiver or a spectrum analyzer with or without preselection, that meets the requirements of the relevant parts of this standard~~

~~NOTE 1 The term "measuring receiver" used in this standard refers to both EMI receivers and spectrum analyzers.~~

~~NOTE 2 See Annex I for further information.~~

instrument such as a tunable voltmeter, an EMI receiver, a spectrum analyzer or an FFT-based measuring instrument, with or without preselection, that meets the relevant parts of this standard

NOTE See Annex I for further information.

3.8
mechanical time constant of a critically damped indicating instrument

T_M

$$T_M = \frac{T_L}{2\pi} \qquad (4)$$

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:

$$T_M^2\left(\frac{d^2\alpha}{dt^2}\right) + 2T_M\frac{d\alpha}{dt} + \alpha = ki \qquad (5)$$

where

α is the deflection;

i is the current through the instrument; and

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:

a) the period of free oscillation having been adjusted to $2\pi T_M$, damping is added so that $\alpha T = 0{,}35\alpha_{max}$.

b) when the period of oscillation cannot be measured, the damping is adjusted to be just below critical such that the overswing is not greater than 5 % and the moment of inertia of the movement is such that $\alpha T = 0{,}35\alpha_{max}$.

3.9
overload factor
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

NOTE 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).

3.10
symmetric voltage
radio-frequency disturbance voltage appearing between the two wires in a two-wire circuit, such as a single-phase mains supply. 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)

3.11
weighting (of e.g. impulsive disturbance)
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

NOTE 1 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)

NOTE 2 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

3.11.1
weighted disturbance measurement
measurement of disturbance using a weighting detector

3.11.2
weighting characteristic
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

3.11.3
weighting detector
detector which provides an agreed weighting function

3.11.4
weighting factor
value of the weighting function relative to a reference PRF or relative to the peak value

NOTE Weighting factor is expressed in dB.

3.11.5
weighting function
weighting curve
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

3.12
measurement time
T_m
effective, coherent time for a measurement result at a single frequency (in some areas also called dwell time)

– for the peak detector, the effective time to detect the maximum of the signal envelope
– for the quasi-peak detector, the effective time to measure the maximum of the weighted envelope
– for the average detector, the effective time to average the signal envelope
– for the rms detector, the effective time to determine the rms of the signal envelope

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

4.1 General

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). Fundamental characteristics of a quasi-peak measuring instrument are provided in Annex H.

Spectrum analyzers and FFT-based measuring instruments that meet the requirements of this clause can be used for compliance measurements. For emission measurements, FFT-based measuring instruments shall sample and evaluate the signal continuously during the measurement time.

4.2 Input impedance

The input circuit of measuring receivers shall be unbalanced. For receiver control settings within the CISPR indication range, the input impedance shall be nominally 50 Ω with a voltage standing wave ratio (VSWR) not to exceed 2,0:1 when the radio frequency (RF) attenuation is 0 dB and 1,2:1 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.

4.3 Sine-wave voltage accuracy

The accuracy of measurement of sine-wave voltages shall be better than ±2 dB when the instrument measures a sine-wave signal with 50 Ω resistive source impedance.