

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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 2-2: Methods of measurement of disturbances and immunity –
Measurement of disturbance power**

**Spécifications des méthodes et des appareils de mesure des perturbations
radioélectriques et de l'immunité aux perturbations radioélectriques –
Partie 2-2: Méthodes de mesure des perturbations et de l'immunité –
Mesure de la puissance perturbatrice**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX



ICS 33.100.10; 33.100.20

ISBN 978-2-88912-097-0

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions	7
4 Types of disturbance to be measured.....	12
4.1 General	12
4.2 Types of disturbance	12
4.3 Detector functions	12
5 Connection of measuring equipment	13
5.1 General	13
5.2 Connection of ancillary equipment.....	13
6 General measurement requirements and conditions	13
6.1 General	13
6.2 Disturbance not produced by the equipment under test	13
6.2.1 General	13
6.2.2 Compliance testing	13
6.3 Measurement of continuous disturbance	13
6.3.1 Narrowband continuous disturbance.....	13
6.3.2 Broadband continuous disturbance.....	14
6.3.3 Use of spectrum analyzers and scanning receivers.....	14
6.4 Operating conditions of the EUT	14
6.4.1 General	14
6.4.2 Normal load conditions.....	14
6.4.3 The time of operation.....	14
6.4.4 Running-in time	14
6.4.5 Supply	14
6.4.6 Mode of operation.....	14
6.5 Interpretation of measuring results.....	14
6.5.1 Continuous disturbance	14
6.5.2 Discontinuous disturbance	15
6.5.3 Measurement of the duration of disturbances	15
6.6 Measurement times and scan rates for continuous disturbance	15
6.6.1 General	15
6.6.2 Minimum measurement times	15
6.6.3 Scan rates for scanning receivers and spectrum analyzers	16
6.6.4 Scan times for stepping receivers	17
6.6.5 Strategies for a spectrum overview using the peak detector.....	18
6.6.6 Timing considerations using FFT-based instruments	21
7 Measurements using the absorbing clamp.....	23
7.1 Introduction to ACMM	23
7.2 Application of the absorbing clamp measurement method	24
7.2.1 General	24
7.2.2 Frequency range.....	24
7.2.3 EUT unit dimensions.....	24
7.2.4 LUT requirements	24
7.3 Requirements for measurements instrumentation and test site	24

7.3.1	General	24
7.3.2	Measuring receiver	24
7.3.3	Absorbing clamp assembly.....	24
7.3.4	Absorbing clamp test site requirements	25
7.4	Ambient requirements	26
7.5	EUT leads requirements	26
7.5.1	General	26
7.5.2	Lead under test.....	26
7.5.3	Leads not under test	27
7.6	Test set-up requirements	27
7.6.1	General	27
7.6.2	EUT set-up	27
7.6.3	LUT set-up.....	28
7.6.4	Absorbing clamp	29
7.6.5	Measurement cable.....	29
7.7	Operating conditions of the EUT	29
7.8	Measurement procedure	29
7.8.1	Ambient measurement procedure.....	29
7.8.2	EUT measurement procedure	29
7.9	Determination of disturbance power	31
7.10	Determination of the measurement uncertainty.....	31
7.11	Compliance criteria.....	31
8	Automated measurement of emissions.....	32
8.1	Precautions for automating measurements.....	32
8.2	Generic measurement procedure	32
8.3	Prescan measurements	33
8.3.1	Purpose.....	33
8.3.2	Determination of the required measurement time	33
8.3.3	Defining the prescan measurement	33
8.4	Data reduction	34
8.5	Emission maximization and final measurement	34
8.6	Post processing and reporting.....	34
8.7	Emission measurement strategies with FFT-based measuring instruments.....	34
Annex A (informative) Historical background to the method of measurement of the interference power produced by electrical household and similar appliances in the VHF range (see 7.1)		35
Annex B (informative) Use of spectrum analyzers and scanning receivers (see Clause 6)		38
Annex C (informative) Scan rates and measurement times for use with the average detector		41
Annex D (normative) Determination of suitability of spectrum analyzers for compliance tests.....		45
Bibliography		46
Figure 1 – Measurement of a combination of a CW signal (“NB”) and an impulsive signal (“BB”) using multiple sweeps with maximum hold.....		18
Figure 2 – Example of a timing analysis.....		19
Figure 3 – A broadband spectrum measured with a stepped receiver		20
Figure 4 – Intermittent narrowband disturbances measured using fast short repetitive sweeps with maximum hold function to obtain an overview of the emission spectrum		20

Figure 5 – FFT scan in segments	22
Figure 6 – Frequency resolution enhanced by FFT-based measuring instrument	23
Figure 7 – Schematic drawing of the absorbing clamp measurement method	25
Figure 8 – Side view of the absorbing clamp measurement set-up for table top EUTs	28
Figure 9 – Side view of the absorbing clamp measurement set-up for floor standing EUTs	28
Figure 10 – Process for reduction in measurement time.....	32
Figure C.1 – Weighting function of a 10 ms pulse for peak (“PK”) and average detections with (“CISPR AV”) and without (“AV”) peak reading; meter time constant 160 ms.....	43
Figure C.2 – Weighting functions of a 10 ms pulse for peak (“PK”) and average detections with (“CISPR AV”) and without (“AV”) peak reading; meter time constant 100 ms.....	43
Figure C.3 – Example of weighting functions (of a 1 Hz pulse) for peak (“PK”) and average detections as a function of pulse width: meter time constant 160 ms.....	44
Figure C.4 – Example of weighting functions (of a 1 Hz pulse) for peak (“PK”) and average detections as a function of pulse width: meter time constant 100 ms.....	44
Table 1 – Minimum measurement times for the four CISPR bands.....	16
Table 2 – Minimum scan times for the three CISPR bands with peak and quasi-peak detectors.....	16
Table 3 – Sample scheme for an absorbing clamp measurement with an upper frequency bound of 300 MHz.....	30
Table 4 – Sample scheme for an absorbing clamp measurement with an upper frequency bound of 1 000 MHz.....	31
Table B.1 – Minimum sweep time/fastest scan rates.....	39
Table C.1 – Pulse suppression factors and scan rates for a 100 Hz video bandwidth.....	42
Table C.2 – Meter time constants and the corresponding video bandwidths and maximum scan rates	42
Table D.1 – Maximum amplitude difference between peak and quasi-peak detected signals	45

IECNORM.COM : Click to view the full PDF of CISPR 16 2-2 (Ed. 2.0 (2010-07):2010

INTERNATIONAL ELECTROTECHNICAL COMMISSION
INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY
MEASURING APPARATUS AND METHODS –**

**Part 2-2: Methods of measurement of disturbances and immunity –
Measurement of disturbance power**

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.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard CISPR 16-2-2 has been prepared by CISPR subcommittee A: Radio-interference measurements and statistical methods, in cooperation with CISPR subcommittee D: Electromagnetic disturbances related to electric/electronic equipment on vehicles and internal combustion engine powered devices.

This second edition cancels and replaces the first edition (2003), its Amendment 1 (2004) and Amendment 2 (2005). It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition: provisions for the use of spectrum analyzers for compliance measurements (Annex D) and the use of FFT-based test instrumentation (Clauses 3, 6 and 8) are now included.

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*.

The text of this standard is based on the following documents:

CDV	Report on voting
CISPR/A/877/CDV	CISPR/A/896/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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 on the IEC website under the general title *Specification for radio disturbance and immunity measuring apparatus and methods*.

The committee has decided that the contents of this publication 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.

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.

SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 2-2: Methods of measurement of disturbances and immunity – Measurement of disturbance power

1 Scope

This part of CISPR 16 specifies the methods of measurement of disturbance power using the absorbing clamp in the frequency range 30 MHz to 1 000 MHz.

NOTE In accordance with IEC Guide 107, CISPR 16-2-2 is a basic EMC publication 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 determination of the value of particular EMC tests for specific products.

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 16-1-1:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-1-3:2004, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-3: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Disturbance power*

CISPR 16-1-4, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Antennas and test sites for radiated disturbance measurements*

CISPR 16-4-2, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements*

IEC 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility*

SOMMAIRE

AVANT-PROPOS	51
1 Domaine d'application	53
2 Références normatives	53
3 Termes et définitions	53
4 Types de perturbations à mesurer	58
4.1 Généralités	58
4.2 Types de perturbations	58
4.3 Fonctions de détection	58
5 Connexion du matériel de mesure	59
5.1 Généralités	59
5.2 Connexion des matériels auxiliaires	59
6 Exigences et conditions générales de mesure	59
6.1 Généralités	59
6.2 Perturbation non produite par le matériel en essai	59
6.2.1 Généralités	59
6.2.2 Essais de conformité	59
6.3 Mesure d'une perturbation continue	60
6.3.1 Perturbation continue à bande étroite	60
6.3.2 Perturbation continue à large bande	60
6.3.3 Utilisation des analyseurs de spectre et des récepteurs à balayage	60
6.4 Conditions de fonctionnement de l'appareil en essai	60
6.4.1 Généralités	60
6.4.2 Conditions normales de charge	60
6.4.3 Durée de fonctionnement	60
6.4.4 Durée de fonctionnement préalable	60
6.4.5 Alimentation	61
6.4.6 Mode de fonctionnement	61
6.5 Interprétation des résultats de mesure	61
6.5.1 Perturbations continues	61
6.5.2 Perturbations discontinues	61
6.5.3 Mesure de la durée des perturbations	61
6.6 Durées de mesure et vitesses de balayage pour les perturbations continues	62
6.6.1 Généralités	62
6.6.2 Durées minimales de mesure	62
6.6.3 Vitesse de balayage des récepteurs à balayage et des analyseurs de spectre	63
6.6.4 Durée de balayage pour les récepteurs à accord par palier	64
6.6.5 Stratégies pour une vue d'ensemble du spectre en utilisant le détecteur de crête	64
6.6.6 Considérations temporelles concernant l'utilisation d'appareils de mesure à FFT	68
7 Mesures à l'aide d'une pince absorbante	70
7.1 Introduction à la méthode de mesure par pince absorbante (ACMM)	70
7.2 Application de la méthode de mesure par pince absorbante	71
7.2.1 Généralités	71
7.2.2 Plage de fréquences	71

7.2.3	Dimensions d'un module d'un équipement en essai	71
7.2.4	Exigences relatives au LUT	71
7.3	Exigences relatives à l'instrumentation de mesure et au site d'essai	71
7.3.1	Généralités	71
7.3.2	Récepteur de mesure	72
7.3.3	Ensemble pince absorbante	72
7.3.4	Exigences relatives au site d'essai au moyen d'une pince absorbante	72
7.4	Exigences d'environnement ambiant	73
7.5	Exigences relatives aux câbles de l'appareil en essai	73
7.5.1	Généralités	73
7.5.2	Câble en essai	74
7.5.3	Câbles non soumis à l'essai	74
7.6	Exigences relatives au montage d'essai	74
7.6.1	Généralités	74
7.6.2	Montage d'essai de l'appareil en essai	74
7.6.3	Montage du câble en essai (LUT)	76
7.6.4	Pince absorbante	76
7.6.5	Câble de mesure	76
7.7	Conditions de fonctionnement de l'appareil en essai	77
7.8	Procédure de mesure	77
7.8.1	Procédure de mesure de l'environnement ambiant	77
7.8.2	Procédure de mesure de l'appareil en essai	77
7.9	Détermination de la puissance perturbatrice	78
7.10	Détermination de l'incertitude de mesure	79
7.11	Critères de conformité	79
8	Mesure automatisée des émissions	79
8.1	Précautions pour les mesures automatisées	79
8.2	Procédure générale de mesure	80
8.3	Mesures par pré-balayage	80
8.3.1	Objectif	80
8.3.2	Détermination de la durée de mesure nécessaire	80
8.3.3	Définition de la mesure de pré-balayage	81
8.4	Réduction des données	81
8.5	Maximisation des émissions et mesures finales	82
8.6	Post-traitement et rapport	82
8.7	Stratégies de la mesure d'émissions avec des appareils de mesure à FFT	82
	Annexe A (informative) Contexte historique de la méthode de mesure du pouvoir perturbateur des appareils électrodomestiques et des appareils analogues dans la gamme des ondes métriques (voir 7.1)	83
	Annexe B (informative) Utilisation des analyseurs de spectre et des récepteurs à balayage (voir Article 6)	86
	Annexe C (informative) Durées de mesure et vitesses de balayage utilisables avec un détecteur de valeur moyenne	89
	Annexe D (normative) Détermination de l'adéquation des analyseurs de spectre à des essais de conformité	93
	Bibliographie	94
	Figure 1 – Mesure d'une combinaison d'un signal à ondes entretenues ("bande étroite") et d'un signal en impulsion ("large bande") en utilisant des balayages multiples avec maintien du maximum	65

Figure 2 – Exemple d'analyse temporelle.....	66
Figure 3 – Spectre large bande mesuré avec un récepteur à accord par palier.....	67
Figure 4 – Perturbations intermittentes à bande étroite mesurées en utilisant des balayages courts et rapides avec la fonction « maintien du maximum » pour obtenir une vue d'ensemble du spectre d'émission.....	67
Figure 5 – Balayage de FFT en segments.....	69
Figure 6 – Résolution en fréquence améliorée au moyen d'un appareil de mesure à FFT.....	70
Figure 7 – Schéma de la méthode de mesure par pince absorbante.....	72
Figure 8 – Vue latérale du montage de mesure par pince absorbante pour les appareils en essai portatifs.....	75
Figure 9 – Vue latérale du montage de mesure par pince absorbante pour les appareils en essai destinés à reposer sur le sol.....	76
Figure 10 – Procédure pour la réduction du temps de mesure.....	80
Figure C.1 – Fonctions de pondération d'une impulsion de 10 ms pour des détections de valeurs crêtes (PK) et moyennes avec (CISPR AV) ou sans (AV) lecteur crête; avec un contrôleur de période de 160 ms.....	91
Figure C.2 – Fonctions de pondération d'une impulsion de 10 ms pour des détections de valeurs crêtes (PK) et moyennes avec (CISPR AV) ou sans (AV) lecteur crête; avec un contrôleur de période de 100 ms.....	91
Figure C.3 – Exemple de fonctions de pondération (d'une impulsion de 1 Hz) pour des détections de valeurs crêtes ("PK") et moyennes équivalentes à une fonction de largeur d'impulsion, avec un contrôleur de période de 160 ms.....	92
Figure C.4 – Exemple de fonctions de pondération (d'une impulsion de 1 Hz) pour des détections de valeurs crêtes ("PK") et moyennes équivalentes à une fonction de largeur d'impulsion, avec un contrôleur de période de 100 ms.....	92
Tableau 1 – Durées minimales de mesure pour les quatre bandes du CISPR.....	62
Tableau 2 – Durées minimales de balayage pour les trois bandes CISPR avec détecteurs crête et quasi-crête.....	62
Tableau 3 – Combinaisons d'échantillonnage pour une mesure à la pince absorbante limitée à la fréquence supérieure de 300 MHz.....	78
Tableau 4 – Combinaisons d'échantillonnage pour une mesure à la pince absorbante limitée à la fréquence supérieure de 1 000 MHz.....	78
Tableau B.1 – Durée minimale de balayage / vitesses de balayage les plus élevées.....	87
Tableau C.1 – Facteurs de suppression d'impulsion et vitesses de balayage pour une largeur de bande vidéo de 100 Hz.....	90
Tableau C.2 – Contrôleur de période et largeurs de bandes vidéo correspondantes et vitesses de balayages maximales correspondantes.....	91
Tableau D.1 – Différence d'amplitude maximale entre les signaux détectés crête et quasi-crête.....	93