INTERNATIONAL ELECTROTECHNICAL COMMISSION

CISPR 16-1-2

First edition
2003-11

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

Specification for radio disturbance and immunity measuring apparatus and methods –

Part 1-2:
Radio disturbance and immunity measuring apparatus – Ancillary equipment – Conducted disturbances

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

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FOREWORD

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International Standard CISPR 16-1-2 has been prepared by CISPR subcommittee A: Radio interference measurements and statistical methods.

This first edition of CISPR 16-1-2, together with CISPR 16-1-1, CISPR 16-1-3, CISPR 16-1-4 and CISPR 16-1-5, cancels and replaces the second edition of CISPR 16-1, published in 1999, amendment 1 (2002) and amendment 2 (2003). It contains the relevant clauses of CISPR 16-1 without technical changes.

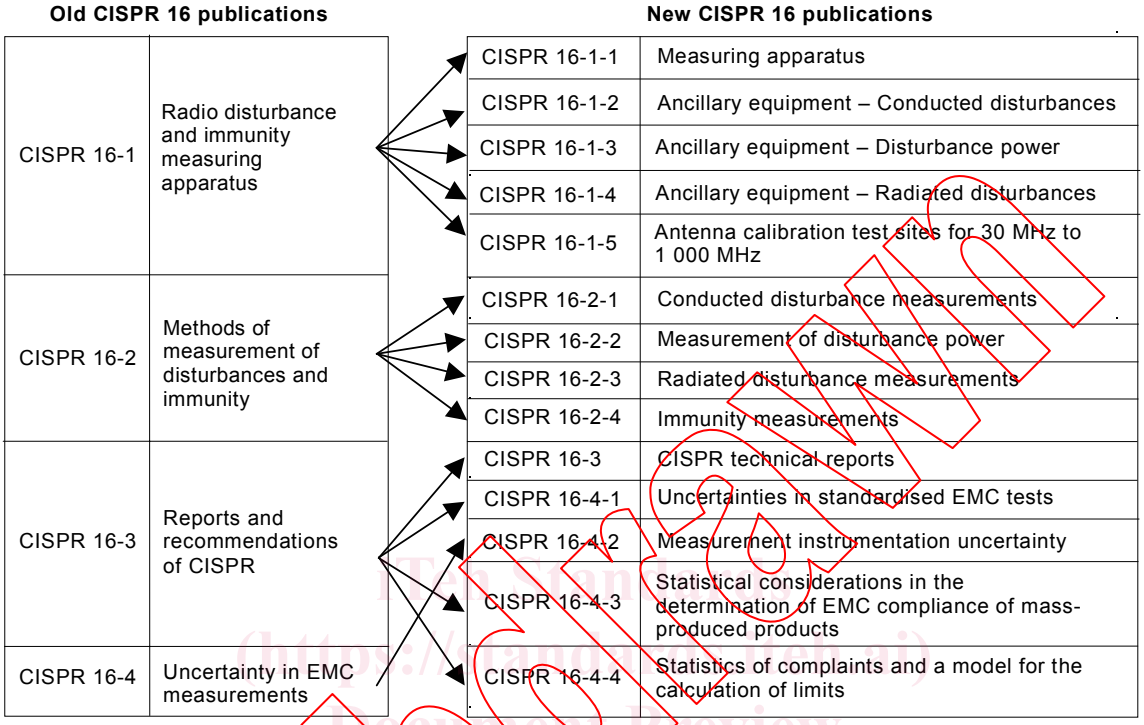
This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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- withdrawn;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

INTRODUCTION

CISPR 16-1, CISPR 16-2, CISPR 16-3 and CISPR 16-4 have been reorganised into 14 parts, to accommodate growth and easier maintenance. The new parts have also been renumbered. See the list given below.



Old CISPR 16 publications		New CISPR 16 publications	
CISPR 16-1	Radio disturbance and immunity measuring apparatus	CISPR 16-1-1	Measuring apparatus
		CISPR 16-1-2	Ancillary equipment – Conducted disturbances
		CISPR 16-1-3	Ancillary equipment – Disturbance power
		CISPR 16-1-4	Ancillary equipment – Radiated disturbances
		CISPR 16-1-5	Antenna calibration test sites for 30 MHz to 1 000 MHz
CISPR 16-2	Methods of measurement of disturbances and immunity	CISPR 16-2-1	Conducted disturbance measurements
		CISPR 16-2-2	Measurement of disturbance power
		CISPR 16-2-3	Radiated disturbance measurements
		CISPR 16-2-4	Immunity measurements
CISPR 16-3	Reports and recommendations of CISPR	CISPR 16-3	CISPR technical reports
		CISPR 16-4-1	Uncertainties in standardised EMC tests
		CISPR 16-4-2	Measurement instrumentation uncertainty
		CISPR 16-4-3	Statistical considerations in the determination of EMC compliance of mass-produced products
CISPR 16-4	Uncertainty in EMC measurements	CISPR 16-4-4	Statistics of complaints and a model for the calculation of limits

More specific information on the relation between the 'old' CISPR 16-1 and the present 'new' CISPR 16-1-2 is given in the table after this introduction (TABLE RECAPITULATING CROSS REFERENCES).

Measurement instrumentation specifications are given in five new parts of CISPR 16-1, while the methods of measurement are covered now in four new parts of CISPR 16-2. Various reports with further information and background on CISPR and radio disturbances in general are given in CISPR 16-3. CISPR 16-4 contains information related to 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.

TABLE RECAPITULATING CROSS-REFERENCES

Second edition of CISPR 16-1	First edition of CISPR 16-1-2
Clauses, subclauses	**Clauses, subclauses**
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3.8, …, 3.10	3.1, …, 3.3
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5.2	5
5.8	6
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5.11	8
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I	B
M	C
N	D
Q	E
Z	F
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18, 22	1, 2
Figures	**Figures**
7, 8, 9, 23, 24	1, 2, 3, 4, 5
10, 20, 52, 53, 54	6, 7, 8, 9, 10
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49, 50	D.1, D.2
Q.1, …, Q.6	E.1, …, E.6

SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 1-2: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Conducted disturbances

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 and currents in the frequency range 9 kHz to 1 GHz.

Specifications for ancillary apparatus are included for: artificial mains networks, current and voltage probes and coupling units for current injection on cables.

The requirements of this publication shall be complied with at all frequencies and for all levels of radio disturbance voltages and currents 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.

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 14-1:2000, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

CISPR 16-1-1:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-2-1:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of immunity and disturbance – Conducted disturbance measurements*

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

CISPR 16-4-1:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-1: Uncertainties, statistics and limit modelling – Uncertainties in standardized EMC tests*

CISPR 16-4-2:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainties*

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

International Vocabulary of Basic and General Terms in Metrology, International Organization for Standardization, Geneva, 2nd edition, 1993

3 Definitions

For the purpose of this part of CISPR 16, the following definitions apply. Also see IEC 60050(161).

3.1
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 *Va* is the vector voltage between one of the mains terminals and earth and *Vb* is the vector voltage between the other mains terminal and earth, the symmetric voltage is the vector difference (*Va*-*Vb*)

3.2
asymmetric voltage
the asymmetric voltage is the radio-frequency disturbance voltage appearing between the electrical mid-point of the mains terminals and earth. It is sometimes called the common mode voltage and is half the vector sum of *Va* and *Vb*, i.e., (*Va* + *Vb*)/2

3.3
unsymmetric voltage
the amplitude of the vector voltage, *Va* or *Vb* defined in 3.1 and 3.2. This is the voltage measured by the use of an artificial mains V-network

3.4
asymmetric artificial network (AAN)
network used to measure (or inject) asymmetric (common mode) voltages on unshielded symmetric signal (e.g. telecommunication) lines while rejecting the symmetric (differential mode) signal

NOTE The term "Y-network" is a synonym for AAN.

3.5
impedance stabilization network (ISN)
generally an artificial network that provides a stabilized impedance to the EUT; often (e.g. in CISPR 22) used as a synonym for AAN

3.6
coupling/decoupling network (CDN)
artificial network for the measurement or injection of signals on one circuit while preventing signals from being measured or injected on another circuit

3.7
longitudinal conversion loss (LCL)
in a one- or two-port network, a measure (a ratio expressed in dB) of the degree of unwanted transverse (symmetric mode) signal produced at the terminals of the network due to the presence of a longitudinal (asymmetric mode) signal on the connecting leads
(definition from ITU-T Recommendation O.9[1)])

1) ITU-T Recommendation O.9, *Measuring arrangements to assess the degree of unbalance about earth*.

4 Artificial mains networks

An artificial mains network is required to provide a defined impedance at radio frequencies at the terminals of the equipment under test, to isolate the test circuit from unwanted radio-frequency signals on the supply mains, and to couple the disturbance voltage to the measuring receiver.

There are two basic types of artificial mains networks, the V-network which couples the unsymmetric voltages, and the delta-network which couples the symmetric and the asymmetric voltages separately.

For each mains conductor, there are three terminals: the mains terminal for connection to the supply mains, the equipment terminal for connection to the equipment under test, and the disturbance output terminal for connection to the measuring equipment.

NOTE Examples of circuits of artificial mains networks are given in annex A.

4.1 Network impedance

The impedance of an artificial mains network is the magnitude of the impedance with respect to reference earth measured at an equipment terminal when the corresponding disturbance output terminal is terminated with 50 Ω.

The impedance at the equipment terminals of the artificial mains network defines the termination impedance presented to the equipment under test. For this reason, when a disturbance output terminal is not connected to the measuring receiver, it shall be terminated by 50 Ω.

The impedance of each of the mains conductors of the network shall comply with 4.2, 4.3, 4.4, 4.5 or 4.6 as appropriate, for any value of external impedance, including a short circuit or the RF filter described in 4.7, connected between the corresponding mains terminal and reference earth. This requirement shall be met at all temperatures which the network may reach under normal conditions for continuous currents up to the specified maximum. The requirement shall also be met for peak currents up to the specified maximum.

4.2 50 Ω/50 µH + 5 Ω artificial mains V-network (for use in the frequency range 9 kHz to 150 kHz)

The network shall have the impedance versus frequency characteristic shown in figure 1a in the relevant frequency range. A tolerance of ±20 % is permitted.

NOTE This network may be constructed such that it can meet the combined impedance requirements of this subclause and 4.3.

4.3 50 Ω/50 µH artificial mains V-network (for use in the frequency range 0,15 MHz to 30 MHz)

The network shall have the impedance versus frequency characteristic shown in figure 1b in the relevant frequency range. A tolerance of ±20 % is permitted.

NOTE The 50 Ω/50 µH + 5 Ω artificial mains V-network of 4.2 may also meet the impedance requirement of this subclause.

4.4 50 Ω/5 µH + 1 Ω artificial mains V-network (for use in the frequency range 150 kHz to 100 MHz)

The network shall have the impedance versus frequency characteristic shown in figure 2. A tolerance of ±20 % is permitted.

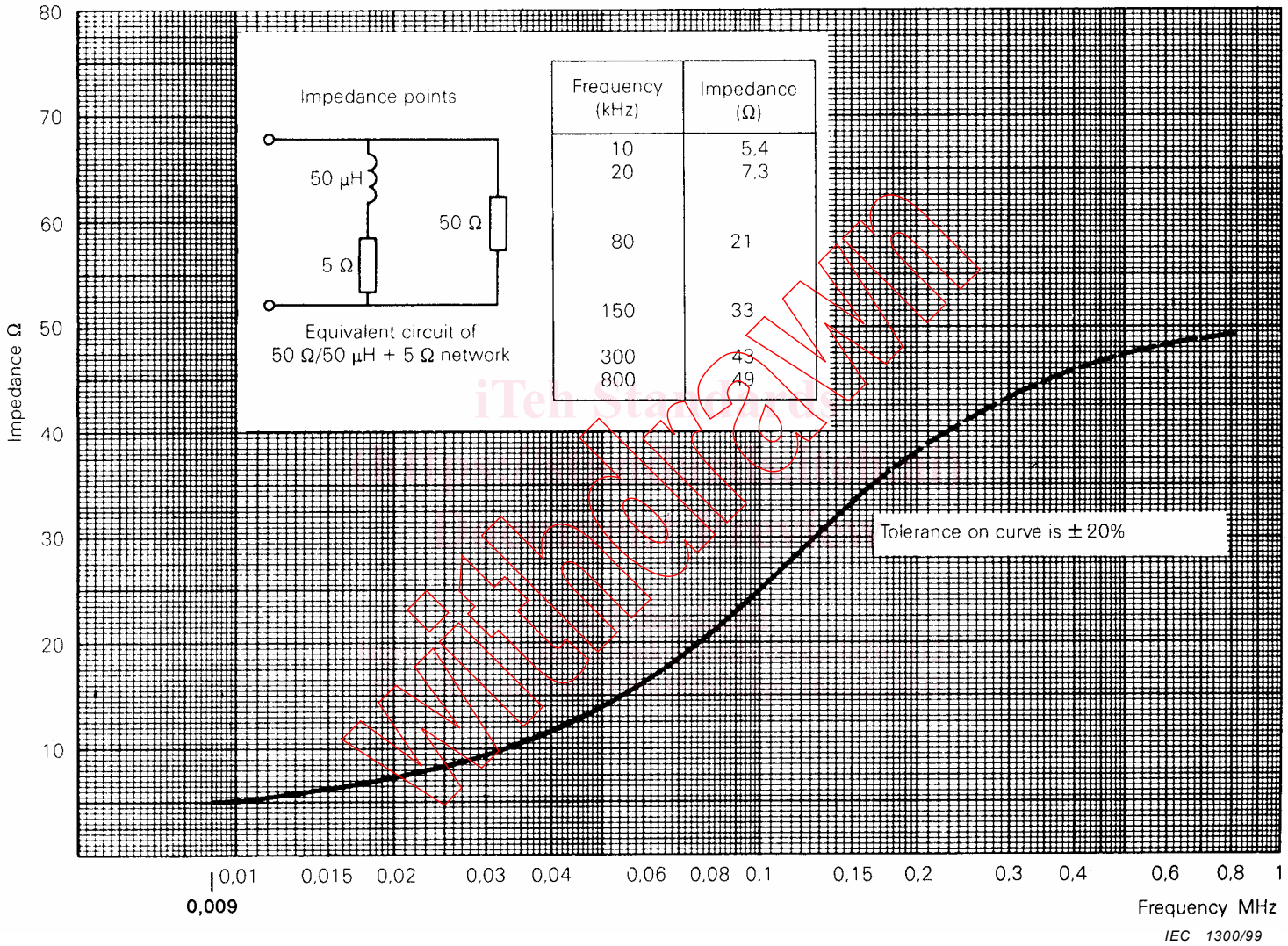

Figure 1a – Impedance of artificial mains network for band A (see 4.2)

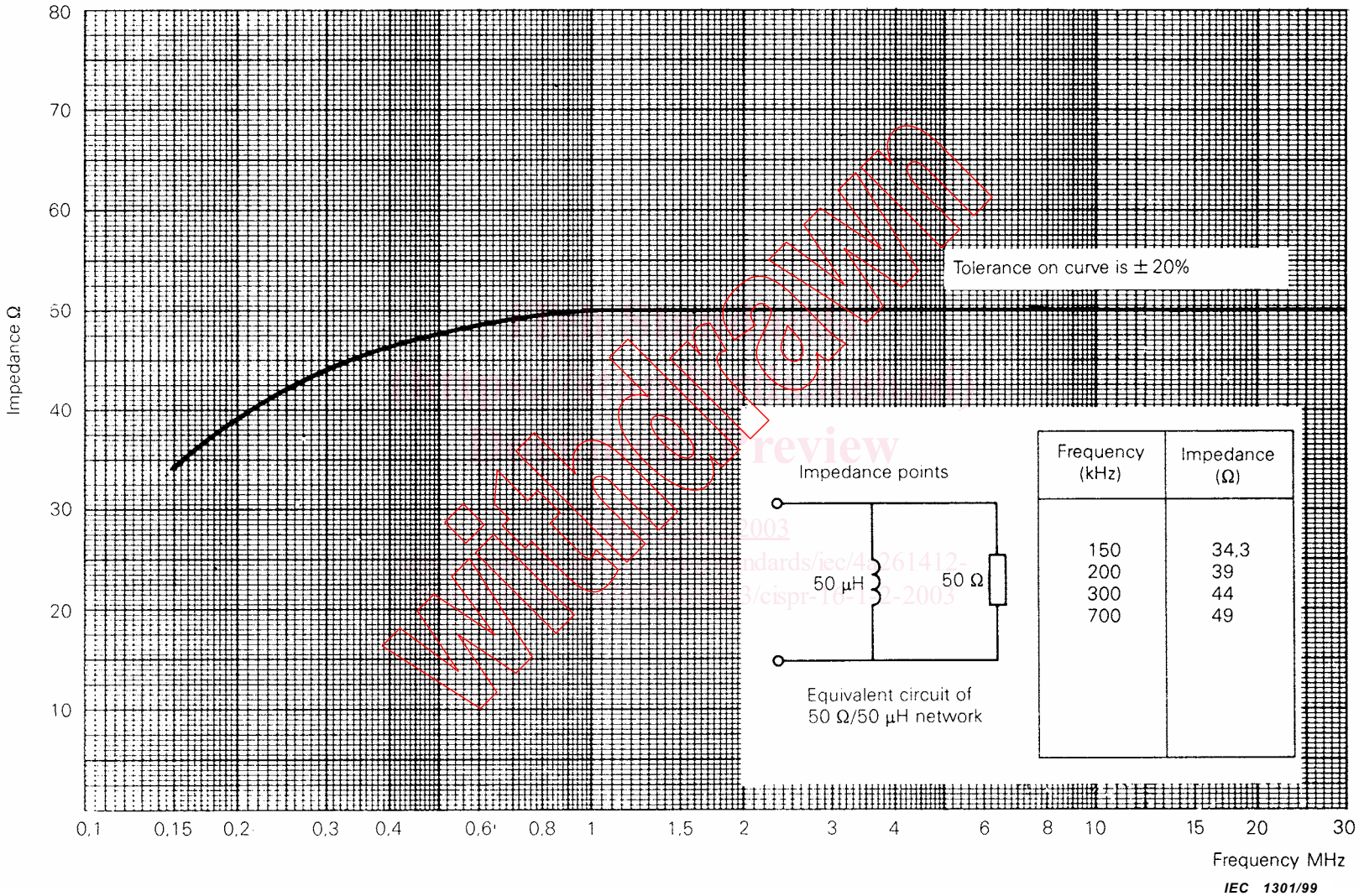

Figure 1b – Impedance of artificial mains network for band B (see 4.3)

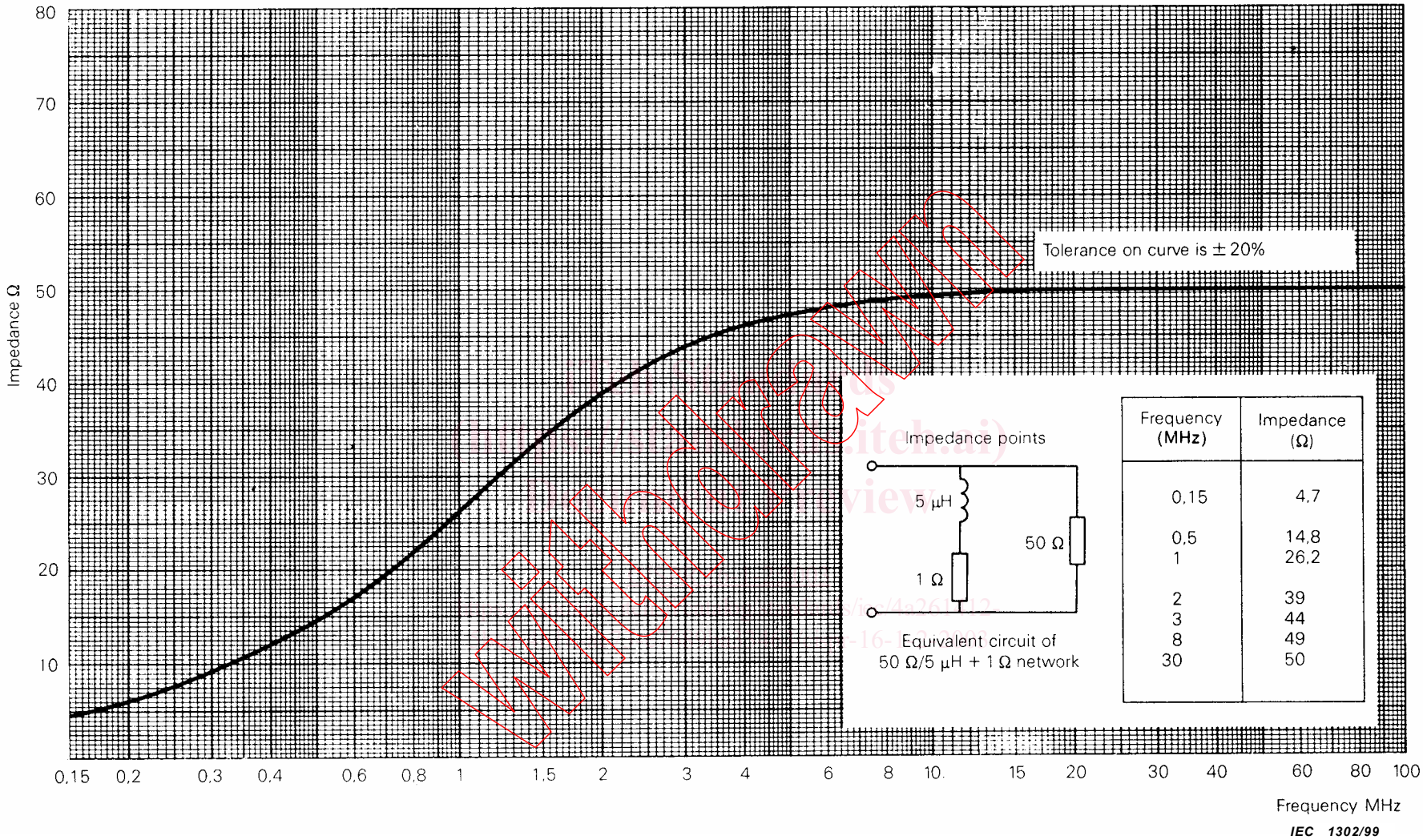

Figure 2 – Impedance of artificial mains network for band B, 0,15 MHz to 30 MHz or band C, 30 MHz to 100 MHz (see 4.4)