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Australian/New Zealand Standard[®]

**Limits and methods of measurement
of electromagnetic disturbance
characteristics of industrial,
scientific and medical (ISM)
radiofrequency equipment**

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee TE/3, Electromagnetic Interference. It was approved on behalf of the Council of Standards Australia on 19 November 1996 and on behalf of the Council of Standards New Zealand on 30 October 1996. It was published on 5 February 1997.

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of electromagnetic disturbance
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radiofrequency equipment**

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee TE/3 on Electromagnetic Interference as one of a series of Standards intended to facilitate control of electromagnetic interference and the compatibility of electrical and electronic equipment. It is equivalent to and has been reproduced from IEC/CISPR 11 (1990), *Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment*, prepared by CISPR Subcommittee B and includes Amendment 1 (1996) and Amendment 2 (1996). This edition supersedes AS/NZS 2064:1992, Parts 1 and 2 of the same title.

The objective of this Standard is to provide designers, manufacturers and installers of ISM equipment having radiofrequency or spark erosion operation with limits and methods of test to afford protection to the radiofrequency spectrum from radio disturbances.

The contents of the Amendments have been inserted in the body of the Standard at the appropriate places and any deletions to the original CISPR 11 as instructed by the amendments have been removed. This Standard now reflects only current information.

Additional Australian and New Zealand requirements are contained in Annex ZZ. They include variations to accommodate local frequency allocations for ISM use and additional allocations and limits for specific safety services, namely air navigation. The application of the additional requirements to the text is indicated by a double vertical bar in the left hand margin.

Statements expressed in mandatory terms in notes and figures are deemed to be requirements of this Standard.

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<i>Reference to International Standard or other Publication</i>		<i>Australian/New Zealand Standard</i>	
CISPR		AS/NZS	
15	Limits and methods of measurement of radio interference characteristics of fluorescent lamps and luminaires	4051	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
16	CISPR specification for radio interference measuring apparatus and measurement methods	1052	Specification for radio disturbance and immunity measuring apparatus and methods
16.1	Part 1: Radio disturbance and immunity measuring apparatus	1052.1	Part 1: Radio disturbance and immunity measuring apparatus
16.2	Part 2: Methods of measurements of disturbances and immunity	—	
19	Guidance on the use of the substitution method for measurement of radiation from microwave ovens for frequencies above 1 GHz	4052	Guidance on the use of the substitution method for measurement of radiation from microwave ovens for frequencies above 1 GHz

CISPR		AS/NZS	
20	Limits and methods of measurement of immunity characteristics of sound and television broadcast receivers and associated equipment	4053	Limits and methods of measurement of immunity characteristics of sound and television broadcast receivers and associated equipment
IEC		AS	
50	International Electrotechnical Vocabulary	1852	International Electrotechnical Vocabulary
50(161)	Electromagnetic compatibility	—	
83	Plugs and socket-outlets for domestic and similar general use standards	3112	Approval and test specification—Plugs and socket-outlets
150	Testing and calibration of ultrasonic therapeutic equipment	—	
801	Electromagnetic compatibility for industrial-process measurement and control equipment	—	

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AUSTRALIAN/NEW ZEALAND STANDARD

LIMITS AND METHODS OF MEASUREMENT OF ELECTROMAGNETIC DISTURBANCE CHARACTERISTICS OF INDUSTRIAL, SCIENTIFIC AND MEDICAL (ISM) RADIO-FREQUENCY EQUIPMENT

1. Scope and object

- 1.1 The limits and methods of measurement laid down in this publication apply to industrial, scientific and medical (ISM) equipment as defined in Clause 2, and to spark erosion equipment.
- 1.2 The assessment of conformity of equipment tested on a test site shall be in accordance with the specifications of Clause 6. For equipment in series production, there shall be 80% confidence that at least 80% of manufactured items comply with the limits given. The statistical assessment procedure is specified in Sub-clause 6.3. For small scale production the application of the statistical assessment may not always be economical. In such cases the assessment procedure contained in Sub-clause 6.2 may be applied. Measurement results obtained for an equipment measured in its place of use and not on a test site shall relate to that installation only, and shall not be considered representative of any other installation and so shall not be used for the purpose of a statistical assessment.

Note. — The limits have been determined on a probabilistic basis taking into account the likelihood of interference. In cases of interference, additional provisions may be required.

- 1.3 Procedures are given for the measurement of radio frequency disturbances and limits are laid down within the frequency range 9 kHz to 400 GHz.
- 1.4 Requirements for lighting apparatus are contained in CISPR 15.

2. Definitions

- 2.1 ISM qualifies equipment or appliances designed to generate and/or use locally radio frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of telecommunications and information technology and other applications covered by other CISPR publications.
- 2.2 For the purposes of this publication the definitions contained in IEC 50(161) apply.
- 2.3 *Electromagnetic radiation:* for the purposes of this publication the extended definition contained in IEC 50(161), which includes near field and induction phenomena, shall apply.
- 2.4 *The boundary of the equipment under test* is defined by an imaginary straight line periphery describing a simple geometric configuration encompassing the equipment under test. All inter-connecting cables shall be included within this boundary.
- 2.5 A click is a disturbance which exceeds the limit of continuous disturbance no longer than 200 ms and which is separated from a subsequent disturbance by at least 200 ms. Both intervals are related to the level of the limit of continuous disturbance.
- A click may contain a number of impulses, in which case the relevant time is that from the beginning of the first to the end of the last impulse.

3. Frequencies designated for ISM use

Certain frequencies are designated by the International Telecommunication Union (ITU) for use as fundamental frequencies for ISM equipment. These frequencies are listed in Table I.

Note. — In individual countries different or additional frequencies may be designated for use by ISM equipment.

Table I
Frequencies designated by ITU for use as fundamental ISM frequencies ¹⁾

Centre frequency	Frequency range	Maximum radiation limit ³⁾	Number of appropriate footnote to the table of frequency allocation to the ITU Radio Regulations
MHz	MHz		
6.780	6.765 - 6.795	Under consideration	524 ²⁾
13.560	13.553 - 13.567	Unrestricted	534
27.120	26.957 - 27.283	Unrestricted	546
40.680	40.66 - 40.70	Unrestricted	548
433.920	433.05 - 434.79	Under consideration	661 ²⁾ , 662 (Region 1 only)
915.000	902 - 928	Unrestricted	707 (Region 2 only)
2 450	2 400 - 2 500	Unrestricted	752
5 800	5 725 - 5 875	Unrestricted	806
24 125	24 000 - 24 250	Unrestricted	881
61 250	61 000 - 61 500	Under consideration	911 ²⁾
122 500	122 000 - 123 000	Under consideration	916 ²⁾
245 000	244 000 - 246 000	Under consideration	922 ²⁾

1) Resolution No.63 of the ITU Radio Regulations applies.

2) Use of these frequency bands is subject to special authorization by administrations concerned in agreement with other administrations whose radio communication services might be affected.

3) The term "Unrestricted" applies to the fundamental and all other frequency components falling within the designated band. Special measures to achieve compatibility may be necessary where other equipment satisfying immunity requirements (e.g CISPR 20, I E C 801), is placed close to ISM equipment.

4. Classification of ISM equipment

ISM equipment shall be labelled by the manufacturer indicating the Class and Group of the equipment.

Note. — See Annex A for examples of the classification of ISM equipment.

4.1 Separation into groups

Group 1 ISM equipment: Group I contains all ISM equipment in which there is intentionally generated and/or used conductively coupled radio frequency energy which is necessary for the internal functioning of the equipment itself.

Group 2 ISM equipment: Group 2 contains all ISM equipment in which radio frequency energy is intentionally generated and/or used in the form of electromagnetic radiation for the treatment of material, and spark erosion equipment.

Excluded from the testing requirements and limits of this publication are components and subassemblies not intended to perform any stand-alone ISM function.

4.2 Division into classes

Class A equipment is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Class A equipment shall meet Class A limits.

Notes 1. — Operation of equipment which does not meet the Class A limits but does not result in unacceptable degradation of radio services may be sanctioned on a case-by-case basis by the competent national authority.

2. — Although Class A limits have been derived for industrial and commercial establishments, administrations may allow, with whatever additional measures are necessary, the installation and use of Class A ISM equipment in a domestic establishment or in an establishment connected directly to domestic electricity power supplies.

Class B equipment is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Class B equipment shall meet Class B limits.

5. Limits of electromagnetic disturbances

Class A ISM equipment may be measured either on a test site or in situ as preferred by the manufacturer.

Note. — Due to size, complexity or operating conditions some ISM equipment may have to be measured in situ in order to show compliance with the radiation disturbance limits specified herein.

Class B ISM equipment shall be measured on a test site.

Limits are under consideration for:

- RF excited arc welding equipment
- radiology equipment
- radio frequency surgical diathermy equipment.

The limits given in Tables II to VI are applicable to all electromagnetic disturbances at all frequencies not exempted according to Table I.

The lower limit shall apply at all transition frequencies.

5.1 Limits of terminal disturbance voltage

The equipment under test shall meet either:

- i) both the average limit specified for measurements with an average detector receiver and the quasi-peak limit specified for measurements with a quasi-peak detector (see 7.2); or
- ii) the average limit when using a quasi-peak detector receiver (see 7.2).

Limits for signal line disturbance voltage are under consideration.

5.1.1 Frequency band 9 kHz to 150 kHz

Limits for mains terminal disturbance voltages in the frequency band 9 kHz to 150 kHz are under consideration, except for induction cooking appliances.

For Class A Group 2 ISM equipment *in situ*, no limits apply unless otherwise specified in this publication.

5.1.2 Frequency band 150 kHz to 30 MHz

Continuous disturbance

Limits for mains terminal disturbance voltages in the frequency band 150 kHz to 30 MHz for equipment measured on a test site using the 50 Ω /50 μ H CISPR network or the CISPR voltage probe (see 7.2.3 and figure 4) are given in tables IIA and IIB, except for the ITU designated frequency bands listed in table I for which the mains terminal disturbance voltage limits are under consideration.

For Class A Group 2 ISM equipment *in situ*, no limits apply unless otherwise specified in this publication.

Table IIA — Mains terminal disturbance voltage limits for class A equipment measured on a test site

Frequency band MHz	Class A equipment limits dB(μ V)					
	Group 1		Group 2		Group 2*	
	Quasi-peak	Average	Quasi-peak	Average	Quasi-peak	Average
0,15–0,50	79	66	100	90	130	120
0,50–5	73	60	86	76	125	115
5–30	73	60	90 decreasing with logarithm of frequency to 70	80 60	115	105
* Mains supply currents in excess of 100 A per phase when using the CISPR voltage probe.						
NOTE – Care should be taken to comply with leakage current requirements.						

Table IIB
Mains terminal disturbance voltage limits
for Class B equipment measured on a test site

Class B equipment limits dB(μ V)		
Frequency band MHz	Groups 1 and 2	
	Quasi-peak	Average
0.15 - 0.50	66 Decreasing with logarithm of frequency to 56	56 Decreasing with logarithm of frequency to 46
0.50 - 5	56	46
5 - 30	60	50

Note. — Care should be taken to comply with leakage current requirements.

Discontinuous disturbance

For diagnostic X-ray generators, operating in intermittent mode, the limit for clicks shall be the quasi-peak limit, as formulated in table IIA or table IIB for continuous disturbance, increased by 20 dB.

5.1.3 Induction cooking appliances for domestic or commercial use

For induction cooking appliances for domestic or for commercial use (group 2 class B equipment), the limits of table IIC apply.

Table IIC – Main terminal disturbance voltage for induction cooking appliances

Frequency range MHz	Induction cooking appliance limits dB(μV)	
	Quasi-peak	Average
0,009 to 0,050	110	—
0,050 to 0,1485	90 Decreasing linearly with logarithm of frequency to 80	
0,1485 to 0,5	66 Decreasing linearly with logarithm of frequency to 56	56 Decreasing linearly with logarithm of frequency to 46
0,5 to 5	56	46
5 to 30	60	50
NOTE – The mains terminal disturbance voltage limits for a 100/110 V rated system are under consideration.		

5.1.4. Frequency band above 30 MHz

No limits are specified for terminal disturbance voltage above 30 MHz.

5.2 Limits of electromagnetic radiation disturbance

Measuring apparatus and methods of measurement are specified in Clauses 7, 8 and 9. The equipment under test shall meet the limits when using a measuring instrument with a quasi-peak detector.

Below 30 MHz the limits refer to the magnetic component of the electromagnetic radiation disturbance. Between 30 MHz and 1 GHz the limits refer to the electric field strength component of the electromagnetic radiation disturbance. Above 1 GHz the limits refer to the power of the electromagnetic radiation disturbance.

5.2.1 Frequency band 9 kHz to 150 kHz

Limits for electromagnetic radiation disturbance in the frequency band 9 kHz to 150 kHz are under consideration, except for induction cooking appliances.

5.2.2 Frequency band 150 kHz to 1 GHz

Except for the designated frequency range listed in Table 1 the electromagnetic radiation disturbance limits for the frequency band 150 kHz to 1 GHz for Group 1, Classes A and B equipment are specified in Table III; for Group 2 Class B equipment in Table IV; and for Group 2 Class A equipment in Table V. Special provisions for the protection of specific safety services are given in 5.3 and Table VI.

For induction cooking appliances falling within group 2 class B, the limits are specified in tables IIIA and IIIB.

Table III
Electromagnetic radiation disturbance limits for Group 1 equipment

Frequency band MHz	Measured on a test site		Measured <i>in situ</i>
	Group 1 Class A 30 m measurement distance dB(μ V/m)	Group 1 Class B 10 m measurement distance dB(μ V/m)	Group 1 Class A limits with measuring distance 30 m from exterior wall outside the building in which the equipment is situated dB(μ V/m)
0.15 - 30 30 - 230 230 - 1000	Under consideration 30 37	Under consideration 30 37	Under consideration 30 37

NOTE – For Group 1 Class A and B equipment, intended to be permanently installed in X-ray shielded locations, an increase in the electromagnetic radiation disturbance limits of 12 dB for tests conducted on a test site is allowed.

Such equipment which does not meet the table III limits is labelled as “Class A + 12” or “Class B + 12”. The installation instructions should contain the following warning:

“Warning: This equipment is allowed to be installed only in X-ray protected rooms, which provide an attenuation of at least 12 dB for radio disturbances from 30 MHz to 1 GHz.”

Table IIIA — Limits of the magnetic field induced current in a 2 m loop antenna around the device under test

Frequency range MHz	Limits in dB(μ A) Quasi-peak	
	Horizontal component	Vertical component
0,009 to 0,070	88	106
0,070 to 0,1485	88 Decreasing linearly with logarithm of frequency to 58	106 Decreasing linearly with logarithm of frequency to 76
0,1485 to 30	58 Decreasing linearly with logarithm of frequency to 22	76 Decreasing linearly with logarithm of frequency to 40

NOTE — The limits of table IIIA apply to induction cooking appliances for domestic use which have a diagonal dimension of less than 1,6 m.
Measurement is performed using the “Van Veen loop method” as described in 7.5 of CISPR 16-2.

Table IIIB — Limits of the magnetic field strength

Frequency range MHz	Limits in dB (μ A/m) at 3 m distance Quasi-peak
0,009 to 0,070	69
0,070 to 0,1485	69 Decreasing linearly with logarithm of frequency to 39
0,1485 to 4,0	39 Decreasing linearly with logarithm of frequency to 3
4,0 to 30	3

NOTE — The limits of table IIIB apply to induction cooking appliances for commercial use and those for domestic use with a diagonal diameter of more than 1,6 m.
Measurements are performed at 3 m distance with a 0,6 m loop antenna as described in 15.2.1 of CISPR 16-1.
The antenna shall be vertically installed, with the lower edge of the loop at 1 m height above the floor.