ECMA

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

STANDARD ECMA-199

IMMUNITY OF VDUs TO POWER FREQUENCY MAGNETIC FIELDS

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Brief history

This Standard is one of a number of ECMA publications on the subject of immunity testing of Information Technology Equipment (ITE), and in particular of visual display units using direct-view cathode ray tube technology (VDUs), with regard to electromagnetic phenomena.

This particular ECMA Standard defines the performance criteria and the procedure for testing the immunity of VDUs to power frequency magnetic fields.

This Standard has been prepared by Technical Committee ECMA TC20, and is based upon the practical experience of ECMA member companies and the results of their active and continuous participation in the work of Subcommittee G (interference characteristics of ITE) of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission (IEC), as well as other international and national standardization bodies. It represents a pragmatic and widely based consensus.

This ECMA Standard references the basic EMC publication IEC 1000-4-8:1993.

Adopted as Standard ECMA-199 by the General Assembly of December 1993.

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1 Scope

This Standard defines the performance criteria and the procedure for testing the immunity of visual display units using direct-view cathode ray tube technology (VDUs) to magnetic disturbances at power frequency occurring in:

- residential and office locations,
- commercial and light industrial locations, and
- heavy industrial locations.

This Standard establishes a common and reproducible basis for evaluating the performance of VDUs.

Disturbances due to capacitive or inductive coupling on the cables or other parts of the field installation are outside the scope of this Standard.

This ECMA Standard is based on the basic standard IEC 1000-4-8, the requirements of which are applicable to the measurement of the magnetic field immunity of VDUs except where in conflict with the requirements of this ECMA Standard.

2 Conformance

A VDU is in conformance with this Standard if it satisfies all requirements of this Standard.

3 Normative references

The documents indicated below contain provisions which, though referenced in the text, constitute provisions of this Standard. At the time of publication of this Standard, the editions indicated below were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below. The IEC maintains registers of currently valid publications.

IEC 50(161):

International Electrotechnical Vocabulary (1990) - chapter 161: Electromagnetic compatibility.

IEC 1000-4-8: 1993

Electromagnetic compatibility (EMC), part 4: Testing and measurement techniques, section 8: Power frequency magnetic field immunity test.

ISO 9241-3: 1992(E)

Ergonomic requirements for office work with visual display terminals (VDTs), part 3: Visual display requirements.

4 Definitions

The definitions of the referenced publications (see clause 3, normative references, above) are applicable to this Standard except where in conflict with those of this clause.

4.1 Equipment Under Test (EUT)

The part or component in the VDU sensitive to the magnetic field, for example the cathode ray tube.

4.2 Jitter

The peak-to-peak variation in the geometric location of picture elements.

5 General

The magnetic fields to which VDUs may be subjected may influence their satisfactory operation and may cause jitter, or spatial instability (section 5.24 of ISO 9241-3 refers).

The tests defined in this Standard are designed to demonstrate, or evaluate, the immunity of VDUs when subjected to the type of magnetic field phenomena that apply to specific location and installation conditions of the VDUs. The power frequency magnetic fields are generated by power frequency currents in conductors or, more seldom, from other devices in the proximity of the VDU.

The test field waveform is the sinusoid of one of the power frequencies of 16 2/3 Hz, 50 Hz, and 60 Hz, depending on the mains frequency of the marketing region and the intended operating distance to railway power lines with 16 2/3 Hz.

In household areas, substations and power plants, the effect of harmonics on the VDU is negligible.

6 Classification

Classification of the VDU shall be mentioned in the instructions for use. Labelling of the VDU with respect to classification shall be avoided.

6.1 Class I - residential / office

A VDU which satisfies the Class I limit will operate without unacceptable jitter in more than 95% of the domestic and commercial urban environment (homes, offices and computer rooms). It may be necessary to restrict the use of less than 5% of typical appliances to 1 m from the VDU. May not operate without unacceptable jitter in some industrial environments and near right-of-way (ROW) of high voltage power lines.

6.2 Class II - commercial / light industrial

A VDU which satisfies the Class II limit will operate without unacceptable jitter in more than 99% of the domestic and commercial urban environment (homes, offices and computer rooms) with close proximity to typical appliances (typically 0,5 m). May not operate without unacceptable jitter in very close proximity to high current appliances and some industrial sources, and establishments bordering the right-of-way (ROW) of high voltage power lines.

6.3 Class III - heavy industrial

A VDU which satisfies the Class III limit will operate without unacceptable jitter in industrial applications (power plants, substations, transformers), in very close proximity to domestic and commercial appliances, and in all locations outside the right-of-way (ROW) of high voltage power lines. May not operate without unacceptable jitter at a distance of less than 1,5 m from bus-bars carrying 2200 amperes.

7 Limits and test levels

The EUT shall be immersed in a sinusoidal magnetic field whose frequency is one or more of the following:
16 2/3 Hz, 50 Hz, or 60 Hz.

The field strength shall depend on the target environment (see clause 6), and shall be either the limit level, or an increased test level which causes more readily measurable jitter.

The limit levels and test levels are specified in table 1 below.

Table 1 - Limit and test levels

Class	Limit levels (A/m)	Test levels (A/m)
	@ specified jitter	@ test jitter
I	0,4	20
II	2,4	120
III	8	400

NOTE 1

1,0 A/m = 1,25 μT = 12,5 mG.

8 Test method

8.1 Test equipment

The test equipment shall consist of the following:

– test generator (as defined in IEC 1000-4-8), and

– induction coil (as defined in IEC 1000-4-8).

8.2 Test set-up

The EUT shall be arranged and connected to satisfy its functional requirements and shall be placed at the centre of the induction coil (immersion method).

The cables supplied by the equipment manufacturer shall be used, or in their absence suitable alternative cables of the type appropriate for the signals involved shall be used.

8.3 EUT operating conditions

The EUT shall display characters in the normal text mode.

Where the EUT is capable of displaying different character sizes (e.g. in different resolution modes), the character size selected shall be sufficient to enable measurements to be made, but in any case shall be no less than 3 mm.

Figure 1 gives a guide to character size as a function of the viewing distance for which the EUT is designed. It is recommended that the character size selected for the test be within the vertically hatched area of the figure, corresponding to 20 - 22 minutes of arc being subtended by the character at the design viewing distance.

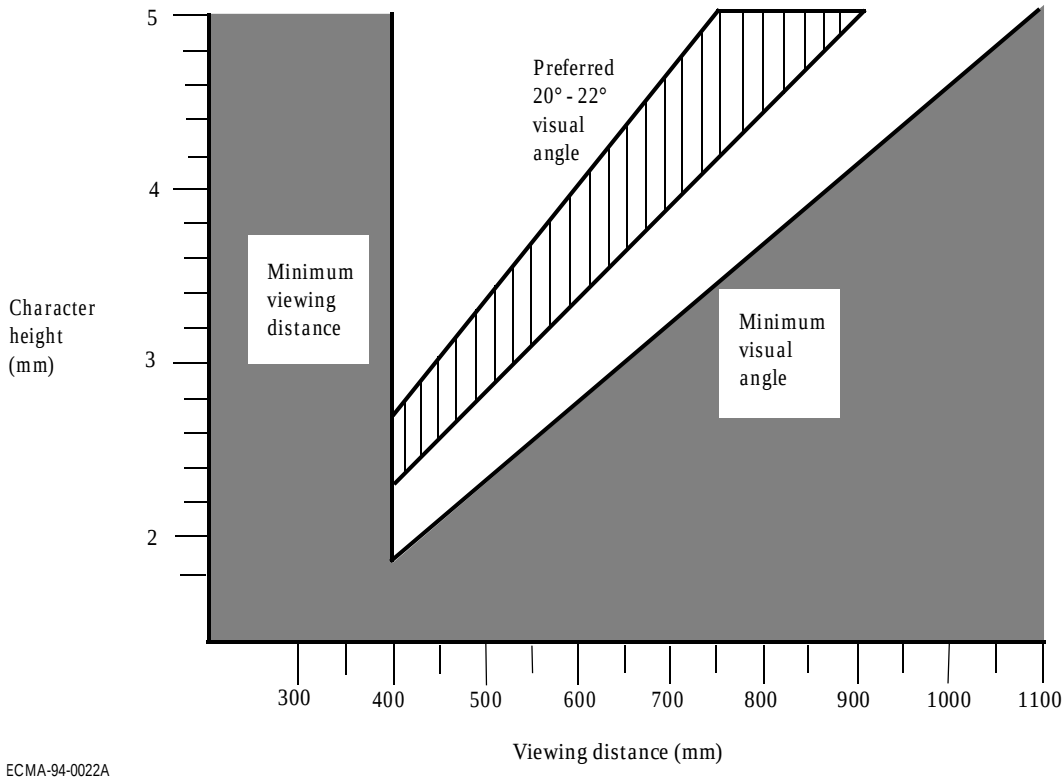

Figure 1 - Design viewing distance and character height (from ISO 9241)

8.4 Test procedure

The EUT shall be tested in two positions, both perpendicular to the magnetic field.

8.5 EUT monitoring

The peak-to-peak variation in the geometric location of the character elements shall be measured.

If the limit level (for the appropriate Class) of table 1 is applied, this variation shall be measured using a measuring microscope as specified in section 6.6.14 of ISO 9241-3.

If the test level of table 1 is applied, a transparent graduated mask may be used to assess the variation.

9 Performance criteria

The jitter limit depends on the character size of the test pattern and shall be computed from the following formula:

$$\text{specified jitter (mm)} = \frac{\text{character size (mm)} + 0,33}{33,3}$$

Conformance may be demonstrated at the limit level or the test level.

If the limit level is applied, the EUT shall not exhibit jitter in excess of the specified jitter computed above.

If the test level is applied, the EUT shall not exhibit jitter in excess of 50 times the specified jitter computed above.

10 Test report

A test report shall be prepared to include sufficient information to allow the test to be replicated, in particular the following:

- location and date of test;
- name and signature of person performing the test;
- EUT model and serial number;
- class of limits to which the EUT was tested;
- operational modes tested;
- character sizes evaluated;
- specified jitter at selected character size (as computed in clause 9);
- test jitter (where used);
- measured jitter at the magnetic field strength for each tested frequency.

Annex A

(informative)

Bibliography

Measurements of Power-Frequency Electrical and Magnetic Fields Around Different Industrial and Household Sources,
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Impact of Electric and Magnetic Field Limits Allowing 500 kV Lines in the Fraser Valley,
P.S. Wong, L.A. Snider, P.Lee.

British Columbia Labs Inc., File F130E 3.4.1.

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A description of this Standard can be found on the ECMA web site, www.ecma.ch. From there, files E199-DOC.EXE (MSWord, self-expanding) and E199-PDF.PDF (Acrobat PDF) can be freely downloaded.

Our web site, http://www.ecma.ch, gives full information on ECMA, ECMA activities, ECMA Standards and Technical Reports.

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