



BSI Standards Publication

Methods of measurement and limits for radiated disturbances from plasma display panel TVs in the frequency range 150 kHz to 30 MHz

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National foreword

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Methods of measurement and limits for radiated disturbances from plasma display panel TVs in the frequency range 150 kHz to 30 MHz

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION
INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**METHODS OF MEASUREMENT AND LIMITS FOR RADIATED
DISTURBANCES FROM PLASMA DISPLAY PANEL TVS IN
THE FREQUENCY RANGE 150 KHZ TO 30 MHZ**

FOREWORD

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IEC/PAS 62825 has been processed by CISPR subcommittee I: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:

Draft PAS	Report on voting
CISPR/1/417/PAS	CISPR/1/424/RVD

Following publication of this PAS, which is a pre-standard publication, CISPR subcommittee I may decide to incorporate the contents of this PAS as it is, or in a modified form, into CISPR 13 and/or CISPR 32.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

The task of CISPR consists of providing methods of measurement and limits for control and limitation of RF disturbances from electric and electronic equipment, which may cause harmful interference to radio reception in the field. For these purposes CISPR has identified essential EMC emission requirements in the frequency range 9 kHz to 400 GHz.

<http://www.iec.ch/Scope of CISPR>

In regard of the frequency range up to 30 MHz, minimum emission requirements for radiated RF disturbances have been established for induction cooking appliances (see CISPR 11 and CISPR 14-1) and for lighting equipment (see CISPR 15).

According to the CISPR standardization policy

http://www.iec.ch/emc/pdf/cispr_standardisation_policy.pdf

these requirements shall be regarded as applying, as minimum requirements, to any type of product.

In addition to the above fact it is noted that accurate measurements below 30 MHz are difficult and that the measurement method with the 60 cm loop antenna is not yet described in the CISPR 16 parts.

Historically, emission standards for IT equipment and radio broadcast receivers have addressed limits only for conducted emissions below 30 MHz (CISPR convention). This has been justified by the low “antenna efficiency” of an EUT whose dimensions are small compared with the wavelength of emission concerned, and by limited use of high-power, high frequency electromagnetic components and circuitry within the EUT. However, the introduction of large-scale flat screen displays for many appliances such as TV-sets, traffic management and information systems, monitor walls in professional entertainment, education white boards, etc. calls into question the convention that measurement of disturbance on external cabling is sufficient.

Besides aspects of physical dimension, evolving display technologies too call for a regular re-assessment of the upper justification concerning antenna efficiency. Particular attention should be given to such technological implementations, which use current loops in form of matrices of magnetic dipoles resulting in a large overall magnetic dipole causing significant magnetic field levels.

Users of this specification are hence invited to check whether the classical CISPR convention applies to their display implementations. Depending on the display’s characteristics (voltage, current and size) they may decide, upon their own discretion, that measurements according to this specification can be disregarded, for principle reasons.

During the annual CISPR subcommittee I Working Group (WG) 1 meeting in Sydney in 2007, a Task Force was formed to investigate radiated emissions of large Plasma TV-sets below 30 MHz following several cases of complaints of interference by amateur radio users. The TF met several times and carried out long investigations and round robin exercises in several laboratories in Japan, Korea and Europe. The results of the investigation presented in Lyon in 2009, in Seattle in 2010, showed that supplementary requirements for control and limitation of radiated disturbances from large scale flat screen displays are necessary to enforce CISPR’s mission and policy.

Finally CISPR subcommittee I decided, at its meeting in Seoul in October 2011, that a PAS shall be drafted and provided to the users setting out an interim solution up until CISPR 13 or its successor CISPR 32 is supplemented with appropriate requirements.

Work is ongoing in CISPR subcommittee I and meanwhile also CISPR subcommittee A and CISPR subcommittee H are involved in the process of validating their respective methods of measurement and associated limits.

The limits defined in this PAS have successfully taken the following points into consideration:

- a) Table 12 of CISPR 11:2009, Amendment 1 (2010) defines limits for radiated emissions in the frequency range 9 kHz to 30 MHz for induction cooking appliances operating in residential and commercial environments. It is assumed that these limits provide adequate protection of radio reception and so formed basis for the limits in this PAS.
- b) Current state of the art of plasma display panel TVs including economically feasible mitigation measures is such that they generate radiated emissions in the frequency range 150 kHz to 30 MHz above the limits of Table 12 of CISPR 11:2009, Amendment 1 (2010). Additionally, it is more difficult to mitigate against low frequency magnetic field emissions below approximately 1 MHz. In particular, the emissions at the fundamental operating frequency of the displays cannot be attenuated without unacceptable loss of picture quality.

Therefore a compromise was proposed in CISPR subcommittee I Working Group (WG) 1 to add 10 dB to the limits in Table 12 of CISPR 11:2009, Amendment 1 (2010). Following further discussions and review of measurements obtained from several plasma TVs manufacturers, it was noted that higher frequency emissions were more likely to meet this increased limit. Emissions below 3,5 MHz although typically over the limit were below the lower boundary of commonly-used radio amateur band. Therefore an additional 5 dB increase was allowed in the frequency range 150 kHz to 3,5 MHz and emissions at the fundamental frequency would be exempted from the limit. Although this proposal was not agreed unanimously during drafting of the PAS, consensus was reached.

Therefore the limits defined in this PAS do not provide protection of radio reception in all cases.

METHODS OF MEASUREMENT AND LIMITS FOR RADIATED DISTURBANCES FROM PLASMA DISPLAY PANEL TVS IN THE FREQUENCY RANGE 150 KHZ TO 30 MHZ

1 Scope

This Publicly Available Specification (PAS) applies to plasma display panel TVs which are intended for use in residential or commercial environments, which have a visible display area with a diagonal dimension of 1 m or greater, and which are within the scope of CISPR 13 or CISPR 32.

NOTE Although this PAS is applied to plasma display technology, it should be noted that in any future International Standard, or amendment to existing International Standard, it may be necessary to ensure technology neutrality. To this end, users of this PAS are invited to investigate the compliance of other display technologies with the limits of this PAS. Depending on the characteristics (voltage, current and size) of other display technologies, users may decide, upon their own discretion, that measurements according to this specification are not necessary.

This specification covers emission requirements related to radiated radio-frequency (RF) disturbances in the frequency range 150 kHz to 30 MHz. It specifies suitable limits and methods of measurement for the assessment of radiated RF disturbances.

The requirements specified in this specification are essential EMC requirements which should be met in order to protect radio reception in the frequency range up to 30 MHz at locations where these display devices are operated in the field.

While application of this specification is recommended, the comprehensive set of normative EMC emission requirements is found in CISPR 13 or CISPR 32. Use of this specification does not remove the obligation to apply any other CISPR publication.

The objectives of this specification are:

- a) to establish supplementary requirements which provide an adequate level of protection of the radio frequency spectrum, allowing radio reception as intended in the frequency range 150 kHz to 30 MHz;
- b) to specify procedures to ensure the reproducibility of measurement and the repeatability of obtained results.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CISPR 13:2009, *Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and methods of measurement*

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 16-1-4:2010, *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 32:2012, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 and CISPR 13, as well as the following apply.

3.1

boundary of the EUT

imaginary circular periphery (circle) just encompassing the equipment under test (EUT), including all interconnecting cables

4 Limits for electromagnetic disturbances

4.1 General

Equipment in the scope of this specification shall be measured at a standardized radiation test site. Use of an OATS or SAC (although validated in the frequency range 30 MHz to 1 GHz according to CISPR 16-1-4) should be the preferred option.

Measuring apparatus and methods of measurement are specified in Clauses 5 and 6.

The equipment under test (EUT) shall meet the quasi-peak limits when using a quasi-peak detector.

4.2 Limits for radiated RF disturbances in the frequency range 150 kHz to 30 MHz

For measurement of radiated RF disturbances in the frequency range up to 30 MHz, limits are specified in terms of magnetic disturbance field strength components in dB(μ A/m). Measurements are performed at a 3 m measuring distance using the limits in Table 1.

The limits apply in active mode of operation.

No limit applies to emissions at the fundamental operating frequency of the display as specified by the manufacturer.

Table 1 – Limits of the magnetic field strength for large plasma display panel TVs

Frequency range MHz	Limits at 3 m distance Quasi-peak dB(μA/m)
0,150 – 4,0	49 Decreasing linearly with logarithm of frequency to 13
4,0 – 30	13
<p>An EUT is permitted to exceed the limits shown above by no more than 5 dB in the frequency range from 150 kHz to 3,5 MHz. This 5 dB relaxation of the limits will be reconsidered at the end of the first validity period of this PAS.</p> <p>NOTE The limits shown in this table are based on the limits in Table 12 of CISPR 11:2009, Amendment 1 (2010), raised by 10 dB. These limits may not provide protection of radio reception in all cases.</p>	

5 Measurement requirements

5.1 Ambient noise

The test site shall allow emissions from the equipment under test to be distinguished from ambient noise. The suitability in this respect can be determined by measuring the ambient noise levels with the equipment under test inoperative and ensuring that the ambient noise levels are at least 6 dB below the limits specified in 4.2, as appropriate for the measurement being carried out.

It is not necessary to reduce the ambient noise level to 6 dB below the specified limit where the combination of the ambient noise plus the emission from the equipment under test does not exceed the specified limit. Under these conditions the equipment under test is considered to satisfy the specified limit.

5.2 Test sites

The preferred test site is an OATS or SAC which has been validated in accordance with CISPR 16-1-4 over the frequency range from 30 MHz to 1 GHz.

Alternatively any room or site can be used satisfying the following requirements:

- a) metal ground plane which extends at least 1 m beyond the boundary of the EUT at one end and at least 1 m beyond the measurement antenna and its supporting structure at the other end;
- b) reflecting obstacles shall be at least 3 m away from both the EUT and the measuring antenna.

5.3 Measuring equipment

5.3.1 Measuring receiver

A measuring receiver according to CISPR 16-1-1 with a quasi-peak detector shall be used.

5.3.2 Antenna

In the frequency range below 30 MHz the antenna shall be a loop with 0,6 m diameter as specified in 4.3.2 of CISPR 16-1-4:2010. The antenna shall be supported in the vertical plane and be rotatable about a vertical axis. The lowest point of the loop shall be 1 m above reference ground plane.

5.4 Configuration of the equipment under test

For configuration of the EUT, 5.7.3 of CISPR 13:2009 applies.

5.5 Operating conditions of the equipment under test

A standard test signal is supplied to the EUT via a coaxial cable. Further information about exercising the EUT during the measurements is found in 5.3.2 of CISPR 13:2009.

6 Measurement arrangement and procedure

6.1 Measurement arrangement

The EUT shall be supported 80 cm above the ground plane using a non-metallic table. The distance between the centre of the loop antenna and the boundary of the EUT shall be 3 m, as shown in Figure 1.

Where the EUT is fitted with a special earth terminal, this shall be connected to earth with a lead as short as possible. Equipment not furnished with a special earth terminal shall be tested as normally connected, i.e. with any earthing obtained through the mains supply cable or the coaxial signal cable.

6.2 Measurement procedure

Emissions shall be measured with the antenna in each of two positions: coaxial and planar. The loop of the antenna defines a plane, and there will be a horizontal line that passes through both the antenna and the centreline of the EUT. In the planar antenna position, the line to the EUT lies in the plane of the antenna loop. In the coaxial antenna position, the line to the EUT is normal to the plane of the antenna. These two positions are shown in Figure 2.

For an EUT located on a turntable, the turntable shall be rotated fully with the plane of the loop antenna oriented subsequently in parallel and orthogonal to the projection of the EUT. The highest recorded level of the electromagnetic radiation disturbance at each frequency shall be reported.

For an EUT not located on a turntable the loop antenna shall be positioned subsequently at least in four orthogonal positions in 3 m distance from the EUT and measurements shall be made in each of these positions with both antenna plane orientations relative to the EUT.

6.3 Reporting of measurement results

Any results obtained from measurements of radiated radio frequency disturbances shall be recorded in the test report. If the results are not recorded in a continuous way and/or in graphical form over the frequency range observed, then the minimum requirements to the reporting are as explained below.

Of those radiated emissions above ($L - 10$ dB), where L is the limit level in logarithmic units, the report shall include at least the disturbance levels and the frequencies of the six highest disturbances in the observed frequency range from 150 kHz to 30 MHz. The report shall include the position of the antenna (coplanar or transverse) and the turntable rotation position for each reported disturbance.

7 Verification of the compliance of the equipment with the requirements of this specification

The verification of the compliance with the requirements of this specification for the equipment tested shall be based on measurement results obtained in accordance with the specifications of Clause 6.

The equipment complies with the provisions of this specification if it can be shown that the readings obtained from the measuring receiver do not exceed the limits specified in Table 1.

It is recommended to observe the CISPR conventions regarding the statistical assessment of series-produced equipment. For such equipment, there shall be 80 % confidence that at least 80 % of manufactured items comply with the limits given (compliance criterion). More detailed information may be found in Clause 6 of CISPR 13:2009.

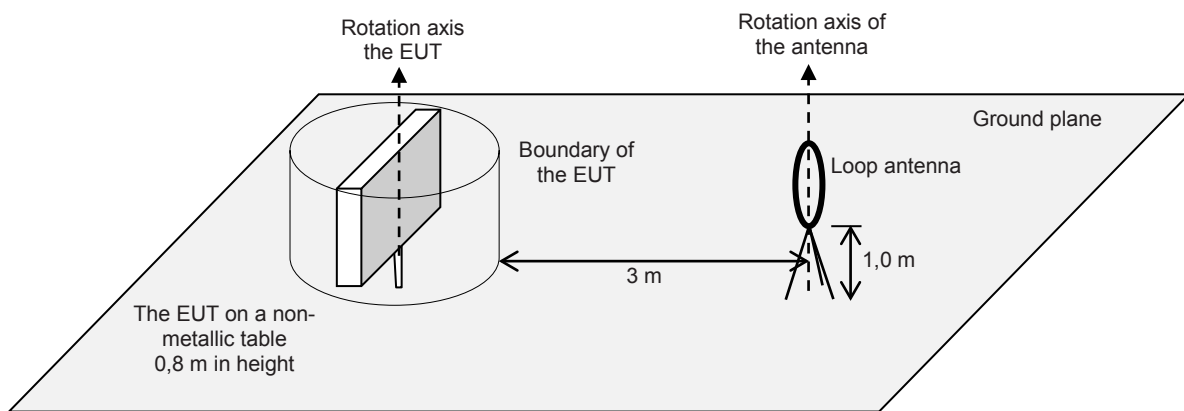


Figure 1 – Setup of a plasma display panel TV for magnetic-field measurement

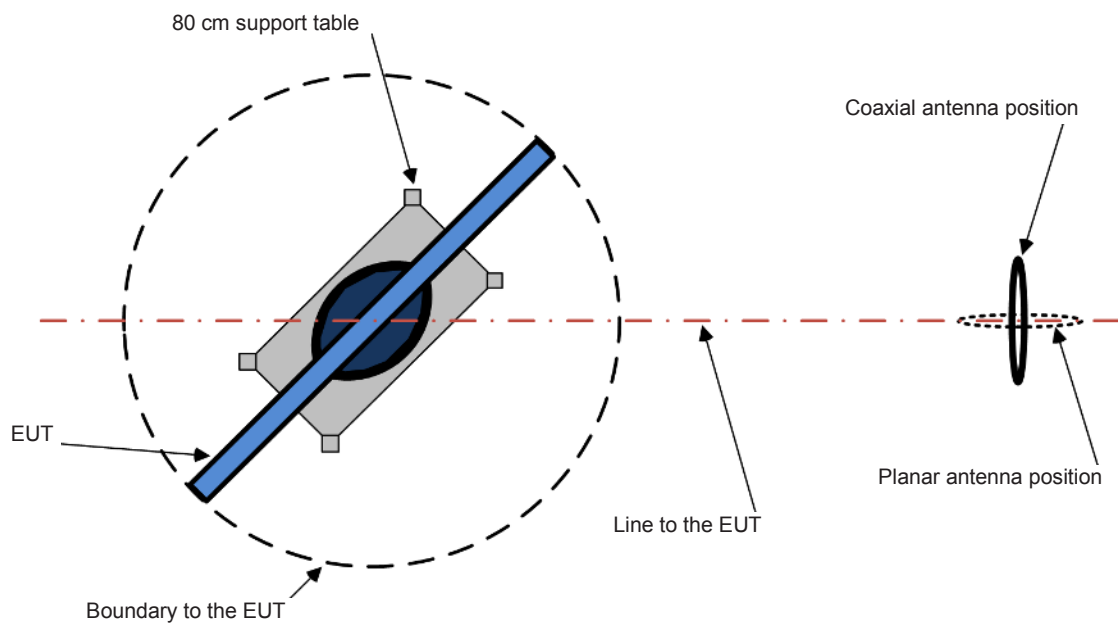


Figure 2 – Top view of antenna positions relative to the EUT

Bibliography

- [1] CISPR 11:2009, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*
Amendment 1:2010
 - [2] CISPR 14-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*
 - [3] CISPR 15, *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*
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