

IEEE Standard Procedures for the Measurement of Electric and Magnetic Fields From Video Display Terminals (VDTs) From 5 Hz to 400 kHz

Sponsor

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Abstract: Procedures for the measurement of electric and magnetic fields in close proximity to video display terminals (VDTs) in the frequency range of 5 Hz to 400 kHz are provided. Existing international measurement technologies and practices are adapted to achieve a consistent and harmonious VDT measurement standard for testing in a laboratory controlled environment.

Keywords: electric field, magnetic field, video display terminal (VDT)

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Introduction

[This introduction is not part of IEEE Std 1140-1994, IEEE Standard Procedures for the Measurement of Electric and Magnetic Fields From Video Display Terminals (VDTs) From 5 Hz to 400 kHz.]

The purpose of this standard is to establish uniform procedures for the measurement of electric and magnetic fields from video display terminals (VDTs). The measurement practices in this standard follow the principles and procedures of MPR (National Board for Measurement and Testing) published in Sweden. The number of test points required, calibration levels, instrumentation and calibration procedures used, grounded and ungrounded system test methods, and calculation of measurement uncertainty are different from MPR. The measurement procedures outlined in this standard are for testing in a laboratory-controlled environment. The measurement distances indicated in this document are based on approximate human operator and VDT interaction distance. The electric field measurements attempt to approximate the field that is perturbed by human operator interaction. Due to insufficient information defining safe or unsafe electric or magnetic field levels for human operators, this document does not assume any human factors other than test distance.

This standard was revised 12 times to incorporate the comments of balloting members.

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IEEE Standard Procedures for the Measurement of Electric and Magnetic Fields From Video Display Terminals (VDTs) From 5 Hz to 400 kHz

1. Scope

This standard provides procedures for the measurement of electric and magnetic fields in close proximity to video display terminals (VDTs) in the frequency range of 5 Hz to 400 kHz. This standard adapts existing international measurement technologies [B7]¹ and practices to achieve a consistent and harmonious VDT measurement standard for testing in a laboratory controlled environment. Such measurements are needed for investigative studies that rely on the knowledge of electric and magnetic field levels near electronic equipment.

The requirements of the controlled laboratory test environment in which the characteristics specified in this standard are to be tested are difficult to establish at a user's installation. Therefore, it is recognized that the results obtained in the laboratory may be difficult to reproduce in the on-site environment.

This standard does not provide measurements at specific frequencies, but does provide one measurement for each of two frequency bands: 5 Hz to 2 kHz and 2 kHz to 400 kHz.

2. Definitions

2.1 band I: The frequency band 5 Hz to 2 kHz.

2.2 band II: The frequency band 2 kHz to 400 kHz.

¹The numbers in brackets preceded by the letter B correspond to those of the bibliography in clause 8.

2.3 background fields: Any electric or magnetic field that does not originate from the VDT under test.

2.4 calibration: The process of determining the numerical relationship, within an overall stated uncertainty, between the observed output of a measurement system and the value, based on standard sources, of the physical quality being measured. (In terms of this standard, the physical quality being measured is electric and magnetic fields.)

2.5 center-center point: A point on a VDT screen [cathode ray tube (CRT) face panel] that is both the horizontal and vertical mid-point. The center-center point is represented by the bisector of the horizontal and vertical center lines on the VDT screen.

2.6 Class I equipment: Equipment in which protection against electric shock is achieved by: a) using basic insulation, and b) providing a means of connecting the conductive parts, which are otherwise capable of assuming hazardous voltages if the basic insulation fails, to the protective ground conductor in the building wire.

2.7 Class II equipment: Equipment in which protection against electric shock does not rely on basic insulation only, but also on the provision of additional safety precautions, such as double insulation or reinforced insulation. There is no provision for protective grounding or reliance upon installation conditions.

2.8 field measuring instrument: A device used to sense and read out the electric or magnetic field intensities surrounding a VDT under test. (For this standard, this instrumentation consists of three parts: probe; readout detector, where the signal from the probe is processed and the data displayed; and any leads between the probe and readout detector.)

2.9 measurement uncertainty: The limits of error for a measured value, between which the true value will lie with the confidence stated. (For this standard, measurement uncertainty is associated with measuring the absolute value of the electric and magnetic fields.)

2.10 tangential plane: The plane that is tangential to the surface of the VDT screen at the center-center point.

2.11 video display terminal (VDT): A device for the presentation of information by controlled excitation of a CRT screen for visual observation designed for interactive use by an operator. [For the purposes of this standard, the keyboard will not be included as part of VDT and is removed from the test area. This standard excludes liquid crystal display (LCD) terminals.]

3. General conditions

3.1 General

3.1.1 Location of VDT under test and measuring probe

The VDT under test, the measuring field sensor (probe), and the signal processor/display (readout device or detector) shall be positioned at least 1 m from all metallic structures and objects.

The VDT under test shall be connected to the mains supply with the power cord/cable supplied by the manufacturer as part of the equipment. The power cord/cable shall be positioned as follows: Horizontally for 0.1 m from the test object, and then vertically down for at least 1 m.

The power cord of the VDT under test shall be connected to the phase and neutral conductors of the mains power network. If the power plug permits an interchange of the phase and neutral conductors, measurements shall be taken with the connection that gives the highest Band I reading. If the VDT under test is designed to

be grounded, then the ground connection of the power cord shall be connected to ground. If the power cord of the VDT under test has a grounded neutral, then the neutral shall be connected to the ground.

Additional units that are not part of the test—such as the central processing unit (CPU), video test pattern signal generators, and connecting cables necessary for the operation of the VDT—shall be positioned so their fields do not exceed the required ambient levels (see 3.2 and 3.3). It is acceptable to add shielding and cables to these additional units as long as a clearance of 1 m is maintained from the closest metallic part of VDT under test or the measuring probe.

The cables between the measuring probe and the readout (detector) shall be positioned so that they do not influence the measured electric field values. The cables will not affect the magnetic field measurements.

3.1.2 Power line voltage

The power line voltage of the VDT under test shall be within 3% of its nominal value, as stated on the manufacturer's name plate. The nominal value of the power line voltage shall be specified in the test report and the actual measured value shall be recorded. If a voltage range is specified, the test shall be performed at the center of the specified range. For this latter case, the power line voltage and the range shall be recorded in the test report.

3.2 Background electric field levels

Background electric field levels in the test area, including power line transmitted disturbances and internally generated noise in the measuring system, shall not together exceed 2 V/m in Band I and 0.2 V/m in Band II.

The background electric field levels shall be measured with the VDT in place prior to beginning the VDT electric field measurements. All signal, power, and peripheral equipment cables required for operation shall be on and terminated at the VDT. The VDT power cable shall be de-energized (otherwise the power cable will radiate an electric field) when making background measurements. If grounding and shielding of peripheral equipment is required to achieve the specified ambient levels, the grounds and shields shall be tied to a common ground and a minimum clearance of 1 m from the closest metallic part of VDT under test or the measuring probe shall be maintained.

If the measuring probe is repositioned, rather than the VDT being rotated, the background electric field levels shall be measured for each location of the measuring probe. The background level for each location shall be recorded in the test report.

3.3 Background magnetic field (magnetic flux density)

The background magnetic field in the test area, including power line transmitted disturbances and internally generated noise in the measuring system, shall not together exceed 40 nT in Band I, and 5 nT in Band II.

The background magnetic field levels shall be measured with the VDT in place prior to beginning the VDT magnetic field measurements. All signal, power, and peripheral equipment and cables required for operation shall be on and terminated at the VDT. The VDT shall be turned off when making background measurements. If grounding and shielding of peripheral equipment is required to achieve specified ambient levels, the grounds and shields shall be tied to a common ground and a minimum clearance of 1 m from the closest metallic part of VDT under test or the measuring probe shall be maintained.

If the measuring probe is repositioned, rather than the VDT being rotated, the background magnetic field shall be measured for each unique location of the measuring probe. The background level for each location shall be recorded in the test report.