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Interface Practices Subcommittee

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**Test Method for Measuring Shielding Effectiveness of
Passive and Active Devices Using a GTEM Cell**

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Document Types and Tags

Document Type: Specification

Document Tags:

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| ☒ Test or Measurement | ☐ Checklist | ☐ Facility |
| ☐ Architecture or Framework | ☐ Metric | ☐ Access Network |
| ☐ Procedure, Process or Method | ☐ Cloud | ☐ Customer Premises |

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1. Introduction

1.1. Executive Summary

The shielding attributes of components in a CATV system are critical to system performance. Ingress and egress issues can have detrimental effects on the overall performance of the system from both regulatory and quality perspectives. Ingress issues can cause problems with television picture quality, and the effective transfer of data by allowing spurious signal into the system.

It is the goal of this document to address the passive and active devices in the system and how to properly gauge their performance in this critical area.

1.2. Scope

The purpose of this test is to determine the shielding effectiveness against Electromagnetic Interference (EMI) of components. This method subjects the component to an electric field of known strength. There are two individual test methods contained therein. The following depicts the type of device each of the methods are intended.

Test Method #1 – Active / Passive Components – where GTEM cell qualification requirements are met, per Appendix B

Test Method #2 – Active / Passive Components – where GTEM cell qualification requirements are not met, per Appendix B, and field strength probe measurements are taken for each frequency in the test.

This procedure exists in order to provide a standard method of testing between laboratories performing Shielding Effectiveness tests. When utilized this procedure helps to ensure confidence in results when published.

1.3. Intended Audience

The intended audience contains both system operators and RF equipment manufacturers.

1.4. Areas for Further Investigation or to be Added in Future Versions

Future revisions of this document may build upon the work started here by increasing the understanding of:

- Variability of data between GTEM Cell systems with varied “uniform field” sizes.
- The effects of location differences between bare wire and shielded samples within the GTEM cell

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

- No normative references are applicable.

2.2. Standards from Other Organizations

- No normative references are applicable.

2.3. Published Materials

- No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. SCTE References

- No informative references are applicable.

3.2. Standards from Other Organizations

- Electronics Engineers' Handbook, 2nd Edition, McGraw-Hill, ISBN 0-0702-0981-2
- EMC for Product Designers, Tim Williams, 3rd Edition, Newnes, ISBN 0-7506-4930-5
- LAB 34, Edition 1, August 2002, The Expression of Uncertainty in EMC Testing, United Kingdom Accreditation Service

3.3. Published Materials

- A GTEM BEST PRACTICE GUIDE – APPLYING IEC 61000-4-20, TO THE USE OF GTEM CELLS. A. Nothofer, M.J. Alexander, National Physical Laboratory, Teddington, UK, D. Bozec, D. Welsh, L. Dawson, L. McCormack, A.C. Marvin, University of York, Heslington, UK(Principal contact: nothofer@ieee.org)
- <http://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=GTEM>
Multiple helpful documents

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5. Abbreviations and Definitions

5.1. Abbreviations

CMTS	cable modem termination system
DUT	device under test
E	electric field strength
<i>f</i>	frequency in MHz
GTEM cell	gigahertz transverse electric field mode cell
Gr	shielding effectiveness
kHz	kilohertz (1 x 1 ⁰³ Hz)
MHz	megahertz (1 x 1 ⁰⁶ Hz)
Pr	power received by the DUT (ingress)
Pm	power measured at the measurement equipment
RF	radio frequency
SNMP	simple network management protocol

5.2. Definitions

K	The sum of all losses and gains between the DUT and the test equipment
GA	The gain of any amplifier between the signal generator and GTEM cell

6. Equipment

6.1. Measurement Device

The measurement device may be a spectrum or network analyzer with the following characteristics:

- 75 Ω or 50 Ω Impedance Input and connector
- Capable of measuring a frequency range required for the device under test. For example, 5 MHz to 1800 MHz
- Noise floor that is 10 dB or better than the DUT at upper frequency being tested, i.e. 1800 MHz (minimum 10 Hz resolution bandwidth), which can be achieved with or without amplification at the input of the GTEM.

6.2. Signal Generator

Depending on the method chosen, the signal generator may be a tracking generator associated with the spectrum or network analyzer. The output power must be sufficient to create a field strength of at least 10 V/m across a test volume occupied by the DUT over the frequency range of the device under test. The signal generator may be combined with a power amplifier to generate the required field strength. See section 5.6 for details of the amplifier.

6.3. GTEM Cell

The GTEM must have a test volume that is large enough to accommodate the DUT. The GTEM cell must be able to provide uniform electric field strength over the area of the DUT. The field is considered uniform if it varies by less than ± 6 dB over the area of the DUT

6.4. Adapters

75 Ω or 50 Ω min-loss pads, adapters terminations and cables as required to connect the test system and DUT.

6.5. Field Strength Monitor

The field strength-monitoring probe shall be an isotropic probe with an accuracy of ± 3 dB from 5 MHz to upper frequency of the test.

6.6. Power Amplifier

The power amplifier shall have sufficient power output to generate at least 10 V/m from 5 MHz to the upper frequency for the device under test and have the following characteristics:

- Input VSWR: 2.0:1 max
- Output VSWR: 2.0:1 max
- Harmonic distortion: -15dBc max