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

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TABLE OF CONTENTS

1.0	SCOPE	2
2.0	INFORMATIVE REFERENCES	2
3.0	COMPLIANCE NOTATION	2
4.0	DEFINITIONS AND ACRONYMS	3
5.0	EQUIPMENT	3
6.0	CHAMBER VERIFICATION	5
7.0	TEST METHOD 1	5
8.0	TEST METHOD 2	7
9.0	ERROR ANALYSIS	9
10.0	RECORDING RESULTS	10
APPENDIX A: RFI/EMI SHIELDING CALCULATIONS AND METHODOLOGY		13
APPENDIX B: GTEM CELL QUALIFICATION METHOD		17
APPENDIX C: FIELD UNIFORMITY VERIFICATION METHOD		19

LIST OF FIGURES

FIGURE 1 – EQUIPMENT SETUP FOR INGRESS SHIELDING TEST (METHOD 2)	7
FIGURE A.1 – RECEIVE PATH BLOCK DIAGRAM	14
FIGURE B.1 – GTEM QUALIFICATION TEST CONFIGURATION	17
FIGURE C.1 – GTEM QUALIFICATION TEST CONFIGURATION	19

LIST OF TABLES

TABLE 1 – LEVELS OF UNCERTAINTY	9
TABLE B.1 – GTEM CELL QUALIFICATION DATA	18
TABLE C.1 – TEST CHAMBER CALIBRATION DATA	20

1.0 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.

2.0 INFORMATIVE REFERENCES

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

2.1 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

3.0 COMPLIANCE NOTATION

"SHALL"	This word or the adjective "REQUIRED" means that the item is an absolute requirement of this specification.
"SHALL NOT"	This phrase means that the item is an absolute prohibition of this specification.
"SHOULD"	This word or the adjective "RECOMMENDED" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
"SHOULD NOT"	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
"MAY"	This word or the adjective "OPTIONAL" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

4.0 DEFINITIONS AND ACRONYMS

E – Electric field strength

f – Frequency in MHz

G_r – Shielding Effectiveness

K – The sum of all losses and gains between the DUT and the test equipment

G_A – The gain of any amplifier between the signal generator and GTEM cell

P_r – Power received by the DUT (ingress)

P_m – Power measured at the measurement equipment

MHz – Megahertz (1×10^6 Hz)

GTEM cell – Gigahertz Transverse Electric Field Mode Cell

kHz – Kilohertz (1×10^3 Hz)

RF – Radio Frequency

DUT – Device Under Test

5.0 EQUIPMENT

5.1 Measurement Device

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

- 75Ω or 50Ω Impedance Input and connector
- Capable of measuring a frequency range of 5 MHz to 1002 MHz
- Noise floor that is 10 dB or better than the DUT at 1002 MHz (minimum 10 Hz resolution bandwidth), which can be achieved with or without amplification at the input of the GTEM.

5.2 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 5 MHz to 1002 MHz. 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.

5.3 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

5.4 Adapters

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

5.5 Field Strength Monitor

The field strength-monitoring probe shall be an isotropic probe with an accuracy of ± 3 dB from 5 MHz to 1002 MHz.

5.6 Power Amplifier

The power amplifier shall have sufficient power output to generate at least 10 V/m from 5 MHz to 1002 MHz and have the following characteristics:

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

6.0 CHAMBER VERIFICATION

- 6.1 Before any testing commences, the chamber must be verified. The verification should be performed every six month unless the chamber has been modified.
- 6.2 Follow any pre-calibration requirements using the appropriate calibration kit as recommended by the manufacturer of the test equipment, including adequate warm-up and stabilization time.
- 6.3 Follow the procedure in Appendix C to verify the field uniformity of the GTEM cell. If the cell does not meet the requirements then it is unsuitable for any of the test methods described in this document.
- 6.4 Follow the procedure in Appendix B to perform a GTEM cell qualification. If the GTEM does not meet the requirements, then test method 2 must be used. If the GTEM cell meets the requirements, either method 1 or 2 may be used.

7.0 TEST METHOD 1

- 7.1 Place the DUT centered in the test volume inside the GTEM cell. Connect one port of the DUT to the measurement device and terminate all other ports. All connections to the DUT, including power cables, must be sufficiently shielded so that their Shielding Effectiveness (Gr) is greater than the anticipated Gr of the DUT to ensure the accuracy of the test.
- 7.2 Follow any pre-calibration requirements using the appropriate calibration kit as recommended by the manufacturer of the test equipment, including adequate warm-up and stabilization time.
- 7.3 Adjust the amplifier gain into the GTEM cell to achieve a minimum of 10 V/m (20 dB V/m). Record the loss/gain of the receive path between the device under test (DUT) and the measurement device at the frequencies of interest. Record this data for future calculations. (Note: Data should be recorded in dB with losses recorded as -dB and gain recorded as +dB.) The combined loss/gain at each frequency shall be recorded as K.
- 7.4 Select a resolution bandwidth (minimum 10 Hz) to ensure that the measurement device has a noise floor that is 10 dBm or better than the DUT at 1002 MHz, which can be achieved with or without amplification at the input of the GTEM.
- 7.5 If the signal generator is a tracking generator or network analyzer, sweep the signal from 5 MHz to 1002 MHz and record the power received at the measurement device.