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EMC Test-Systems GmbH

GTEM 250

For emission and immunity testing according to IEC 61000-4-20 (CEI 210-78)

Introduction

The GTEM cell is a TEM waveguide with the upper frequency limit extended to the GHz range.
It is under consideration as an alternative measurement facility for both radiated emission and immunity measurements. It is included in the recently published standard IEC 61000-4-20 “Emission and Immunity Testing in Transverse Electromagnetic (TEM) Waveguides”.

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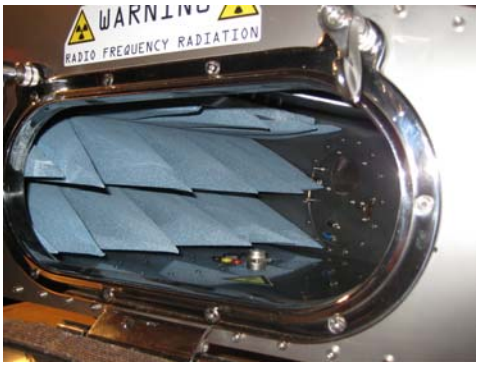
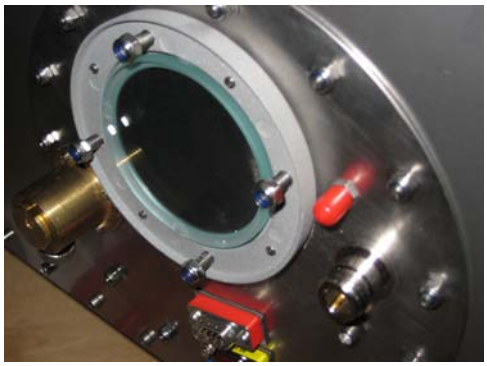
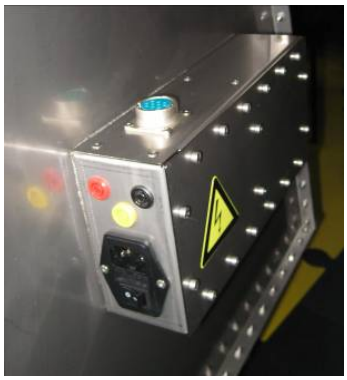


Main Door



Technical Panel

Locking System



Filter Box

Key Features

- Ruggedized fully INOX steel construction
- Unique compact design.
- Optimized for EMI and EMC.
- Strong fields achieved with low input power
- Broadband up to 6GHz (up-gradable to 20Ghz.)
- High effective shielding
- 15 poles filter standard

Applications

- EMI and EMS devices
- Radiation and susceptibility test
- Specifically designed for telecom application
- Biomedical and dosimetrical applications
- Isotropic sensors calibration
- Receiver sensitivity test

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Theory of operation

GTEM-cells (Giga-hertz Transversal Electro-Magnetic cells) are waveguide structures intended for electro-magnetic compatibility measurements, as well as biomedical applications. The electromagnetic field distribution inside the cell is in TEM mode. With TEM mode propagation, there is no component of electric and magnetic field in the direction of propagation of electromagnetic wave. Therefore the field components are strictly perpendicular. Assuming the field distribution ideal TEM below the cut-off frequency of the cell (before the introduction of higher order modes), the electromagnetic field distribution can be considered static.

Specifications

Operating range:	0,1MHz-6GHz (0,1MHz-20GHz)
RF Input	max continuous. input power: 25W RF
Input connector type	"N" UG-21 connector
Shielding:	better than 60 to 100dB depending from freq
Absorbers:	350 mm TDK
Outer cell dimension:	(L)1150x(W)640x(H)440mm
Door Size:	450 x 250mm
Construction:	Fully Inox steel 10/10 and 20/10

Technical panel

- N.1 Feed-thru "N"
- N.2 “SMA” connectors
- N.1 fibre optic feed-thru for two fibers

Power supply / Filter box - In and out.

- N.1 6 amp. 250VAC, two phase + line filter
- N.1 filtered 10 poles connector 10A 600Vdc
- N.3 filtered banana sockets 1A 1000Vac

Installed Options

- Inspection window with shielded polycarbonate glass
- Halogen 50w 230V ac Lamp
- N.1 feed- thru DB9 filtered for 9 poles.
- N.1 feed-thru DB9 un-filtered for 9 poles.

Installation manual and general safety instructions

The GTEM (GigaHertz Transverse Electromagnetic) cell is a precision electromagnetic compatibility (EMC) test instrument primarily intended for use as radiated immunity and radiated emission test facility without environmental electromagnetic interference.
The cell is electrically similar to a coaxial cable with one side open (the apex) and other side closed on the impedance of the generator or receiver connected. In this case with a multi-meter appears as 50 Ohm resistance.

Measurement setup

The setup for emission measurements in a GTEM cell is shown in Fig.1. the EUT is placed inside the GTEM and its radiation is measured with a receiver. The receiver can be software controlled, and some software that includes the GTEM to OATS correlation is commercially available.

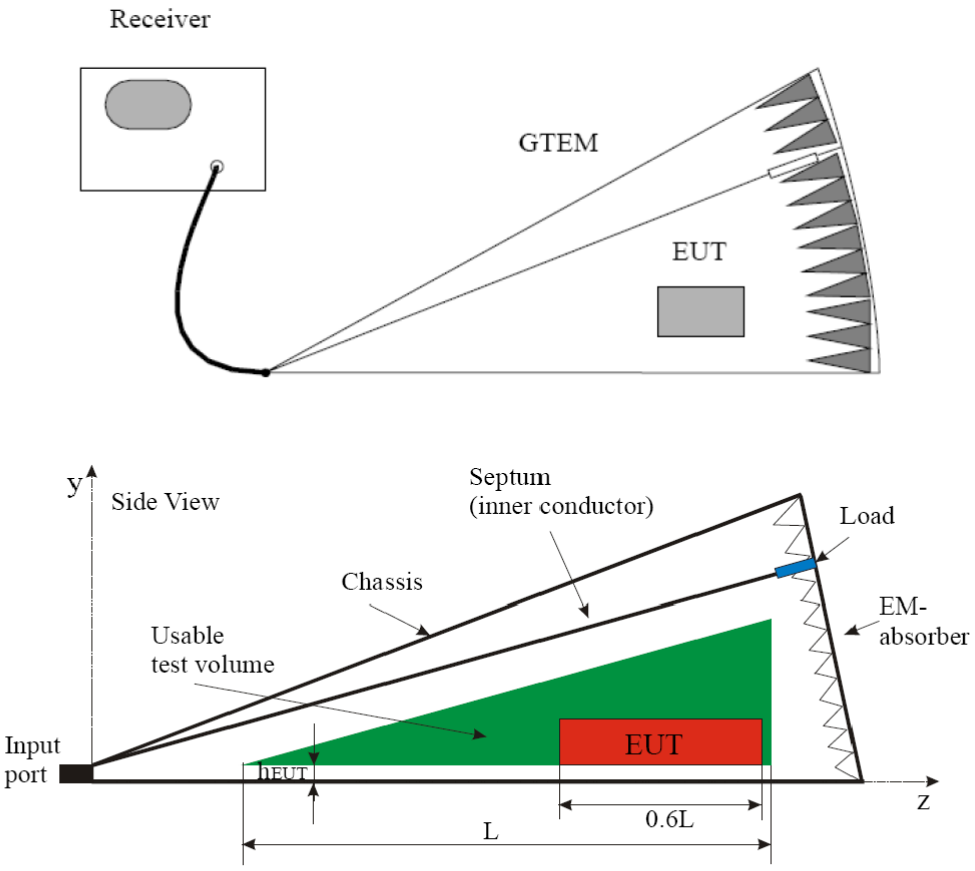

Fig. 1

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Before using GTEM-250 cell, please read the following instructions

The cell is made to work in Horizontal position.
The Input port N connector at the top of the pyramid is very delicate: please take care avoiding to break the internal pin. For frequent use leave a coax cable in a stable connection.
The internal coaxial semi-rigid cable require care during handle, don't make torsion or fold too much .
The filter and the technical panel units contents feed-trough connections Pin-to-pin to supply EUT (Equipments under test) with AC or DC source or I/O connection. Please refer to the max limit stated in the specification section.
Don't apply over currents and over-voltage.

The unit must be separately earthed, or connected to an AC main source with a hearth connection.
Possibly supply energy from a tapes source equipped with earth connection and differential magneto- thermic protection switch

During immunity test, Don't leave open door, Radio frequency could interfere with civil communications. Long term Expositions at High RF levels could be dangerous for the health.

Maintenance require periodically check of the gaskets and the lock system. Don't apply strong pressure on to the gaskets. Leave the door open when the cell is stored for a long time, it preserve the gaskets. Keep clean the internal ambient of the cell from the carbon residual, it could cause short circuit in the E.U.T. and between the connections! If necessary help you with an air vacuum cleaner.

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TESTING VOLUME

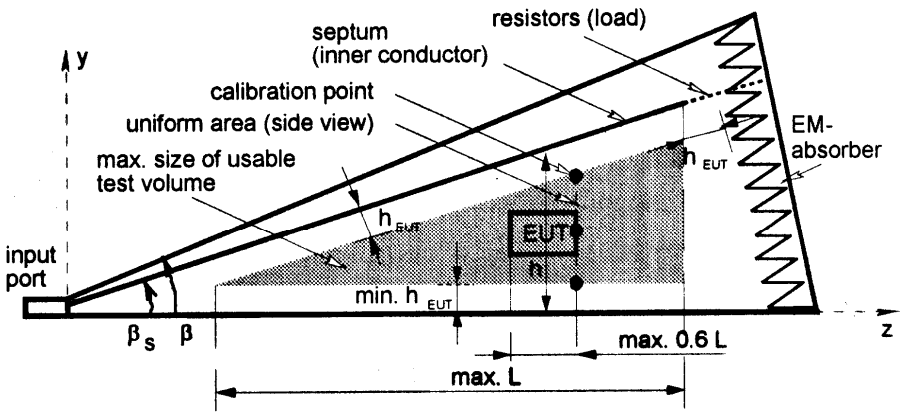

Fig.2 - Maximum EUT size and maximum size of the usable test volume in a GTEM cell, longitudinal section

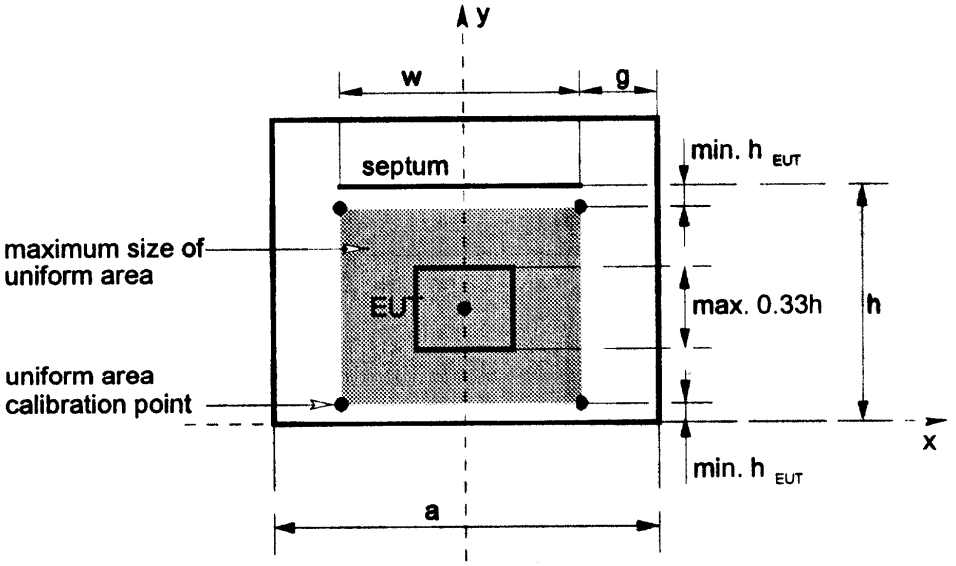

Fig.3 Maximum EUT size and maximum size of the usable test volume in a GTEM cell, cross section

GTEM 250			
Height of septum in the back of cell	Hh=300 mm		Fig.4
Distance of the testing section from back of the cell along *z* axis	L_S=300 mm		Fig.4
Testing section dimensions [mm]	a=430, b=300, h=230, w=280		Fig.3
Maximum testing volume	205 x 280 x 450 mm	(h-2h_{EUT}) x w x L	Fig. 3-4
Maximum testing volume (IEC 61000-4-20)	75 x 165 x 270 mm	h/3 x 0.6w x 0.6L	
h_{EUT}	12,5 mm	0.05h	

Calculating Power Required. Theory.

Basically, the volts per meter, the height of the septum, an allowance for voltage peaks caused by amplitude modulation and the flatness with frequency are considered. For flatness, 3 dB are allowed, this only takes effect after the first resonance point.

The example below shows 10 V/m with a GTEM 250

GTEM 250

Septum height = 0,250 m

Flatness = 3 dB = 2

Power Required = $(E \times h)^2$ /R x Flatness x Modulation Allowance

Where E = required field strength: h = septum height: R = GTEM input impedance (50Ohm)

Power Required = $(10 \times 0{,}250)^2$ / 50 x 2 x 3.24 = 0,25 Watt

The diagram Fig. 4, shows the power required for GTEM 250 with 80 % amplitude modulation at 1GHz frequency.

GTEM Calculating Power requirement

Field Strength E	Flat-ness	Modulation allowance	Required power (modula-ted)	Required power (CW)
V/m	3dB = 2	80% AM	Watts	Watts
3	2	3,24	0,073	0,0225
10	2	3,24	0,81	0,25
30	2	3,24	7,29	2,25
100	2	3,24	81	25

Factory control.

Performance test.

A verification test was performed at 0.25mt. section height,

A template placed in the middle of the section.

Immunity test application in according standard EN 61000-4-3

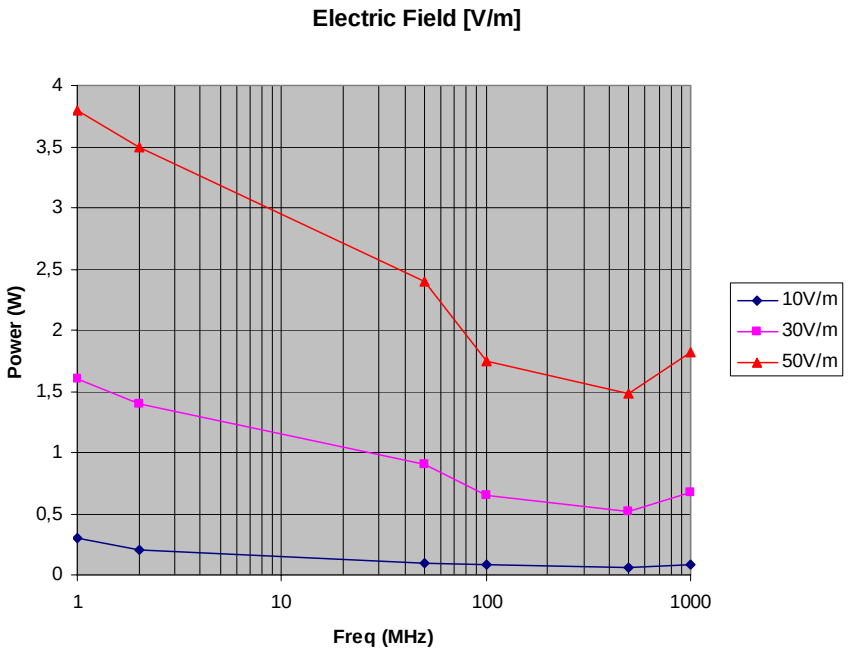

Fig. 4 Power required / Electric field Vs. frequency

List of the equipments for the measurements:

- EmcTest software for data storage
- HP8648A 0,15-1000MHz RF generator
- IFI CMX105 0,15-1000MHz Power Amplifier
- BIRD RF POWER ANALYST Mod. 4391
- PMM 8053 Mainframe + EM330 electric field sensor Electric field 0,1-3GHz.
- GTEM cell mod. GTEM-250
- Advantest Network analyzer 40Mhz-3,8GHz
- HP Network analyzer HP8753B 300KHz-6GHz

REFLECTION COEFFICIENT S11

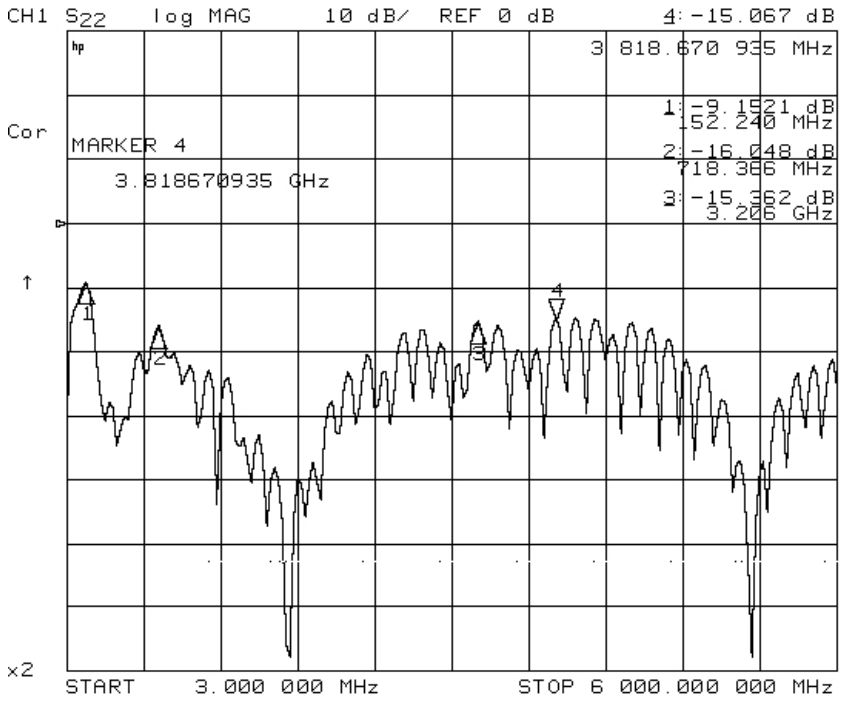

Fig.5 S11 magnitude of GTEM 250

Tab.5-Guarantied reflection coefficient S11

G T E M 2 5 0	
Reflection coefficient S11	**S11 accuracy magnitude/phase**
<-14 dB in 200 MHz-6 GHz	± 2 dB / 1 degrees