www.GtemCell.com

ITALIA

# GTEM 250

**For emission and immunity testing according to IEC/EN 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 a low-cost alternative measurement facility for both radiated emission and immunity measurements. It is included in the recently published standard IEC/EN 61000-4-20 “Emission and Immunity Testing in Transverse Electromagnetic (TEM) Waveguides”. Compared to other measuring methods like EMC test in anechoic chambers or OATS (Open Area Test Sites), GTEM-cells offer some significant advantages for the testing of small and medium sized EUT´s

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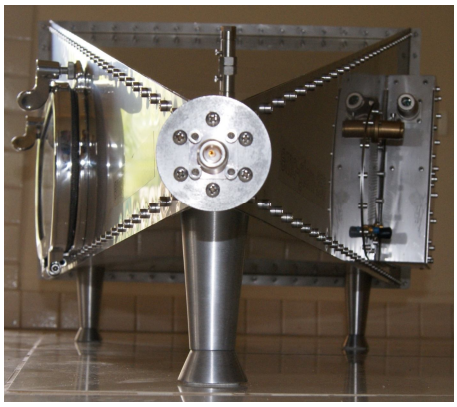
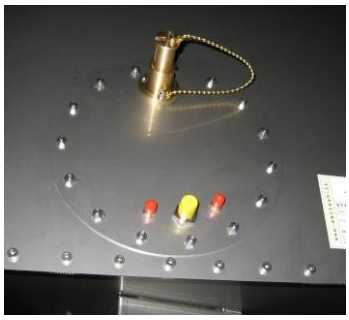
(Equipment Under Test) up to a frequency range of 20 GHz. Quick turnarounds of the EUT as well as numerous testing variations are easy and fast to handle. Switching from emission to immunity testing requires only simple adjustments from receiver input to amplifier output.
You are irrespective of long waiting times associated with off-site test labs or weather and ambient delays that can occur at OATS facilities. Whether you are at the design qualification, pre-compliance, compliance, or production sampling stage, the GTEM is the right choice for you!.

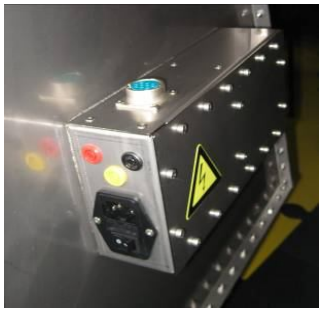


**Apex**

**Locking System**



**Technical Panel**



**Multipoles Filter**

**Key Features**

- Ruggedized fully Hot galvanized and INOX steel construction
- Unique compact design.
- Optimized for EMI and EMC.
- Strong fields achieved with low input power
- Broadband up to 20Ghz
- High effective shielding

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- 6A 2 poles standard line filter
- 10A 80V DC 2 poles line filter
- Excellent quality at Low cost

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## Theory of operation

GTEM-cells (Giga-hertz Transversal Electro-Magnetic cells) are waveguide structures intended for electromagnetic 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.

### Applications

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

### Specifications *

| | |
|---|---|
| **Operating range:** | 0,1MHz-20GHz |
| **RF Input** | max continuous. input power: 500W RF |
| **Input connector type** | "N" UG-21 connector |
| **Shielding:** | better than 65 to 110dB depending from frequencies |
| **Absorbers:** | 350 mm TDK |
| **Outer cell dimension:** | (L)1250x(W)640x(H)440mm |
| **Door Size:** | 450 x 250mm |
| **Construction** | Fully hot galvanized and inox steel 10/10 and 20/10 |

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| **Technical panel** | **Power supply / Filter box - In and out.** |
|---|---|
| N.1 Feed-thru "N" | N.1 6 amp. 250VAC, two phase + line filter |
| N.2 “SMA” connectors | N.3 filtered banana sockets 1A 1000Vac |
| N.1 feed-thru fibre optic penetration for 3 couples. | |

**Installed Options**

| |
|---|
| Inspection window with shielded polycarbonate glass |
| Halogen 50w 230V ac Lamp |
| N.1 feed-thru DB9 filtered for 9 penetration wires. |
| N.1 feed-thru DB25-filtered for 25 penetration wires. |
| Customized IN/OUT filters |
| INOX Stainless Steel chassy |

* data subject to variations without notice

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# 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.

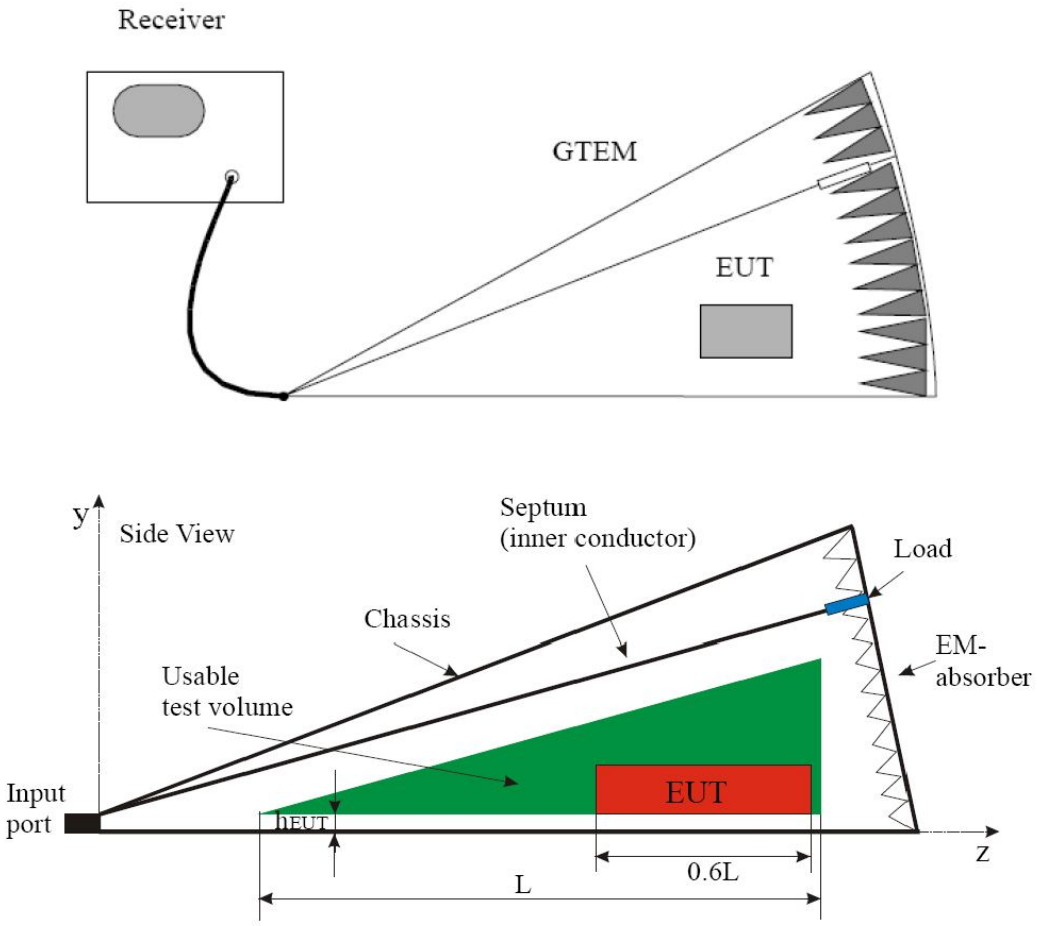


**Fig. 1**

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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**

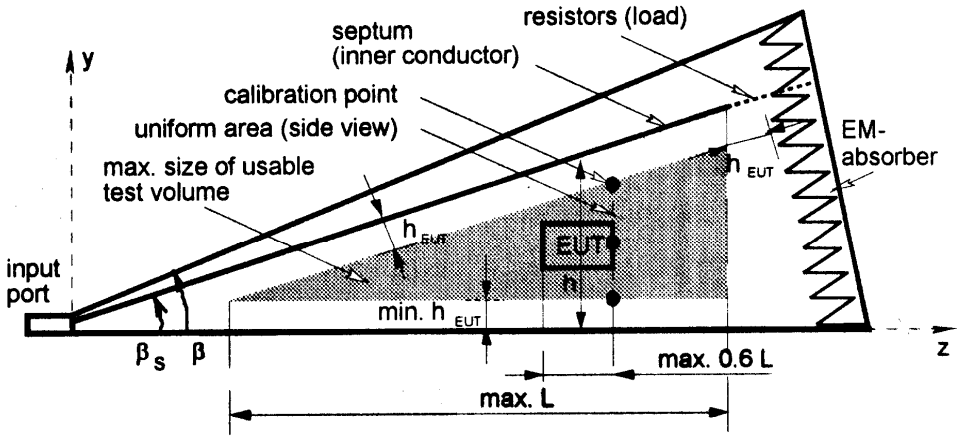


**Fig.2 - Maximum EUT size and maximum size of the usable test volume in a GTEM cell, longitudinal section**

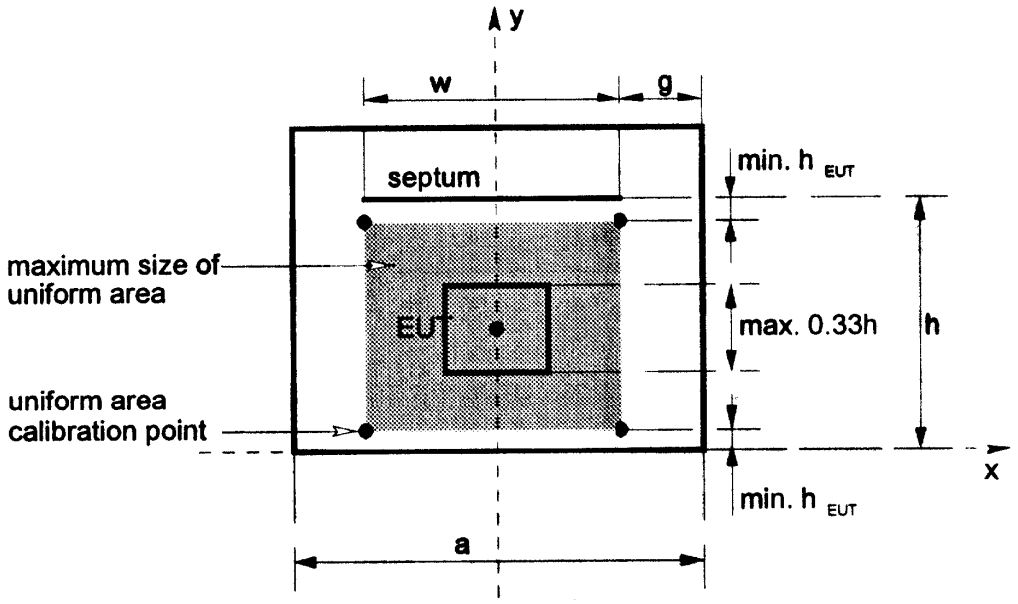


**Fig.3 Maximum EUT size and maximum size of the usable test volume in a GTEM cell, cross section**

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| GTEM 250 | | | |
|---|---|---|---|
| **Height of septum in the back of cell** | Hh=300 mm | | Fig.4 |
| **Distance of the testing section from back of 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 | |
| $\mathbf{h_{EUT}}$ | 12,5 mm | 0.05h | |

## Calculating Power Required. Theory.

Basically, we have to consider the volts per meter, the height of the septum, an allowance for voltage peaks caused by amplitude modulation and the flatness with frequency. For flatness, we generally allow 3 dB, this only takes effect after the first resonance point.

The example above 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.

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## GTEM Calculating Power requirement

| Field Strenght E | Flatness | Modulation allowance | Required power modulated | 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 controls.

**Performance test.**

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

A template placed in the middle of the section.

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

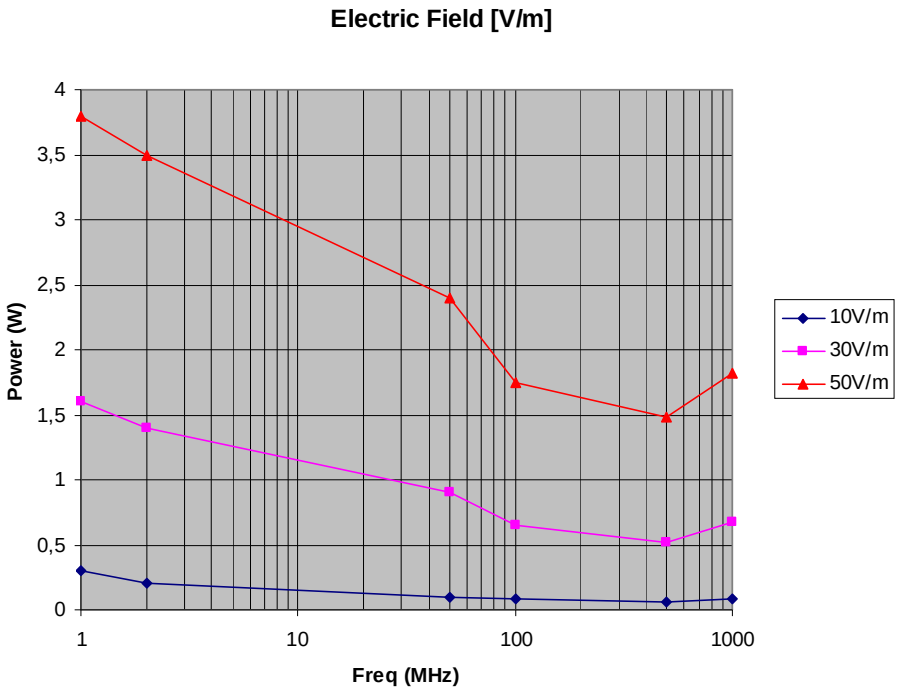


**Fig. 4 Power required / Electric field Vs. frequency**

**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. Emctest GTEM-250
- Advantest Network analyzer 40Mhz-3,8GHz
- HP Network analyzer HP8753B 300KHz-6GHz

## REFLECTION COEFFICIENT S11

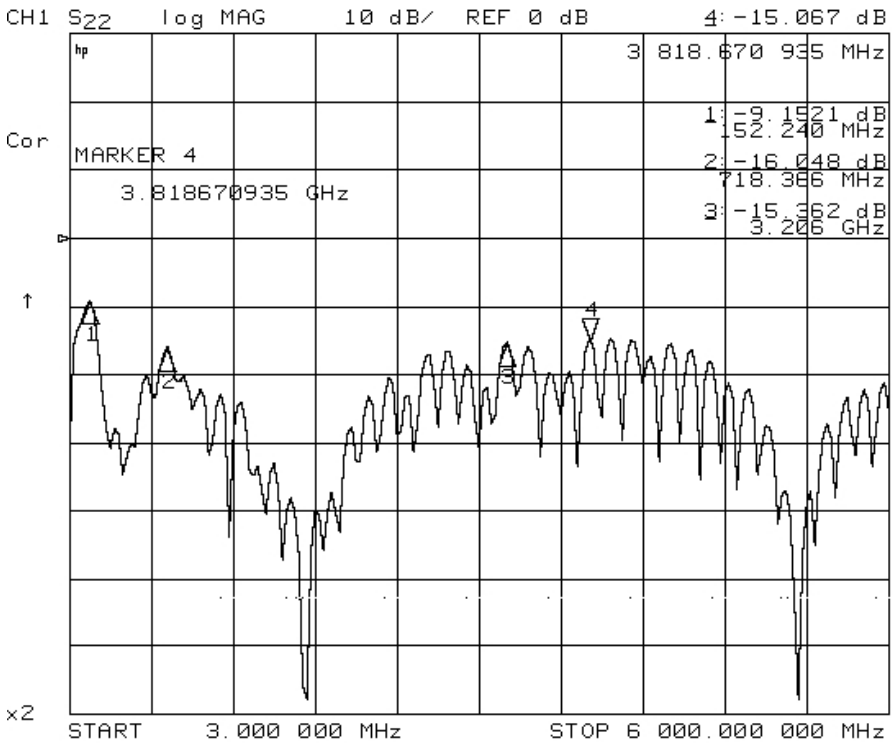


**Fig.5 S11 magnitude of GTEM 250**

**Tab.5-Guarantied reflection coefficient S11**

| **G T E M 2 5 0** | |
|---|---|
| **Reflection coefficient S11** | **S11 accuracy magnitude/phase** |
| <-15 dB in 200 MHz-6 GHz | ± 2 dB / 1 degrees |

Notes:

- 152MHz. Transition point or anomaly resonant region points depending from the volume of the cell

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