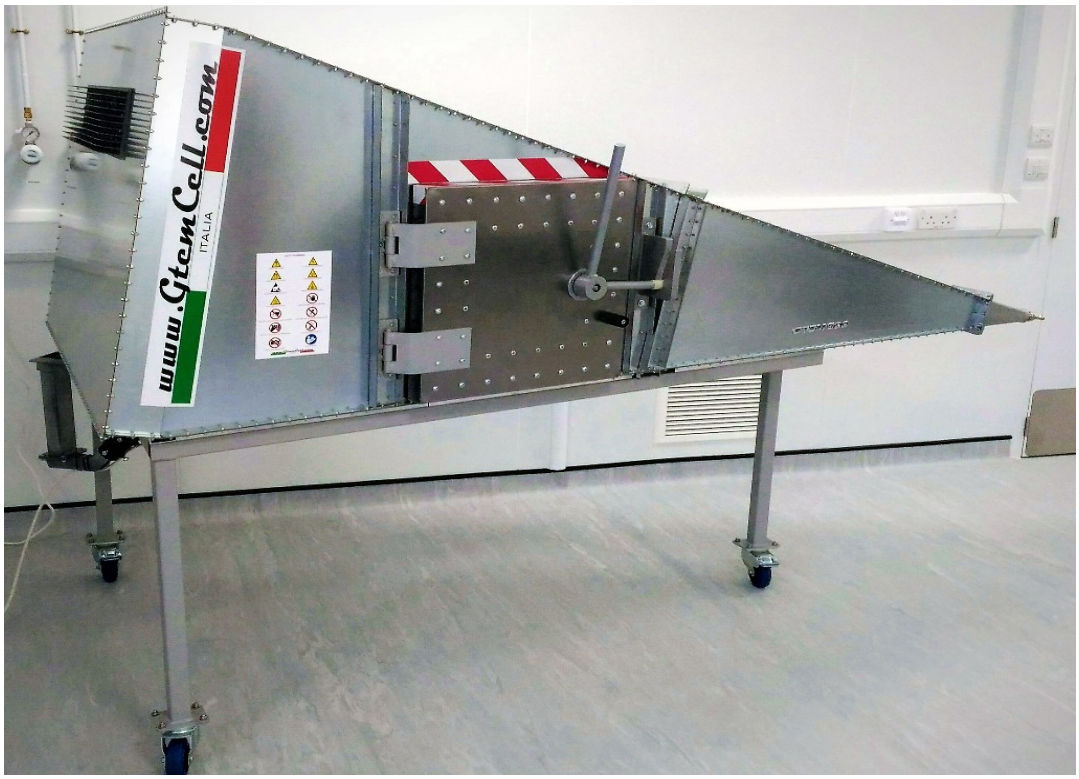
GTEM-400

For emission and immunity testing according to IEC/EN 61000-4-20



Introduction

The GTEMCELL GTEM-400 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 standard IEC 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 (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!

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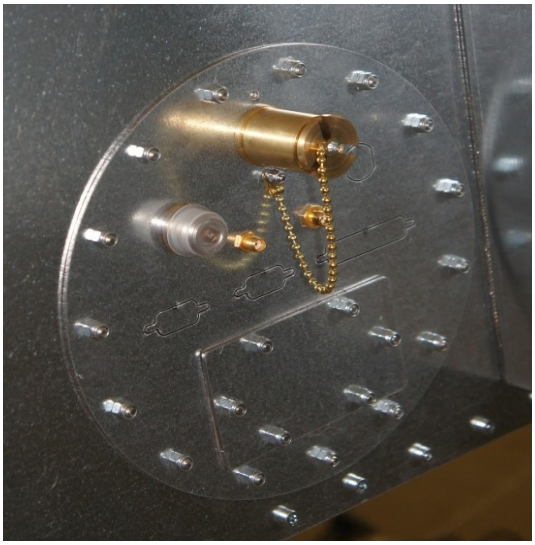
Key Features

- Ruggedized fully hot galvanized and INOX steel construction
- Unique compact design with new Apex impedance matching transition
- Optimized for EMI and EMC
- Strong fields achieved with low input power
- Broadband line and termination up to 20GHz
- Excellent quality at low cost



Technical panel

Line filters box

Apex

Technical specifications	
Frequency range	For emissions: 9KHz - 3 Ghz, For immunity applications: 80MHz – 6GHz * DC-20GHz optional
Septum height	400 mm
Max EUT size (LxWxH)	35x40x20cm
Defined test volume	13,5 x 13,5 x 13,5 cm
Typical VSWR (average value)	1:1.2 (for immunity test range)
Typical VSWR at critical frequency (average value)	< 1:1.6 (for immunity test range)
Max. input power, W continuous/pulsed	1 kW/2.5 kW
Input connector	7/16“ or N UG-21
Nominal impedance	50 Ohm
Mechanical	
Construction Materials	Hot galvanized steel, Door Inox steel, HPP60 Carbon loaded pyramidal poliurethan foam 65cm Height
Outer dimensions (LxWxH)	238 x 122 x 83cm + 70cm Trolley
Door (WxH)	Standard: 40 x 40cm * Optional: 40x60cm
Window in the door (WxH)	* Optional: circular Diam.200mm.
Weight	Approx. 250kg
Wheeled undercarriage (with brakes)	
Electrical	
Mains connectors	Fix/CEE
Main switch	magneto-thermal 16A mono phase
Input socket plug	16 AC IEC Type (mono phase + ground)
Output socket EUT tape	16 AC SHUCO type (mono phase + ground)
Additional EUT sockets	* Optional
Ground connection	M6 bolt,(it is required be always connected)
EMI AC Line filter (mono phase + ground)	16A 250V n.2 terminals +ground
EMI AC/DC secondary filter	10A 250V AC/DC N.2 terminals
Channel for fiber optic leads	3 couples (18GHz Cut-off frequency)
RF feed-thru connector	N.1 N-N female
RF feed-thru SMA connectors	N.2 SMA-SMA female
Technical panel pre-drilled for options	supplied

Options	
Midia filter unit	*Optional: N.1 RJ45, N.1 DB9-RS232, N.2 USB-2, N.1 DC filter.
Video camera system	* Optional
Indoor lighting	10W LED
Manipolator X,Y,Z	Motorized USB, Manual, Remote controlled

Installation manual and general safety instructions

The GTEM (Giga Hertz 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 multimeter appears a 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.

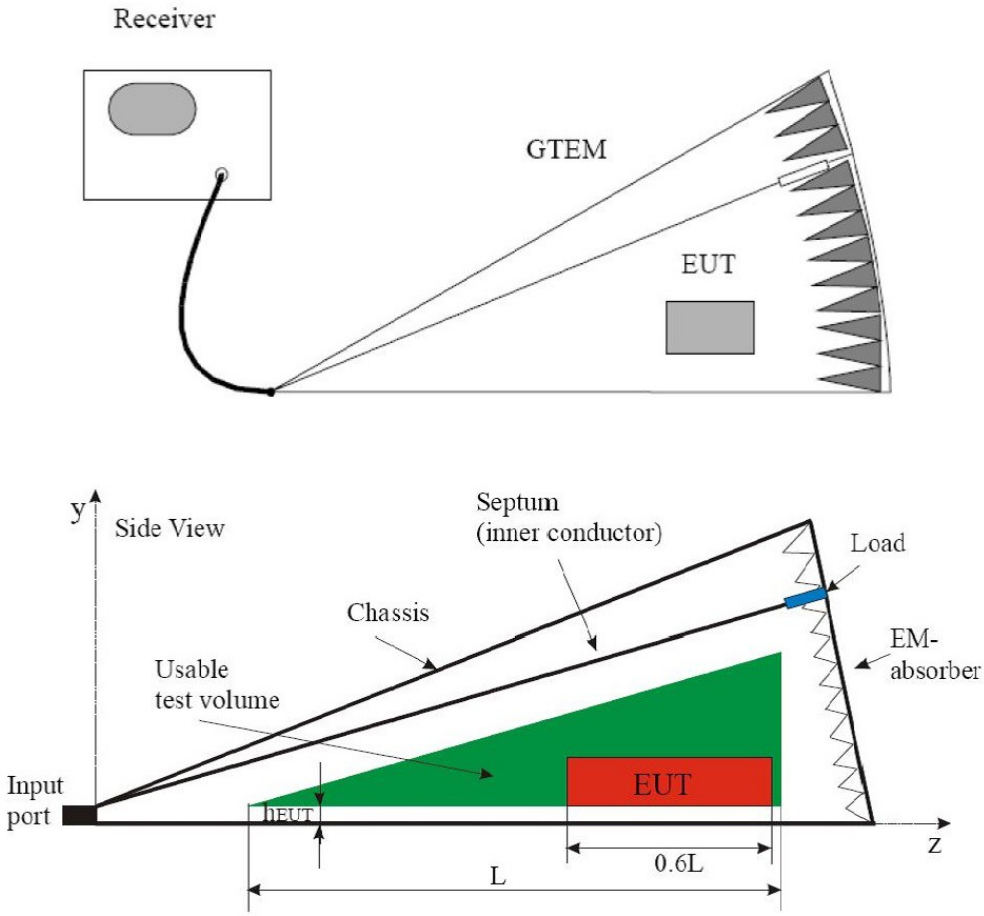


Fig. 1

Testing Volume

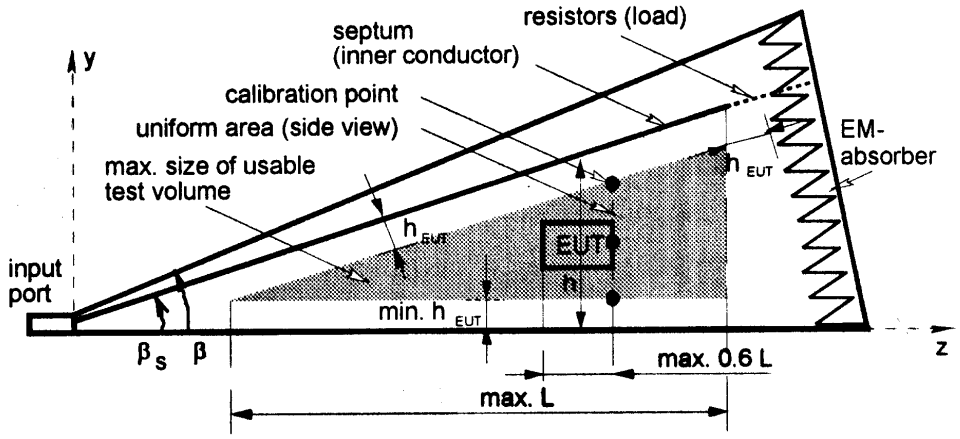


Fig.2 - Maximum EUT size and maximum size of the usable test volume in a GTEM cell, longitudinal section

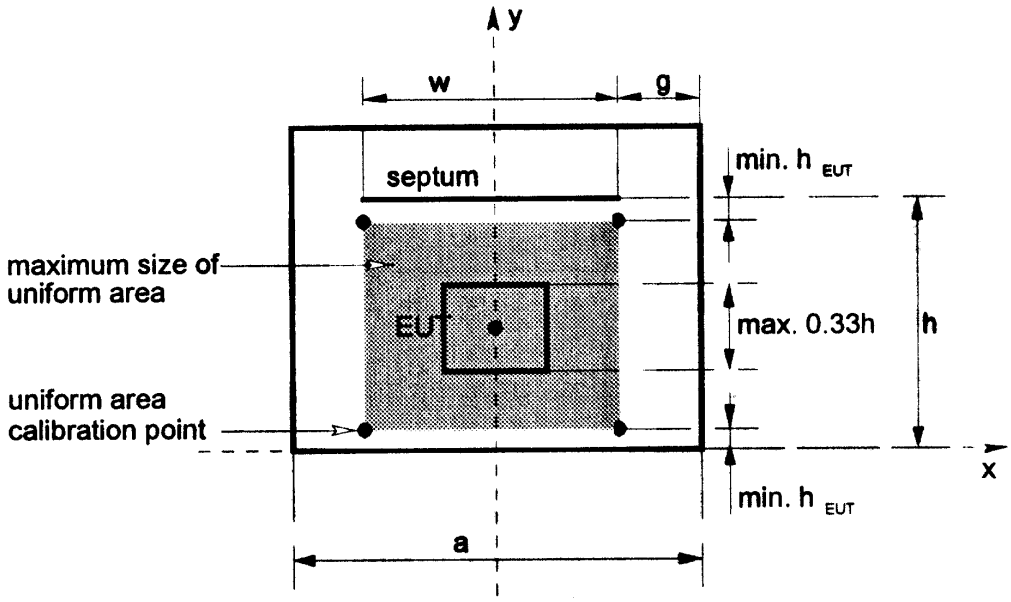


Fig.3 Maximum EUT size and maximum size of the usable test volume in a GTEM cell, cross section

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Calculating Power Required - Theory

Basically, we have to consider the volts per meter, the height of the septum, the allowance of 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 450 Septum height = 0,40 m
Flatness = 3 dB = 2
Power Required = [$(E \times h)^2 / R$] x Flatness x Modulation Allowance
E [V/m] = required field strength: (i.e. 10V/m)
h [m] = septum height
R = GTEM input impedance (50 Ohm)
Power Required = [$(10 \times 0.40)^2 / 50$] x 2 x 3.24 = 0,18 Watt

GTEM-400 Power requirement

Field Strenght E	Flatness	Modulation allowance	Required power modulated	Required power CW
V/m	3dB = 2	80% AM, 1kHz	Watts	Watts
3	2	3,24	0,18	0,06
10	2	3,24	2,01	0,62
30	2	3,24	18,09	5,58

Factory controls - Performance test:

A verification test was performed on site of the installation with a Network analyzer VNA Tiny.

REFLECTION COEFFICIENT: S11 magnitude of GTEM-400 in the range 80-3000MHz

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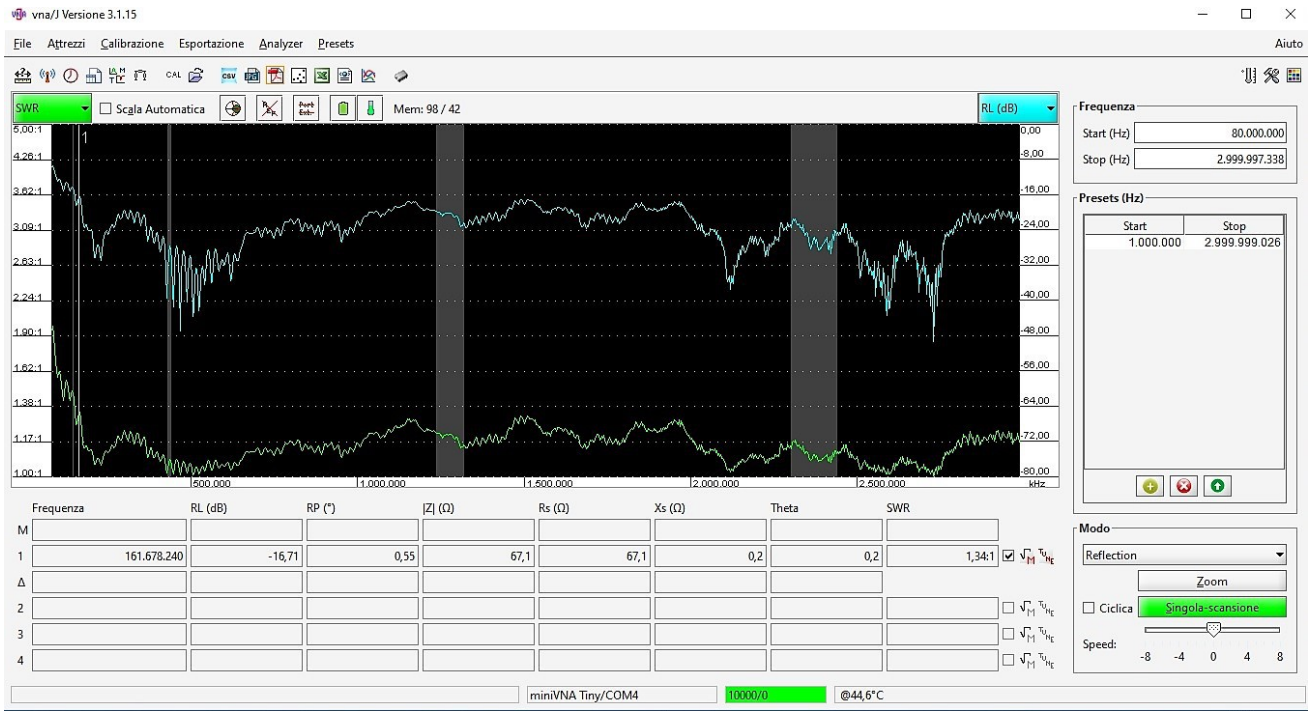

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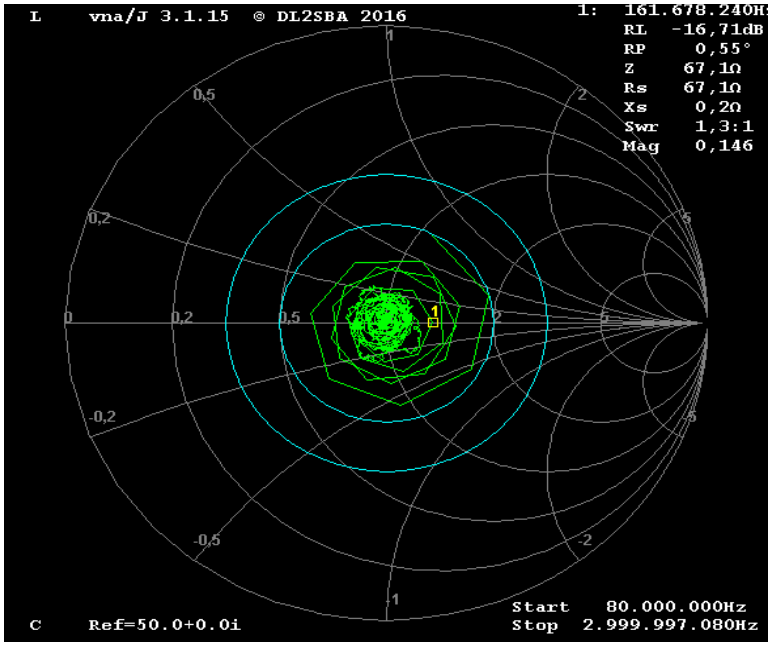

Guaranteed reflection coefficient S11

GTEM-400	
Reflection coefficient S11	**S11 accuracy magnitude/phase**
<-14 dB in 80 MHz -4GHz	± 2 dB / 1 degrees

Electronic Component list (Filter box):

16A, 250V IEC input power line panel male socket (external)
16A, 250V SCHUCO output power line female tape (internal)

FILTER CONCEPTS 250Vac 2x20A, 50/60 Hz

L=2x60uH+2x8.3mH, Cx=2x2,2uF, Cy=2x0.0068uF, R=1.2MOhm

N.2 Feed-thru filter Arcotronics 16A 250Vac

N.1 Magnet-thermally switch GEWISS Mod. C-16, 16Amp.* Mains switch

WARNINGS! READ BEFORE USING

HANDLE CAREFULLY

The GTEM cell is professional test equipment intended for EMC emissions and immunity test purposes operated by trained personnel. Some care are necessary:

- Don't push or pull the apex to move the cell, move only from the frame trolley.
- Before move the cell, loosen the unlock the wheel brake than when you finish lock again.
- Open or close the door softly . Handle carefully.
- Insert always straight the N and SMA connectors, don't tight too much, it is not necessary!
- One N type corner adaptor connector is supplied to protect the apex, please don't remove it. If it brokes replace with one of the same quality

RADIO FREQUENCY RADIATION

Personnel should not be exposed to the microwave energy which may radiate from this device. All inputs or output RF connection gaskets must be leak proof. Never look inside or leave doors open when this device is energized!

ELECTROMAGNETIC FIELD

Strong RF levels may cause de-magnetization and interference to others services. Operate always with the door closed and keep sensitive devices far from the door.

SHOCK HAZARD

Accidental short circuit or leakage current may occurs: Supply the unit through magneto-thermal differential switches lines. Keep always the GTEM cell grounded also with power supply disconnected. During normal tests operation connect energy only with the door closed.

ELECTROSTASTIC DISCHARGE

To avoid ESD keep always the GTEM cell grounded fitted with a permanent earth 16 mmq. wire conductor.

DANGER

Risk of injury at hands and head or cuts around the metallic surfaces of the chamber may occur. Leave around the cell a free area from obstacles.

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MAINTENANCE

Verify periodically:

- the status of the door gasket,
- I/O connectors integrity.
- Oil the wheels of the trolley and the door hinges.

Clean inside the chamber excess of dust with a vacuum cleaner.
Protect metallic surfaces against **corrosion**, clean it with a soft cloth wet of Vaseline, Silicon or Paraffin oils.
Avoid cleaning with water based products or chlorine solutions!

Maintenance

- When you are not operating live partially open the door avoiding stressing too much the gasket (they could take "memory form" reducing the shielding properties).
- Avoid touching the anechoic pyramids with the fingers or objects as they can be damaged easily.
- Take care at the N input connector, do not remove the protection angle adaptor, if damaged occurs replace urgently the adaptor with one similar: straight or angular just to save the input connector.
- For cleaning purposes remove before any power supply source from the GTEM cell, then use only a wet of water added with soft detergent tissue for the window, avoid aggressive products: they can damage the meta-acrylate glass.
- Periodically remove dust inside the cell with a vacuum cleaner

Troubleshooting

No power supply in the plugs : fuse interrupted in the socket (replace with the same value 16A to protect the line filter) or magneto-thermall switch off.
No field with RF power applied: pin of the corner coaxial adaptor broken: replace urgently with a similar one

Additional info

Power supply: when necessary connect the AC 230V or 400V power cord, verify the presence of differential switch and magneto-thermal switches.

Load: Do not apply over load to the line filter: remember the max. load is 16A for the plug and 10Amps for the banana jacks.

Ground: A ground connection is necessary for your safety: please connect a 16mm^2 wire at the building earth system permanently by the screw placed down the filter box . Verify periodically the status of the connection. Keep in mind that the metallic structure in case of leackage is conductive!

Door: During immunity test the door (if necessary) could remain also opened; the field losses are negligible and the result of the test do not suffer a lot.

Additional holes: You can make feed-throught passages only on the technical panel (remove it if necessary)

RF Max Power input: No care are necessary, the terminations are over dimensioned, the limit is 1200W and Peack pulse power up to 2,5KW (2uSec) with operating temperature up to 100°C.

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