



Test systems

## Reverberation chambers

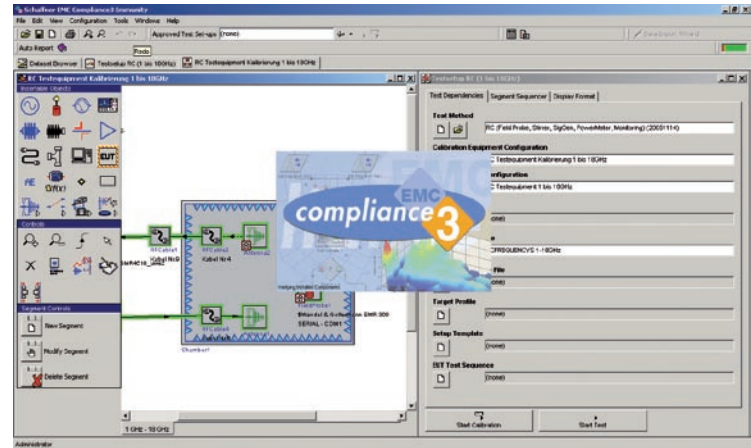
**SCHAFFNER**

safety for electronic systems

## Features.

- Wide frequency range 100MHz to > 18GHz
- Excellent field homogeneity (< 3dB)
- Full and pre-compliance testing
- Radiated emission and immunity measurements
- Stirrer optimized by numerical analysis
- Continuous or stepped rotation
- Calibrated per IEC 61000-4-21 and various other standards
- Powerful control software for automated system operation
- Consulting, calibration and services

Individual equipment configuration for the reverberation chamber system.



## Reverberation chambers.

Reverberation chambers (RCs) are modern EMC test environments in addition to the established methods like semi- or full anechoic rooms, open area test sites or (G)TEM cells. They can be used for emission and immunity testing. A reverberation chamber basically consists of a shielded room and a stirrer which changes (“stirs”) the electromagnetic field inside the chamber. The chamber itself behaves like a multi mode resonator.

### Model range

- Model S: 2.5 x 4 x 2.55m, LUF 200MHz, max. EUT volume 1m<sup>3</sup>
- Model M: 3.1 x 7 x 2.55m, LUF 100MHz, max. EUT volume 4m<sup>3</sup>
- Model L: 12.5 x 5.5 x 4m, LUF 80MHz, max. EUT volume 30m<sup>3</sup>
- Other sizes and upgrades of existing screened rooms to a reverberation chamber on request

### Screened room properties

- Screening effectiveness E-field min.
 

LUF to 1GHz:	>100dB
1GHz to 6GHz:	>90dB
6GHz to 18GHz:	>80dB
- Feedthrough connectors and filters according to customer specifications

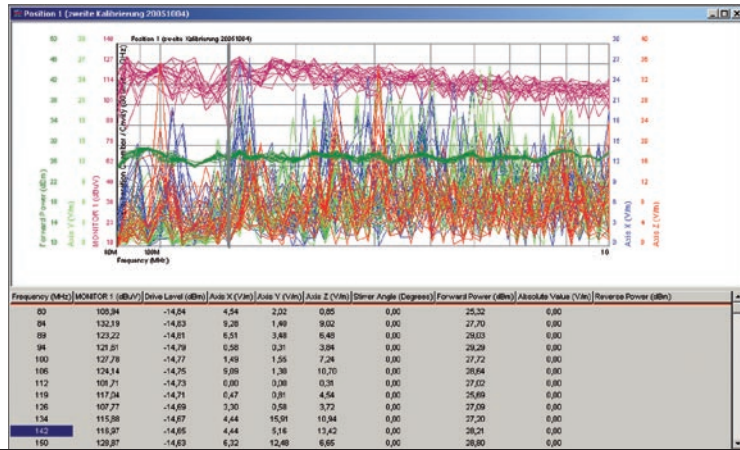
### Standard configuration

- Model S, M or L screened room
- Mode tuner with stepping motor
- Control software
- Shield test of the screened room
- Calibration per IEC 61000-4-21

### Options

- Custom room sizes
- Shielded control room
- Antennas and tripods from Schaffner
- Calibration and performance tests per various standards incl. RTCA DO 160, MIL461E, GMW3097
- Turnkey systems

Results are displayed simultaneously in graphical and tabular form.



## High field strength with low input power.

The stirrer moves the inevitable standing waves of the chamber in a way that a time-averaged spatially homogenous field distribution inside the chamber is achieved.

### Supported standards

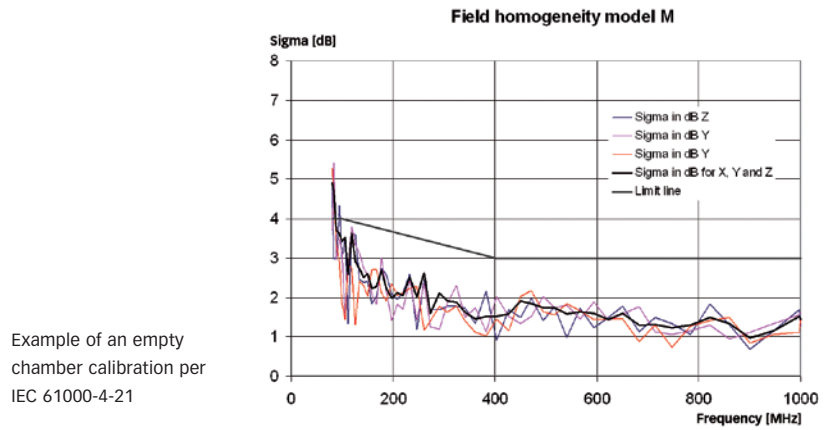
- IEC 61000-4-21
- RTCA DO 160 D/E
- MIL461E
- GMW3097
- ES-XW7T-1A278-AC
- Others on request

### Advantages of reverberation chambers

- High field strengths at relatively low input power levels
- Thus less powerful amplifier needed (cost reduction)
- (Almost) no absorbers needed
- Random field coming from all directions in any orientation and polarization, therefore no turning of the EUT necessary

**Powerful control software.** One of the most important points during establishment, calibration and final use of a reverberation chamber is the calibration, control and evaluation software. Using Schaffner's powerful system software (C++ based) Compliance 3, these procedures are solved comfortable and time effective, e.g.

- Individual equipment configuration for the reverberation chamber system
- Complex EUT test sequences can be defined on worksheets
- Different test segments can be created, any details are stored in an input window
- Results are displayed simultaneously in graphical and tabular form
- Powerful test report generator and measurement data export options



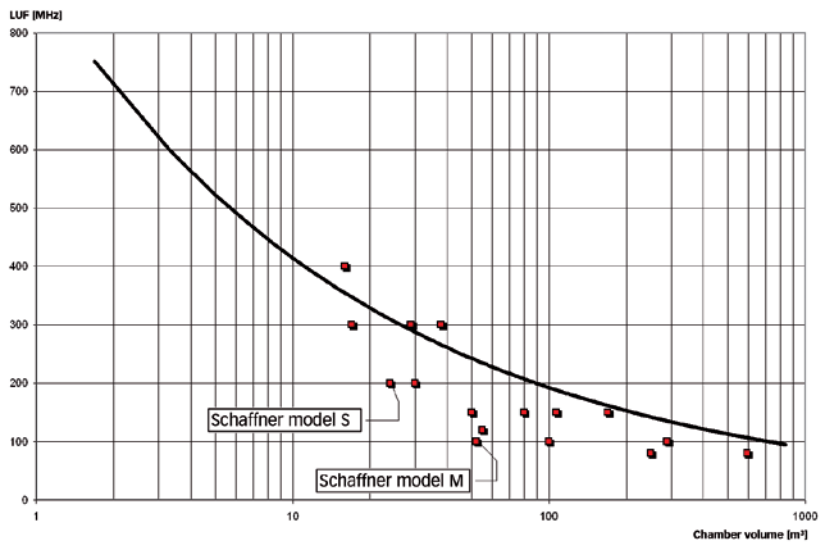
Example of an empty chamber calibration per IEC 61000-4-21

## Recommended chamber size for applications.

The chamber size determines the lowest usable frequency (LUF). A rough estimate of the recommended mini-mum chamber volume for a desired LUF according to IEC 61000-4-21 can be done using the diagram below. Example: For a desired LUF of 300MHz a chamber volume of 30m<sup>3</sup> is recommended.

### Examples of standards

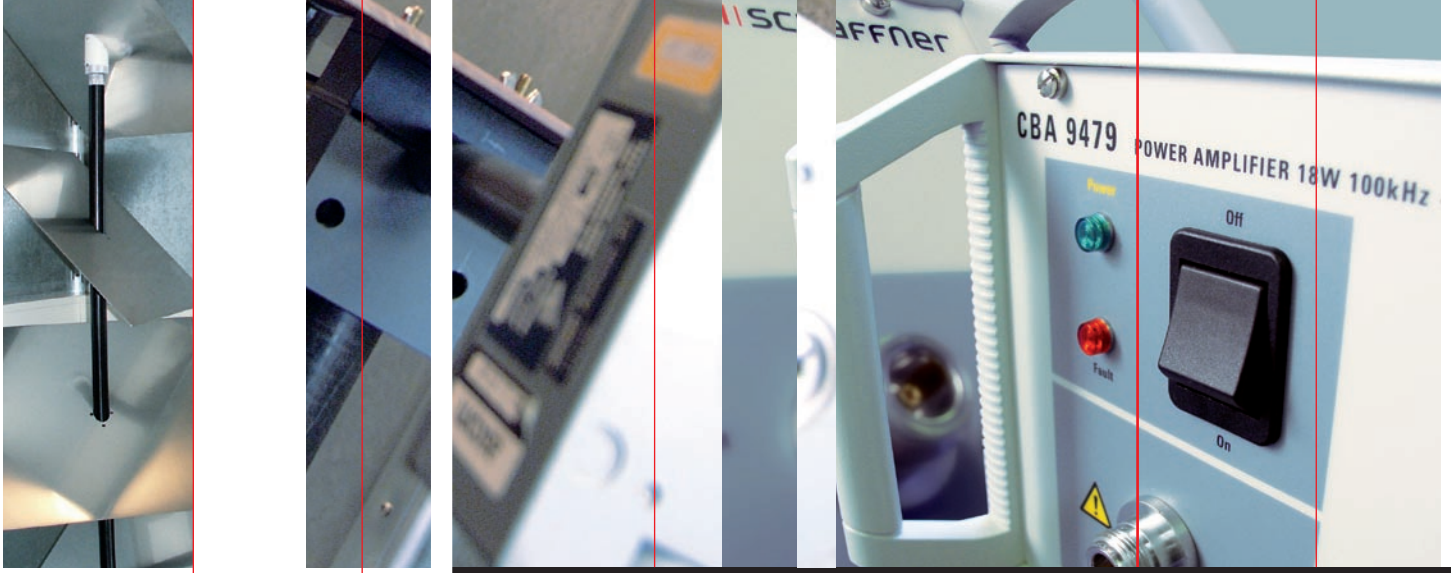
- RTCA DO 160 D/E:  
LUF < 100MHz
- MIL461E:  
LUF < 200MHz
- GMW3097:  
LUF < 400MHz
- Ford ES-XW7T-1A278-AC:  
LUF < 400MHz



Schaffner solutions feature lowest LUF per size.

Note: This estimate uses the “3 times of the first resonance frequency” criterion based on a chamber length, width and height relation of 2.1:1:0.8.

Depending on chamber and stirrer design lower LUFs can be achieved as indicated with squares in the diagram.



## Example configuration.

This example is intended to provide basic information and recommendations for a sample configuration for a RC system. Please note that each system may require other and/or additional equipment or configurations.

### Chamber size and application

E.g. standard GMW3097

Thus: LUF < 400MHz (from example of standards)

Thus: chamber volume min.  $11\text{m}^3$  (from graph)

The closest standard model for this application would be model S. However, if possible, it is advisable to choose a larger chamber in order to achieve a higher testing efficiency (save test time), since the number of required tuner steps is reduced at higher frequencies. For example, a chamber with a LUF of 100MHz would require only 18 tuner steps in the range above 300MHz instead of 50 for a chamber with a LUF of 300MHz (IEC 61000-4-21).

We choose model M for this example, which could also be used for other standard applications.

Feedthrough and filter connectors as well as electrical installation and light fixtures are part of the screened room and have to be specified by the customer.

The stirrer will be designed according to the chamber size.

### Test and measurement equipment examples

GMW3097 frequency range: 400MHz to 2GHz

Transmit and receive antenna

Optional: horn (transmit) antenna above 1GHz for higher efficiency

Power amplifier for 100V/m CW and AM 80% 400MHz to 1GHz

Power amplifier for 70V/m PM 1 to 2GHz

Power amplifier for 600V/m PM 1.2 to 1.4GHz

Power meter 400MHz to 2GHz

Signal generator 400MHz to 2GHz AM and PM

Arbitrary waveform generator for radar pulse packets

2x CBL 6112

BHA 9118

CBA 9413B

CBA 9429

3rd party

CPW 9670

3rd party

3rd party

## World-wide fast and cost effective calibration and customer services.

For reverberation chamber projects Schaffner offers presales consultation, system design, installation and integration, calibrating, training and applications support.

For fast-turnaround calibration and repair of all your commonly used EMC test equipment, choose Schaffner's calibration and customer services. The most extensive, single-source service for the calibration of RF and conducted EMI test equipment in the world, Schaffner provides accredited test laboratories with a fast, reliable, high quality service.



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