

## Anechoic Chambers / RF-Shielded Rooms



### Turn-key solutions from Frankonia

We supply turn-key shielded rooms and anechoic-chambers acc. to IEC / EN / ISO / MIL and CISPR-standards, including immunity and emission test systems.



**FRANKONIA**

## RF-Shielded Rooms & Anechoic Chambers:

Technical Construction .....	3
Installation / Shielded doors and gates .....	4-5
Ventilation & Feed-Through Components .....	6
Feed-Through Components .....	7
Floors / Lining of Inner Walls and Ceiling .....	8
Electrical Installation .....	9
Antenna Support / Turntable / Video & Audio Systems .....	10
Absorbers .....	11-12
Installation / Abbreviation of Absorbers .....	13
Illustrated Details .....	14-15

## Frankonia Standard Chambers:

<b>UCC</b>	Ultra Compact Chamber .....	17
<b>CHC</b>	Compact Hybrid Chamber .....	18
<b>ACTC</b>	Automotive Component Testing Chamber .....	19
<b>AVTC</b>	Automotive Vehicle Testing Chamber .....	20
<b>MIL-CHC</b>	MIL Compact Hybrid Chamber .....	21
<b>SAC-3 / -5 Plus</b>	Semi Anechoic Chamber .....	22-23
<b>FAC-3 Plus</b>	Fully Anechoic Chamber .....	24
<b>SAC-10</b>	Anechoic Chamber for 10.0 m measuring distance .....	25
	Impressions .....	26-27



## Modular

Prefabricated pan-type shielding modules made of 2 mm thick galvanized sheet steel, 20 µm minimum acc. to DIN 17162 - EN 10142 - Quality DX 52 D + Z

Thickness of the galvanization: min. 275 g/m<sup>2</sup> by chemical passivation and tolerances acc. to DIN/EN 10143

Bolted every 75 mm

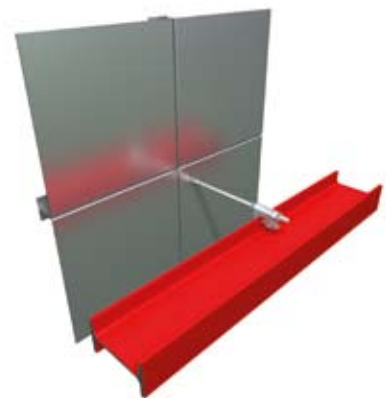
Self-supporting construction

## Technical construction

Our RF-shielded rooms and anechoic chambers are designed as a modular concept. This means that we use standardized parts, which assure a maximum of flexibility in view of the possible dimensions. The various shielding components are matched in a way that variations of length, width and height as well as lateral offsets may be realized without any problem during later modifications. In order to use the maximum available space of the existing installation area, special adjusting modules are available which allow the realization of almost any dimensions requested. In the normal configuration, the individual shielding modules are bolted from the inside so that they can be installed close to the walls of the building. If required, the panels can also be bolted from outside (e.g. when chambers must be attached to each other). The panels are made of galvanized sheet steel with a thickness of 2.0 mm. The sheet steel is double-edged in order to achieve two things: self-supporting stability and assembly by screwing. The corners of the individual panels are welded and spray-galvanized. The individual shielding panels are bolted every 75 mm with a wire mesh gasket inserted into the gap. The small screwing distance as well as the precise tightening of the screws with pre-defined torque guarantees long life shielding attenuation characteristics. All chambers are self-supporting up to a width, length and height of 3.0 m. Beyond these dimensions, additional steel supports (beams, columns) are installed on the outside to stabilize the chamber.

## Steel structure

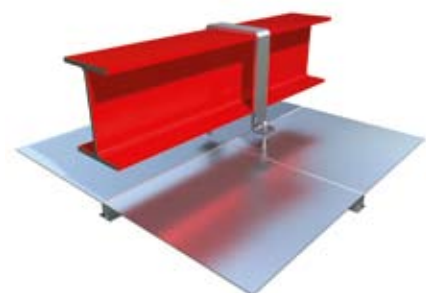
The steel structure of Frankonia is made of strong steel girders which are totally self-supporting. When designing customized anechoic chambers and shielded rooms we especially take into consideration the stability of the chamber, seismic conditions as well as the achievement of a low point load to the concrete slabs of the building. Our steel girders are painted with a corrosion prevention on which we give a guarantee of 10 years.



Example of wall fixation



Screwing of shielding panels



Example of ceiling fixation

# Installation / Shielded doors and gates

## Requirements regarding the place of installation

Since the floor shielding panels are installed flat on the floor of the building, the max. unevenness of the floor must not exceed  $\pm 5$  mm, measured across a length of 5.0 m. All deviations above this value must be considered before installation of the chamber, e.g. compensated by installation of a floating floor. If the floor of the building is not dry enough, the chamber must be protected against rising humidity (e.g. rubber membrane also used for garden ponds etc.). The main power supply of the chamber will be realized through power line filters according to customers' specification (current / voltage). The electrical earth connection point must be provided by the customer, with a value of max.  $0.5 \Omega$  and wire cross section of at least  $16 \text{ mm}^2$ .

## Shielded doors and gates

The following door types are available:

- hinged doors (single-leaf and double-leaf)
- sliding doors / gates
- customized solutions

Special attention must be drawn on the RF-shielded contact between door leaf and door frame. To assure a good electrical connection we are using copper beryllium contact springs, which are pressed onto opposite contact surfaces during the closing procedure. These highly flexible springs, which are installed on the circumference of the door frame, are provided with a holding clip which latches onto a groove in the supporting material. This permits an easy exchange of these wearing parts without special tools and assures a good electrical and RF proof contact. The doors are provided as a standard with three rows of contact springs on all sides. All bright surfaces are protected against corrosion by hot galvanizing.

## Options

- Integrated door stopper at the top of the door in order to limit the door movement or to fix the door at a certain position
- Integrated lock (operated by key) inside the axis of the handle
- Door preparation for badge- and code pin locking system (available for pneumatic and electric drive)
- Sluice gate function (available for pneumatic and electric drive)
- Switch for interlock system



Hinged standard doors



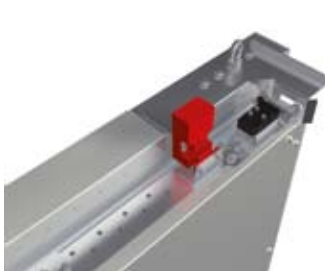
Door with ferrite absorbers



Double-leaf door



Sliding door with pyramid absorbers



Contact switch for interlock system



Door stopper

# Installation / Shielded doors and gates

## Sliding doors and gates:

A considerable advantage of sliding doors / gates is the fact that pyramid absorbers up to a length of 2.5 m may be installed on the door leaves directly. In this case, the opening procedure of the sliding doors is performed in two steps as follows:

- a) Disengaging from the contact spring system and reverse movement over the full length of the pyramid absorbers
- b) Lateral movement of the door leaf to the left or right until the passage is completely opened

For automatic operation, electric / pneumatic controls with a safety circuit can be delivered. For the bridging of the door step, several automated ramp systems are available. If the chamber can be placed into a pit, it is also possible to choose a solution without doorstep.

## Standard doors

Type	Standard dimensions (width x height)
<b>Single-leaf doors</b>	
SLD 09 / 19	938 mm x 1.968 mm
SLD 10 / 20	1.013 mm x 2.043 mm
SLD 12 / 21	1.238 mm x 2.118 mm
SLD 15 / 21	1.538 mm x 2.118 mm
<b>Double-leaf doors</b>	
DLD 18 / 21	1.838 mm x 2.163 mm
DLD 21 / 21	2.138 mm x 2.163 mm
DLD 21 / 24	2.138 mm x 2.463 mm
DLD 24 / 24	2.438 mm x 2.463 mm
DLD 30 / 30	3.038 mm x 3.063 mm
DLD 39 / 39	3.938 mm x 3.963 mm
<b>Sliding doors</b>	
SD 12 / 21	1.238 mm x 2.118 mm
SD 15 / 21	1.538 mm x 2.118 mm
SD 18 / 21	1.838 mm x 2.118 mm
SD 21 / 21	2.138 mm x 2.118 mm
SD 24 / 21	2.438 mm x 2.118 mm
<b>Sliding gates</b>	
SG 24 / 24	2.438 mm x 2.493 mm
SG 30 / 30	3.038 mm x 3.093 mm
SG 39 / 39	3.938 mm x 3.993 mm
SG 42 / 42	4.238 mm x 4.293 mm
SG 51 / 51	5.138 mm x 5.193 mm
<b>Options</b>	
• pneumatical drive / • electrical drive	
• manual ramp / • pneumatical ramp	
Customized versions are available on request	



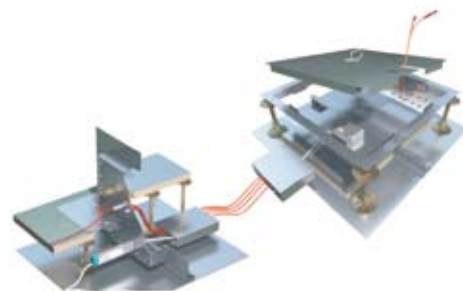
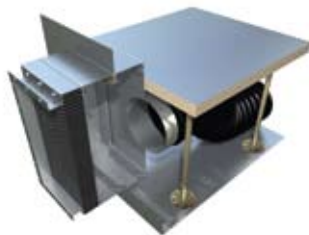
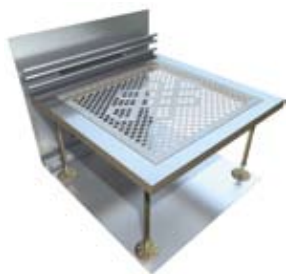
## Special features

- 3 rows of contact springs, made of tinned bronze beryllium
- 3 knife contact system
- Easy maintenance, no need of special tools for exchange of the contact springs
- Many different door sizes available
- Manual, electrical or pneumatical latching
- Surface hot galvanized
- Two strong hinges and two strong latching points are integrated in the door frame
- Direct lining with ferrite tiles and pyramid absorbers is possible

## Installation of RF-absorbers on doors / gates directly

All Frankonia doors / gates are designed strong enough for installation of ferrite absorbers as well as of pyramid absorbers directly on the door leaves. In most cases, separate mobile absorber walls are dispensable. If pyramid absorbers with a larger size (>30 cm) shall be installed, sliding doors must be used.

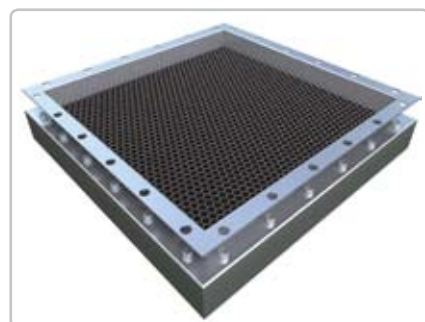
# Ventilation & Feed-Through Components



From Penetration Panel to Floor Connection Panel

## Ventilation / Air Conditioning

Ventilation / air conditioning of shielded rooms is on principle realized by so-called honeycomb inserts. The diameter and the length of the individual honeycomb openings depend on the maximum usable frequency of the chamber. The standard configuration of our honeycombs is for a frequency range from 10 kHz to 18 GHz. For smaller rooms, and if the surrounding room is well ventilated, a diagonal installation of the honeycombs will provide sufficient ventilation. For larger chambers, additional fans with adjustable speed can be installed in front of the honeycombs using connecting flanges, which are available as standard. The same connecting flanges can also be used for a direct connection to air conditioning systems. For special applications honeycombs with a frequency extension up to 40 GHz are available.



Honeycomb

## Penetration Panels / Feed-Through Components

All feed-throughs into the chamber must be installed using special RF-shielded feed-through components, which guarantee high shielding attenuation characteristics over the whole specified frequency range. Since the requirements regarding durability may change, the feed-through components are normally screwed onto exchangeable penetration panels, which are bolted to the shielding panels. Penetration panels are available in standard sizes of 400 x 400 mm and 500 x 500 mm and they may be ordered separately, if required later.

## Penetration Panels Anechoic Chambers

In rooms with absorber lining, an additional "C-type" frame is installed in front of the installation panels; this provides a larger installation space between shielding panels and absorbers, which is an advantage especially when the bending radius of cables would become critical. On the inside, the absorbers in the proximity of the penetration panels are installed on swivelling covers or on mobile supports. Convenient access to the penetration panels is assured.



Direct connection to air conditioning system

## Coaxial Feed-Throughs

By design, coaxial feed-throughs in the installation panels are realized as "N-type" since they qualify for highest shielding attenuation characteristics. The conversion to all other types is performed on the inside and outside using suitable adapters. A threaded sealing cap is included in the delivery for coaxial feed-throughs, which are not used permanently.



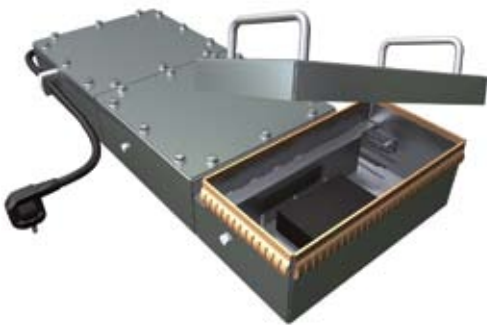
Penetration panel with C-type frame

# Feed-Through Components



## Power-, Data- and Signal Line Filters

The feeding of all mains, data and signal lines has to be realized via suitable filters whose insertion loss corresponds at least to the shielding attenuation values of the shielded chamber. We offer a wide range of filters for various applications, e.g. mains filters, single-phase and three-phase, from 1 A to 800 A in standard version, or with low leakage current, 400 Hz filters, telephone line filters, filter assemblies for up to 200 data lines etc.



## Fibre Optic Converters

Due to continuously increasing data transmission rates, the use of data and signal line filters is often not recommended since the lowest critical frequency of these filters would have to be relatively high to guarantee perfect data transmission (influence on the shielding attenuation characteristics). Provided that suitable converters are available on the market, we recommend the conversion to fibre optics. At present we can supply fibre optic converters for the following connections: GPIB, RS-232, RS-485, RJ-45 (Ethernet), USB....

## RFI Trap

The mechanical design of this feature is similar to the drain siphon of a washbasin, with one half on the outside and the other half on the inside of the chamber / room. With the filling of copper granulates it is possible to feed all kinds of shielded cables into a chamber / room without disconnecting them (as in case of the filters or coaxial feed-throughs). The external plastic isolation of the corresponding cables has to be stripped off in the section where the cable would pass through copper chips, so that the shielding of the cable is uncovered. After inserting the cables, the passage is filled from both sides with copper chips of 1-2 mm size; this assures the electric contact of the cable shielding with the shielding panel. The RFI Trap can be mounted on an penetration panel. Appropriate openings are provided for the removal of the copper granulates.



## Feed-Throughs for fibre optics, compressed air, water and oil

For feed-through of fibre optics and compressed air, it is possible either to install suitable feed through connectors (cables connected on both sides) or wave-guide tubes (cable itself would penetrate the shielding). For the latter we recommend our "universal screw-type feed-through" or "multi-hole-feed-through" which can be disassembled completely (like a nutshell) to insert the cables, so that the size of the plugs is only of minor importance. Additionally we offer special feed-throughs for liquids, like water and oil but also for compressed air.

# Floors / Lining of Inner Walls and Ceiling



Raised floor

## Floor for Shielded Rooms

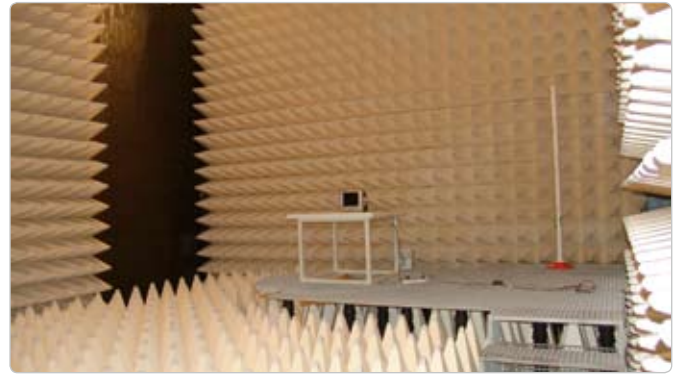
In shielded rooms we install a so-called false floor above the floor shielding panels. This false floor consists of chipboard modules (panel thickness 38 mm), size 600 mm x 600 mm, which are placed on metal supports of adjustable height. The internal floor level of the chamber is adjusted to the level of the doorsill; a step into the inside of the chamber is thus avoided. A PVC covering is glued onto the surface of the modules. The space between the floor shielding panels and the floor panels can be used for cable trunking. The standard version is suitable for a surface load of 500 kg/m<sup>2</sup>. Special versions for higher loads are available.



Semi-anechoic chamber with groundplane

## Floor for Semi-Anechoic Chambers

In this case, the standard outfit is also a so-called false floor, but covered with an aluminium foil on the surface. Above these false floor panels, a ground plane of 2.0 mm thick hot-galvanized sheet steel is installed with a RF contact to the wall shielding panels. The electrical contact between the sheet steel panels is made via the aluminium foil of the false floor panels.



Fully anechoic chamber with cat walk

## Floor for Fully Anechoic Chambers

In case of anechoic chambers with a full absorber lining (with floor absorbers) several versions may be realized depending on the sizes and weights of the test specimen to be placed in the room. However, it is a general rule that only the absolutely necessary amount of material should be placed above the absorbers, since any material has an influence (even if minor) on the room characteristics. The following standard arrangement of anechoic chambers with pyramid absorber lining on the floor is available:

- Supported wooden floor over the whole surface with individually removable panels
- Supported catwalk, fabricated of wood or plastic, in certain parts of the chamber
- Free walkways (without absorber lining) on the boundary area of the room and behind the turntable.

If only ferrite absorbers are placed on the floor a false floor is installed as described above but lowered by the height of the ferrite absorbers. A 5.0 mm thick felt covering would be laid out on the ferrite surface.



## Lining of Inner Walls and Ceiling in Shielded Rooms

On request the inner walls and the ceiling can be lined with material chosen by the customer. Soundproof linings are available for special application.



## Electric Installation in Shielded Rooms

The electrical installation in the chamber (starting from mains filter) may be performed either by our electricians or by the customer himself. If Frankonia performs the installation the following standard equipment is included.

- Electrical distribution box with MCBs (over-current protection, e.g. 16 A, 32 A etc.), and RCDs (earth fault protection, e.g. 30 mA tripping current)
- Chamber illumination
- Raised floor connection boxes with trunking or dado trunking around perimeter of walls with corresponding plug installation
- Emergency Panic switch
- Battery buffered emergency lighting above the door

## Electric Installation in Chambers with Absorber Lining

### a) Electric Distribution

In rooms with ferrite / hybrid absorber lining, the electrical distribution box is accessible from the inside of the chamber. The door of the distribution box is lined with ferrite absorbers as well. In rooms with pyramid absorber lining, the electrical distribution box is accessible from the outside of the chamber. A shielded door can be opened easily to gain access to all MCBs and RCDs.

### b) Illumination

For anechoic chambers, the standard illumination consists of halogen lamps which are preferably installed in the corner areas of the ceiling (in case of ferrite absorbers) or between the absorber tips (in case of pyramid absorbers). For large chambers (e.g. 10 m test range) a lamp lift is available as an option which allows lowering the lamps from the ceiling if bulbs must be changed. The cables to the lamps are installed behind the absorbers in metallic tubes.

### c) Connection Boxes in the Raised Floor

In anechoic chambers, no installations can be made on the chamber walls. In this case the complete electric installation (Power outlets, RF connectors, DC connectors etc.) as well as the necessary connections to the EUT (fibre optic lines, control lines, compressed air etc.) and to the test equipment (RF-cable etc.) is placed into trunking systems under the raised floor. If a turntable is installed in the chamber / room, a box for electric supplies can be installed as integral part in the center of the turntable.



Electrical distribution box access from inside



Electrical distribution box access from outside



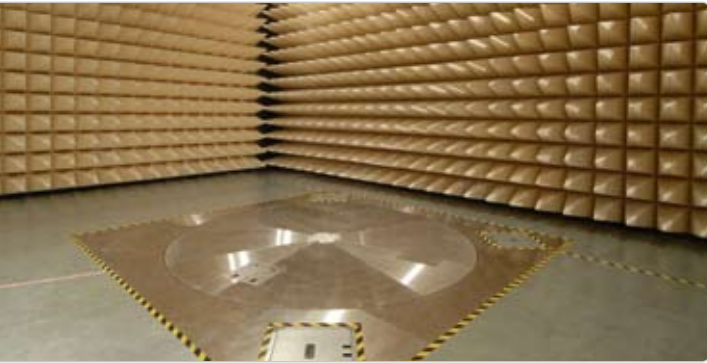
Lamp lift



Outlet box in raised floor

# Antenna Support / Turntables

## Video & Audio Systems



Turntable

### Antenna Support / Turntables

An antenna support and a turntable including the necessary controller and feed-throughs for the control lines are available and may be ordered as an option (see our separate catalogue).



Antenna support

### Video & Audio Systems

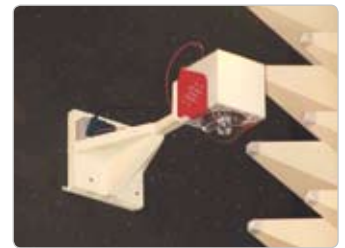
Video and audio systems for EUT and / or chamber monitoring including the necessary controllers and feed-throughs for the control lines are available and may be installed as option (see our separate catalogue).



Controller for CCTV and Intercom



Camera fixed on a tripod for EUT monitoring



Dome-camera fixed on a wall for chamber monitoring

### Shielding Attenuation

For measurements according to EN 50147-1 we guarantee at least the following shielding attenuation values for our RF-shielded rooms / halls:

Frequency	Shielding attenuation with single leaf and sliding doors	Shielding attenuation with double leaf doors	
10 kHz	≥80 dB	≥60 dB	Magnetic field
100 kHz	≥100 dB	≥70 dB	Magnetic field
1 MHz	≥100 dB	≥80 dB	Magnetic field
100 MHz	≥120 dB	≥100 dB	Plane wave
400 MHz	≥120 dB	≥100 dB	Plane wave
1 GHz	≥120 dB	≥80 dB	Plane wave
1 GHz ...	≥100 dB	≥70 dB	Microwave
18 GHz	90 dB	≥60 dB	Microwave
Optional:			
18 GHz ... 40 GHz	90 dB - 80 dB	Not available	Microwave



## Absorber Lining

For the selection of the absorber material several things must be considered; the frequency range that have to be covered (including the requirements regarding chamber performance), the size of the place of installation as well as the respective costs.

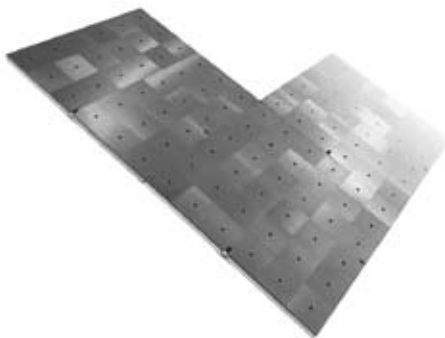
You can choose ferrite, pyramid or hybrid absorbers.

The following differences between the absorber types must be taken into account:

- **Reflectivity over a defined frequency range**
- **Dimensions (length) and consequently the space required**
- **Cost**



Ferrite absorber panel



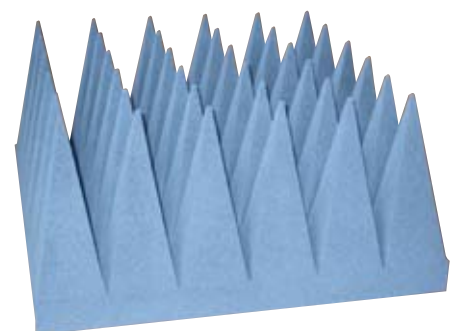
## Ferrite Absorbers

An important advantage of ferrite absorbers is the fact that, despite their small thickness, they offer very good reflection attenuation characteristics starting already from a frequency of 30 MHz, thus being perfectly suitable for the use in smaller rooms. The biggest disadvantage however, is the relatively high price as well as the limitation of frequencies up to 1 GHz.

Ferrite absorbers should be considered in all the cases where pyramid absorbers cannot be used due to limited space. An extension of the frequency range up to 18 GHz can be achieved by using a combination of ferrite absorbers with short pyramid absorbers (see hybrid absorbers).

## Pyramid Absorbers

Pyramid absorbers are available in sizes (lengths) of 100 mm to 2.500 mm. The required length depends mainly on the wavelength of the lowest usable frequency specified for the anechoic chamber. The length decreases with increasing frequency. Pyramid absorbers of a size of  $\geq 2.000$  mm are mainly used in chambers with measuring distances of up to 10.0 m where the requirement for NSA correlation of better than  $\pm 4$  dB has to be fulfilled from 30 MHz to 1 GHz. In tests with frequencies starting at 80 MHz (e.g. in immunity tests according to IEC/EN 61000-4-3) the respective requirements can be fulfilled already with a pyramid length of 75 cm. For measurements in the range  $\geq 1$  GHz, even sizes of 200 to 300 mm are sufficient. Compared to ferrite absorbers, the pyramid absorbers offer the considerable advantage of lower price (depending on size), lower weight and their practically unlimited use up to the high GHz range.



Foam pyramid absorbers

# Absorbers

## Non-Combustible Pyramid Absorbers in Thin-Film Technology

The Franko<sub>sorb</sub><sup>®</sup> RF absorbers are constructed in the so-called "thin film" technology which totally replaces the carbon filled foam absorber technology. This gives the Franko<sub>sorb</sub><sup>®</sup> RF absorber the following significant advantages:

- High absorption capability
- No aging or drooping problems
- Non-combustible acc. to DIN 4102, fire-class A2
- Weatherproof
- Low ongoing ownership costs
- High repeatable performance characteristics
- Non-toxic waste
- No carbon dust

The mechanical realization of the absorber shape is independent from the absorbing function, realized by the resistance film. The shape of the absorber can be made of a light-weight non-combustible, weatherproof and otherwise suitable material. In comparison, the absorber film is very thin. Typically it has a thickness of 10 µm. Consequently, all the advantages of the "shape material" also holds for the complete absorber.

- The absorbing foil is situated on the surface of the absorber and mounted directly on the shape material. Consequently, it can transfer absorbed energy very effectively to its surrounding and the absorber is capable of resisting very high field strength.
- Transportation volume is low because the hollow construction allows stacking.
- All the material in the thin-film technology absorber is non-toxic and non-combustible according to DIN 4102 class A2.
- Franko<sub>sorb</sub><sup>®</sup> pyramid absorbers (fire class A2 and B2) fulfil the requirements for cleanroom compatibility acc. to ISO 14644-1, class 5.

## Hybrid Absorbers

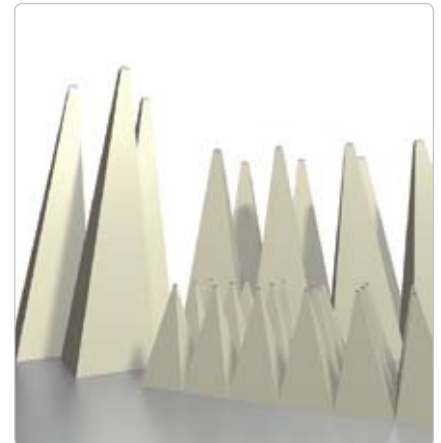
Hybrid Absorbers are a combination of ferrite absorbers with impedance matched pyramid absorbers installed in front of them. The hybrid absorbers combine the advantages of:

- Ferrite absorbers with good attenuation characteristics starting at 30 MHz and being flat
- Short pyramid absorbers with good attenuation characteristics up to the high GHz range

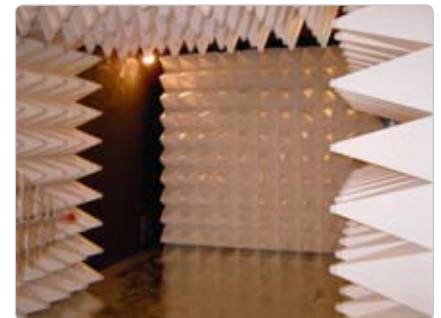
Hybrid absorbers are a good solution for smaller rooms (e.g. 3 m test range) with restricted external dimensions and frequency ranges from 30 MHz up to approx. 20 GHz.

## Customized Solutions

A combined arrangement of pyramid and hybrid absorbers is also possible if the available space requires special solutions for best performance.



Pyramid absorbers / thin-film technology



Hybrid absorbers with non-combustible pyramid absorbers / thin-film technology

**FRANKONIA IS THE ONLY  
MANUFACTURER WORLDWIDE  
WHO PRODUCES NON-COMBUSTIBLE  
ABSORBERS ACCORDING TO  
FIRE-CLASS DIN 4102 A2**



Hybrid absorber, thin-film technology

# Installation / Abbreviation of Absorbers

## Installation of the Absorbers

### a) Ferrite Absorbers

The individual ferrite tiles are pre-assembled on chip wood boards, size 600 mm x 600 mm. For assembly in the chamber a rail system is installed in a grid of 600 mm which is screwed to the double bent edges of the shielding panels. The absorber panels are then bolted to the rails. If the chamber is constructed as a fully anechoic chamber, including the floor, the same absorber panels are used for the floor. To protect the ferrites on the floor, the surface is covered with a 5.0 mm thick felt covering. The floor height of the false floor will be at the same level as the doorsill.

### b) Pyramid Absorbers

Pyramid absorbers are hung into a rail system construction, either directly (in case of thin-film absorbers) or after having been pre-assembled on supporting plates (in case of foam absorbers). In combination with ferrite absorbers the thin-film absorbers are installed using plastic threaded rods and the foam absorbers using a "Velcro" fastening.

All types of installation allow easy disassembly of the absorbers without damage.

## Abbreviation (name convention) of Absorber Types

- Franko<sub>Sorb</sub>® Fxxx: Ferrite absorber
- Franko<sub>Sorb</sub>® Pxxx: Thin-film pyramid absorber
- Franko<sub>Sorb</sub>® PFxxx: Foam pyramid absorber
- Franko<sub>Sorb</sub>® Hxxx: Hybrid absorber with thin-film pyramid absorber
- Franko<sub>Sorb</sub>® HFxxx: Hybrid absorber with foam pyramid absorber

(xxx = height of the absorbers)

The suffixes B2 and A2 indicate the respective fire class of the absorbers. Non-combustible absorbers (fire class A2) can only be realized with thin-film pyramid absorbers.



Structure for the installation of ferrite absorbers



Rail system for the installation of pyramid absorbers

## Installation of Hybrid absorbers:



Step 1

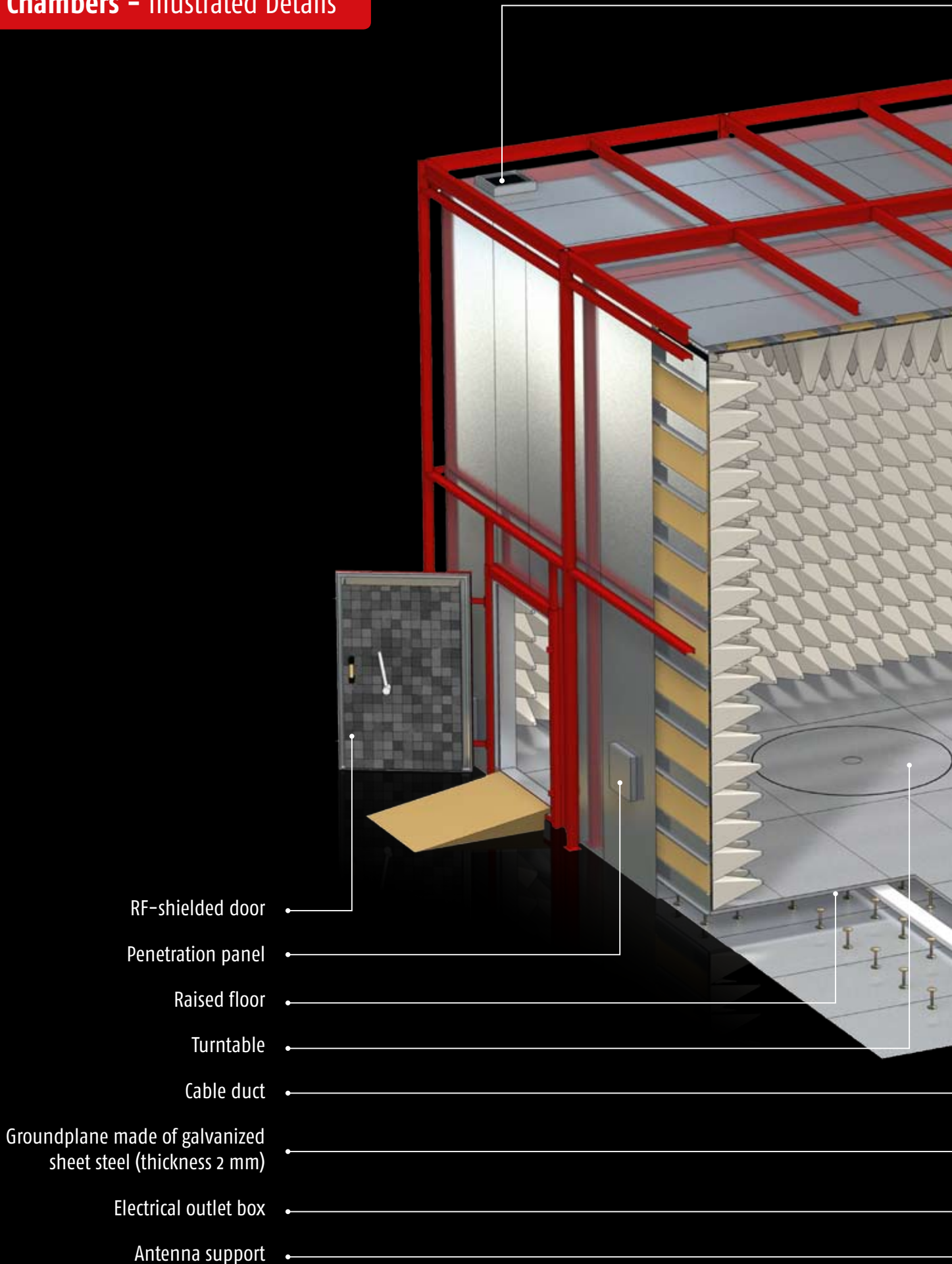


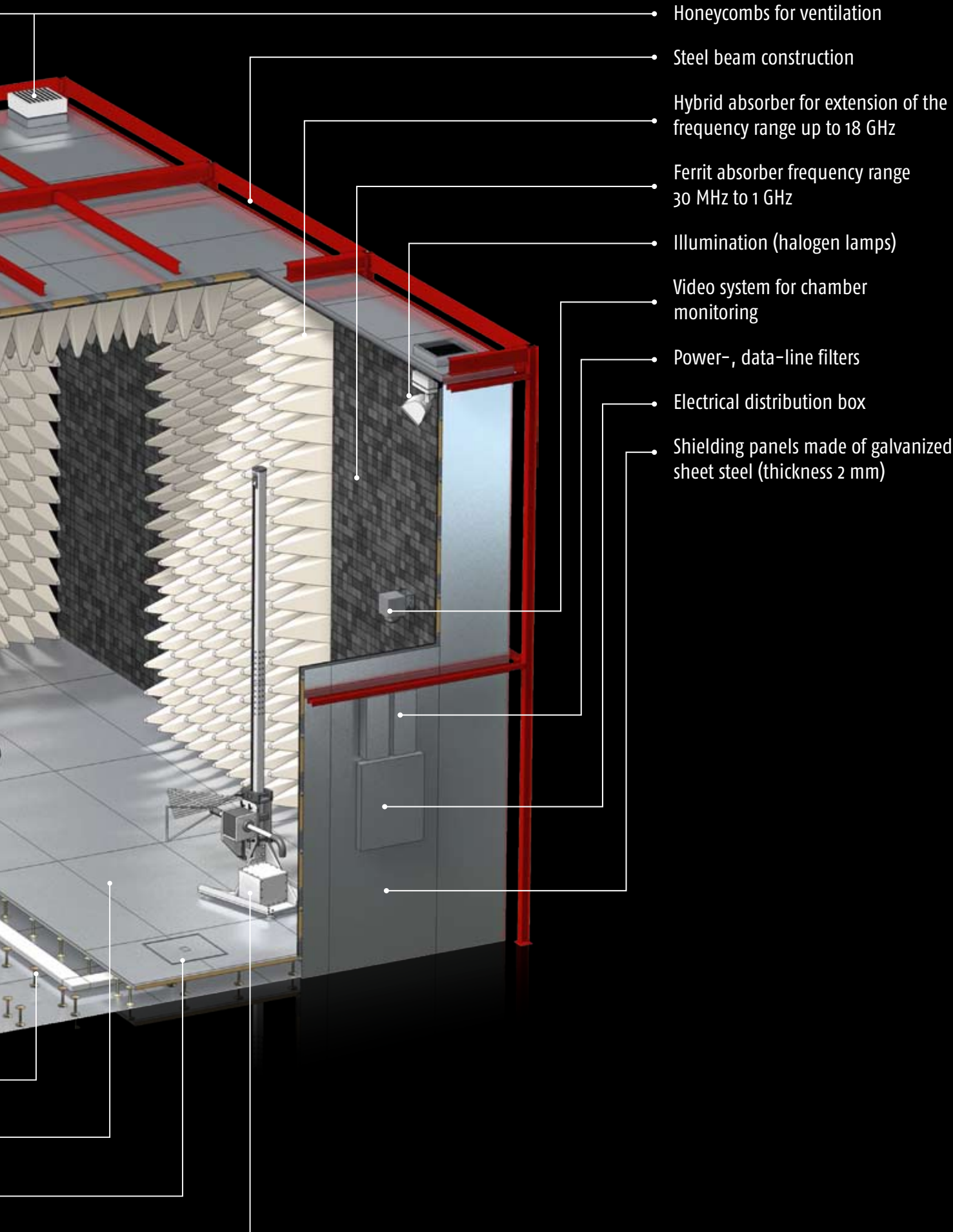
Step 2



Step 3

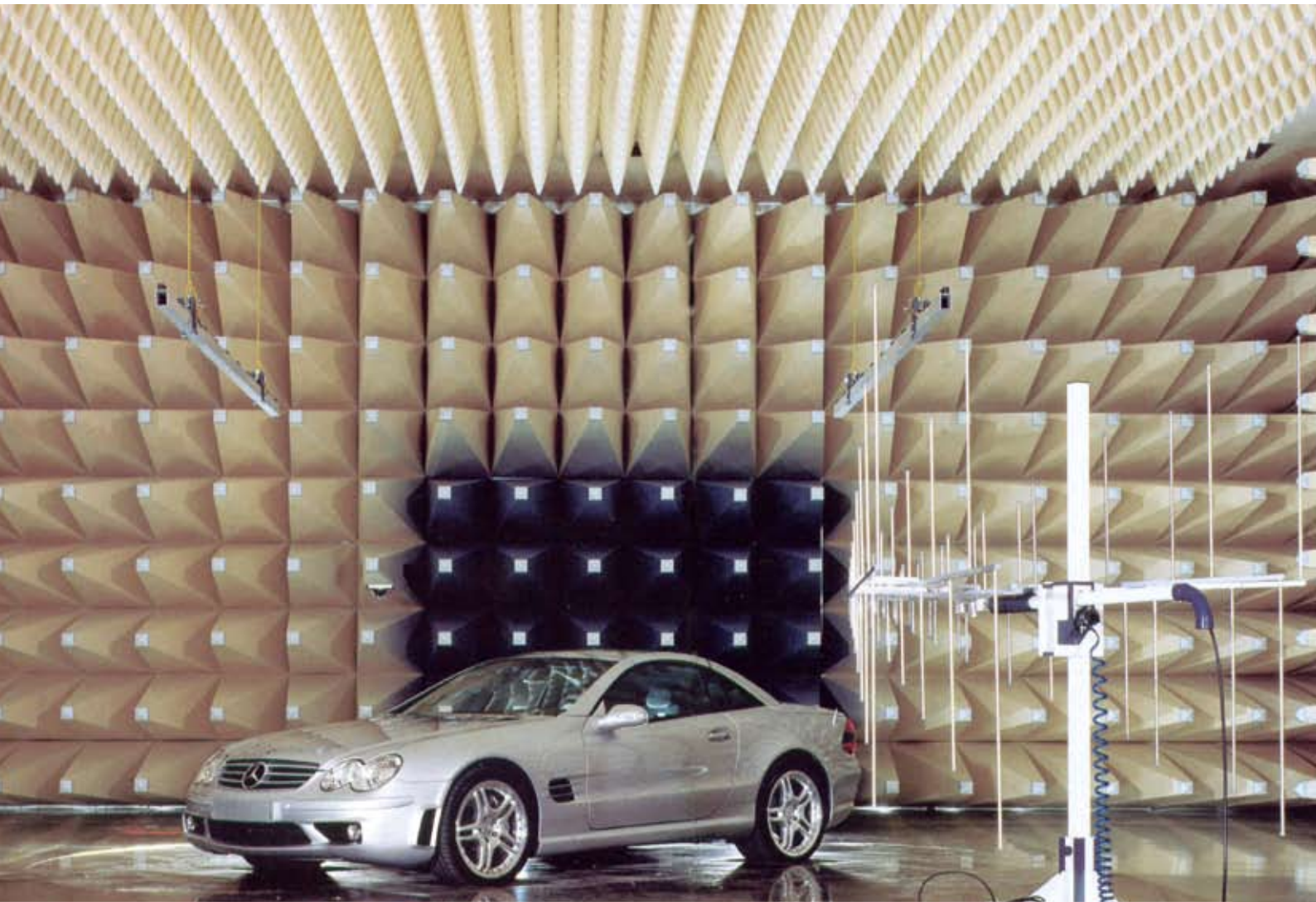
## Chambers - Illustrated Details





- Honeycombs for ventilation
- Steel beam construction
- Hybrid absorber for extension of the frequency range up to 18 GHz
- Ferrite absorber frequency range 30 MHz to 1 GHz
- Illumination (halogen lamps)
- Video system for chamber monitoring
- Power-, data-line filters
- Electrical distribution box
- Shielding panels made of galvanized sheet steel (thickness 2 mm)

# Standard Anechoic Chambers



## Frankonia Standard Chambers:

<b>UCC</b>	Ultra Compact Chamber .....	17
<b>CHC</b>	Compact Hybrid Chamber .....	18
<b>ACTC</b>	Automotive Component Testing Chamber .....	19
<b>AVTC</b>	Automotive Vehicle Testing Chamber.....	20
<b>MIL-CHC</b>	MIL Compact Hybrid Chamber .....	21
<b>SAC-3 / -5 Plus</b>	Semi Anechoic Chambers.....	22-23
<b>FAC-3 Plus</b>	Fully Anechoic Chambers.....	24
<b>SAC-10</b>	Anechoic Chambers for 10.0 m measuring distance .....	25
	Impressions .....	26-27



# Ultra Compact Chamber – UCC

for 1.0 m Measuring Distance

## Short Description

The UCC was designed as an alternative to GTEM-Cells for pre-compliance measurements as well as for the fields of research and science. The walls and the ceiling of the chamber are lined completely with ferrite absorbers and the rear wall next to the EUT has an additional hybrid absorber lining of 6 m<sup>2</sup>, which qualifies the chamber for measurements in the frequency range from 30 MHz to 18 GHz. The most important advantages, compared to GTEM-Cells, are the facts that the staff can walk into this chamber (more simple EUT setup), the practical test setup with corresponding cable feeding to peripheral equipment, as well as the possibility of taking larger test specimen into the chamber. The UCC can be used for pre-compliance radiated emission measurements and immunity tests according to the standard IEC/EN 61000-4-3 in 1.0 m measuring distance. In addition, it is very well suited for pre-compliance measurements of automotive components according to DIN/ISO 11452-2 and EN 55025 (CISPR 25). If required, the UCC can also be used as a normal shielded room for conducted testing. Because of its small dimensions the chamber can be placed in normal laboratories or office rooms.



## Technical specifications

External dimensions (L x W x H)	4,280 mm x 3,080 mm x 2,550 mm
Frequency range	30 MHz to 18 GHz
Measuring distance	1 m
<b>Absorber lining</b>	
Walls and ceiling	Ferrite absorbers, type F006
Rear wall showing to EUT	6 m <sup>2</sup> hybrid absorbers, type HF300
Floor	2 m <sup>2</sup> ferrite absorbers between EUT and antenna
Emission measurements	Pre-compliance measurement
Immunity tests	Full compliance measurement acc. to IEC/EN 61000-4-3 for a measuring distance of 1.0 m
Size of the uniform area acc. to IEC/EN 61000-4-3	0.5 m x 0.5 m
Max. deviation	-0 dB / +6 dB at 4 of 4 measuring points

## Standard Equipment

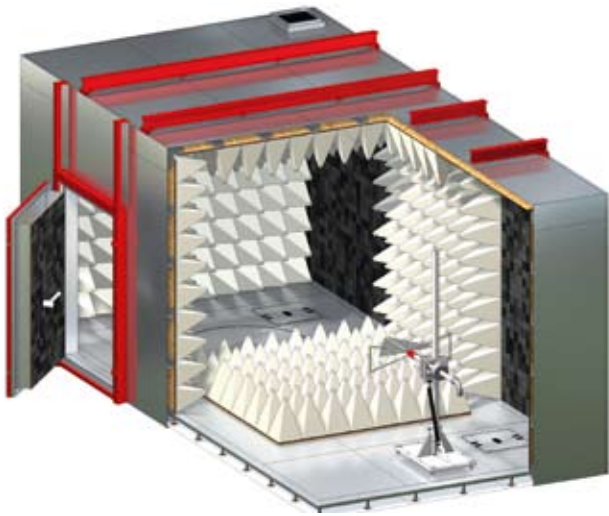
- 1 access door, 1.013 x 2.043 mm
- 1 honeycomb insert for ventilation
- 1 mains filter 250 VAC, 2 x 16 A
- 1 penetration panel
- Feed-throughs: 4 x "N", 4 x "BNC" and 1 x for fibre optics
- Electric installation
- Illumination
- Raised floor
- Absorber lining

## Options

- 3 phase mains filter
- Signal and / or data line filter
- Fan
- Antenna tripod
- Video and / or audio system
- Verification of the chamber
- Measuring equipment
- Other extras

# COMPACT HYBRID CHAMBER – CHC

Compact anechoic chamber for 3.0 m measuring distance



## Short Description

The CHC is the optimal solution for immunity tests according to the standard IEC/EN 61000-4-3 for a measuring distance of 3.0 m and offers in this size the best characteristics for pre-acceptance emission measurements. The installation of ferrite and partially of hybrid absorbers allows measurements in the frequency range from 30 MHz to at least 18 GHz. The CHC can be delivered optionally as a semi-anechoic chamber (with ground plane) or as a fully anechoic chamber (floor absorbers on the whole floor surface). For immunity tests, floor absorbers are required in each case between transmitting antenna and EUT and are therefore included in the standard delivery volume.

## Technical specifications

External dimensions (L x W x H)	7,355 mm x 3,755 mm x 3,300 mm
Frequency range	30 MHz to 18 GHz
Measuring distance	3.0 m
<b>Absorber lining</b>	
Long walls	Ferrite absorbers F006 +7.2 m <sup>2</sup> hybrid absorbers H450 in the center
Short wall behind EUT	Ferrite absorbers F006 +9.9 m <sup>2</sup> hybrid absorbers H450 in the center
Short wall behind antenna	Ferrite absorbers F006 (>1 GHz measurement with horn antennas)
Ceiling	Ferrite absorbers F006 +5.76 m <sup>2</sup> hybrid absorbers H450 in the center
Floor (SAC)	7.2 m <sup>2</sup> transportable hybrid absorbers H450
Floor (FAC)	Ferrite absorbers F006 +7.2 m <sup>2</sup> hybrid absorbers H450 in the center
Emission measurements	Pre-Compliance measurements
Immunity tests	Full Compliance according to IEC/EN 61000-4-3 for a measuring distance of 3.0 m
Size of the uniform area	1.5 m x 1.5 m
Max. deviation	-0 dB / +6 dB at 75 % of 16 measuring points

## Standard Equipment

- 1 access door, 1.013 x 2.043 mm
- 2 honeycomb inserts for ventilation
- 1 mains filter, 250 VAC, 2 x 32 A
- 2 penetration panels
- Feed-throughs: 6 x "N", 6 x "BNC" and 2 x for fibre optics
- Electric installation
- Illumination
- Raised floor
- Absorber lining

## Options

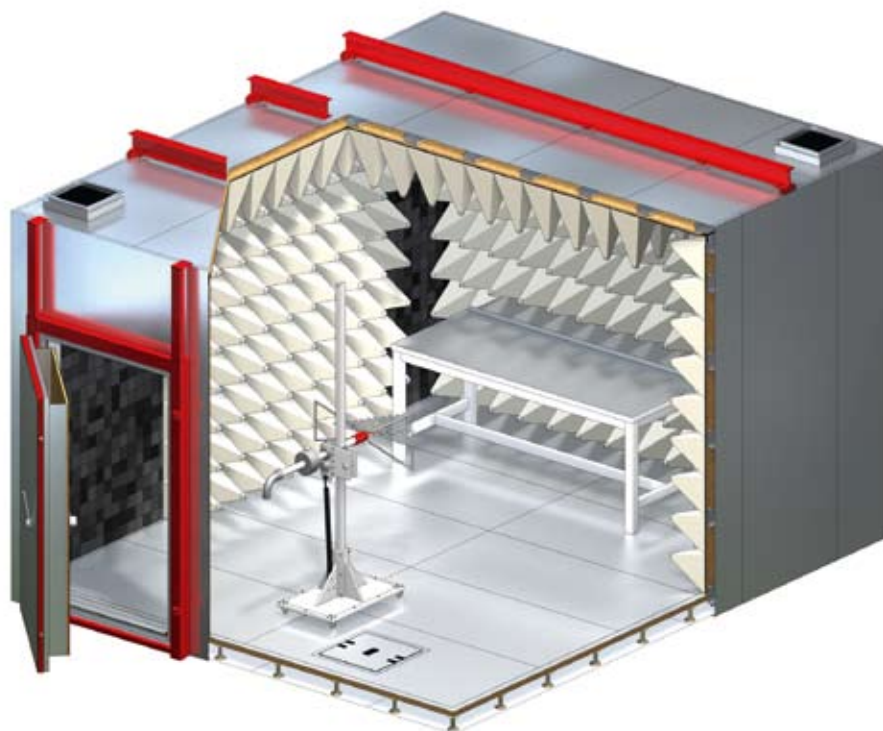
- 3 phase mains filter
- Signal and / or data line filter
- Fan
- Antenna tripod
- Video and / or audio system
- Turntable
- Non-combustible hybrid absorbers
- Measurement of the chamber
- Measuring equipment
- Other extras

# AUTOMOTIVE COMPONENT TESTING CHAMBER – ACTC

Anechoic chamber for testing of automotive components

## Short Description

The ACTC was developed especially for radiation testing of automotive components according to the standard DIN/ISO 11452-2 and EN 55025 (CISPR 25) and adjusted in all details to this objective. The chamber is lined with ferrite absorbers and approximately up to the middle of the chamber with additional hybrid absorbers. In the standard version the floor of the chamber consists of a normal false floor. As an option this version can be delivered with an additional ground plane or with floor absorbers. The standard version of the ACTC is qualified for measurements in the frequency range from 30 MHz to at least 18 GHz. A (plug-in) contact-strip, to be permanently installed between the absorbers for assuring the electric contact of the ground plane of the testing table to the shielding panels, is available as standard as well as the testing table itself.



## Technical specifications

External dimensions (L x W x H)	6,380 mm x 5,480 mm x 3,750 mm (min. height 3,450 mm possible acc. to standards)
Frequency range	30 MHz to 18 GHz
Measuring distance	1.0 m
<b>Absorber lining</b>	
Walls and ceiling	Ferrite absorbers, type F006 + approximately up to the middle of the chamber, hybrid absorbers, type H450
Floor	Optional
Emission measurements	According to EN 55025 / CISPR 25 (ALSE requirements, performance of absorption material min $\geq 6$ dB)
Immunity tests	According to DIN/ISO 11452-2 (reduction of reflections in the test area min. $-10$ dB)

## Standard Equipment

- 1 access door, 1.238 x 2.118 mm
- 4 honeycomb inserts for ventilation
- 1 mains filter, 250 VAC, 2 x 32 A
- 2 penetration panels
- Feed-throughs: 6 x "N", 6 x "BNC" and 4 x for fibre optics
- Electric installation with illumination
- Contact-strip and testing table
- Raised floor
- Absorber lining

## Options

- 3 phase mains filter
- Signal and / or data line filter
- Fan
- Antenna tripod
- Video and / or audio system
- Floor ground-plane
- Non-combustible hybrid absorbers
- Floor absorbers
- Measuring equipment
- Other extras

# AUTOMOTIVE VEHICLE TESTING CHAMBER – AVTC

Anechoic chamber for vehicle testing



## Short Description

The AVTC is a standard chamber for radiated emission and immunity testing on vehicles and components acc. to CISPR 12 / 25 and ISO 11451-2 / ISO 11452-2.

The standard dimensions of the chamber allow vehicle testing up to a length of 5.5 m (on turntable) and a measuring distance of 3.0 m. With additional (optional available) floor absorbers it is simply possible to upgrade the chamber for emission measurements acc. to EN 55022 (CISPR 16-1-4) and immunity tests acc. to IEC/EN 61000-4-3.

## Technical specifications

External dimensions (L x W x H)	11,480 mm x 9,380 mm x 6,000 mm
Frequency range	20 MHz – 18 GHz (optional 40 GHz)
Measuring distance	3.0 m
<b>Absorber lining</b>	
Walls and ceiling	Hybrid absorber, type H600
Floor	Optional
Emission measurement	Full compliant acc. to CISPR 12 / CISPR 25 and EN 55022 (30 MHz-1 GHz) Optional (with floor absorbers) acc. to CISPR 16-1-4 from 1-18 GHz
Immunity tests	Full compliant acc. to ISO 11451-2 and ISO 11452-2 Optional (with additional floor absorbers) full compliant acc. to IEC/EN 61000-4-3

## Standard Equipment

- 1 access door, 1.013 x 2.043 mm
- 1 sliding door, 3.038 x 3.093 mm
- 1 mains filter 440 VAC, 4 x 32 A
- 2 penetration panels
- Electric installation
- Feed-throughs: 8 x "N", 8 x "BNC" and 4 x fibre optics
- Illumination
- Raised floor
- Ground plane
- Turntable, 5.0 m diameter, 8.0 to
- Antenna Mast, 1-4 m
- Controller for mast and turntable
- Absorber lining
- 10 honey comb inserts for ventilation

## Options

- Additional mains filters
- Signal and / or data line filters
- Non-combustible absorbers
- Measuring equipment
- Floor absorbers
- Video and / or audio system

# MIL COMPACT HYBRID CHAMBER – MIL-CHC

Anechoic chamber for testing acc. to MIL-STD 461E

## Short Description

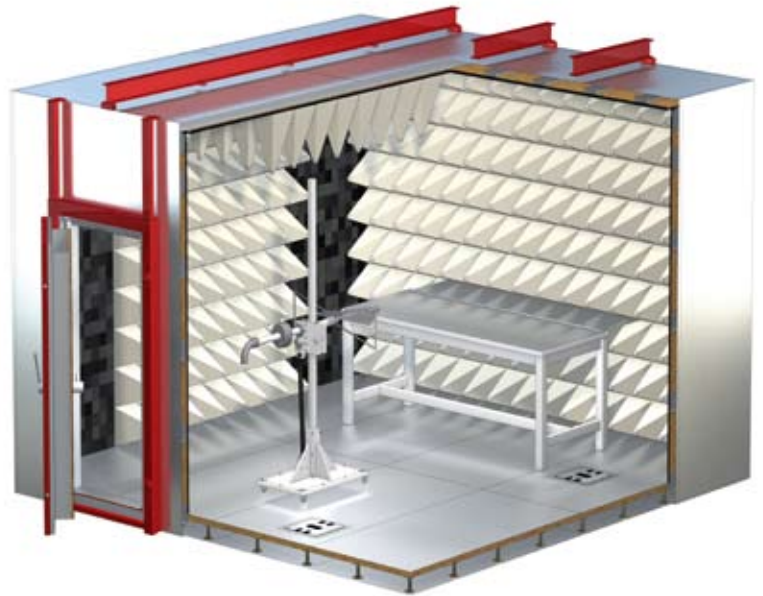
The MIL-CHC has been designed to fulfill the requirements for radiated emission and immunity testing acc. to MIL-STD 461E. The below specified standard dimensions of the chamber are suitable for a width of the testing table up to 3.0 m. Bigger dimensions are available on request. The standard version does already include the contact strip for the ground-plane of the testing table as well as the testing table itself.



Contact strip



Test table



## Technical specifications

External dimensions (L x W x H)	4,880 mm x 4,880 mm x 3,000 mm
Frequency range	30 MHz to 18 GHz
Measuring distance	1.0 m
<b>Absorber lining</b>	
Walls and ceiling	Ferrite absorbers, type F006 + approximately up to the middle of the chamber, hybrid absorbers type H450
Floor	Optional
Emission measurements	According to MIL-STD 461E
Immunity tests	According to MIL-STD 461E
<b>Absorption at normal incidence</b>	
80 MHz-200 MHz	≥6 dB
above 200 MHz	≥10 dB

## Standard Equipment

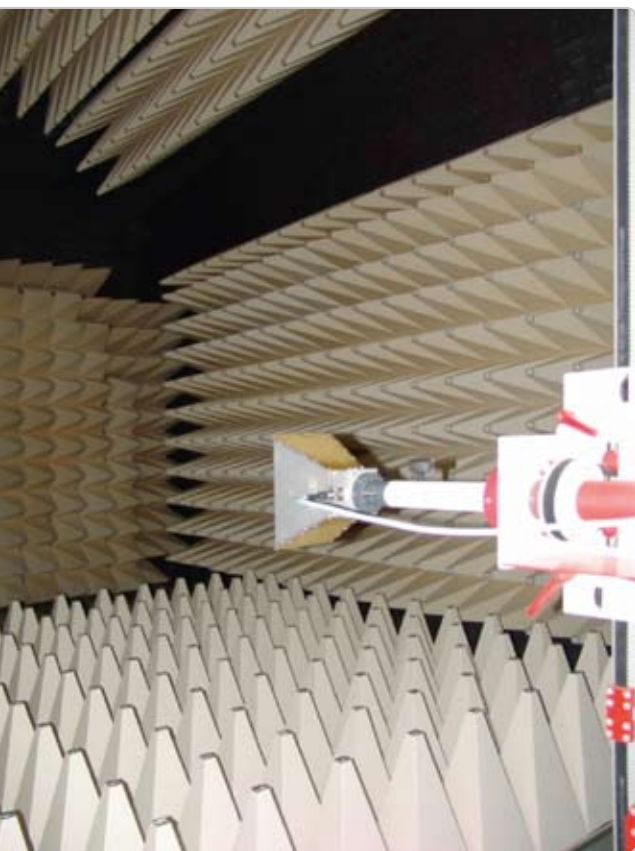
- 1 access door, 1.013 x 2.043 mm
- 2 honeycomb inserts for ventilation
- 1 mains filter, 250 VAC, 2 x 32 A
- 2 penetration panels
- Feed-throughs: 6 x "N", 6 x "BNC" and 2 x for fibre optics
- Electric installation with illumination
- Contact-strip and testing table
- Raised floor
- Absorber lining

## Options

- 3 phase mains filter
- Signal and / or data line filter
- Fan
- Antenna tripod
- Video and / or audio system
- Non-combustible absorbers
- Other extras

# SEMI ANECHOIC CHAMBER – SAC-3 / -5 Plus

Anechoic Chamber for emission measurements acc. to EN 55022 / CISPR 22 class B and immunity tests acc. to IEC/EN 61000-4-3



## Short Description

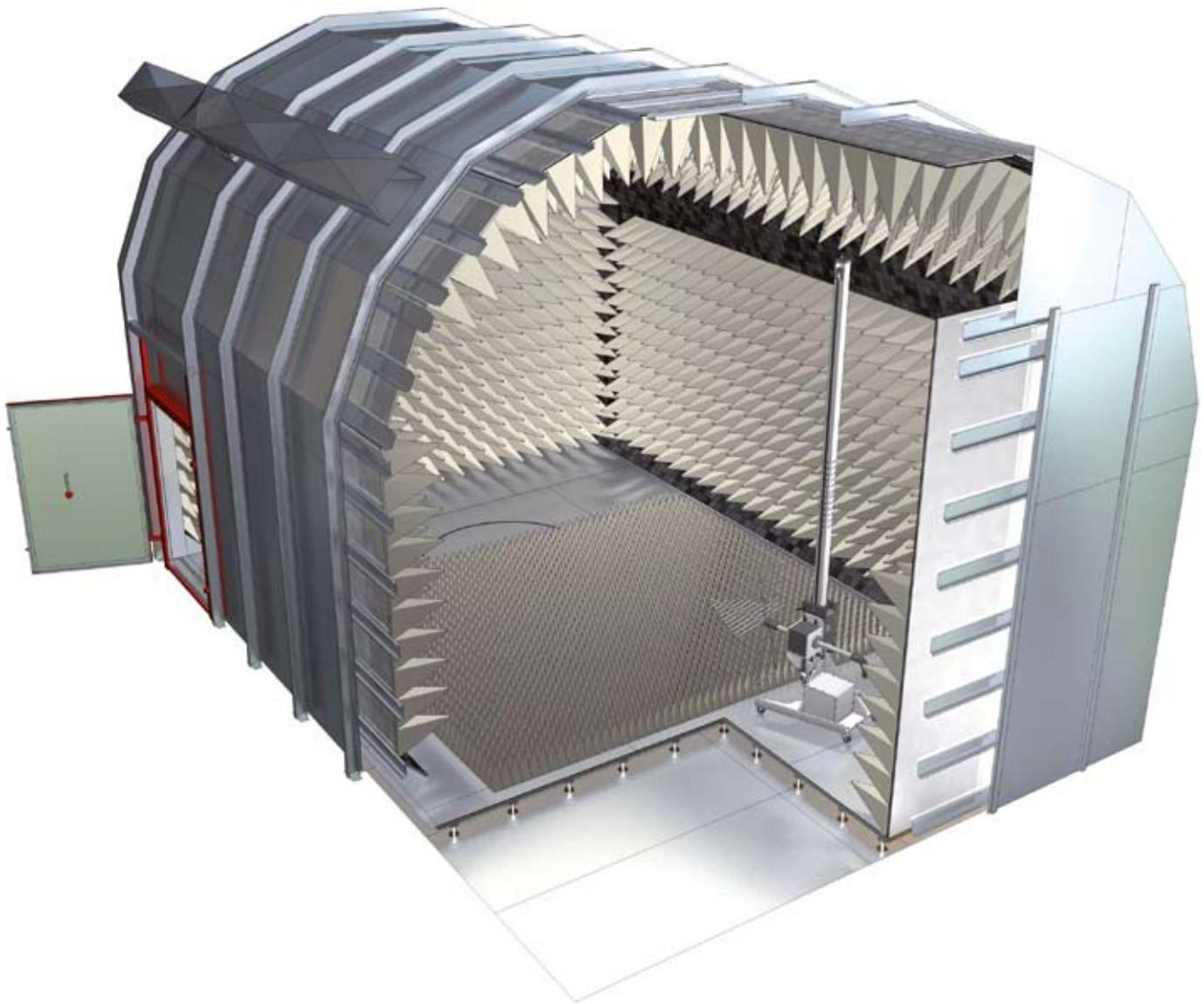
The SAC-3 / -5 Plus is a full-compliant semi anechoic chamber for a measuring distance of 3 or 5 meters. It's dome shaped roof as well as it's optimized absorber layout, with ferrite and partial hybrid absorber lining for the frequency range from 26 MHz to 18 GHz, leads to minimized reflections. Due to the relative short hybrid absorbers, the chamber can be smaller in its dimensions than a chamber lined with long pyramid absorbers. The SAC-3 / -5 Plus delivers outstanding performances for both, NSA ( $\pm 3.5$  dB) from 30 MHz to 1 GHz, and SVSWR (5 dB) from 1 GHz to 18 GHz conforming to the site validation standard CISPR 16-1-4 for SVSWR. The standard version does already include the antenna mast for 1-4 m height scan, the turntable as well as their controller.



Technical specifications	SAC-3 Plus S	SAC-3 Plus L	SAC-5 Plus
External dimensions (L x W x H)	8,480 mm x 6,530 mm x 6,000 mm	9,230 mm x 6,530 mm x 6,000 mm	12,680 mm x 7,730 mm x 6,000 mm
Frequency range	26 MHz - 18 GHz		
Measuring distance	3.0 m		5.0 m
<b>Absorber lining</b>			
Walls / ceiling	Full-lining with ferrite absorbers F006 and partial lining with additional hybrid absorbers H600 and H1000		
Floor	9 m <sup>2</sup> transportable pyramid absorbers P600 for immunity tests 14.2 m <sup>2</sup> transportable pyramid absorbers P450 Plus for emission measurement > 1 GHz		
Emission measurement	Full compliance acc. to EN 55022 and CISPR 22 class B (30 MHz - 1 GHz) Full compliance acc. to CISPR 16-2-3 (1 GHz - 18 GHz)		
Immunity tests	Full compliance acc. to IEC/EN 61000-4-3		
Max. deviation from NSA acc. to CISPR 16-1-4	$\pm 4$ dB, optional $\pm 3.5$ dB		
Max. Site-VSWR acc. to. CISPR 16-1-4	6 dB, optional 5 dB		
Size of test volume	1.2 m diameter / 1.2 m height	2.0 m diameter / 2.0 m height	
Size of uniform area	1.5 m x 1.5 m		
Max. deviation	0 dB / + 6 dB for 75 % of 16 measuring points		

# SEMI ANECHOIC CHAMBER – SAC-3 / –5 Plus

Anechoic Chamber for emission measurements acc. to EN 55022 / CISPR 22 class B and immunity tests acc. to IEC/EN 61000-4-3



## Standard Equipment

- 1 access door, 1.238 x 2.118 mm (3-Plus) / 1.538 x 2.118 mm (5-Plus)
- 4-6 honeycomb inserts for ventilation
- 1 mains filter, 250 VAC, 2 x 32 A
- 1 mains filter, 440 V, 50 / 60 Hz, 4 x 32 A (SAC-5Plus)
- 2 penetration panels
- Feed-throughs: 6 x "N", 6 x "BNC" and 2 x for fibre optics
- Electric installation
- Illumination
- Groundplane
- Raised floor
- Absorber lining
- Turntable
- Antenna mast
- Controller for antenna mast and turntable

## Special Features

- Dome design (offers better RF properties, saves space e.g. for ventilation ducting)
- Reduced price (reduced shielding and absorber quantity)

## Options

- 3 phase mains filter
- Signal and / or data line filter
- Fan
- Antenna tripod
- Video and / or audio system
- Measurement of the chamber
- Measuring equipment
- Non-combustible hybrid absorbers

# FULLY ANECHOIC CHAMBER – FAC-3 Plus



## Short Description

FAC's are defined in CISPR 16-1-4 as "Test site without ground-plane". In comparison to a SAC (Semi Anechoic Chamber) it means that not only the walls and ceiling are lined with absorbers, but also the floor. The advantage of FAC's is mainly, that reflections from the floor cannot occur and therefore an antenna height scan is not longer necessary, what may save a lot of measuring time. However, special constructions will be necessary (because of the lining with floor absorbers) for the test setup of especially heavy and big EUT's.

Technical specifications	FAC-3 Plus
External dimensions (L x W x H)	9,680 mm x 6,530 mm x 6,000 mm
Frequency range	26 MHz to 18 GHz
Measuring distance	3.0 m
<b>Absorber lining</b>	
Walls / Ceiling / Floor	Full-lining with ferrite absorbers type F006 and partial lining with additional pyramid absorbers type H600 / H1000
Emission measurement	Full compliance acc. to CISPR 16-2-3
Max. deviation from FSNSA acc. to CISPR 16-1-4	±4 dB
Max. Site-VSWR acc. to CISPR 16-1-4	6 dB
Size of test volume	1.2 m diameter / 1.5 m height
Immunity tests	Full compliance acc. to IEC/EN 61000-4-3
Size of uniform area	1.5 m x 1.5 m
Max deviation	-0 dB / +6 dB for 75 % of 16 measuring points

## Standard Equipment

- 1 access door, 1.238 x 2.118 mm
- 6 honeycomb inserts for ventilation
- 1 mains filter, 440 VAC, 4 x 32 A
- 2 penetration panels
- Electric installation
- Illumination
- Wooden floor
- 1 wooden table
- Absorber lining
- 1 Turntable
- 1 Antenna mast
- 1 Controller for antenna mast and turntable
- Catwalk to the turntable / antenna mast
- Feed-throughs: 6 x "N", 4 x "BNC" and 4 x for fibre optics

## Options

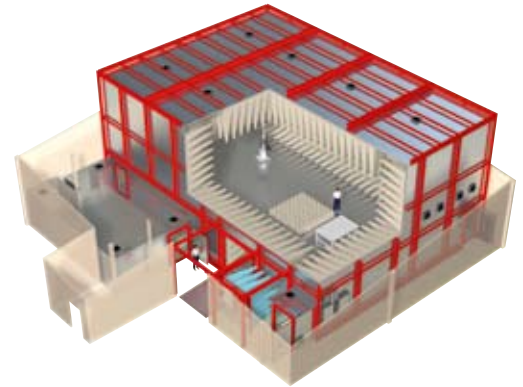
- 3 phase mains filter
- Signal and / or data line filter
- Fan
- Antenna tripod
- Video and / or audio system
- Measurement of the chamber
- Measuring equipment
- Non-combustible hybrid absorbers



# ANECHOIC CHAMBERS FOR 10.0 m MEASURING DISTANCE – SAC-10

## Short Description

Anechoic chambers for 10.0 m measuring distance are planned and realized almost exclusively at customers' requirements. However, for a first impression about size and performance of a SAC-10 we defined below 4 standard model with quiet zone diameter from 2.0 m to 5.0 m. The planning of an anechoic chamber should be made as early as possible, i.e. together with the planning of the building itself so that the interfaces can be defined in time which will avoid later modifications. Typical interfaces are as follows: any kind of supply media, spaces reserved in the concrete floor for turntables / rolling test stands or driving pits for sliding gates, as well as a possible fastening of the room construction to the building construction. Furthermore, possible interfaces to emergency control / alarm systems, for example fire alarm and fire extinguishing systems, have to be considered, too. Such systems are normally not required when using our non-combustible pyramid absorbers in "thin-film" technology (fire class A2).



Technical specifications	SAC-10-2	SAC-10-3	SAC-10-4	SAC-10-5
Diameter of quiet zone	2.0 m	3.0 m	4.0 m	5.0 m
External dimensions (L x W x H)	21,080 mm x 13,730 mm x 8,550 mm	21,680 mm x 13,730 mm x 8,550 mm	22,580 mm x 15,980 mm x 9,000 mm	23,480 mm x 16,580 mm x 9,000 mm
Frequency range	26 MHz to 18 GHz			
Measuring distance	3 m and 10 m			
<b>Absorber lining</b>				
Walls / Ceiling	long Pyramid absorbers P 2200 and P2400			
Floor	Movable absorbers for immunity tests acc. to IEC/EN 61000-4-3 and for emission measurements >1 GHz (SVSWR) included			
Emission measurements	Full compliance acc. to CISPR 16-2-3 and CISPR 22			
Max. deviation from normalized site attenuation acc. to. CISPR 16-1-4	±3.5 dB			
Max. Site-VSWR acc. to. CISPR 16-1-4	6 dB			
Immunity tests	Full compliance acc. to IEC/EN 61000-4-3			
Size of uniform area	1.5 m x 1.5 m			
Max. deviation	-0 dB / +6 dB at 75 % of 16 measuring points			

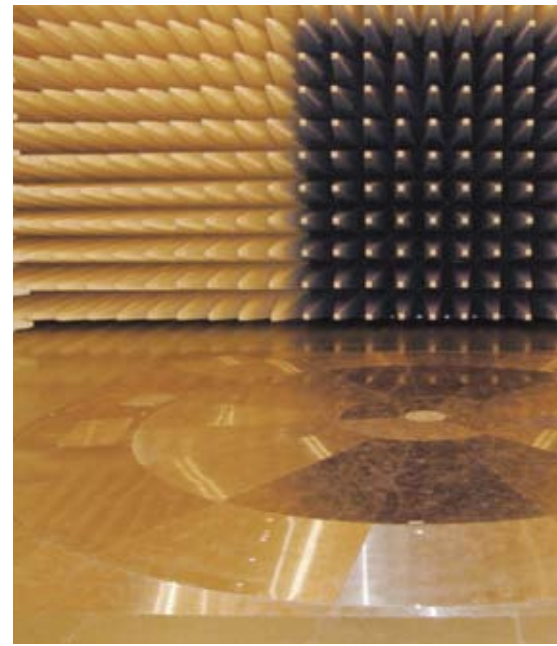
## Standard Equipment

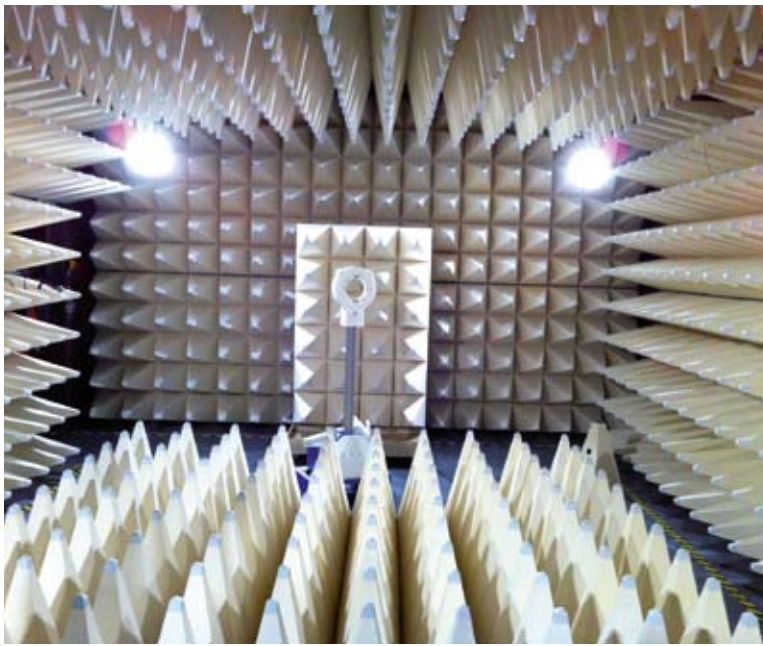
- 1 sliding door, 1 single leaf door
- 12-16 honeycomb inserts for ventilation
- 1 mains filter, 250VAC, 2 x 16A
- 1 mains filter, 440VAC, 4 x 64A
- Penetration panels
- Electric installation
- Illumination
- Groundplane
- False floor
- Absorber lining
- 1 Turntable
- 1 Antenna mast
- 1 Controller for antenna mast and turntable
- Feed-throughs: "N", "BNC" and fibre optics

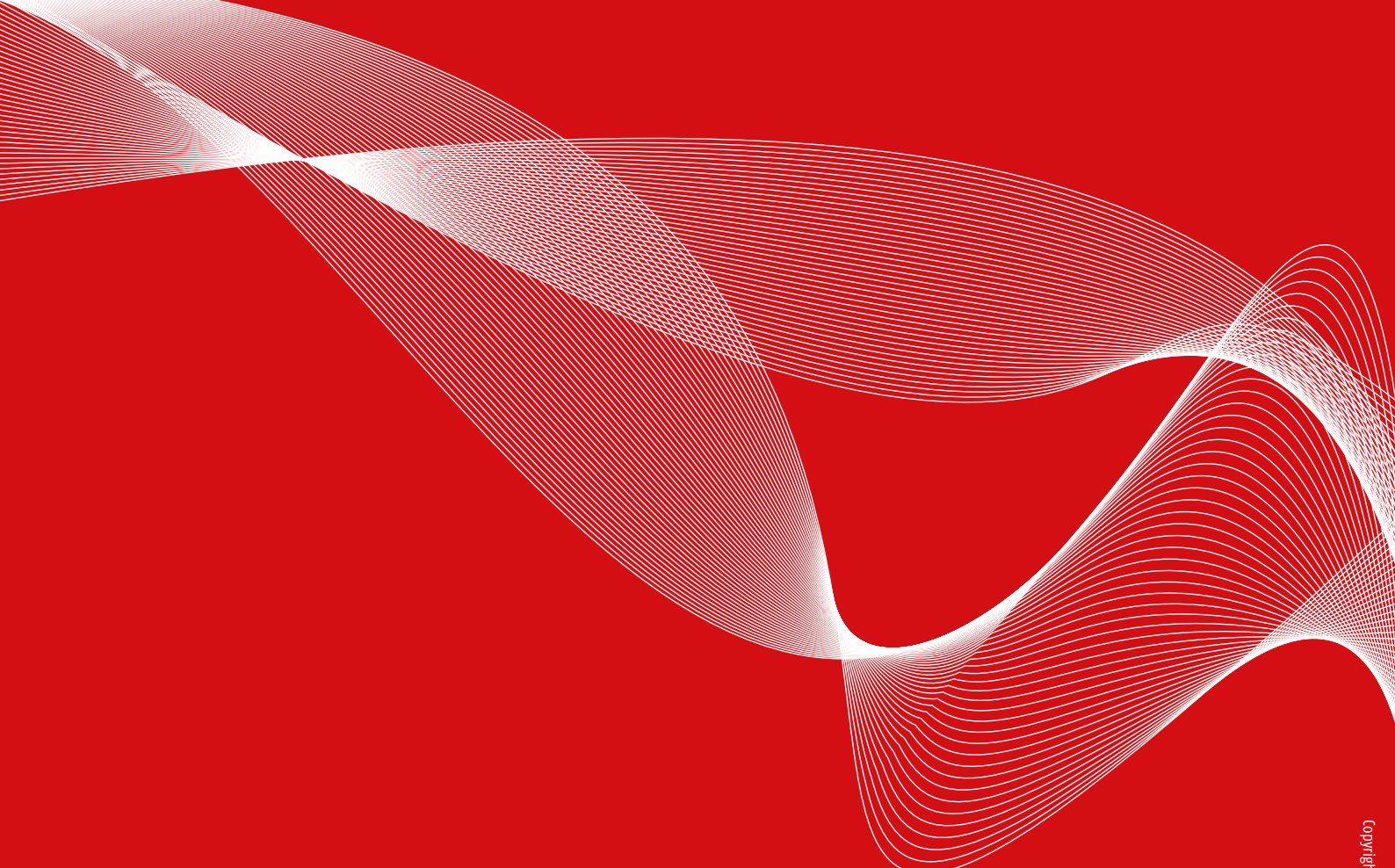
## Options

- 3 phase mains filter
- Signal and / or data line filter
- Fan
- Antenna tripod
- Video and / or audio system
- Measurement of the chamber
- Measuring equipment
- Non-combustible pyramid absorbers

# IMPRESSIONS







**FRANKONIA**

**Frankonia EMC Test-Systems GmbH**  
Daimlerstraße 17, 91301 Forchheim  
Germany

Web. [www.frankonia-emv.com](http://www.frankonia-emv.com)  
Mail. [sales@frankonia-emv.com](mailto:sales@frankonia-emv.com)

Tel. +49 (0) 91 91 / 73 666 - 0  
Fax. +49 (0) 91 91 / 73 666 - 20

**Frankonia GmbH**  
Industriestraße 16, 91180 Heideck  
Germany

Web. [www.frankoniagroup.com](http://www.frankoniagroup.com)  
Mail. [info@frankoniagroup.com](mailto:info@frankoniagroup.com)

Tel.: +49 (0) 91 77 / 98 - 500  
Fax. +49 (0) 91 77 / 98 - 520