



## COMMERCIAL EMC

IEC | CISPR | ISO | FCC  
FULL COMPLIANT CHAMBERS



Our EMC Test Sites offer much more than the sum of components, products, services and integration. Our solution philosophy begins with the initial customer inquiry and continues through the entire process to include maintenance service and a lifelong commitment to our customer's EMC facilities.

## Chamber Overview

STANDARDIZATION MAKES CUSTOMIZED SOLUTIONS AFFORDABLE. ....

Today, we directly control the R&D and manufacturing of the two principal components found in any EMC facility solution namely the shielding and the RF absorbers. Additionally, we work closely with our suppliers in the development of the components (i.e. RF filters, turntables, antenna masts, etc.), to insure they meet our stringently defined specifications.

Fully compliant test sites and their components are designed to have the lowest possible contribution to the total measurement uncertainty of the test facility, (i.e. to allow reproducible, accurate and fast measurements). Our family of fully compliant EMC Test Sites includes all semi-anechoic chambers (SAC) for 3 m, 5 m, and 10 m test distance and fully anechoic rooms (FAR) for 3 m and 5 m

test distance. The chamber validation of these solutions is described in CISPR 16-1-4. The final dimensions of the 10 m semi-anechoic chambers depend a lot on the dimensions of the EUT, whereas the dimensions of the fully-anechoic 3 m and 5 m chambers easily can be standardized.

Dedicated solutions for the FAR 10 m test distance are available upon customer's request.

All fully compliant test sites provide shielding compliant to EN 50147-1 and IEEE 299. Conducted EMC measurements, according to all of the relevant standards, can be performed in all chambers, provided that the geometry of the test site allows it.

# Chamber Validation

A WIN-WIN SITUATION FOR BOTH CUSTOMER AND SUPPLIER. ....

The chamber validation procedure and test reports serve many functions but, most importantly, are proof positive that we fulfill our contractual obligation to the client by providing a high performance RF chamber.

In order for the customer to receive accreditation for their chamber, it is necessary that the chamber undergo final verification testing by an independent third party who will certify conformity to the required standards.

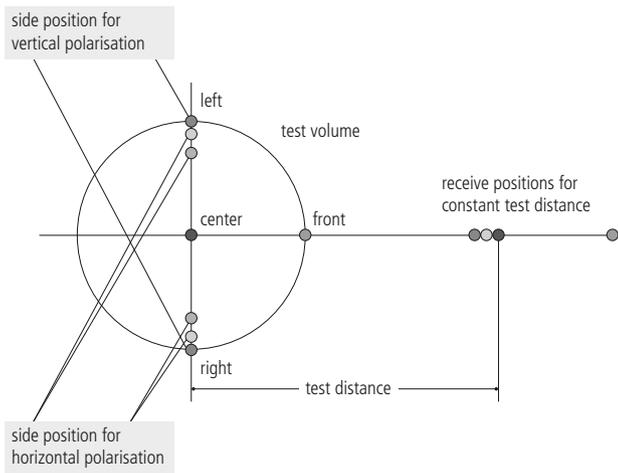
We, as an EMC Test Site solution provider, consider the validation procedure to be the final and irrevocable quality control of the chamber design, selected materials and installation skills. From the very beginning we have invested considerable resources in the capability of independently performing the chamber validation procedure according to the recognized international standards. Our record of more than 200 continuous chamber validations over the past ten years furthers our understanding of the behavior of an anechoic chamber. Our close cooperation with globally recognized independent test houses ensures a continuous and accurate calibration of our measuring antennas.

We offer chamber validation service wherever requested and appropriate. The international rules for the certification of EMC Test Sites require the validation of the:

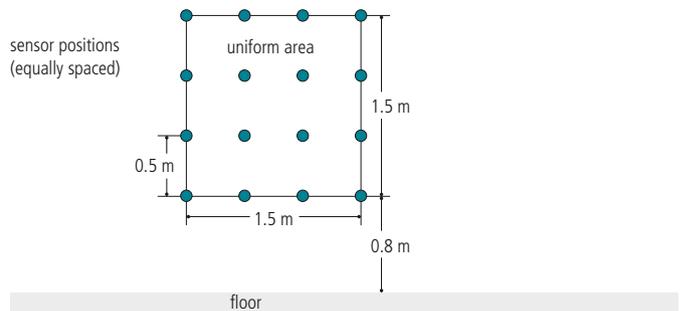
- Shielding effectiveness (SE)
- Emission performance (NSA, sVSWR)
- Susceptibility performance (FU)

Our participation in the international Standard Committees (CISPR/ IEC) contributes to the evolution of the validation procedures. Our fully compliant EMC Test Sites are designed to meet or exceed the performance criteria set in those relevant standards. The validation procedure of semi-anechoic chambers (SAC) and fully-anechoic chambers (FAC) for emission testing are defined in CISPR 16-4-1, chapter 5 and 8. The validation covers the frequency range from 30 MHz to 18 GHz and is based on the principle of testing a volume in the chamber. (see lower left diagram)

The validation procedure for susceptibility testing is defined in IEC 61000-4-3 and is usually applied in the frequency range from 80 MHz to 18 GHz. This validation procedure is based on the principle of uniform area. (see lower right diagram)



Basic set-up for test volume measurement



Uniform area for field uniformity test

# Purpose & Standards

## WHAT IS THIS SOLUTION FOR? .....

Electro Magnetic Compatibility is the ability of electrical and electronic equipment and systems to share the electromagnetic spectrum and perform their desired functions without unacceptable degradation to or from the specified electromagnetic environment.

This basic statement must be implemented by manufacturer and dealer into all electrical and electronic equipment brought into the market. Our fully compliant EMC Test Sites are designed for conducted and radiated measurements on industrial, electrical, and electronic equipment.

It should be noted that the high shielding effectiveness is at least 100 dB and the low ambient noise level in our anechoic chambers allow for several additional applications such as an EMC hardening test on equipment and boxes/cabinets as well as measurements of the shielding effectiveness of materials. Obviously size and configuration of the anechoic chamber should suit the requirements of such specific applications.

For industrial equipment, the product family standard for emission measurements should refer to ANSI C63.4, CISPR 16-1-4, EN 55016-1-4, IEEE C63.4, VCCI and other national standards. For conducted and radiated susceptibility tests, the product family standard should refer to IEC 61000-4-3, EN 6100-4-3, EN 6001-4-6 and IEC 61000-4-6.

Additionally, the applicable requirements of the following standards can be met:

- Bellcore, ETSI, FCC (Telecom)
- CISPR 25, ISO and SAE (Automotive)
- MIL-STD 461, RTCA DO-160 (Military/Aerospace)

# Quality Management

## QUALITY MEANS DOING IT RIGHT FROM THE VERY FIRST THOUGHT. ....

Our quality management ensures a most efficient quality control over products, management and organizational systems.

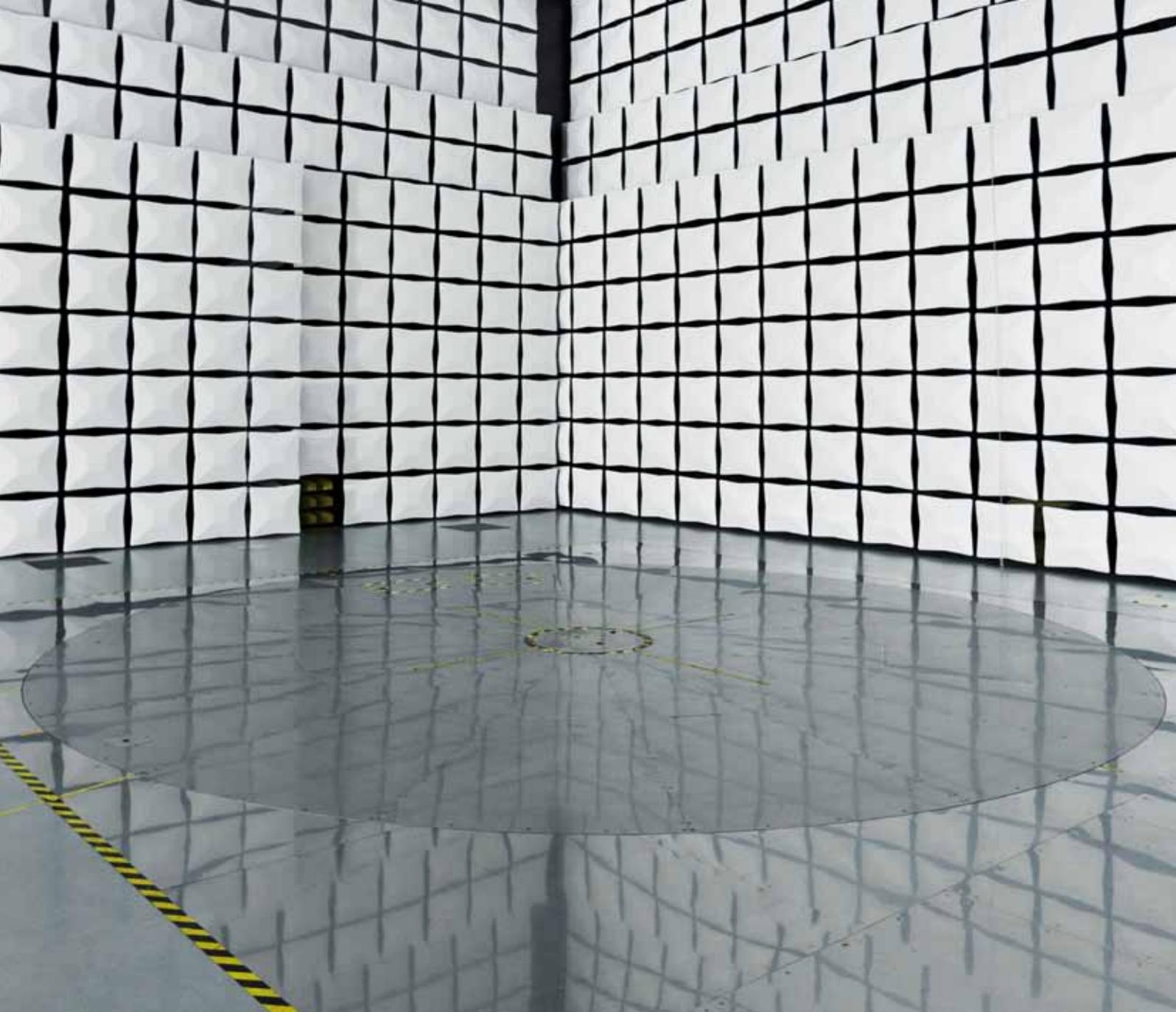
The organization ensures the availability of resources and information necessary to support the operation and monitoring of these processes. All relevant processes are defined in our management system. Through monitoring, analysis, and improvement, the highest quality and customer satisfaction is our target.

In an effort to improve our quality assurance systems, we ask our customers to provide an evaluation of our performance at the conclusion of each project. This feedback, coupled with input from the market and the Standards Committees gives, continuous enhancement to our systems and correction to any non-conformity found.

Product purchasing and sourcing is a priority in our role as system integrator, so much that it encompasses one of sixteen chapters in our quality management system. Key process figures are:

- audit & approval of suppliers
- evaluation of products by our technical team
- technical reporting on delivered products
- project related factory acceptance by the project manager.

Our ISO 9001 certification guarantees that our designs, products, and solutions will always meet the highest quality standards. It's our goal to provide you the very best of expertise, project management, and products. The main system components like shielding, absorbers etc. are manufactured by daughter companies or by our shareholders. This ensures a full control with regard to quality and delivery time.



# SAC

# SAC

The function and performance of a SAC aligns very closely with the OATS, which is considered the “gold standard.” The semi-anechoic chamber (SAC) is the most popular alternative test site for EMC measurements and tests.

## Basic Outline SAC

### KEY FEATURES .....

- Self-supporting modular pan shielding for floor, walls and ceiling inclusive of an earthing stud
- High quality ground plane on a raised floor with distributed load of 2 t (4,410 lb)
- Reinforced raised floor according to turntable load between main entrance and turntable
- Floor connection points and wall access panels as to chamber size
- Honeycomb vents in walls and ceiling 0.33 m x 0.33 m (12 in x 12 in) as to the chamber size
- One automatic RF shielded EUT sliding gate 2.4 m x 2.4 m (8 ft x 8 ft) inclusive of lift table
- One manually operated RF shielded personnel door 0.9 m x 2.05 m (3 ft x 7 ft)
- One gate and door maintenance kit
- Hybrid and pyramidal absorber lining for floor, walls and ceiling, as to the chamber performance
- Fully functional positioning system including controller, and turntable according to test volume size and antenna mast
- EMC power line filters: one filter 3 phase 32 A for EUT supply and one 2 phase 64 A for internal use
- Connectors including a six-fold fiber optic connector, two N-precision connectors and two SMA connectors
- Standard electrical package: electrical distribution, lighting, emergency and signal lamps
- Installation of the SAC including leakage test after shielding installation

## Option SAC

### CUSTOMIZABLE UPGRADES .....

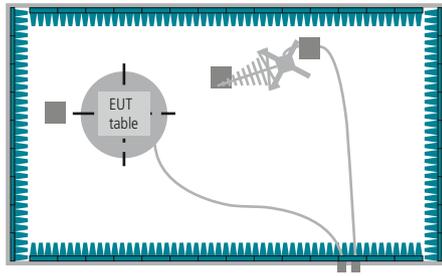
- Fully functional shielded control room
- Fully functional shielded amplifier room
- One additional manually operated RF shielded personnel door 0.9 m x 2.05 m (3 ft x 7 ft)
- Digital CCTV monitoring system
- FO converter for Ethernet, GPIB, RS232, VGA, USB, MM and Digi 88
- EMC filters for control- and communication lines
- Fire detection and extinguishing system
- Lights lowering system for maintenance purpose
- Integrated chassis dynamometer
- Movable chassis dynamometer
- Automatic absorber storage lift
- Heating, ventilation and air conditioning system (HVAC)
- Intercom system
- Painted hybrid absorbers
- Exterior paint on the visible shielding surfaces
- SE measurement according to EN 50147-1, IEEE 299
- Chamber validation according to CISPR 16-1-4, ANSI C63.4, EN 55016-1-4
- Chamber validation according to IEC 61000-4-3, EN 61000-4-3

# 3 m SAC

## ROOM DIMENSIONS

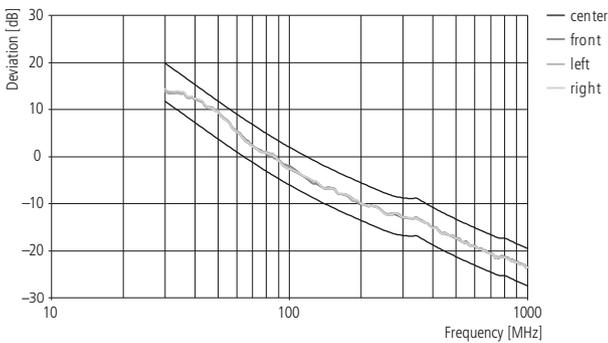
Room type	Total required space <sup>1)</sup>	Shielding external <sup>2)</sup>	Clear internal <sup>3)</sup>
3 m SAC – 2 m Ø	10.0 m x 7.8 m x 6.0 m 32.1 ft x 25.6 ft x 19.7 ft	9.4 m x 5.5 m x 5.55 m 30.8 ft x 18.0 ft x 18.2 ft	8.4 m x 4.3 m x 5.1 m 27.6 ft x 14.1 ft x 16.7 ft

L x W x H <sup>1)</sup>Dimensions including steel structure, gate drive track and HVAC ducts. <sup>2)</sup>Dimensions excluding steel structure. <sup>3)</sup>Absorber to absorber, i.e. ground plane to absorber.

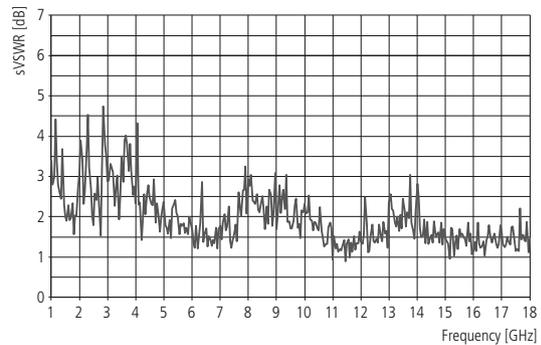


## PERFORMANCE

	NSA	Site VSWR	Field Uniformity
Standard	CISPR 16-1-4, ANSI C63.4 EN 55016-1-4	CISPR 16-1-4 EN 55016-1-4	IEC 61000-4-3 EN 61000-4-3
Frequency range	30 MHz – 1 GHz	1 GHz – 18 GHz	80 MHz – 18 GHz
Test distance	3 m	3 m	3 m
Test volume	2 m	2 m	1.5 m x 1.5 m (vertical plane)
Test axis	Off axis	Off axis	In axis
Deviation	±3.5 dB	≤ 6 dB	0 to +6 dB / 75% rule



Typical performance SAC 3 m (NSA)



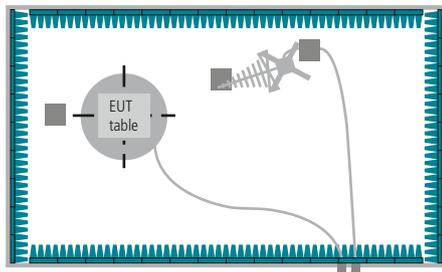
Typical performance SAC 3 m (sVSWR)

# 5 m SAC

## ROOM DIMENSIONS

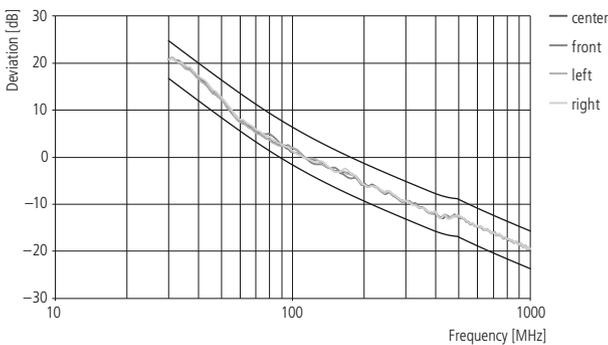
Room type	Total required space <sup>1)</sup>	Shielding external <sup>2)</sup>	Clear internal <sup>3)</sup>
5 m SAC – 3 m Ø	12.7 m x 9.6 m x 6.5 m 41.7 ft x 31.5 ft x 21.3 ft	12.1 m x 7.3 m x 6.0 m 39.7 ft x 24.0 ft x 19.7 ft	11.1 m x 5.5 m x 5.12 m 36.4 ft x 18.0 ft x 16.8 ft

L x W x H <sup>1)</sup>Dimensions including steel structure, gate drive track and HVAC ducts. <sup>2)</sup>Dimensions excluding steel structure. <sup>3)</sup>Absorber to absorber, i.e. ground plane to absorber.

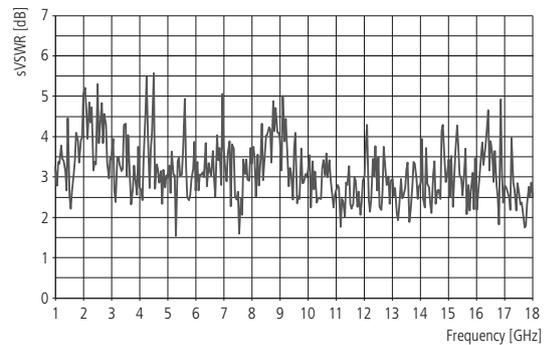


## PERFORMANCE

	NSA	Site VSWR	Field Uniformity
Standard	in analogy to CISPR 16-1-4 ANSI C63.4, EN 55016-1-4	CISPR 16-1-4 EN 55016-1-4	IEC 61000-4-3 EN 61000-4-3
Frequency range	30 MHz – 1 GHz	1 GHz – 18 GHz	80 MHz – 18 GHz
Test distance	5 m	5 m	3 m
Test volume	3 m	3 m	1.5 m x 1.5 m (vertical plane)
Test axis	Off axis	Off axis	In axis
Deviation	±3.5 dB	≤ 6 dB	0 to +6 dB / 75% rule



Typical performance SAC 5 m (NSA)



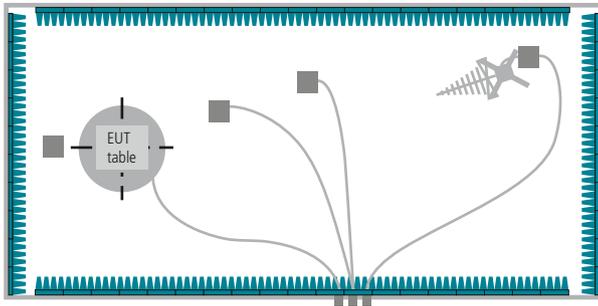
Typical performance SAC 5 m (sVSWR)

# 10 m SAC

## ROOM DIMENSIONS

Room type	Total required space <sup>1)</sup>	Shielding external <sup>2)</sup>	Clear internal <sup>3)</sup>
10 m SAC – 3 m Ø	20.0 m x 14.8 m x 9.1 m 65.6 ft x 48.6 ft x 29.9 ft	19.0 m x 11.8 m x 8.6 m 62.3 ft x 38.7 ft x 28.2 ft	17.5 m x 10.0 m x 7.3 m 57.4 ft x 32.8 ft x 24.0 ft
10 m SAC – 4 m Ø	21.2 m x 15.4 m x 9.1 m 69.6 ft x 50.5 ft x 29.9 ft	20.2 m x 12.4 m x 8.6 m 66.3 ft x 40.7 ft x 28.2 ft	18.7 m x 10.6 m x 7.2 m 61.4 ft x 34.8 ft x 23.6 ft
10 m SAC – 5 m Ø	22.7 m x 16.0 m x 9.1 m 74.5 ft x 52.5 ft x 29.9 ft	21.7 m x 13.0 m x 8.6 m 71.2 ft x 42.7 ft x 28.2 ft	20.2 m x 11.2 m x 7.1 m 66.3 ft x 36.7 ft x 23.3 ft

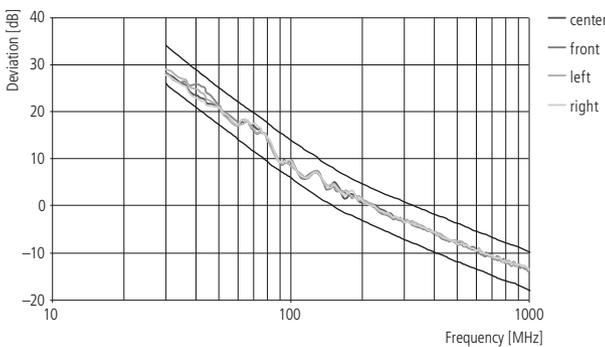
L x W x H <sup>1)</sup>Dimensions including steel structure, gate drive track and HVAC ducts. <sup>2)</sup>Dimensions excluding steel structure. <sup>3)</sup>Absorber to absorber, i.e. ground plane to absorber.



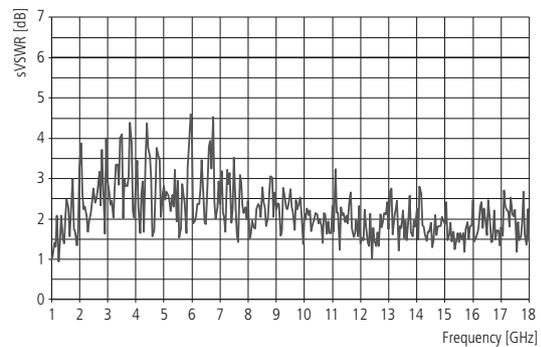
## PERFORMANCE

	NSA	Site VSWR	Field Uniformity
Standard	CISPR 16-1-4, ANSI C63.4 EN 55016-1-4	CISPR 16-1-4 EN 55016-1-4	IEC 61000-4-3 EN 61000-4-3
Frequency range	30 MHz – 1 GHz	1 GHz – 18 GHz	80 MHz – 18 GHz
Test distance	10 m	10 m	3 m
Test volume	*)m	*)m	1.5 m x 1.5 m (vertical plane)
Test axis	Off axis	Off axis	In axis
Deviation	±4.0 dB or better	≤ 6 dB	0 to +6 dB / 75% rule

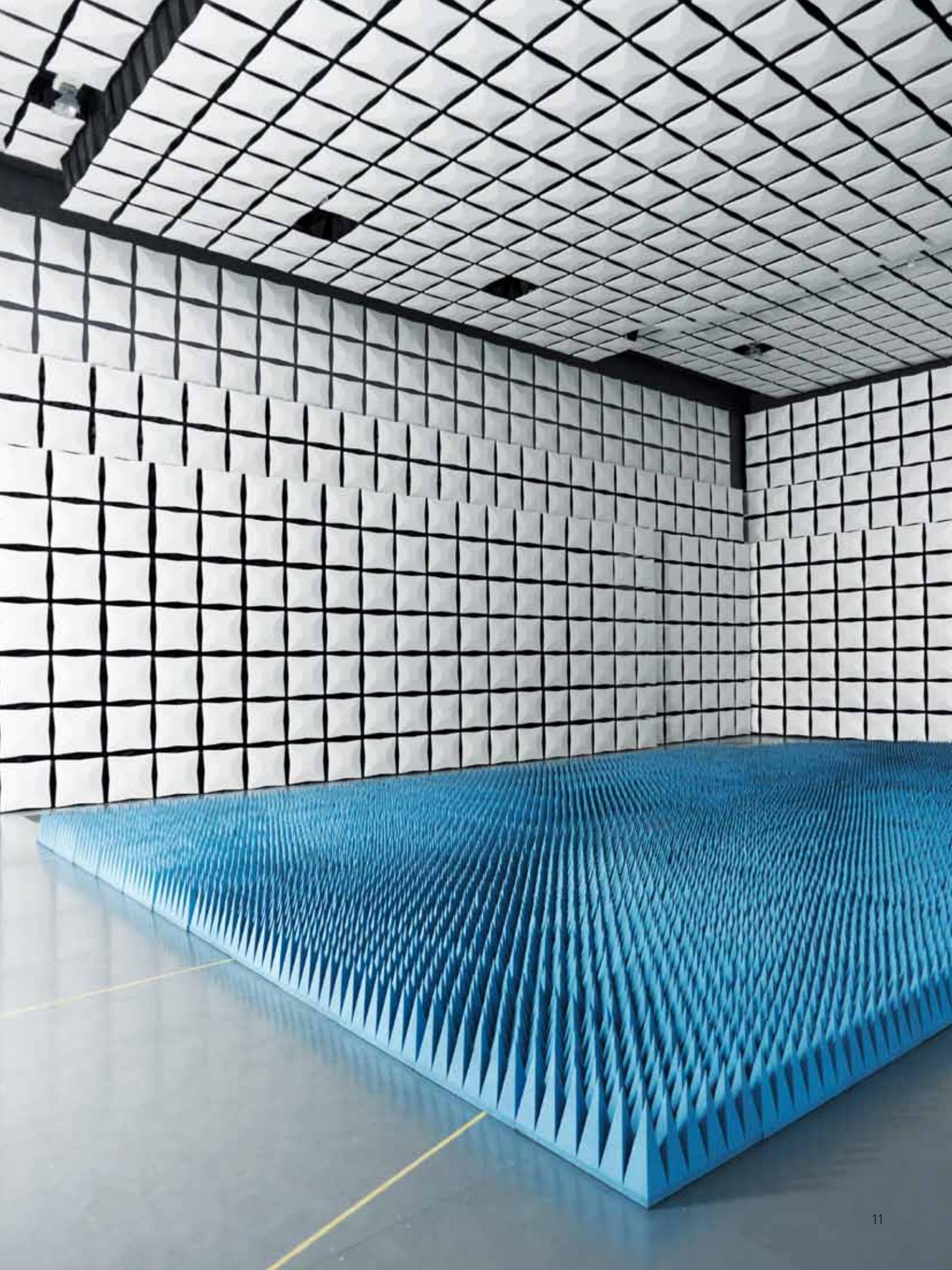
\*)according to room type test volume



Typical performance SAC 10 m (NSA)



Typical performance SAC 10 m (sVSWR)





FAR

# FAR

The fully anechoic room (FAR) is officially recognized since February 2007 from the CISPR 16-1-4, Chapter 5.4. The FAR is most suitable for 3 m testing of tabletop equipment and/or floor standing equipment up to a few hundred kilograms (450 lb). Compact in size its absorber lining remains in place for all EMC measurements and tests up to 18 GHz.

## Basic Outline FAR

### KEY FEATURES .....

- Self-supporting modular pan shielding for floor, walls and ceiling inclusive of an earthing stud
- Raised floor with distributed load of 1 t (2,205 lb)
- Floor connection points and wall access panels as to chamber size
- Honeycomb vents in walls and ceiling 0.33 m x 0.33 m (12 in x 12 in) as to the chamber size
- One manually operated RF shielded EUT door 1.5 m x 2.5 m (5 ft x 8 ft) inclusive of an access ramp
- One door maintenance kit
- One set of hybrid absorber lining for floor, walls and ceiling, designed to the chamber performance
- Fully functional positioning system including controller, and turntable according to test volume size and antenna stand
- EMC power line filters: one filter 3 phase 32 A for EUT supply and one 2 phase 32 A for internal use
- Connectors including one six-fold fiber optic connector, two N-precision connectors and two SMA connectors
- Standard electrical package: electrical distribution, lighting, emergency and signal lamps
- Installation of the FAR including leakage test after shielding installation

## Options FAR

### CUSTOMIZABLE UPGRADES .....

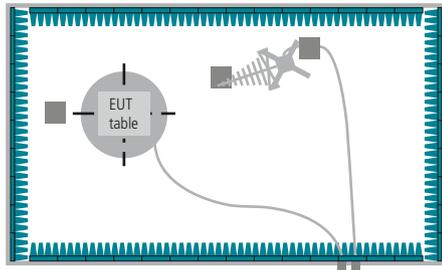
- Fully functional shielded control room
- Fully functional shielded amplifier room
- One additional manually operated RF shielded personnel door 0.9 m x 2.05 m (3 ft x 7 ft)
- Digital CCTV monitoring system
- FO converter for Ethernet, GPIB, RS232, VGA, USB, MM and Digi 88
- EMC filters for control- and communication lines
- Fire detection and extinguishing system
- Lights lowering system for maintenance purpose
- Heating, ventilation and air conditioning system (HVAC)
- Intercom system
- Painted hybrid absorbers
- Exterior paint on the visible shielding surfaces
- SE measurement according to EN 50147-1, IEEE 299
- Chamber validation according to CISPR 16-1-4, ANSI C63.4, EN 55016-1-4
- Chamber validation according to IEC 61000-4-3, EN 6100-4-3

# 3 m FAR

## ROOM DIMENSIONS

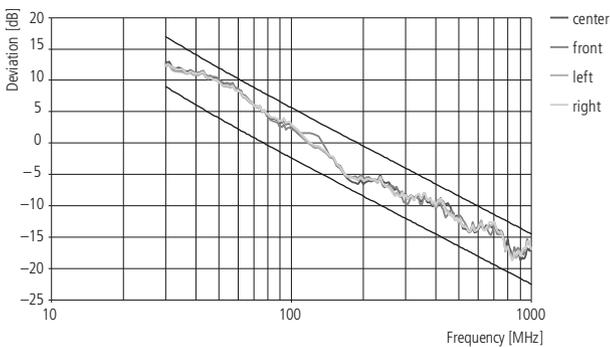
Room type	Total required space <sup>1)</sup>	Shielding external <sup>2)</sup>	Clear internal <sup>3)</sup>
3 m FAR – 1.5 m Ø	9.0 m x 6.8 m x 4.4 m 29.5 ft x 22.3 ft x 14.4 ft	8.8 m x 4.6 m x 4.2 m 28.9 ft x 15.1 ft x 13.8 ft	7.8 m x 3.4 m x 3.0 m 25.6 ft x 11.2 ft x 9.8 ft

L x W x H <sup>1)</sup>Dimensions including steel structure, gate drive track and HVAC ducts. <sup>2)</sup>Dimensions excluding steel structure. <sup>3)</sup>Absorber to absorber, i.e. ground plane to absorber.

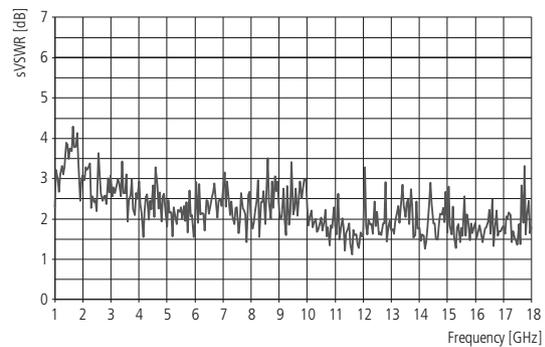


## PERFORMANCE

	NSA	Site VSWR	Field Uniformity
Standard	CISPR 16-1-4, ANSI C63.4 EN 55016-1-4	CISPR 16-1-4 EN 55016-1-4	IEC 61000-4-3 EN 61000-4-3
Frequency range	30 MHz – 1 GHz	1 GHz – 18 GHz	80 MHz – 18 GHz
Test distance	3 m	3 m	3 m
Test volume	1.5 m	1.5 m	1.5 m x 1.5 m (vertical plane)
Test axis	Off axis	Off axis	In axis
Deviation	±4 dB	≤ 6 dB	0 to +6 dB / 75% rule



Typical performance FAR 3 m (FS NSA)



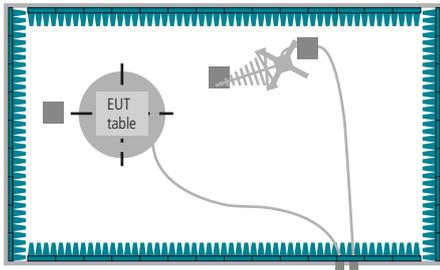
Typical performance FAR 3 m (sVSWR)

# 5 m FAR

## ROOM DIMENSIONS

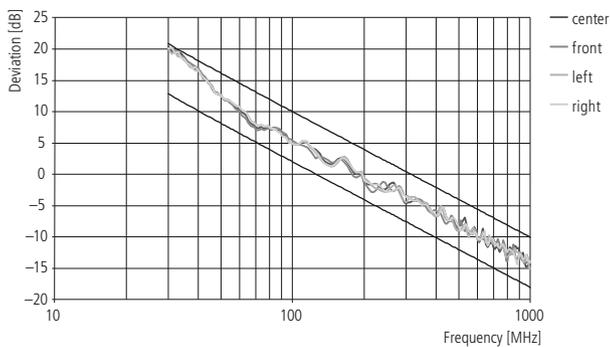
Room type	Total required space <sup>1)</sup>	Shielding external <sup>2)</sup>	Clear internal <sup>3)</sup>
5 m FAR – 2.5 m Ø	12.4 m x 9.8 m x 7.8 m 40.7 ft x 32.2 ft x 25.6 ft	11.8 m x 7.6 m x 7.2 m 38.7 ft x 24.9 ft x 23.6 ft	10.6 m x 6.4 m x 6.0 m 34.8 ft x 21.0 ft x 19.7 ft

L x W x H <sup>1)</sup>Dimensions including steel structure, gate drive track and HVAC ducts. <sup>2)</sup>Dimensions excluding steel structure. <sup>3)</sup>Absorber to absorber, i.e. ground plane to absorber.

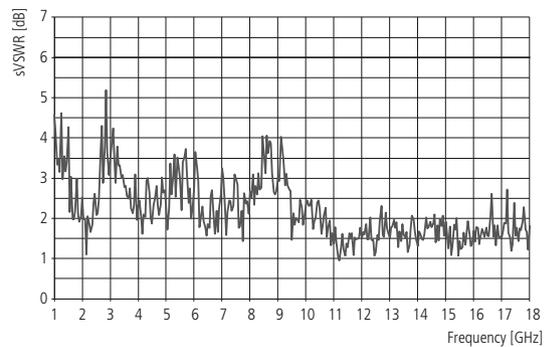


## PERFORMANCE

	NSA	Site VSWR	Field Uniformity
Standard	CISPR 16-1-4, ANSI C63.4 EN 55016-1-4	CISPR 16-1-4 EN 55016-1-4	IEC 61000-4-3 EN 61000-4-3
Frequency range	30 MHz – 1 GHz	1 GHz – 18 GHz	80 MHz – 18 GHz
Test distance	5 m	5 m	3 m
Test volume	2.5 m	2.5 m	1.5 m x 1.5 m (vertical plane)
Test axis	Off axis	Off axis	In axis
Deviation	±4 dB	≤ 6 dB	0 to +6 dB / 75% rule



Typical performance FAR 5 m (FS NSA)



Typical performance FAR 5 m (sVSWR)

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