R&S®TS7124M
RF Shielded Box
User Manual

1525539402

User Manual

Version 04

ROHDE&SCHWARZ

This user manual describes the following R&S®TS7124M models and options:

- **R&S®TS7124M (1525.8564.02) RF Shielded Box without Front Feedthrough Ports**
- **R&S®TS7124M (1525.8564.12) RF Shielded Box with two Front Feedthrough Ports**
- R&S®TS-F24ABS (1525.8593.02) Basic Absorber
- R&S®TS-F24P1 (1525.8664.02 / .04) DUT Holder Tray with Raster
- R&S®TS-F24-AH1 (1525.8887.02) Half Antenna Ring
- R&S®TS-F24-AH3 (1530.5999.02 / .04) Half Antenna Ring with three Vivaldi Antennas
- R&S®TS-F24-AR (1525.8906.02) Full Antenna Ring
- R&S®TS-F24-AR3 (1530.6008.02 / .04) Full Antenna Ring with three Vivaldi Antennas
- R&S®TS-F24-AH2 (1525.8893.02 / .12 / .22) Antenna Holder
- R&S®TS-F24FN1 (1525.8870.02) Twin N-SMA Feedthrough
- R&S®TS-F24FS1 (1530.1058.02) 4x SMA-SMA Feedthrough
- R&S®TS-F24FK2 (1530.6372.02/.04) 2x / 4x PC 2.92 mm Feedthrough
- R&S®TS-F24FV1 (1532.0836.02) 2x PC 1.85 mm Feedthrough
- R&S®TS-F24FD1 (1525.8835.02) D-Sub Feedthrough (25 pin + 9 pin)
- R&S®TS-F24FU1 (1525.8735.02) USB 2.0 Feedthrough
- R&S®TS-F24FET (1525.8729.02) Gigabit Ethernet (LAN) Feedthrough
- R&S®TS-F24FP1 (1525.8864.02) 4x FSMA Fiberoptic Feedthrough
- R&S®TS-F24FF1 (1525.8858.02) 4x Pneumatic Feedthrough
- R&S®TS-F24FAC1 (1526.4840.02) Power Feedthrough
- R&S®TS-F24-V1 (1525.8964.02) Vivaldi Antenna V1 (0.7 - 14 GHz)
- R&S®TS-F24-V2 (1525.8970.02) Vivaldi Antenna V2 (2.4 - 16 GHz)
- R&S®TS-F24-V3 (1525.8987.02) Cross-Polarized Vivaldi Antenna V3 (1.7 - 20 GHz)
- R&S®TS-F24NB2 (1525.8793.02) Narrowband Antenna (0.7 - 0.96 GHz)
- R&S®TS-F24WA1 (1525.8670.02) Wideband Antenna (0.3 - 6 GHz)
- R&S®TS-F2X-VH4 (1525.8758.02) 45° Adapter for Lateral Antenna Tilt
- R&S®TS-F24HML1 (1530.8430.02) 3D Magnetic Helmholtz Coil (20 kHz - 1 MHz)
- R&S®TS-F24HLF1 (1530.8446.02) Low Frequency Loop Antenna (20 kHz - 1 MHz)
- R&S®TS-F24-Z1 (1526.6942.02) 19" Rack Mounting Kit

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1525.5394.02 | Version 04 | R&S®TS7124M

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol , e.g. R&S®TS7124M is indicated as R&S TS7124M.

Contents

1 Preface

1.1 Key Features

The high-performance RF Shielded Box R&S TS7124M was developed to meet demanding measurement requirements in radiated and conducted RF testing.

Figure 1-1: RF Shielded Box with front door / drawer opened

The use of a RF Shielded Box is a prerequisite for reliable and reproducible RF interface performance tests. It ensures that Devices under Test (DUTs) are not affected by interference from external test systems that would distort the measurement results. The shielding also prevents other external instruments or test systems from being affected by the radiation tests.

To meet these requirements, the RF Shielded Box R&S TS7124M features:

- A wide frequency range from 300 MHz to 6 GHz
- A rugged mechanical design for reproducible results and long lifetime
- A good antenna coupling factor
- High shielding efficiency
- Low reflection due to use of absorbent material
- Multiple integrated and exchangeable RF connectors and filtered feedthroughs
- A customer-configurable DUT holder and measurement tray
- Flexible configurations of antenna ring and antennas

- Extended modularity

The RF Shielded Box is exclusively intended for the use as a measurement equipment in RF interface performance tests. It is intended to be used in conjunction with RF measurement instruments and an RF test system. You must not use the RF Shielded Box for any other purposes.

WARNING

Risk of injury

Operation and handling of an RF Shielded Box implies risks.

To reduce these risks and prevent accidents, carefully read the user manual.

Especially read Chapter 2, "Specific Safety Instructions", on page 9.

1.2 Documentation Overview

The technical documentation for the RF Shielded Box consists of the following parts:

- This user manual including important Specific Safety Instructions (printed or in electronic format)
- General safety instructions (separate, printed or in electronic format)
- A CD-ROM that contains user manual, certificates, product brochure & data sheet

The entire user manual must be carefully read, understood and observed by:

- Operators, tasked with working on the RF Shielded Box, prior to operating it for the first time
- Service engineers, prior to performing any maintenance or service tasks

Observing the user manual ensures the following:

- Prevent hazards during transport, positioning and assembly
- Prevent hazards during operation
- Prevent hazards during configuration, maintenance and repair
- Increase operation efficiency
- Avoid downtime
- Increase the reliability and lifetime of the RF Shielded Box

The operating instructions must always be available in the location where the RF Shielded Box is used. The operating organization is to supplement the operating instructions, as appropriate, with information on national health, safety and environmental regulations.

2 Specific Safety Instructions

WARNING

Risk of injury

Setup and operation of an RF Shielded Box implies risks.

To reduce these risks and prevent accidents, carefully read the following chapter and the rest of the user manual as well as the general safety instructions.

The RF Shielded Box has been manufactured in accordance with accepted engineering practices and the latest scientific and technical findings. Nevertheless, any RF Shielded Box generates risks that cannot be prevented by design. To provide sufficient safety for personnel using the RF Shielded Box, additional safety instructions have been defined. A satisfactory level of safety while using the RF Shielded Box is assured only if these instructions are observed.

For handling and operating the RF Shielded Box, some in-depth knowledge and skills are required.

Personnel assigned to work with the RF Shielded Box must first read and understand the entire user manual, particularly this chapter, before starting to work.

Operators must be trained and instructed on safety aspects and have to comply with:

- National law and local regulations on health, safety, and environmental protection
- Applicable standard procedures for health and safety
- Technical standards, rules and instructions for the safe operation of test systems
- Specific organizational obligations (e.g. regarding supervision, reporting, the organization of work, schedules, human resources, etc.)

The operating organization must, by means of internal precautions, ensure the following:

- Only authorized persons are allowed to work on the RF Shielded Box, see Chapter 2.3, "Authorized Operators", on page 11.
- During operation of the RF Shielded Box, all safety regulations and operating instructions must be adhered to strictly.
- It is not permitted to make any changes, modifications or additions to the RF Shielded Box that could affect safety.

2.1 Explanation of Symbols

Labels with the following symbols point out areas of risk on the chamber. In addition, sections in this chapter which describe a specific risk are marked with the associated symbol in the margin. The symbols have the following meaning:

Symbol	Explanation
	WARNING! Indicates the risk of personal injury In order to prevent personal injury observe and follow safety instructions.
	WARNING! Indicates the risk of contusion of hand and fingers In order to prevent contusion of the hand and fingers follow the safety instructions on how to operate the chamber.
	WARNING! Indicates the risk of toes / foot injury due to the heavy chamber and its door. In order to prevent toes or foot injury, follow the safety instructions for transport, unpacking and operation.
	CAUTION! Indicates a weight for heavy units >34 kg In order to prevent personal injury, follow the safety instructions for transport, unpacking and operation.
	NOTICE Indicates the risk of ESD In order to prevent electrostatic discharge effects, follow the instructions in Chapter 6.1.1, "ESD Requirements", on page 69. Electrostatic sensitive devices require special care.
	NOTICE Indicates a risk of damage to the installation To prevent damage to the RF Shielded Box or incorrect measurement results, follow the safety instructions.
	Earth (ground)

2.2 Intended Use

The RF Shielded Box is intended for radiation testing of electronic devices. Use the device under test (DUT) only with the appropriate, specially manufactured cables and adapters. Any other use is regarded as improper use, which can result in safety hazards and damage.

The RF Shielded Box is only permitted to be operated within the permissible parameter ranges as specified in the data sheet.

The RF Shielded Box is intended for industrial use and must only be installed, operated, configured, maintained and repaired by appropriately trained personnel.

2.3 Authorized Operators

An authorized operator is a person who, as a result of special instruction or training courses, is familiar with handling the RF Shielded Box. The operator must have read and understood all operating instructions. Only trained personnel with the proper instruction is permitted to carry out work on the RF Shielded Box.

The duties of personnel responsible for the following must be clearly defined:

- Installation
- Operation
- Configuration
- Maintenance
- Repair

When instructing personnel, particular emphasis should be laid on possible hazards and on the safety procedures. Proper use also includes the observance of this user manual and the observance of the inspection and maintenance requirements (see Chapter 8, "Maintenance", on page 153).

2.4 Safety Instructions for Unpacking, Transport and Mounting

Risk of contusion due to heavy moving parts

For transportation, the RF Shielded Box is originally contained in a special transport protection packaging. After unpacking, there is no additional protection to prevent opening of the drawer. Especially when the chamber is tilt, the drawer can slide open unintentionally. This movement can cause personal injuries, especially contusion.

To avoid this risk, make sure that the RF Shielded Box is always in a horizontal position.

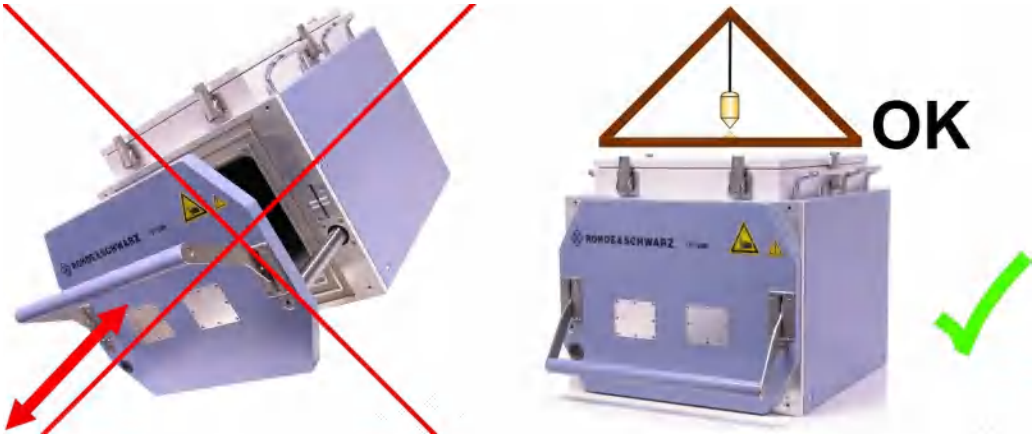


Figure 2-1: Tipping hazard with the drawer sliding open in an uncontrolled manner

An additional safety measure is implemented by a metal safety latch next to the top left corner of the front door. This latch prevents unintentional opening of the drawer:

Figure 2-2: Metal safety latch

When you remove this safety latch and especially when the chamber is tilt, the drawer can slide open unintentionally. This movement can cause personal injuries, especially contusion.

To avoid this risk, leave the safety latch mounted until the chamber is securely mounted.

Never use the handle for lifting the RF Shielded Box.

Packaging material

To be prepared for later transportation or shipping of the RF Shielded Box, retain the original special transport protection packaging and the safety latch (Figure 2-2). If the RF Shielded Box has to be transported or shipped again, attach the safety latch and repack the chamber in its original packaging, which keeps the drawer closed.

If the original packaging material and the metal safety latch are no longer available, secure the drawer against unintentional opening in an appropriate way.

Risk of injury due to heavy weight

Handling the heavy chamber (e.g. lifting or transporting it) may result in personal injury. In order to prevent this, at least two persons are required for handling the RF Shielded Box. Never use the handle for lifting the RF Shielded Box.

The RF Shielded Box must be mounted by fixing it horizontally to a stable bench/ support with screws and four brackets, see Chapter 6.1, "Setup", on page 68.

Risk of injury due to unstable mounting

The support (bench, table, rack, or the like) onto which the RF Shielded Box is to be mounted, has to be sufficiently stable to bear the chamber's weight and to withstand the door's momentum during operation. The screws with which the mounting brackets (see Chapter 6.1.3, "Positioning the Chamber", on page 70) are fixed to the support, have to be suitable to hold a tight grip in the support's material and strong enough to withstand a dynamic long-term load. If the support or the screws should fail, the chamber may become destabilized and eventually tip out of place. This could cause personal injuries, especially contusion.

To avoid this risk, make sure that the RF Shielded Box is securely mounted on a stable support.

2.5 Safety Instructions for Operation

Risk of injury due to door operation

The heavy RF Shielded Box features a solid metal door that can be manually opened and closed. The heavy weight is required to achieve high levels of electromagnetic shielding. If the door is closed without caution, this implies some risk of injury for the operators.

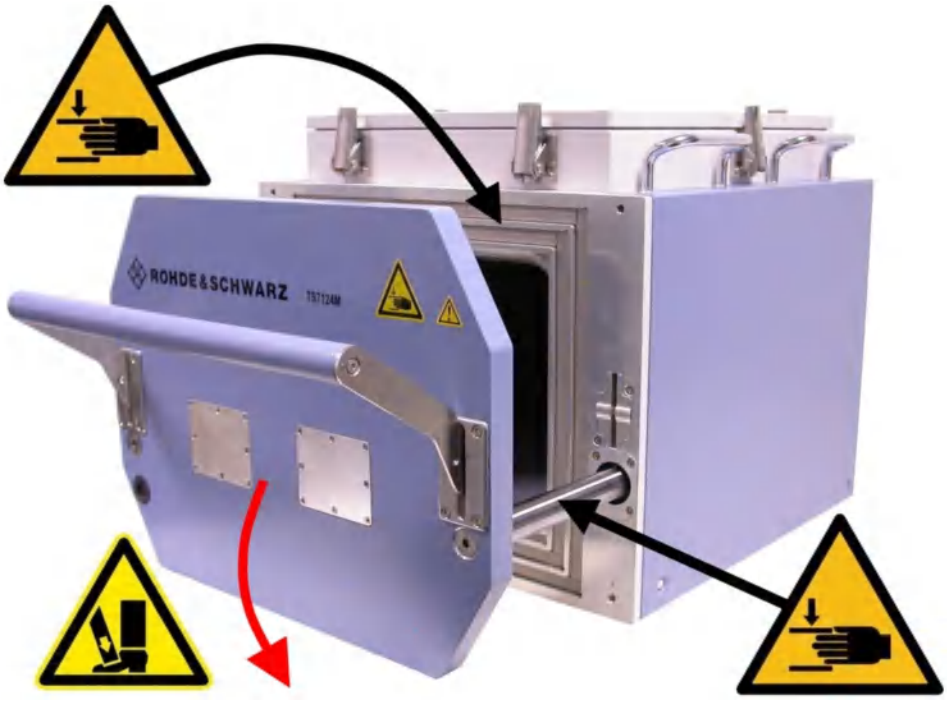


Figure 2-3: Mechanical hazards involved with the moving front door / drawer (left) as well as with the guide rail. The red arrow indicates the risk of a tipping chamber if it is opened without being fixed to a stable support

The inertia of the door, if it is closed fast, may be sufficient to cause personal injury, especially contusion of hands and fingers. To avoid this risk of "fast" contusion, always keep away from the gap between the chamber's door and wall, while closing the door.

Additionally, there is a risk of "slow" contusion between door and chamber, while locking the door by its handle. To reduce this risk, the locking mechanism is only engaged if the door is almost closed: Once the locking hooks of the handle are caught in their counterpart in the chamber wall, the gap between door and chamber is too small to insert fingers.

However, any mechanism could fail. To avoid potential risks, keep away from the gap between the door and the chamber, when the door is about to be closed. Also, do not touch the movable guide rails.

Risk of contusion due to heavy moving parts

Both the chamber and the door are heavy. The weight and the leverage effect of the open drawer is sufficient to destabilize the whole chamber and make it tilt forward. This risk is enhanced by the typical situation of the opened door protruding over the edge of a table or support.

The risk of tilting is especially high during the installation phase, before the RF Shielded Box is securely mounted in a horizontal position (see Figure 2-1). With neither the special transport protection packaging nor the handle keeping the door closed, the

combination of a tilting movement of the whole chamber and the drawer sliding open unintentionally could enhance the risk.

Any of these instability conditions might lead to personal injury, especially contusion. To avoid this risk, make sure that prior to operation the chamber is securely mounted to a stable support (see Chapter 6.1, "Setup", on page 68).

Risk of injury in case of malfunction

If the RF Shielded Box is operated without being in proper working order, malfunctions could lead to unpredictable events.

To avoid risks in the event of a malfunction,

- immediately take the chamber out of operation,
- report the malfunction to the responsible department,
- eliminate any faults before work is continued.

Other Safety Instructions

Persons not trained in handling the RF Shielded Box must be kept out of the range of operation, as they may not know about all potential hazards of injury.

Observe the site's internal instructions and ensure that the area of operation is always clear and clean. All areas for operation and maintenance must be kept easy to access.

2.6 Safety Instructions for Maintenance

Risk of injury in case of uninformed maintenance

If maintenance tasks are performed by untrained personnel, this may lead to risks of personal injury and damage to the equipment.

To avoid these risks, maintenance tasks may only be performed by trained personnel.

Risk of damaging mechanical parts

To avoid malfunction and damage to mechanical parts,especially the drawer guide rails (3 in Figure 4-1), do not apply liquid cleaning agents such as contact spray.

3 System Overview and Usage

The RF Shielded Box is an adaptation platform, built for the testing of electronic devices with RF interfaces, especially

- Mobile phones
- PDAs
- Radio keys
- WLAN / Wi-Fi modules
- Bluetooth® modules, etc.

The R&S TS7124M is used in production, for service, repairs and other applications.

For radiation testing, the DUT is inserted into the chamber by means of a drawer, which is closed by a tightly sealing door. Antennas installed on the inside of the RF Shielded Box then interact with the DUT by emitting or receiving electromagnetic radiation. The antennas can be placed and oriented in a customer-specific geometrical arrangement.

Submitting a DUT to conducted instead of radiated RF signals via feedthroughs for RF cables (or guiding conducted RF signals away from the DUT) can be applied as an alternative or supplement to antennas.

The susceptibility and behavior of the DUT can be monitored via USB or D-Sub feedthrough connections, which can also be used to send control commands to the DUT. For this purpose, it is recommended to use version 1525.8564.12 of the RF Shielded Box with two feedthrough ports in the front door.

To minimize redundancy in the manual, most of the descriptions refer to this RF Shielded Box version. However, the descriptions apply in a similar way to the basic version 1525.8564.02 that does not feature port openings for front feedthroughs.

Control signals and measured signals may typically be managed by a customer-specific test system. This could be designed to handle one individual RF Shielded Box, or several, or even a large number of chambers. The test system may typically comprise:

- Signal generators
- RF cables
- Signal switch boxes
- Signal analyzers
- Data recorders
- A computer-based control system
- Racks for mounting multiple RF Shielded Boxes

4 Hardware Description

This chapter describes all components of the RF Shielded Box. It also provides some information on their use and function (for more, see Chapter 3, "System Overview and Usage", on page 16).

For operation issues, see Chapter 6, "Putting into Operation", on page 68.

For configuration issues, see Chapter 7, "Configuration", on page 77.

For maintenance issues, see Chapter 8, "Maintenance", on page 153

4.1 Hardware Overview

4.1.1 Front Tour

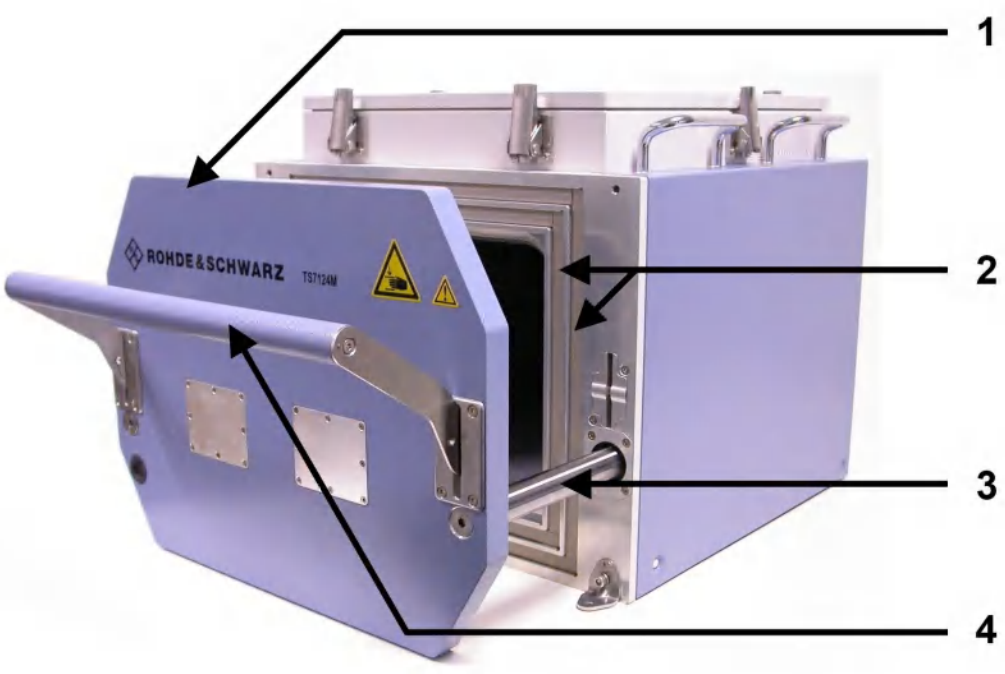


Figure 4-1: Front view of the opened RF Shielded Box

1 = Front door of the drawer (RF Shielded Box version 1525.8564.12), for DUT exchange
2 = Two grooves filled with elastic gasket for sealing the drawer's door
3 = Drawer guide rail
4 = The door's handle, here lifted up to the "open" position

The front drawer (1) of the RF Shielded Box is used for insertion of the DUT. The drawer guide rails (3, one on each side) support the drawer when it is manually opened and closed by means of the handle (4).

The polymeric gasket (2) features a conductive chromated aluminum surface to prevent leakage of RF radiation out of the chamber, and into it. Avoid touching or soiling the gasket. The front door's gasket is highly elastic for a long life over many opening and closing cycles (see Chapter 8.3, "Maintenance Intervals", on page 153).

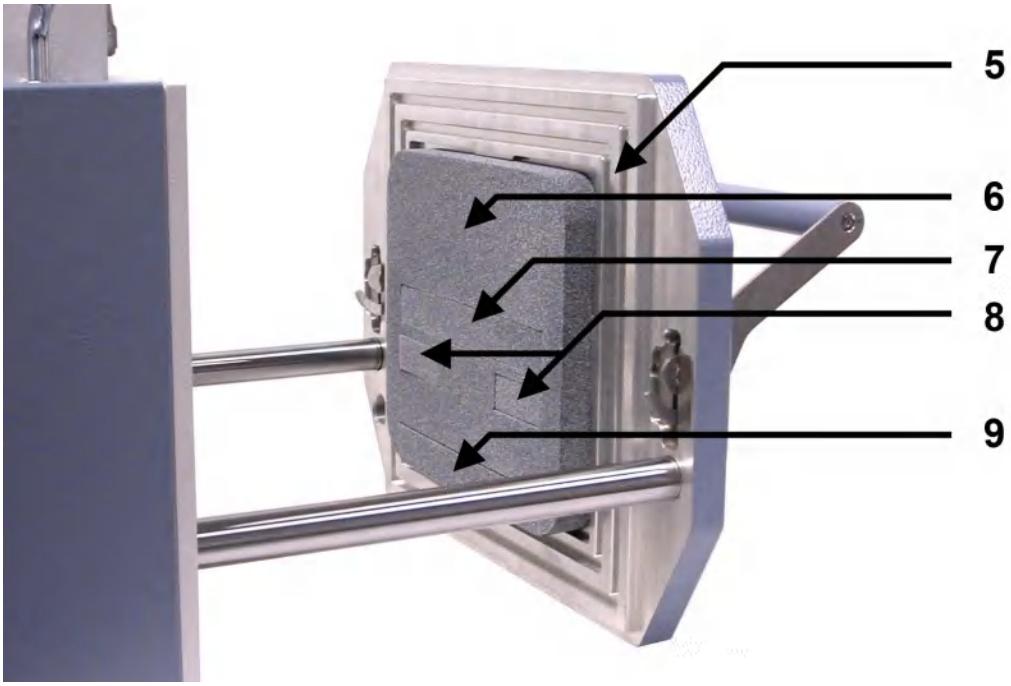


Figure 4-2: Rear view of the drawer door

5 = Profile grooves for sealing the door
6 = RF absorber foam
7 = Upper position inside the drawer door for mounting the DUT holder tray
8 = Two openings in the absorber foam for accessing the feedthroughs (only in RF Shielded Box version 1525.8564.12)
9 = Lower position inside the drawer door for mounting the DUT holder tray

Several profile grooves (5) in the door and an optional absorber plate (6) help to seal the chamber against leakage of electromagnetic radiation.

On the inside of the drawer door of the RF Shielded Box, it is possible to fix various optional DUT holder trays:

- standard or custom-made
- with or without raster for DUT positioning
- directly mounted to the door or fixed with the help of an adapter

Such a tray is intended to hold the DUT during insertion into the chamber and during the test.

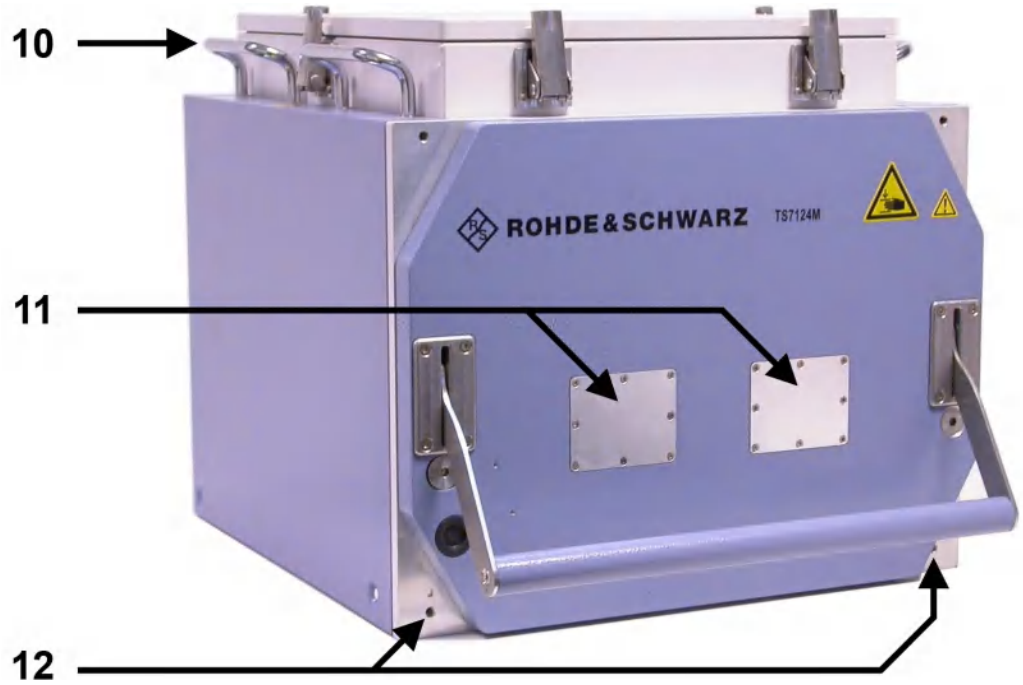


Figure 4-3: Front view of the closed RF Shielded Box

10 = Handles for lifting the RF Shielded Box
11 = Only in RF Shielded Box version 1525.8564.12: two openings in the front door for optional feedthroughs (here covered with two metal plates)
12 = Two front screw holes for mounting brackets (included in shipment)

There are two handles (10) on each side of the RF Shielded Box. If the chamber is lifted or transported (prior to mounting), at least two persons are required for handling it.

Two screw holes (12) at the lower end (and two more at the rear side) serve for fixing the chamber to a stable support by means of special brackets (see Chapter 6.1, "Setup", on page 68).

Various filtered control feedthroughs and RF feedthroughs are available (see Chapter 5, "Accessories", on page 23). They can be mounted in the front door after removing one or both of the metal plates (11) that cover the openings. The interfaces in the feedthroughs can be used for controlling and monitoring a DUT while it is tested inside the closed chamber, or for feeding RF signals through the door to or from the DUT. As the three openings on the rear side of the RF Shielded Box (see Figure 4-4) are numbered 1 to 3, the numbering convention for the two openings on the front side of the chamber is 4 to 5 from left to right.

In Figure 4-3, a few small threaded holes on the outside of the front door can be seen on the lower left side. These are no through holes, the chamber's RF shielding is not impaired. They are intended to screw on a fixture that guides cables from the front feedthroughs to an optional energy chain.

4.1.2 Rear Tour

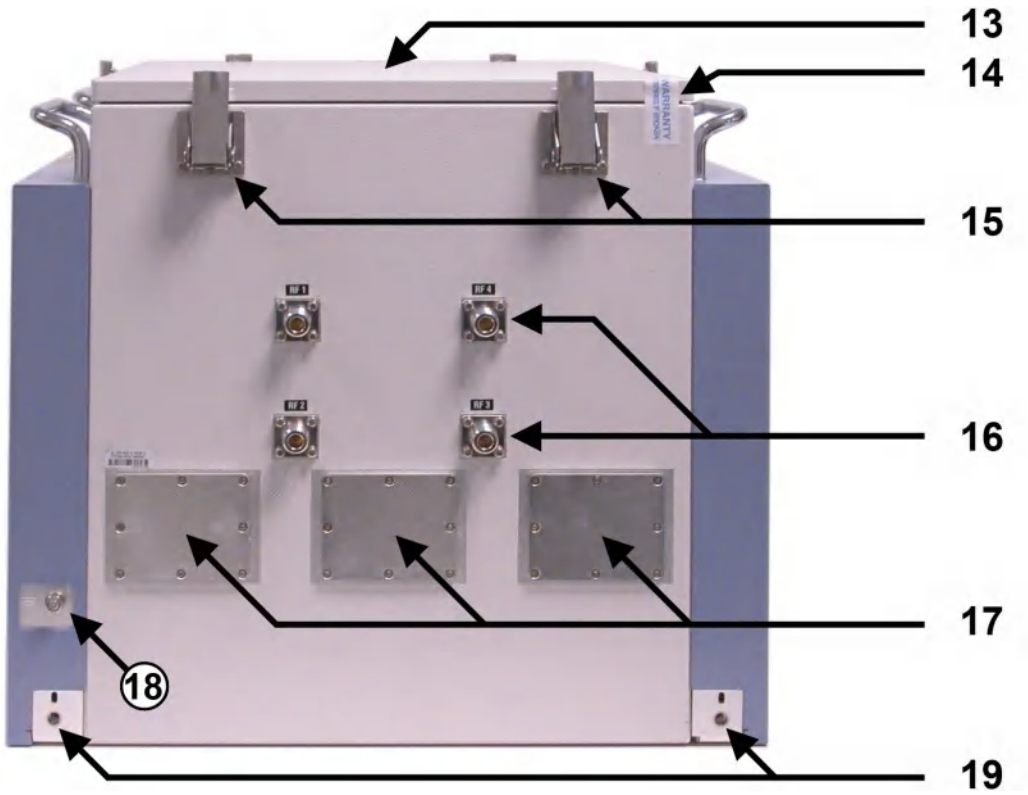


Figure 4-4: Rear side view of the RF Shielded Box

13 = Top cover for configuration and service issues
14 = Warranty seal of the top cover
15 = Six quick clamps of the top cover
16 = Four Rear Feedthroughs for up to four antennas inside the chamber
17 = Three metal plates covering openings in the rear chamber wall for up to three optional feedthroughs, specified in Chapter 5, "Accessories", on page 23
18 = Earth (ground) contact
19 = Two rear screw holes for mounting brackets (included in shipment)

The top cover (13) of the RF Shielded Box is fixed by six quick clamps (15). It can be removed for antenna configuration and service issues (see Chapter 7.1, "Opening and Closing the Top Cover", on page 78).

The warranty seal (14) indicates that the R&S TS7124M is in its original delivery state, with a shielding effectiveness as specified in the data sheet. For configuration of the interior of the RF Shielded Box, the top cover has to be opened and the seal has to be broken. After closing the cover it is in the user's responsibility to restore a good shielding effectiveness. To do so, proceed as described in Chapter 7.1.3, "Adjusting the Locking Force of the Cover", on page 83.

At the rear side of the RF Shielded Box, there are four shielded RF feedthrough connectors (16, see Chapter 4.1.2.1, "Rear Feedthroughs", on page 21). These can be used, e.g., for up to four individual antennas (see Chapter 5, "Accessories", on page 23), or for up to two antennas with dual polarization (see Chapter 5.20, "Cross-Polarized Vivaldi Antenna R&S TS-F24-V3", on page 50).

Three metal cover plates (17) at the rear side of the chamber can optionally be replaced by additional filtered control feedthroughs or RF feedthroughs (see Chapter 5, "Accessories", on page 23). For example, with each Twin N-SMA Feedthrough R&S TS-F24FN1 providing two additional RF feedthroughs (from SMA to N connector), a total of ten individual antennas can be connected inside the RF Shielded Box. For more details, see Chapter 4.1.2.1, "Rear Feedthroughs", on page 21.

Two screw holes (19) at the lower end (and two more at the front side) serve for fixing the chamber to a stable support by means of special brackets (see Chapter 6.1, "Setup", on page 68).

4.1.2.1 Rear Feedthroughs

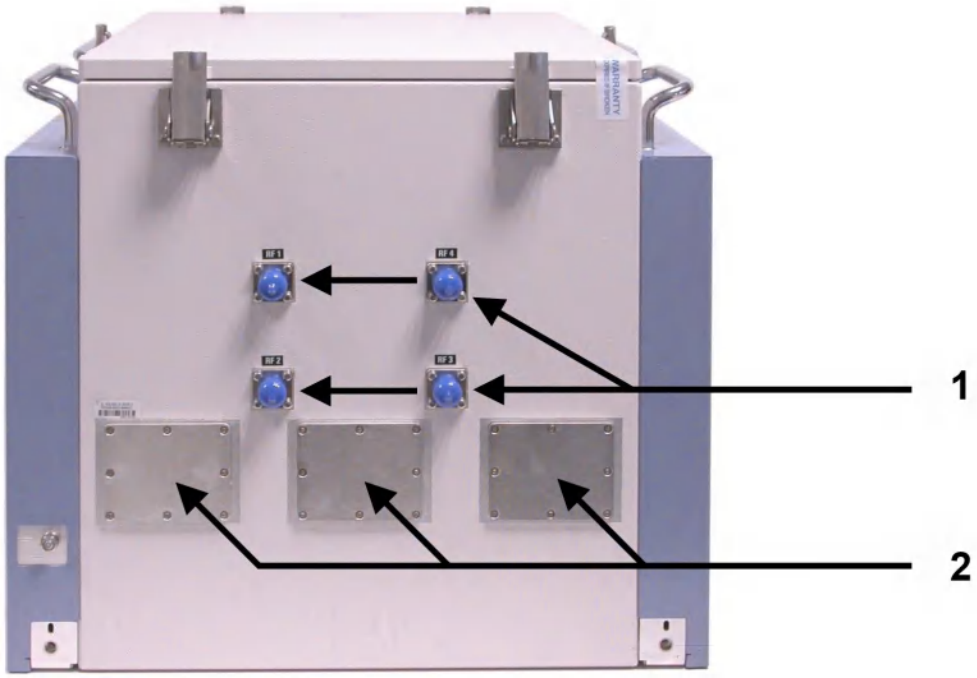


Figure 4-5: Four rear RF feedthroughs and three openings for additional optional feedthroughs

1 = Four N connectors for feeding RF signals through the chamber wall to the antennas
2 = Three metal cover plates for additional exchangeable feedthroughs, specified in Chapter 5, "Accessories", on page 23. The numbering convention for these openings is 1 to 3 from left to right, when seen from the rear side.

The numbering convention of the RF feedthrough connectors (1) is anti-clockwise from 1 to 4, when seen from the rear side of the RF Shielded Box, as shown below:

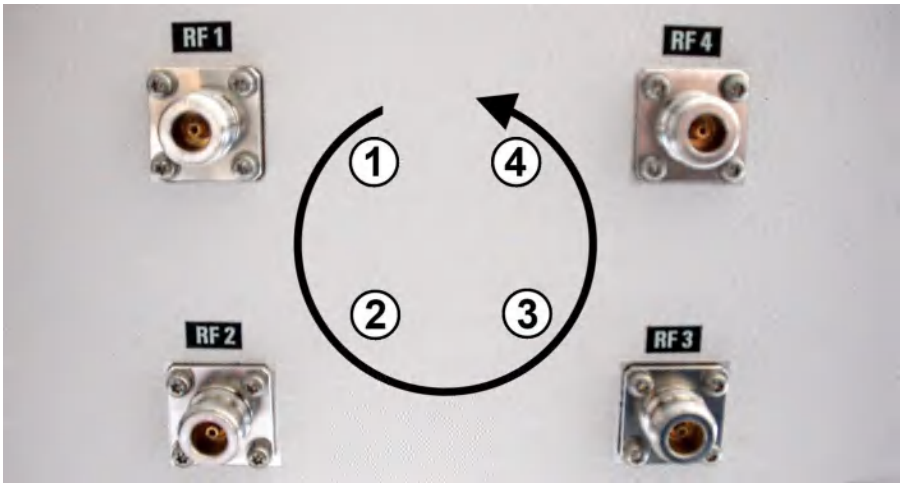


Figure 4-6: Numbering of the RF feedthrough connectors on the rear side of the chamber

When looking from the front into the shielded chamber, the numbering on the inside is clockwise, as shown in the next figure:

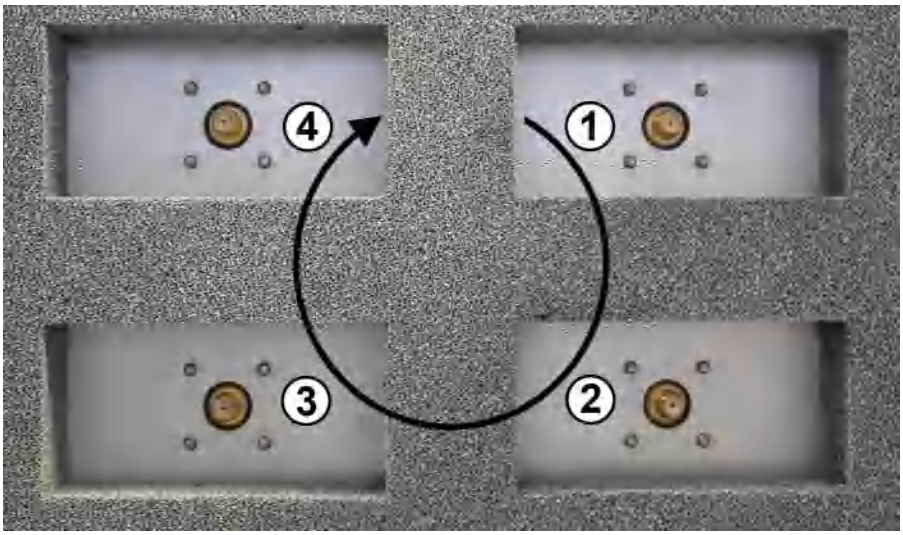


Figure 4-7: Numbering of the RF feedthrough connectors as seen on the inside of the chamber

The three metal cover plates (labeled 2 in Figure 4-5) can be removed to install additional optional filter or RF feedthrough connectors. These openings are numbered 1 to 3 from left to right, when seen from the rear side of the chamber.

NOTICE

Risk of reduced shielding efficiency

If the metal cover plates are replaced by feedthrough connectors, care must be taken to restore the chamber's shielding efficiency. For correct installation, see mounting instructions for feedthrough connectors. If a feedthrough is installed incorrectly, the shielding efficiency may deteriorate dramatically.

5 Accessories

The following accessories are available for the R&S TS7124M:

5.1 Basic Absorber R&S TS-F24ABS

The R&S TS-F24ABS (1525.8593.02) is the basic absorber material placed on the inside of all walls of the chamber, including the door, the top cover and the ground. Optionally, the RF Shielded Box can be ordered without these absorbers, but for most applications (and for this user manual) it is assumed that it would typically be installed in the chamber.

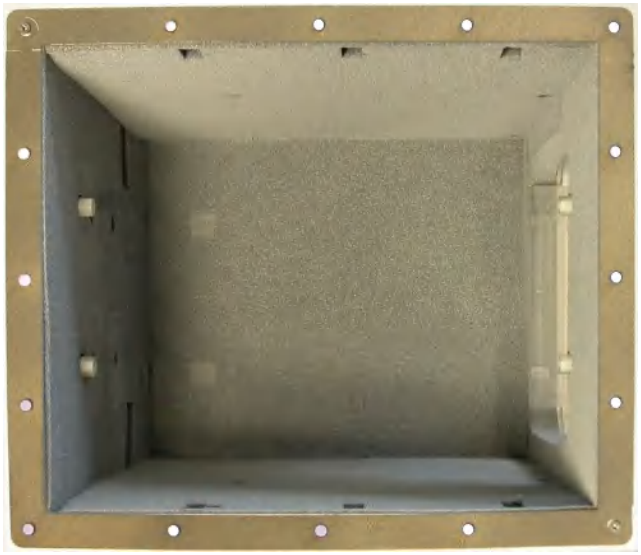


Figure 5-1: Empty chamber with basic absorber material (seen from top, cover removed)

The absorber type Eccosorb LS22 from Emerson and Cuming is used, featuring the following properties:

Absorber material properties	at 3 GHz	at 10 GHz
Attenuation (dB/cm)	7.4	14.9
Relative Impedance ($\|Z\|/Z_0$)	0.55	0.74

Depending on the accessories installed inside the RF Shielded Box, different configurations of absorber material are provided for the chamber's top cover:

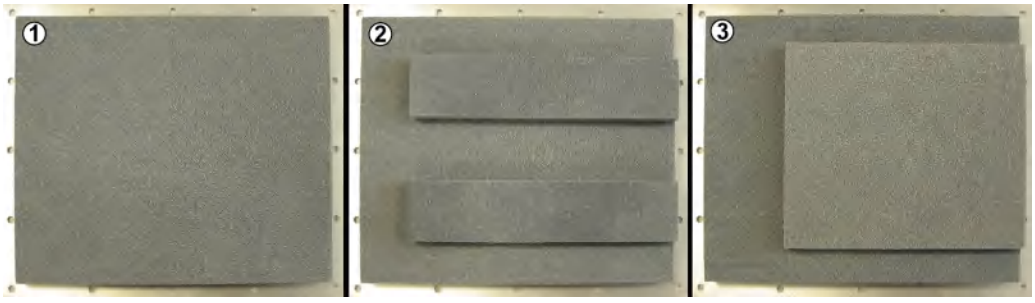


Figure 5-2: Different absorber material configurations on the inside of the top cover. In these pictures, the "FRONT" edge of the cover is on the right-hand side

1 = Standard absorber for use with Narrowband Antenna R&S TS-F24NB2
2 = Absorber for use with Half Antenna Ring R&S TS-F24-AH1 or Full Antenna Ring R&S TS-F24-AR
3 = Absorber for use with Wideband Antenna R&S TS-F24WA1

All three absorber material configurations are compatible with antennas mounted on the Antenna Holder R&S TS-F24-AH2.

If the basic absorber material is damaged, it has to be replaced.

5.2 DUT Holder Tray R&S TS-F24P1

The R&S TS-F24P1 (1525.8664.02 or 1525.8664.04) is an optional tray for holding a DUT in a defined position. The maximum load on the tray is 1 kg.

Variant **.02**: DUT holder tray pre-mounted in the upper position of the chamber door, see Figure 5-5.

Variant **.04**: DUT holder tray pre-mounted in the lower position.

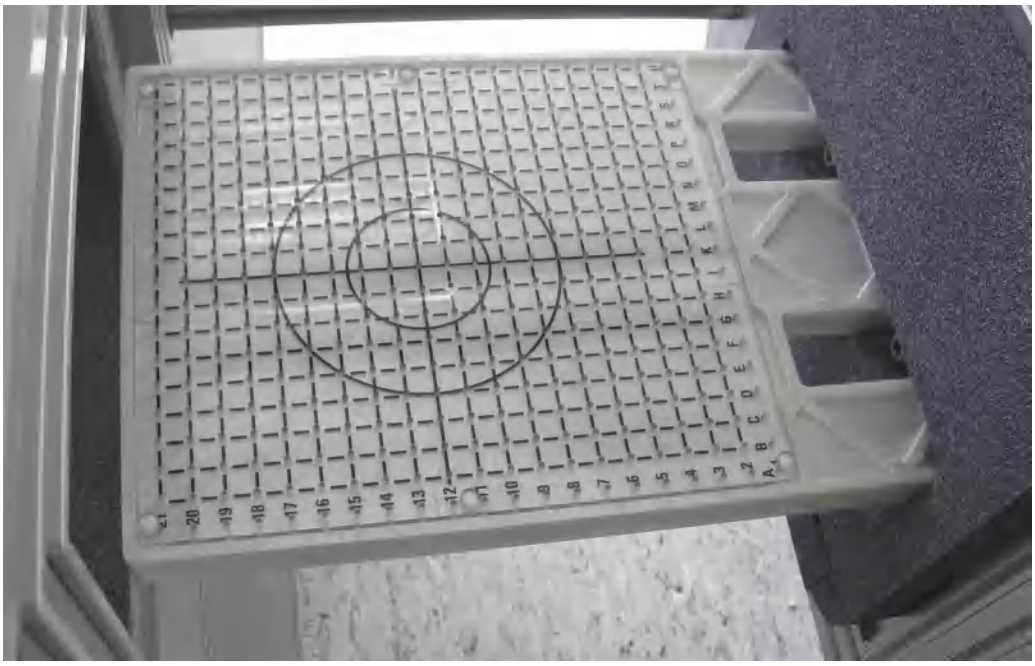


Figure 5-3: DUT holder tray (R&S TS-F24P1)

The DUT holder tray is mounted on the inside of the drawer door with two hexagon socket screws. To loosen or tighten the screws, use a 5 mm hex key with ball end:

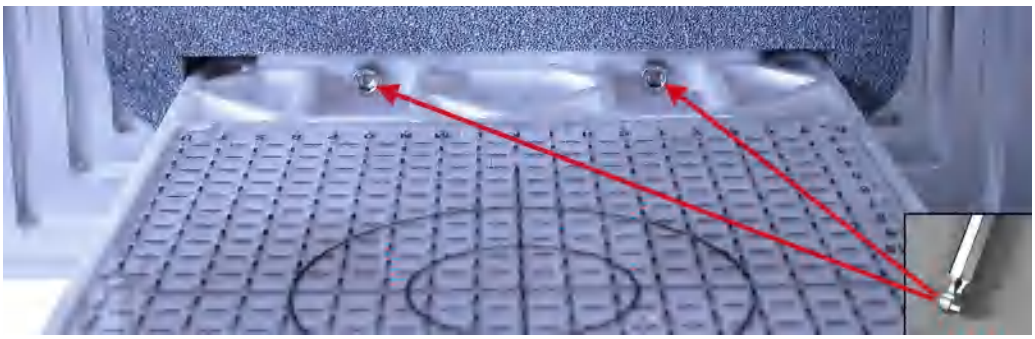


Figure 5-4: Mounting the DUT holder tray on the inside of the drawer door

The DUT holder tray is mounted either in a lower or a higher position on the inside of the drawer door.

For an instruction on how to change that position, see Chapter 6.1.7, "Mounting a DUT Holder Tray", on page 73.

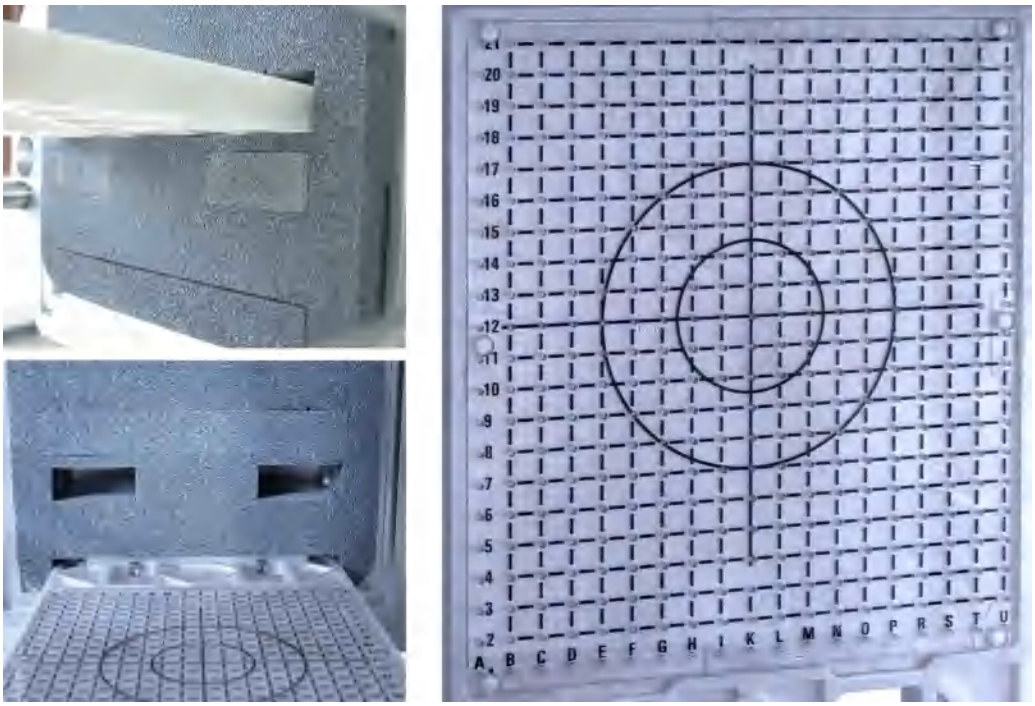


Figure 5-5: DUT holder tray mounted at the drawer door

Top left = Variant 1525.8664.02, tray pre-mounted in the upper position
Lower left = Variant 1525.8664.04, tray pre-mounted in the lower position
Right = Tray with printed raster from A to U and from 1 to 21 for reproducible DUT positioning

If the full antenna ring is placed in the chamber, the DUT holder tray must **not** be mounted in the **lower position**, to avoid a collision.

See "Risk of tray collision with the full antenna ring" on page 74

The DUT holder tray is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.3 Half Antenna Ring R&S TS-F24-AH1

The R&S TS-F24-AH1 (Rohde & Schwarz order number 1525.8887.02) is an optional antenna mounting structure to be placed inside the RF Shielded Box, in the upper half of it. Hence, this antenna ring is called "half antenna ring" to differentiate it from the Full Antenna Ring R&S TS-F24-AR that fills the whole chamber.

It would be possible to place two half antenna rings inside the R&S TS7124M, but this setup is not recommended, since it is not stable. If necessary, use the full antenna ring instead.

The half antenna ring is compatible with the following antennas on their antenna fixtures:

- Vivaldi Antenna R&S TS-F24-V1
- Vivaldi Antenna R&S TS-F24-V2
- Cross-Polarized Vivaldi Antenna R&S TS-F24-V3
- Additionally, each Vivaldi antenna can be mounted on the 45° Adapter for Lateral Antenna Tilt R&S TS-F2X-VH4, which is also compatible with the half antenna ring.

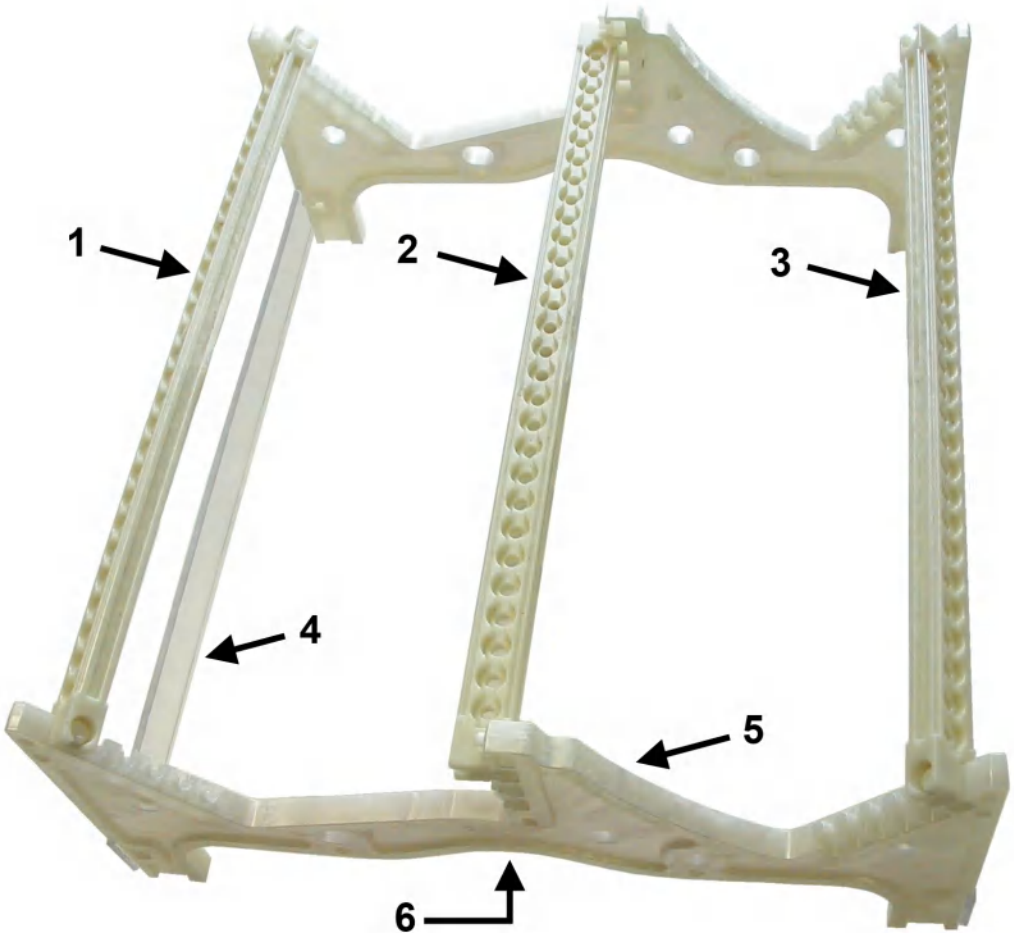


Figure 5-6: Half antenna ring with three rails (or antenna ring bars, or cross struts)

1 = Rail 1
2 = Rail 2
3 = Rail 3
4 = Stiffening rib (one on the left, one on the right-hand side)
5 = Half antenna ring plate (one in the front, one rear)
6 = Label "FRONT", indicating the front side of the half antenna ring

The rails (or bars, or cross struts) in the half antenna ring are numbered 1 - 2 - 3 from left to right as shown in Figure 5-6, seen from the front of the RF Shielded Box.

Various antennas can be mounted to the rails by means of special antenna fixtures:

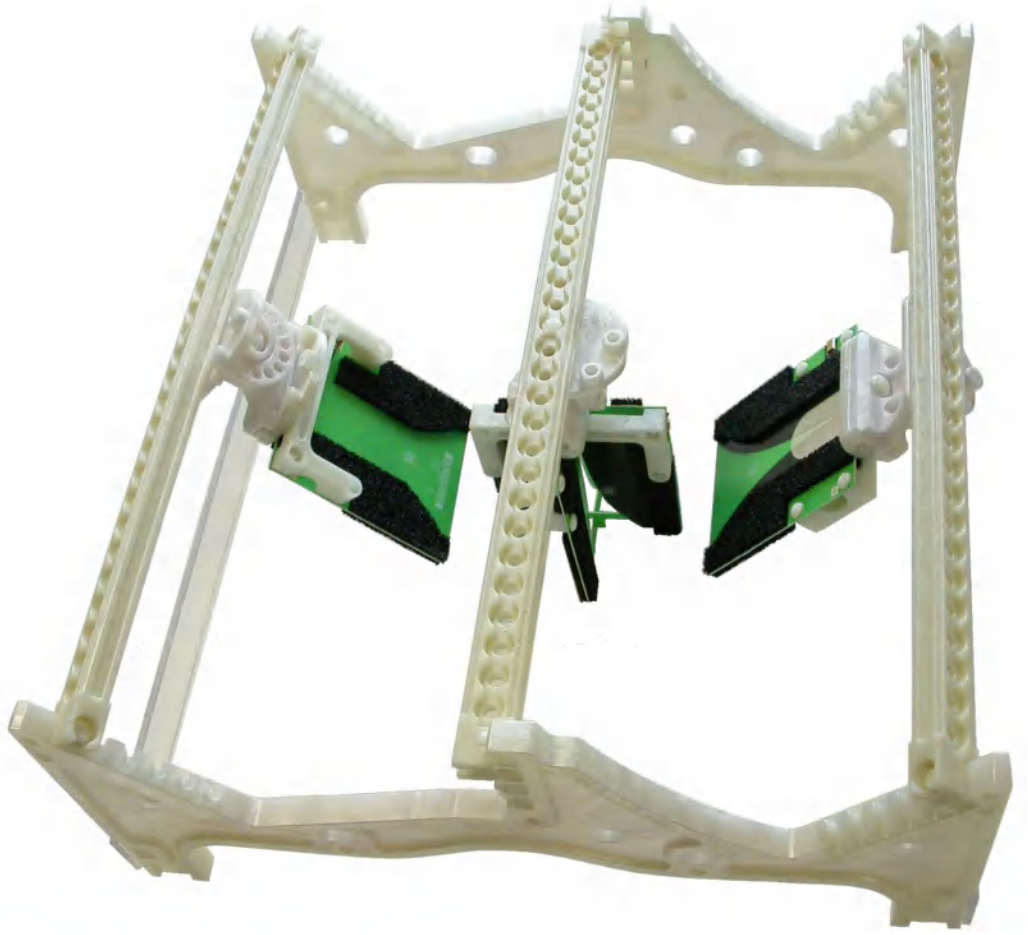


Figure 5-7: Half antenna ring with three Vivaldi antennas mounted on 45° adapters (here: not tilted)

Figure 5-8: Expanding rivet

a = Drive pin and expansion peg
b = The drive pin is inserted into the expansion peg

Expanding rivets as shown above serve for keeping the antenna ring components together, as shown below, and also for mounting antennas onto their fixtures (see Figure 5-11).

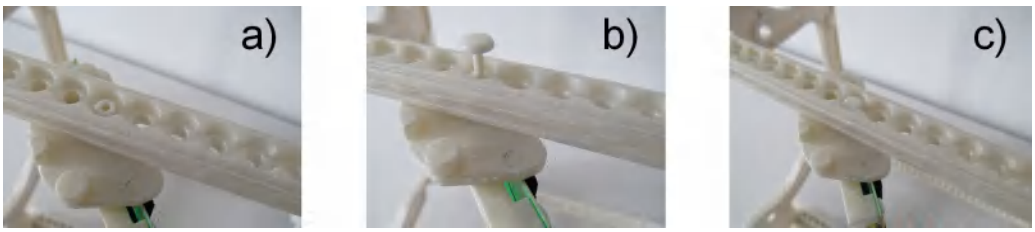


Figure 5-9: Mounting an antenna on the antenna ring bar (or rail)

a = Place the antenna fixture in the desired position and insert the expansion peg (through the rail)
b = Insert the drive pin into the expansion peg
c = Push the drive pin all the way into the expansion peg

For removing an expanding rivet, carefully push back the drive pin from the opposite side. A small tool tip (flat screw driver) is helpful for this purpose. Alternatively, lift the cap of the rivet's drive pin with a slim pointed tool.

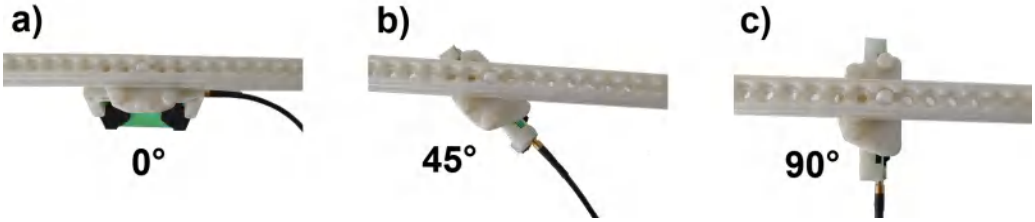


Figure 5-10: Variable orientation of a Vivaldi antenna on the rails of the half antenna ring

a = Antenna in 0° axial rotation
b = Antenna in 45° axial rotation
c = Antenna in 90° axial rotation

The antenna fixture and antenna ring bar allow changing the rotational orientation of an antenna in angular steps of 45° as in Figure 5-10.

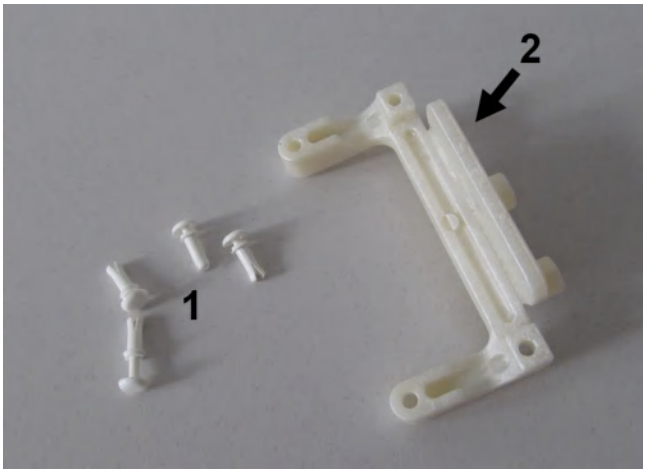


Figure 5-11: Antenna fixture with expanding rivets

1 = Expanding rivets
2 = Antenna fixture

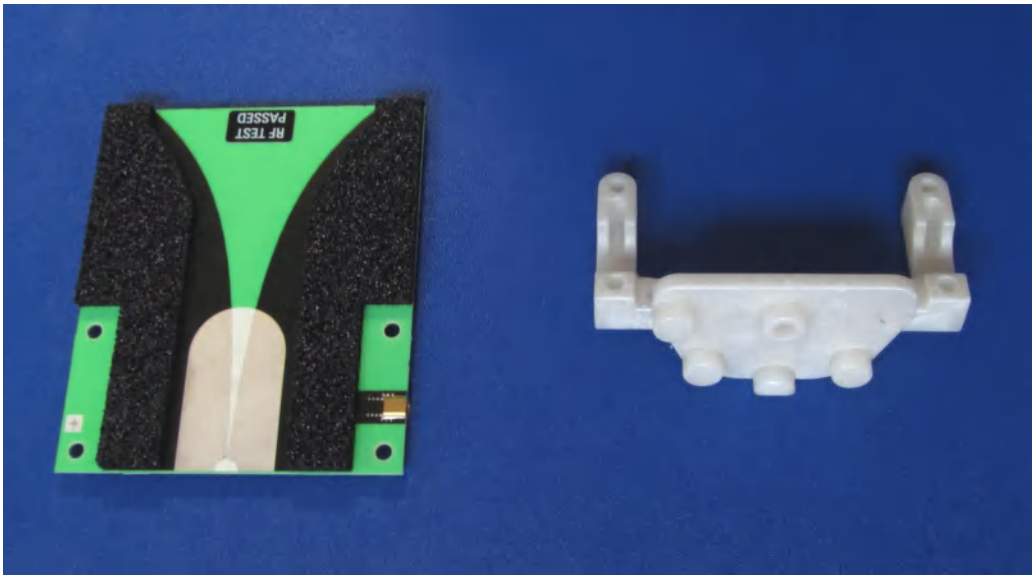


Figure 5-12: One of the Vivaldi antennas and its fixture

Mounting procedure for Vivaldi antennas and their fixtures

To mount a Vivaldi antenna onto its fixture, proceed as follows:

1. Place the antenna on the fixture, with holes aligned, oriented as in Figure 5-12 (SMP connector on the right).
2. Insert four expansion pegs into the holes.
3. While keeping the antenna and fixture in close contact, insert the drive pins into the expansion pegs.
4. Push the drive pins all the way into the expansion pegs.

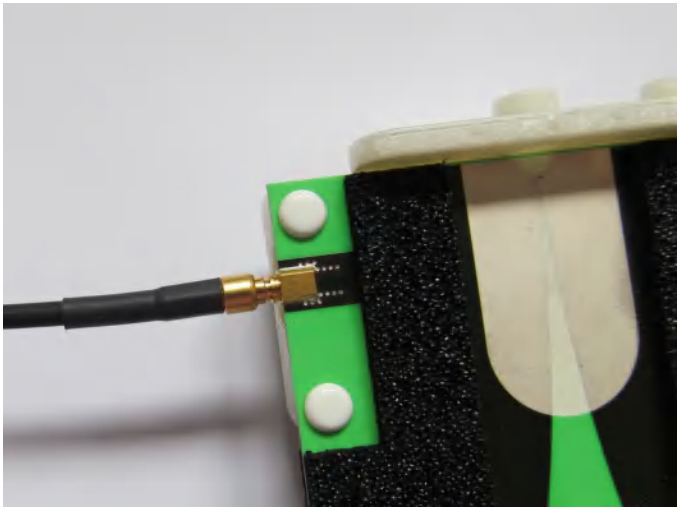


Figure 5-13: Vivaldi antenna with antenna fixture and SMP connection

You can mount the half antenna ring into the RF Shielded Box.

The mounting procedure is described in Chapter 7.2.2, "Mounting the Half Antenna Ring into the Chamber", on page 90.

The half antenna ring is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.4 Half Antenna Ring with Three Vivaldi Antennas R&S TS-F24-AH3

The R&S TS-F24-AH3 (1530.5999.02 or 1530.5999.04) is a Half Antenna Ring R&S TS-F24-AH1, equipped with three Vivaldi antennas.

Variant **.02**: antenna ring pre-installed with three Vivaldi Antenna R&S TS-F24-V1.

Variant **.04**: antenna ring pre-installed with three Vivaldi Antenna R&S TS-F24-V2.

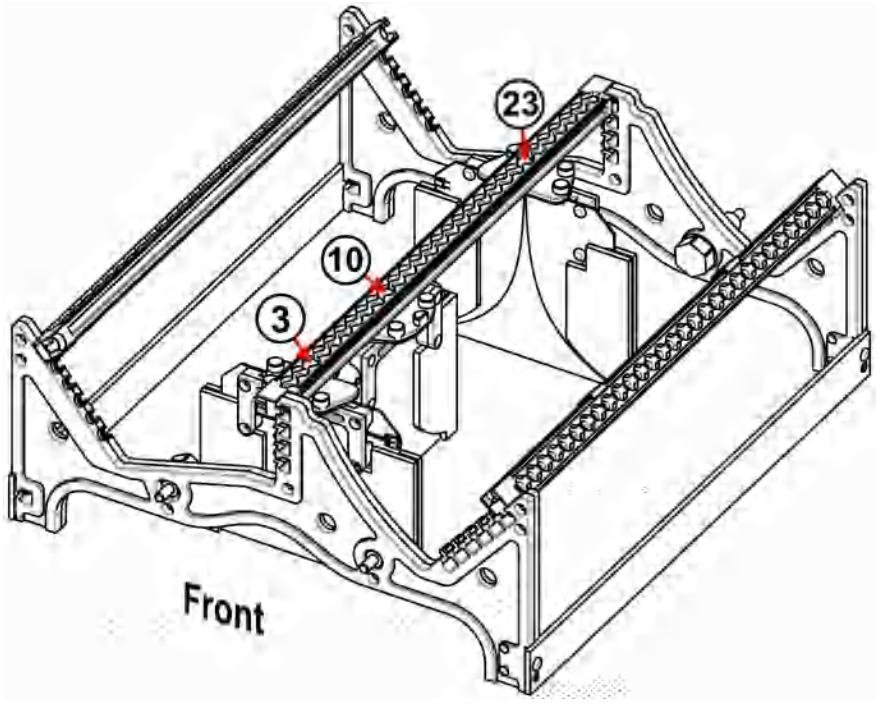


Figure 5-14: Half antenna ring with three Vivaldi antennas (V1 or V2)

3 = Vivaldi antenna on rail 2, top, position 3 (3rd hole), rotation 90°
10 = Vivaldi antenna on rail 2, top, position 10 (10th hole), rotation 0°
23 = Vivaldi antenna on rail 2, top, position 23 (23rd hole), rotation 90°

The antennas are mounted on the center rail (rail 2), which is mounted in position 4 (top of the antenna ring). On the rail, the three antennas are mounted in positions/ holes 3, 10 and 23, as indicated in Figure 5-14. The first and the third antennas are mounted in 90° angular position. The second (center) antenna is mounted in 0° angular position.

Apart from the fact that the antennas are pre-installed in the antenna ring, all details are as described in

- Chapter 5.3, "Half Antenna Ring R&S TS-F24-AH1", on page 26
- Chapter 5.18, "Vivaldi Antenna R&S TS-F24-V1", on page 47
- Chapter 5.19, "Vivaldi Antenna R&S TS-F24-V2", on page 49
- Chapter 7.2, "Installation of an Antenna Ring or Holder", on page 85
- Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118

The antenna ring and the antennas are no serviceable parts. If they are defective or not working correctly, they have to be replaced.

5.5 Full Antenna Ring R&S TS-F24-AR

The R&S TS-F24-AR (Rohde & Schwarz order number 1525.8906.02) is an optional antenna mounting structure to be placed inside the RF Shielded Box. This antenna ring is called "full antenna ring" to differentiate it from the Half Antenna Ring R&S TS-F24-AH1 that fills the upper half of the chamber.

The full antenna ring is compatible with the following antennas on their antenna fixtures:

- Vivaldi Antenna R&S TS-F24-V1
- Vivaldi Antenna R&S TS-F24-V2
- Cross-Polarized Vivaldi Antenna R&S TS-F24-V3
- Additionally, each Vivaldi antenna can be mounted on the 45° Adapter for Lateral Antenna Tilt R&S TS-F2X-VH4, which is also compatible with the full antenna ring.

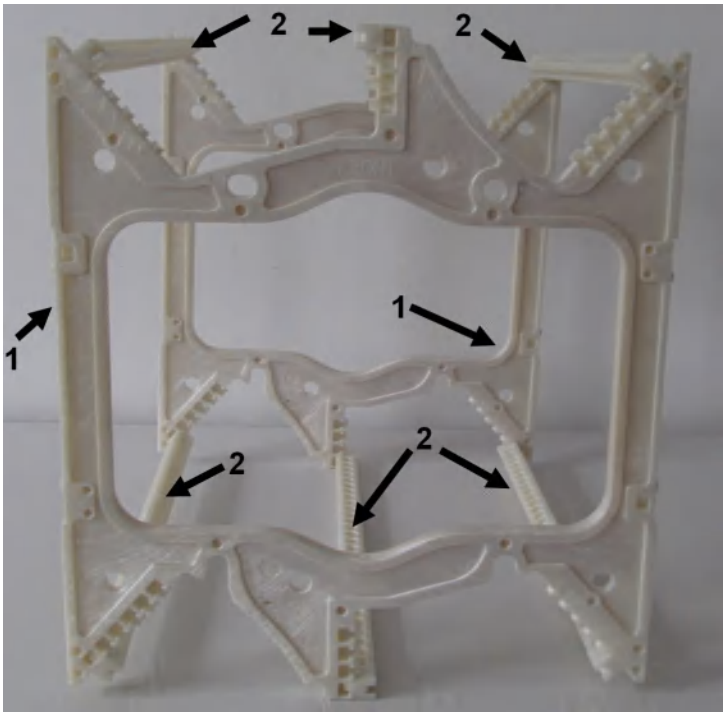


Figure 5-15: Full antenna ring

1 = Antenna ring plate (one in the front, one rear)
2 = Antenna ring bar (or rail, or cross strut)

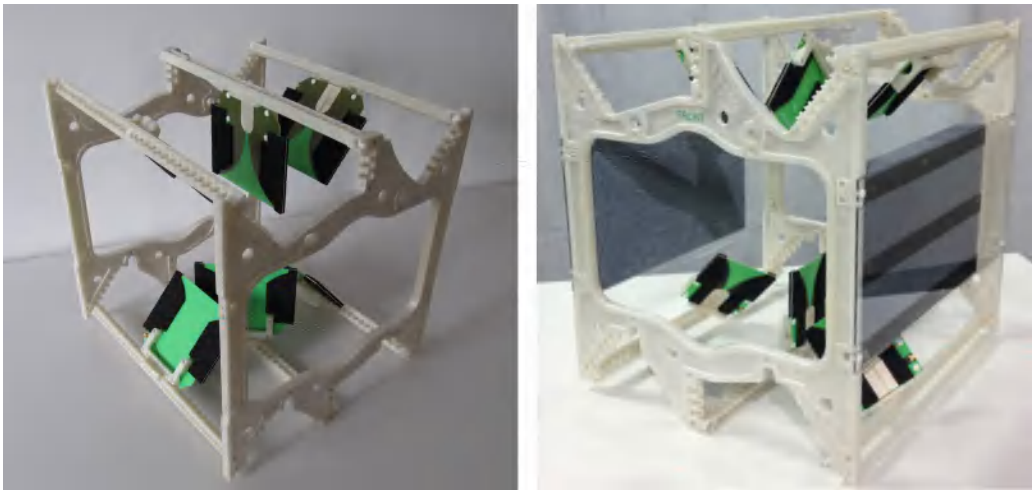


Figure 5-16: Antenna ring with six Vivaldi antennas, right: with two absorber brackets and absorbers

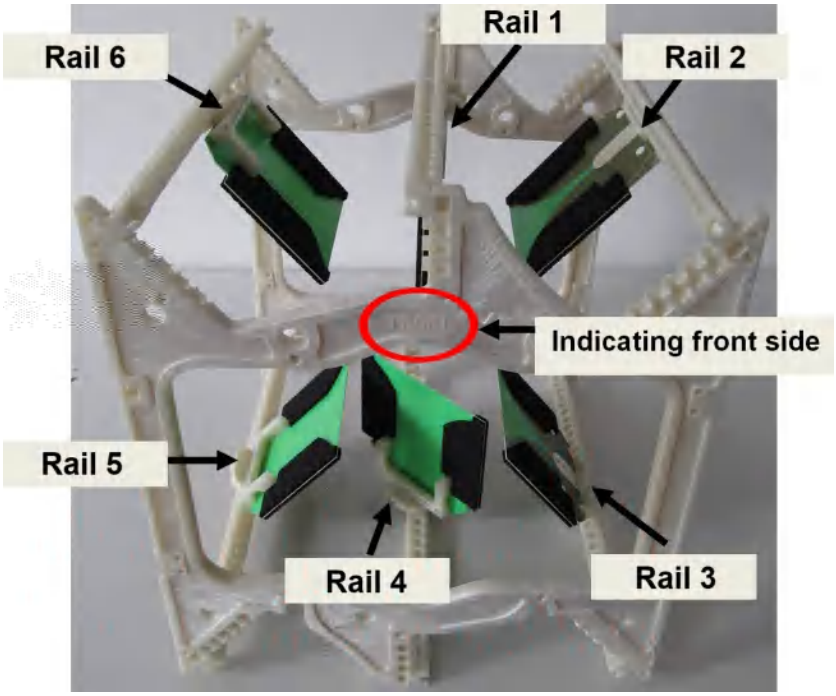


Figure 5-17: Convention of numbering antenna ring bars (rails) in the full antenna ring

Rail 1 = Antenna ring bar in 0° position
Rail 2 = Antenna ring bar in 45° position
Rail 3 = Antenna ring bar in 135° position
Rail 4 = Antenna ring bar in 180° position
Rail 5 = Antenna ring bar in 225° position
Rail 6 = Antenna ring bar in 315° position

The full antenna ring in Figure 5-17 shows numbered rails. The view of the figure is from the front of the RF Shielded Box. Looking inside the chamber through the opened drawer, the antenna ring bars are numbered clockwise, starting with "Rail 1" in the 0° (or 12 o'clock) position.

Expanding rivets that keep most of the antenna ring components together are shown in Figure 5-8. Mounting and orientation of the antenna fixtures and antennas is shown in Figure 5-9 and Figure 5-10.

You can mount the full antenna ring into the RF Shielded Box.

The mounting procedure is described in Chapter 7.2.4, "Mounting the Full Antenna Ring into the Chamber", on page 102.

The full antenna ring is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.6 Full Antenna Ring with Three Vivaldi Antennas R&S TS-F24-AR3

The R&S TS-F24-AR3 (1530.6008.02 or 1530.6008.04) is a Full Antenna Ring R&S TS-F24-AR, equipped with three Vivaldi antennas.

Variant **.02**: antenna ring pre-installed with three Vivaldi Antenna R&S TS-F24-V1.

Variant **.04**: antenna ring pre-installed with three Vivaldi Antenna R&S TS-F24-V2.

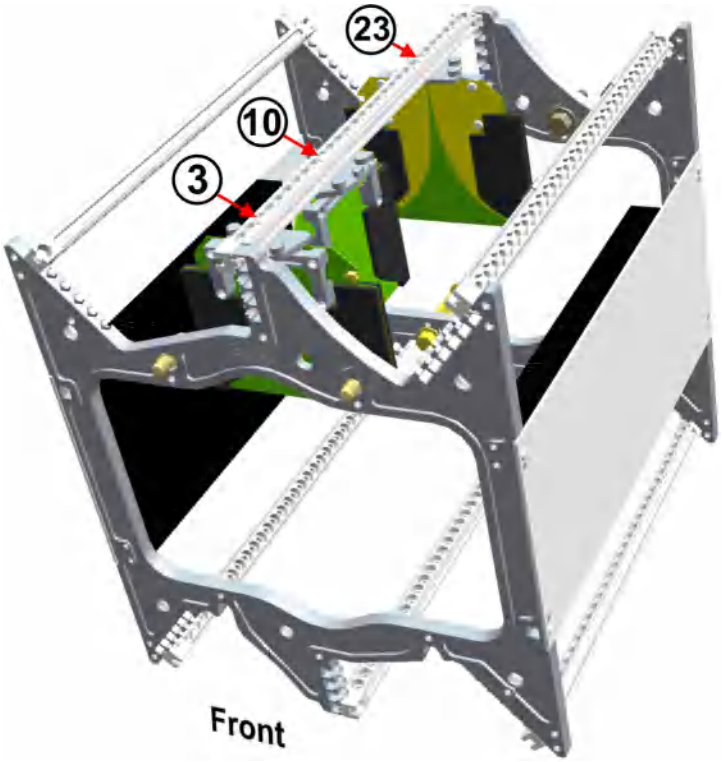


Figure 5-18: Full antenna ring with three Vivaldi antennas (V1 or V2)

3 = Vivaldi antenna on rail 1, top, position 3 (3rd hole), rotation 90°
10 = Vivaldi antenna on rail 1, top, position 10 (10th hole), rotation 0°
23 = Vivaldi antenna on rail 1, top, position 23 (23rd hole), rotation 90°

The antennas are mounted on the top center rail (rail 1), which is mounted in position 4 (top of the antenna ring). On the rail, the three antennas are mounted in positions/ holes 3, 10 and 23, as indicated in Figure 5-14. The first and the third antennas are mounted in 90° angular position. The second (center) antenna is mounted in 0° angular position.

Apart from the fact that the antennas are pre-installed in the antenna ring, all details are as described in

- Chapter 5.3, "Half Antenna Ring R&S TS-F24-AH1", on page 26
- Chapter 5.18, "Vivaldi Antenna R&S TS-F24-V1", on page 47
- Chapter 5.19, "Vivaldi Antenna R&S TS-F24-V2", on page 49

- Chapter 7.2, "Installation of an Antenna Ring or Holder", on page 85
- Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118

The antenna ring and the antennas are no serviceable parts. If they are defective or not working correctly, they have to be replaced.

5.7 Antenna Holder R&S TS-F24-AH2

The R&S TS-F24-AH2 (Rohde & Schwarz order number 1525.8893.x2) is an optional antenna mounting structure for one, two or three Vivaldi antennas.

The antenna holder is compatible with the following antennas on their antenna fixtures:

- Vivaldi Antenna R&S TS-F24-V1
- Vivaldi Antenna R&S TS-F24-V2
- Cross-Polarized Vivaldi Antenna R&S TS-F24-V3
- Additionally, each Vivaldi antenna can be mounted on the 45° Adapter for Lateral Antenna Tilt R&S TS-F2X-VH4, which is also compatible with the antenna holder.

Alternatively, you can use the antenna holder to mount an LF Loop Antenna R&S TS-F24HLF1, as described in Chapter 7.6, "Installation of the LF Loop Antenna", on page 147.

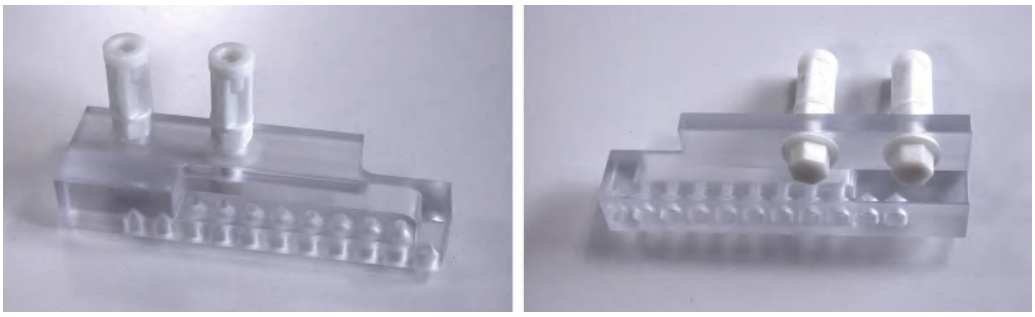


Figure 5-19: Two views of the antenna holder without antenna

The antenna holder is available in three versions:

- Basic holder without antenna (order number 1525.8893.**02**), see Figure 5-19, consisting of
  - Antenna holder rail
  - Two polymer bolts
  - Two polymer spacers
  - One antenna cable with SMA and SMP connectors, length 20 cm (Rohde & Schwarz order number 1530.6066.00)
- The basic holder with an additional Vivaldi Antenna R&S TS-F24-V1 (order number 1525.8893.**12**), see Figure 5-20 (left-hand side)
- The basic holder with an additional Vivaldi Antenna R&S TS-F24-V2 (order number 1525.8893.**22**), see Figure 5-20 (right-hand side)

Note: An expanding rivet for the connection between antenna fixture and antenna holder is delivered with the antenna (part of the antenna fixture kit).

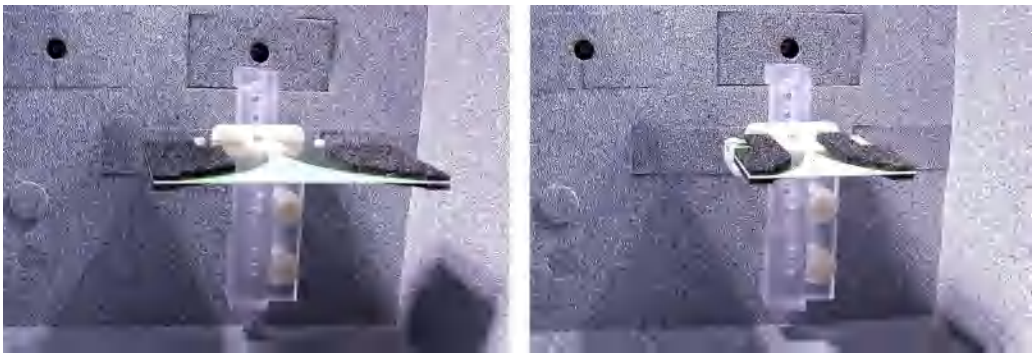


Figure 5-20: Antenna holder mounted inside the chamber at the rear wall with one Vivaldi antenna

Left = Antenna holder with Vivaldi Antenna R&S TS-F24-V1
Right = Antenna holder with Vivaldi Antenna R&S TS-F24-V2

To mount a Vivaldi antenna onto its fixture (see Figure 5-11), proceed as described in the "Mounting procedure for Vivaldi antennas and their fixtures" on page 30.

You can mount the antenna holder at the inside rear wall of the RF Shielded Box, either left or right.

The mounting procedure is described in Chapter 7.2.6, "Mounting the Antenna Holder into the Chamber", on page 113. The configuration is described in Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118 and Chapter 7.3.2, "Definition of Antenna Positions on the Antenna Holder", on page 126.

The antenna holder is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.8 Twin N-SMA Feedthrough R&S TS-F24FN1

The R&S TS-F24FN1 (1525.8870.02) is an optional RF feedthrough for 2x N-SMA to connect antennas inside the R&S TS7124M. It allows for adding more RF connections to the four standard RF connectors available on the rear side of the chamber. As the standard RF connectors, the feedthrough has N connectors on the outside of the chamber, and SMA connectors on the inside.

Figure 5-21: Two RF feedthroughs with N and SMA connectors

Left = Outside view with two female N connectors
Right = Inside view with two female SMA connectors

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

When connecting cables to the N or SMA connectors, use a torque wrench and mind the TORQUE RECOMMENDATIONS.

The twin N-SMA feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.9 Four Times SMA-SMA Feedthrough R&S TS-F24FS1

The R&S TS-F24FS1 (1530.1058.02) is an optional RF feedthrough for 4x SMA-SMA connectors to connect antennas inside the R&S TS7124M. It allows for adding more RF connections to the four standard RF connectors available on the rear side of the chamber. The feedthrough has SMA connectors both outside and inside the chamber.

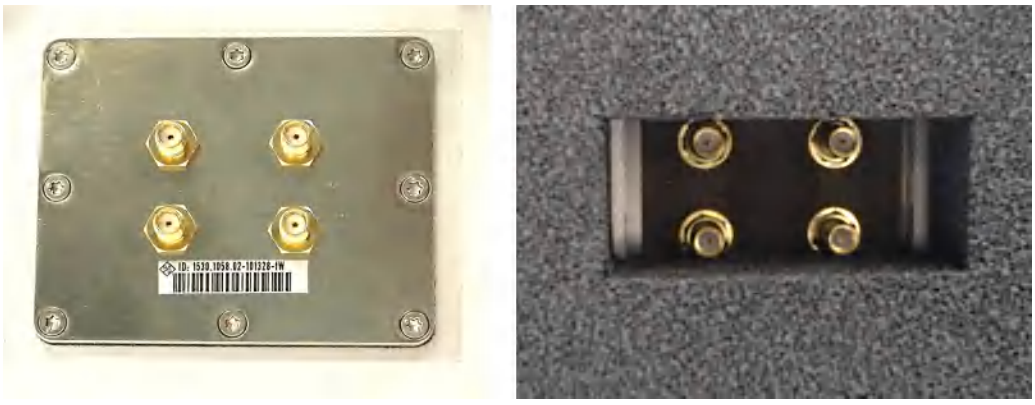


Figure 5-22: Four RF feedthroughs with SMA connectors

Left = Outside view with four female SMA connectors
Right = Inside view with four female SMA connectors

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

When connecting cables to the SMA connectors, use a torque wrench and mind the TORQUE RECOMMENDATIONS.

The 4x SMA-SMA feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.10 PC 2.92 mm Feedthrough R&S TS-F24FK2

The R&S TS-F24FK2 (1530.6372.02/.04) is an RF feedthrough for 2x or 4x PC 2.92 connectors to connect antennas or devices inside the R&S TS7124M. It covers a frequency range up to 40 GHz and has female PC 2.92 mm connectors both outside and inside the chamber.

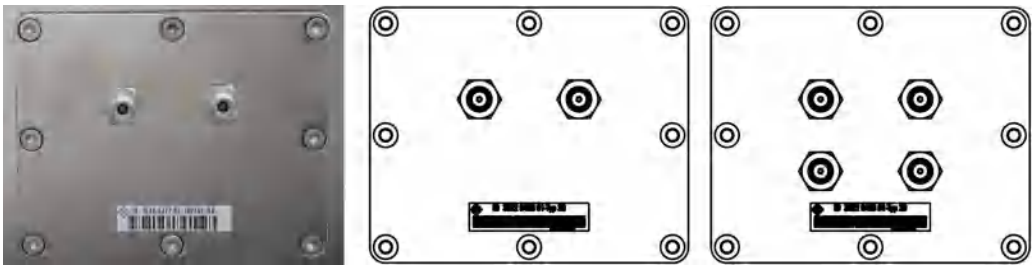


Figure 5-23: RF feedthrough with Female 2.92 mm connectors

Left = Outside view with two female PC 2.92 mm connectors (version .02)
Center = Version .02 with two connectors
Right = Version .04 with four connectors

There are feedthrough versions with 2 and with 4 connectors:

- 2 connectors: order no. 1530.6372.02
- 4 connectors: order no. 1530.6372.04

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

When connecting cables to the SMA connectors, use a torque wrench and mind the TORQUE RECOMMENDATIONS.

The PC 2.92 mm feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.11 Twin PC 1.85 mm Feedthrough R&S TS-F24FV1

The R&S TS-F24FV1 (1532.0836.02) is an RF feedthrough for 2x PC 1.85 connectors to connect antennas or devices inside the R&S TS7124M. It covers a frequency range up to 70 GHz and has female PC 1.85 mm connectors both outside and inside the chamber.

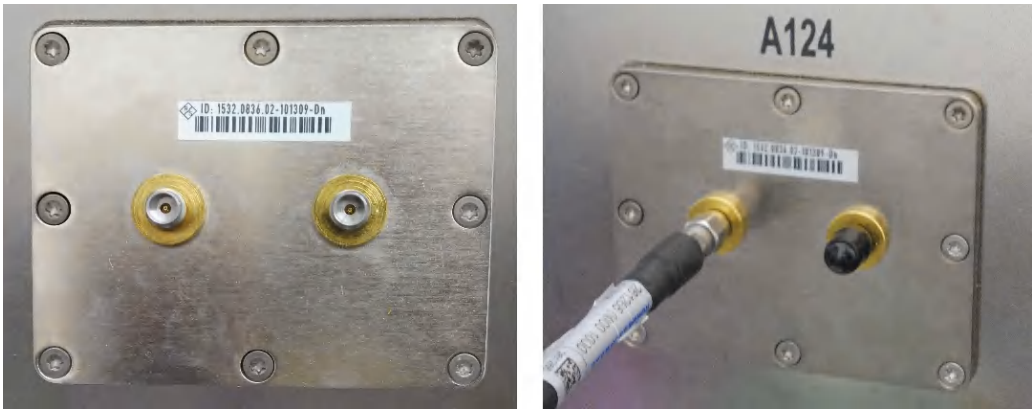


Figure 5-24: Twin RF feedthrough with two female PC 1.85 mm connectors

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

When connecting cables to the SMA connectors, use a torque wrench and mind the TORQUE RECOMMENDATIONS.

The twin PC 1.85 mm feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.12 D-Sub Feedthrough R&S TS-F24FD1

The R&S TS-F24FD1 (1525.8835.02) is an optional filtered feedthrough for serial bus interfaces with D-subminiature connectors (25 pin and 9 pin, respectively).

Figure 5-25: Feedthrough with 25-pin and 9-pin D-Sub connectors

Left = Outside view with female connectors
Right = Inside view with male connectors

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

It allows for directly connecting the serial interfaces of a DUT inside the RF Shielded Box to any compatible device outside the chamber, typically a computer that is part of the test system. This setup enables controlling and monitoring the DUT while it is tested inside the closed chamber.

D-Sub feedthrough properties (identical for 25 pin and 9 pin)	
Filter Circuits	Pi type
3 dB Cutoff Frequency Max.	3.2 MHz
Dielectric Withstanding Voltage	300 V
Working Voltage DC (at -55°C to +125°C)	100 V
Minimum Insertion Loss	5 dB at 10 MHz 9 dB at 20 MHz 19 dB at 50 MHz 30 dB at 100 MHz 43 dB at 200 MHz 62 dB at 500 MHz 70 dB at 1000 MHz 68 dB at 2000 MHz 63 dB at 5000 MHz

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

The filtered D-Sub feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.13 USB 2.0 Feedthrough R&S TS-F24FU1

The R&S TS-F24FU1 (1525.8735.02) is an optional filtered USB 2.0 feedthrough. It allows for directly connecting the DUT inside the chamber to any USB compatible device, typically a computer that is part of the test system. This setup enables controlling and monitoring the DUT while it is tested inside the closed RF Shielded Box.

Figure 5-26: Filtered USB 2.0 feedthrough

Left = Outside view with USB 2.0 Standard B female connector
Right = Inside view with USB 2.0 Standard A female connector

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

The filtered USB 2.0 feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.14 Ethernet (LAN) Feedthrough R&S TS-F24FET

The R&S TS-F24FET (1525.8729.02) is an optional filtered feedthrough for Gigabit Ethernet interfaces (8-pin LAN connectors).

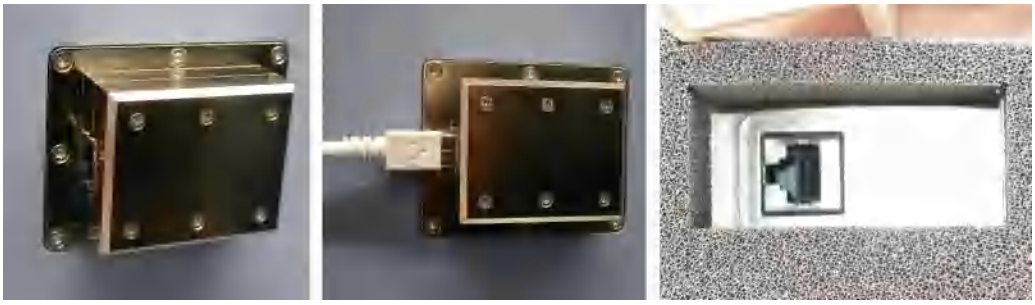


Figure 5-27: Gigabit Ethernet feedthrough for a LAN connection

Left = View from the outside of the chamber, LAN not connected
Center = Outside view, LAN cable connected
Right = Inside view, mounted in the front door (seen below a DUT holder tray), LAN not connected

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

It allows for directly connecting the Gigabit Ethernet interfaces of a DUT inside the RF Shielded Box to any compatible device outside the chamber, typically a computer in the test system. This setup enables communicating with the DUT while it is tested inside the closed chamber.

Ethernet feedthrough properties	
Shielding Effectiveness (with 30 cm LAN cable connected inside the chamber and 100 cm LAN cable connected outside the chamber, open ended)	≥ 70 dB
Filter Circuits	Pi type
Transfer Rate	1 Gbit/s
Power over Ethernet (PoE)	no
Operating Temperature Range	+5°C to +40°C
Storage Temperature Range	-40°C to +70°C

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

The filtered Ethernet feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.15 Fiber-optic Feedthrough R&S TS-F24FP1

The R&S TS-F24FP1 (1525.8864.02) is an optional fiber-optic feedthrough for 4x FSMA. You can use it to connect optical components inside the R&S TS7124M to any compatible device outside the chamber. The feedthrough has four FSMA connectors inside and outside the chamber, respectively.

Figure 5-28: Fiber-optic feedthrough with four FSMA connectors

Left = Outside view with four female FSMA connectors
Right = Inside view with four female FSMA connectors

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

When connecting fiber-optic cables to the FSMA connectors, do not use a wrench, but fix them finger-tight.

The 4x FSMA feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.16 Pneumatic Feedthrough R&S TS-F24FF1

The R&S TS-F24FF1 (1525.8858.02) is an optional 4x pneumatic feedthrough with 4 mm push-pull valves. It allows for connecting pneumatic components inside the R&S TS7124M to any compatible device outside the chamber. The feedthrough has four push-pull valves inside and outside the chamber, respectively.

Figure 5-29: Pneumatic feedthrough with four push-pull valve connectors

Left = Outside view with four female push-pull valves (4 mm inner diameter)
Right = Inside view with four female push-pull valves (4 mm inner diameter)

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

To connect 4 mm pneumatic tubing to this feedthrough, push the tube all the way into the connector, as shown left (1) in Figure 5-30. For best results, use a tube that has a straight cut end (not an angled end).

To disconnect 4 mm pneumatic tubing from this feedthrough, first switch off the pressurized air supply. Then gently pull the tube out of the connector while firmly pushing in the gray ring in the opposite direction, as indicated by the blue arrows (2) in Figure 5-30.

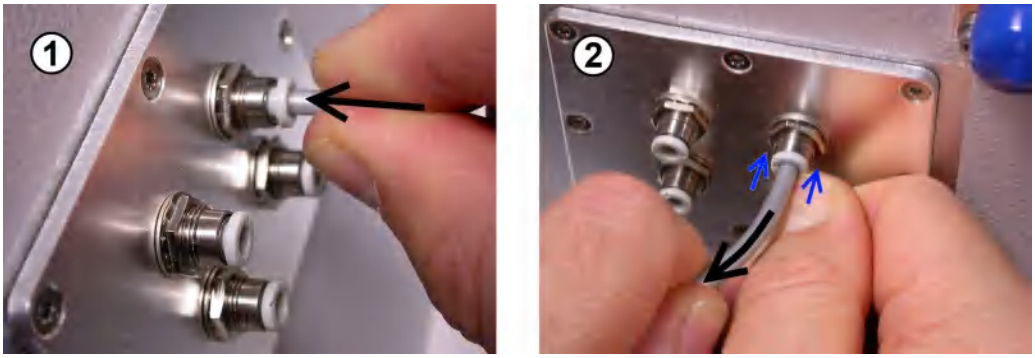


Figure 5-30: Handling pneumatic tubing with the push-pull connector

1 = To connect a 4 mm tube, push it all the way into the connector
2 = To disconnect the tube, switch off the pressurized air supply. Then gently pull the tube out of the push-pull connector while firmly pushing in the gray ring in the opposite direction, as indicated by the blue arrows

The 4x pneumatic feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.17 Power Feedthrough R&S TS-F24FAC1

The R&S TS-F24FAC1 (1526.4840.02) is an optional filtered power feedthrough to provide an AC power supply interface to the chamber interior. It allows connecting components with maximum current consumption of 2 A inside the R&S TS7124M to electrical mains power. The integrated lowpass filter ensures high shielding effectiveness of the AC power supply.

The feedthrough has an IEC C14 male connector and two 2 A fuses on the outside of the chamber, and an IEC C13 female connector inside the chamber. The two exchangeable fuses for electrical safety are type IEC60127-2/5 - T2.0H / 250V, one each for the L and N line.

NOTICE

Risk of damaging the power feedthrough by mechanical shock

The R&S TS-F24FAC1 contains mechanically sensitive filter elements. If the power feedthrough drops or receives a mechanical impact, these elements can easily break or be damaged. A damaged filter element can lead to a shortcut in the feedthrough, which blows one or both fuses.

To avoid this risk, handle the power feedthrough R&S TS-F24FAC1 with care.

Figure 5-31: Electric power feedthrough

Left = Outside view with IEC C14 male connector
Right = Inside view with IEC C13 female connector

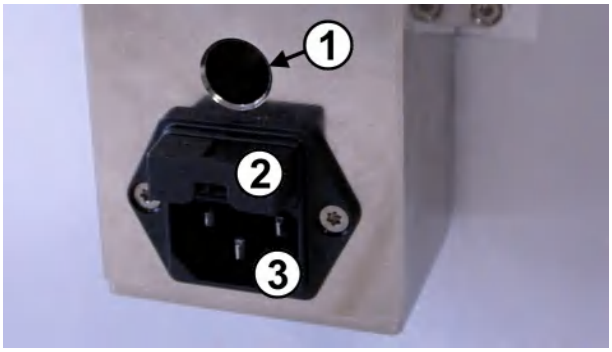


Figure 5-32: Details of the power feedthrough

1 = Hole for one of the eight torx mounting screws
2 = Holder for two fuses (2 A, 250 V), see Figure 5-33
3 = Power and ground contacts of the IEC C14 male connector

For mounting the feedthrough, start with the torx screw in the hole labeled (1) in Figure 5-32. Otherwise, it is difficult to place this screw correctly.

Use the power feedthrough only with 2 A, 250 V fuses. To exchange the fuses, press the latch (labeled (1) in Figure 5-33) and pull out the fuse holder.

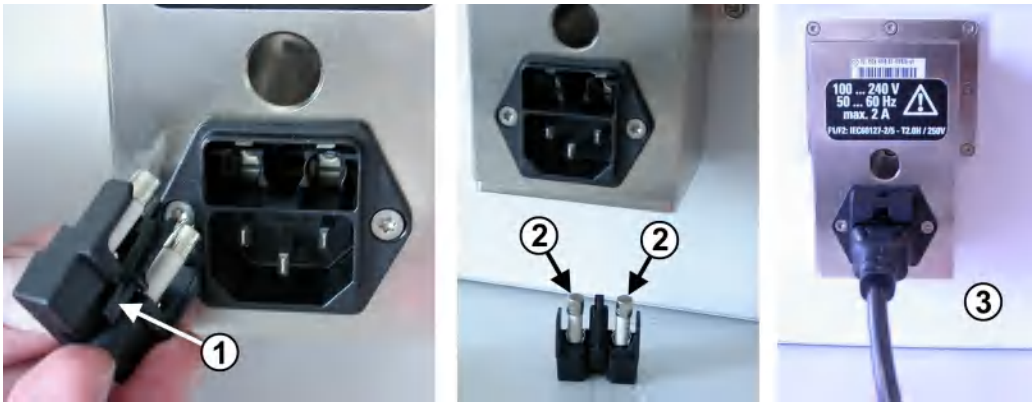


Figure 5-33: Connecting the power feedthrough

1 = Latch for releasing the fuse holder
2 = The two fuses (2 A, 250 V)
3 = Fuses inserted and power cord connected

You can mount the feedthrough in any of the three rear openings (number 1, 2 and 3) of the RF Shielded Box, or in any of the two front openings (4 and 5).

For an instruction on how to install a feedthrough, see Chapter 6.1.6, "Mounting a Feedthrough", on page 72.

The power feedthrough is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

If the fuses are blown repeatedly, one possible reason is damage in the internal low-pass filter elements due to mechanical shock. In this case, if you can exclude other possible reasons, the power feedthrough has to be replaced.

5.18 Vivaldi Antenna R&S TS-F24-V1

The Vivaldi broadband antenna R&S TS-F24-V1 (1525.8964.02) with SMP connector features excellent transmission properties in the frequency range from 0.7 to 14 GHz. The antenna is based on a printed board with a structured metal coating that spreads out in a logarithmic shape. The delivery includes an antenna fixture kit and two RF cables, each with SMP (female) and SMA (male) connectors, length 40 cm and 55 cm, respectively.

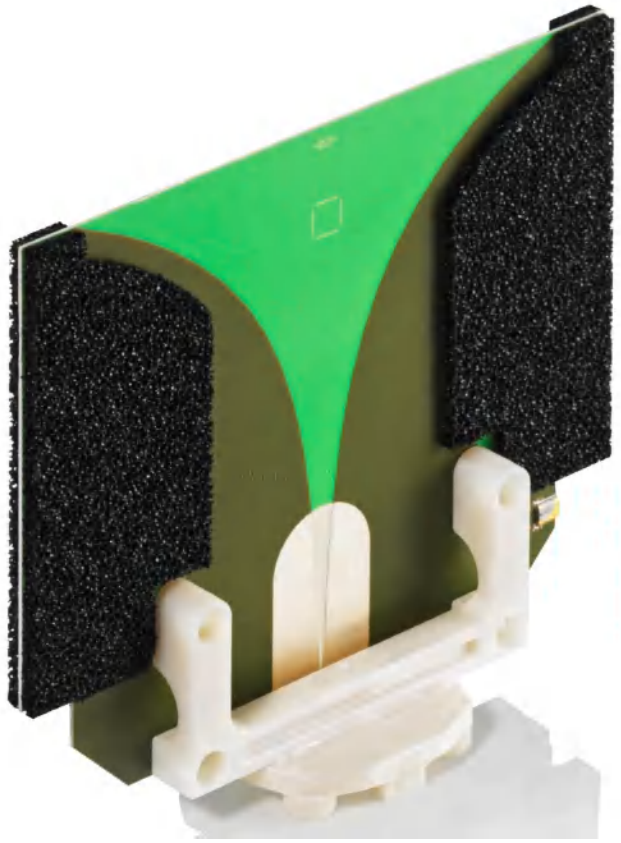


Figure 5-34: Vivaldi antenna (0.7 to 14 GHz) with SMP connector, mounted on an antenna fixture

This Vivaldi antenna can be used as a communication antenna, allowing to transmit signals towards the DUT, and to receive signals from it.

In this context, typical DUTs include mobile communication devices based upon, e.g., GSM, UMTS, LTE, Bluetooth, Wi-Fi, GPS, GLONASS, Galileo, ZigBee and similar technology standards.

The antenna in combination with its fixture can be flexibly mounted on the antenna ring, as shown in Figure 5-9.

Table 5-1: Vivaldi Antenna Specifications

Parameter	Value
Frequency	700 MHz to 14 GHz
VSWR (reflection coefficient)	< 3.5 (at 0.7 to 1 GHz) < 2 (at 1 to 14 GHz)
Gain	-4 to 6 dBi (at 0.7 to 2.7 GHz) 6 to 8 dBi (at 2.7 to 14 GHz)
Max. Input Power	30 dBm (1 W)
Impedance	50 Ω
Polarization	linear (nom.)

Parameter	Value
Connector	SMP (male)
Dimensions (W x H x D)	120 mm x 100 mm x 7 mm

This Vivaldi antenna with antenna fixture is not a serviceable part. If it is defective, or if checking reveals that it is not working correctly, it has to be replaced.

See Chapter 8.4, "Checking", on page 154

5.19 Vivaldi Antenna R&S TS-F24-V2

The Vivaldi broadband antenna R&S TS-F24-V2 (1525.8970.02) with SMP connector features excellent transmission properties in the frequency range from 2.4 to 16 GHz. The antenna is based on a printed board with a structured metal coating that spreads out in a logarithmic shape. The delivery includes an antenna fixture kit and two RF cables, each with SMP (female) and SMA (male) connectors, length 40 cm and 55 cm, respectively.

Figure 5-35: Vivaldi antenna (2.4 to 16 GHz) with SMP connector, mounted on an antenna fixture

This Vivaldi antenna can be used as a communication antenna, allowing to transmit signals towards the DUT, and to receive signals from it.

In this context, typical DUTs include mobile communication devices based upon, e.g., Wi-Fi, Bluetooth, ZigBee and similar technology standards.

An advantage of this antenna over the Vivaldi Antenna R&S TS-F24-V1 is its smaller size, which allows for more flexible positioning in the RF Shielded Box.

In combination with its fixture, the antenna can be flexibly mounted on the antenna ring, as shown in Figure 5-9.

Table 5-2: Vivaldi Antenna Specifications

Parameter	**Value**
Frequency	2.4 to 16 GHz
VSWR (reflection coefficient)	< 2; typ. < 1.5
Gain	2 to 6 dBi (at 2.4 to 4 GHz) 6 to 8 dBi (at 4 to 16 GHz)
Max. Input Power	30 dBm (1 W)
Impedance	50 Ω
Polarization	linear (nom.)
Connector	SMP (male)
Dimensions (W x H x D)	70 mm x 80 mm x 7 mm

This Vivaldi antenna with antenna fixture is not a serviceable part. If it is defective, or if checking according to Chapter 8.4, "Checking", on page 154 reveals that it is not working correctly, it has to be replaced.

5.20 Cross-Polarized Vivaldi Antenna R&S TS-F24-V3

The cross-polarized Vivaldi broadband antenna R&S TS-F24-V3 (1525.8987.02) with two SMP connectors features excellent transmission properties in the frequency range from 1.7 to 20 GHz. The antenna is based on a perpendicular arrangement of two printed boards with structured metal coatings that spread out in a logarithmic shape. The delivery includes a special antenna fixture kit and four RF cables, each with SMP (female) and SMA (male) connectors, 2x length 40 cm and 2x length 55 cm, respectively.

Figure 5-36: Cross-polarized Vivaldi antenna (1.7 to 20 GHz) with two SMP connectors, mounted on a special antenna fixture

This dual Vivaldi antenna can be used as a communication antenna, allowing to transmit signals towards the DUT, and to receive signals from it.

In this context, typical DUTs include mobile communication devices based upon, e.g., GSM-1800, GSM-1900, selected UHF, UMTS and LTE bands, Bluetooth, Wi-Fi, ZigBee and similar technology standards.

An advantage of this antenna over the Vivaldi Antenna R&S TS-F24-V2 is the feature of providing two antennas in the same geometrical position and with perpendicular polarization.

In combination with its fixture, the antenna can be flexibly mounted on the antenna ring, as shown in Figure 5-9.

Table 5-3: Vivaldi Antenna Specifications

Parameter	Value
Frequency	1.7 to 20 GHz
VSWR (reflection coefficients)	< 2.3 (at 1.7 to 2.4 GHz) < 2 (at 2.4 to 20 GHz)
Port Isolation	> 22 dB

Parameter	Value
Cross Polarization Rejection	>25 dB (at 1.7 to 6 GHz) >15 dB (at 6 to 18 GHz) >10 dB (at 18 to 20 GHz)
Gain	-1 to 6 dBi (at 1.7 to 5 GHz) 6 to 10 dBi (at 5 to 20 GHz)
Max. Input Power	30 dBm (1 W)
Impedance	50 Ω
Polarization	dual, cross-polarized linear (nom.)
Connectors	2x SMP (male)
Dimensions (W x D x H)	70 mm x 70 mm x 80 mm

This cross-polarized Vivaldi antenna with antenna fixture is not a serviceable part. If it is defective, or if checking according to Chapter 8.4, "Checking", on page 154 reveals that it is not working correctly, it has to be replaced.

5.21 Narrowband Antenna R&S TS-F24NB2

The narrowband bow-tie antenna R&S TS-F24NB2 (1525.8793.02) with SMP connector features excellent transmission properties in the frequency range from 0.7 to 0.96 GHz. The antenna is based on a printed board with a structured metal coating that spreads out in a bow-tie shape. The delivery includes an acrylic glass sheet for mounting the antenna and an RF cable with SMP (female) and SMA (male) connectors.

Figure 5-37: Narrowband antenna (0.7 to 0.96 GHz) with SMP connector

This narrowband antenna can be used as a communication antenna, allowing to transmit signals towards the DUT, and to receive signals from it.

In this context, typical DUTs include mobile communication devices based upon, e.g., selected UHF, GSM, UMTS and LTE bands and similar technology standards.

Besides the narrow bandwidth, an advantage of this antenna over the Vivaldi antennas is the feature of a balun SMD component soldered in the center of the antenna. This component makes the antenna's radiation properties insensitive to an attached unbalanced transmission line.

In combination with its holder assembly, you can mount the antenna directly into the RF Shielded Box, as shown in Figure 5-38.

The mounting procedure is described in Chapter 7.4, "Installation of Narrowband Antennas", on page 128.

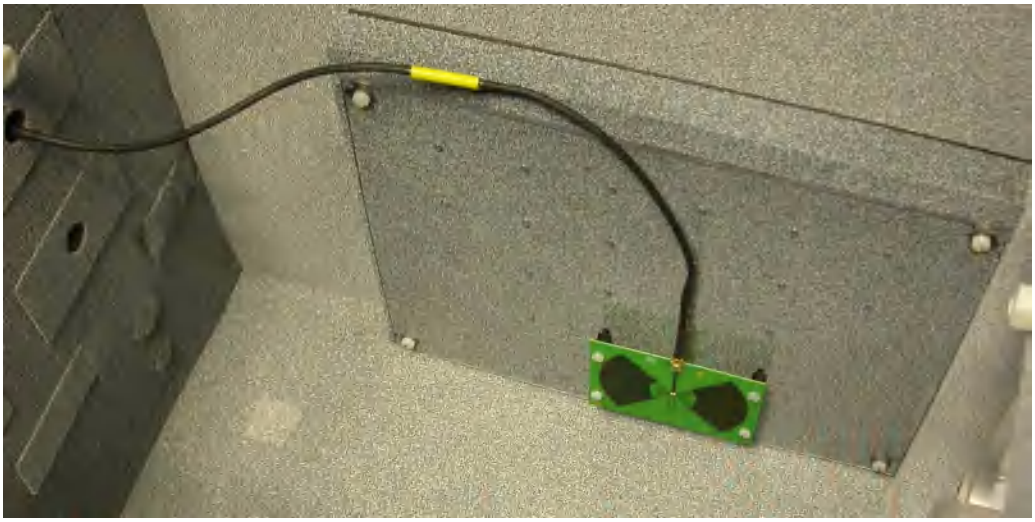


Figure 5-38: One narrowband antenna mounted in a low position on the right chamber wall

Table 5-4: Narrowband Antenna Specifications (*)

Parameter	Value
Frequency	700 to 960 MHz
VSWR (reflection coefficient)	< 3 (at 700 to 730 MHz) < 2 (at 730 to 930 MHz) < 3 (at 930 to 960 MHz)
Directivity	4.2 dBi (nom.)
Total Efficiency	-11 to -6 dB
Gain	-7 to -6 dBi
Max. Input Power	27 dBm (0.5 W)
Impedance	50 Ω
Polarization	linear (nom.) (The linear orientation is horizontal in Figure 5-37 and Figure 5-38.)
Connector	SMP (male)
Dimensions (W x H x D)	80 mm x 60 mm x 4 mm

(* These specifications are valid if the antenna is mounted 10 mm above an acrylic glass sheet and a flat RF absorber that are placed on a conducting plate.)

This narrowband antenna with antenna holder is not a serviceable part. If it is defective, or if checking according to Chapter 8.4, "Checking", on page 154 reveals that it is not working correctly, it has to be replaced.

5.22 Wideband Antenna R&S TS-F24WA1

The wideband spiral antenna R&S TS-F24WA1 (1525.8670.02) features excellent transmission properties in the frequency range from 0.3 to 6 GHz. The antenna is based on a printed board with a structured metal coating that spreads out in a spiral shape. The delivery includes a special holder kit for mounting the antenna and an RF cable with two SMA (male) connectors.

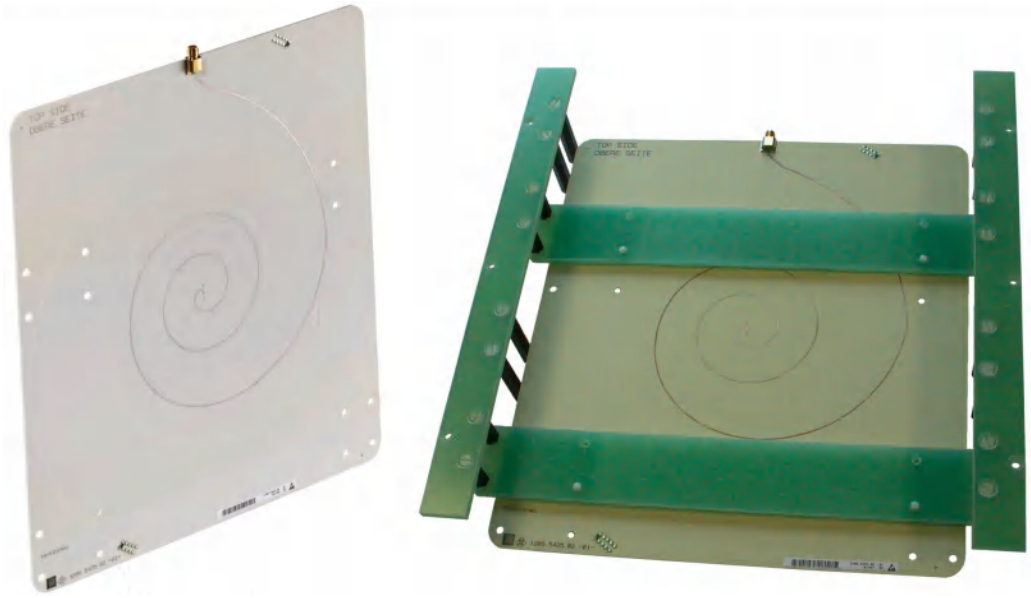


Figure 5-39: Wideband antenna (0.3 to 6 GHz) with SMP connector; right: mounted in special holder

This antenna can be used as a communication antenna, allowing to transmit signals towards the DUT, and to receive signals from it.

In this context, typical DUTs include mobile communication devices based upon, e.g., selected ISM bands, UHF, GSM, UMTS, LTE, Bluetooth, Wi-Fi, GPS, GLONASS, Galileo, ZigBee and similar technology standards.

Advantages of this antenna over the Vivaldi antennas and the Narrowband Antenna R&S TS-F24NB2 are:

- A wide bandwidth, which ranges down to frequencies as low as 300 MHz
- Absence of a defined polarization, which makes it unnecessary to match the directional characteristics of the antenna and the DUT

In combination with its special holder, you can mount the antenna directly into the RF Shielded Box.

The mounting procedure is described in Chapter 7.5, "Installation of the Wideband Antenna", on page 141. When connecting a cable to the SMA connector, use a torque wrench and mind the TORQUE RECOMMENDATIONS.

Table 5-5: Wideband Antenna Specifications (*)

Parameter	Value
Frequency	300 MHz to 6 GHz
VSWR (reflection coefficient)	< 2 (at 300 MHz to 4 GHz) < 2.3 (at 4 to 6 GHz)
Gain	-7 to 2 dBi (at 400 MHz to 3 GHz) -15 to 0 dBi (at 3 to 6 GHz)
Max. Input Power	27 dBm (0.5 W)
Impedance	50 Ω
Polarization	circular (nom.)
Connector	SMA (female)
Dimensions (W x D x H)	246 mm x 280 mm x 7 mm

(* These specifications are valid if the antenna is mounted 5 mm above an acrylic glass sheet and a flat RF absorber that are placed on a conducting plate.)

This wideband antenna with antenna holder is not a serviceable part. If it is defective, or if checking reveals that it is not working correctly, it has to be replaced.

See Chapter 8.4, "Checking", on page 154

5.23 45° Adapter for Lateral Antenna Tilt R&S TS-F2X-VH4

The antenna ring and its standard antenna fixtures allow for longitudinal and radial translation as well as rotation of the Vivaldi antennas. An additional degree of freedom is achieved with an optional special adapter: the 45° adapter R&S TS-F2X-VH4 (1525.8758.02). It is designed for the fixtures of the Vivaldi antennas and allows for their lateral tilting from -45° to +45°, in steps of 22.5°. The tilt angles are fixed by expanding rivets, as shown below.

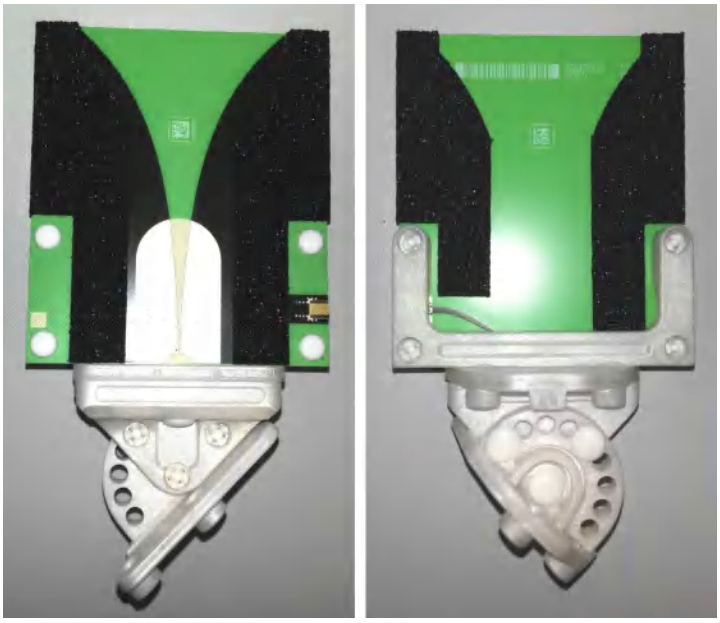


Figure 5-40: Antenna in fixture with adapter for -45° to +45° tilting (left: front view, right: rear view)

The 45° adapter is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.24 Magnetic Coil R&S TS-F24HML1

The 3D magnetic Helmholtz coil R&S TS-F24HML1 (1530.8430.02) is used to generate a homogeneous alternating electromagnetic field in the frequency range from 20 kHz to 1 MHz. The central part of the assembly is a hollow polymer cube, 223 mm x 223 mm x 223 mm, with three pairs of copper wire coils in orthogonal orientation.

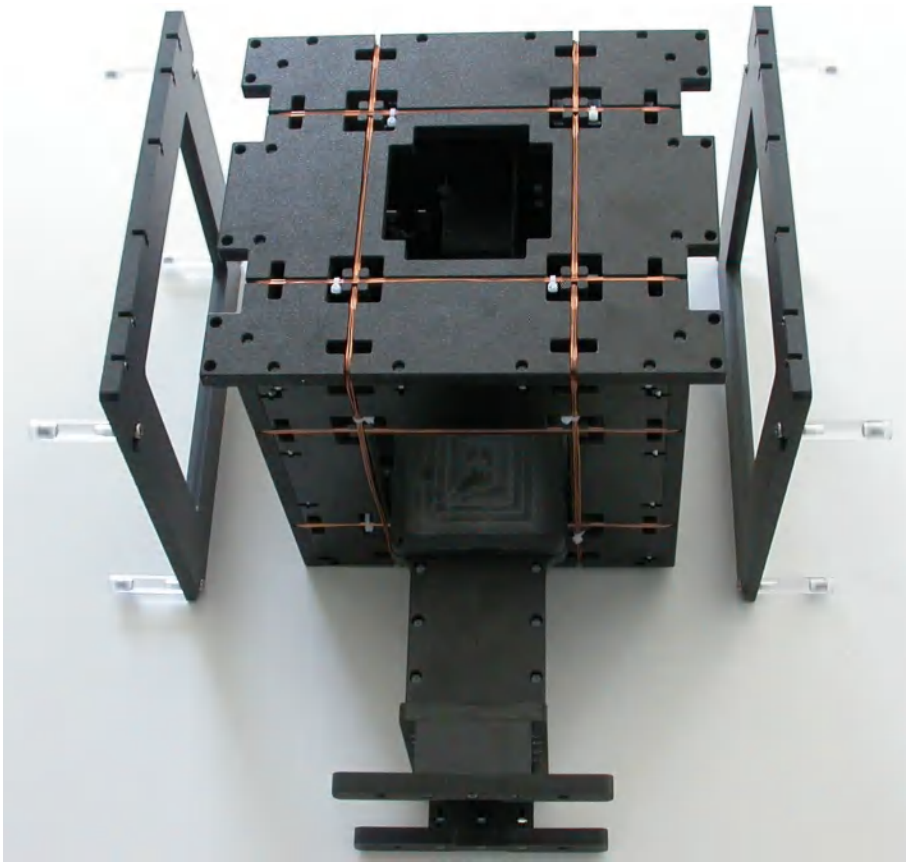


Figure 5-41: 3D magnetic Helmholtz coil (20 kHz to 1 MHz) with DUT holder

Center = Polymer cube with three orthogonal pairs of coils
Front = DUT holder with door mounting kit and DUT tray
Left and right = Two mounting plates, each with four screws and spacers

Each coil has three loops. The two coils in each parallel pair of coils are coupled in a serial circuit, hence with a total of six loops.

The three pairs of coils are perpendicular to the X, Y and Z axis, respectively. Therefore, the coils are labeled X1 and X2, Y1 and Y2, Z1 and Z2.

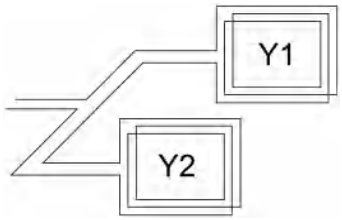
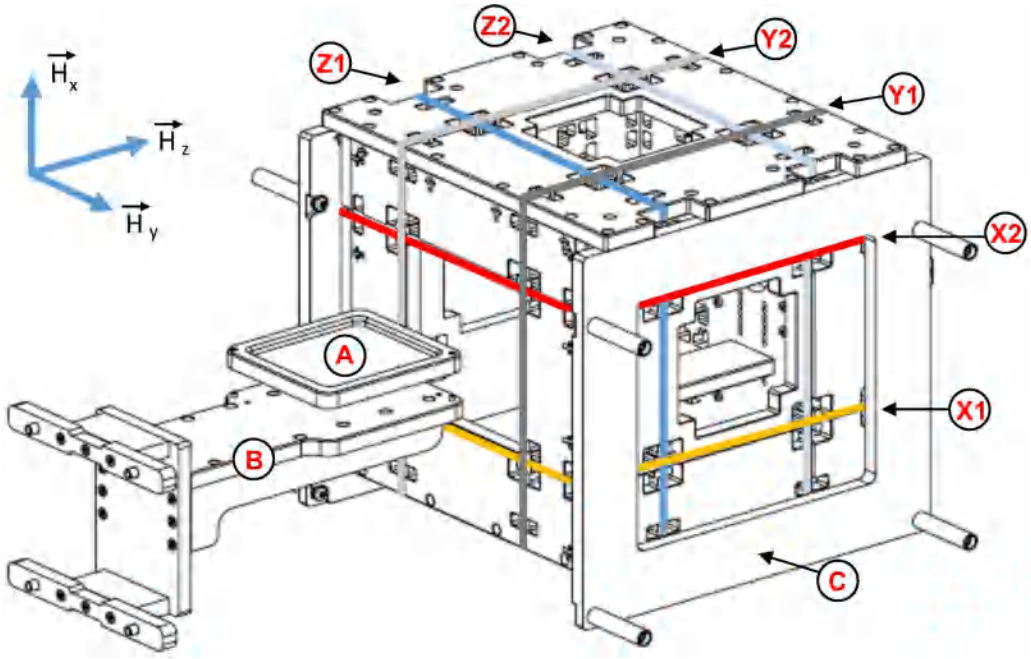


Figure 5-42: One parallel pair of coils, for example Y1 and Y2

Each pair of coils can be addressed individually. The combined usage of different pairs of coils allows generating a magnetic field in any arbitrary spatial orientation.



H_x, H_y, H_z = Normal vectors of the magnetic field in X, Y and Z direction
X1, X2 = Pair of coils perpendicular to the X axis
Y1, Y2 = Pair of coils perpendicular to the Y axis
Z1, Z2 = Pair of coils perpendicular to the Z axis
A = DUT tray, reproducibly positioned by two pins on the DUT holder
B = DUT holder with door mounting kit
C = One of the two mounting plates

Ohmic resistance

The ohmic resistance of one pair of coils is 0.2 Ω. Matching the coils with an external signal generator requires raising the ohmic resistance of the coils. For this purpose, each pair of coils is serially connected to two 12 Ω resistors. Due to the special arrangement of these resistors (see Figure 5-43), you can choose to operate a pair of coils with an additional serial resistance of either 6 Ω or 12 Ω:

- If you bridge the pins number 1 and 2, for example, the two resistors are connected in a parallel circuit with a combined resistance of 1 / [1/12Ω + 1/12Ω] = **6 Ω**.
- If you use only pin number 1 or pin number 2 for the coils X1 and X2, for example, the involved resistor is connected with its resistance of **12 Ω**.

The same rule applies for pins number 3 and 4 and for pins number 5 and 6, respectively. Together with the 0.2 Ω resistance of the coils themselves, the total resistance per pair of coils is either 6.2 Ω or 12.2 Ω.

Each pin of the connector is specified for a maximum current of 2 A. To enable a current of up to 4 A for each pair of coils, use two bridged pins (pins 1 & 2, pins 3 & 4, pins 5 & 6) with the connected 12 Ω resistors in parallel. Therefore, using the coils with a current load of >2 A up to 4 A requires a parallel (bridged) connection with an effective total resistance of 6.2 Ω.

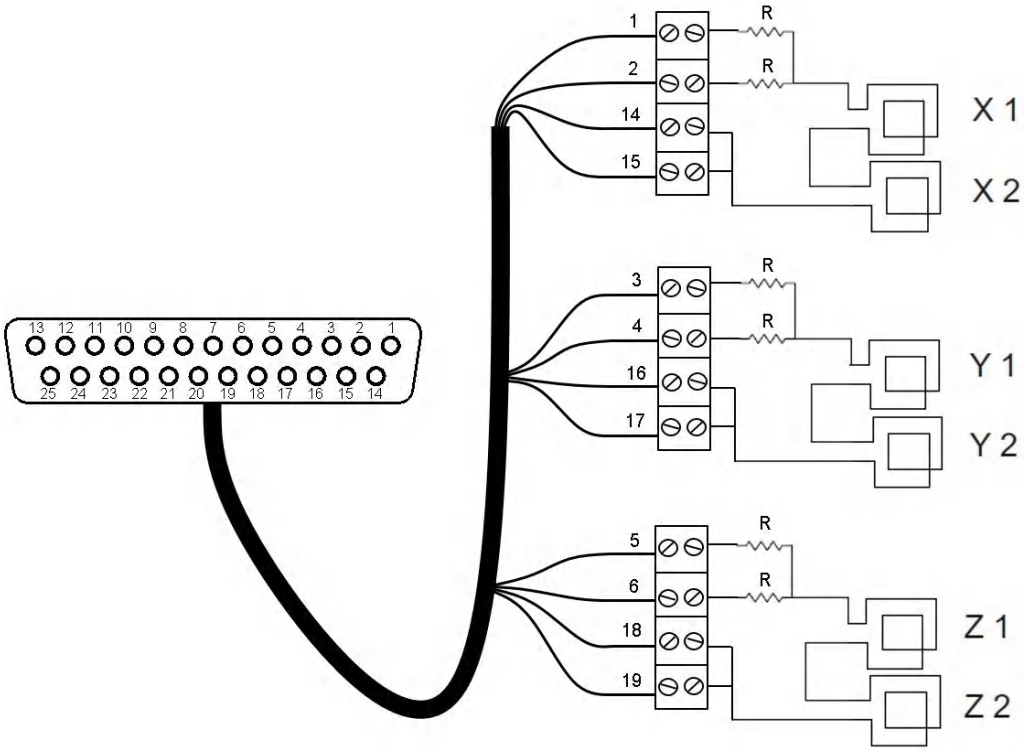


Figure 5-43: Circuitry of the three pairs of coils

R = 12 Ω resistors
X1 and X2 = Coils perpendicular to the X axis
Y1 and Y2 = Coils perpendicular to the Y axis
Z1 and Z2 = Coils perpendicular to the Z axis
1 ... 19 = Pin numbers in the D-sub 25-pin female connector

A wiring board at the rear side of the polymer cube holds the connections of all coils with their resistors and the connection with the internal supply cable. This cable connects the coils to a D-Sub 25 connector feedthrough.

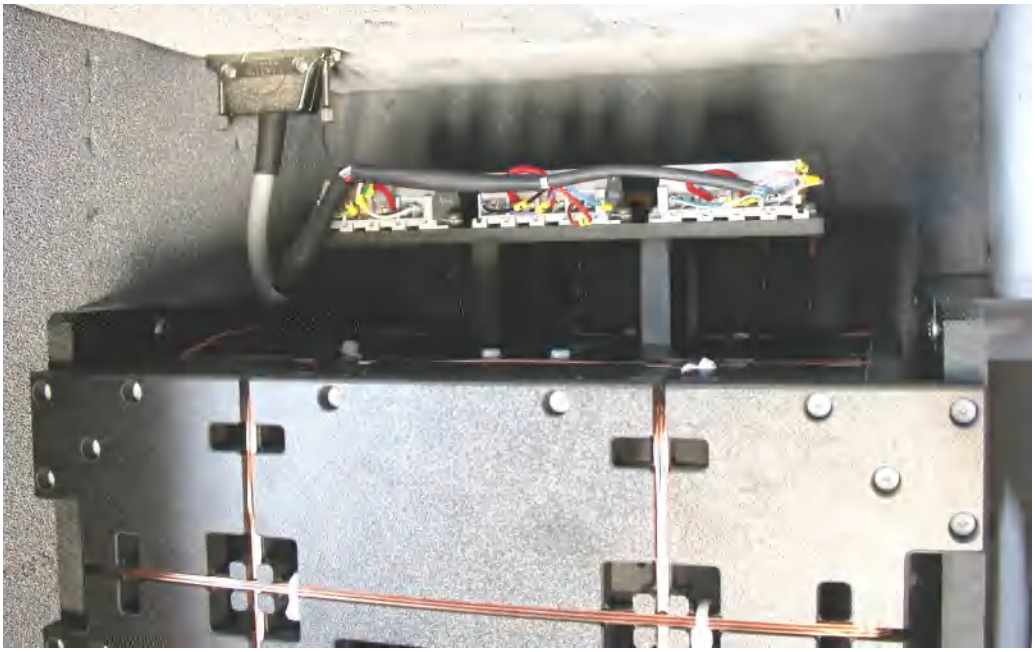


Figure 5-44: View from above (top cover opened): wiring board, cables and connector

The delivery includes:

- Polymer cube with 3x2 coils
- Two mounting plates that hold the cube in the RF Shielded Box
- Wiring board with resistors
- DUT holder with door mounting kit and DUT tray (to be placed on the DUT holder)
- Cable assembly with D-Sub 25 connector
- One D-Sub Feedthrough R&S TS-F24FD1

Applications

The 3D magnetic Helmholtz coil can be used to transmit signals towards the DUT, and to receive signals from it.

Typical DUTs include remote control car keys and immobilizer transmitters in keyfab testing at 125 kHz or similar devices that operate in the frequency range 20 kHz to 1 MHz. You can also use the 3D magnetic Helmholtz coil to generate a static field at 0 Hz.

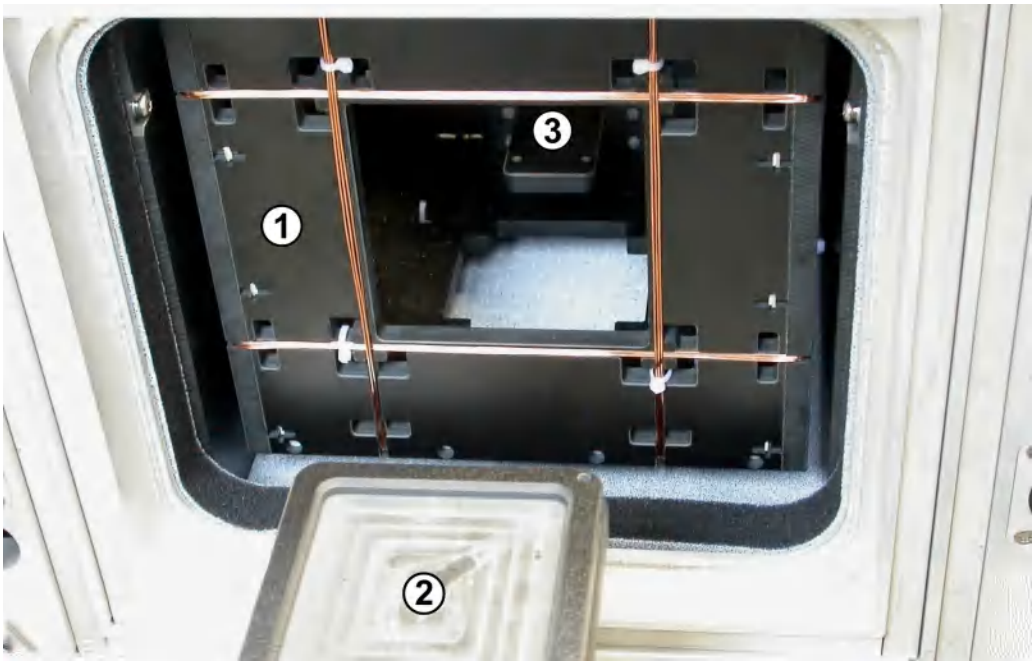


Figure 5-45: View from front: opened RF Shielded Box with magnetic Helmholtz coil mounted inside

1 = Polymer cube with copper wire coils
2 = DUT holder tray
3 = One of two polymer latches inside the cube for fixing a field probe

The assembly is pre-mounted in the R&S TS7124M by the manufacturer. Per default, the D-Sub Feedthrough R&S TS-F24FD1 is mounted in the feedthrough opening number 1, which is the left opening behind the coil (right when seen from the rear side of the R&S TS7124M.

You can unmount the DUT holder from the inside of the drawer door and remount it in the same position. To do so, proceed as with the DUT Holder Tray R&S TS-F24P1.

Figure 5-46: DUT holder with door mounting kit (left) and DUT tray (center), the assembly is shown on the right (two pins match two holes in the tray)

To measure the magnetic field inside a closed RF Shielded Box, fix a field probe at one of the two latches, labeled (3) in Figure 5-45.

Table 5-6: 3D magnetic Helmholtz coil specifications

Parameter	Value
Frequency	20 kHz to 1MHz
Max. current per pin	2 A (AC)
Max. current per pair of coils	4 A (AC), if you bridge two pins per pair of coils
Resistance per pair of coils (including the 12 Ω resistors)	• 12.2 Ω, if you use one pin (see Ohmic resistance) with max. 2 A • 12.2 Ω, if you bridge two pins (pins 1 & 2, pins 3 & 4, pins 5 & 6)
Operating temperature	+5°C to +45°C
Operating relative humidity	90% (non-condensing) at +10°C to +30°C, or 75% (non-condensing) at +10°C to +40°C
Storage temperature	-20°C to +60°C
Storage relative humidity	90% (non-condensing) at up to +60°C
Connector	D-Sub 25 (female) plugged into the D-Sub Feedthrough inside the RF Shielded Box. On the outside, use the D-Sub 25 (female) connector. The D-Sub 9 connector in the same feedthrough is unused.
Front opening for DUT	100 mm x 100 mm (W x H)
DUT holder tray, dimensions	84 mm x 75 mm (W x D, inside tray), with rounded corners
Outer dimensions of the cube	223 mm x 223 mm x 223 mm (width of top plate = 257 mm)
Polymer material	Synthetic phenol formaldehyde resin (Hornitex)

This 3D magnetic Helmholtz coil is not a serviceable part. If it is defective, or if checking according to Chapter 8.4, "Checking", on page 154 reveals that it is not working correctly, it has to be replaced.

5.25 LF Loop Antenna R&S TS-F24HLF1

The low-frequency loop antenna R&S TS-F24HLF1 (1530.8446.02) is used especially for testing RFID applications that operate at a low frequency range from 20 kHz to 1 MHz.

The loop antenna is encased in a rounded housing made of POM (polyoxymethylene) that measures approximately 80 mm x 90 mm x 14.5 mm (plus some protruding elements). A 20 cm RF cable is included in the delivery.

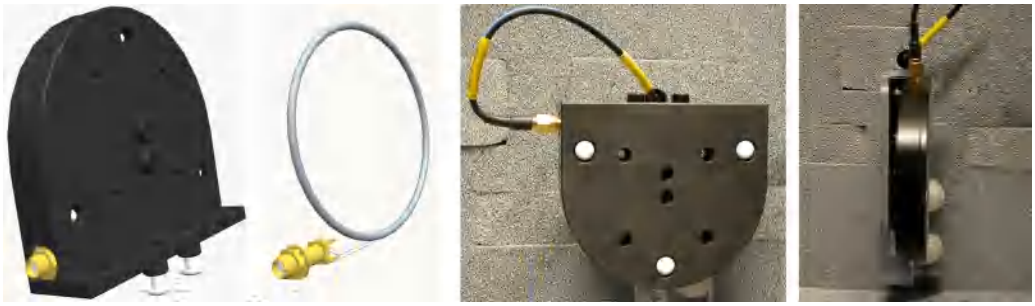


Figure 5-47: Two design illustrations of the antenna (left) and two typical mounting positions (right)

Antenna properties	
Frequency range	20 kHz to 1 MHz
Resistance R	500 Ω @ 125 kHz > 6 kΩ q 566 kHz > 1.5 kΩ q 1 MHz
Connector	SMA
Included cable	SMA (m) / SMA (m), 200 mm

We recommend mounting the LF loop antenna on the single Antenna Holder R&S TS-F24-AH2, but you can also mount it on an antenna ring or on the absorber plate at the inside wall of the R&S TS7124M (option with Narrowband Antenna R&S TS-F24NB2).

For an instruction on how to mount the antenna into the chamber using the single antenna holder, see Chapter 7.6, "Installation of the LF Loop Antenna", on page 147.

The LF loop antenna is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

5.26 Rack Mounting Kit R&S TS-F24-Z1

The R&S TS-F24-Z1 (1526.6942.02) is an optional rack mounting kit. It is used to fix the R&S TS7124M in a standard 19" rack, requiring a height of 10 HU (17.5" or 444.5 mm).

The rack mounting kit allows mounting the RF Shielded Box securely to a standard 19" rack. It consists of a metal rack cover sheet and a set of washers and torx screws. The metal sheet has a shape that goes around the chamber's front door, fits with the threaded holes in the front of the chamber's body and with threaded holes in the frame of the rack.

Inside the rack, the chamber must rest on stable rails that are designed to jointly carry a load of at least 40 kg. The chamber must be fixed to these rails (or to the rack) by means of screws and brackets (see Figure 6-1).

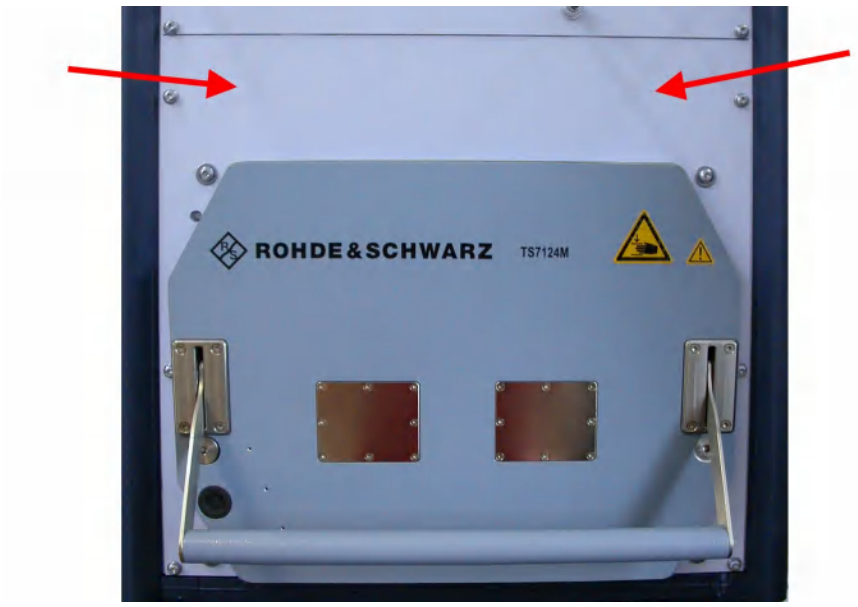


Figure 5-48: RF Shielded Box fixed in a 19" rack by the rack mounting kit

Red arrows = Metal sheet of the rack mounting kit

Figure 5-48 shows the rack mounting kit with the related pneumatically operated R&S TS7124AS, which has no handle for opening the door. However, the installation and function of the rack mounting kit is the same for the R&S TS7124M.

As a prerequisite for installation, the 19" rack with universal square holes must be equipped with M5 cage nuts:

Figure 5-49: Cage nuts for metric M5 screws (not included in the delivery)

To install the R&S TS7124M into a standard 19" rack by means of the rack mounting kit, proceed as follows:

1. Prepare the rack with stable rails that can jointly carry a load of at least 40 kg.
2. Mount the rails at the desired altitude.
3. Make sure that from the level of the rails, a height of 10 HU (444.5 mm) is available for the RF Shielded Box.

4. Insert the R&S TS7124M into the rack, lifting the chamber with at least two persons.
5. Position the chamber in the rack in such a way that the front of the chamber (not the drawer door) is flush with the front of the rack.
6. Use the included set of screws:

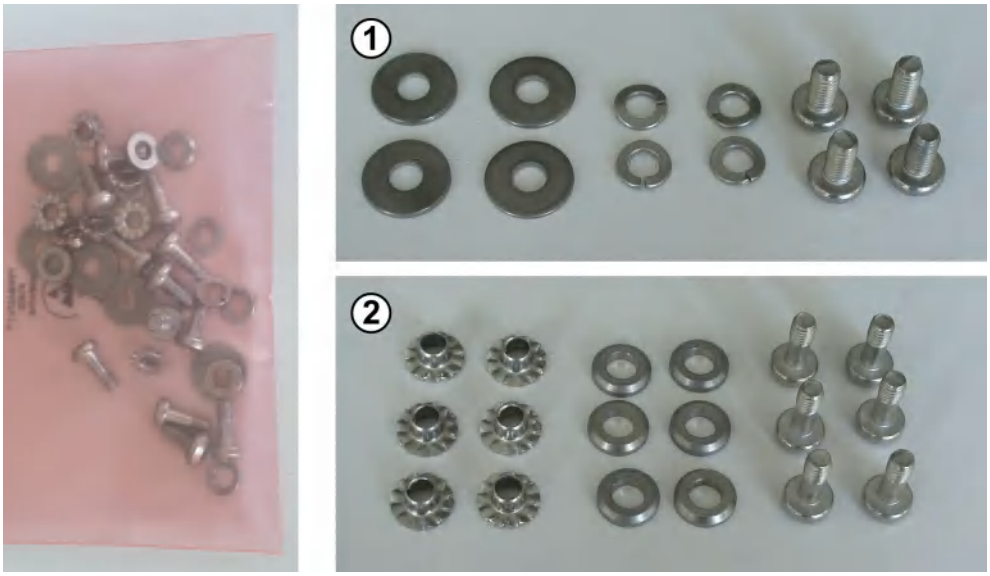


Figure 5-50: Set of torx screws and washers for the rack mounting kit

1 = Large washers, small spring lock washers and M6 x 12 screws (4 each) for fixing the metal sheet to the RF Shielded Box
2 = Grounding sockets, small thick washers and M5 x 14 screws (6 each) for fixing the metal sheet to the rack

7. Attach the six screws, washers and grounding sockets (labeled (2) in Figure 5-51) to the six outer holes in the metal rack cover sheet. Make sure to insert the grounding sockets (2b) from the rear side of the cover sheet, and the M5 screws and small washers (2a) from the front side. The result is shown in detail (4) in Figure 5-51. Once inserted and tightened to the grounding sockets, the M5 screws cannot be removed from the metal sheet.

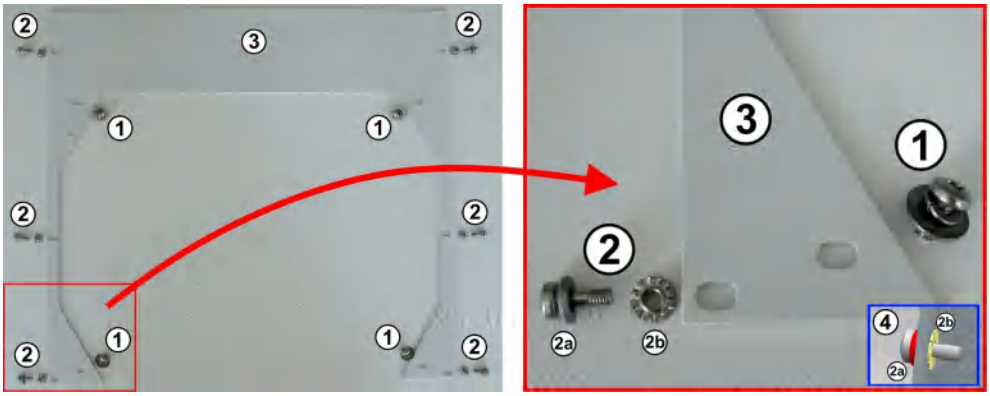


Figure 5-51: Matching the screws and washers to the various holes in the metal rack cover sheet

1 = Large washers, spring lock washers and M6 screws (4 each) for fixing the metal sheet to the RF Shielded Box
2 = Grounding sockets, small washers and M5 screws (6 each) for fixing the metal sheet to the rack
2a = M5 screw and small washer. Insert from the front side of the metal rack cover sheet
2b = Grounding socket. Insert from the rear side of the metal rack cover sheet
3 = Metal rack cover sheet
4 = Detail: M5 screw and small washer (2a) inserted from the front side and grounding socket (2b) inserted from the rear side of the cover sheet

8. Position the metal sheet around the drawer door in such a way that the holes in the sheet align with the holes in the chamber and in the rack.
9. Fix the metal rack cover sheet to the M5 cage nuts in the rack by the six screws (2) in Figure 5-51.
10. Fix the metal rack cover sheet to the chamber, using the four screws and washers (1) in Figure 5-51.
11. On the rear side of the rack, fix the chamber to the rails that carry the chamber, using two of the mounting brackets shown in Figure 6-1.

The rack mounting kit is not a serviceable part. If it is defective or not working correctly, it has to be replaced.

6 Putting into Operation

WARNING

Risk of injury

Operation and handling of an RF Shielded Box implies risks.

To reduce these risks and prevent accidents, carefully read Chapter 2, "Specific Safety Instructions", on page 9.

6.1 Setup

Prerequisites for the installation of the RF Shielded Box:

Provide a stable mounting space (see weight and dimensions specified in the data sheet).

Make sure that the location, in which the RF Shielded Box is mounted, leaves sufficient room to open the drawer, to easily access the drawer from all sides, and to access all connectors and mounting brackets, including those on the rear side.

6.1.1 ESD Requirements

NOTICE

Risk of ESD

To avoid damage to the measurement equipment by electro-static charging or discharging (ESD), appropriate ESD protection must be provided for the operation area around the RF Shielded Box. Operators must observe all applicable ESD regulations.

6.1.2 Unpacking and Checking

⚠ CAUTION

Risk of injury due to heavy weight

Handling the heavy chamber (e.g. lifting or transporting it) may result in personal injury. In order to prevent this, at least two persons are required for handling the RF Shielded Box.

1. Check the RF Shielded Box for completeness, using the delivery note and the accessory lists.
2. Check the RF Shielded Box for damage. If there is any damage, immediately report this to the carrier who delivered it.

Packaging material

To be prepared for transportation or shipping of the RF Shielded Box at a later time, retain the original special transport protection packaging. If the RF Shielded Box has to be transported or shipped again, re-pack it in its original packaging, which keeps the drawer closed. In case that the original packaging material should no longer be available, secure the drawer against unintentional opening in an appropriate way.

NOTICE

Risk of damage during transportation and shipment

Insufficient protection against mechanical and electrostatic effects during transportation and shipment can damage the RF Shielded Box.

- When shipping the RF Shielded Box, the original packaging should be used. If the original packaging is not available, use sufficient padding to prevent the chamber from moving around inside the box.
- Secure the chamber to prevent any movement and other mechanical effects during transportation.
- Always make sure that sufficient mechanical and electrostatic protection is provided.

6.1.3 Positioning the Chamber

⚠ WARNING

Risk of injury due to heavy moving parts

Failure to properly fix the chamber prior to the first usage will lead to a risk of injury as described in Chapter 2.5, "Safety Instructions for Operation", on page 13. To avoid this risk, make sure to securely mount the chamber as described below.

⚠ CAUTION

Risk of injury due to heavy weight

Handling the heavy chamber (e.g. lifting or transporting it) may result in personal injury. In order to prevent this, at least two persons are required for handling the RF Shielded Box.

If you wish to mount the RF Shielded Box into a 19" rack by means of the Rack Mounting Kit R&S TS-F24-Z1, proceed as described in chapter 5.26.

Otherwise fix the RF Shielded Box in place by screwing the four mounting brackets to the front and rear panels of the chamber and to a stable bench or support. Use the mounting brackets as shown in Figure 6-1 (black arrows). Make sure to position the mounting brackets in such a way that their notch (see red arrow) is at the upper end, latching into the bore on top of the screw hole.

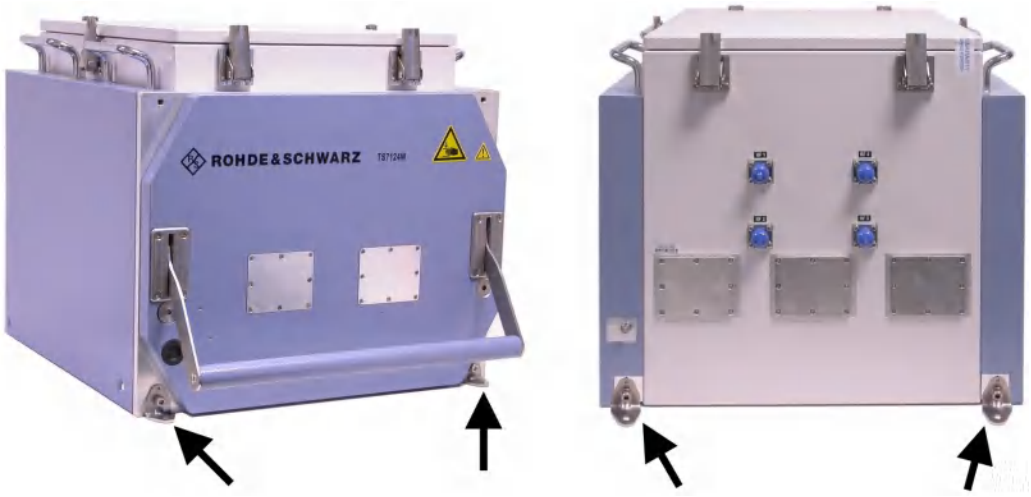


Figure 6-1: Positions of the four mounting brackets for fixing the chamber on its front and rear side

If it should be required to remove the box from this location, for example in order to open the top cover, observe the Safety Instructions for Unpacking, Transport and Mounting. Only open the drawer while the RF Shielded Box is securely mounted to a stable support.

6.1.4 Grounding the RF Shielded Box

As soon as the setup of the RF Shielded Box is prepared according to chapters 6.1.1, 6.1.2, and 6.1.3, ground the chamber using the electrical grounding connection as shown in Figure 6-2:

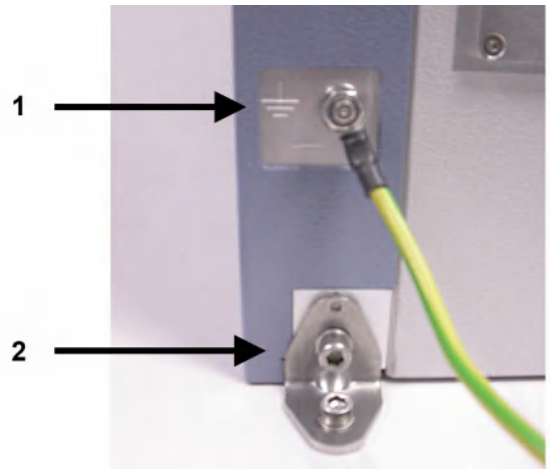


Figure 6-2: Ground connector in the rear left corner of the RF Shielded Box

1 = Connector for electrical grounding (earth)
2 = Mounting bracket, fixed to a stable bench or support

The RF Shielded Box is now ready to be used. The chamber does not have any [ON / OFF] switch.

6.1.5 RF Interfaces

Figure 6-3: N connectors with blue protective caps (left), two caps removed (right)

On the rear side of the RF Shielded Box, remove the protective caps from as many N connectors as required. For more than four RF connections, install additional units of Twin N-SMA Feedthrough R&S TS-F24FN1.

When linking the N connectors to your test system, use shielded RF cables and a torque wrench to tighten the cables' N connectors, minding the TORQUE RECOMMENDATIONS.

Correct positioning of the antenna connectors can be verified visually by inspecting the connectors inside the chamber. Alternatively, a measurement of S11 parameters at all ports may serve for verification.

6.1.6 Mounting a Feedthrough

For installing a feedthrough in the front door or in the rear wall of the R&S TS7124M, proceed as follows:

1. Open the front door of the RF Shielded Box.
2. On the outside of the chamber, remove the eight Torx 8 screws that hold the cover plate which has to be removed.

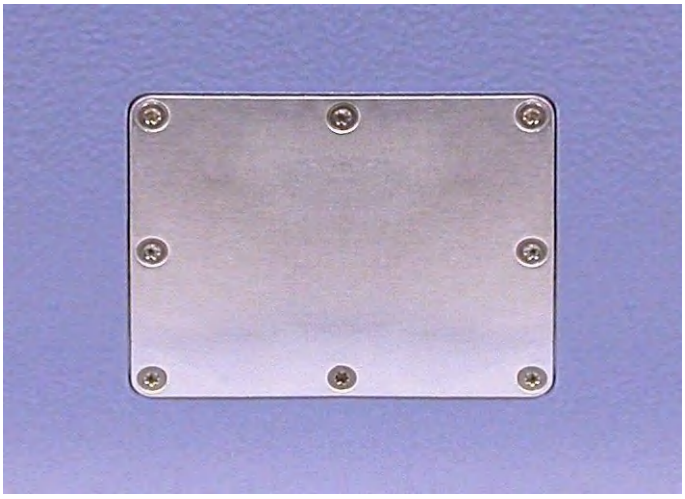


Figure 6-4: Cover plate, fixed by eight Torx 8 screws

3. Remove the cover plate by carefully pushing it out from the inside of the chamber.
4. Remove the old RF sealing around the hole in the door or rear wall.
5. Clean the surface, from which the sealing has been removed, with alcohol and a lint-free cloth.
6. Put in the new RF sealing.
7. Insert the feedthrough into the hole from the outside of the chamber.
8. Fix the feedthrough from the outside of the chamber with the same eight Torx 8 screws.
9. When finished, close the front door.

6.1.7 Mounting a DUT Holder Tray

The R&S TS7124M can optionally be equipped with the DUT Holder Tray R&S TS-F24P1 to be mounted to the inside of the drawer door. You can mount the tray either in a lower or in a higher position, depending on your intended application.

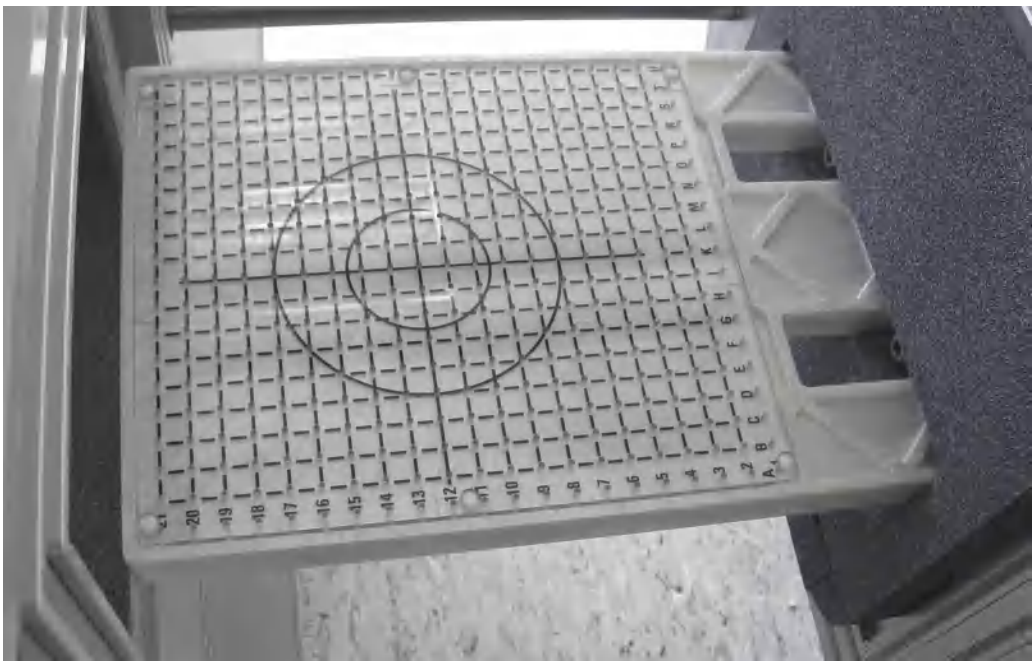


Figure 6-5: DUT holder tray, here mounted in the higher position

NOTICE

Risk of tray collision with the full antenna ring

If the full antenna ring is placed in the chamber, the DUT holder tray must **not** be mounted in the **lower position**, to avoid a collision. In this combination, closing the drawer can damage the antenna ring, any mounted antennas and the tray.

Together with the full antenna ring, only mount the DUT tray in the **higher position**.

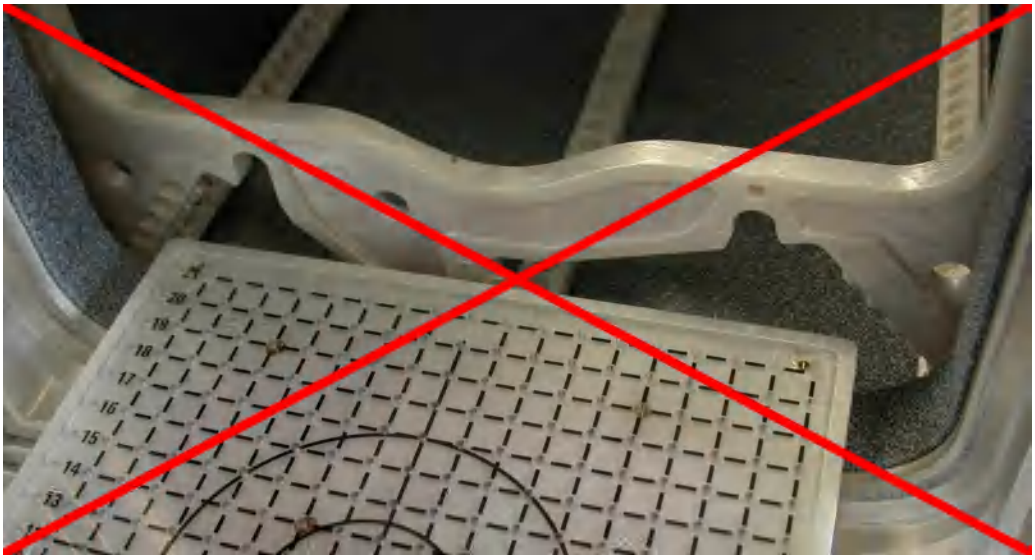


Figure 6-6: Do not mount the DUT tray in the lower position, if the full antenna ring is in the chamber

NOTICE

Risk of tray collision with Vivaldi antennas

If one or more Vivaldi antennas are mounted in the chamber on the antenna holder, the DUT holder tray mounted in the upper or lower position can collide with the antennas. The risk of collision depends on the *positions*, on the *rotational orientation* and on the *size* of the antennas. In a situation that leads to collision, closing the drawer can damage or destroy the antennas, and possibly also the antenna holder, cables, the DUT holder tray and the DUT.

To avoid a collision, mount the antennas out of the way of the DUT holder tray. This is possible in some antenna positions, but not in all positions.

To be sure that a collision is avoided, carefully test the chosen antenna positions: Manually close the drawer and watch the path of the tray, while the top cover is opened. Be aware that a heavy DUT (maximum load 1 kg) on the DUT holder tray can bend its far end down by several millimeters.

If you have identified safe antenna positions, prevent other users or operators from changing these positions.

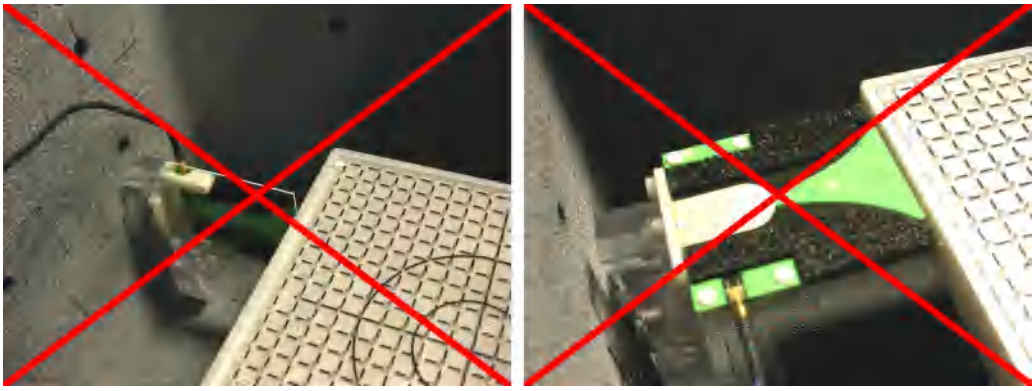


Figure 6-7: Do not mount Vivaldi antennas in the way of the DUT holder tray

The following mounting instruction uses the DUT Holder Tray R&S TS-F24P1 as an example. Other DUT holder trays are mounted in a similar way.

To change the tray position (low to high, or high to low):

1. Open the front door of the RF Shielded Box.
2. Unscrew the two hexagon socket screws, using a 5 mm hex key with ball end as shown in Figure 6-8.

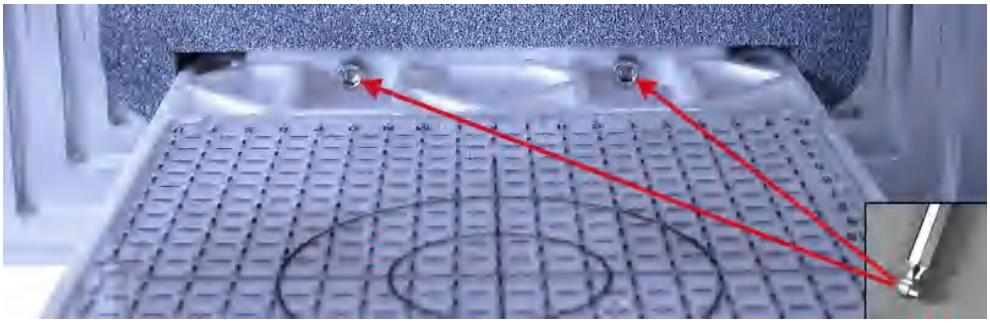


Figure 6-8: DUT holder tray, here mounted in the lower position

3. Remove the DUT holder tray from the door. As the tray can sit firmly in the door's notch, slightly wobble the tray back and forth to loosen it.
4. Attach the DUT holder tray to the other position.
5. Use the two hexagon socket screws to pull the tray all the way into the notch.
6. To securely fix the tray to the front door, tighten the two screws with a torque of 8 Nm.
7. When finished, close the front door.

7 Configuration

The RF Shielded Box is typically delivered with a customer-specific, pre-configured antenna arrangement. It can be composed of the following available options:

- Multiple Vivaldi antennas of various types can be mounted on the Half Antenna Ring R&S TS-F24-AH1, the Full Antenna Ring R&S TS-F24-AR or on the Antenna Holder R&S TS-F24-AH2 inside the chamber. These rings and the holder provide high flexibility for rotating and translating the Vivaldi antennas, which include:
  - The Vivaldi Antenna R&S TS-F24-V1
  - The Vivaldi Antenna R&S TS-F24-V2
  - The Cross-Polarized Vivaldi Antenna R&S TS-F24-V3
- The Narrowband Antenna R&S TS-F24NB2, or multiple of those antennas, can be mounted in the lower part of the chamber.
- The Wideband Antenna R&S TS-F24WA1 can be mounted in the top part of the chamber.
- The Magnetic Coil R&S TS-F24HML1 (mounted without any other antennas)
- The LF Loop Antenna R&S TS-F24HLF1

The wideband antenna, one or multiple narrowband antennas, one or multiple Vivaldi antennas or an LF loop antenna on one or two antenna holders can be mounted at the same time. However, either of them prevents the installation of an antenna ring. The only exception from this exclusion rule is the combination of the half antenna ring with LF loop or Vivaldi antennas on one or two antenna holders.

These options allow configuring the R&S TS7124M reproducibly for a comprehensive range of application-specific DUT test scenarios.

The configuration examples given in this user manual, such as specific cable connections and antenna positions, are not more than representative of many possible configurations. Rohde & Schwarz does not recommend any specific configuration.

NOTICE

Risk of RF connector and cable damage / TORQUE RECOMMENDATIONS

Excessive tightening of the coaxial RF connectors can damage the cables and connectors. Too weak tightening leads to inaccurate measurement results.

Always use a torque wrench suitable for the connector type and apply the torque specified in **application note 1MA99**, which is available on the Internet at www.rohde-schwarz.com. It provides additional information on care and handling of RF connectors.

For N, SMA and PC connectors, we recommend applying the following torque limits:

- **150 N·cm** for **N** connectors
- **56 N·cm** for **SMA** connectors
- **90 N·cm** for **PC** connectors (3.5 mm / 2.92 mm / 2.4 mm / 1.85 mm)

Never use a standard open-end wrench. Rohde & Schwarz offers torque wrenches for various connectors. For ordering information, see the application note 1MA99.

The following chapters describe the details of the configuration process.

To get started with the antenna arrangement, the top cover of the chamber has to be removed, as described in Chapter 7.1, "Opening and Closing the Top Cover", on page 78.

The antennas or the antenna ring can then be taken out of the chamber to be re-configured. For detailed instructions see:

- Chapter 7.2, "Installation of an Antenna Ring or Holder", on page 85
- Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118
- Chapter 7.4, "Installation of Narrowband Antennas", on page 128
- Chapter 7.5, "Installation of the Wideband Antenna", on page 141
- Chapter 7.6, "Installation of the LF Loop Antenna", on page 147

7.1 Opening and Closing the Top Cover

⚠ CAUTION

Risk of injury while the chamber's top cover is opened

There is a risk of personal injury due to moving parts, when the top cover is removed for configuration, service, maintenance or inspection tasks.

To prevent any risk due to unintended movement (especially opening / closing of the drawer or tipping of the chamber), make sure that the chamber is fixed with brackets in a horizontal position during configuration, service, maintenance and inspection.

NOTICE

Risk of reducing the chamber's shielding effectiveness by touching the gasket

Opening and closing the chamber's top cover involves a risk to damage the gasket by touching it. Even low amounts of sweat, grease or soil from fingerprints might increase the gasket's electrical contact resistance. This locally reduces the conductivity between top cover and chamber, and hence compromises the chamber's shielding effectiveness.

To avoid this risk, do not touch the gasket's contact area. If required, clean the gasket as described in Chapter 7.1.3, "Adjusting the Locking Force of the Cover", on page 83.

7.1.1 Opening the Top Cover

Figure 7-1: Top cover, locked with six quick clamps

The top cover is fixed and locked by six quick clamps. Open all of them by hand and carefully lift the top cover upwards.

When opening the top cover of the R&S TS7124M for the first time, its warranty seal has to be broken. The seal indicates that the chamber is in its original delivery state, with a shielding effectiveness as specified in the data sheet. After closing the cover it is in the user's responsibility to restore a good shielding effectiveness. To do so, proceed as described in Chapter 7.1, "Opening and Closing the Top Cover", on page 78.

Note that, due to the tightly fitted absorber material inside the chamber, there could be some resistance against the top cover to be lifted.

Make sure not to touch the gasket contact area.

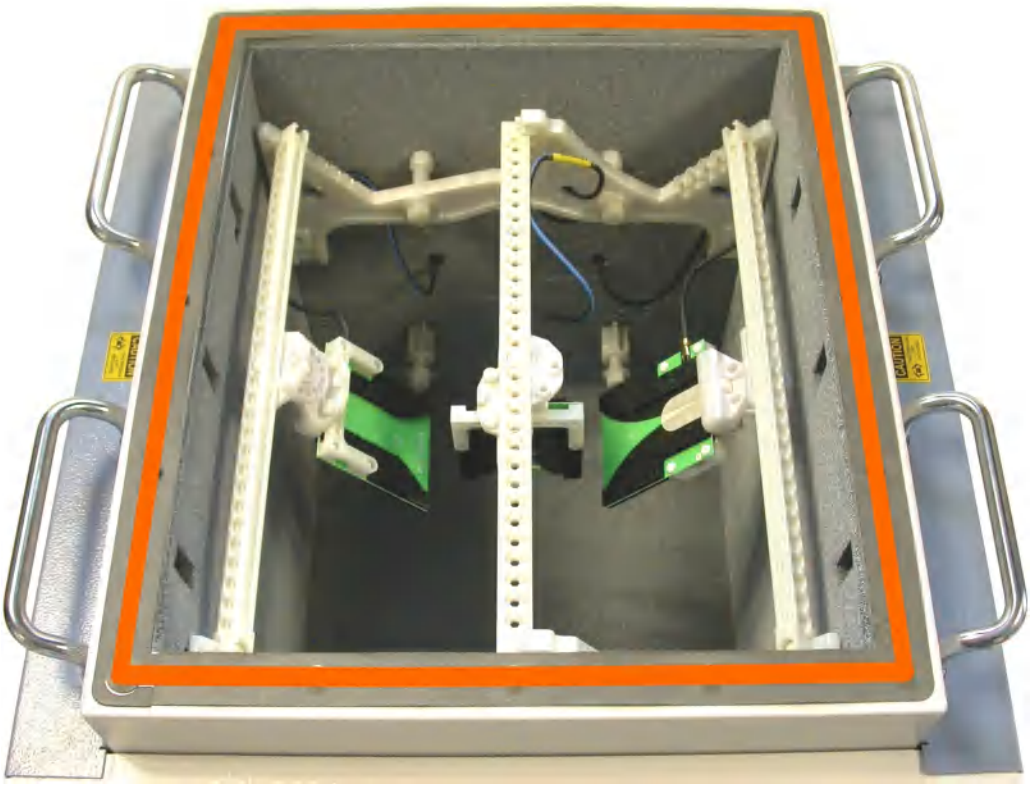


Figure 7-2: RF Shielded Box with top cover opened. The gasket is marked in orange color

7.1.2 Closing the Top Cover

NOTICE

Risk of reduced shielding effectiveness

If the top cover is not installed correctly, shielding effectiveness may deteriorate dramatically. To avoid this risk, it is recommended to perform a shielding effectiveness measurement after closing the cover.

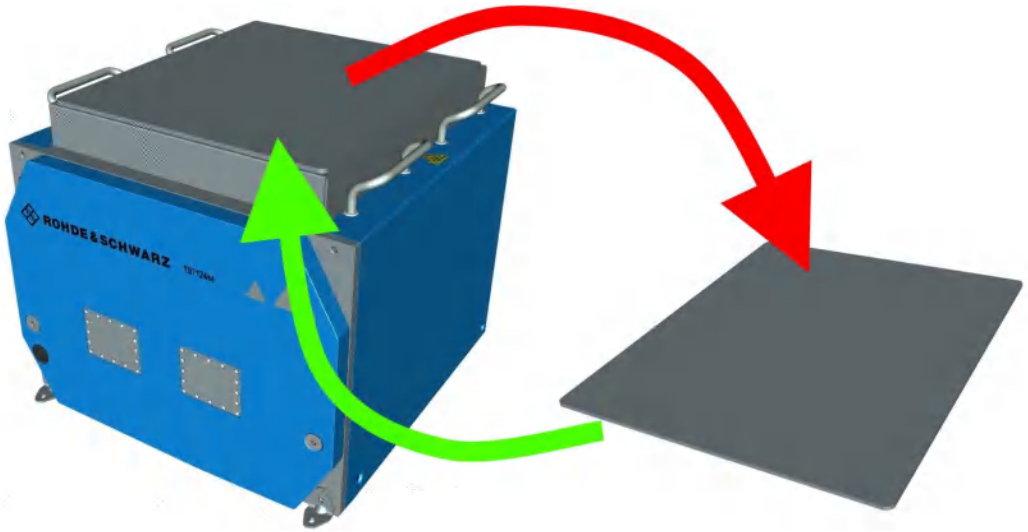


Figure 7-3: Removing the top cover and putting it back on top of the RF Shielded Box

Before the cover is closed again, the gasket has to be cleaned as described in Chapter 8.5.2, "Cleaning the Gasket Contact Area", on page 157.

Note that the gasket is sensitive to sweat, grease and soil. Make sure not to damage the gasket.

Before putting back the top cover, select the correct absorber configuration on the inside, depending on the antenna arrangement mounted in the chamber:

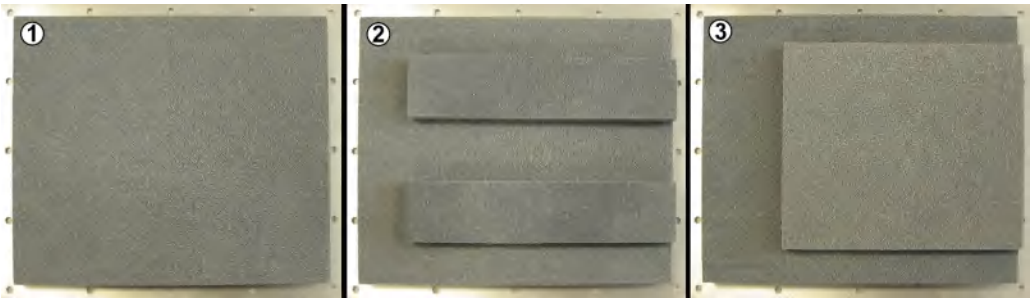


Figure 7-4: Different absorber material configurations on the inside of the top cover. In these pictures, the "FRONT" edge of the cover is on the right-hand side

1 = Standard absorber for use with Narrowband Antenna R&S TS-F24NB2
2 = Absorber for use with Half Antenna Ring R&S TS-F24-AH1 or Full Antenna Ring R&S TS-F24-AR
3 = Absorber for use with Wideband Antenna R&S TS-F24WA1

All three absorber material configurations are compatible with antennas mounted on the Antenna Holder R&S TS-F24-AH2.

When putting back the top cover, make sure that its front edge is at the front side of the RF Shielded Box. This is indicated by a sticker on the top cover:

Figure 7-5: Top cover with sticker indicating the cover's front edge

The top cover has to be locked by closing the six quick clamps. Close each quick clamp as shown in Figure 7-6:

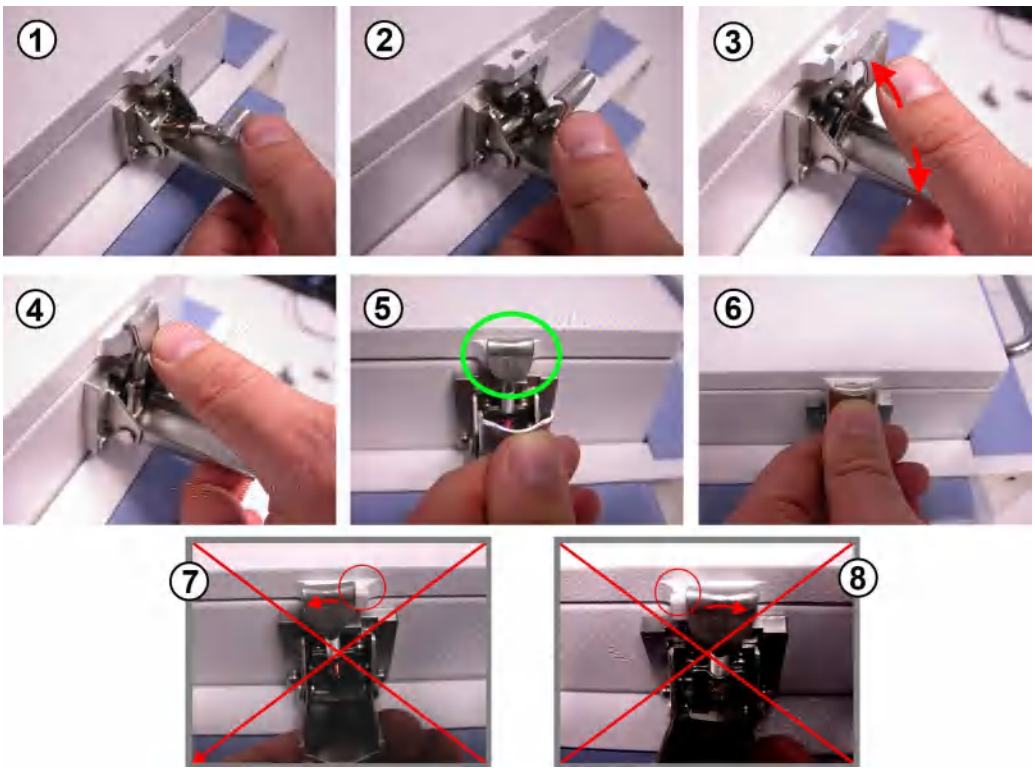


Figure 7-6: Closing the top cover's quick clamps

1 = Lift the inner clamp out of the lever
2 = Bring the inner clamp closer to the retaining lug on the top cover's edge
3 = While bringing the inner clamp closer, make sure to leave the lever in a low position
4 = Push the inner clamp over the retaining lug
5 = While bringing up the lever, make sure to position the inner clamp on the center of the lug (in the green circle)
6 = Fully close the lever
7 = Here, the inner clamp is badly positioned, too far to the left
8 = Here, the inner clamp is badly positioned, too far to the right

7.1.3 Adjusting the Locking Force of the Cover

Over time, the tension force that the quick clamps exert on the cover may change. This is due to aging effects of the gasket.

- Too high force becomes obvious if the quick clamps can hardly be closed by hand.
- Too low force may result in a reduced shielding effectiveness of the top cover.

To adjust the tension force, the quick clamps can be shifted up or down a little bit. This is supported by an adjustment screw (1). However, **do not rotate** the holder screw (2) of the inner clamp's hooked flap (3), because one rotation of this holder screw is typically too much for adjusting the tension force.

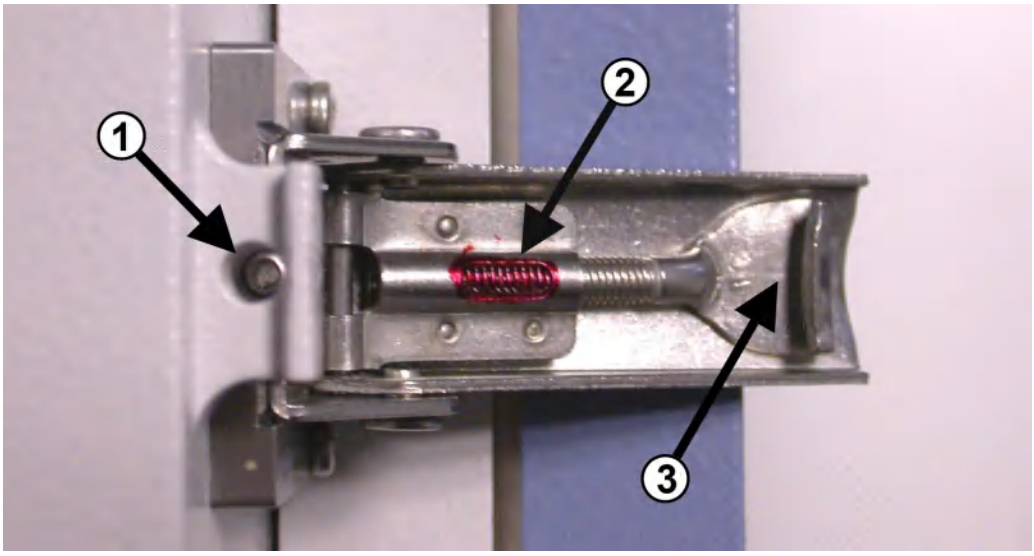


Figure 7-7: Inside view of a quick clamp

1 = Adjustment screw, seen through a hole in the top cover's retaining lug
2 = Red seal: locking varnish on the inner clamp's holder screw
3 = Hooked flap of the inner clamp - DO NOT ROTATE THIS PART

For adjusting the tension force by fine-tuning the quick clamp's vertical position, proceed as follows:

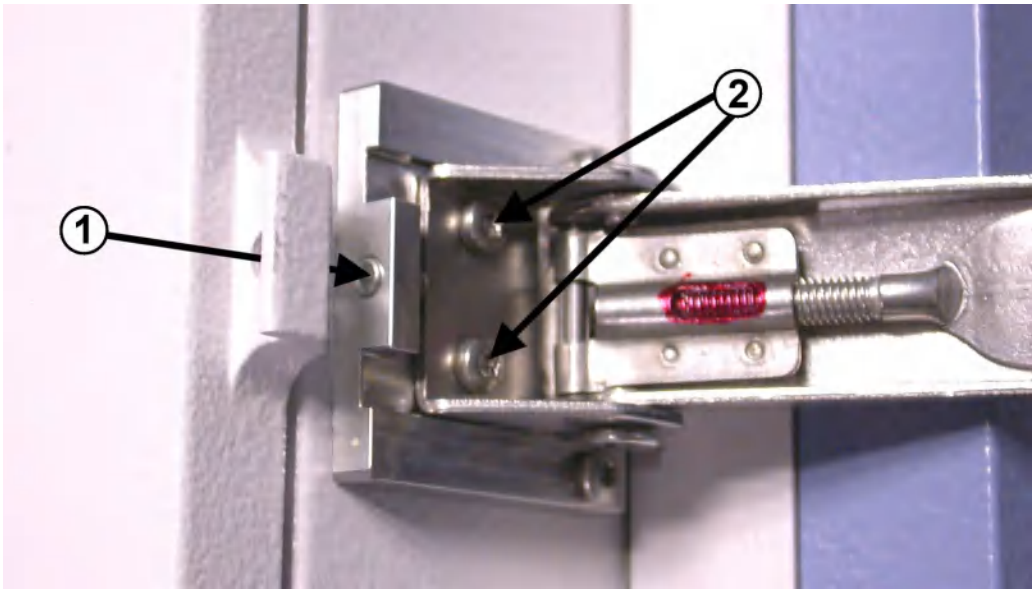


Figure 7-8: Adjustment of a quick clamp

1. Loosen the two fixing screws (labeled (2) in Figure 7-8) by a Torx 9 screwdriver.
2. Use a 2 mm hex key to turn the adjustment screw (1) through the hole in the top cover's retaining lug.
3. **Rotate the adjustment screw half a turn**, either clockwise or anti-clockwise:

- Rotate **clockwise** for a lower position of the quick clamp, leading to a stronger tension force.
- Rotate **anti-clockwise** for a higher position of the quick clamp, leading to a weaker tension force.

4. In case of anti-clockwise rotation (for a higher position), make sure to shift the quick clamp upwards to keep it in contact with the adjustment screw.
5. Tighten the two fixing screws (2) by a Torx 9 screwdriver.
6. Check the tension force and the good operability of the quick clamp by closing it as shown in Figure 7-6.
   In the best position of the quick clamp, it should be possible to close it by hand with mild force, while the top cover is being pulled downwards by a fraction of a millimeter. To detect this movement, hold a fingertip across the small gap between the top cover and the chamber's body. This should only be done once the top cover is close enough to the chamber's body (<1 mm), to avoid any risk of contusion. By touching the gap while closing the clamp, the slight downwards movement of the top cover can just be felt. This is a good indication for an appropriate adjustment of the tension force.

   As long as the tension force and the operability of the quick clamps are not ideal, repeat the procedure:
   - If the force is too weak (hence the top cover is not noticeably pulled down), rotate the adjustment screw half a turn *clockwise* in the repeated procedure.
   - If the force is too strong (hence closing the quick clamps by hand is hardly possible), rotate the adjustment screw half a turn *anti-clockwise* in the repeated procedure.

7.2 Installation of an Antenna Ring or Holder

Before configuring the half or full antenna ring or the antenna holder with Vivaldi antennas, the entire antenna ring or the antenna holder must be taken out of the RF Shielded Box. After configuration, it can be installed back into the chamber. These activities are described in the following sections:

7.2.1 Taking the Half Antenna Ring out of the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

For taking the half antenna ring out of the RF Shielded Box:

1. Remove the top cover (see Chapter 7.1.1, "Opening the Top Cover", on page 79). For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.
2. Remove the detachable absorber pads from the rear chamber wall, wherever an antenna cable is attached to an SMA connector.

3. Use an SMA wrench to disconnect the antenna cables from the SMA connectors at the chamber's rear wall.

4. Remove the four polymer bolts (the short- and long-distance bolts shown in Figure 7-17) that hold the half antenna ring, using a wrench No.13:

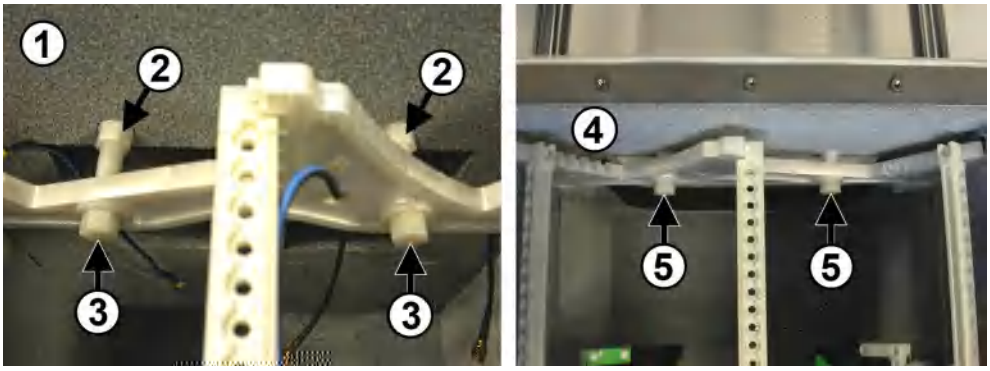


Figure 7-9: Left: remove two long bolts (3) at the rear wall inside the chamber. Right: remove two short bolts (5) at the front wall

1 = Rear chamber wall
2 = Two spacers (do NOT remove)
3 = Two rear long-distance bolts (remove)
4 = Front chamber wall
5 = Two front short-distance bolts (remove)

5. Carefully and slowly lift the half antenna ring out of the RF Shielded Box.

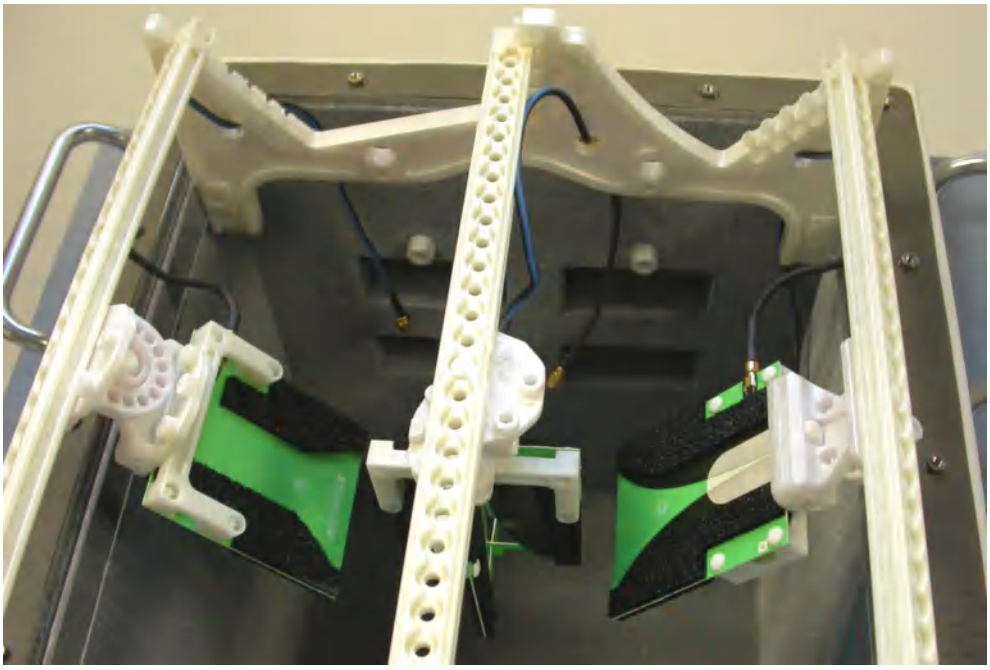


Figure 7-10: Take the half antenna ring out of the chamber

6. Place the antenna ring outside the chamber
7. Remove the cable guide clips (highlighted in Figure 7-11 by a red circle).

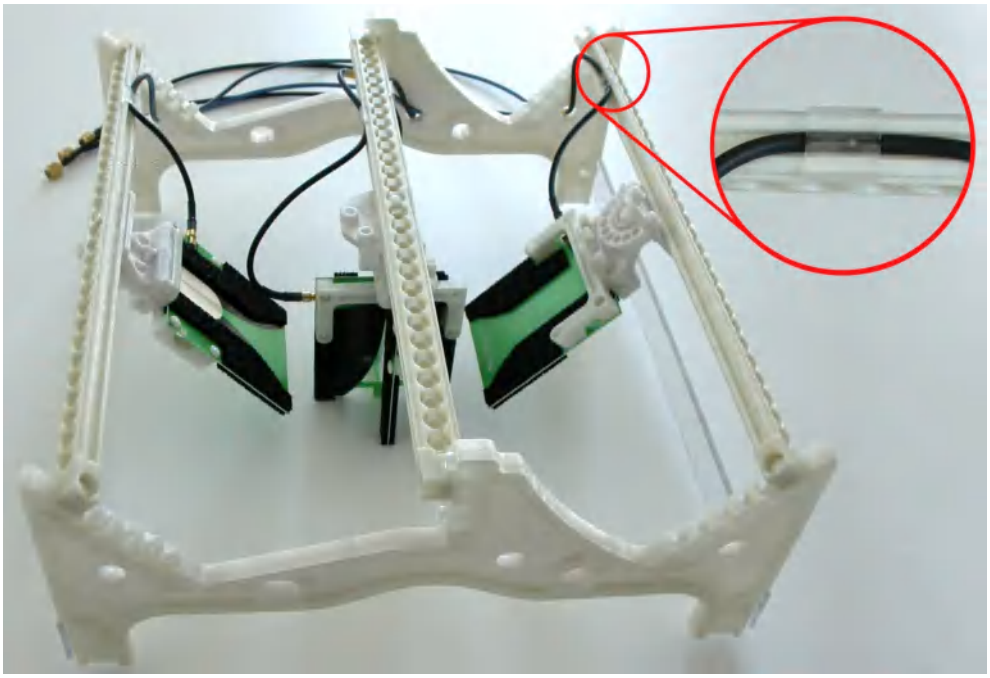


Figure 7-11: Half antenna ring with some antennas and cables still mounted (red: cable guide clip)

8. Detach the cables from the cable guide holes and from the SMP connectors at the antennas.

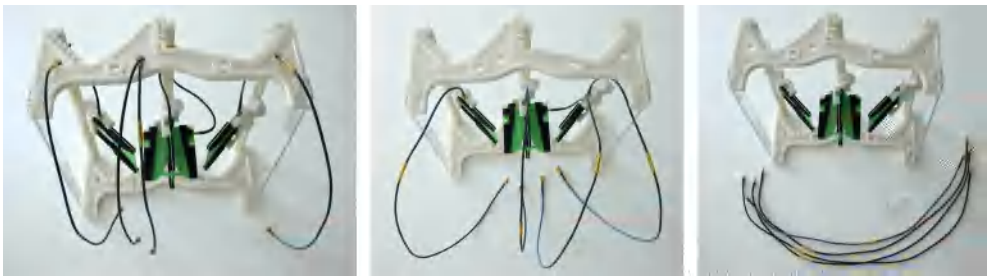


Figure 7-12: Detach the antenna cables

9. The antenna ring and antennas are now ready for configuration according to Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118.

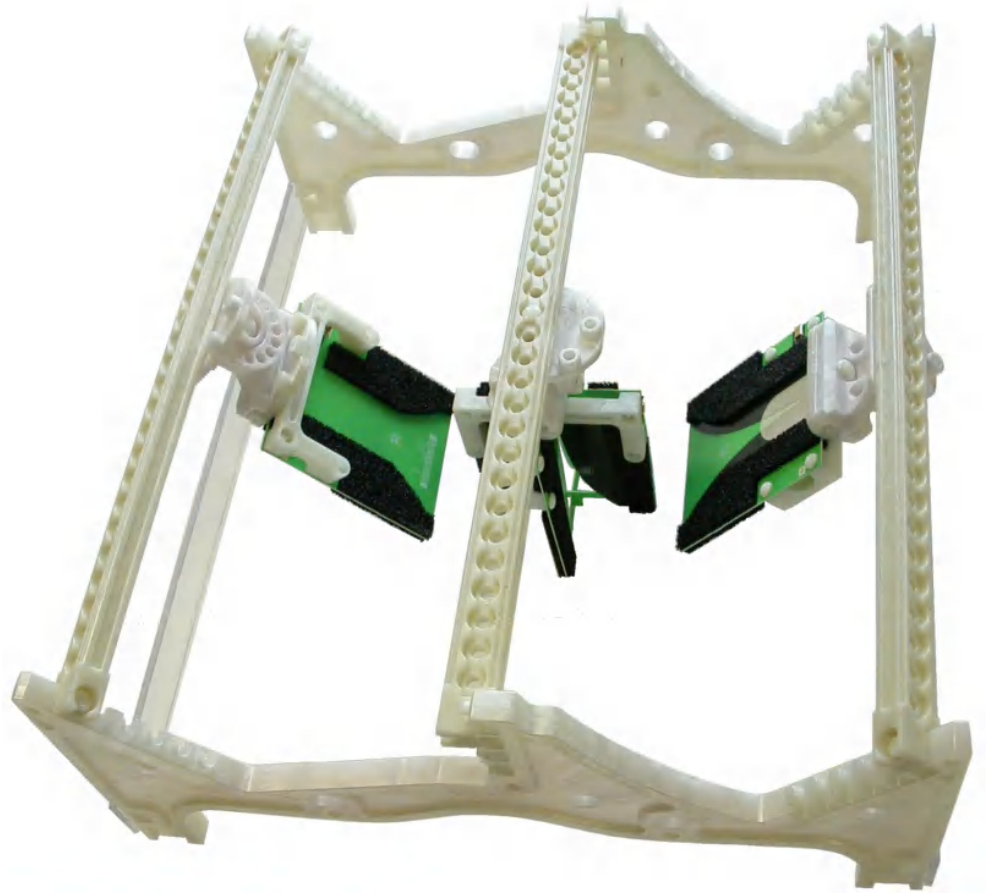


Figure 7-13: Antenna ring with some antennas mounted

10. Attach the protective caps to the SMA connectors.
11. Insert the previously detached absorber pads into the gaps in the rear chamber wall.

Figure 7-14: Detachable absorber pads re-installed at the chamber's rear wall

12. Optionally close the chamber's top cover (see Chapter 7.1.2, "Closing the Top Cover", on page 80), especially if the half antenna ring will remain outside of the chamber for an extended period of time.

7.2.2 Mounting the Half Antenna Ring into the Chamber

⚠ WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

For mounting the antenna ring into the RF Shielded Box, the top cover has to be removed (see Chapter 7.1.1, "Opening the Top Cover", on page 79).

For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.

Start with the following:

- The half antenna ring with antennas, configured as described in Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118

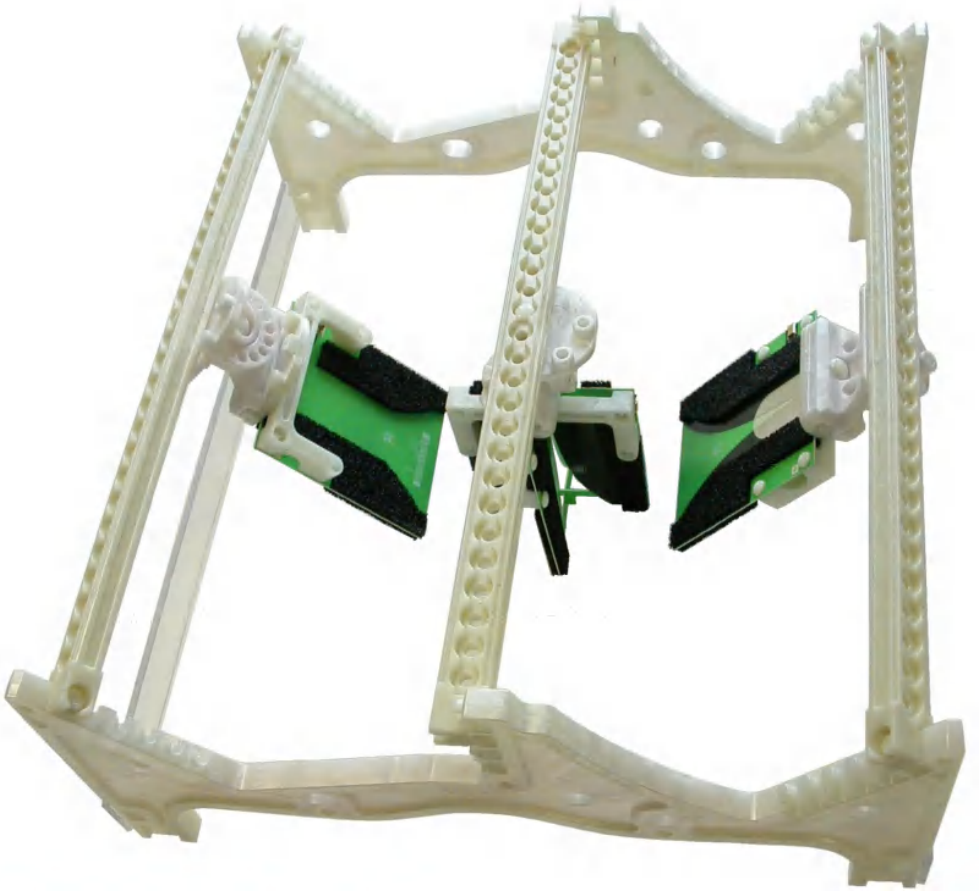


Figure 7-15: Antenna ring with some antennas mounted

- The empty chamber (empty except for the absorber material covering the walls). If spacers and disk fixtures (see Figure 7-16) are already installed in the RF Shielded Box, you can leave them there.
  If the wideband antenna or narrowband antennas are present in the chamber, remove them as described in Chapter 7.4.2, "Taking Narrowband Antennas Out of the Chamber", on page 138 or Chapter 7.5.2, "Taking the Wideband Antenna Out of the Chamber", on page 145.
  If one or more Vivaldi antennas mounted on the antenna holder are present in the chamber, remove them as described in Chapter 7.2.5, "Taking the Antenna Holder out of the Chamber", on page 111.

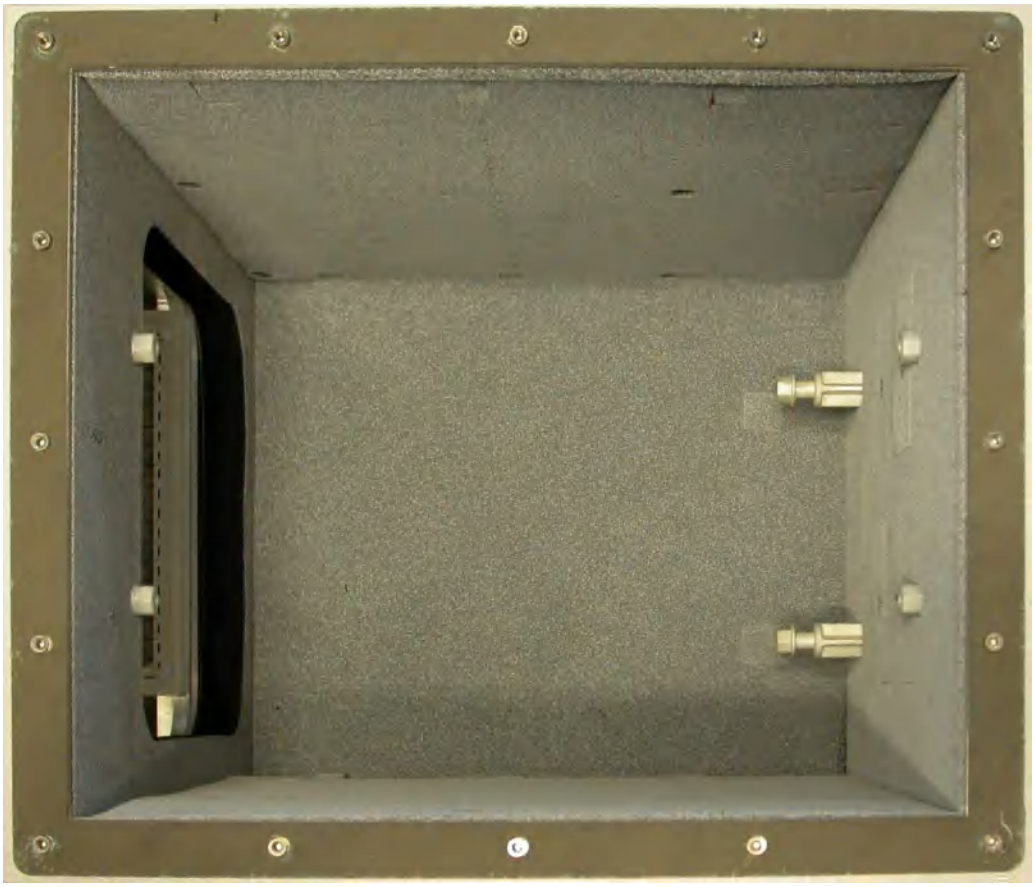


Figure 7-16: Top view of the empty chamber, with four spacers as well as two long disk fixtures at the lower rear side

Figure 7-17: The short- and the long-distance bolt, the spacer and the long disk fixture

Mount the half antenna ring into the chamber as follows:

1. If the four spacers are not installed as in Figure 7-16, remove the four round absorber pads at the upper end of the front and rear chamber wall.

2. Screw the four spacers into the four upper positions, using a torque wrench No. 13 with a torque of 4.6 Nm.
3. Connect SMA/SMP cables of appropriate length to the SMP connectors at the antennas.
4. Thread the cables through the holes in the half antenna ring. Make sure to thread them to the rear side (away from the "FRONT" label).
   If two cables go through the same hole, it is easier to first thread both of them through that hole by using the cables' thinner SMP connector ends. Then connect the cables to the antennas.

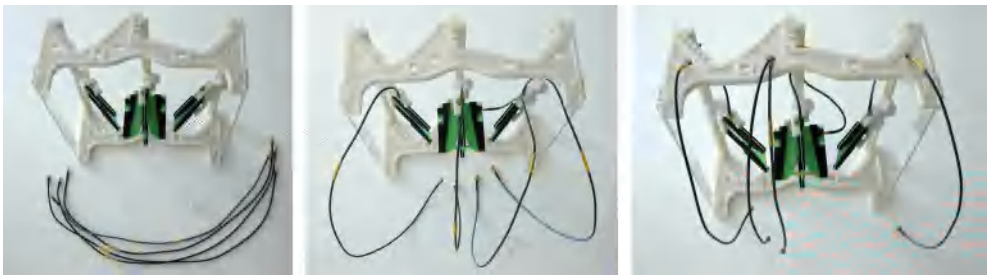


Figure 7-18: Attach the antenna cables to the antennas and thread them through the holes in the half antenna ring

5. Fix the cables to the antenna ring bars (rails), using the cable guide clips (this detail is highlighted in Figure 7-19 by a red circle).

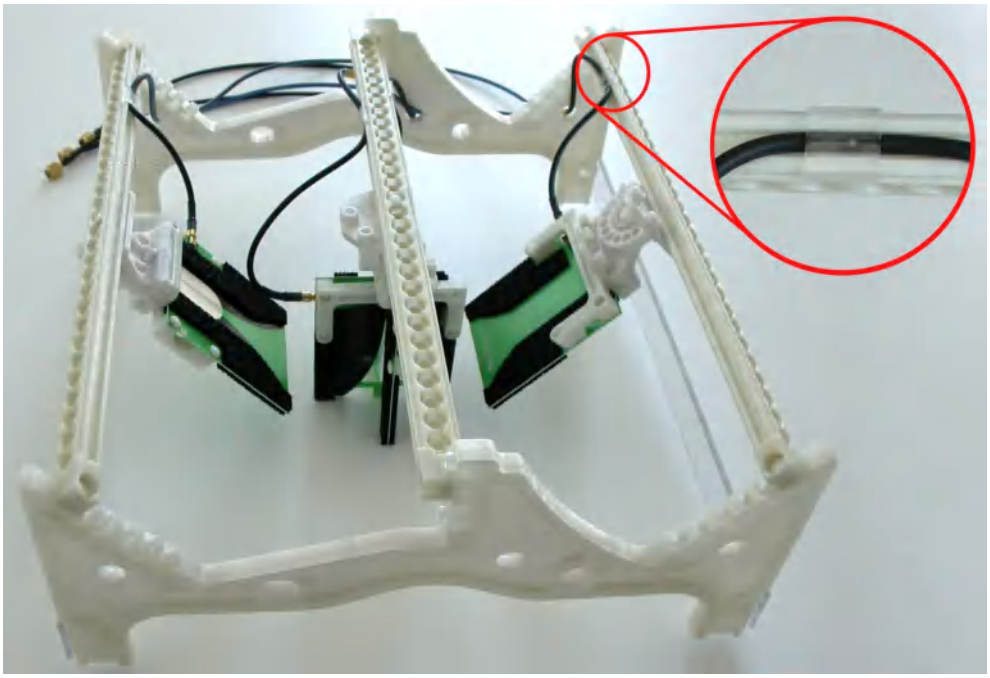


Figure 7-19: Half antenna ring with some antennas and cables mounted (detail: cable guide clip)

6. Depending on the number of antenna cables to be connected, remove an appropriate number of detachable absorber pads from the rear wall inside the chamber. Also remove the protective caps from the SMA connectors.

Figure 7-20: Remove detachable absorber pads from the rear wall, as required

7. Carefully and slowly insert the half antenna ring into the chamber. Make sure that the half antenna ring's "FRONT" label is at the front side of the chamber.

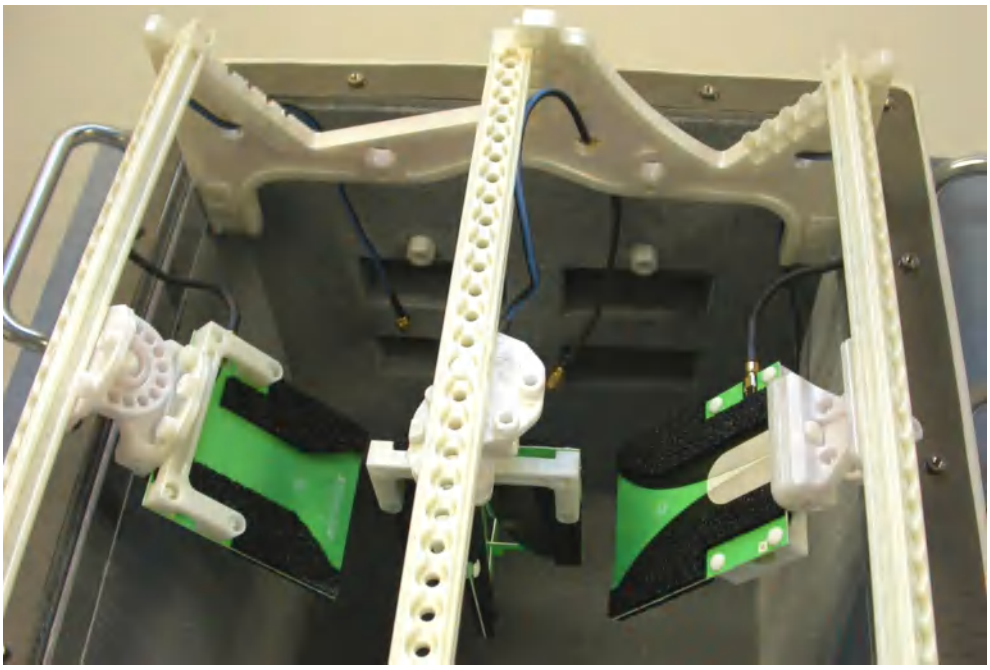


Figure 7-21: Inserting the half antenna ring into the chamber

8. Fix the half antenna ring with the two long-distance bolts at the rear wall, and with the two short-distance bolts at the front wall. The bolts are shown in Figure 7-17. To screw the bolts into the spacers and tighten them, use a torque wrench No.13 with a torque of 2.8 Nm.

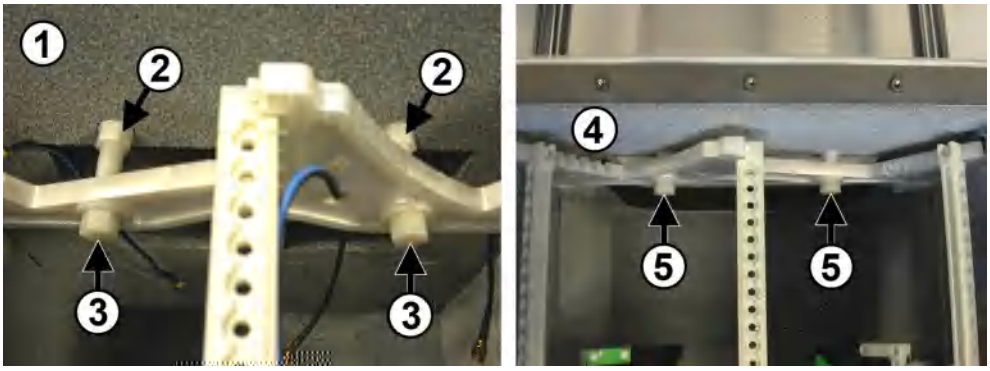


Figure 7-22: Left: fix two long bolts (3) at the rear wall inside the chamber. Right: fix two short bolts (5) at the front wall

1 = Rear chamber wall
2 = Two spacers
3 = Two rear long-distance bolts
4 = Front chamber wall
5 = Two front short-distance bolts

9. Use an SMA wrench to attach the antenna cables to the SMA connectors at the chamber's rear wall, minding the TORQUE RECOMMENDATIONS.
   Make sure to make a note of the allocation of which antenna is connected to which SMA connector.

10. Insert the previously detached absorber pads into the gaps in the rear chamber wall.

11. Check the SMP connectors: verify that all antennas are properly connected to their cables.

NOTICE

Risk of damage in case of collision of the DUT or DUT holder with any antenna

Verify that no DUT holder tray (and no DUT on it) can potentially collide with any antenna inside the chamber or with the antenna ring, once the drawer is closing. If any antenna comes too close to the DUT or DUT holder tray, consider placing the antenna further away from the center of the chamber.

Finally, close the chamber's top cover (see Chapter 7.1.2, "Closing the Top Cover", on page 80).

With the half antenna ring mounted, use the second absorber version (2) on the top cover:

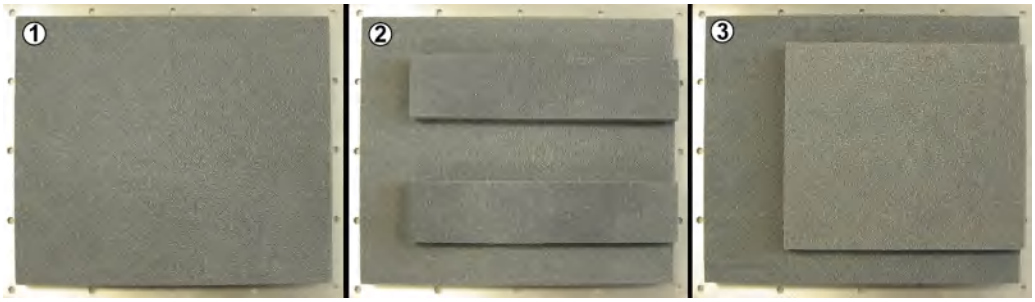


Figure 7-23: Different absorber material configurations on the inside of the top cover. In these pictures, the "FRONT" edge of the cover is on the right-hand side

1 = Standard absorber for use with Narrowband Antenna R&S TS-F24NB2
2 = Absorber for use with Half Antenna Ring R&S TS-F24-AH1 or Full Antenna Ring R&S TS-F24-AR
3 = Absorber for use with Wideband Antenna R&S TS-F24WA1

All three absorber material configurations are compatible with antennas mounted on the Antenna Holder R&S TS-F24-AH2.

7.2.3 Taking the Full Antenna Ring out of the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

For taking the full antenna ring out of the RF Shielded Box:

1. Remove the top cover (see Chapter 7.1.1, "Opening the Top Cover", on page 79). For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.
2. Remove the detachable absorber pads from the rear chamber wall, wherever an antenna cable is attached to an SMA connector.

3. Use an SMA wrench to disconnect the antenna cables from the SMA connectors at the chamber's rear wall.

4. Remove the four polymer bolts that hold the full antenna ring, using a wrench No. 13:

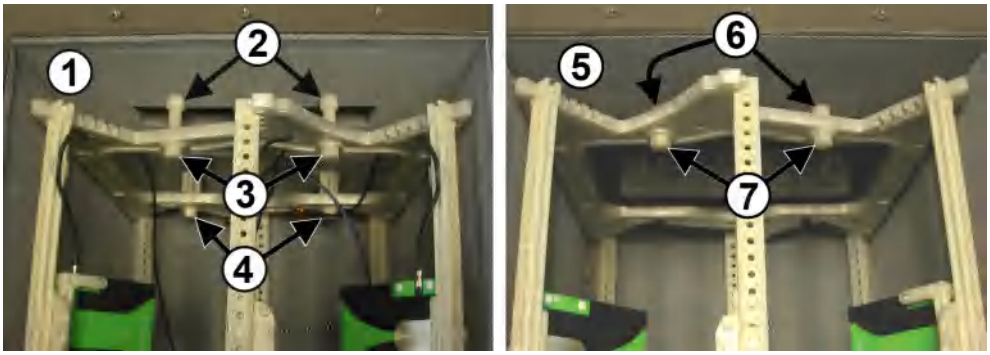


Figure 7-24: Left: remove two long bolts (3) at the rear wall inside the chamber. Right: remove two short bolts (7) at the front wall

1 = Rear chamber wall
2 = Two spacers (do NOT remove)
3 = Two rear long-distance bolts (remove)
4 = Two disk fixtures (do NOT remove)
5 = Front chamber wall
6 = Two spacers (do NOT remove)
7 = Two front short-distance bolts (remove)

5. **NOTICE!** Risk of damage in case of collision of the antenna ring with the DUT holder.

   Before lifting the full antenna ring out of the RF Shielded Box, make sure that the DUT holder is not within the chamber at the same time. Either manually pull the drawer open (while preventing the chamber from tilting) or make sure that the DUT holder is not attached to the drawer's door.
   Then carefully and slowly lift the full antenna ring out of the RF Shielded Box.

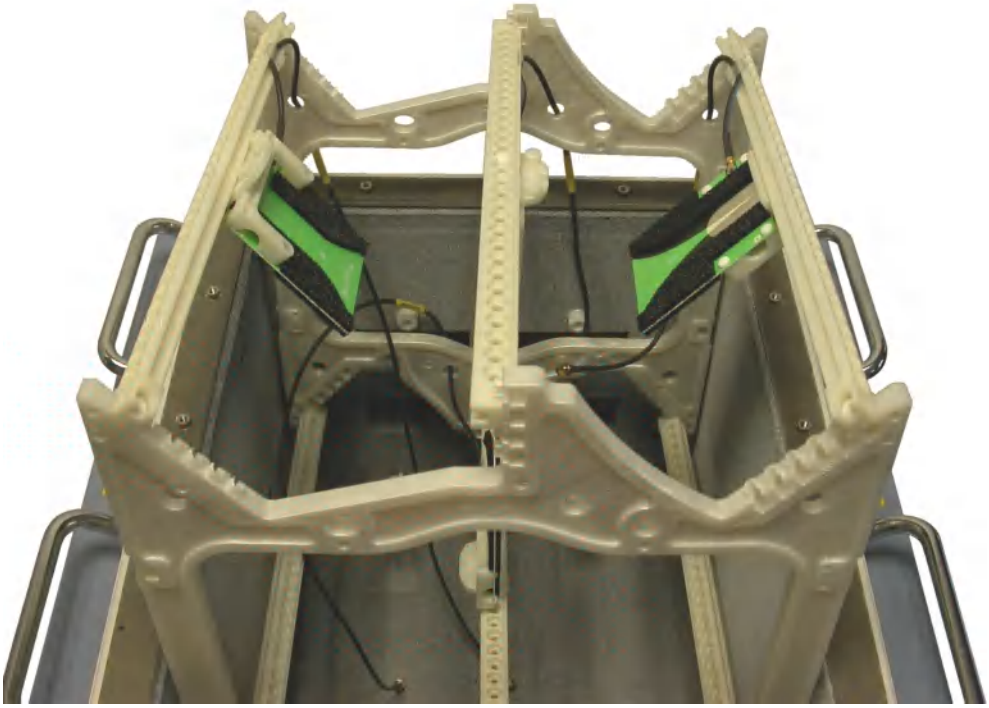


Figure 7-25: Take the full antenna ring out of the chamber

6. Place the full antenna ring outside the chamber

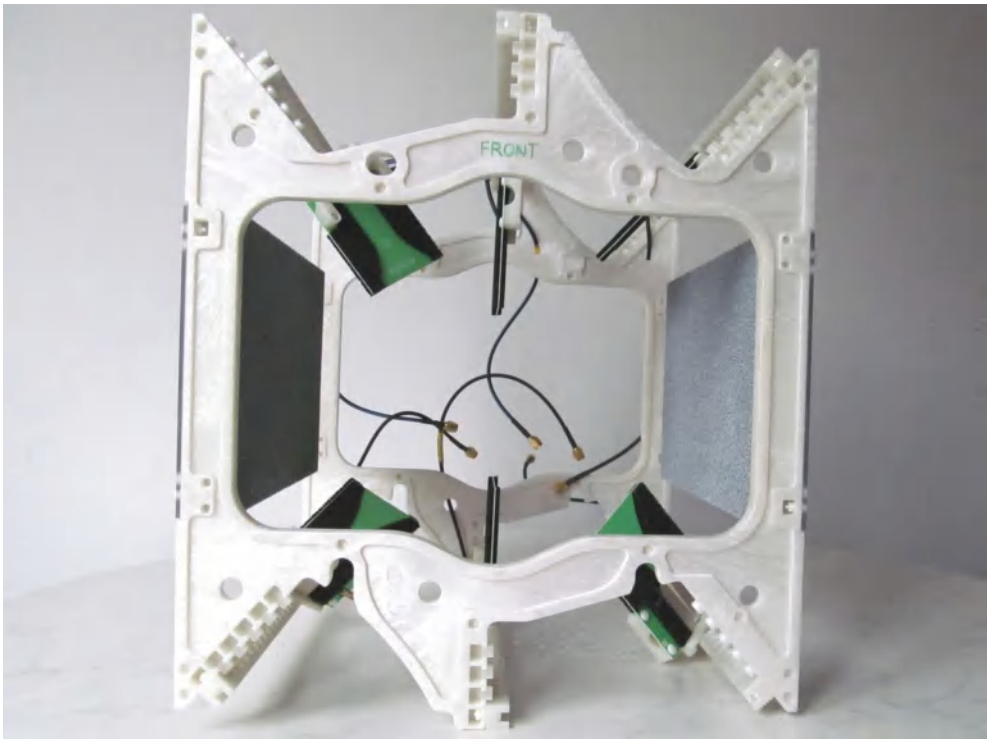


Figure 7-26: Antenna ring with some antennas and cables still mounted

7. Remove the cable guide clips (2 in Figure 7-27).

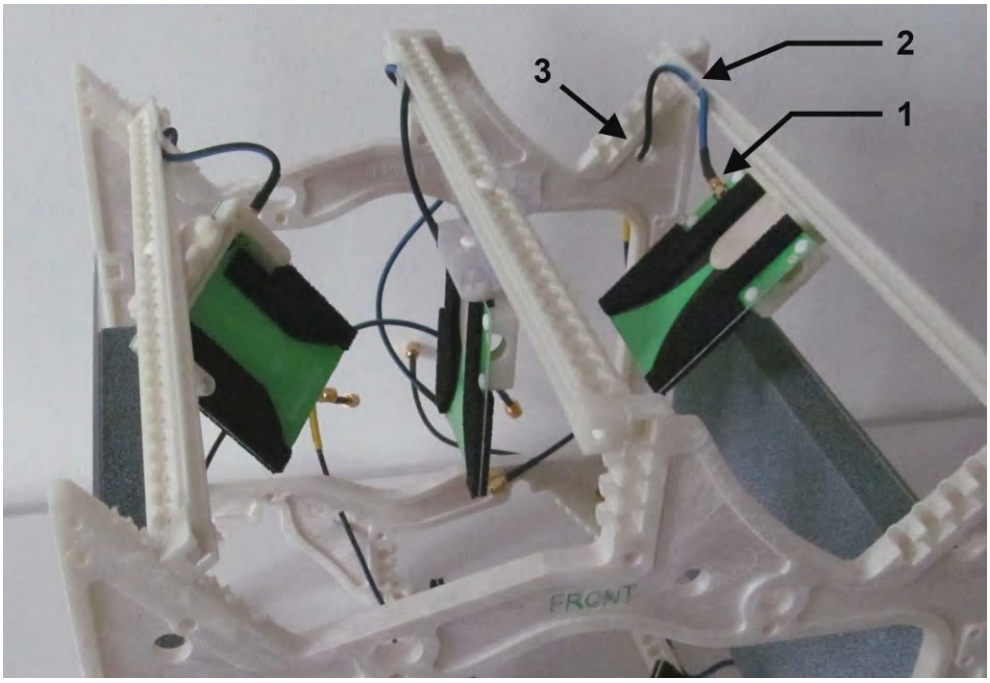


Figure 7-27: The antenna cables can be detached

1 = SMP connector
2 = Cable guide clip
3 = Cable guide hole

8. Detach the cables from the cable guide holes (3 in Figure 7-27) and from the SMP connectors (1) at the antennas.
9. Remove the absorber brackets and absorbers.

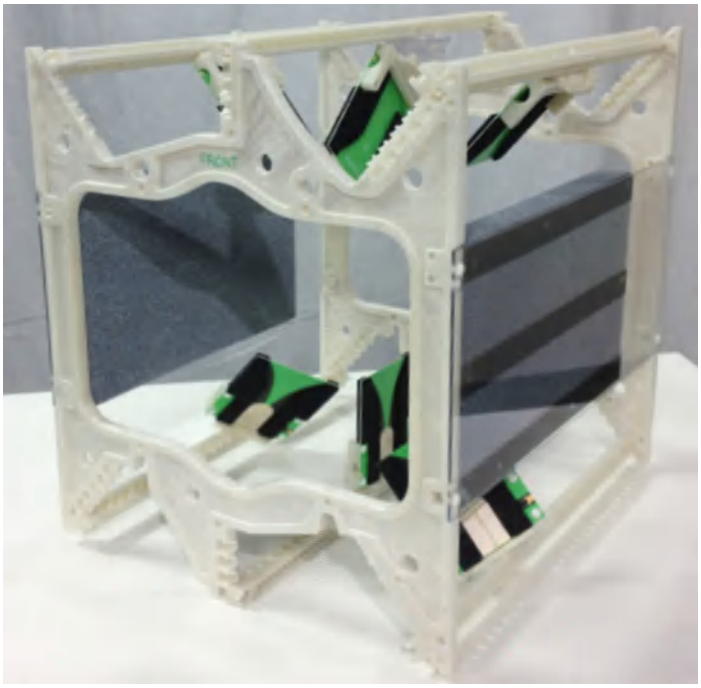


Figure 7-28: Pull the four expanding rivets out of each absorber bracket to remove them together with the absorbers

10. The full antenna ring and antennas are now ready for configuration according to Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118.

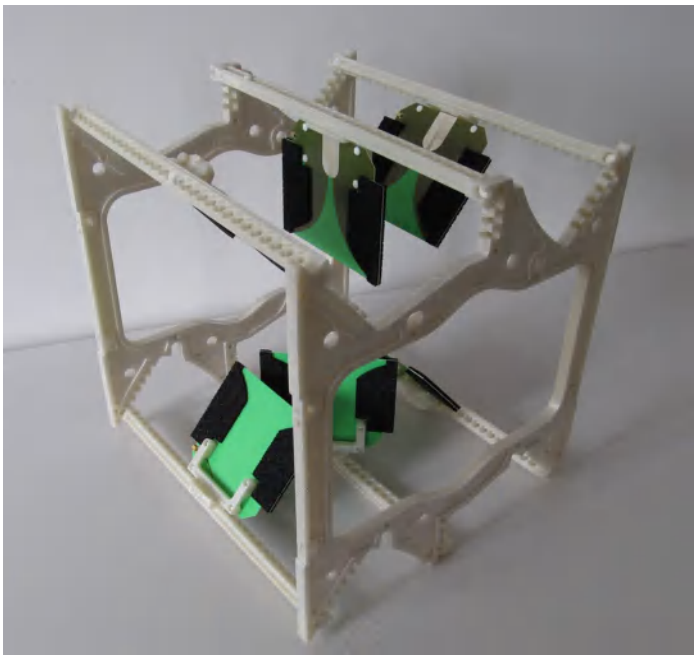


Figure 7-29: Full antenna ring with some antennas mounted

11. Attach the protective caps to the SMA connectors.

12. Insert the previously detached absorber pads into the gaps in the rear chamber wall.

Figure 7-30: Detachable absorber pads re-installed at the chamber's rear wall

13. Optionally close the chamber's top cover (see Chapter 7.1.2, "Closing the Top Cover", on page 80), especially if the full antenna ring will remain outside of the chamber for an extended period of time.

7.2.4 Mounting the Full Antenna Ring into the Chamber

⚠ WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

For mounting the full antenna ring into the RF Shielded Box, the top cover has to be removed (see Chapter 7.1.1, "Opening the Top Cover", on page 79).

For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.

Start with the following:

- The full antenna ring with antennas, configured as described in Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118

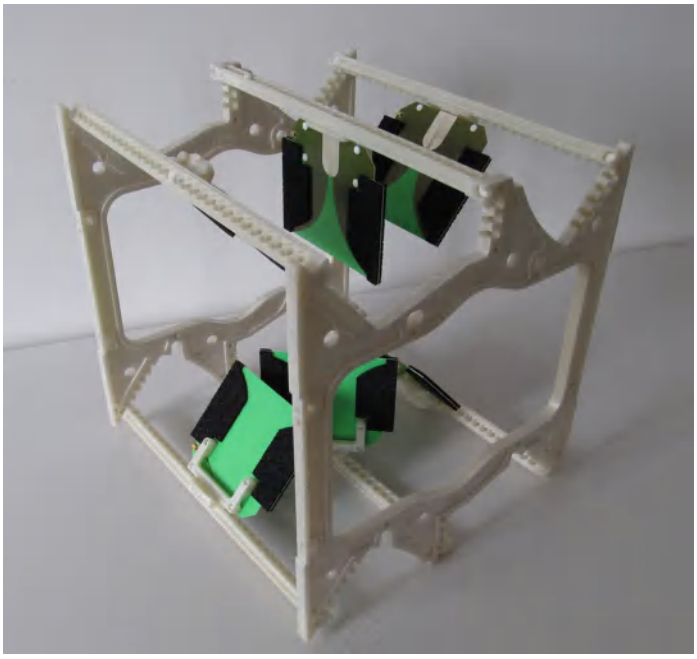


Figure 7-31: Full antenna ring with some antennas mounted

- The empty chamber (empty except for the absorber material covering the walls). If spacers and disk fixtures (see Figure 7-32) are already installed in the RF Shielded Box, you can leave them there.
  If any narrowband or wideband antennas are present in the chamber, remove them as described in Chapter 7.4.2, "Taking Narrowband Antennas Out of the Chamber", on page 138 or Chapter 7.5.2, "Taking the Wideband Antenna Out of the Chamber", on page 145.
  If one or more Vivaldi antennas mounted on the antenna holder are present in the chamber, remove them as described in Chapter 7.2.5, "Taking the Antenna Holder out of the Chamber", on page 111.

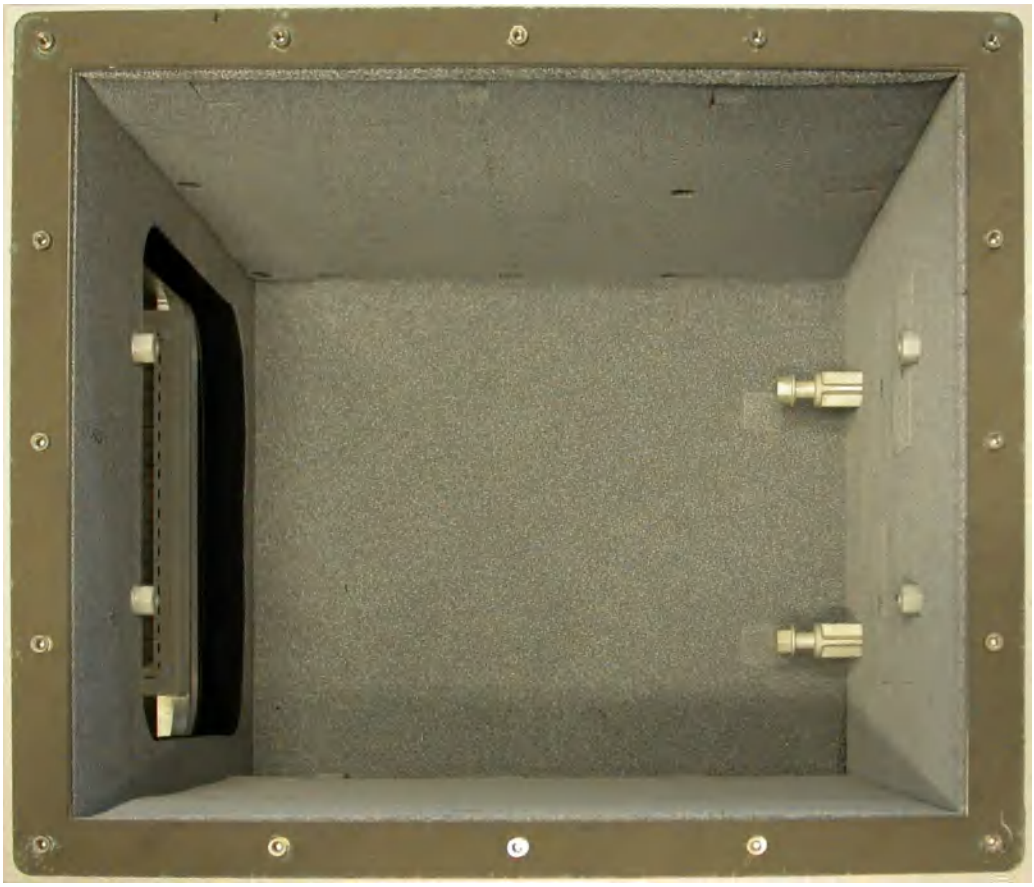


Figure 7-32: Top view of the empty chamber, with four spacers as well as two long disk fixtures at the lower rear side

Figure 7-33: The short- and the long-distance bolt, the spacer and the long disk fixture

If the four spacers and two disk fixtures are not installed as in Figure 7-32, remove the six round absorber pads.

- Screw the four spacers into the four upper positions, using a torque wrench No. 13 with a torque of 4.6 Nm.

- Screw the two disk fixtures into the two lower positions, using a torque wrench No. 13 with a torque of 4.6 Nm.

Proceed with mounting the full antenna ring into the chamber as follows:

1. Attach the absorber brackets and absorbers to the sides of the antenna ring.

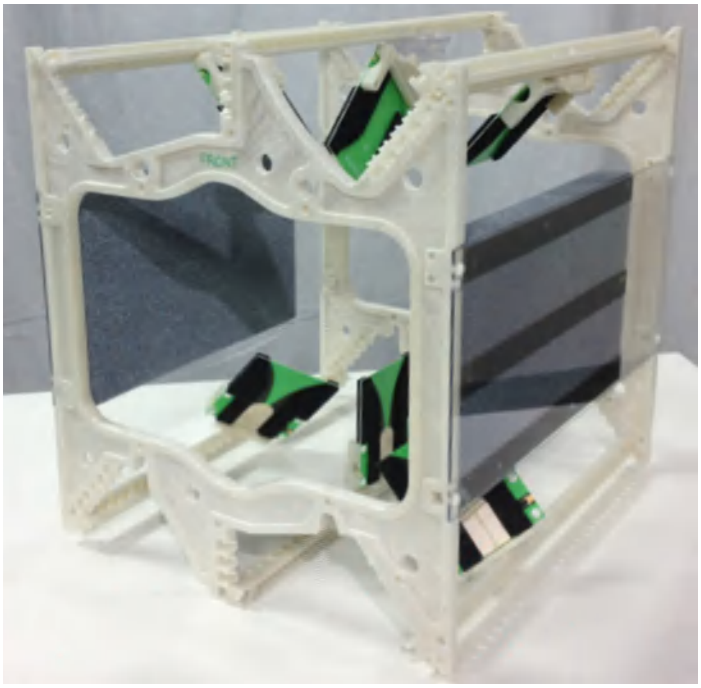


Figure 7-34: Putting the absorber brackets together with the absorbers into place and fixing each of them with four expanding rivets

2. Connect SMA/SMP cables of appropriate length to the SMP connectors at the antennas (1 in Figure 7-35) .

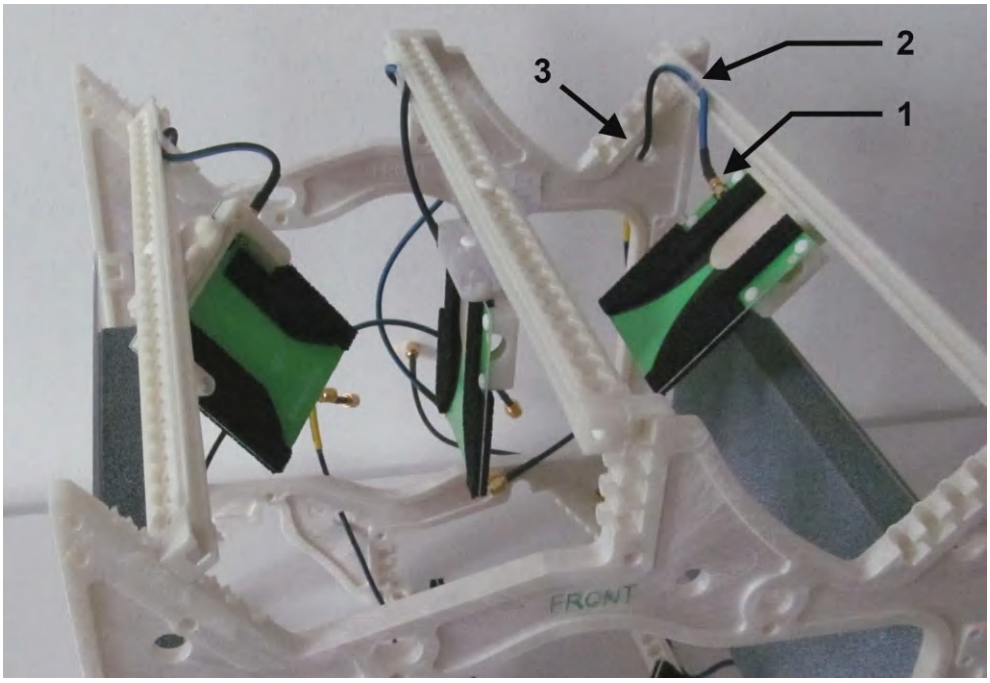


Figure 7-35: Connecting the antennas and attaching the antenna cables

1 = SMP connector
2 = Cable guide clip
3 = Cable guide hole

3. Fix the cables to the antenna ring bars (rails), using cable guide clips (2 in Figure 7-35).
4. Thread the cables through the holes (3 in Figure 7-35) in the antenna ring towards the rear side of the full antenna ring (away from the "FRONT" label).
   If two cables go through the same hole, it is easier to first thread both of them through that hole by using the cables' thinner SMP connector ends. Then connect the cables to the antennas.
5. Depending on the number of antenna cables to be connected, remove an appropriate number of detachable absorber pads from the rear wall inside the chamber. Also remove the protective caps from the SMA connectors.

Figure 7-36: Remove detachable absorber pads from the rear wall, as required

6. **NOTICE!** Risk of damage in case of collision of the antenna ring with the DUT holder.

Before inserting the full antenna ring into the RF Shielded Box, make sure that the DUT holder is not within the chamber at the same time. Either manually pull the drawer open (while preventing the chamber from tilting) or make sure that the DUT holder is not attached to the drawer's door.
Then carefully and slowly insert the full antenna ring into the RF Shielded Box, with the antenna ring's "FRONT" label pointing towards the front door.

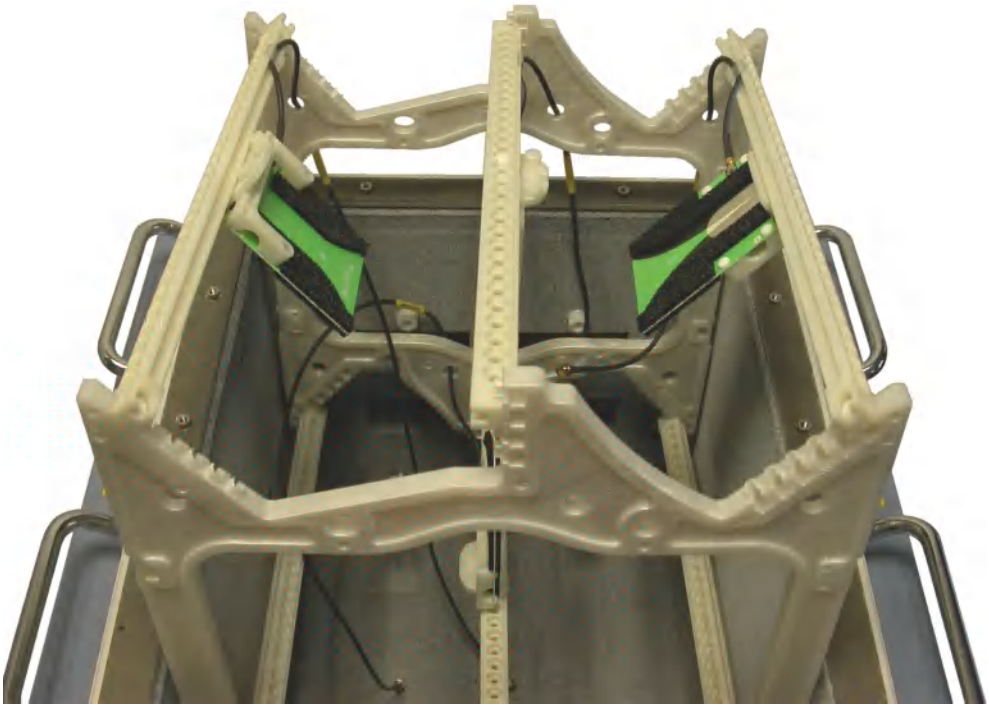
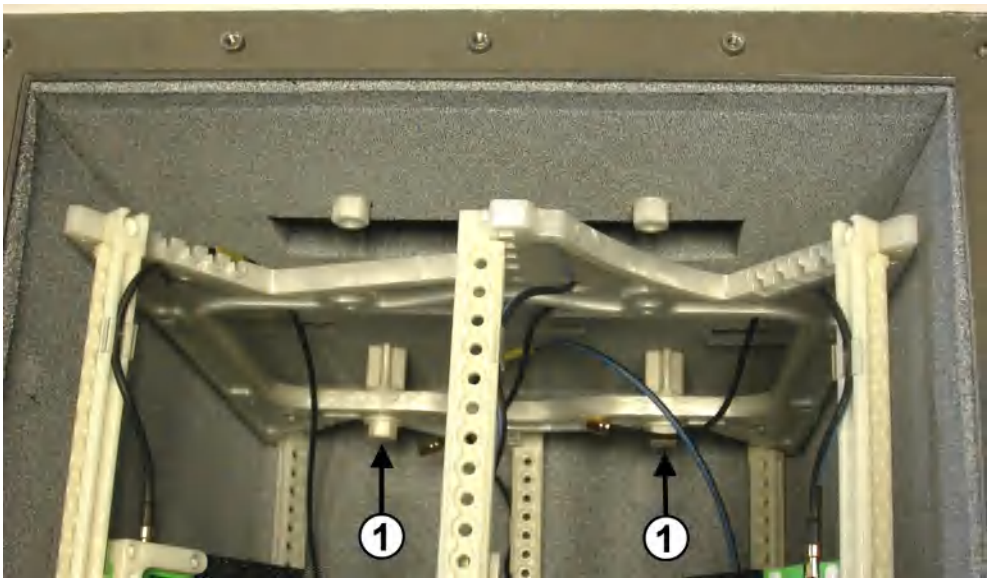


Figure 7-37: Inserting the full antenna ring into the chamber

7. Move the full antenna ring further down, until it is caught in the two disk fixtures.



1 = Two disk fixtures

8. Use the two long-distance bolts to fix the full antenna ring at the rear wall.

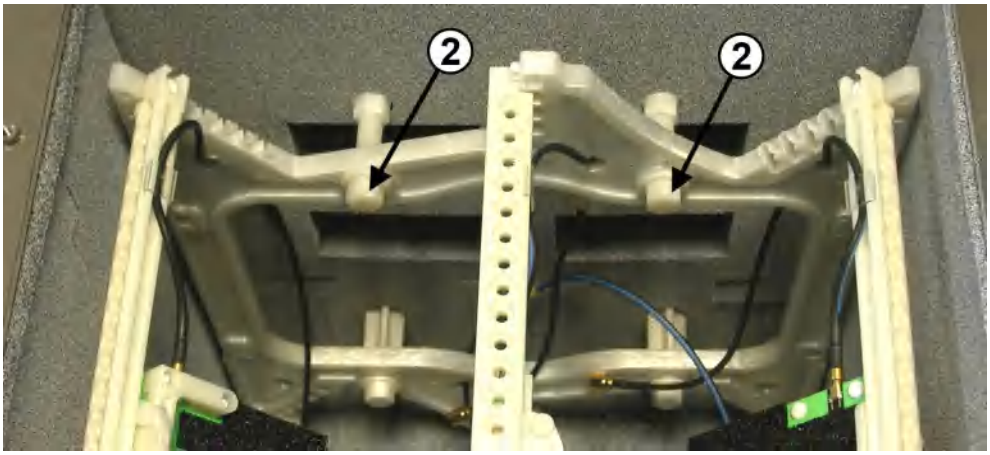


Figure 7-38: Fixing the full antenna ring with the two long-distance bolts at the rear wall

2 = Two long-distance bolts

9. Use the two short-distance bolts to fix the antenna ring at the front wall.

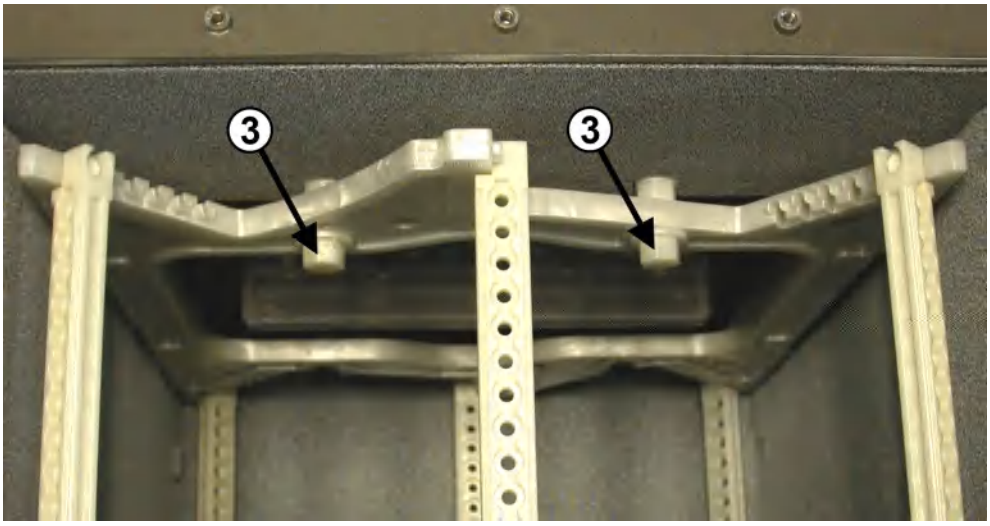


Figure 7-39: Fixing the full antenna ring with the two short-distance bolts at the front wall

3 = Two short-distance bolts

Figure 7-33 shows the short- and long-distance bolts. To screw the bolts into the spacers and tighten them, use a torque wrench No.13 with a torque of 2.8 Nm.

10. Use an SMA wrench to attach the antenna cables to the SMA connectors at the chamber's rear wall, minding the TORQUE RECOMMENDATIONS.
    Make sure to make a note of the allocation of which antenna is connected to which SMA connector.

11. Insert the previously detached absorber pads into the gaps in the rear chamber wall.

12. Check the SMP connectors: verify that all antennas are properly connected to their cables.

NOTICE

Risk of damage in case of collision of the DUT or DUT holder with any antenna

Verify that no DUT holder tray (and no DUT on it) can potentially collide with any antenna inside the chamber, or with the antenna ring, once the drawer is closing. If any antenna comes too close to the DUT or DUT holder tray, consider placing the antenna further away from the center of the chamber.

Finally, close the chamber's top cover (see Chapter 7.1.2, "Closing the Top Cover", on page 80).

With the full antenna ring mounted, use the second absorber version (2) on the top cover:

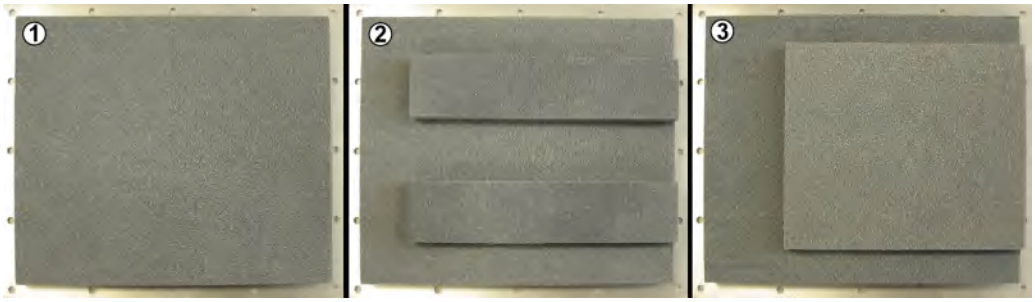


Figure 7-40: Different absorber material configurations on the inside of the top cover. In these pictures, the "FRONT" edge of the cover is on the right-hand side

1 = Standard absorber for use with Narrowband Antenna R&S TS-F24NB2
2 = Absorber for use with Half Antenna Ring R&S TS-F24-AH1 or Full Antenna Ring R&S TS-F24-AR
3 = Absorber for use with Wideband Antenna R&S TS-F24WA1

All three absorber material configurations are compatible with antennas mounted on the Antenna Holder R&S TS-F24-AH2.

7.2.5 Taking the Antenna Holder out of the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

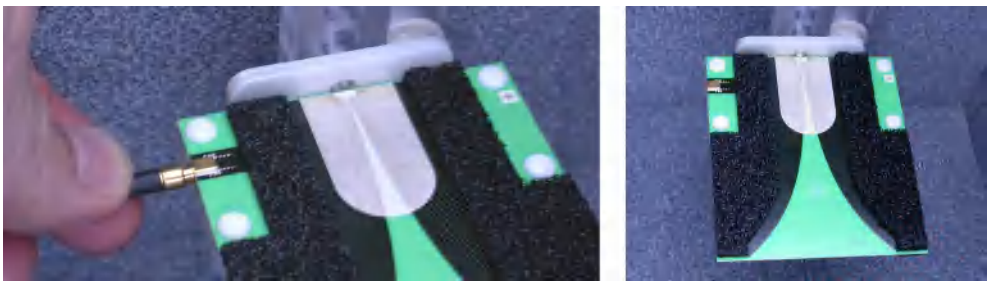
The following mounting instruction assumes one Vivaldi antenna mounted on one Antenna Holder R&S TS-F24-AH2. For multiple antennas or multiple holders, proceed accordingly. For the assembly of LF loop antenna and antenna holder, see Chapter 7.6, "Installation of the LF Loop Antenna", on page 147.

For taking the antenna holder out of the RF Shielded Box:

1. Remove the top cover (see Chapter 7.1.1, "Opening the Top Cover", on page 79). For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.
2. Remove the detachable absorber pad from the rear chamber wall, where the antenna cable is attached to the SMA connector.

3. Use an SMA wrench to disconnect the antenna cable from the SMA connector at the chamber's rear wall.

4. Attach a protective cap to the SMA connector at the rear chamber wall.
5. Insert the previously detached absorber pad into the gap around the SMA connector.
6. Detach the antenna cable from the SMP connector at the antenna:

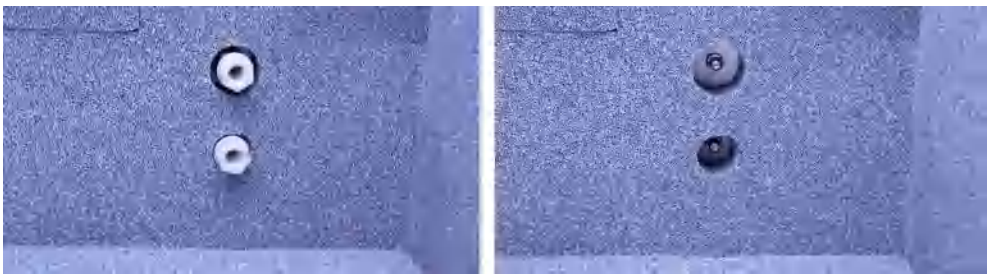


7. Remove the two polymer bolts that hold the antenna holder, using a socket wrench No.13:

Figure 7-41: Removing the polymer bolts at the rear wall inside the chamber

Left = For best access, first remove the upper bolt
Center = Upper bolt removed
Right = Then rotate the antenna holder to remove the lower bolt

8. Remove the two polymer spacers that held the antenna holder at the rear wall, using a wrench No.13:



9. Insert two round absorber pads into the spacers' gaps in the rear chamber wall. (Use the pads that were removed from there when the antenna holder was mounted.)
10. Place the antenna holder and antenna outside the RF Shielded Box.

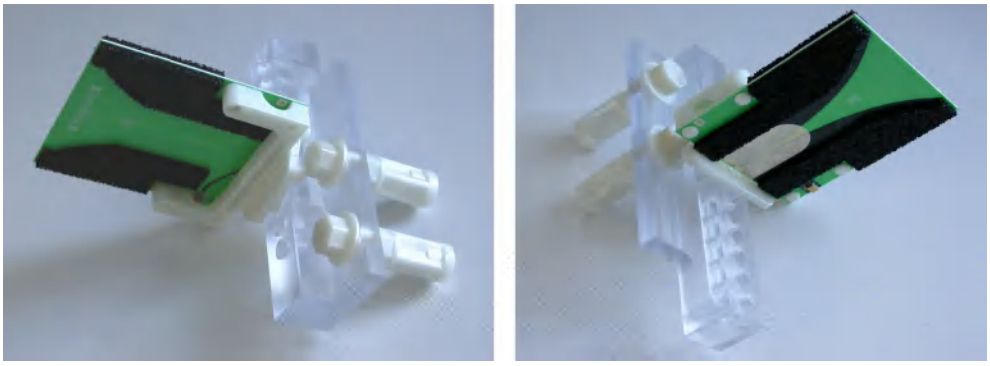


Figure 7-42: Two views of the antenna holder with one antenna mounted

1 = SMP connector

11. The antenna holder and antenna are now ready for configuration according to Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118 and Chapter 7.3.2, "Definition of Antenna Positions on the Antenna Holder", on page 126.
12. Optionally close the chamber's top cover (see Chapter 7.1.2, "Closing the Top Cover", on page 80), especially if the antenna holder remains outside of the chamber for an extended period of time.

7.2.6 Mounting the Antenna Holder into the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

The following mounting instruction describes mounting one Vivaldi antenna on one Antenna Holder R&S TS-F24-AH2. For multiple antennas or multiple holders, proceed accordingly. For the assembly of LF loop antenna and antenna holder, see Chapter 7.6, "Installation of the LF Loop Antenna", on page 147.

For mounting the Antenna Holder R&S TS-F24-AH2 into the RF Shielded Box, the top cover has to be removed (see Chapter 7.1.1, "Opening the Top Cover", on page 79).

For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.

Start with the following:

- One or two antenna holders, each with one, two or three Vivaldi antennas, configured as described in Chapter 7.3, "Configuration of Vivaldi Antennas", on page 118 and Chapter 7.3.2, "Definition of Antenna Positions on the Antenna Holder", on page 126

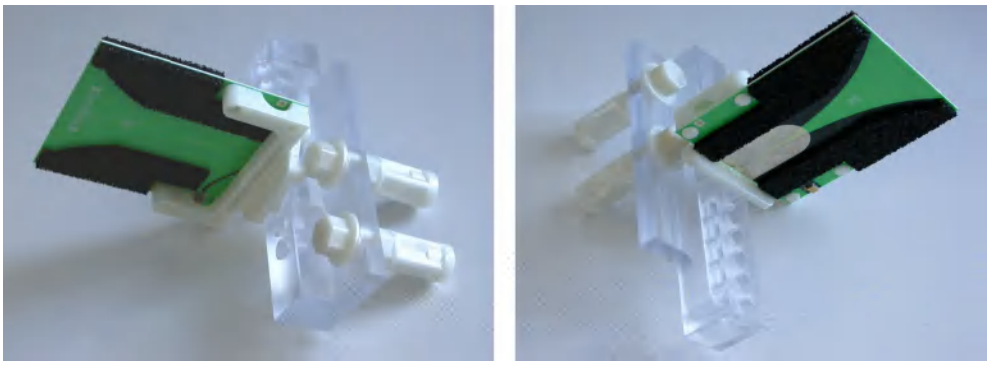


Figure 7-43: Two views of an antenna holder with one antenna mounted

- The empty chamber (empty except for the absorber material covering the walls). The following rules apply for other items in the chamber:
  - If spacers and disk fixtures (see Figure 7-44) are already installed in the RF Shielded Box, **remove** at least the disk fixtures.
  - If the full antenna ring is present in the chamber, remove it as described in Taking the Full Antenna Ring out of the Chamber.
  - If the half antenna ring is present in the chamber, remove it as described in Taking the Half Antenna Ring out of the Chamber, to be able to mount the antenna holder. After mounting the antenna holder, you can mount the half antenna ring again as described in Chapter 7.2.2, "Mounting the Half Antenna Ring into the Chamber", on page 90, if necessary.
  - If narrowband antennas are present in the chamber, they can remain there, if necessary.
  - If the wideband antenna is present in the chamber, remove it as described in Chapter 7.5.2, "Taking the Wideband Antenna Out of the Chamber", on page 145, to be able to mount the antenna holder. After mounting the antenna holder, you can mount the wideband antenna again as described in Chapter 7.5.1, "Mounting the Wideband Antenna Into the Chamber", on page 141, if necessary.

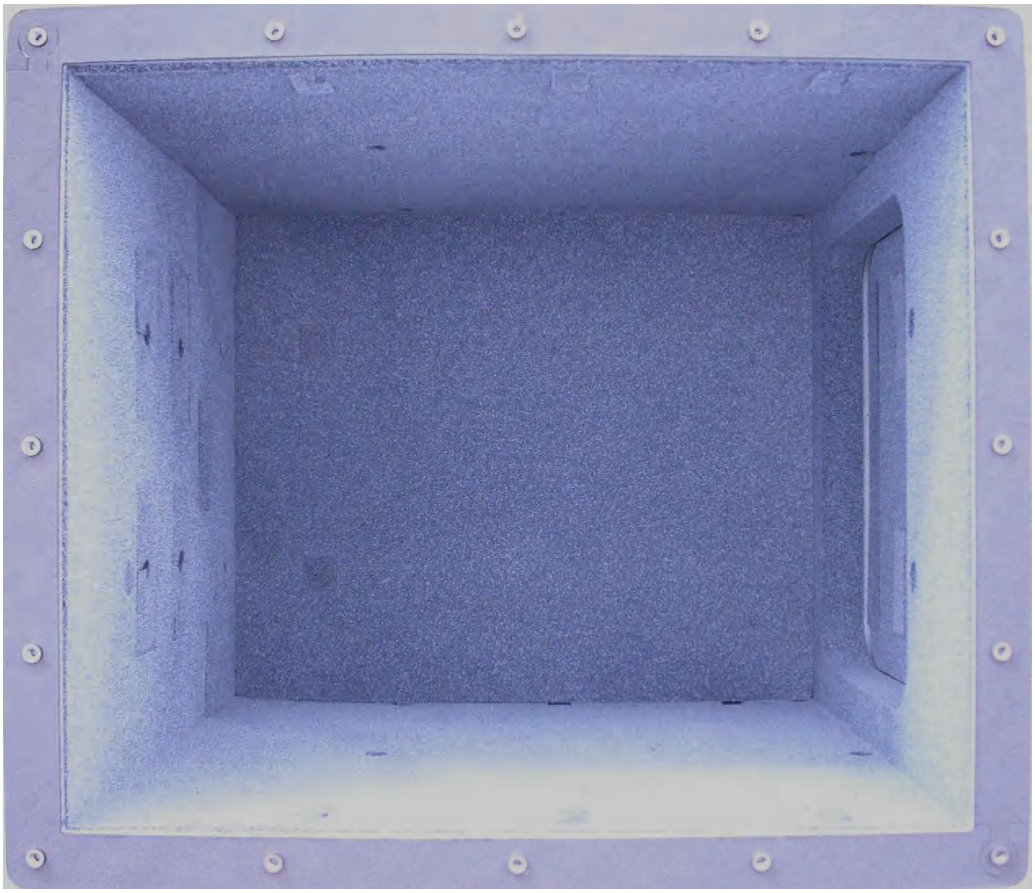


Figure 7-44: Top view of the empty chamber

The following mounting instruction assumes one Vivaldi antenna mounted on one antenna holder. For multiple antennas or multiple holders, proceed accordingly.

Mount the antenna holder into the chamber as follows:

1. Remove two detachable round absorber pads at the lower end of the rear chamber wall, either on the right or left side.
2. Screw the two spacers into the two positions, using a torque wrench No. 13 with a torque of 4.6 Nm.

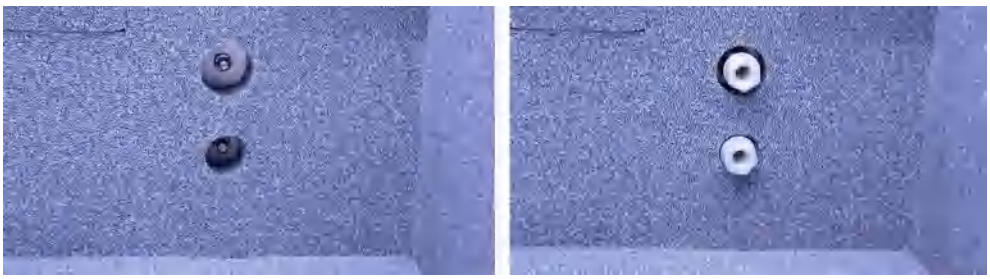


Figure 7-45: Mounting two spacers at the rear chamber wall, here on the right side

3. Insert the antenna holder with antenna into the RF Shielded Box.

4. Use the two polymer bolts to screw the antenna holder to the two spacers, as shown below:

Figure 7-46: Fixing the antenna holder with the two polymer bolts at the rear wall

Left = For best access, first loosely screw in the lower bolt
Center = Then rotate the antenna holder to its final position
Right = Screw in the upper bolt (for example using a socket wrench)

5. To tighten the bolts, use a socket torque wrench No. 13 with a torque of 2.8 Nm.
6. Remove a detachable absorber pad inside the chamber from an N-SMA feed-through in the rear wall.
7. Remove the protective cap from the SMA connector.
8. Use an SMA wrench to attach the antenna cable to the SMA connector at the chamber's rear wall, minding the TORQUE RECOMMENDATIONS.
   Make sure to make a note of the allocation of which SMA connector the antenna is connected to.

9. Insert the previously detached absorber pads into the gaps in the rear chamber wall.

10. Connect the 20 cm SMA/SMP cable, delivered with the Antenna Holder R&S TS-F24-AH2, to the SMP connector at the antenna:

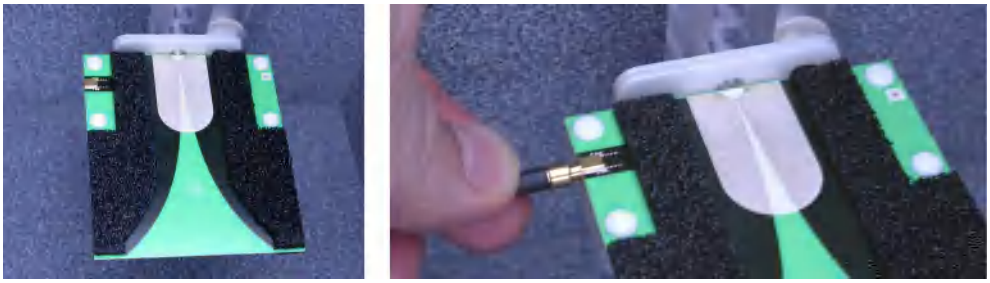


Figure 7-47: Connecting an antenna

11. Check the SMP connector: verify that the antenna is properly connected to its cable.

NOTICE

Risk of damage in case of collision of the DUT or DUT holder with any antenna

Verify that no DUT holder tray (and no DUT on it) can potentially collide with any antenna inside the chamber, once the drawer is closing. If any antenna comes too close to the DUT or DUT holder tray, consider placing the antenna in a different position. See "Risk of tray collision with Vivaldi antennas" on page 75.

Finally, close the chamber's top cover (see Chapter 7.1.2, "Closing the Top Cover", on page 80).

With the antenna holder mounted, use any of the three absorber versions on the top cover:

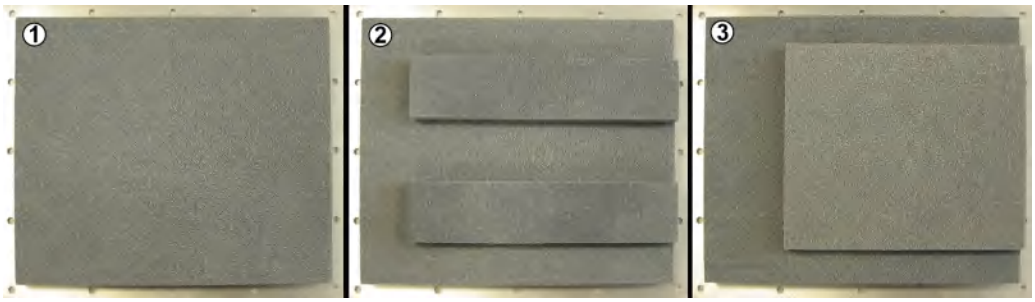


Figure 7-48: Different absorber material configurations on the inside of the top cover. In these pictures, the "FRONT" edge of the cover is on the right-hand side

1 = Standard absorber for use with Narrowband Antenna R&S TS-F24NB2
2 = Absorber for use with Half Antenna Ring R&S TS-F24-AH1 or Full Antenna Ring R&S TS-F24-AR
3 = Absorber for use with Wideband Antenna R&S TS-F24WA1

All three absorber material configurations are compatible with antennas mounted on the Antenna Holder R&S TS-F24-AH2.

7.3 Configuration of Vivaldi Antennas

For configuration of the Vivaldi antennas, take the half or full antenna ring or the antenna holder out of the RF Shielded Box (see Chapter 7.2.1, "Taking the Half Antenna Ring out of the Chamber", on page 86 or Chapter 7.2.3, "Taking the Full Antenna Ring out of the Chamber", on page 97 or Chapter 7.2.5, "Taking the Antenna Holder out of the Chamber", on page 111).

As soon as the configuration of the Vivaldi antennas is completed, insert the half or full antenna ring or the antenna holder back into the RF Shielded Box (see Chapter 7.2.2, "Mounting the Half Antenna Ring into the Chamber", on page 90 or Chapter 7.2.4, "Mounting the Full Antenna Ring into the Chamber", on page 102 or Chapter 7.2.6, "Mounting the Antenna Holder into the Chamber", on page 113).

As the following description applies in an equivalent way to both the full and half antenna ring, the most information is only presented for one of the two antenna ring versions.

For the antenna holder, see Chapter 7.3.2, "Definition of Antenna Positions on the Antenna Holder", on page 126.

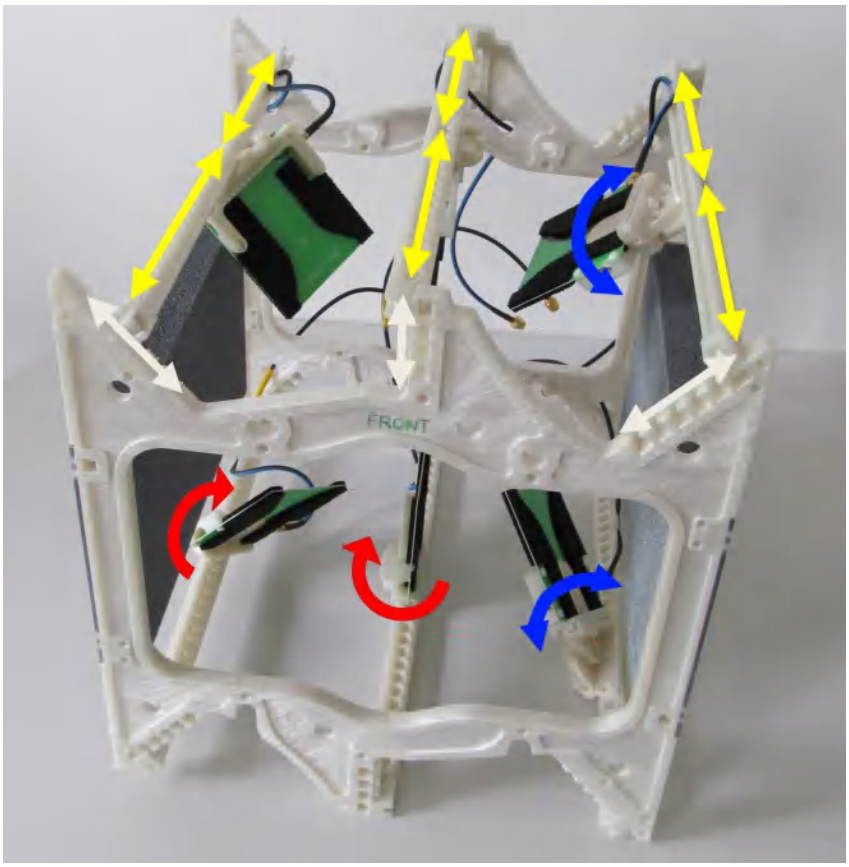
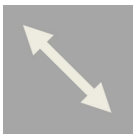
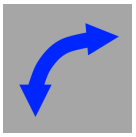


Figure 7-49: Possible adjustments of antenna positions on the antenna ring bars (rails)

Table 7-1: Explanation of the adjustment arrows both in the previous and the next figure

	**Radial translation**: Change the rail's position to increase or decrease the antenna's distance from the DUT holder tray (see Figure 7-51)
	**Lateral translation**: Change the antenna's position (distance from the chamber's front side, or depth within the chamber) to determine the radiation's angle of incidence upon the DUT, see Figure 7-53)
	**Axial rotation**: Change the antenna's rotational angle relative to the antenna ring bars (rails), thus influencing the polarization relative to the DUT (see Figure 7-54 and Figure 7-56)
	**Lateral tilting**: Change the antenna's tilting angle relative to the antenna ring bars (rails), thus influencing the polarization relative to the DUT (see Figure 7-57)

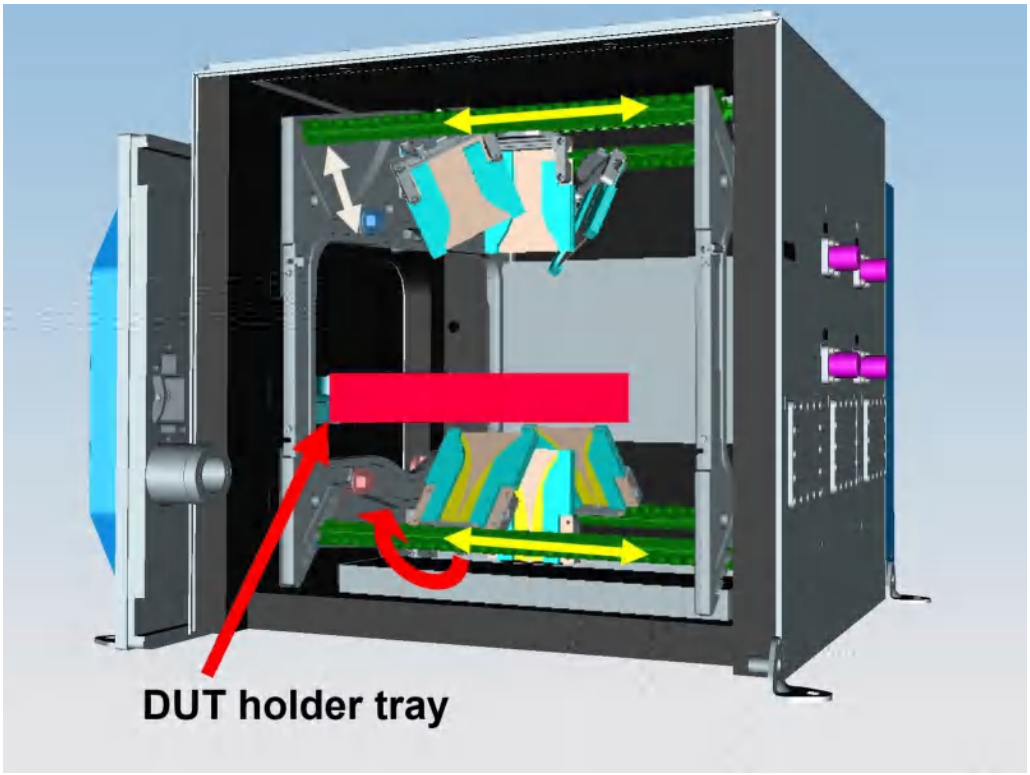


Figure 7-50: RF Shielded Box with built-in full antenna ring and some antennas

The schematic section in Figure 7-50 gives a general overview of how the adjustments according to Figure 7-49 influence the positions of the antennas in relation to the DUT

holder. The antenna ring allows many different arrangements of the Vivaldi antennas. Details are provided in the following chapter.

7.3.1 Definition of Rail and Antenna Positions on an Antenna Ring

For reproducible antenna configuration, the following positions and angles are defined:

- Numbering of the rails (or antenna ring bars) on the antenna ring
  - Rail number 1 – 6 on the full antenna ring
  - Rail number 1 – 3 on the half antenna ring
- Positions 1 – 6 of the rails on the antenna ring
- Positions 1 – 29 of the antennas on the rails
- Angle of rotation α (alpha) of an antenna fixture on the rail
- Angle of rotation β (beta) of a 0-45° adapter on the rail
- Angle of tilting γ (gamma) of a 0-45° adapter

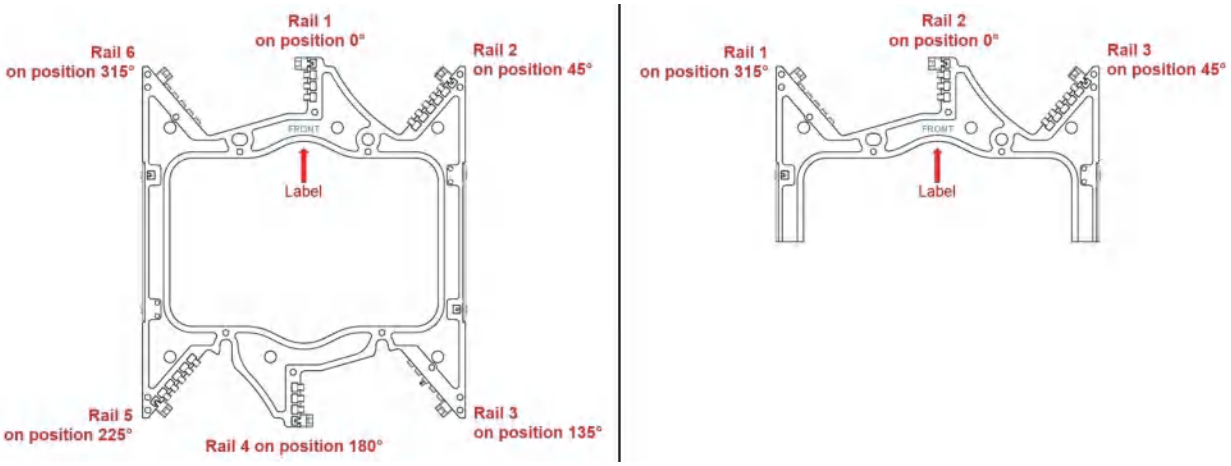


Figure 7-51: Numbering of the rails on the full antenna ring (left) and half antenna ring (right)

Rail 1 = Position 0°
Rail 2 = Position 45°
Rail 3 = Position 135°
Rail 4 = Position 180°
Rail 5 = Position 225°
Rail 6 = Position 315°

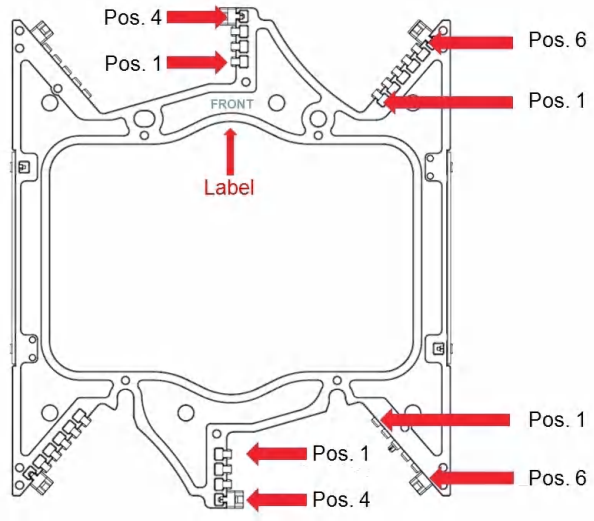


Figure 7-52: Positions of the rails on the full antenna ring (accordingly on the half antenna ring)

Rail 1 and Rail 4 = Positions 1 – 4
Rail 2, 3, 5, 6 = Positions 1 – 6

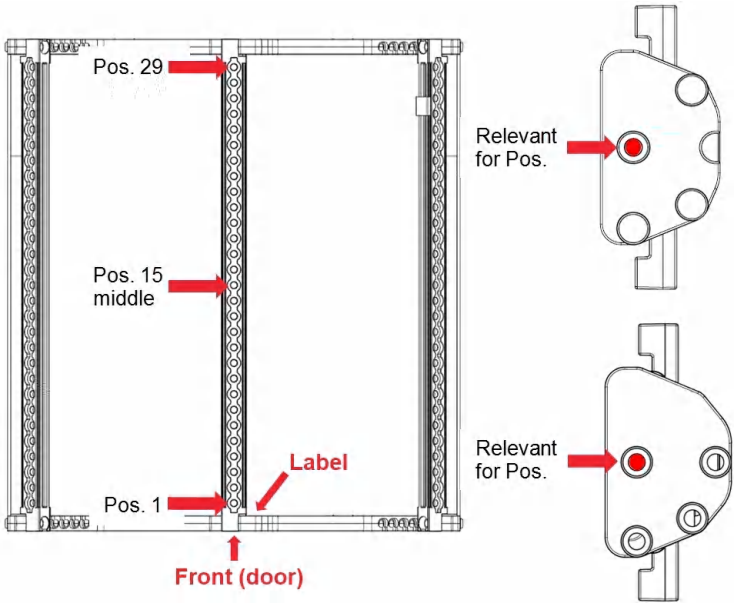


Figure 7-53: Positions of the antennas on the rails

The mounting hole in the middle of the antenna fixture (highlighted with a red disk in the figure above) is relevant for the fixture's position on the rail.

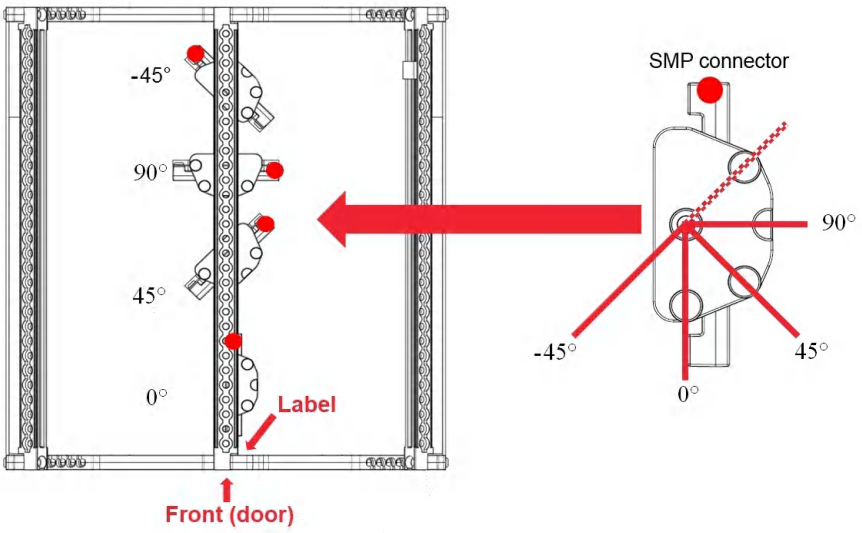


Figure 7-54: Angle of rotation α (alpha) of an antenna fixture on the rail (or on a 45° adapter, which is mounted in a 0° position). The SMP connector (highlighted with a red disk in the figure above) helps to define the orientation unambiguously

In the example above, the antenna fixture rotation is seen from the side of the rail, to which the antenna is mounted. For any other rail, the antenna ring has to be turned, as in Figure 7-55, to always look at that rail from an equivalent position.

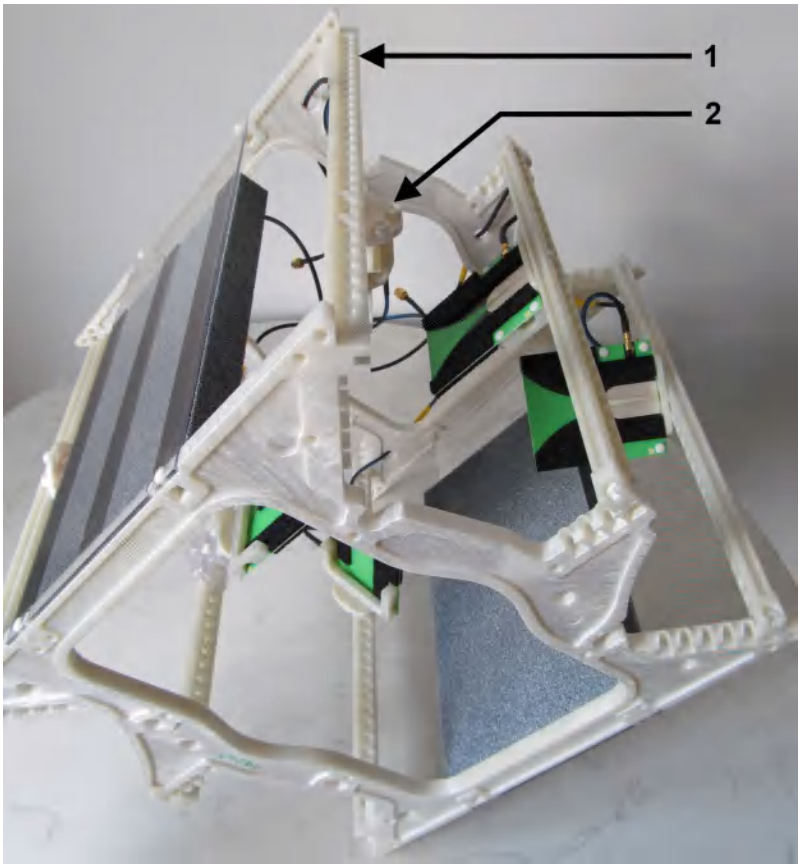


Figure 7-55: In this example, the full antenna ring stands on rail 6, to bring rail 3 up to the top side of the antenna ring. For configuring the antenna(s) mounted at rail 3, look at the rail from above (bird's eye view)

1 = Rail 3
2 = Antenna fixture with 0-45° adapter, mounted on rail 3

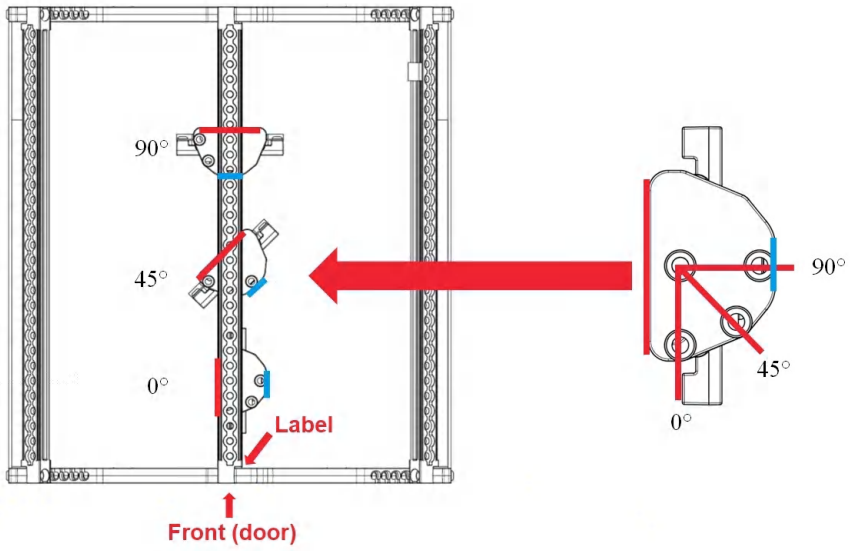


Figure 7-56: Angle of rotation β (beta) of a 45° adapter on the rail

In the most simple case, the antenna fixture is mounted on a rail. If instead the antenna fixture is mounted on a 45° adapter, the same definition as in Figure 7-54 is true for the antenna fixture's angle α, relative to the adapter.

If the adapter is mounted on the rail at an angle β > 0°, then both angles α + β add up to the total rotation of the antenna (as long as the 45° adapter is not tilt, ɣ = 0°, see below).

For illustration, refer to Figure 7-59 and Figure 7-60.

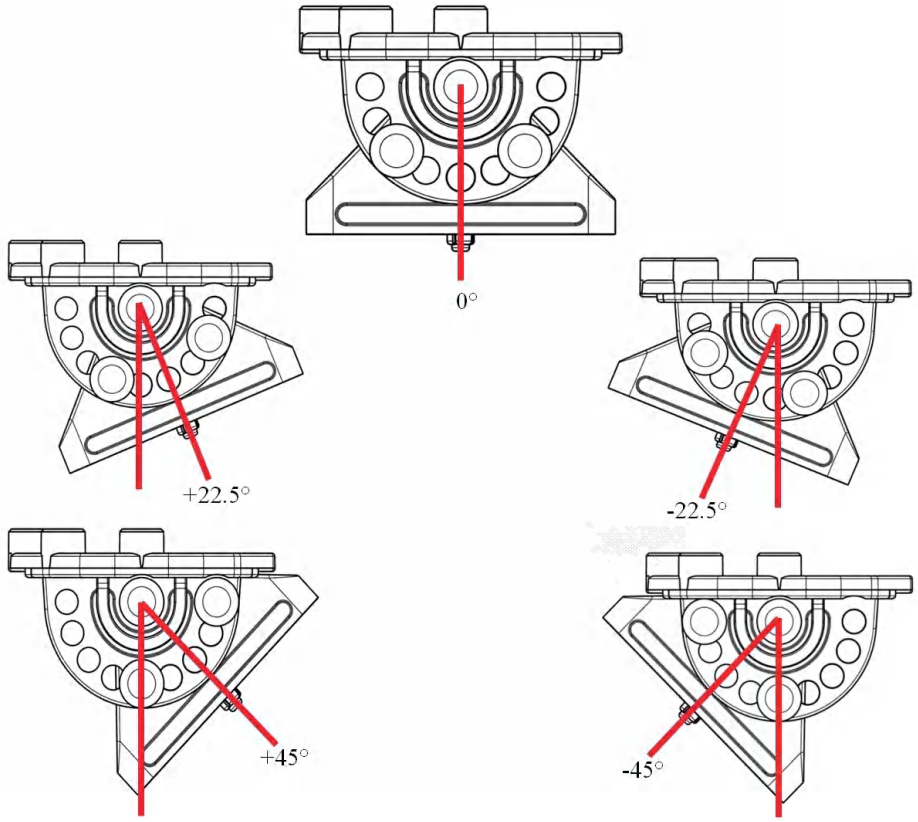


Figure 7-57: Angle of tilting γ (gamma) of a 45° adapter

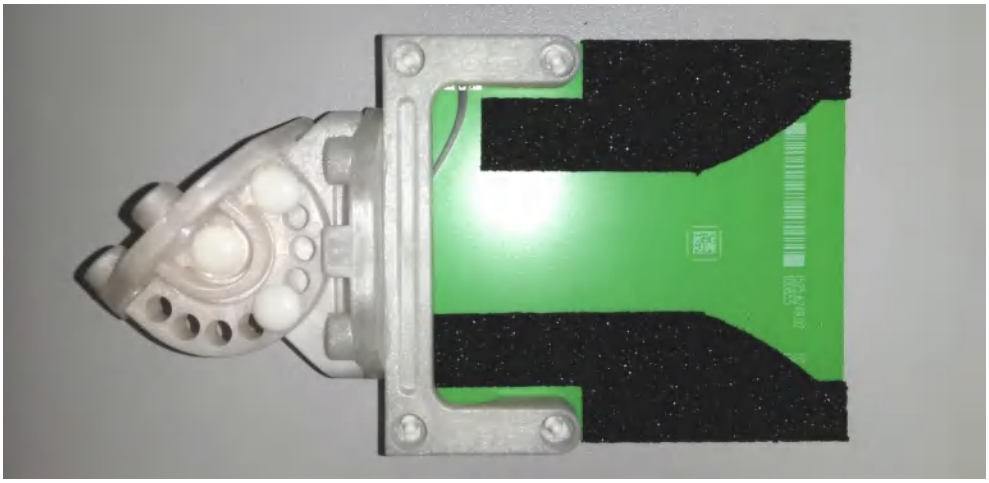


Figure 7-58: Antenna on fixture and 45° adapter, tilted at γ = +45°

To illustrate the configuration of the angles α, β and γ, two views of one given combination of these angles are shown in the following figures:

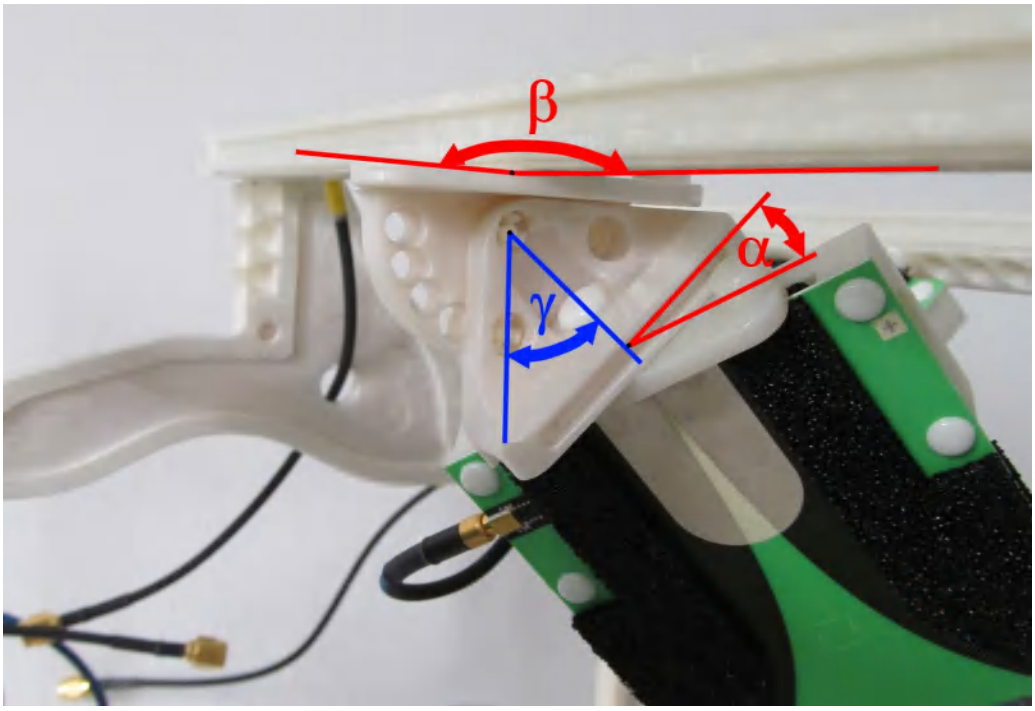


Figure 7-59: Constellation of α = +45°, β = -90° and γ = -45°, seen from the side

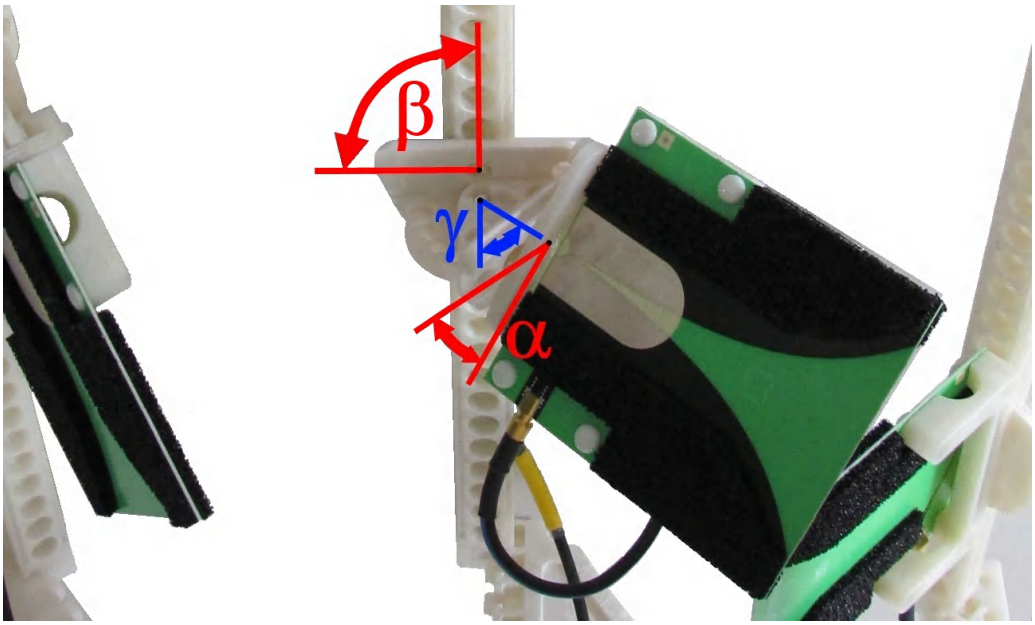


Figure 7-60: Constellation of α = +45°, β = -90° and γ = -45°, seen from below

7.3.2 Definition of Antenna Positions on the Antenna Holder

For reproducible antenna configuration, the following positions and angles are defined:

- Antenna holder mounted left or right in the chamber (when seen from the front)

- Positions 1 to 11 on the antenna holder rail, of which positions 3 to 10 are through holes. Only these positions 3 to 10 can be occupied by the center hole (A) of an antenna fixture, see Figure 7-61
- Angle of rotation α (alpha) of an antenna fixture on the rail
- Angle of rotation β (beta) of a 0-45° adapter on the rail
- Angle of tilting γ (gamma) of a 0-45° adapter

The mounting hole in the middle of the antenna fixture (highlighted with a red disk (A) in the figure below) is relevant for the fixture's position on the rail.

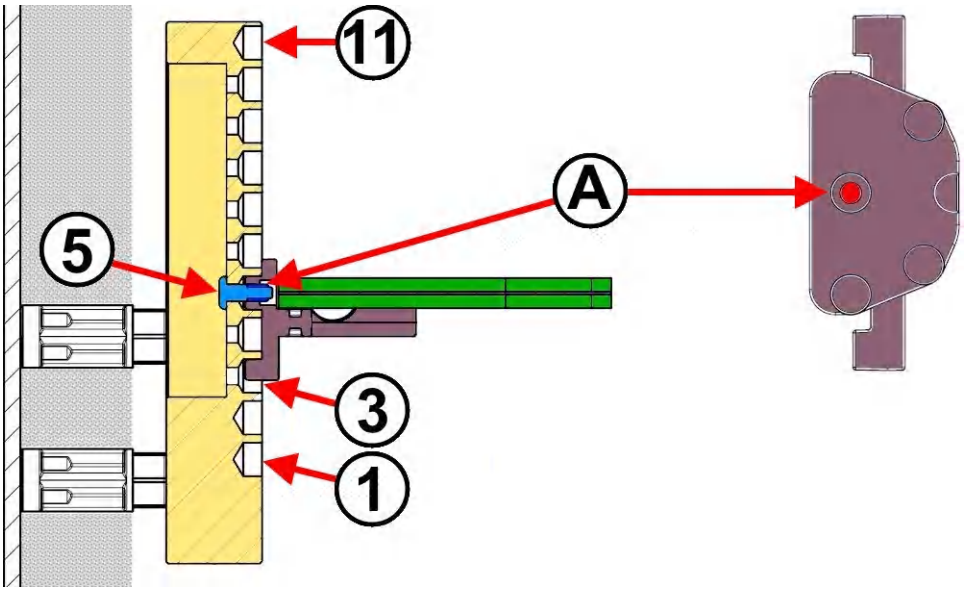


Figure 7-61: Definition of vertical positions on the antenna holder rail

Yellow = Antenna holder rail, here shown as mounted in the chamber
Green = Vivaldi antenna (seen from the side)
Brown = Antenna fixture
Blue = Drive pin and expansion peg
1 = Position 1, start counting from this hole at the rail's lower end
3 = Position 3, the lowest through hole and hence the lowest mounting position
5 = The antenna in this figure is mounted in position 5
11 = Position 11, no through hole (hence, hole 10 is the highest mounting position)
A = The center hole in the antenna fixture is relevant for the position

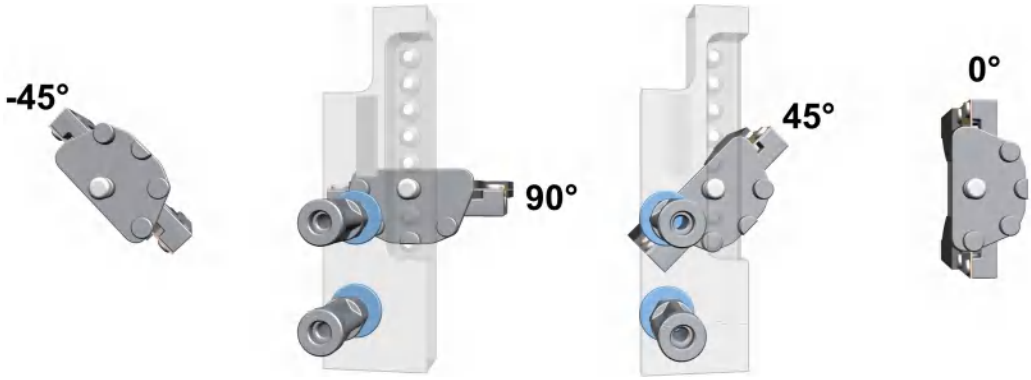


Figure 7-62: Angle of rotation α (alpha) of an antenna fixture on the antenna holder

The representation in Figure 7-62 is seen from behind the holder rail (or from the chamber's rear wall), to be compatible with the definition of angles on an antenna ring in Figure 7-54. The SMP connector is at the side that is marked with the degrees number, allowing to define the orientation unambiguously.

The rotation β (beta) of the 45° tilt adapter is defined as in Figure 7-56.

The angle of tilting ɣ (gamma) of this adapter is defined as in Figure 7-57.

7.4 Installation of Narrowband Antennas

The Narrowband Antenna R&S TS-F24NB2 (or several of these antennas) can be used inside the RF Shielded Box for a range of test scenarios. The following section describes how it is mounted.

To remove one or more narrowband antennas from the chamber, follow the procedure in Chapter 7.4.2, "Taking Narrowband Antennas Out of the Chamber", on page 138.

7.4.1 Mounting Narrowband Antennas Into the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

One or more Narrowband Antenna R&S TS-F24NB2 can be mounted into the RF Shielded Box:

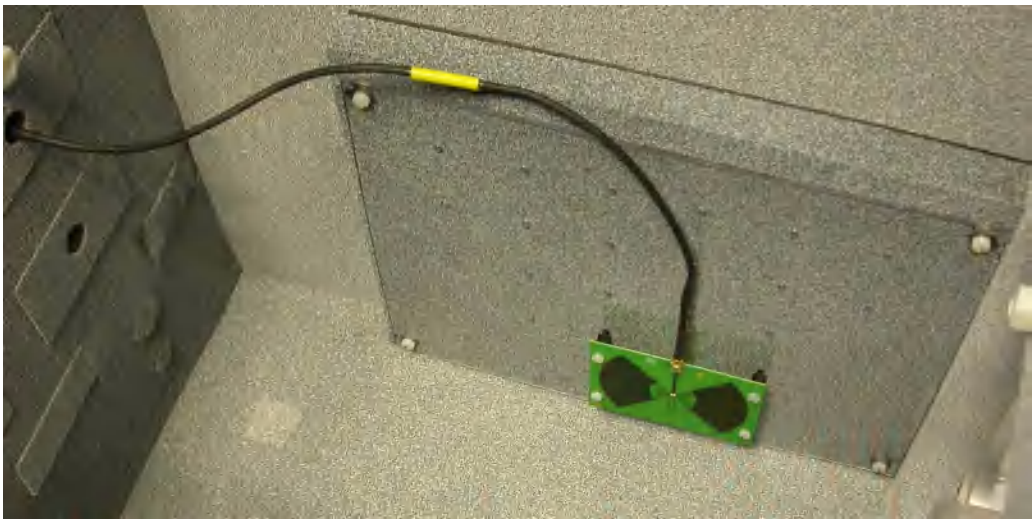


Figure 7-63: RF Shielded Box (open) with one narrowband antenna mounted

For mounting narrowband antennas into the RF Shielded Box, the top cover has to be removed (see Chapter 7.1.1, "Opening the Top Cover", on page 79).

For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.

Start with the following:

- The narrowband antenna mounting kit
- The empty chamber (empty except for the absorber material covering the walls). The following rules apply for other items in the chamber:

– If in the chamber an antenna ring is present, remove it as described in Chapter 7.2.1, "Taking the Half Antenna Ring out of the Chamber", on page 86 or Chapter 7.2.3, "Taking the Full Antenna Ring out of the Chamber", on page 97.
– If the wideband antenna is present in the chamber, remove it as described in Chapter 7.5.2, "Taking the Wideband Antenna Out of the Chamber", on page 145, to be able to mount narrowband antennas. After mounting narrowband antennas, you can mount the wideband antenna again as described in Chapter 7.5.1, "Mounting the Wideband Antenna Into the Chamber", on page 141, if necessary.
– If antennas mounted on an antenna holder are present in the chamber, they can remain there, if necessary. Or you can remove them, to have more room for mounting narrowband antennas.

To mount narrowband antennas into the R&S TS7124M, proceed as follows:

1. Have the set of screws available that are included with the antenna mounting kit.

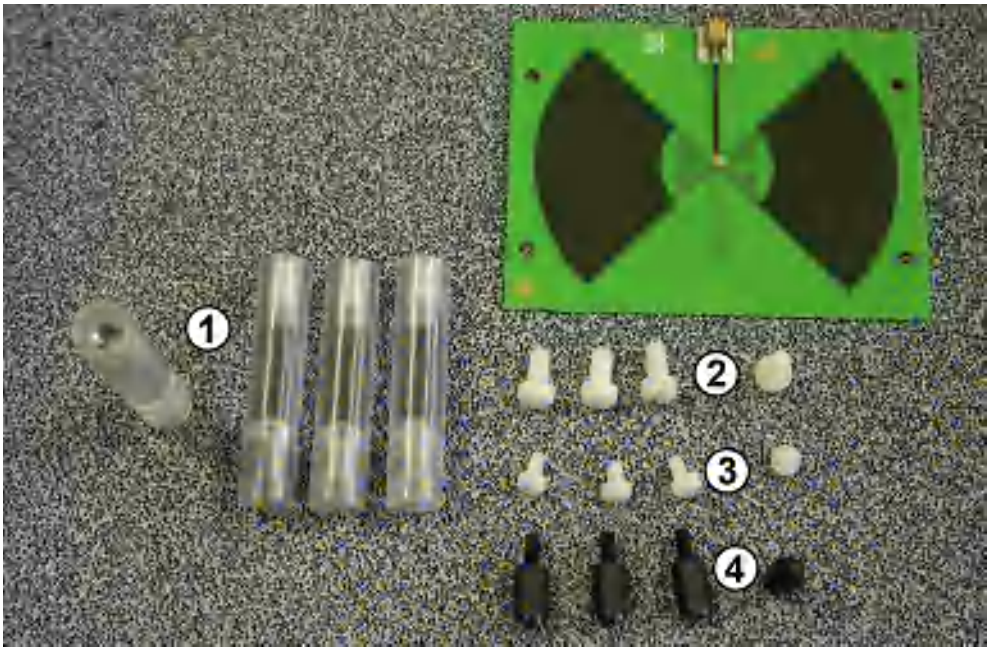
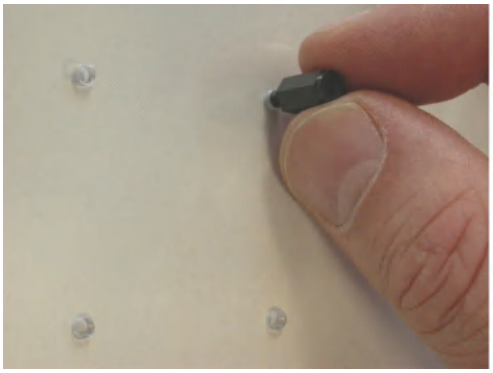
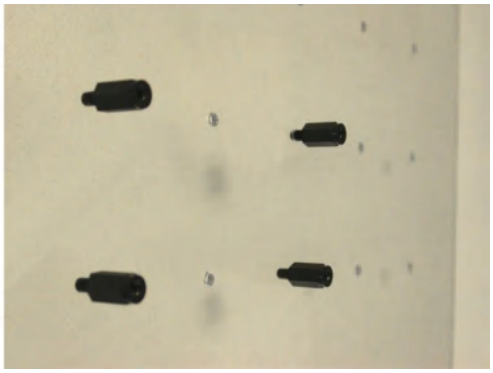


Figure 7-64: Screws for mounting the narrowband antenna into the chamber

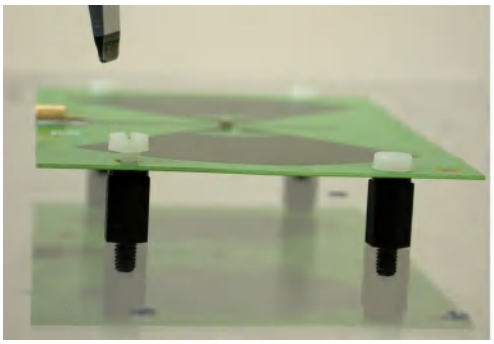
1 = Four spacers (transparent polymer with metal thread inset at one end)
2 = Four big screws (white polymer)
3 = Four small screws (white polymer)
4 = Four distance screws (black polymer)

2. For each narrowband antenna to be mounted, insert four black distance screws into four selected holes in the acrylic glass sheet, as shown below. The screws' positions depend on the desired antenna position. Make sure to arrange the screws in such a way that they align with the four holes in the body of the narrowband antenna.





3. Mount the narrowband antenna on top of the four distance screws with the four small screws, as shown below, using a flat-head screwdriver.



If you mount the antenna next to the lower edge of the acrylic glass sheet (close to the chamber's ground), orient this antenna's SMP connector pointing away from the edge. Hence, let the SMP connector point upwards, as the lower antenna in Figure 7-65 and Figure 7-63.

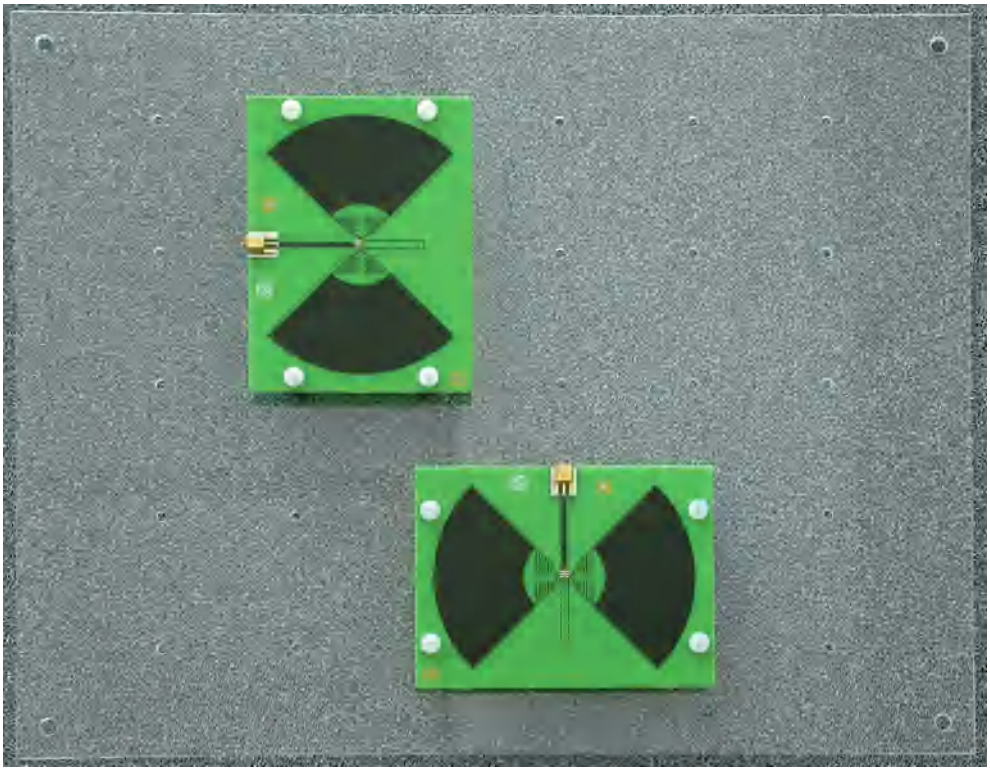


Figure 7-65: Acrylic glass sheet with two narrowband antennas mounted

Make sure not to overlap any antennas.
Mind an appropriate guiding of the RF cable: Do not guide RF cables across any antenna, especially not across their center, as indicated in Figure 7-66.

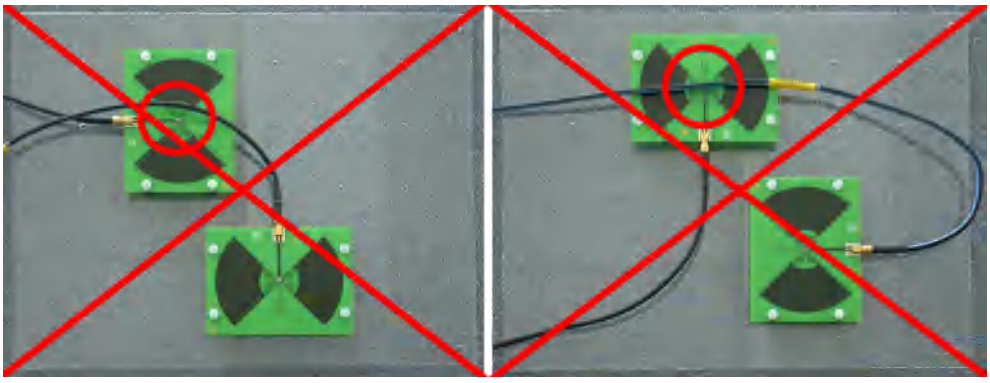


Figure 7-66: Bad examples: Avoid RF cables to cross other antennas, as shown here (red circles)

Especially a situation as on the right hand side of Figure 7-66 can lead to high currents being induced by the antenna in the sheath of the collinear RF cable.
Instead, guide all cables around the antennas, as shown in Figure 7-67. If necessary, fix the cables using suitable cable tie mounts and cable ties, made from polymeric material (not included in the delivery).

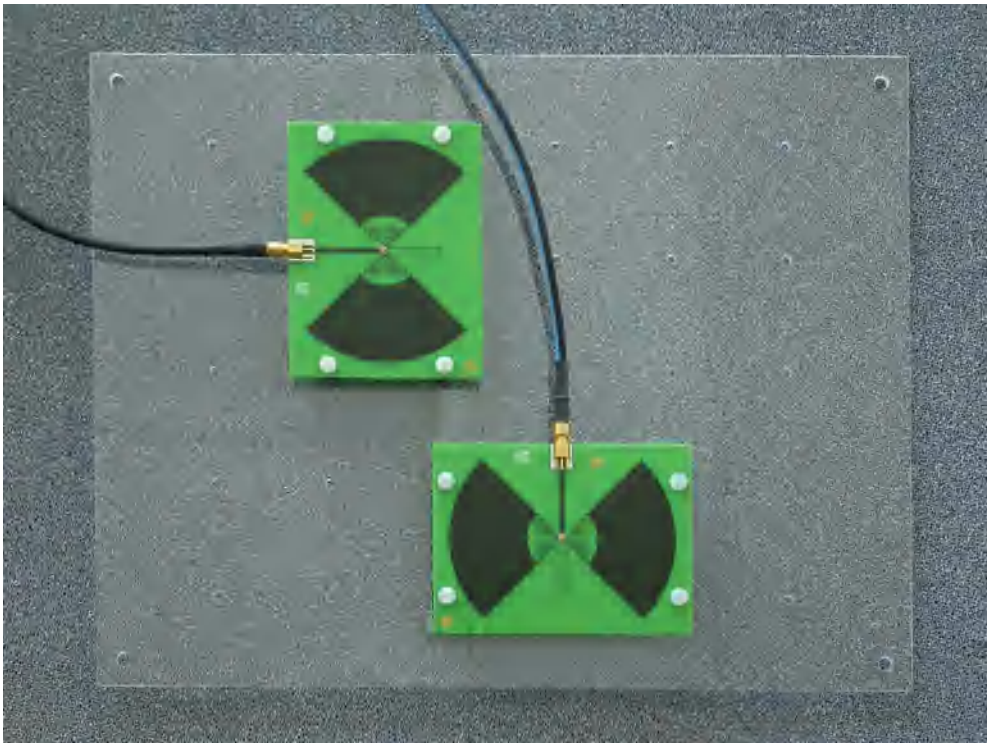


Figure 7-67: Good example: RF cables do not cross other antennas, but bypass them

4. Find the metal-threaded ends of the four spacers (the threads on the other ends are directly cut into the bulk polymer).

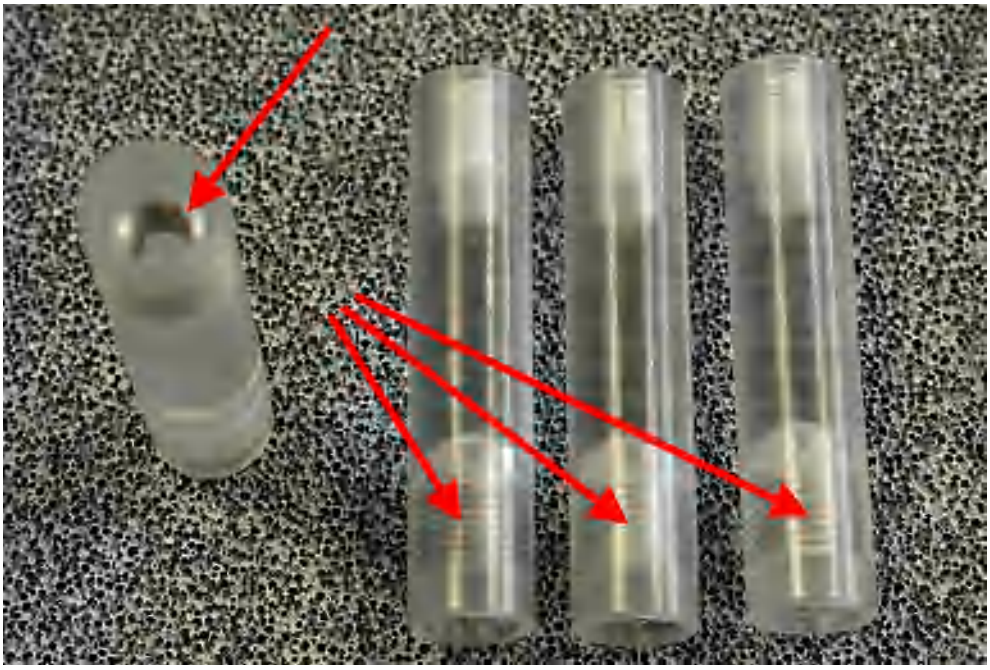


Figure 7-68: Four spacers, the red arrows point to the metal-threaded ends

5. Mount the four spacers inside the chamber (either on the right or the left side wall, depending on the desired antenna position). To do so, insert the spacers with their metal thread, first, into the holes in the basic absorber on the wall. It is sufficient to manually tighten the spacers.

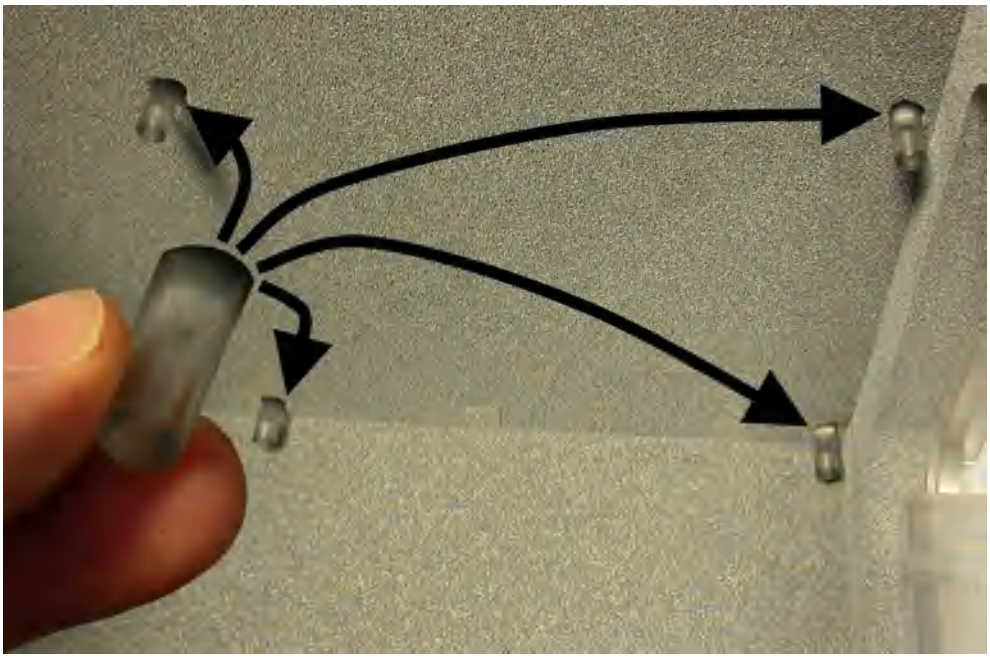


Figure 7-69: Positions of the four spacers at the chamber's right side wall (the door is seen on the left)

6. Attach the included absorber sheet to the chamber's wall, while meeting the four spacers.

In doing so, take care not to place the absorber sheet upside down: The distances of the holes to the sheet's long edges are not the same. The edge that has to be at the upper end has a greater distance:

1 = Bigger distance of the upper holes to the sheet's upper long edge
2 = Smaller distance of the lower holes to the sheet's lower long edge

7. Place the acrylic glass sheet with the pre-mounted narrowband antenna over the absorber sheet.
   Note that the screw holes in the four corners of the acrylic glass sheet are all at the same distance from the edges, other than in case of the absorber sheet. Therefore, take care to mount the acrylic glass sheet in the intended orientation, and not upside down.
8. Fix the acrylic glass sheet with the four big screws, as shown below, using a flat-head screwdriver. This also fixes the absorber sheet in place.

9. Connect the included SMP / SMA cable to the antenna's SMP connector.
10. Remove a pad of detachable absorber material at one of the SMA connectors at the inside rear wall of the chamber.
11. Attach the cable's SMA connector to the SMA feedthrough connector at the rear wall.

Make sure to make a note of the allocation of which antenna is connected to which SMA connector.

12. Use a torque wrench to tighten the cable's SMA connector, minding the TORQUE RECOMMENDATIONS.

13. Insert the previously removed pad of absorber material at the SMA connector and around the cable.

    The result of the antenna installation procedure then looks like in Figure 7-63 (or with a different positioning of the one or multiple antennas).

14. If necessary, mount the antenna holders and / or the wideband antenna (back) into the chamber, as described in Chapter 7.2.6, "Mounting the Antenna Holder into the Chamber", on page 113 and Chapter 7.5.1, "Mounting the Wideband Antenna Into the Chamber", on page 141. (You cannot mount an antenna ring and a narrowband antenna in the RF Shielded Box at the same time.)

15. Close the top cover as described in Chapter 7.1.2, "Closing the Top Cover", on page 80.

With one or several narrowband antennas mounted, use the standard absorber version (1) on the top cover:

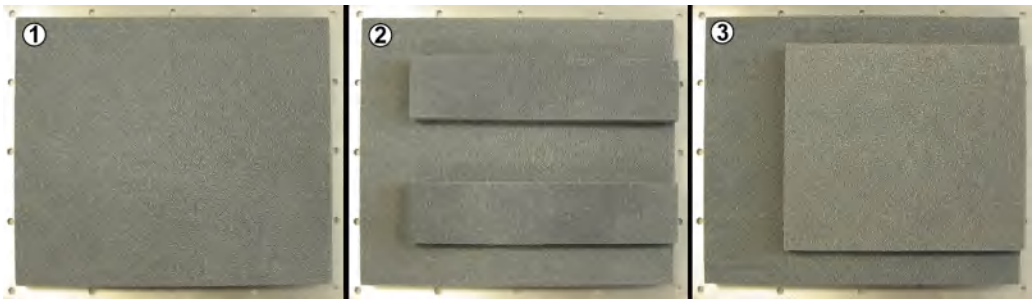


Figure 7-70: Different absorber material configurations on the inside of the top cover. In these pictures, the "FRONT" edge of the cover is on the right-hand side

1 = Standard absorber for use with Narrowband Antenna R&S TS-F24NB2
2 = Absorber for use with Half Antenna Ring R&S TS-F24-AH1 or Full Antenna Ring R&S TS-F24-AR
3 = Absorber for use with Wideband Antenna R&S TS-F24WA1

All three absorber material configurations are compatible with antennas mounted on the Antenna Holder R&S TS-F24-AH2.

7.4.2 Taking Narrowband Antennas Out of the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

To remove one or more Narrowband Antenna R&S TS-F24NB2 from the RF Shielded Box, proceed as follows:

1. Remove the top cover as described in Chapter 7.1.1, "Opening the Top Cover", on page 79.
   For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.
2. If the wideband antenna is present in the chamber, remove it as described in Chapter 7.5.2, "Taking the Wideband Antenna Out of the Chamber", on page 145.
3. Disconnect the cable from the narrowband antenna's SMP connector.

4. Remove the pad of detachable absorber material at the SMA connector to which this cable leads.
5. Disconnect the cable from the SMA feedthrough connector at the rear wall, using a torque wrench.

6. Insert the previously removed pad of absorber material back in place at that SMA connector.
7. Using a flat-head screwdriver, unscrew the four big screws that hold both the acrylic glass sheet and the absorber sheet.

8. Remove the acrylic glass sheet and the absorber sheet from the chamber's wall.

Note: It may be a bit difficult to detach the absorber sheet from the spacer in the lower corner, close to the door. In this case, try to squeeze your fingers between the absorber sheet and the absorber material on the chamber's ground, to be able to pull from underneath.

9. Remove the four spacers from the chamber's side wall (or four each from both walls, if antennas were mounted on either side).

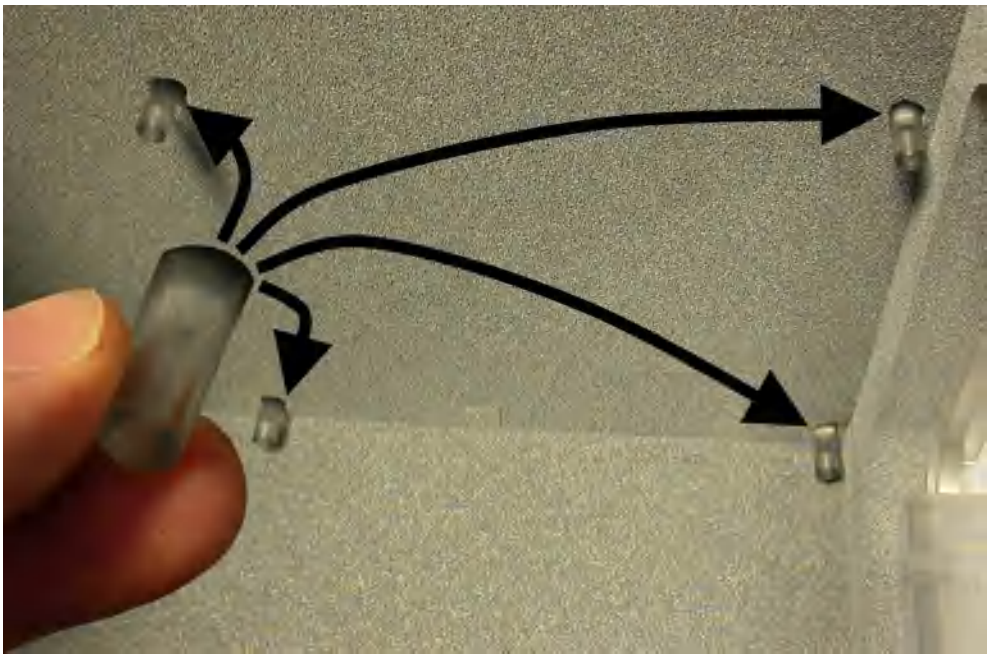
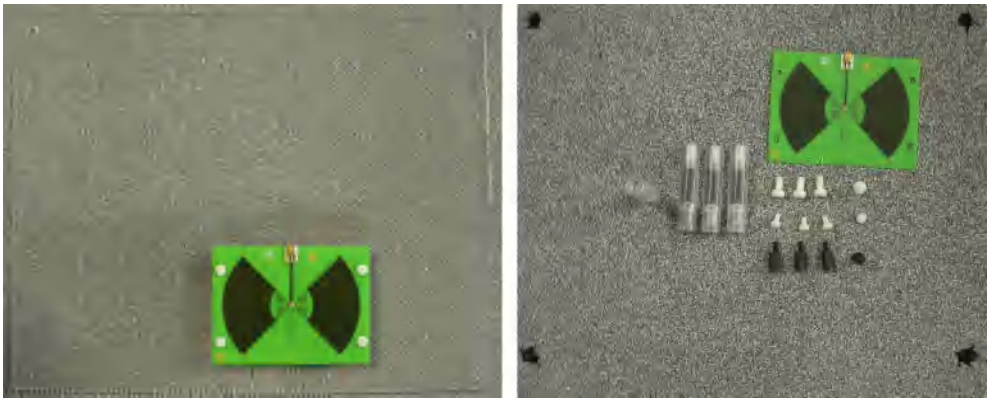


Figure 7-71: Remove all the spacers

10. Optionally, disassemble the narrowband antenna(s) arrangement from the acrylic glass sheet.



11. If required, mount the wideband antenna (back) into the chamber, as described in Chapter 7.5.1, "Mounting the Wideband Antenna Into the Chamber", on page 141.
12. Close the top cover as described in Chapter 7.1.2, "Closing the Top Cover", on page 80.

7.5 Installation of the Wideband Antenna

The Wideband Antenna R&S TS-F24WA1 can be used inside the RF Shielded Box for a range of test scenarios. The following section describes how it is mounted.

To remove the wideband antenna from the chamber, follow the procedure in Chapter 7.5.2, "Taking the Wideband Antenna Out of the Chamber", on page 145.

7.5.1 Mounting the Wideband Antenna Into the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

The Wideband Antenna R&S TS-F24WA1 can be mounted into the RF Shielded Box:

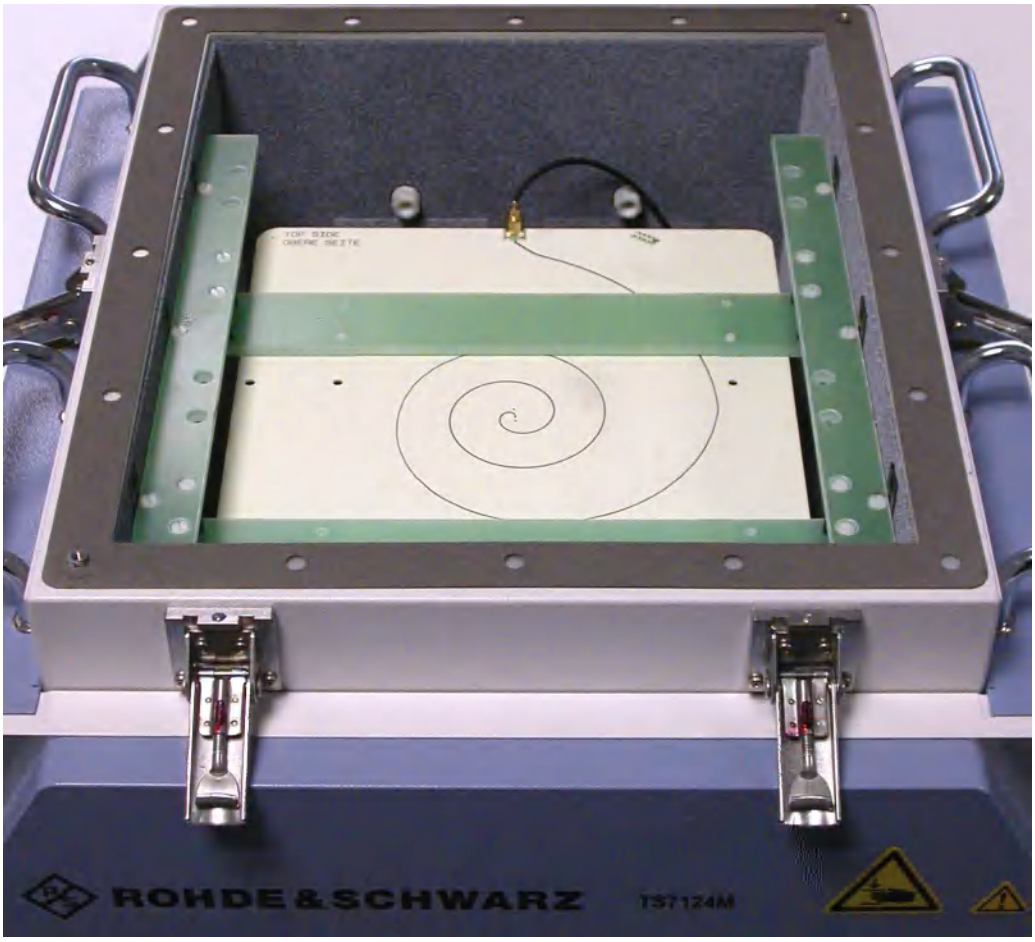


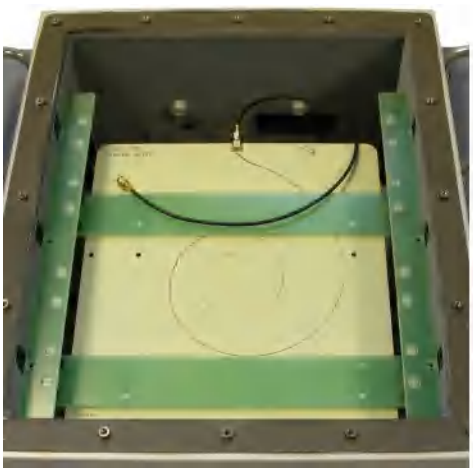
Figure 7-72: RF Shielded Box (open) with mounted wideband antenna

To mount the pre-assembled wideband antenna into the chamber, proceed as follows:

1. Remove the top cover as described in Chapter 7.1.1, "Opening the Top Cover", on page 79.
   For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.
2. If in the chamber an antenna ring is present, remove it as described in Chapter 7.2.1, "Taking the Half Antenna Ring out of the Chamber", on page 86 or Chapter 7.2.3, "Taking the Full Antenna Ring out of the Chamber", on page 97. (Narrowband antennas or antennas mounted on an antenna holder can remain in the chamber, if necessary.)
3. Inside the chamber, close to its top edge, remove the six rectangular absorber pads (three on each side).
4. In these openings, mount the six included anodized supports for the antenna holder. Three supports are mounted on the left side, as shown below, and the other

three supports are mounted on the right side of the chamber. Use a Torx 10 screwdriver to tighten the twelve included screws.

5. Use a torque wrench to attach the included RF cable to the antenna's SMA connector, minding the TORQUE RECOMMENDATIONS.
6. Place the antenna inside the chamber, with the SMA connector pointing to the rear and the [TOP SIDE] label on the upper side.
7. Fix the antenna to the supports with the included six polymer screws (shown below), using a flathead screwdriver.



8. Remove a pad of detachable absorber material at one of the SMA connectors at the inside rear wall of the chamber.
9. Attach the cable's SMA connector to the SMA feedthrough connector at the rear wall, as shown below.

Make sure to make a note of the allocation of which SMA connector the antenna is connected to.

10. Use a torque wrench to tighten the cable's SMA connector, minding the TORQUE RECOMMENDATIONS.
11. Insert the previously removed pad of absorber material at the SMA connector and around the cable.

    The result of the antenna installation procedure then looks like in Figure 7-72.
12. Close the top cover as described in Chapter 7.1.2, "Closing the Top Cover", on page 80.

With the wideband antenna mounted, use the third absorber version (3) on the top cover:

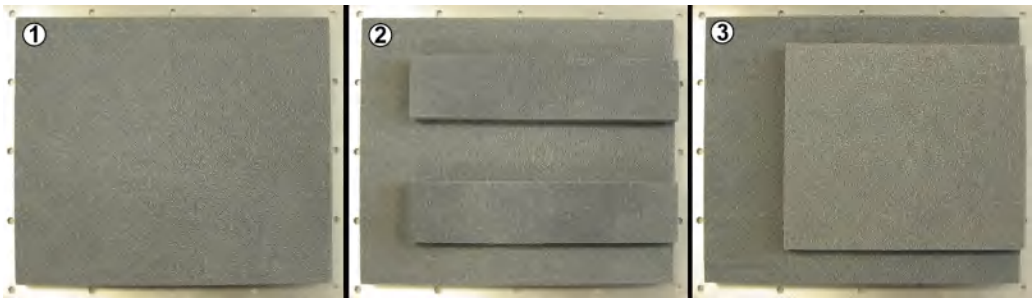


Figure 7-73: Different absorber material configurations on the inside of the top cover. In these pictures, the "FRONT" edge of the cover is on the right-hand side

1 = Standard absorber for use with Narrowband Antenna R&S TS-F24NB2
2 = Absorber for use with Half Antenna Ring R&S TS-F24-AH1 or Full Antenna Ring R&S TS-F24-AR
3 = Absorber for use with Wideband Antenna R&S TS-F24WA1

All three absorber material configurations are compatible with antennas mounted on the Antenna Holder R&S TS-F24-AH2.

7.5.2 Taking the Wideband Antenna Out of the Chamber

WARNING

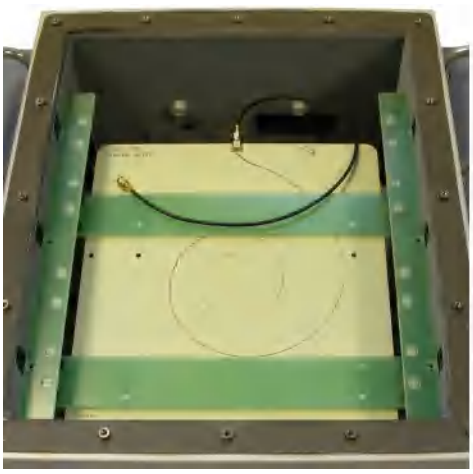
Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

To remove the Wideband Antenna R&S TS-F24WA1 from the RF Shielded Box, proceed as follows:

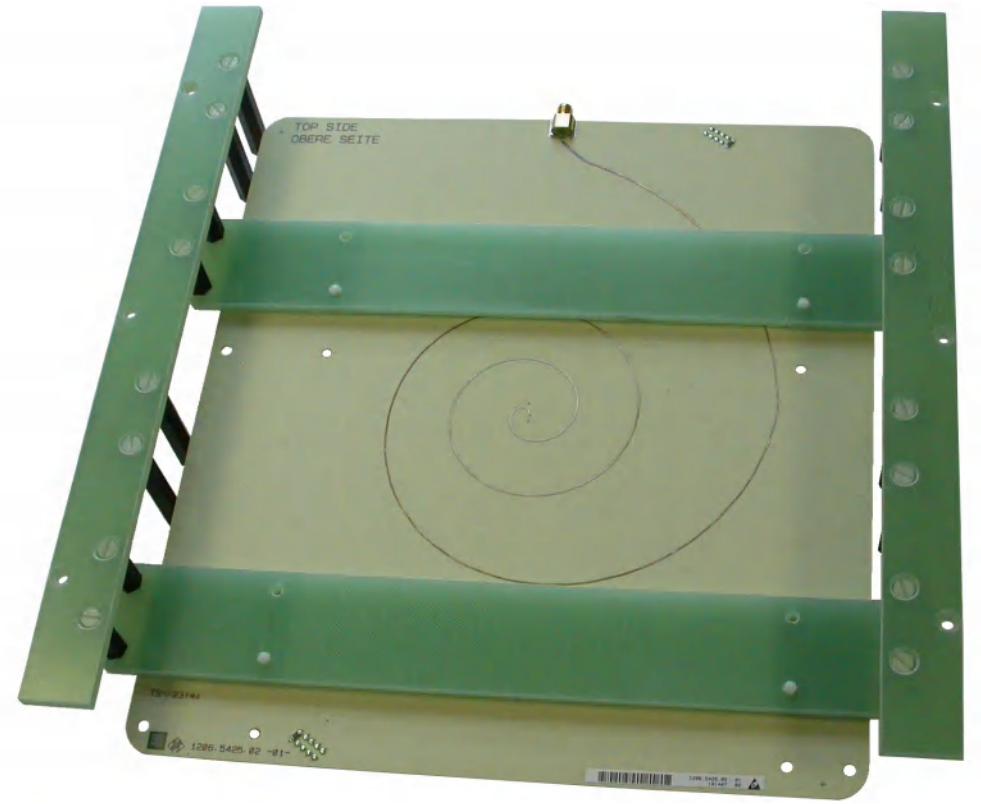
1. Remove the top cover as described in Chapter 7.1.1, "Opening the Top Cover", on page 79.
   For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.
2. At the chamber's rear wall, remove the pad of detachable absorber material at the SMA connector to which the RF cable leads.
3. Disconnect the cable from the SMA feedthrough connector at the rear wall, using a torque wrench.

4. Insert the previously removed pad of absorber material back in place at that SMA connector.
5. Remove the six polymer screws that fix the antenna, using a flathead screwdriver.



6. Take the antenna out of the chamber.
7. Inside the chamber, remove the six supports (twelve screws), using a Torx 10 screwdriver.

8. Insert six rectangular absorber pads into the supports' gaps in the chamber walls. (Use the pads that were removed from there when the wideband antenna was mounted.)
9. Disconnect the cable from the wideband antenna's SMA connector, using a torque wrench.



10. Close the top cover as described in Chapter 7.1.2, "Closing the Top Cover", on page 80.

7.6 Installation of the LF Loop Antenna

The LF Loop Antenna R&S TS-F24HLF1 can be used inside the RF Shielded Box for a range of test scenarios. The following section describes how it is mounted.

To remove the LF loop antenna from the chamber, follow the procedure in Chapter 7.6.2, "Taking the LF Loop Antenna Out of the Chamber", on page 151.

7.6.1 Mounting the LF Loop Antenna Into the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

The LF Loop Antenna R&S TS-F24HLF1 can be mounted into the RF Shielded Box.

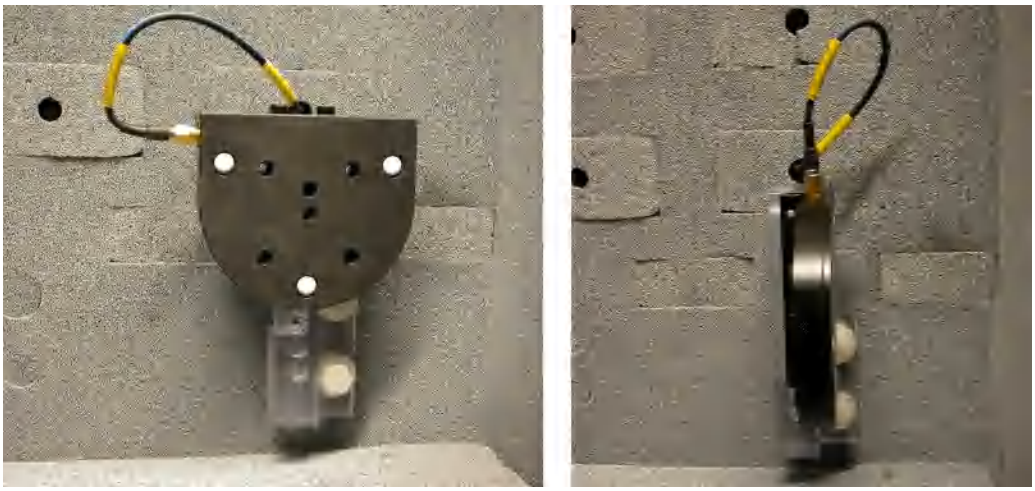


Figure 7-74: LF loop antenna mounted in RF Shielded Box (two of various possible positions)

Left = Front-facing orientation
Right = Side-facing orientation

The following procedure describes the recommended mounting on the Antenna Holder R&S TS-F24-AH2 in the side-facing orientation shown on the right hand side in Figure 7-74. To mount the LF loop antenna in the front-facing orientation shown on the left hand side in Figure 7-74, proceed accordingly.

To mount the LF loop antenna into the chamber, proceed as follows:

1. Start with the empty chamber (empty except for the absorber material covering the walls) and with one Antenna Holder R&S TS-F24-AH2.
2. Remove the top cover as described in Chapter 7.1.1, "Opening the Top Cover", on page 79.

For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.

3. If in the chamber an antenna ring is present, remove it as described in Chapter 7.2.1, "Taking the Half Antenna Ring out of the Chamber", on page 86 or Chapter 7.2.3, "Taking the Full Antenna Ring out of the Chamber", on page 97. (Narrowband antennas or antennas mounted on a second antenna holder can remain in the chamber, if necessary. Also, you can mount the half antenna ring or the wideband antenna into the chamber after mounting the LF loop antenna.)
4. Inside the chamber, remove a rectangular pad of detachable absorber material at the RF feedthrough SMA connector number 2 (see Figure 4-7).
5. Also, remove two detachable round absorber pads on the right side at the lower end of the rear chamber wall.
6. Screw the two spacers into the two positions, using a torque wrench No. 13 with a torque of 4.6 Nm.

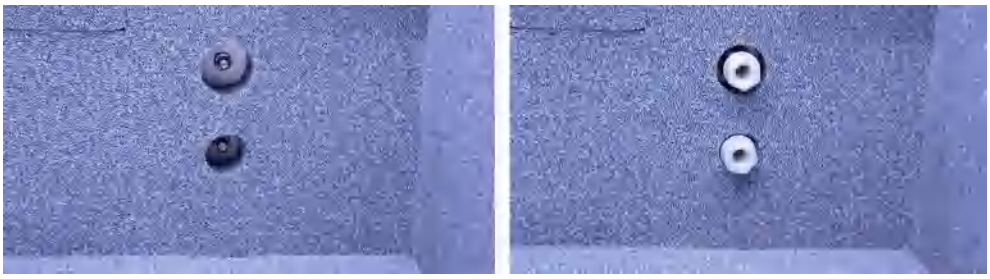


Figure 7-75: Mounting two spacers on the right side of the rear chamber wall

7. Use a torque wrench to attach the included RF cable to the antenna's SMA connector, minding the TORQUE RECOMMENDATIONS.
8. Insert the two polymer bolts into the antenna holder.
9. Attach the the included RF cable to the antenna's SMA connector.
10. Use a torque wrench to tighten the cable's SMA connector, minding the TORQUE RECOMMENDATIONS.
11. Place the antenna in the desired position onto the antenna holder as shown in Figure 7-76.
    Different lateral positions are possible, but in the chamber, the physical effects of different elevations of the LF loop antenna can be considered very low.
    Alternatively, for mounting the antenna in the front-facing orientation shown on the left hand side in Figure 7-74, use the two protruding rivet holes in the center of the antennas flat side (visible on top in Figure 7-76).
12. Fix the antenna to the antenna holder with at least one expanding rivet, as shown below:

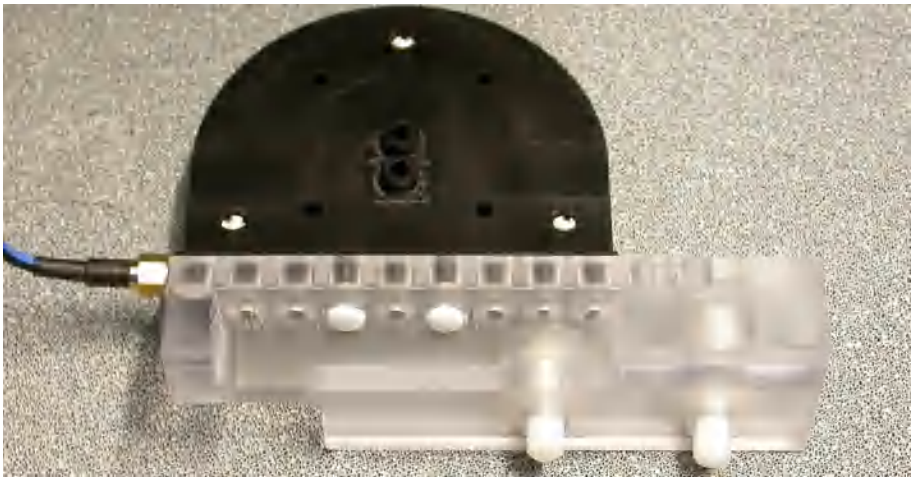


Figure 7-76: LF loop antenna fixed on the antenna holder

13. Insert the antenna holder with attached antenna into the RF Shielded Box.
14. Attach the cable's SMA connector to the SMA feedthrough connector at the rear wall.
15. Use a torque wrench to tighten the cable's SMA connector, minding the TORQUE RECOMMENDATIONS.
16. Insert the previously removed pad of absorber material at the SMA connector and around the cable.
17. Loosely screw in the upper bolt of the antenna holder into the upper spacer in the rear chamber wall.

18. Rotate the antenna holder to its final position.
19. Screw in the lower bolt of the antenna holder into the lower spacer in the rear chamber wall.
20. Tighten the bolts, either just finger-tight (which typically is sufficient), or use a socket torque wrench No. 13 with a torque of 2.8 Nm.

    The result of the antenna installation procedure then looks like on the right hand side in Figure 7-74.
21. Close the top cover as described in Chapter 7.1.2, "Closing the Top Cover", on page 80.

With the LF loop antenna mounted, use any of the available absorber versions on the top cover:

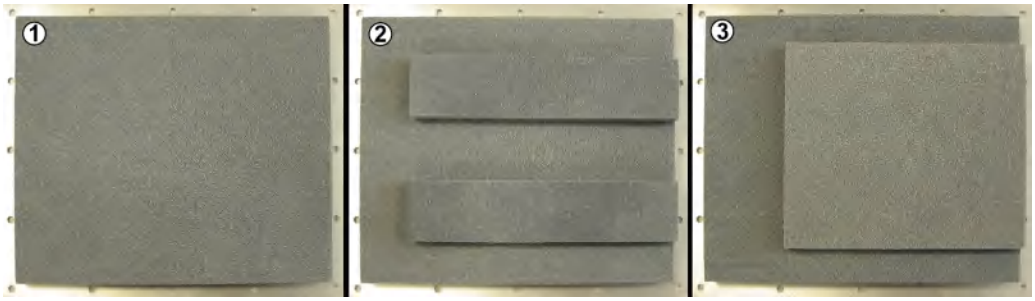


Figure 7-77: Different absorber material configurations on the inside of the top cover. In these pictures, the "FRONT" edge of the cover is on the right-hand side

1 = Standard absorber for use with Narrowband Antenna R&S TS-F24NB2
2 = Absorber for use with Half Antenna Ring R&S TS-F24-AH1 or Full Antenna Ring R&S TS-F24-AR
3 = Absorber for use with Wideband Antenna R&S TS-F24WA1

All three absorber material configurations are compatible with antennas mounted on the Antenna Holder R&S TS-F24-AH2.

7.6.2 Taking the LF Loop Antenna Out of the Chamber

WARNING

Risk of contusion due to heavy moving parts

If for configuration the RF Shielded Box has to be removed from its mounted position, the chamber can tilt and the drawer can slide open unintentionally. These movements can cause personal injuries, especially contusion. To avoid this risk, fix the chamber in a horizontal position.

To remove the LF Loop Antenna R&S TS-F24HLF1 from the RF Shielded Box, proceed as follows:

1. Remove the top cover as described in Chapter 7.1.1, "Opening the Top Cover", on page 79.
   For the remainder of this procedure, remember to **avoid touching the gasket** that seals the top cover.
2. Unscrew the two polymer bolts that fix the antenna holder.

3. At the chamber's rear wall, remove the pad of detachable absorber material at the SMA connector to which the RF cable leads.
4. Disconnect the cable from the SMA feedthrough connector at the rear wall, using a torque wrench.

5. Insert the previously removed pad of absorber material back in place at that SMA connector.
6. Take the antenna out of the chamber.
7. Remove the two spacers on the right side at the lower end of the rear chamber wall.
8. Insert two detachable round absorber pads into the spacers' holes in the absorber material.(Use the pads that you removed from there when you mounted the LF loop antenna.)
9. Optionally disconnect the cable from the LF loop antenna's SMA connector, using a torque wrench.
10. Optionally detatch the antenna from the antenna holder by removing the one or two expanding rivets.
11. Close the top cover as described in Chapter 7.1.2, "Closing the Top Cover", on page 80.

8 Maintenance

8.1 Safety Instructions for Maintenance

WARNING

Risk of injury in case of uninformed maintenance

If maintenance tasks are performed by untrained personnel, this may lead to risks of personal injury and damage to the equipment.

To avoid these risks, maintenance tasks may only be performed by trained personnel.

8.2 Compliant Maintenance

To retain the functional readiness and long operational life of the RF Shielded Box, perform maintenance tasks according to the intervals specified in Chapter 8.3, "Maintenance Intervals", on page 153.

Operating the RF Shielded Box involves producing some inevitable waste and expendables. Handle these in an environmentally friendly way.

8.3 Maintenance Intervals

The following table shows the maintenance tasks that are to be carried out in the stated intervals on the RF Shielded Box. The intervals are valid for a single work shift corresponding to about 160 hours per month.

Table 8-1: Scheduled maintenance

Maintenance Interval	Maintenance Tasks
Daily	**Functional checking** • Check the door's gasket for soiling, damage and wear • Check the drawer's manual close mechanism for proper function • Check antennas, cables and connectors for proper function • Check the door closure for the right gap size
Weekly	**Absorber and shielding effectiveness checking** • Check the absorber material on the inside of the drawer and around the chamber's door opening for damage or wear • Check the tension force at the top cover
Every 100 000 cycles	**Gasket cleaning** • Clean the door's gasket every 100 000 cycles to maintain RF shielding
After opening and closing the top cover	**Shielding effectiveness of the top cover** • Check the tension force at the top cover
Depending on amount of soiling	**RF Shielded Box cleaning** • Clean the chamber, if it is soiled
Depending on test instrument calibration intervals (typically once a year)	**System calibration** • As soon as the test system's instruments (to which the RF Shielded Box is connected) are being calibrated, make sure that the RF Shielded Box is included into this calibration procedure
Once a year (recommended)	**Performance check by Rohde & Schwarz** • A regular check by Rohde & Schwarz service personnel is recommended once a year, to make sure that the performance of the RF Shielded Box is not compromised.

For details on checking, see Chapter 8.4, "Checking", on page 154.

For details on cleaning, see Chapter 8.5, "Cleaning", on page 156.

8.4 Checking

The RF Shielded Box has to be checked on a regular basis, as specified in Chapter 8.3, "Maintenance Intervals", on page 153. Checking is performed according to the following guidelines:

► Check the **door's gasket** for soiling, damage and wear [1]:
If the gasket is soiled, clean it.
If the gasket is obviously damaged or worn, have it replaced by Rohde & Schwarz Service.

[1] The attainable radiation shielding efficiency of the door's RF gasket depends on how long the gasket remains in a relaxed state. Extended periods of gasket relaxation will

preserve its long-term shielding efficiency. The door's gasket was tested by Rohde & Schwarz in a 2:1 time ratio of opened versus closed state. With reverse time ratios, the amount of wear will increase, requiring replacement at shorter intervals. When the RF Shielded Box is not in use, e.g. between production periods, it is recommended to leave the door open.

► Check **antennas**, **cables** and **connectors** for proper function:
The recommended checking option is by coupling measurements from one antenna towards the others. For example, if six antennas are installed, send a defined RF signal to antenna #1 and measure it at antenna #2. Then send the same RF signal to antenna #2 and measure it at antenna #3, and so on. This procedure could be automated, depending on the available measurement equipment and the customer-specific test system.
Another option for checking is a measurement of the S11 parameters at all RF ports of the RF Shielded Box.
If one or several antennas, cables or connectors do not seem to function properly, open the chamber (see Chapter 7.1, "Opening and Closing the Top Cover", on page 78) and verify the antenna/cable connections, as well as the cable/feed-through connections. Close the chamber and check again for proper function.
If there still is a lack of functionality, and if the fault can be located in individual antenna(s) or cable(s), replace it (or them).
If there still is a lack of functionality, inform Rohde & Schwarz Service.

► Check the **Magnetic Coil R&S TS-F24HML1** for proper function:
If you detect problems in generating the magnetic field (or one component of it), measure the resistance between the pins of the 25-pin D-Sub connector. The resistance must be as in the following matrix.

Table 8-2: Specified ohmic resistance between two selected connector pins

Pins	1	2	3	4	5	6	14	15	16	17	18	19
1	-	**24Ω**	∞	∞	∞	∞	**12Ω**	**12Ω**	∞	∞	∞	∞
2		-	∞	∞	∞	∞	**12Ω**	**12Ω**	∞	∞	∞	∞
3			-	**24Ω**	∞	∞	∞	∞	**12Ω**	**12Ω**	∞	∞
4				-	∞	∞	∞	∞	**12Ω**	**12Ω**	∞	∞
5					-	**24Ω**	∞	∞	∞	∞	**12Ω**	**12Ω**
6						-	∞	∞	∞	∞	**12Ω**	**12Ω**
14							-	**0Ω**	∞	∞	∞	∞
15								-	∞	∞	∞	∞
16									-	0	∞	∞
17										-	∞	∞
18											-	**0Ω** 0
19												-

If your measurements deviate from these values by more than 1 Ω, the deviating resistance values can help to locate a broken cable or a bad connection. You can try to fix bad connections by verifying the tightness of the terminal strip's contacts on the wiring board (Figure 5-44). If there still is a lack of functionality, inform Rohde & Schwarz Service.

► Check the **absorber material** on the inside of the door and around the chamber's door opening for damage or wear:
If the absorber material is obviously damaged or worn, have it replaced by Rohde & Schwarz Service. This may require an exchange of the complete door.

► Check the **door closure** for the right gap size:
If the gap is more than a fingernail's thickness, have it adjusted by Rohde & Schwarz Service. This may typically require an exchange of the gasket and of (parts of) the locking mechanism, or worst case of the complete door.

► Check the **tension force** at the top cover:
To check the tension force that the quick clamps exert on the top cover, proceed as described in Chapter 7.1.3, "Adjusting the Locking Force of the Cover", on page 83. If the tension force is not ideal, adjust it as described in that procedure.

8.5 Cleaning

NOTICE

Risk of damaging mechanical parts

To avoid malfunction and damage to mechanical parts, especially the drawer guide rails (3 in Figure 4-1), do not apply liquid cleaning agents such as contact spray.

8.5.1 Cleaning the Chamber

The inside of the RF Shielded Box can be cleaned with a vacuum cleaner.

8.5.2 Cleaning the Gasket Contact Area

For a constant level of high radiation shielding efficiency, the gasket must be cleaned according to Chapter 8.3, "Maintenance Intervals", on page 153.

The following equipment and materials are recommended for cleaning:

- Soft, lint-free cleaning cloth
- Alcohol
- Soft brush

To clean the gasket, proceed in the following way:

1. Carefully use the soft brush in a dry condition to pre-clean the gasket.
2. Use the cloth and alcohol to remove any soil, including sweat or grease from fingerprints, from the gasket's chromated aluminum contact area.

8.6 Storage

If the RF Shielded Box is not in use for some time (e.g., between production periods), it is recommended to leave the door open. Due to the relaxation of the door's RF gasket, its long-term radiation shielding efficiency will be improved. For more information on gasket relaxation effects, see Chapter 8.3, "Maintenance Intervals", on page 153.

Glossary: List of Frequently Used Terms and Abbreviations

B

Bluetooth: A wireless mobile technology standard for radiocommunication over short distances of up to 60 m, using RF frequencies from 2.4 to 2.485 GHz

D

D-Sub: Electrical D-subminiature connector, surrounded by a D-shaped metal support

DUT: Device under test

E

EMC: Electromagnetic compatibility

ESD: Electrostatic discharge

G

Gasket: A mechanical seal

N

N connector: A ruggedized RF connector, originally developed for navy (N) applications

P

PC connector: Precision connector (not to be confused with the acronym for personal computer)

PDA: Personal digital assistant

R

Radio key: Car key with remote control features

RF: Radio frequency, electromagnetic oscillation in the range of 3 kHz to 300 GHz

S

SMA / SMP connector: SubMiniature coaxial RF connector, version A (standard) / version P (precision, pluggable)

SMD: Surface mountable device

U

USB: Universal Serial Bus, industrial connector standard

V

VSWR: Voltage standing wave ratio, ratio of the maximum standing wave amplitude over the minimum standing wave amplitude

W

Wi-Fi: A wireless internet-connectivity technology for electronic devices (synonym for WLAN, wireless local area network)

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