

R&S®CMQ500

Shielding Cube mmW

Instructions Handbook



1179292502
Version 02

ROHDE & SCHWARZ
Make ideas real



Original instructions, in the following referred to as "this handbook".

It describes the following model of the shielding cube **mmW** with firmware version 1.4.2 and later:

- R&S®CMQ500 (order no. 1201.0005K12) for signaling tests and use cases, with one of the following remotely controllable or manual door operation options:
 - R&S®CMQ-B20B, **electrical** operation (order no. 1537.6010.03)
 - R&S®CMQ-B20C, **electrical** operation (order no. 1537.6010.04)
 - R&S®CMQ-B21A, **pneumatic** operation (order no. 1537.6026.02)
 - R&S®CMQ-B21C, **pneumatic** operation (order no. 1537.6026.04)
 - R&S®CMQ-B22C, **manual** operation (order no. 1537.6078.04)

The shielding cube **mmW** is also referred to as the "chamber" or the "product".

The firmware of the instrument uses several valuable open source software packages. For information, see the "Open Source Acknowledgment" document, which is available for download from the customer web section on GLORIS, the global Rohde & Schwarz information system: <https://extranet.rohde-schwarz.com>.

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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1179.2925.02 | Version 02 | R&S®CMQ500

Throughout this handbook, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®CMQ500 is indicated as R&S CMQ500.

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1 Introduction

This instructions handbook addresses every **user** of the **chamber** (also referred to as the **product**). To use the chamber safely, first read and understand this entire handbook. If you are unsure about a topic, ask your supervisor or contact Rohde & Schwarz customer support.

The instructions handbook helps you to use the chamber safely and efficiently during its entire lifecycle; installation, operation, maintenance and disabling. If you are only involved in one part of the lifecycle, focus on the chapter about that topic. But always get a deep understanding of the safety aspects described in **Chapter 2, "Safety"**, on page 10 before starting.


The chapter titles give a clear idea of the lifecycle stage and the tasks described. For example, if you are an **operator**, most activities intended for you are described in **Chapter 7, "Operation"**, on page 37. If tasks are restricted to certain roles, these roles are mentioned at the beginning of the chapter that describes the tasks. The **roles** are explained in the glossary.

Abbreviations and frequently used terms are explained in the glossary at the end of this handbook.

1.1 Regulatory information

The following labels and the associated certificates declare conformance with legal regulations.

1.1.1 CE declaration

 Certifies compliance with the applicable provisions of the Directive of the Council of the European Union. A copy of the CE declaration in English is at the beginning of the printed version of this handbook, after the table of contents.

1.1.2 Korea certification class A



이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

1.1.3 China RoHS certification



Certifies compliance with the Chinese government's regulation on the restriction of hazardous substances (RoHS).

The chamber is built of environmentally sound materials. It is free of substances that are either restricted or prohibited by law.

1.2 Documentation overview

This section provides an overview of the R&S CMQ500 user documentation. Unless specified otherwise, you find the documents on the R&S CMQ500 product page at:

www.rohde-schwarz.com/product/cmq500

1.2.1 Instructions handbook

This handbook contains the description of all operating modes and functions of the chamber. It also provides an introduction to remote control, a complete description of the remote control commands, information on maintenance, interfaces and error messages.

The handbook does **not** describe the special activities required for permitted hardware reconfigurations of the chamber, which are described in the [Configuration manual](#). Only an **expert user** who has read and understood the [Configuration manual](#) is allowed to perform reconfigurations. Other users are limited to tasks described in the instructions handbook.

A printed copy of this handbook is included in the delivery and available at:

www.rohde-schwarz.com/manual/cmq500

1.2.2 Configuration manual

Describes all hardware reconfigurations and adjustments of the chamber that are permitted.

These activities are restricted to the role of an **expert user** who has read and understood the [Configuration manual](#) and who has all skills required for reconfiguring the chamber.

The configuration manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

gloris.rohde-schwarz.com > [Support & Services](#) > [Sales Web](#) > [Test and Measurement](#) > [Wireless Communication](#) > [CMQ](#) > [Manuals](#)

1.2.3 Data sheets and brochures

The data sheet contains the technical specifications of the chamber. It also lists optional accessories and their order numbers.

The data sheet is available for registered users on the global Rohde & Schwarz information system (GLORIS):

gloris.rohde-schwarz.com > Support & Services > Sales Web > Test and Measurement > Wireless Communication > CMQ > Promotional Material > Specifications

The brochure provides an overview of the chamber and deals with the specific characteristics. See www.rohde-schwarz.com/brochure-datasheet/cmq500

1.2.4 Open source acknowledgment (OSA)

The open source acknowledgment provides verbatim license texts of the used open-source software.

See www.rohde-schwarz.com/software/cmq500

1.3 Conventions

The R&S CMQ500 is also referred to as the "chamber" or the "product".

The following text markings are used throughout this handbook:

| Convention | Description |
|--------------------------------------|--|
| [Keys] | Names of connectors, keys and knobs are enclosed by square brackets. |
| Filenames, commands, program code | Filenames, commands, coding samples and screen output are distinguished by their font. |
| Links | Links that you can click are displayed in blue font. |
| bold or <i>italic</i> | Highlighted text is shown in bold or italic font. |
| "quote" | Quoted text or terms are shown in quotation marks. |



Tip

Tips are marked as in this example and provide useful hints or alternative solutions.



Note

Notes are marked as in this example and indicate important additional information.

2 Safety

Products from the Rohde & Schwarz group of companies are manufactured in accordance with the highest technical standards. Follow the instructions provided throughout this handbook. Keep the product documentation nearby and offer it to other users.

Use the chamber only for its intended use and within its performance limits, as described in [Chapter 2.1, "Intended use"](#), on page 10 and in the data sheet. Reconfigure or adjust the chamber only as described in the product documentation. Other modifications or additions can affect the safety and are not permitted.

For safety reasons, only trained personnel are allowed to handle the chamber. Trained personnel are familiar with the safety measures and know how to avoid potentially dangerous situations while performing the assigned tasks.

If any part of the chamber is damaged or broken, stop using the chamber. Only service personnel authorized by Rohde & Schwarz are allowed to repair the chamber. Contact Rohde & Schwarz customer support at www.customersupport.rohde-schwarz.com.

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2.1 Intended use

The chamber is intended for radiation testing of electronic components and devices in industrial, administrative, and laboratory environments, see [Chapter 6.1, "Choosing the operating site"](#), on page 24. Use the chamber only for its designated purpose, as described in this handbook. Observe the operating conditions and performance limits stated in the data sheet. If you are unsure about the appropriate use, contact Rohde & Schwarz customer support.

2.2 Residual risks

Despite the inherent safe design measures, safeguarding and complementary protective measures adopted, residual risks remain because of the following facts.

Chamber is heavy

The weight of the chamber without accessories and antenna cage is approximately 60 kg. In total, the chamber can weigh up to roughly 70 kg. If the chamber drops on a person, it can cause severe injuries, even death.

Door of the chamber is heavy

The center of gravity moves with the door when you open it. If the chamber topples, it can cause severe injuries, even death.

Moving door

Applies only to a chamber with an electrically or pneumatically operated door.

When you trigger the closing of the door, the door starts closing with reduced force. A built-in soft-close mechanism prevents the door from closing with full force as long as the gap is large enough to put a finger in it, maximum 8 mm. But if this safety mechanism fails, and the door closes with full force with a finger between the door and door frame, the finger is crushed. Even the loss of the limb is possible.

The safety mechanism is described in detail in [Chapter 3.2, "Automatic emergency deactivation"](#), on page 15.

Electrically powered

The risks, requirements for installation and safety measures are described in ["Connecting to power"](#) on page 12.

Pneumatically operated door

Applies only to a chamber with a pneumatically operated door.

Supply the compressed air for the pneumatic system at a pressure of 6 bar. If the pressure exceeds the limit of 7 bar, the chamber operates under unspecified conditions.

When operating the door at > 7 bar, uncontrolled situations can occur, causing injuries like crushed fingers. See [Chapter 6.4, "Connecting compressed air"](#), on page 28.

2.3 Potentially dangerous situations

Potentially dangerous situations can occur during the following activities.

Transport

Wear appropriate protective clothing that complies with your local rules and regulations. If you are unsure of which equipment to use, ask your safety inspector. For example, gloves help to keep a tight grip on the handles when carrying the chamber. Without gloves, you have less friction and your grip can slip if your hand is oily or wet. As a result, the chamber can drop and crush your foot or someone else's. Therefore, always wear safety shoes with toe cap when moving the chamber.

Always secure the door when moving the chamber, even if it is only for a short distance. See [Chapter 5.3, "Securing"](#), on page 22 for details on how to do it properly. If the door is not secured and opens while you are carrying the chamber, the center of gravity shifts. As a result, one of the carrying persons suddenly has to bear a much larger portion of the weight. When the sliding door hits its end position, the sudden stop results in a powerful thrust. If the person cannot manage the extra weight or loses grip of the handle, the chamber can drop and cause severe injuries, even death.

The chamber is heavy. Do not move, lift or carry the chamber by yourself. A single person can only carry a maximum of 18 kg safely depending on age, gender and physical condition. So at least 4 people are required. With fewer people, you risk injuries, ranging from back injuries from too heavy lifting to severe injuries like contusions or limb loss if the chamber is dropped.

If you suffer from medical problems such as spinal and back disorder, or if your physical state is not compatible with lifting a heavy chamber, do not participate in carrying it.

Use the handles to move or carry the chamber. See [Chapter 4, "Machine overview"](#), on page 17 to see where the handles are located.

To move the chamber safely, you can use lifting or transporting equipment such as lift trucks and forklifts. Follow the instructions provided by the equipment manufacturer.

A chamber with optional height extension R&S CMQ-B703 ([Figure 4-3](#)) is significantly more heavy, and the center of gravity is higher. Never lift, carry or transport a chamber with height extension, because it can tip over easily, leading to an increased risk of injuries. Also, the handles are not suited for the increased weight. To enable separate transport of the height extension and the base chamber, let an [expert user](#) or Rohde & Schwarz [service personnel](#) uninstall the height extension from the chamber.

For detailed instructions, see [Chapter 5.1, "Lifting and carrying"](#), on page 21.

Setting up

Place the chamber on a sufficiently sturdy support that can bear the weight of the chamber. Secure the support against toppling over, for example by fixing it to the floor. Observe the specifications of the manufacturer. Always place the chamber on a flat and level surface with the bottom of the chamber facing down. If the support is not sturdy enough, it can collapse. If the support is not level, the chamber can slide and drop from the support. In both cases, severe injuries are possible, even death.

When the chamber is positioned, secure the chamber as shown in [Figure 6-3](#). If you do not secure the chamber, the chamber can topple when opening the door, as described in ["Door of the chamber is heavy"](#) on page 11.

Set up a restricted area that only trained personnel are allowed to enter. In the restricted area, mark the space on the floor that is required for fully opening the door.

Route cables carefully and ensure that nobody can trip over loose cables.

For detailed instructions, see [Chapter 6.3, "Mounting the chamber"](#), on page 26 and [Chapter 6.7, "Defining zones of restricted access"](#), on page 34.

Connecting to power

The chamber runs on 24 V DC supplied by an external power supply unit that is included in the delivery. The power supply unit has overvoltage category II. Connect it to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Be aware of electrical risks, such as electric shock, fire, personal injury or even death.

Take the following measures for your safety:

- Before connecting the power supply unit to a power source (your mains grid), ensure that this source matches the voltage and frequency [INPUT] range indicated on the power supply unit.
- Only use the external power supply unit that is delivered with the chamber. It complies with country-specific safety requirements.
Only insert its plug into an outlet with protective conductor terminal.
- Only connect the power supply unit to a power source that is protected by a 16 A circuit breaker (branch protection).
- Ensure that you can disconnect the power supply unit from the power source at any time. Pull the power plug to disconnect the chamber. The power plug must be easily accessible.
- Install an easily accessible panic button (power-off switch, not included in the delivery) for interrupting power supply to the chamber.

Operating the door

Applies only to a chamber with an electrically or pneumatically operated door.

You can open and close the door by pressing a button while standing next to the chamber. Also, you can operate the door remotely. In either case, ensure that nobody has their fingers on the guide rails of the door or between the door and door frame. Establish safety rules as the following:

- During manual door operation, only the person pressing the button is allowed in the restricted area. After pressing the button, the person steps back from the chamber.
- During remote door operation, nobody is allowed in the restricted area.
- During operation, hands are kept out of the chamber, except for exchanging a **DUT**. During **DUT** exchange, nobody is allowed to operate the door.

Use the chamber as it is designed. Never tamper with its safety installations.

For detailed instructions, see [Chapter 7.3, "Operating the door"](#), on page 39.

Maintenance

Carry out the maintenance tasks as required. You thus ensure flawless functionality of the chamber and, in consequence, the safety of everyone working with the chamber. For detailed instructions, see [Chapter 9, "Inspection and maintenance"](#), on page 58.

Cleaning

See [Chapter 9.4.4, "Cleaning the chamber"](#), on page 62 and [Chapter 9.4.5, "Cleaning the gasket"](#), on page 62.

2.4 Warning messages in this handbook

A warning message points out a risk or danger that you need to be aware of. The signal word indicates the severity of the safety hazard and how likely it will occur if you do not follow the safety precautions.

WARNING

Potentially hazardous situation. Could result in death or serious injury if not avoided.

CAUTION






Potentially hazardous situation. Could result in minor or moderate injury if not avoided.

NOTICE

Potential risks of damage. Could result in damage to the supported product or to other property.

2.5 Labels on the chamber

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 |
|---|--|
|  | Potential hazard Read the product documentation to avoid personal injury or product damage. |
|  | Risk of crushing your fingers Be careful when operating the door. See: <ul style="list-style-type: none"> • "Moving door" on page 11 • "Operating the door" on page 13 Follow the instructions in this handbook. |
|  | Chamber is heavy Indicates a weight for heavy units > 60 kg, typically up to 70 kg. Be careful when lifting, moving or carrying the chamber. Carry the chamber with a sufficient number of people or with transport equipment. See: <ul style="list-style-type: none"> • "Chamber is heavy" on page 10 • "Transport" on page 11 |
|  | Grounding terminal See "To prepare the power connection" on page 32. |
|  | Disposal Do not dispose of the chamber in normal household waste. See Chapter 11, "Disabling and scrapping", on page 65. |

The labels providing regulatory information are described in [Chapter 1.1, "Regulatory information"](#), on page 7.

3 Emergencies

Applies only to a chamber with an electrically or pneumatically operated door.



Possible emergencies can result from a failure of the soft-close mechanism that stops the door, if an obstacle prevents closing, see [Automatic emergency deactivation](#).

But if the soft-close mechanism fails and you have your hands in the way of the closing door, your hands can get caught between the door and the chamber's frame. In this case, use the [Emergency stop](#).

3.1 Emergency stop

Applies only to a chamber with an electrically or pneumatically operated door.

To stop the chamber's door quickly at any time, interrupt the electric power supply.



To interrupt the electric power supply

1. Hit the panic button that switches power off.
See ["Prerequisites for power connection"](#) on page 31.
2. If no panic button is installed:
 - Pull the power supply unit out of the grid power socket.
 - Or pull the DC plug out of its socket on the rear side of the chamber.
See [Figure 7-1](#).



Interrupting the electric power supply has the following effects:

- The door movement stops immediately.
- The door's LED is off.
- If the door is operated pneumatically, the pneumatic system is depressurized and the door is left forceless. You can push it open or close manually against a merely frictional resistance.
- If the door is operated electrically, you can move it manually only with great force.

To reactivate the chamber, proceed as described in [Chapter 7.1, "Activating the chamber"](#), on page 37.

3.2 Automatic emergency deactivation

Applies only to a chamber with an electrically or pneumatically operated door.

During normal operation, the door closes tightly with high force to provide sufficient shielding effectiveness. To prevent injury due to this forced closing, the door's **soft-close mechanism** moves with a lower force until it is almost closed: maximum 8 mm

gap remaining. The door mechanism switches to high force to close the final 8 mm gap only if no obstacle stops this low-force closing.

3.2.1 Electrically operated door

Applies to a chamber with the R&S CMQ-B20B or R&S CMQ-B20C option.

The door movement stops automatically if:

- Something larger than 8 mm gets caught between the chamber and the door.
- The door is pulled with force.

This emergency deactivation mechanism relaxes the door by approximately 1 cm and is accompanied by a short clacking sound. The LED starts **flashing red** to indicate a door error, but frictional forces resist against moving the door manually.

To reactivate the chamber

1. Remove any obstacle out of the door's way.
2. Push the door slightly towards closing until it makes a clacking sound.
3. Continue as described in [Chapter 7.3.6, "Procedure when LED is flashing"](#), on page 44.

3.2.2 Pneumatically operated door

Applies to a chamber with the R&S CMQ-B21A or R&S CMQ-B21C option.

If the door does not open or close within the predefined **timeout** period of **8 s**, the control system switches to "ERROR" mode.

The LED starts **flashing red** to indicate the door error, and the pneumatic system is depressurized automatically, leaving the door forceless. This deactivation prevents a situation in which the operator's hands are caught between the chamber and the door and the operator cannot reach for the door's open/close button.

To reactivate the chamber

1. Remove any obstacle out of the door's way.
2. Continue as described in [Chapter 7.3.6, "Procedure when LED is flashing"](#), on page 44.



You can verify proper functioning of the door's soft-close mechanism as described in [Chapter 6.6, "Testing safety systems"](#), on page 33.

4 Machine overview

This chapter describes all components of the chamber. Function and use of these components is described in [Chapter 7, "Operation"](#), on page 37.

Accessories for the chamber are described in the [Configuration manual](#).

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4.1 Front tour



Figure 4-1: Front view of the chamber

- 1 = Groove filled with elastic RF gasket for sealing the chamber's door
- 2 = Door (sometimes called drawer) for DUT exchange
- 3 = Guide rail of the door
- 4 = 3 numbered openings, covered by metal plates or optional feedthroughs (only for expert users)
- 5 = Contact point of mechanically powered cylinder, not available in chambers with manual door operation
- 6 = Button for opening and closing the door, with status LED below
- 7 = Opening of the cable duct towards the energy chain, which is mounted behind the cable duct
- 8 = Handles for carrying the chamber, see [Chapter 5.1, "Lifting and carrying"](#), on page 21

You can open the door (2) to position a DUT in the chamber, see [Chapter 7.4, "Placing a DUT in the chamber"](#), on page 45. In an automated chamber, one mechanically powered cylinder (5, in the middle of the chamber) opens and closes the door, with two guide rails (labeled 3, one on each side) providing stability. Instead of (5), a chamber with manual door operation has a handle, see [Figure 7-4](#).

The polymeric gasket (1) has a conductive nickel coating to prevent leakage of RF radiation out of the chamber, and into it. Avoid touching or soiling the gasket. The door's gasket is highly elastic for a long life over many opening and closing cycles, see [Chapter 5.5, "Storage"](#), on page 23.

Three openings (4), numbered A11 to A13, are provided for optional RF-filtered feedthroughs. Openings that are not used are covered with blank metal plates.

Front feedthroughs allow feeding control or RF signals or electric power through the wall to a DUT in the chamber, see [Chapter 7.5, "Connecting a DUT"](#), on page 48. Only an [expert user](#) is allowed to exchange the metal plates or feedthroughs, and to connect, disconnect or exchange cables at the feedthroughs.

The door's open/close button (6) triggers the opening and closing of a chamber with automatically operated door. The LED below this button indicates the door status; see [Chapter 7.3, "Operating the door"](#), on page 39.

4.2 Rear tour

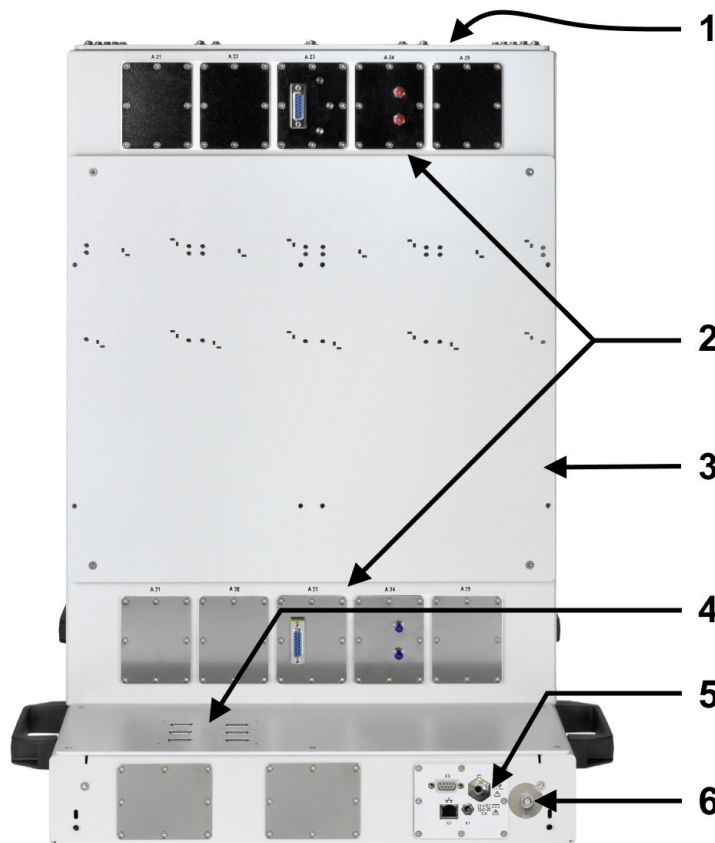


Figure 4-2: Rear view of the chamber

- 1 = Top cover for interior configuration and service (only for expert users)
- 2 = 10 numbered openings, covered by metal plates or optional feedthroughs for antennas inside the chamber (only for expert users)
- 3 = Rear carrier plate for test equipment
- 4 = Six D-Sub 9 control connectors for integrated RF switches (SP6T relays)
- 5 = Supply and control panel, see [Chapter 6.5](#)
- 6 = Grounding terminal (earth ground contact)

The top cover (1) of the chamber is fixed by 16 screws. Only an [expert user](#) is allowed to open it.

In the rear wall, 10 openings (2), numbered A21 to A25 and A31 to A35, are provided for optional RF-filtered feedthroughs. Openings that are not used are covered with blank metal plates.

Rear feedthroughs allow feeding control or RF signals through the wall to antennas or to other equipment in the chamber. Only an [expert user](#) is allowed to exchange the metal plates or feedthroughs, and to connect, disconnect or exchange cables at the feedthroughs.

The carrier plate (3) between the feedthroughs (2) is prepared for holding remote radio heads ([RRH](#)). This setup allows short cable lengths from the RRHs to the antennas inside the chamber.

The lower compartment of the chamber, which contains the electric or pneumatic door mechanism, provides the following:

- Six D-Sub 9 control connectors (4) for six R&S CMQ-B744A RF Connection Kit 4 options: integrated RF switches (SP6T relays).
- Two additional feedthrough openings, covered with metal plates.
- The supply and control panel (5) with connectors for power, control and compressed air; see [Chapter 6.5, "Connecting to control and power"](#), on page 30.

4.3 Performance-enhancing options

A pneumatically or manually operated chamber with option R&S CMQ-B501H for **higher shielding efficiency** (order no. 1540.4020.04) has a higher door with two built-in electromagnets in the top corners. These magnets can pull the door close with strong force, reducing the door gap and enhancing the RF sealing of the door.

A chamber version with **manual** door operation, R&S CMQ-B22C (left in [Figure 4-3](#)), has a different front panel with a handle.

A chamber version with optional **height extension**, R&S CMQ-B703A/B/C (right in [Figure 4-3](#)), has a hood on top of the chamber. The hood has the same dimensions as the chamber below.



Figure 4-3: Chamber version with manually operated door (left) and with optional height extension (right)

5 Transportation, handling and storage

Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.

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| • Packing | 21 |
| • Securing | 22 |
| • Transport | 23 |
| • Storage | 23 |

5.1 Lifting and carrying



Correct lifting and carrying

1. **WARNING!** The door of the chamber is heavy and can move. See ["Door of the chamber is heavy"](#) on page 11 and ["Moving door"](#) on page 11.

If the door is not secured against opening, secure it as described in [Chapter 5.3, "Securing"](#), on page 22.

2. **WARNING!** Chamber is heavy. See ["Transport"](#) on page 11 and ["Chamber is heavy"](#) on page 10.

For short distances, lift a single chamber at its handles with at least 4 people. [Figure 4-1](#) shows the handles.

Note: Never lift, carry or transport a chamber with optional height extension R&S CMQ-B703 ([Figure 4-3](#)), because it can tip over easily, and the handles are not suited for the increased weight. To enable separate transport of the height extension and the base chamber, let an [expert user](#) or Rohde & Schwarz [service personnel](#) uninstall the height extension from the base chamber.

3. For longer distances or if one or more chambers are on a pallet, use lifting or transporting equipment such as lift trucks and forklifts.

Follow the instructions provided by the equipment manufacturer.

See also [Chapter 5.4, "Transport"](#), on page 23.

5.2 Packing

Use the original packaging material. It consists of antistatic wrap for electrostatic protection and packing material designed for the product.

If you do not have the original packaging, use similar materials that provide the same level of protection.

The original packaging material also keeps the door closed. If this material is no longer available, secure the door against opening and use similar materials that provide the

same level of protection. Use sufficient padding to prevent unintentional mechanical effects during transportation.

5.3 Securing

When delivered, the chamber is contained in a special transport protection packaging that prevents the door from opening.

After unpacking, there is no additional protection to prevent unintentional movement of the door.



If you tilt the chamber, for example when you lift it, the door can slide open or close unintentionally, especially in chambers with pneumatic door operation. Read the consequences in "Transport" on page 11.



Figure 5-1: Do not lift with unsecured door: risk of uncontrolled door movement

To avoid this risk, close the chamber's door and secure it against opening, before you lift the chamber and until the chamber is securely mounted.

To secure the door

1. Firmly tie a rope from a handle on the chamber's left side to a handle on the right. Use a rope that is strong enough to hold a weight of 100 N (10 kg). The rope is not included in the delivery.
2. Lift the chamber as described in [Chapter 5.1, "Lifting and carrying"](#), on page 21.

Note: If you proceed with mounting and operating the chamber, we recommend that after mounting, you remove the rope or any item that secures the door. Removing it avoids unintentional interaction with the door during operation.

5.4 Transport

The following activities are restricted to the [transportation appointee](#).

When moving the product in a vehicle or using transporting equipment, make sure that the product is properly secured. Only use items intended for securing objects.

You can secure the chamber at its handles, see [Figure 4-1](#). Do not secure the chamber at any mounted accessories.

Transport altitude

Unless otherwise specified in the data sheet, the maximum transport altitude without pressure compensation is 4500 m above sea level.

5.5 Storage

Protect the product against dust. Ensure that the environmental conditions, e.g. temperature range and climatic load, meet the values specified in the data sheet.

If you leave the chamber unused for some time (e.g. between production periods), consider the following:

1. **NOTICE!** Gasket can suffer from wear. Keeping the door's RF gasket under the closed door's mechanical pressure for a long time can reduce the gasket's elasticity.
To improve the chamber's long-term radiation shielding efficiency, we recommend relaxing the gasket by leaving the door open.
2. If the chamber is connected to a compressed-air supply, you can disconnect it.

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 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 increases, requiring replacement at shorter intervals.

6 Installation and commissioning

The following activities are restricted to the [maintenance personnel](#).

Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.

Execute these activities in the same order as given in this handbook:

| | |
|---|----|
| • Choosing the operating site | 24 |
| • Unpacking | 25 |
| • Mounting the chamber | 26 |
| • Connecting compressed air | 28 |
| • Connecting to control and power | 30 |
| • Testing safety systems | 33 |
| • Defining zones of restricted access | 34 |

6.1 Choosing the operating site

Only use the chamber indoors. The chamber casing is not waterproof.

Select an operating site that provides safe conditions for mounting and operating the chamber.

Ensure the following:

- Only trained personnel can access the operating site, with restrictions as described in [Chapter 6.7, "Defining zones of restricted access"](#), on page 34.
- The room has an even floor and sufficient bearing capacity.
- The operating site leaves sufficient room to open the door without obstruction and to access:
 - Chamber, especially the area behind the open door
 - Connectors on the front and rear side
 - Mounting brackets
 - Panic button or power plug, see ["Prerequisites for power connection"](#) on page 31 and [Chapter 3.1, "Emergency stop"](#), on page 15
- The environmental conditions such as ambient temperature and humidity match the values in the data sheet.
- The operating site is at an altitude of maximum 2000 m above sea level.
- The environment has pollution degree 2, where only nonconductive contamination occurs. Occasionally, temporary conductivity caused by condensation is to be expected.
- The electromagnetic compatibility (EMC) class of the chamber is class A.

Electromagnetic compatibility classes

The [EMC](#) class indicates where you can operate the chamber.

- Class B equipment is suitable for use in:
 - Residential environments
 - Environments that are directly connected to a low-voltage supply network that supplies residential buildings
- Class A equipment is intended for use in industrial environments. It can cause radio disturbances in residential environments due to possible conducted and radiated disturbances. It is therefore not suitable for class B environments. If class A equipment causes radio disturbances, take appropriate measures to eliminate them.

6.2 Unpacking



Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.

To unpack the chamber

1. If the cardboard box that contains the chamber is strapped to a pallet by plastic laces, cut the laces.
2. Open the cardboard box.
3. If a cardboard insert covers the chamber, remove the insert.
4. If accessories are included next to the chamber, take the accessories out of the cardboard box.
5. Remove the upper part of the cardboard box.

The chamber sits in shaped pieces of polymer foam.
6. **WARNING!** The door of the chamber is heavy and can move. If the door slides open while you lift the chamber, the center of gravity shifts. The door hitting its end position results in a powerful thrust.

Make sure that the door is secured against opening as described in [Chapter 5.3, "Securing"](#), on page 22.
7. **WARNING!** The chamber is heavy. Wear protective clothing. If your physical state is not compatible with lifting heavy loads, do not participate in lifting the chamber.

Lift the chamber out of the box with at least 4 people.
For lifting the chamber, hold it at its handles, see [Figure 4-1](#).
8. Place the chamber on a sturdy, flat and level surface.
9. Remove the antistatic wrap from the chamber.

10. Retain the original packing material. Use it when transporting or shipping the chamber later.
11. Using the delivery notes or an accessories list, check the delivery for completeness.
12. Check the chamber for damage.

If the delivery is incomplete or equipment is damaged, contact Rohde & Schwarz.

6.3 Mounting the chamber



Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.

Mount the chamber on a stable support that meets the following requirements:

- Type of support is a table or bench.
- Matches the chamber's dimensions specified in the data sheet.
- Leaves room for the opening door, see [Figure 6-2](#).
- Can bear the chamber's weight of up to roughly 70 kg with accessories. For mounting a chamber with optional height extension R&S CMQ-B703 ([Figure 4-3](#)), the support must be capable of bearing a weight of roughly 110 kg.
- Can withstand the door's momentum during operation.
- Allows fixing the chamber by mounting brackets, see [step 4](#).
- Keeps the chamber always in a horizontal position:

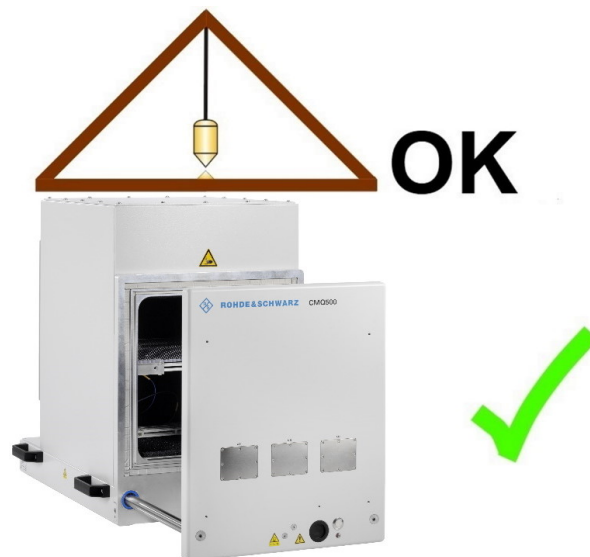


Figure 6-1: Horizontal position of the chamber

6.3.1 Table mounting

Use a support that meets the requirements. Make the support robust and safe.

For mounting a chamber with optional height extension R&S CMQ-B703 ([Figure 4-3](#)), first mount the base chamber as described below. Then let an [expert user](#) mount the height extension on top, as described in the [Configuration manual](#).

To mount the chamber on the support

1. **WARNING!** The door of the chamber is heavy and can move. If the door slides open while you lift the chamber, the center of gravity shifts. The door hitting its end position results in a powerful thrust.

Secure the door of your chamber against unintentional opening.

See [Chapter 5.3, "Securing"](#), on page 22.

2. **WARNING!** Risk of injury due to heavy weight. See [Chapter 5.1, "Lifting and carrying"](#), on page 21.

Lift the chamber at its handles with at least 4 people and place it on the support.

3. Position the chamber in either way:

- a) The front edge of the chamber is in line with the edge of the table.
- b) The opened door is completely above the table, as shown in [Figure 6-2](#).
To do so without opening the chamber's door, position the closed chamber at least 315 mm back from the table's front edge.

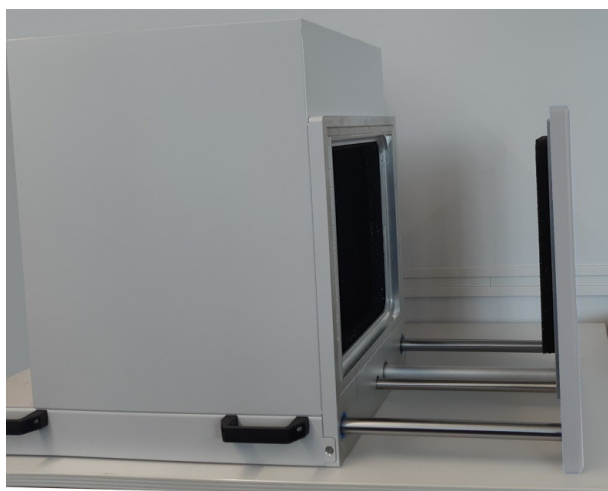


Figure 6-2: Open door completely above table



4. Fix the chamber in place with mounting brackets (included in delivery):
 - a) Place two mounting brackets at the lower rear corners of the chamber.
The black arrows in [Figure 6-3](#) show the positions for the mounting brackets.
 - b) Position each bracket so that its notch (see red arrow in top-left picture) is at the upper end, latching into the bore on top of each screw hole.
 - c) Screw each bracket to the chamber.
 - d) Screw each bracket to the table.



Figure 6-3: Positions of the mounting brackets for fixing the chamber to its support

5. Optionally, repeat [step 4](#) at the front corners of the chamber's left and right side.
6. If you have secured the chamber's door against unintentional opening, remove any door-securing device.

If you remove the chamber from its location, follow the instructions in [Chapter 5.1, "Lifting and carrying"](#), on page 21.

6.4 Connecting compressed air

This chapter applies only to a chamber with pneumatically operated door. Skip this chapter if your chamber has a purely electrically or manually operated door.

The quick-coupling plug [P1] (see [Figure 6-6](#)) is delivered with an additional push-pull adapter to 6 mm diameter flexible tubing.

Prerequisites for compressed-air connection

Use the chamber only in a site that features an air preparation or service unit providing the following:

- Filtered, grease-free compressed air at a pressure of 6 bar, limiting the pressure to a maximum of 7 bar (0.7 MPa).
If the pressure from the supply system exceeds the limit of 7 bar, the chamber operates under unspecified conditions as described in ["Pneumatically operated door"](#) on page 11.
- The compressed air is supplied by a flexible push-in tube with a diameter of 6 mm. If the tube has a straight cut end, it is easier to connect it.

To connect compressed air

1. Make sure that the compressed-air supply is switched off.
2. Make sure that the chamber is connected to the grounding terminal (earth ground contact \perp).
3. If the push-pull adapter is connected to the chamber's quick-coupling plug, remove it as shown in [Figure 11-1](#).
4. Insert the 6 mm tube into the rear side of the push-pull adapter, which has a blue plastic ring.
5. Push the tube all the way into the adapter, as shown in [Figure 6-4](#).

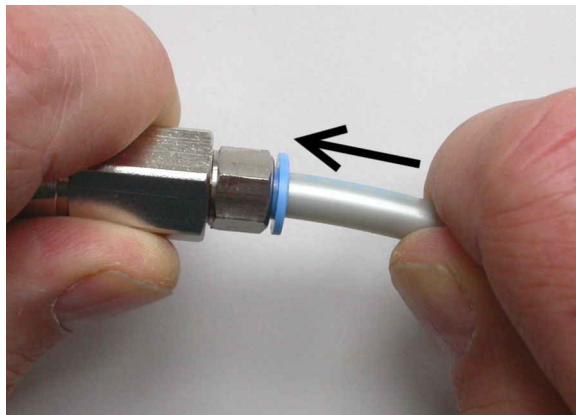


Figure 6-4: Assembly of push-pull adapter (left) and 6 mm tube (right)

Note: For a description of how to **separate** this connection, see "[To disconnect the tube from the push-pull adapter](#)" on page 66.

6. If you want to connect the push-pull adapters of multiple chambers to the compressed-air supply tubing, repeat [step 3](#) and [step 5](#) for each chamber.
7. Before connecting the push-pull adapter to the chamber's quick-coupling plug:
 - a) Switch on the compressed-air supply. If you connect multiple chambers, switch on the compressed-air supply, before you connect the first push-pull adapter.
 - b) Check the pressure. You need to provide an air pressure of 6 bar. See "[Pneumatically operated door](#)" on page 11.
8. Connect the push-pull adapter to the quick-coupling plug.
To do so, hold the adapter at its rear part (see 1 in [Figure 6-5](#)) and push it onto the quick-coupling plug (2).
The adapter's mechanism automatically locks the connection and opens a valve inside the push-pull adapter.

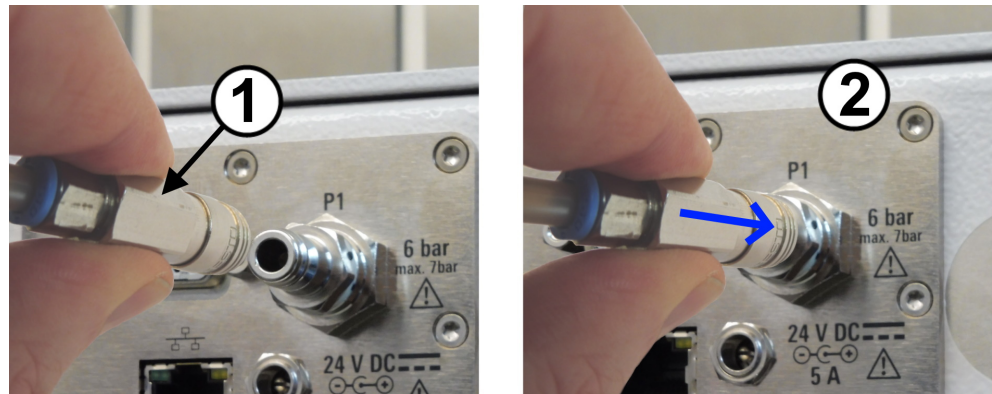


Figure 6-5: Connecting the compressed-air supply

9. Check whether the connection is tight. If compressed air is leaking at the connection, you can hear it or feel it with a wetted finger.
10. If you want to connect the push-pull adapter to the quick-coupling plug of multiple chambers, repeat [step 8](#) and [step 9](#) for each chamber.

6.5 Connecting to control and power

The DC power socket and the control interfaces are at the rear of the chamber.

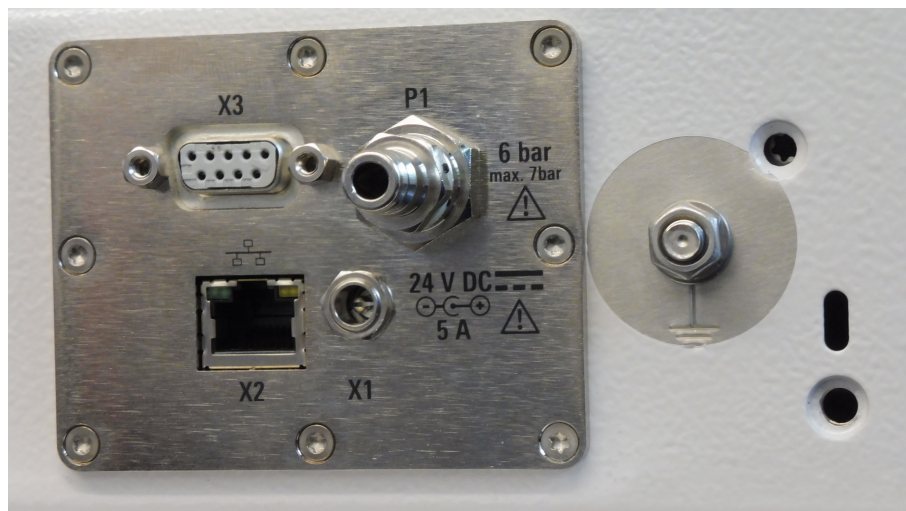


Figure 6-6: Supply and control panel

- X1 = Socket for 24 V DC power supply unit (center pin: positive voltage)
- X2 = RJ45 (LAN) control connector
- X3 = D-Sub 9 control connector
- P1 = Quick-coupling plug for compressed air, see [Chapter 6.4](#)
- ⊥ = Grounding terminal (earth ground contact) next to the supply and control panel

To connect a control system

Applies only to a chamber with an electrically or pneumatically operated door.

For local manual control of the door, use the door button.

For remote control, connect the chamber to your control system. Depending on your system requirements, you can use the Ethernet (LAN) or RS-232 interface.

1. For remote control via a **serial port**, connect an RS-232 cable from your control system to the D-Sub 9 connector (see **[X3]** in [Figure 6-6](#)).
For port settings, see ["Command protocol"](#) on page 50.
Use a "straight-through" RS-232 cable, see ["Use a straight-through cable for the RS-232 connection to the control computer"](#) on page 31.
For **EMC** reasons, limit the length of the RS-232 cable to a maximum of 30 m.
2. For remote control via **Ethernet**, connect a LAN cable from your control system to the RJ45 connector (see **[X2]** in [Figure 6-6](#)).
You can use a LAN cable of arbitrary length. For Ethernet configuration, see ["To configure the LAN network"](#) on page 32.



Use a straight-through cable for the RS-232 connection to the control computer

Two types of devices compatible with RS-232 interfaces must be distinguished:

- A "DTE" is a *Data Terminal Equipment*, for example a built-in serial port in a PC
- A "DCE" is a *Data Communications Equipment*, for example the chamber's remote control interface

Connecting two DTE devices requires a cable with crossed wires between the TXD-RXD and RTS-CTS pins. On the contrary, connecting the remote control interface (DCE) of your chamber to a control computer (DTE) requires a **straight-through cable**.

Prerequisites for power connection

Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.



We recommend installing a **panic button**. It is a power-off switch that ensures quick deactivation of the chamber if an **emergency** occurs. A panic button is not included in delivery. The picture shows an example.

Make sure that:

- The panic button is installed in a place that the operator can reach easily.
- Every operator knows where the panic button is located.
- Hitting the panic button interrupts the AC power supply to the chamber. Meaning the mains grid power socket where the power supply unit is connected is disconnected from power.

To prepare the power connection



1. Connect the grounding terminal (earth ground contact \perp) to earth in the operating site, to avoid electrostatic charging of the chamber's body.
2. Assemble the external power supply unit (order no. 1210.7812.00) with the power cord that fits for your regional power socket type.
To do so, plug the power cord's C14 connector into the external power supply unit.
3. Place the power supply unit in a position that prevents collision of the opening door with the power supply unit and its cables.
We recommend placing the power supply unit behind the chamber.
4. Connect the power supply unit to your mains grid power socket.
Use only the 24 V DC power supply unit included in the delivery.
For EMC reasons, limit the DC cable length to a maximum of 3 m.
Make sure that the grid power socket is disconnected from mains grid power when you hit the panic button, see "[Prerequisites for power connection](#)" on page 31.

To activate the chamber

Connecting the chamber to power activates it. It does not have a separate [ON / OFF] switch.

1. **CAUTION!** Initial movement of automated door can cause injury. When you connect the chamber to power, a pneumatically operated door can move abruptly. To prevent unexpected movement of the door upon first activation, perform the following safety measure.
If the chamber has **pneumatic** door operation, push the door until it is fully closed.



2. Connect the DC plug of the power supply unit (included in the delivery) to the 24 V DC power supply connector, see "[To prepare the power connection](#)" on page 32.

[Figure 7-1](#) shows the resulting connections.

The chamber is activated.

3. If the chamber has **electric** door operation, open the door by pushing the door button ([Figure 4-1](#)).
Wait until the door is fully open. It can take more time than usual, because the chamber uses the first open-close cycle for referencing the door positions:
 - a) If originally the door is closed during power-up, it opens slowly until it is fully open.
 - b) If originally the door is open during power-up, the chamber uses the open position for referencing, with little movement, only.

To configure the LAN network

Only a [user](#) can perform this task.

- Configure the LAN network by using the commands described in [Chapter 8.2, "Remote configuration commands"](#), on page 52.

The default IP address is 192.168.178.41, port 5000.

Note that the **RESET** command returns the start screen with an overview of the available commands only via the RS-232 interface, **not via LAN**.

6.6 Testing safety systems

Applies only to a chamber with an electrically or pneumatically operated door.

Test the door's **automatic emergency deactivation** mechanism for proper functioning as follows:

1. Activate the chamber according to ["To activate the chamber"](#) on page 32.
2. Open the door according to [Chapter 7.3.4, "Opening the automated door"](#), on page 42.
3. Hold a flat obstacle across the edge of the door opening.
We recommend using a flat piece of wood or similar material, 1 cm to 2 cm thick. Alternatively, use the handle of a screwdriver.
4. Close the door.
5. Verify that the door's automatic emergency deactivation mechanism stops the door when it hits the obstacle, as described in ["Test passed"](#) on page 33.
If the test fails, see ["Test failed"](#) on page 33, and proceed as described in [step 6](#).
6. **WARNING!** Risk of personal injuries. See ["Moving door"](#) on page 11.
Take these steps if the automatic emergency deactivation mechanism fails:
 - a) Stop working with the chamber immediately.
 - b) Take the chamber out of commission to make sure that nobody else uses it.
See [Chapter 11.1, "Taking out of commission"](#), on page 65.
 - c) Contact Rohde & Schwarz customer support.

Test passed

If the door **stops closing** and the door LED starts flashing red (indicating error mode), the automatic emergency deactivation works as desired.

1. To verify that the door is in error mode, send the `DOOR?` query. In error mode, the reply is `DOOR STATE ERR`.
2. Proceed with reactivating the door as described in [Chapter 3.2, "Automatic emergency deactivation"](#), on page 15.

Test failed

If the door **continues** to try closing against the obstacle without switching to error mode, the emergency deactivation has failed.

- A chamber with an electrically operated door is designed to stop and also to relax the gap by approximately 1 cm.
- A chamber with a pneumatically operated door is designed to stop and also to depressurize the pneumatic system, leaving the door forceless if the total closing time exceeds 8 s.

6.7 Defining zones of restricted access

Applies only to a chamber with an electrically or pneumatically operated door.

To reduce the risk of an accident due to door operation, define two zones that restrict the access to the chamber. Establish exact rules as to who is allowed to enter a zone and when. See "[Operating the door](#)" on page 13.

- **Door zone:** the area utilized by the opened door, including accessories mounted at the door's outer face.
Everything and everybody must **stay out** of the door zone during door operation.
- **Work zone:** an area of 1 m radius around the door zone. The distance of 1 m ensures that nobody can reach into the chamber when standing outside of the work zone.
Only **one user** at a time is allowed access to the work zone while the chamber is connected to power.
If more than one person must have access to the work zone, first disconnect the chamber from power. See "[To disconnect from power and control](#)" on page 65.

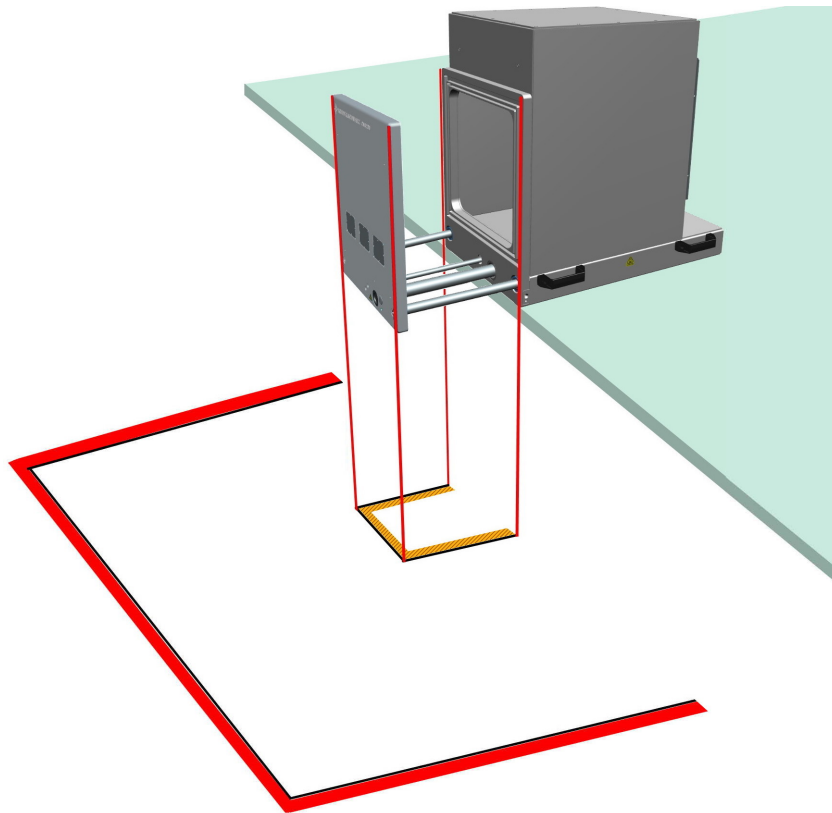


Figure 6-7: Zones of restricted access marked on the ground

Door zone = Inner marking lines; here: yellow and black

Work zone = Outer marking lines; here: red and black

To mark the zones of restricted access

1. Make sure that the chamber is mounted securely and connected to its supplies.
2. Step aside to the left or right of the chamber.
3. Make sure that a space 40 cm in front of the door is clear.
4. Press the button to open the door. See [Chapter 7.3, "Operating the door"](#), on page 39.
5. Mark the door zone on the ground below the chamber's opened door, as shown in [Figure 6-7](#).
If any accessories, for example feedthroughs, are present on the chamber's door, these mounted accessories enlarge the door zone. Mark the door zone according to its actual size.
6. Close the door according to [Chapter 7.3.5, "Closing the automated door"](#), on page 43.
7. Make sure that nobody opens the door again.

8. Mark the work zone at a distance of 1 m outside from the *door zone* on the ground. See [Figure 6-7](#).
9. If the work zones of neighboring chambers overlap or touch each other, establish an extra set of safety rules to regulate the work at neighboring chambers. We recommend leaving enough space between chambers so that individual work zones can be established.
10. If you move the chamber to a new location, mark the zones on the ground again.

7 Operation

Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.

Operating the chamber consists of the activities described in the following subchapters:

| | |
|--|----|
| • Activating the chamber | 37 |
| • Deactivating the chamber | 38 |
| • Operating the door | 39 |
| • Placing a DUT in the chamber | 45 |
| • Connecting a DUT | 48 |
| • Preparing for shift end | 49 |

7.1 Activating the chamber

As a prerequisite, ensure that all instructions described in [Chapter 6, "Installation and commissioning"](#), on page 24 are executed.

To activate the chamber

Connecting the chamber to power activates it. It does not have a separate [ON / OFF] switch.

1. **CAUTION!** Initial movement of automated door can cause injury. When you connect the chamber to power, a pneumatically operated door can move abruptly. To prevent unexpected movement of the door upon first activation, perform the following safety measure.

If the chamber has **pneumatic** door operation, push the door until it is fully closed.

2. Connect the DC plug of the power supply unit (included in the delivery) to the 24 V DC power supply connector, see ["To prepare the power connection"](#) on page 32.



[Figure 7-1](#) shows the resulting connections.

The chamber is activated.

3. If the chamber has **electric** door operation, open the door by pushing the door button ([Figure 4-1](#)).

Wait until the door is fully open. It can take more time than usual, because the chamber uses the first open-close cycle for referencing the door positions:

- a) If originally the door is closed during power-up, it opens slowly until it is fully open.
- b) If originally the door is open during power-up, the chamber uses the open position for referencing, with little movement, only.



Figure 7-1: 24 V DC power supply connector [X1] (center)

In [Figure 7-1](#), the supply and control panel (labeled 5 in [Figure 4-2](#)) is not connected to a remote control system via Ethernet [X2] or serial interface [X3]. In this example, the supply and control panel has no quick-coupling plug [P1] for compressed air, hence the chamber has no pneumatically operated door.



Booting without compressed-air supply

A chamber with pneumatic door operation is booting also, once electric power supply is connected, independent of compressed-air supply. However, operating the pneumatic chamber type requires compressed air. Without compressed-air supply, the chamber generates an error message and deactivates the door opening mechanism.

To reactivate the door opening mechanism, disconnect the electric power supply and enable the compressed-air supply (by connecting it or by switching it on). Then connect the electric power supply and proceed as described in [Chapter 7.1, "Activating the chamber"](#), on page 37.

7.2 Deactivating the chamber

Disconnecting the chamber from power deactivates it. It does not have a separate [ON / OFF] switch.

To deactivate the chamber

1. Disconnect it from its electric power supply.
2. If the chamber has pneumatic door operation, also disconnect the pneumatic system (see ["To disconnect from compressed air"](#) on page 65).

- If you deactivate the chamber for a long time, we recommend relaxing the door's gasket by manually opening the chamber's door (as far as you wish), see [Chapter 5.5, "Storage"](#), on page 23.

Emergency deactivation

See [Chapter 3, "Emergencies"](#), on page 15.

7.3 Operating the door

This chapter describes manual control of the door by a handle or by pushing the door button (labeled 6 in [Figure 4-1](#)).

For remotely controlled door operation, refer to [Chapter 8.3, "Door operation commands"](#), on page 54. If the software of a test system sends the door control commands, also DUT handling can be automated by a system that replaces the tasks of a human operator.

| | |
|--|----|
| • Door status indication | 39 |
| • Opening the manually operated door | 39 |
| • Closing the manually operated door | 41 |
| • Opening the automated door | 42 |
| • Closing the automated door | 43 |
| • Procedure when LED is flashing | 44 |

7.3.1 Door status indication

The LED below the door button ([Figure 7-6](#)) indicates the door's status as follows:

| LED | Door and chamber status |
|--------------------|---|
| Green light | Door is completely closed and the chamber is in a state ready for measurement. |
| Red light | Door is open , or currently opening or closing. |
| Flashing red light | Error, see Procedure when LED is flashing on page 44 . |
| No light | Chamber is disconnected from power. |

For querying the door's status remotely, use the `DOOR?` command.

7.3.2 Opening the manually operated door

Applies only to chambers with option R&S CMQ-B22C for **manual** opening and closing of the door.

The door of these chambers has a handle with "over-center compression-latch" mechanism, but no electrical or pneumatic operation. Hence you cannot trigger automated door movement.

Although the door button (labeled 6 in [Figure 4-1](#)) does not open or close the door, the following functions are available:

- The LED below the button indicates the door status, see [Chapter 7.3.1, "Door status indication"](#), on page 39.
- If your chamber is equipped with option R&S CMQ-B501H for higher shielding efficiency (see ["Magnets for stronger door closing"](#) on page 44), pushing the button while the door is closed disables the electromagnets that enhance the closing force.

The components of the compression-latch mechanism are shown in [Figure 7-2](#):

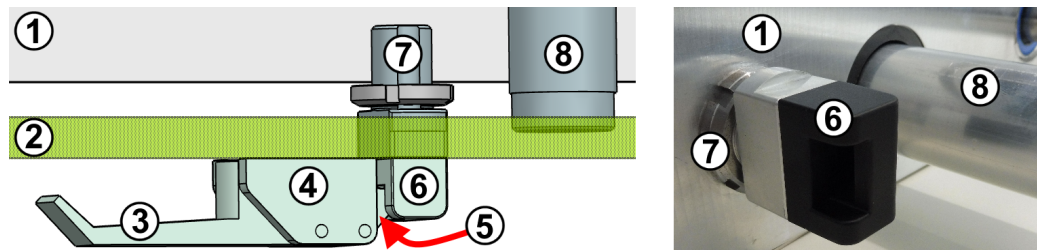


Figure 7-2: Cross-sectional top view of over-center compression-latch mechanism (left), and details picture (right)

- 1 = Front wall of chamber
- 2 = Door (here shown semi-transparent)
- 3 = Handle of over-center compression-latch mechanism
- 4 = Lever bearing of over-center compression-latch mechanism
- 5 = Locking latch
- 6 = Catch block for latch
- 7 = Catch-block fixture in the chamber's wall
- 8 = Cable duct towards the energy chain

To open the door manually

1. Open the handle from position 1 to 2 in [Figure 7-4](#).
The door mechanism's strong closing force is released.
2. Further open the handle from position 2 to 3 in [Figure 7-4](#).
The latch disengages from the catch block.
3. If your chamber is equipped with option R&S CMQ-B501H for higher shielding efficiency, push the door button.
The built-in electromagnets for enhanced closing force are disabled.
In a manual chamber without this option, pushing the button has no effect.
4. Pull the door open manually.
The LED turns red when the door gap exceeds 8 mm.
In a chamber with option R&S CMQ-B501H, the LED turns red when the door gap exceeds 0.3 mm.

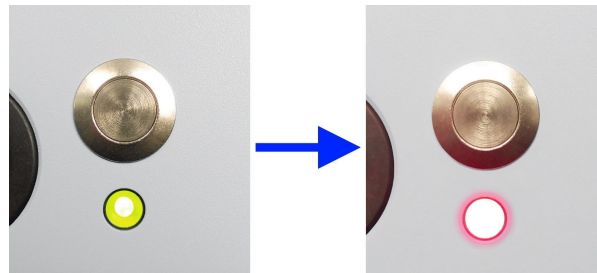


Figure 7-3: Green LED when door is closed (left), red when open (right)

The catch block, which is attached to the chamber's wall, stays where it is and disappears through the hole in the door, while the door moves forward.

When the door reaches its front stop, the opening procedure is completed.

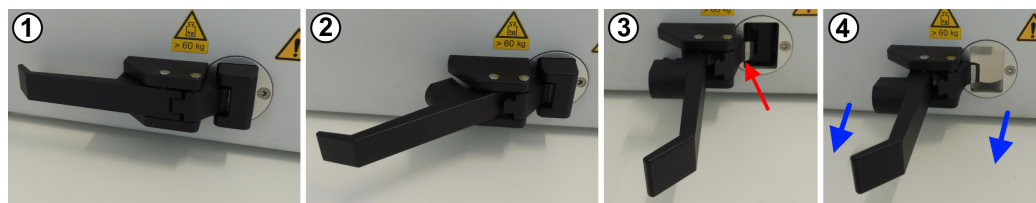


Figure 7-4: Manual opening procedure

- 1 = Handle in parallel position: chamber is closed and tightly locked
- 2 = Handle in half-opened position: mechanical closing force is released from door
- 3 = Handle in fully opened position: latch is released (red arrow)
- 4 = Handle in fully opened position: pull door open in direction of blue arrows

7.3.3 Closing the manually operated door

Applies only to chambers with option R&S CMQ-B22C for **manual** opening and closing of the door.

For a description of the manual door's over-center compression-latch mechanism, see [Chapter 7.3.2, "Opening the manually operated door"](#), on page 39.

For door maintenance, see [Chapter 9.4.2, "Monthly check of the manual door"](#), on page 60.

To close the door manually

1. Ensure that no obstacle is in the way of the door.
2. Ensure that the handle is in fully opened position at an angle of 90° from the door, as in pictures 3 and 4 in [Figure 7-4](#).

This position prevents a collision of the latch (labeled 5 in [Figure 7-2](#)) with the catch block (6).

3. Manually push the door to its closed position.

The door touches the chamber wall, and the catch block protrudes through the hole in the door.

The LED turns green when the door gap is < 8 mm.

If your chamber is equipped with option R&S CMQ-B501H for higher shielding efficiency, and when the door gap is < 8 mm, the built-in electromagnets for enhanced closing force are enabled. The LED turns green when the door gap is < 0.3 mm.

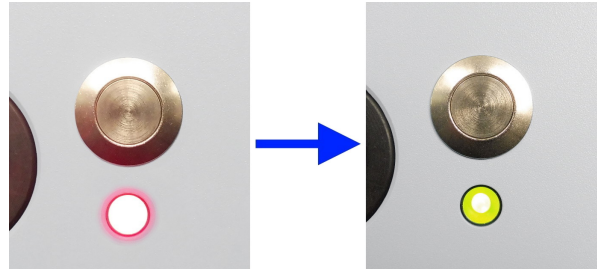


Figure 7-5: Red LED when door is open (left), green when door is closed (right)

4. Move the handle from position 3 to 2 in [Figure 7-4](#).

The latch engages with the catch block.

5. Further close the handle from position 2 to 1 in [Figure 7-4](#).

The door is closed with strong force.

When the handle is parallel with the door while the latch is engaged with the catch block, the closing procedure is completed.

7.3.4 Opening the automated door

Applies only to chambers with the following automation options:

- R&S CMQ-B20B or R&S CMQ-B20C for **electrical** door operation
- R&S CMQ-B21A or R&S CMQ-B21C for **pneumatic** door operation

Familiarize yourself with residual risks and potentially dangerous situations.

See "[Operating the door](#)" on page 13 and [Chapter 6.7, "Defining zones of restricted access"](#), on page 34.



To open the chamber door, it must be closed and the LED at its front must be illuminated **green**. If it is not green, refer to [Chapter 6.5, "Connecting to control and power"](#), on page 30 and to the section [Chapter 7.1, "Activating the chamber"](#), on page 37.

1. Push the button above the green LED at the closed door.

The LED turns red, and the door starts opening.

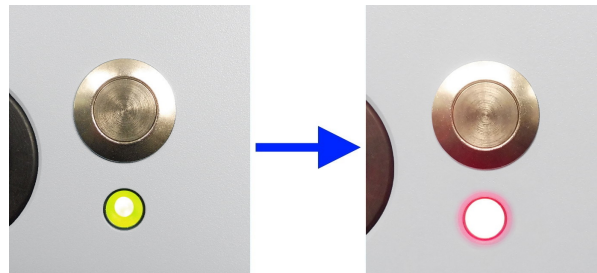


Figure 7-6: Green LED when door completely closed (left), red when not closed (right)

Note: If your chamber is equipped with option R&S CMQ-B501H for higher shielding efficiency (see **Note "Magnets for stronger door closing"** on page 44), pushing the button also disables the electromagnets that pull the door close.

2. Wait until the door is completely open and stops moving.

This step completes the opening procedure.



If an electrically operated door stops during opening, which can happen if you pull the door open, reactivate the chamber as described in [Chapter 7.3.6, "Procedure when LED is flashing"](#), on page 44.

7.3.5 Closing the automated door

Applies only to chambers with the following automation options:

- R&S CMQ-B20B or R&S CMQ-B20C for **electrical** door operation
- R&S CMQ-B21A or R&S CMQ-B21C for **pneumatic** door operation

Familiarize yourself with residual risks and potentially dangerous situations.



See ["Operating the door"](#) on page 13 and [Chapter 6.7, "Defining zones of restricted access"](#), on page 34.

To close the chamber door, it must be open and the LED at its front must be illuminated **red**. If the LED is red but the door is not fully open, refer to [Chapter 7.1, "Activating the chamber"](#), on page 37. If the LED is not illuminated at all, connect the chamber to its electric power supply; see [Chapter 6.5, "Connecting to control and power"](#), on page 30 and [Chapter 7.1, "Activating the chamber"](#), on page 37.

1. Push the button above the red LED at the open door.

The door starts closing.

2. Wait until the door is completely closed.

The LED turns green:

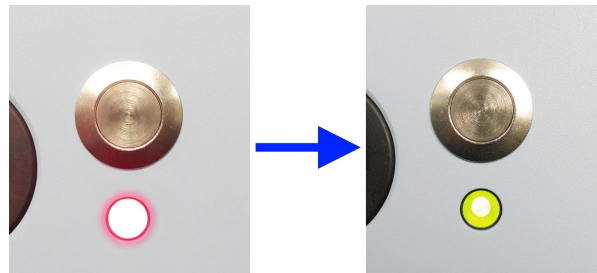


Figure 7-7: Red LED when door is open (left), green after closing is completed (right)

Note: Magnets for stronger door closing. If your chamber is equipped with option R&S CMQ-B501H for higher shielding efficiency (order no. 1540.4020.04), closing the door also automatically activates two electromagnets in the top corners of the door. These magnets are activated, when the door gap is < 8 mm. The magnets pull the door close with strong force, reducing the door gap and enhancing the RF sealing of the door. A proximity sensor between the magnets monitors this enforced closing state and switches the LED below the door button to green, when the door gap is < 0.3 mm.

This step completes the closing procedure.



If the door stops during closing due to an obstacle in its way, remove the obstacle and proceed as described in [Chapter 7.3.6, "Procedure when LED is flashing"](#), on page 44.

7.3.6 Procedure when LED is flashing

Applies only to chambers with the following automation options:

- R&S CMQ-B20B or R&S CMQ-B20C for **electrical** door operation
- R&S CMQ-B21A or R&S CMQ-B21C for **pneumatic** door operation

If the LED in the door button is flashing red, the control system is in "DOOR STATE ERR" mode (see [DOOR?](#) on page 54) due to a failure while opening or closing the door. The chamber is deactivated. If it has a pneumatically operated door, the pneumatic system is depressurized.

To reactivate the chamber

1. If an obstacle blocks the door, remove the obstacle.
2. If the chamber has electric door operation, push the door slightly towards closing. It makes a clacking sound when the magnet in its deactivated mechanism snaps into place again.
3. If the chamber has pneumatic door operation, push the door until it is fully closed.
4. Push the door button for 2 seconds.
5. Release the button (while the LED is still flashing).

6. Wait 3 seconds, while the system reboots.
The LED stops flashing and shows continuous red light.
7. **CAUTION!** Initial door movement can cause injury. When you reactivate a pneumatically operated chamber, its door can move abruptly.
Push the door button again.
 - If the door operates electrically, it moves to its open position.
 - If the door operates pneumatically, the following happens:
 - The pneumatic system is pressurized.
 - If the door is open >8 mm, it moves to its open position.
 - If the door is open <8 mm, it closes with high pressure.

You can proceed with normal door operation.

7.4 Placing a DUT in the chamber



Familiarize yourself with residual risks and potentially dangerous situations.

See "[Moving door](#)" on page 11 and "[Operating the door](#)" on page 13.

Placing options

You can place your DUT in a vertical or horizontal position on a DUT holder that is mounted at the inside of the door or in the antenna cage. [Table 7-1](#) gives an overview of these options.

Table 7-1: Placing options by fixation (door / cage) and DUT orientation (vertical / horizontal)

| DUT holder | DUT in vertical position | DUT in horizontal position |
|--|--|--|
| Fixed at door | <ul style="list-style-type: none"> • Drawer Support 1 + DUT Clamp 1 | <ul style="list-style-type: none"> • Drawer Support 1 + DUT table • Drawer Support 1 + DUT Clamp 2 • Drawer Fixture 2 |
| Fixed at antenna cage (inner frame) | <ul style="list-style-type: none"> • Inner Support 1 + DUT Clamp 1 | <ul style="list-style-type: none"> • Inner Support 1 (incl. DUT table) • Inner Support 1 + DUT Clamp 2 (requires dual-plate configuration) |

Only an expert user is allowed to mount and configure DUT holders.

The following chapters show how to use the various types of DUT holders.

- [Using Inner Support 1](#)..... 46
- [Using Drawer Support 1](#)..... 46
- [Using DUT Clamp 1](#)..... 47
- [Using DUT Clamp 2](#)..... 47
- [Using Drawer Fixture 2](#)..... 48

7.4.1 Using Inner Support 1

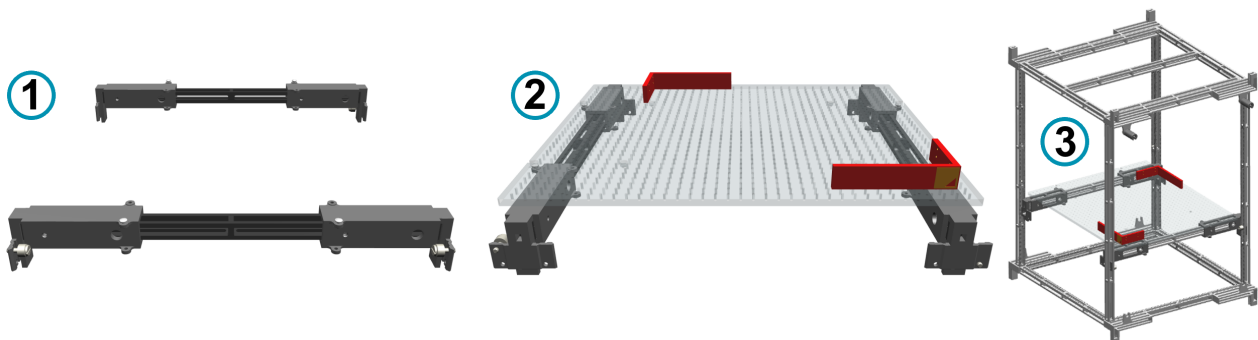


Figure 7-8: R&S CMQ-B711A "Inner Support 1" option, order no. 1537.6310.02

- 1 = Side view of the inner support, to be mounted in the antenna cage
 2 = Front view with DUT table (transparent) and 2 rectangular stop brackets (here shown in red color)
 3 = Inner support with DUT table and stop brackets, mounted in the "pure" antenna cage

"Inner Support 1" (R&S CMQ-B711A) can carry a DUT as follows:

- Directly on the DUT table (included with "Antenna Cage" (R&S CMQ-B701A or R&S CMQ-B702A)
- Mounted on the holder DUT Clamp 1

7.4.2 Using Drawer Support 1

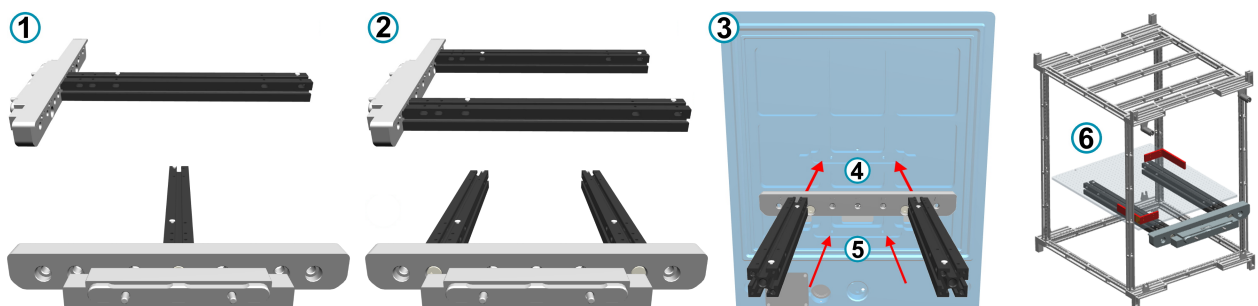


Figure 7-9: R&S CMQ-B712A "Drawer Support 1" option, order no. 1537.6310.02, with door adapter (gray) and holder struts (black)

- 1 = Side and front view of Drawer Support 1, single-strut configuration
 2 = Side and front view of Drawer Support 1, dual-strut configuration
 3 = Rear view with 2 mounting options (4) and (5) at the inner surface of the chamber's door
 4 = Upper mounting position in the door
 5 = Lower mounting position in the door
 6 = Drawer Support 1 with DUT table and stop brackets, mounted at the door (not shown) and inserted into the antenna cage

"Drawer Support 1" (R&S CMQ-B712A) serves for carrying one of the following holders:

- DUT table, included with "Antenna Cage" (R&S CMQ-B701A or R&S CMQ-B702A)
- "DUT Clamp 1" (R&S CMQ-B714A)
- "DUT Clamp 2" (R&S CMQ-B715A)

- "Drawer Fixture 2" (R&S CMQ-B719A)

"Drawer Support 1" can be mounted at the chamber's door in the upper or lower position, labeled 4 and 5 in [Chapter 7.4.2, "Using Drawer Support 1"](#), on page 46.

7.4.3 Using DUT Clamp 1



Figure 7-10: R&S CMQ-B714A "DUT Clamp 1" option, order no. 1537.6255.02

- 1 = Lift latch to release DUT fixation
 2 = Screw for fixing lower bracket
 3 = "DUT Clamp 1" with mobile device fixed in vertical position (side view)
 4 = "DUT Clamp 1" mounted on "Drawer Support 1" (top view)

"DUT Clamp 1" serves for vertical loading of a DUT of variable size up to 190 mm x 190 mm x 8 mm.

"DUT Clamp 1" can be mounted in the chamber on the "Drawer Support 1" (see top right (4) in [Figure 7-10](#)) or on the "Inner Support 1".

7.4.4 Using DUT Clamp 2

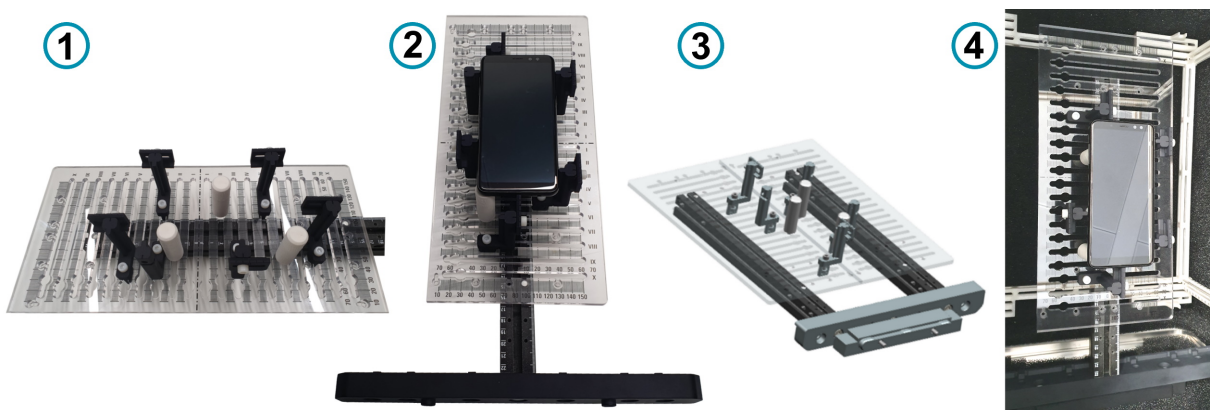


Figure 7-11: R&S CMQ-B715A "DUT Clamp 2" option, order no. 1537.6261.02

- 1 = Single-plate configuration, size 336 mm x 159.5 mm, with support and adjustment rods
- 2 = Single-plate configuration on "Drawer Support 1", holding a DUT
- 3 = Dual-plate configuration on "Drawer Support 1", size 336 mm x 319 mm
- 4 = "DUT Clamp 2" (single-plate configuration) with a DUT, inserted into the chamber (top view)

"DUT Clamp 2" serves for horizontal loading of a DUT of variable size.

"DUT Clamp 2" can be mounted in single- or dual-plate configuration on "Drawer Support 1" (Figure 7-10).

7.4.5 Using Drawer Fixture 2

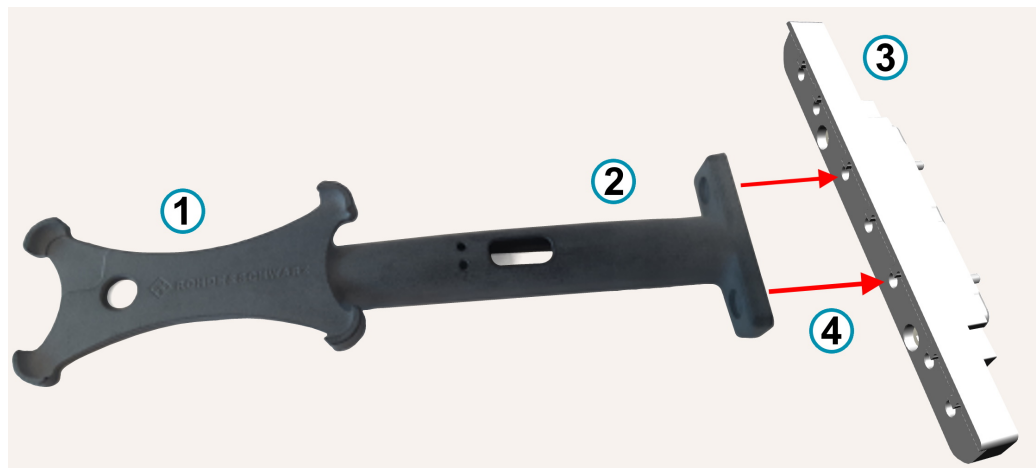


Figure 7-12: R&S CMQ-B719A "Drawer Fixture 2" option, order no. 1537.6355.02

- 1 = Holder for a smart device (horizontal loading)
- 2 = Fixture base
- 3 = Door adapter
- 4 = Fixture (1, 2) and adapter (3) are attached to the chamber's door

"Drawer Fixture 2" serves for horizontal loading of a DUT of a given size: 144.7 mm x 70.7 mm x 8.5 mm, which is a typical size of many commercially available smart-phones.

"Drawer Fixture 2" can be mounted to the door in an upper or lower position with the help of a door interface, which allows a left, right or center mounting position. The door interface is equivalent with "Drawer Support 1" without its 2 holder struts.

7.5 Connecting a DUT



Familiarize yourself with residual risks and potentially dangerous situations.

See "Moving door" on page 11 and "Operating the door" on page 13.

Feedthroughs

Optional feedthroughs in the chamber's door allow feeding control or RF signals or power through the door to the DUT while it is tested in the chamber.

These feedthroughs have interior and exterior connectors.

- Every **user** can connect a DUT to **interior** feedthrough connectors in the door, hence connectors that face the chamber's inside.
- Only an **expert user** is allowed to do the following:
 - Mount, remove or exchange feedthroughs
 - Connect, disconnect or exchange cables at exterior feedthrough connectors

If you connect your DUT to a feedthrough via RF cables, use shielded RF cables and a torque wrench to tighten the connectors.

Risk of RF connector and cable damage / torque recommendations

Excessive tightening of coaxial RF connectors can damage the cables and connectors. Too weak tightening causes 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 the care and handling of RF connectors.

For RF connectors, we recommend applying the following torque limits:

- **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. We offer torque wrenches for various connectors. For ordering information, see application note 1MA99.

7.6 Preparing for shift end

Between production periods, do the following:

1. Open the chamber's door. See [Chapter 7.3.2, "Opening the manually operated door"](#), on page 39 or [Chapter 7.3.4, "Opening the automated door"](#), on page 42.
Opening the door relaxes the gasket and maintains its RF shielding efficiency, see [Chapter 5.5, "Storage"](#), on page 23.
2. Deactivate the chamber. See [Chapter 7.2, "Deactivating the chamber"](#), on page 38.

8 Remote control commands

Every **user** except the **operator** is allowed to use all remote control commands.

As an **operator**, you are allowed to use only the remote control commands in [Chapter 8.3, "Door operation commands"](#), on page 54.

Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.



Risk of hurting another person

During remote operation, nobody is allowed in the work zone. Make sure of it by observing the work zone in front of the chamber all the time. See ["Operating the door"](#) on page 13 and [Figure 6-7](#).

Command protocol

For sending remote control (RC) commands to the RC module in the chamber, you must use ASCII characters.

- If you use the serial **RS-232** interface for command communication, set the UART port via a terminal tool as follows:
 - Baud rate: 115200 bps
 - Word length: 8 bit
 - Parity: none
 - Stop: 1 bit
 - Flow control: none
 - Echo input data: none
- If you use the **LAN** interface, you can send RC commands via TCP/IP protocol or VISA, using the chamber's [IP address](#) or [hostname](#).
 - Controlling the chamber via LAN requires specifying port 5000
 - DHCP (dynamic host configuration protocol) is set by default

For selecting the address model, use the command `NET:DHCP`.

Changes in the LAN connection state are communicated via the RS-232 interface:

- Ethernet connection established: `"ETH link up"`
Ethernet connection interrupted, for example when disconnecting the LAN cable: `"ETH link down"`

Before changing the interface, we recommend disconnecting the chamber from power. After establishing a control connection, activate the chamber as described in [Chapter 7.1, "Activating the chamber"](#), on page 37.

Command syntax

The RC commands are **not** compatible with SCPI syntax.

The RC module uses "\r" (carriage return, CR, ASCII character 13) as termination character. No other configuration is possible. Therefore, you must send "\r" from your client to the RC module at the end of each command. If the RC module replies to a remote command, it sends "\r" at the end of the reply.

For a description of all commands and replies, refer to the following chapters.

Errors

If the RC module detects a syntax error in a command, or if it cannot open or close the door, it returns an `ERR` statement.

Numerical format

As the decimal separator, all numbers sent or returned in the communication commands with the chamber use a dot (or full stop, ASCII character 2E_{hex}).

This chapter describes all available remote control commands:

| | |
|---|----|
| • Common commands | 51 |
| • Remote configuration commands | 52 |
| • Door operation commands | 54 |
| • Relay operation commands | 55 |
| • List of commands | 57 |

8.1 Common commands

Every `user` except the `operator` is allowed to use these commands.

The following commands allow basic communication and queries.

| | |
|------------------------------|----|
| *IDN? | 51 |
| RESET | 51 |
| MODEL? | 52 |
| STAT? | 52 |

*IDN?

Identification

Returns the instrument identification.

Usage: Query only

RESET

Usage: Setting only

Resets the RC module. Also returns the start screen with an overview of the available commands via the RS-232 interface, only.

Do not confuse with `*RST`.

MODEL?

Queries the model name, firmware version and firmware release date of the chamber.

Example: MODEL?
Reply:
CMQ500
FW Version: 1.3.0
DATE: 2020.04.18

Usage: Query only

STAT?

Queries statistical information related to the entire life of the chamber:

- Operational hours counter
- Door cycles counter

Example: STAT?
Reply:
RUNTIME=13;CYCLES=246
The chamber has operated for 13 hours and performed 246 open/close cycles.

Usage: Query only

8.2 Remote configuration commands

Every **user** except the **operator** is allowed to use these commands.

The following commands allow configuration of the remote control interface.

| | |
|-----------------------------------|----|
| NET?..... | 52 |
| NET:DHCP..... | 53 |
| NET:<IP>:<NETMASK>:<GATEWAY>..... | 53 |
| NET:HN:<hostname>..... | 54 |

NET?

Queries the current network configuration of the chamber.

Example: NET?
 Reply:
 AM=DHCP:HOSTNAME=CMQ:IP=192.168.78.4:
 NETMASK=255.255.255.0:GATEWAY=192.168.78.1
 In this example, the address model (AM) is DHCP, hence not STATIC, see [NET:DHCP](#).
 The hostname is CMQ.
 The IP address is 192.168.78.4
 The netmask is 255.255.255.0
 The gateway is 192.168.78.1

Usage: Query only

If the address model (AM) is STATIC, the hostname part of the reply string is omitted.

NET:DHCP <Boolean>

Sets the address model (AM) to static network configuration ([STATIC](#)) or dynamic host control protocol ([DHCP](#)).

To query the network configuration, use the [NET?](#) command.

In the original state as delivered, the RC module is configured for DHCP.

Using DHCP is functional only if the network provides a domain name server (DNS).

Parameters:

<Boolean>

1

Enables the DHCP to automatically specify the IP address, netmask and gateway.

0

Disables DHCP, requiring static network configuration. You must specify the IP address, netmask and gateway by using the [NET:<IP>:<NETMASK>:<GATEWAY>](#) command.

Usage: Setting only

NET:<IP>:<NETMASK>:<GATEWAY>

Sets the static network configuration, if you have disabled DHCP, see [NET:DHCP](#).

To query the network settings, use the [NET?](#) command.

Parameters:

<IP>

Specifies the IP address in "000.000.000.000" format. The default IP port is "5000".

<NETMASK>

Specifies the netmask, typically "255.255.255.000".

<GATEWAY>

Specifies the gateway in "000.000.000.000" format.

Example: NET:192.168.78.4:255.255.255.000:192.168.78.1

Usage: Setting only

NET:HN:<hostname>

Sets an optional hostname that you can use instead of the IP address.

Using a hostname is functional only in DHCP mode, see [NET:DHCP](#).

Syntax: You can use digits 0 to 9 and letters a to z or A to Z, where the difference between uppercase and lowercase letters is ignored. You can use hyphens ("-"), but not at the beginning or end of the hostname. No special characters or blank spaces are permitted, even though the RC module does not check your input for character validity.

If setting the hostname was successful, the RC module returns "OK".

If you use the command without entering any characters for the hostname, the RC module returns "ERR".

Parameters:

<hostname> The default hostname is "CMQ-123456", where the six-digit number is the chamber's serial number.
For example, "CMQ-100123".

Usage: Setting only

8.3 Door operation commands



Familiarize yourself with residual risks and potentially dangerous situations.

See ["Operating the door"](#) on page 13 and ["Risk of hurting another person"](#) on page 50.

| | |
|-----------------------------|----|
| DOOR? | 54 |
| OPEN | 55 |
| CLOSE | 55 |

DOOR?

Queries the chamber's door status.

Example:

DOOR?

Possible replies:

OPEN: the door has already opened completely.

CLOSED: the door has already closed completely. If the chamber is equipped with option R&S CMQ-B501H for higher shielding efficiency (order no. 1540.4020.04), the reply CLOSED is returned only, if the door gap is < 0.3 mm.

PENDING: the door is currently opening or closing; details: see below.

UNDEFINED: the door status is unknown.

DOOR STATE ERR: the door is in error state; see [Chapter 10, "Troubleshooting and repair"](#), on page 64.

Usage: Query only

Note that `PENDING` is sent as a reply for the `DOOR?` query, only, if you have triggered the opening or closing operation by pushing the door button. If you have triggered the door operation by the commands `OPEN` or `CLOSE`, the `DOOR?` query never returns the reply `PENDING`.

OPEN

Applies only to a chamber with an electrically or pneumatically operated door.

Before you open the door remotely, make sure that nobody is in the work zone; see [Figure 6-7](#).

`OPEN` opens the door of the chamber and reports the state.

- If the door is already open when you send the command, the RC module sends `OPEN`
- If the door is closed or has not yet opened completely when you send the command, the RC module first sends `PENDING` and then
 - `OPEN`, when the door has completed opening
 - `ERR`, if the door did not open completely within the expected time
The expected time is 8 s.

To query the state at any time, use the `DOOR?` command.

Usage: Event

CLOSE

Applies only to a chamber with an electrically or pneumatically operated door.

Before you close the door remotely, make sure that nobody is in the work zone; see [Figure 6-7](#).

`CLOSE` closes the door of the chamber and reports the state.

- If the door is already closed when you send the command, the RC module sends `CLOSED`
- If the door is open or has not yet closed completely when you send the command, the RC module first sends `PENDING` and then
 - `CLOSED`, when the door has completed closing
 - `ERR`, if the door did not close completely within the expected time
The expected time is 8 s.

To query the state at any time, use the `DOOR?` command.

Usage: Event

8.4 Relay operation commands

Every [user](#) except the [operator](#) is allowed to use these commands.

The chamber has six SP6T relays on its rear, labeled (4) in [Figure 4-2](#). The following commands allow operating the relays.

| | |
|---|----|
| ROUTE:CLOSE<list> | 56 |
| RELAY? | 56 |
| *RST | 57 |

ROUTE:CLOSE<list>

Switches a selected relay to a selected channel (or port) and returns a reply with the switched state.

Parameters:

<list> (@A1(0r0c))

Selects the relay and channel. The syntax requires all brackets and the characters "@A1", which addresses the module that controls all six relays.

r
Relay number, r = 1 to 6 (do not skip the "0" in 01 to 06).

c
Channel or port number of the SP6T relay, c = 1 to 6 (do not skip the "0" in 01 to 06).

You can switch up to all 6 relays in the same command, using the following syntax: `ROUTE:CLOSE (@A1 (0r0c, . . . , 0r0c))`

Example: `ROUTE:CLOSE (@A1 (0204))`
Switches relay 2 to channel 4, hence connecting the common port [C] of the 2nd relay to the port labeled [4].
The controller returns a reply: `OK (RELAY2:CHANNEL4)`

Usage: Setting only

RELAY?

Queries the state of all 6 relays (set by the [ROUTE:CLOSE<list>](#) command).

- Each relay is either connected or disconnected
- If a relay is connected, it can have 0 or 1 active channel

Example: `RELAY?`
Reply:
`RELAY1=CONNECTED:CHANNEL1=ACTIVE`
`RELAY2=CONNECTED:CHANNEL3=ACTIVE`
`RELAY3=DISCONNECTED`
`RELAY4=DISCONNECTED`
`RELAY5=CONNECTED:NO ACTIVE CHANNEL`
`RELAY6=DISCONNECTED`

Usage: Query only

***RST**

Usage: Setting only

Resets the channels of all relays to their default configuration and returns the reply OK.

The default configuration is `CONNECTED:NO ACTIVE CHANNEL`.

Do not confuse with [RESET](#).

8.5 List of commands

| | |
|-----------------------------------|----|
| *IDN?..... | 51 |
| *RST..... | 57 |
| CLOSE..... | 55 |
| DOOR?..... | 54 |
| MODEL?..... | 52 |
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9 Inspection and maintenance

Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.

The chamber has no factory default settings.

- [Recommended intervals](#)..... 58
- [Regular safety inspections](#)..... 58
- [Preparing the chamber for maintenance](#)..... 59
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9.1 Recommended intervals

To ensure safe operation and to retain the functional readiness and long operational life of the chamber, perform the inspection and maintenance tasks as scheduled:

Table 9-1: Scheduled inspection and maintenance

| Maintenance interval | Maintenance tasks |
|---|---|
| Daily | "Daily safety check" on page 58 Chapter 9.4.1, "Daily functional check" , on page 59 |
| Weekly | Chapter 9.4.3, "Checking the absorber" , on page 61 |
| Monthly / every 1500 cycles | Chapter 9.4.2, "Monthly check of the manual door" , on page 60 |
| Every 100 000 cycles | Chapter 9.4.5, "Cleaning the gasket" , on page 62 |
| If necessary | Chapter 9.4.4, "Cleaning the chamber" , on page 62 |
| Every time you calibrate test instruments | Chapter 9.4.6, "System calibration" , on page 63 |
| Once a year | "Yearly safety check" on page 59 |

The intervals in [Table 9-1](#) are recommended for 160 operating hours per month. If you operate the chamber for more hours, adapt the maintenance intervals accordingly.

9.2 Regular safety inspections

Daily safety check

- ▶ Before operation, test the door's automatic emergency deactivation mechanism for proper functioning. See [Chapter 6.6, "Testing safety systems"](#), on page 33.

Yearly safety check

This check is restricted to the Rohde & Schwarz [service personnel](#).

Due to normal wear, the performance of any system can degrade over time. This performance degradation can also impair system safety. To prevent any risks, we recommend a regular safety and performance check of the chamber once a year.

9.3 Preparing the chamber for maintenance

Before carrying out any of the maintenance tasks described in [Chapter 9.4, "Performing maintenance tasks"](#), on page 59, perform the following steps.

1. Make sure that nobody uses the chamber during maintenance. Take the steps that are stipulated in your company for that purpose.
2. If your chamber operates electrically, open the door. See [Chapter 7.3.4, "Opening the automated door"](#), on page 42.
3. Deactivate the chamber. See [Chapter 7.1, "Activating the chamber"](#), on page 37.
4. If your chamber operates pneumatically, disconnect it from the compressed-air supply. See ["To disconnect from compressed air"](#) on page 65.
5. If you need to move the chamber to a different location for maintenance, follow the instructions in ["Correct lifting and carrying"](#) on page 21.

9.4 Performing maintenance tasks

The recommended intervals are listed in [Table 9-1](#).

9.4.1 Daily functional check

To check the door's gasket

1. Check the door's gasket for soiling, damage and wear. For information on increasing the lifetime of the gasket, see [Chapter 5.5, "Storage"](#), on page 23.
2. If the gasket is soiled, clean it as described in [Chapter 9.4.5, "Cleaning the gasket"](#), on page 62.
3. If the gasket has visible damage or wear, contact Rohde & Schwarz customer support to replace it; see [Chapter 10.2, "Contacting customer support"](#), on page 64.

To check the pneumatic system

This check is restricted to the [maintenance personnel](#).

Applies only to chambers with pneumatically operated doors.

1. Check the pressure tubes and couplings:
 - a) Visually inspect the compressed-air supply system.
 - b) Listen for any air leakage.
2. If pressure tubes or couplings are defective, replace these parts.

To check the test equipment

This check is restricted to the [maintenance personnel](#).

1. Check the antennas, cables and connectors by coupling measurements from one antenna towards the others. For example, if six antennas are installed:
 - a) Send a defined RF signal to antenna #1.
 - b) Measure it at antenna #2.
 - c) Send the same RF signal to antenna #2.
 - d) Measure it at antenna #3.
 - e) Proceed in the same way with the other antennas, cables and connectors.

You can automate this procedure, depending on your available measurement equipment and test system. Another way of checking is a measurement of the S11 parameters at all RF ports of the chamber.
2. If one or more antennas, cables or connectors do not seem to function properly, ask an [expert user](#) to solve the problem.

9.4.2 Monthly check of the manual door

Applies only to chambers with option R&S CMQ-B22C for **manual** opening and closing of the door.

Check the door every 1500 closing cycles or every month, whichever happens first.



Mechanical wear

The over-center compression-latch mechanism of the manually operated door can wear out over time, leading to an increased door gap, which compromises the chamber's shielding effectiveness.

To check the door mechanism

This check is restricted to the [maintenance personnel](#).

1. Check if the locking latch and its catch block ([Figure 7-2](#)) are lubricated.
2. If the matching surfaces of these parts are not lubricated, proceed as follows:
 - a) Clean the matching surfaces with alcohol and a lint-free cloth.
 - b) Apply a drop of grease to the matching surface of the catch block
3. Close the door as in [Chapter 7.3.3, "Closing the manually operated door"](#), on page 41.

4. In each of the four corners of the door, measure the width of the gap between the door and the chamber's front plate that faces the door.
For example, use a feeler gauge to measure the gap width.
[Figure 9-1](#) shows the four measurement positions.
 5. If your chamber is equipped with option R&S CMQ-B501H for higher shielding efficiency, proceed as follows (otherwise skip this step):
 - a) If in any of the **lower** two corners, the door gap is wider than **0.3 mm**, let an [expert user](#) readjust the latch, as described in the [Configuration manual](#).
 - b) If in any of the **upper** two corners, the door gap is wider than **0.3 mm**, let Rohde & Schwarz [service personnel](#) check and possibly replace the electromagnets or the proximity sensor.
 - c) Repeat [step 4](#) to [step 5](#), until the gap is smaller than 0.3 mm in all four corners.
 6. In a chamber without enhanced shielding efficiency, if in any of the **four** corners, the door gap is wider than **0.6 mm**, proceed as follows:
 - a) Let an [expert user](#) readjust the latch, as described in the [Configuration manual](#).
 - b) Repeat [step 4](#) and [step 6](#), until the gap is smaller than 0.6 mm in all four corners.
- Tip:** Typically, readjust the latch every 7500 cycles.
7. Query the number of closing cycles by the remote command [STAT?](#).
 8. Note the number of closing cycles as a reference for the next check.

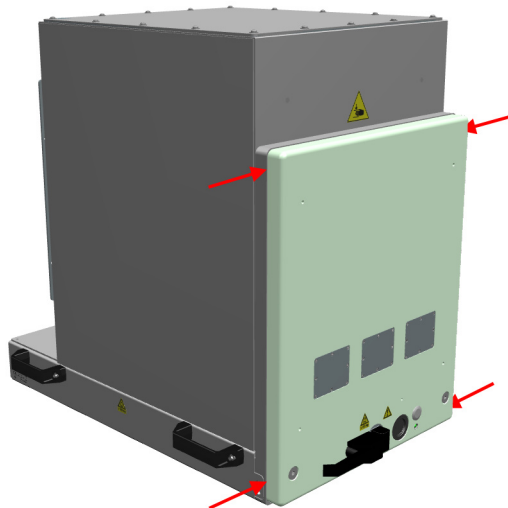


Figure 9-1: Four positions (red arrows) for measuring the door gap

9.4.3 Checking the absorber

This check is restricted to the [maintenance personnel](#).

To check the absorber material

1. Check the absorber material inside the door and around the chamber's door opening for damage or wear.
2. If the absorber material has visible damage or wear, contact Rohde & Schwarz customer support to replace it; see [Chapter 10.2, "Contacting customer support"](#), on page 64. This replacement can require an exchange of the complete door.

9.4.4 Cleaning the chamber

If the chamber is soiled on its inside or outside, clean it.

To clean the chamber

1. If you want to clean only the outside, you can leave the chamber closed. Otherwise, open the chamber as described in [Chapter 7.3.4, "Opening the automated door"](#), on page 42.
2. Deactivate the chamber as described in [Chapter 7.2, "Deactivating the chamber"](#), on page 38.
Deactivation prevents any door movement that can lead to collision during cleaning activities.
For cleaning only the outside, proceed with [step 4](#).
3. Clean the interior of the chamber with a vacuum cleaner.
Run the vacuum cleaner on a low-power setting and move its nozzle carefully, to avoid damaging the absorber material in the chamber.
4. **NOTICE!** Do not use liquid cleaning agents such as contact spray. Liquid agents can cause malfunction and damage to electrical interfaces and mechanical parts.
Clean the outside of the chamber with a dry cloth.
Do not touch the gasket.
5. Optionally, activate the chamber as described in [Chapter 7.1, "Activating the chamber"](#), on page 37.

9.4.5 Cleaning the gasket

The gasket contact area can be soiled, for example by sweat or grease from fingerprints. Clean the gasket every 100 000 cycles to maintain RF shielding.

To clean the door's gasket

1. Open the chamber as described in [Chapter 7.3.4, "Opening the automated door"](#), on page 42.
2. Deactivate the chamber as described in [Chapter 7.2, "Deactivating the chamber"](#), on page 38.

Deactivation prevents any door movement that can lead to collision during cleaning activities.

3. Use the following cleaning equipment and materials:
 - Soft, lint-free cleaning cloth
 - Alcohol
 - Soft brush
4. Carefully use the soft brush in a dry condition to pre-clean the gasket.
5. Carefully use the cloth and alcohol to remove any soil from the gasket's nickel-coated contact area.
6. Optionally, activate the chamber as described in [Chapter 7.1, "Activating the chamber"](#), on page 37.

9.4.6 System calibration

This activity is restricted to the [calibration appointee](#).

When the test system's instruments to which the chamber is connected are calibrated, make sure that the chamber is included in this calibration procedure. Calibration is performed typically once a year.

10 Troubleshooting and repair

Every **user** except the **operator** is allowed to perform the activities described in this chapter. Any **repair** activities are allowed for Rohde & Schwarz **service personnel** only.

For shipment, see [Chapter 5, "Transportation, handling and storage"](#), on page 21.

10.1 Door error

If the door LED flashes red, the door has a state error, which you can verify by sending a `DOOR?` query. If the control system replies `"DOOR STATE ERR"`, proceed as follows:

1. If there is an **automatic emergency deactivation** (typically due to an obstacle in the door's way), see [Chapter 7.3.6, "Procedure when LED is flashing"](#), on page 44.
2. Otherwise, if no automatic emergency deactivation has occurred, disconnect the chamber from its electric power supply.
3. Reactivate it according to [Chapter 7.1, "Activating the chamber"](#), on page 37.
4. If the door error persists, inform Rohde & Schwarz customer support.

10.2 Contacting customer support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

Contact our customer support center at www.rohde-schwarz.com/support, or follow this QR code:



Figure 10-1: QR code to the Rohde & Schwarz support page

11 Disabling and scrapping

Every **user** except the **operator** is allowed to perform the activities described in this chapter.

Familiarize yourself with residual risks and potentially dangerous situations.

See [Chapter 2.2, "Residual risks"](#), on page 10 and [Chapter 2.3, "Potentially dangerous situations"](#), on page 11.

- [Taking out of commission](#).....65
- [Dismounting](#).....67
- [Disposal](#).....67

11.1 Taking out of commission

To secure the door

1. If a **DUT** or other equipment of yours is still in the chamber, take it out.
2. Close the door of your chamber.
3. Secure the door against unintentional opening.

To label the chamber as out of commission

- ▶ If you take a malfunctioning chamber out of commission, make sure that nobody uses the chamber. Take the steps that are stipulated in your company for malfunctioning equipment.

To disconnect from power and control

1. Disconnect the DC (low voltage) plug of the power supply unit from the chamber.
The chamber is deactivated.
2. Disconnect the power supply unit from mains grid power.
3. Store the power supply unit for later use.
4. Disconnect all control connections from the chamber.
5. Disconnect the earth cable from the chamber's grounding terminal (earth ground contact \perp).

To disconnect from compressed air

Applies only to a chamber with pneumatically operated door. Proceed as follows:

Proceed as follows:

1. Hold the push-pull adapter at its front ring (1 in [Figure 11-1](#)).

- Pull the adapter away from the chamber. By doing so, the ring (2) releases the connection with the quick-coupling plug KS3-1/8-A.

At the same time, the adapter is automatically locked by an internal spring-loaded valve, which prevents losing compressed air.

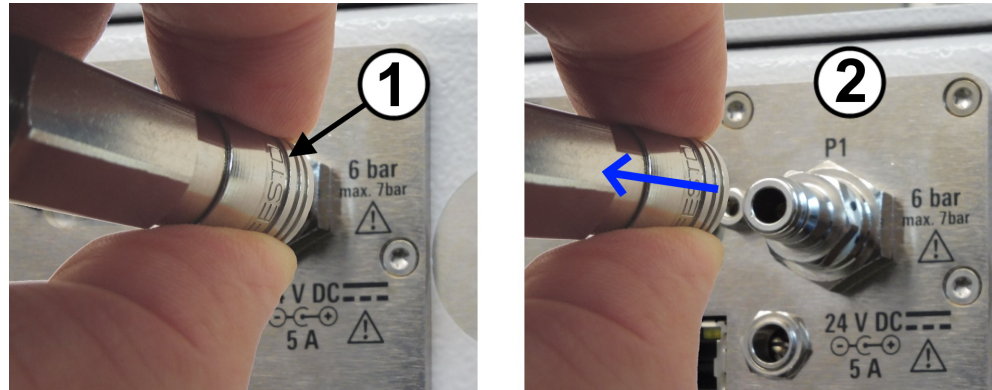
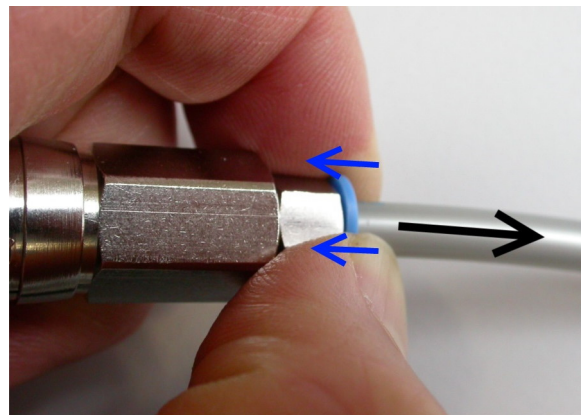


Figure 11-1: Disconnecting the compressed-air supply

To disconnect the tube from the push-pull adapter

- Switch off the compressed-air supply.
Otherwise, when you remove the adapter from the tube, your compressed-air supply system loses pressure.
- Push the push-pull adapter's blue ring firmly in the direction indicated by the blue arrows:



- While keeping the blue ring pushed in, gently pull the tube out of the adapter in the opposite direction, as indicated by the black arrow.
- If you wish to keep the push-pull adapter with the chamber, place it back on the quick-coupling plug:
 - Hold the adapter at its rear part.
 - Push the adapter onto the plug as shown in [Figure 6-5](#).

11.2 Dismounting



1. **WARNING!** Risk of tilting. See ["Chamber is heavy"](#) on page 10.
Remove all mounting brackets that fix the chamber at its corners to the table or similar support.



2. **WARNING!** Chamber is heavy. See [Chapter 5.1, "Lifting and carrying"](#), on page 21.
Lift the chamber at its handles with at least 4 people and place it on the floor or on a transporting equipment.
3. If you wish to transport the chamber to a different place or into storage, see [Chapter 5, "Transportation, handling and storage"](#), on page 21.

11.3 Disposal

Rohde & Schwarz is committed to making careful, ecologically sound use of natural resources and minimizing the environmental footprint of our products. Help us by disposing of waste in a way that causes minimum environmental impact.

Disposing electrical and electronic equipment

A product that is labeled as follows cannot be disposed of in normal household waste after it has come to the end of its service life. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.



Figure 11-2: Labeling in line with EU directive WEEE

Rohde & Schwarz has developed a disposal concept for the eco-friendly disposal or recycling of waste material. As a manufacturer, Rohde & Schwarz completely fulfills its obligation to take back and dispose of electrical and electronic waste. Contact your local service representative to dispose of the product.

Glossary: List of frequently used terms and abbreviations

Symbols

3GPP: 3rd generation partnership project, collaboration of telco standards associations

5G: 5th generation of wireless technology for digital cellular networks, based on [3GPP](#) standards. An early release was "New Radio" (NR), often used as a synonym for 5G.

C

calibration appointee: Person with technical skills and profound experience in calibrating electronic and [RF](#) systems. See also [roles](#).

chamber: The R&S CMQ500, also referred to as "the product"

D

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

DUT: Device under test

E

EMC: Electromagnetic compatibility

expert user: Engineer with professional experience in radiation testing of electronic components and devices. A sound knowledge of the English language is crucial. Expert users are allowed to perform the configuration tasks described in the user documentation. See also [roles](#).

G

gasket: A mechanical seal that, in this case, provides RF shielding.

M

maintenance personnel: Person with technical skills. Has profound experience in installing and maintaining electronic devices and pneumatic systems. See also [roles](#).

mmW: Millimeterwave electromagnetic radiation in the frequency range from 30 GHz to 300 GHz, equivalent to a wavelength range from 1 mm to 10 mm. mmW is used in [5G](#) technology, where [3GPP](#) defines "FR2" (frequency range 2 according to release 15) as ranging from 23.45 GHz to 40.8 GHz.

O

operator: Person instructed and trained to operate the chamber in well-defined procedures, mainly according to [Chapter 7, "Operation"](#), on page 37. See also [roles](#).

P

PC connector: Precision connector (not to be confused with "personal computer").

product: The R&S CMQ500, also referred to as "the chamber"

R

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

roles: The handbook defines the following roles for performing various tasks with the chamber:

user

operator

expert user

supervisor

trainer

transportation appointee

maintenance personnel

service personnel

calibration appointee

RRH: Remote radio head, a transceiver for wireless connection to a DUT

S

service personnel: Service personnel appointed or employed by Rohde & Schwarz. See also [roles](#).

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

supervisor: Expert user who instructs and supervises other users. Has leadership experience and production control expertise. See also [roles](#).

T

trainer: Expert user who trains other users. Has experience in training and instruction. See also [roles](#).

transportation appointee: Carrier with experience in using transporting equipment. Trained to handle heavy, sensitive equipment with care and without disregard for safety and health. See also [roles](#).

U

user: Anyone who uses or handles the chamber during its lifecycle. Includes the operating company and its personnel, for example maintenance personnel, trainers and operators. See also [roles](#).

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