

**ROHDE & SCHWARZ**

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# R&S®ATS1800C COMPACT 3GPP COMPLIANT OTA CHAMBER FOR 5G NR mmWAVE SIGNALS

Product Brochure | Version 01.01

5G NR device testing  
in a small footprint



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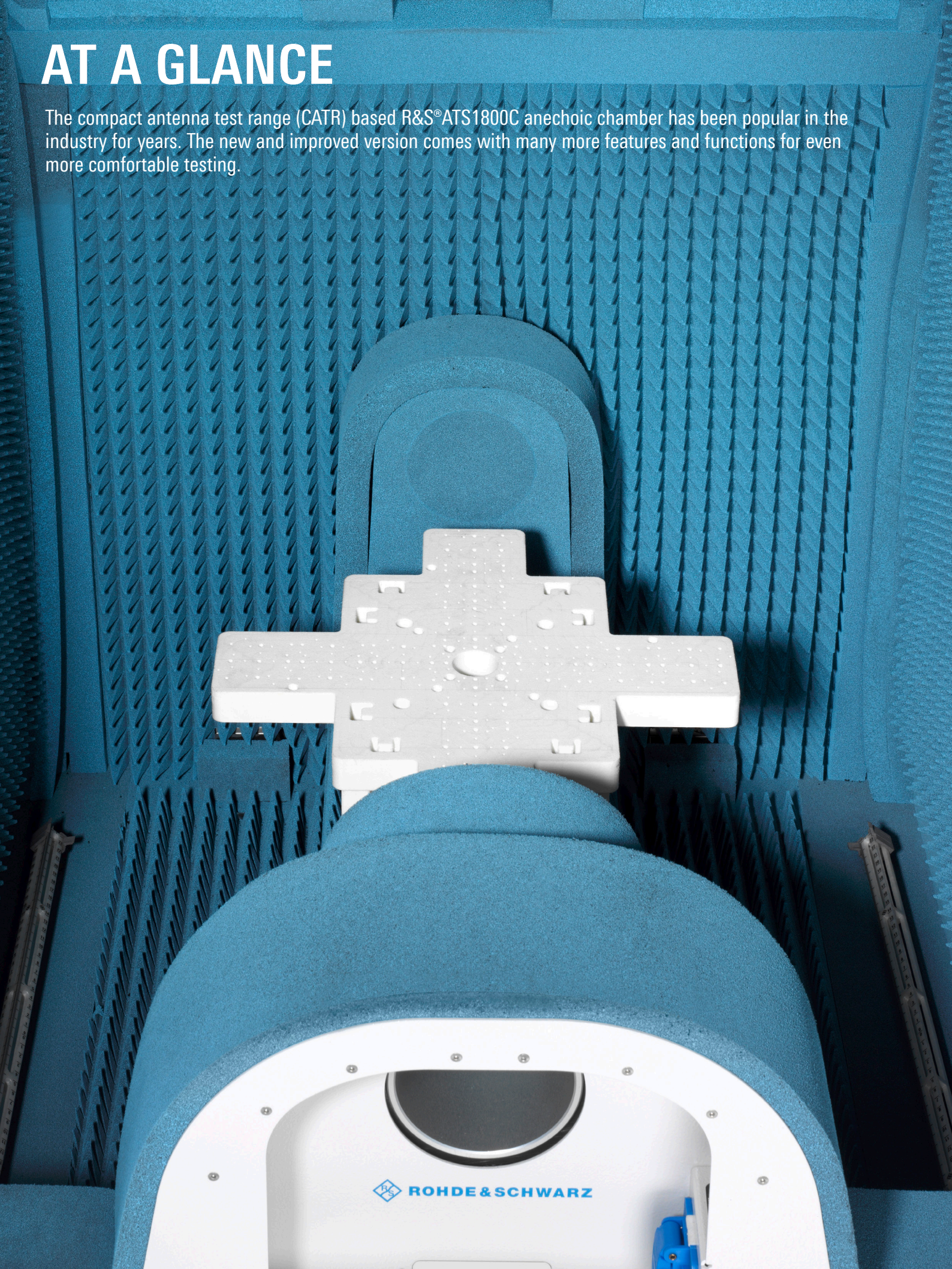
Телефон: +7 (499) 685-4444

info@4test.ru

www.4test.ru

# AT A GLANCE

The compact antenna test range (CATR) based R&S®ATS1800C anechoic chamber has been popular in the industry for years. The new and improved version comes with many more features and functions for even more comfortable testing.



The turnkey chamber for indirect far-field over-the-air measurements provides an ideal environment for testing 5G FR2 antennas, modules and devices throughout the entire lifecycle: from R&D to conformance. It can be easily transported and fits through most doors with its small footprint and wheeled chassis. The wide frequency range offers great functionality and test coverage. The flexibility and broad range of extension options make the R&S®ATS1800C a solid and future-proof environment for your FR2 testing needs.

The compact antenna test range (CATR) features a feed antenna, a bidirectional parabolic reflector and a 3D positioner inside the highly shielded chamber. The parabolic reflector is specially designed and manufactured by Rohde&Schwarz with optimized rolled edges for superior power distribution of the collimated beams after reflection. The reflector also has an extremely high-precision surface to minimize errors and enable the reflector to be used in a very wide frequency range for accurate measurement results.

The CATR technology enables a quiet zone big enough to accommodate both black box measurements and large DUTs. Heavy DUTs can be placed on the highly accurate and stable 3D positioner to automatically measure TRP, EIRP and EIS parameters. Positioner stability and device weight specifications also allow for CTIA frequency range 2 (FR2) antenna performance tests using phantom heads and hands.

The compact R&S®ATS1800C setup is a big help for all required measurements from R&D to product validation. During design optimization, specific beam characterizations can be measured to verify the beamforming capabilities of modules and devices. Out-of-band testing or 3D assessment under extreme temperature conditions can be comfortably carried out by adding the required options. Even extension to an RRM test setup with multiple angles of arrival (AoA) is easy with the R&S®ATS1800C.

Rohde&Schwarz is a one-stop-shop for a full range of test equipment to complement the R&S®ATS1800C and enable 5G conformance testing in the mmWave range. The solution is fully compliant with 3GPP standards, making it the most complete 5G test chamber.

# KEY FACTS

**VERY COMPACT AND MOBILE FAR-FIELD OVER-THE-AIR (OTA) TEST SYSTEM BASED ON COMPACT ANTENNA TEST RANGE (CATR) TECHNOLOGY**

**STATE-OF-THE-ART CATR REFLECTOR WITH OPTIMIZED EDGES FOR UNIFORM POWER DISTRIBUTION AND HIGH-PRECISION SURFACE FINISHING FOR MINIMAL DEVIATIONS IN THE QUIET ZONE**

**VERY HIGH FREQUENCY RANGE, INCLUDING 5G FREQUENCY RANGE 2 AND IN LINE WITH OOB REQUIREMENTS**

**HIGH SHIELDING EFFECTIVENESS**

**LARGE, 3GPP COMPLIANT QUIET ZONE**

**HIGHLY ACCURATE SPHERICAL 3D POSITIONER WITH BUILT-IN HARDWARE TRIGGER FUNCTIONALITY FOR SIGNIFICANTLY SHORTER TEST TIMES**

**SUITABLE FOR 3GPP CONFORMANCE TESTING, CTIA ANTENNA PERFORMANCE TESTING AND DEVICE BEAM CHARACTERIZATION**

**EXTREME TEMPERATURE CONDITIONS TESTING IN 3D**

**EXTENSION TO MULTIPLE AOA TESTING**

# LATEST FUNCTIONALITY

Since its introduction, the R&S®ATS1800C has become renowned in the industry. Feedback from users of the very compact CATR setup helped improve this best in class chamber even further. The new design with a darker interior and exterior coloring scheme allows you to see the chamber status from a distance, letting you know if your setup needs attention or intervention. You can also clearly see when measurements are finished so that nobody accidentally interrupts your tests.

New high-precision and high-resolution trigger support has further increased the potential speed for time consuming measurement routines such as TRP. Optimized cable lengths increase the dynamic range and more feedthrough openings allow for better customization when more cables need to run into the shielded chamber. Integrated USB 3 hubs and Ethernet switches enable trouble free connection to your DUT at any time and the DUT can be heavier since the positioner uses higher torque drives.

Performing 3D measurements when the DUT is heated or cooled to extreme temperatures has been improved and is now possible for a wider temperature range of over 120 °K thanks to specially designed air rotary joints with very high temperature isolation hoses. The inside of the chamber is ventilated at all times and can be temperature monitored. The user can setup alarm messages for increases in ambient temperatures. Additional alarm sensors can be added to the message as needed and the optional infrared camera enables visual inspections of the chamber interior for thermal dissipation of the DUT during testing.

The powerful R&S®ATS1800C controller allows optional and convenient integration of a motorized feed switcher for a wide range of use cases. And by making preparations for dedicated side chambers with additional CATR reflectors and feed antennas, R&S®ATS1800C usability knows even fewer limits.



# WIDE FREQUENCY RANGE COVERAGE

The frequency range of a CATR setup is mainly defined by the quality of the reflector and the frequency range of the feed antenna. The reflectors in all Rohde&Schwarz CATR setups have very high quality edge treatments and surface smoothness to support a very wide frequency range. The feed antenna properties need to fulfil very specific requirements to serve as a high performance CATR feed. These antennas are typically band limited and provide high performance bandwidth in the range of specified gigahertz decades.

The configuration of the R&S®ATS1800C allows the required frequency range to be selected by picking one of the many available feed antennas to be mounted as a fixed feed in the reflector focal point, enabling usability far beyond the 5G NR FR2 frequency range. The chamber size and absorbers allow precise measurements down to 20 GHz. The reflector quality enables the chamber to be used beyond 100 GHz. The desired frequency range can be covered simply by picking the matching feed antenna.

When more than a single feed is required to cover the desired bandwidth, an automatic feed switcher can be installed for an easy and smooth shift between different feed antennas with the click of a button. Every feed on the feed switch is mounted on a motorized mover and connected with high precision RF cables to a dedicated RF feedthrough at the backwall of the chamber. Depending on the desired frequency range, the matching mover automatically shifts into the focal point of the reflector while all other feeds are parked in a hidden position at the far end of the feed switcher. Precise and convenient testing over a wide frequency range is possible without the bandwidth limits of a single feed antenna.

The automatic feed switcher controls are fully integrated in the R&S®ATS1800C user interface and the remote-control interface and drivers, allowing for fully automatic out-of-band testing or other testing requiring wide frequency range coverage.



# TESTING UNDER EXTREME TEMPERATURE CONDITIONS

FR2 devices use active array antennas to overcome path loss in high frequencies with beamforming techniques. The active components inside the antenna array, such as amplifiers and phase shifters have to be high precision in wide and varying ambient temperature ranges for proper beamforming.

The R&S®ATS1800C fully supports 3D radiation measurements under extreme temperature conditions to analyze temperature effects on a DUT. An isolated yet RF transparent enclosure can be placed on the 3D positioner without limiting movement. The DUT is placed inside the enclosure which can be heated or cooled with an external heat pump. The dome-shaped lid is made from RF transparent

material that tightly encloses the DUT and has little to no influence on RF radiation. The enclosure size can also comfortably accommodate bigger devices for extreme temperature testing. Thickly insulated, temperature-resistant hoses run through a specially designed air rotary joint for full 3D movement even when the temperature enclosure is on the positioner, enabling testing in a wide temperature range. RF shielded air feedthroughs in the chamber wall connect the hoses to the external temperature forcing system.

This allows for testing in a wide temperature range without compromising the R&S®ATS1800C functionality.

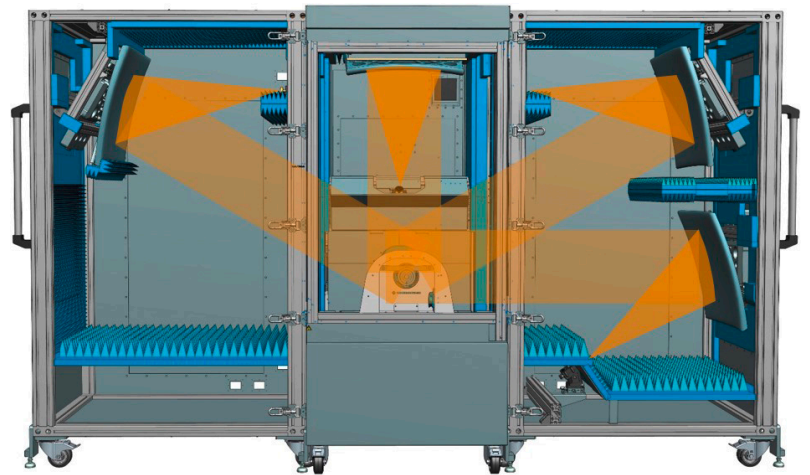
# MULTIPLE ANGLE OF ARRIVAL TESTING

The new extension for the R&S®ATS1800C can help when multiple millimeterwave signals are required to reach the DUT and a big and convenient CATR reflector quiet zone is desired

Radio resource management (RRM) testing requires the DUT to receive two 5G NR signals from different angles at the same time. At least four different signal directions in various combinations are needed to obtain the five relative angles between two signals required by 3GPP. The unique R&S®ATS1800C side chamber extension provides this functionality and creates the same quiet zone for signals from each direction. This ensures the lowest possible measurement uncertainty even in these complex test scenarios.

Other complex cases such as different handover or roaming scenarios can also be simulated very conveniently with the multiple angle of arrival (AoA) setup or the R&S®ATS1800M.

Adding side chamber extension to the R&S®ATS1800C center chamber is easy and fast and maintains great shielding effectiveness. Each side chamber contains one or two additional reflectors with feed antennas where each direction generates an independent signal with a 30 cm cylindrical quiet zone, making full black box testing possible even in RRM scenarios while allowing the same chamber to be used for all other FR2 test requirements, such as RF or protocol conformance. And since the feed antennas for each reflector are independent of one another, even different frequency ranges can be implemented without any issues.



# ADDITIONAL FEATURES

With its options such as automatic feed switching or testing under extreme temperature conditions, the R&S®ATS1800C is already very versatile. But many more options are available for even more convenience and possibilities.

## Short cable length for great dynamic range

Since signals in the millimeterwave domain suffer high loss whether over the air or conducted, keeping cable lengths both inside and outside the chamber to a minimum is a good idea. The optional mounting plate on the back of the chamber enables RF equipment such as combiners, amplifiers, frequency converters or remote radio heads to be conveniently mounted directly onto the chamber and very close to RF feedthroughs to minimize cable lengths.

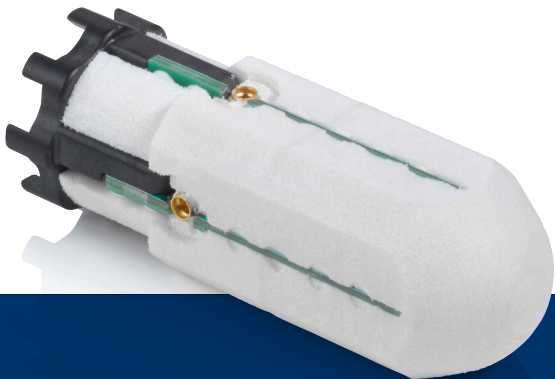
## Running RF cables to the DUT

Once inside the chamber, running an RF signal cable to the DUT on the positioner requires extra care so that the positioner is not restricted. The R&S®ATS1800C comes with RF rotary joints in the positioner. An additional RF path through other RF rotary joints is available as an option.

## Link antenna for testing under signaling conditions (1)

5G NSA (non-standalone) signaling setups require an anchor cell in a legacy technology (LTE) and the 5G FR2 signal to be transmitted to the DUT simultaneously. In the R&S®ATS1800C, the FR2 signal radiates from the feed antenna via the reflector to the DUT on the positioner, while an optional antenna on the positioner provides the anchor signal. This link antenna is mounted so that it remains in a fixed position relative to the DUT for the best link stability. When a 4x4 MIMO anchor signal is required, link antennas can be added on the side of the positioner.

(1)



(1)





### Phantoms in the chamber (2)

The R&S®ATS1800C positioner has strong and precise motors to move heavier loads, either a heavy DUT or weighty phantom heads or phantom hands. CTIA test plans require phantoms for testing phone type devices. The optional phantom fixture in the R&S®ATS1800C is ideal for mounting them on the positioner in the chamber. The phantom fixture also allows for customized mounting cradles if a DUT requires a customized fixture design.

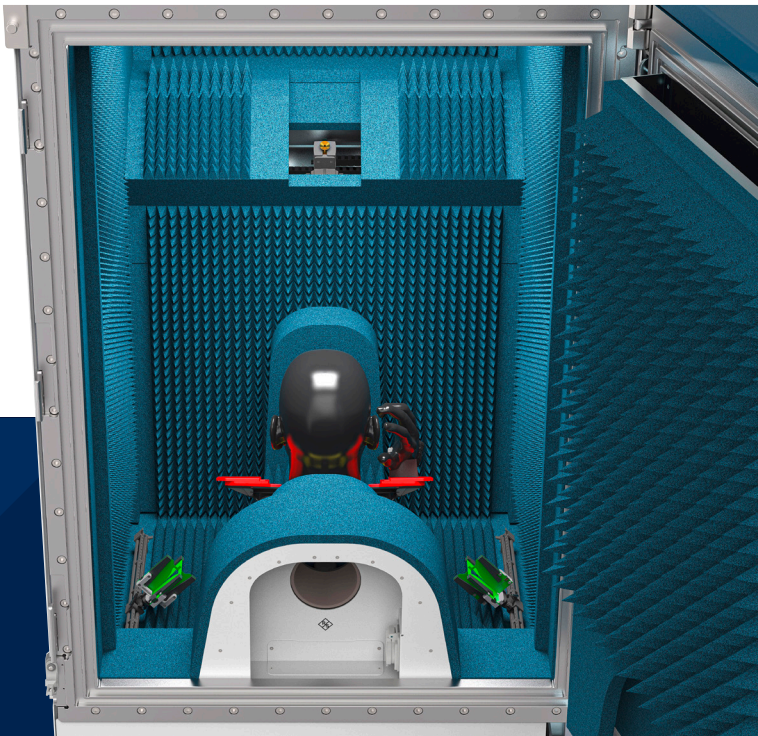
### What is happening inside the chamber (3)

It is difficult to look inside an anechoic chamber during testing since the door needs to be closed for proper shielding. The optional camera enables a close look at the DUT while testing is in progress. Viewing can also be done remotely since the camera uses an Ethernet connection and a dedicated IP address to log in. And since heat dissipation of 5G terminals is a potential issue, the camera can provide infrared imaging with a heat map display of the DUT.

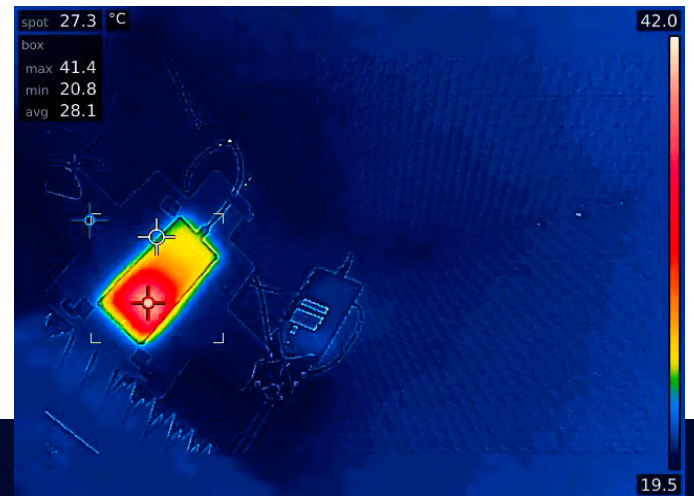
### Connectivity and speed

Today's modern devices offer many different wireless connections but often come with a USB 3 wired interface. This is why the R&S®ATS1800C can be equipped with a USB 3 feedthrough and cable with an A/B type connector or with the more modern C type connector. The USB connection is routed through a USB hub for a stable connection to the DUT at all times. If different kinds of additional cables are required at the DUT, the R&S®ATS1800C can be equipped with an extensive list of other optional feedthroughs.

(2)



(3)



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