IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF TEXAS
DALLAS DIVISION

PRESTWICK LICENSING LLC, Plaintiff, v. **ROHDE & SCHWARZ USA, INC.,** Defendant.	C.A. No. 3:22-cv-1653 **JURY TRIAL DEMANDED** **PATENT CASE**

ORIGINAL COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Prestwick Licensing LLC files this Original Complaint for Patent Infringement against Rohde & Schwarz USA, Inc., and would respectfully show the Court as follows:

I. THE PARTIES

1. Plaintiff Prestwick Licensing LLC ("Prestwick" or "Plaintiff") is a Texas limited liability company having an address at 5121 Collin McKinney Pkwy, Ste 500, McKinney, TX 75070-1524.

2. On information and belief, Defendant Rohde & Schwarz USA, Inc., ("Defendant") has a place of business at 410 N. Freeport Parkway, Ste 160, Coppell, TX 75019. Defendant has a registered agent at 211 E. 7th Street, Suite 620, Austin, TX 78701.

II. JURISDICTION AND VENUE

3. This action arises under the patent laws of the United States, Title 35 of the United States Code. This Court has subject matter jurisdiction of such action under 28 U.S.C. §§ 1331 and 1338(a).

4. On information and belief, Defendant is subject to this Court's specific and general personal jurisdiction, pursuant to due process and the Texas Long-Arm Statute, due at least to its

business in this forum, including at least a portion of the infringements alleged herein, at 410 N. Freeport Parkway, STE 160, Coppell, TX 75019.

5. Without limitation, on information and belief, within this state, Defendant has used the patented inventions thereby committing, and continuing to commit, acts of patent infringement alleged herein. In addition, on information and belief, Defendant has derived revenues from its infringing acts occurring within Texas. Further, on information and belief, Defendant is subject to the Court's general jurisdiction, including from regularly doing or soliciting business, engaging in other persistent courses of conduct, and deriving substantial revenue from goods and services provided to persons or entities in Texas. Further, on information and belief, Defendant is subject to the Court's personal jurisdiction at least due to its sale of products and/or services within Texas. Defendant has committed such purposeful acts and/or transactions in Texas such that it reasonably should know and expect that it could be haled into this Court as a consequence of such activity.

6. Venue is proper in this district under 28 U.S.C. § 1400(b). On information and belief, Defendant has businesses in this district at 410 N. Freeport Parkway, Ste 160, Coppell, TX 75019. On information and belief, from and within this District Defendant has committed at least a portion of the infringements at issue in this case.

7. For these reasons, personal jurisdiction exists, and venue is proper in this Court under 28 U.S.C. § 1400(b).

III. COUNT I
(PATENT INFRINGEMENT OF UNITED STATES PATENT NO. 7,668,301)

8. Plaintiff incorporates the above paragraphs herein by reference.

9. On February 23, 2010, United States Patent No. 7,668,301 ("the '301 Patent") was duly and legally issued by the United States Patent and Trademark Office. The '301 Patent is titled "Simulated User Calling Test System and Method with Built-In Digital SPC-Exchange." A true

and correct copy of the '301 Patent is attached hereto as Exhibit A and incorporated herein by reference.

10. Prestwick is the assignee of all right, title, and interest in the '301 patent, including all rights to enforce and prosecute actions for infringement and to collect damages for all relevant times against infringers of the '301 Patent. Accordingly, Prestwick possesses the exclusive right and standing to prosecute the present action for infringement of the '301 Patent by Defendant.

11. The invention in the '301 Patent relates to the field of digital stored program control (SPC) switch technique in telecommunications, particularly, to a simulated user call test system built-in digital SPC switch and method. (Ex. A at 1:13-16).

12. In the prior art, simulated user calling performance tests for digital SPC switches mainly employed large traffic call test instruments. (*Id.* at 1:20-22). The available commercial simulated user calling test instruments simulated the calling process of actual users realistically, in which the test is performed by transmitting and receiving pass detecting tone and judging the pass detecting tone while a call is initiated on a user line, a dial is simulated, and the call is communicated. (*Id.*at 1:23-28). However, these systems were expensive and therefore many network operators do not buy this type of equipment and therefore calling tests are vey complicated during pass tests of many digital SPC switches. (*Id.* at 1:31-37). It is therefore advantageous and simpler if a calling test instrument was built into the switch. (*Id.*at 1:35-37).

13. There are existing switches with a built-in large traffic calling test system characterized by designing a virtual calling process on a user element processor, simulating the whole process including initiating a call by a user and answering the call by the called user. (Ex. A at 1:43-48). However, the main disadvantage of these kind of system was that it could only realistically test the process of call signaling by the main control system in a test switch, but not

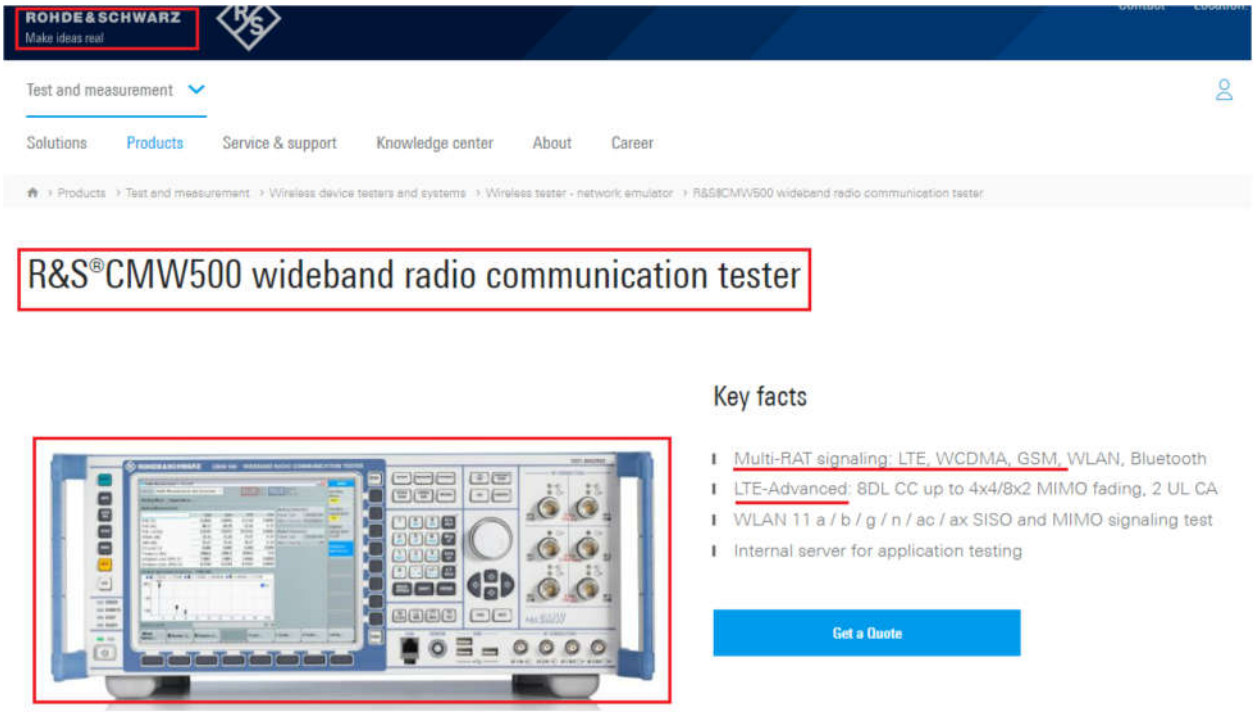
the performance such as the hardware interface performance in the switch and the performance of the switching connection path. (*Id.*at 1:48-53). Furthermore, they cannot accurately reflect the call process performance of the switch system. (*Id.*at 1:53-54).

14. The technical problem solved by the inventors is to provide a simulated user call test system located within a digital SPC switch, and to provide a test method based on built-in modules of a digital SPC switch, in which equal functions to commercial external call test systems can be realized with a lower cost by user the current hardware and software resources in a digital SPC switch. (*Id.* at 1:58-64).

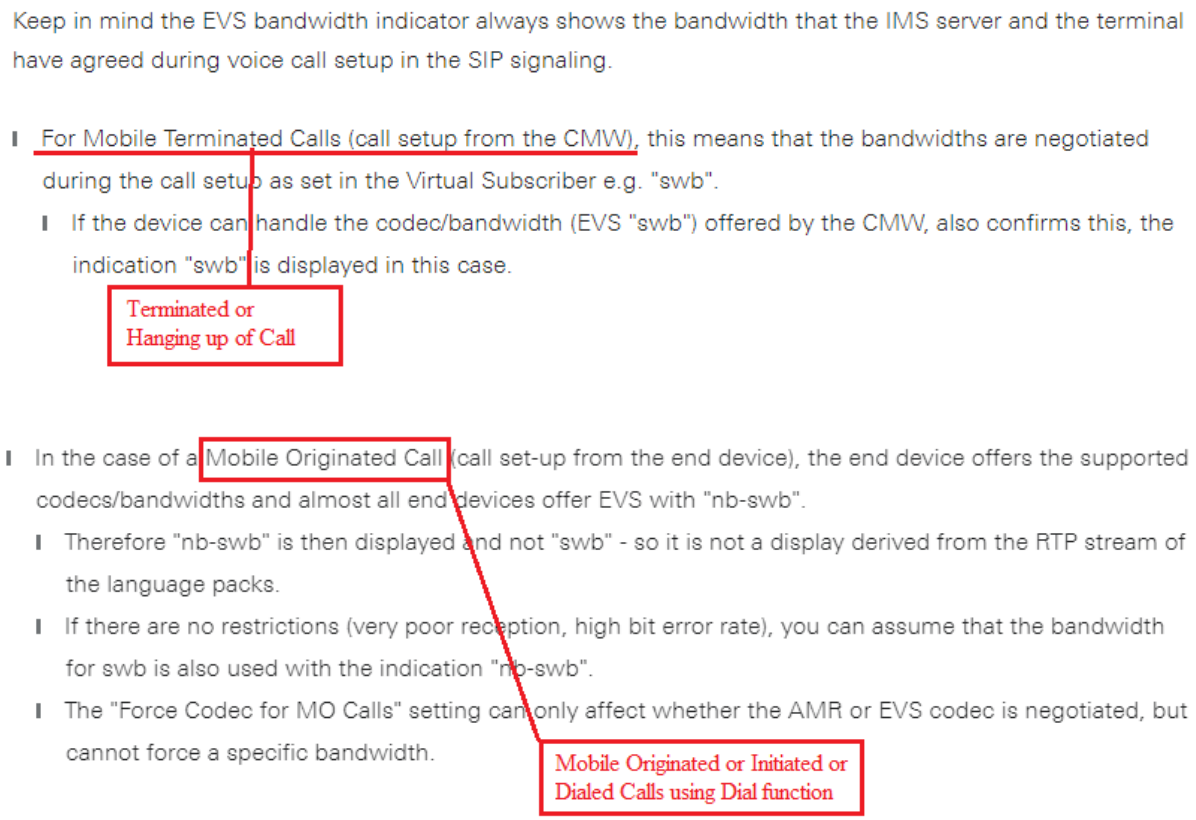
15. **Direct Infringement.** Upon information and belief, Defendant has been directly infringing claim 1 of the '301 Patent in Texas, and elsewhere in the United States, by making, using, selling, and or offering to sell the Rohde & Schwarz CMW500 ("Accused Instrumentality").

16. The Accused Instrumentality is a simulated user call test system (*e.g.,* GUI-based SCMWrun software with the R&SCMW 500 tester interface), characterized in that the simulated user call test system is built in a digital stored program control switch (*e.g.,* the Accused Instrumentality), and comprises a back process module (*e.g.,* GUI-based R&SCMWrun software and R&SCMW 500 tester interface), a front call control process module (*e.g.,* user equipment (UE)) and a hardware subsystem (*e.g.,* Hardware Units in the Accused Instrumentality) for performing a call test (*e.g.,* LTE signaling test). As shown below, the Accused Instrumentality is a part of the simulated user call test system which is a GUI-based R&SCMWrun software with the R&SCMW 500 tester. The Accused Instrumentality comprises back process module (*e.g.,* GUI-based R&SCMWrun software with the R&SCMW 500 tester), a front call control process module (*e.g.,* user equipment (UE)) and a hardware subsystem (*e.g.,* Hardware) for performing a call test (*e.g.,* LTE signaling test). The back process module (GUI-based R&SCMWrun software) provides

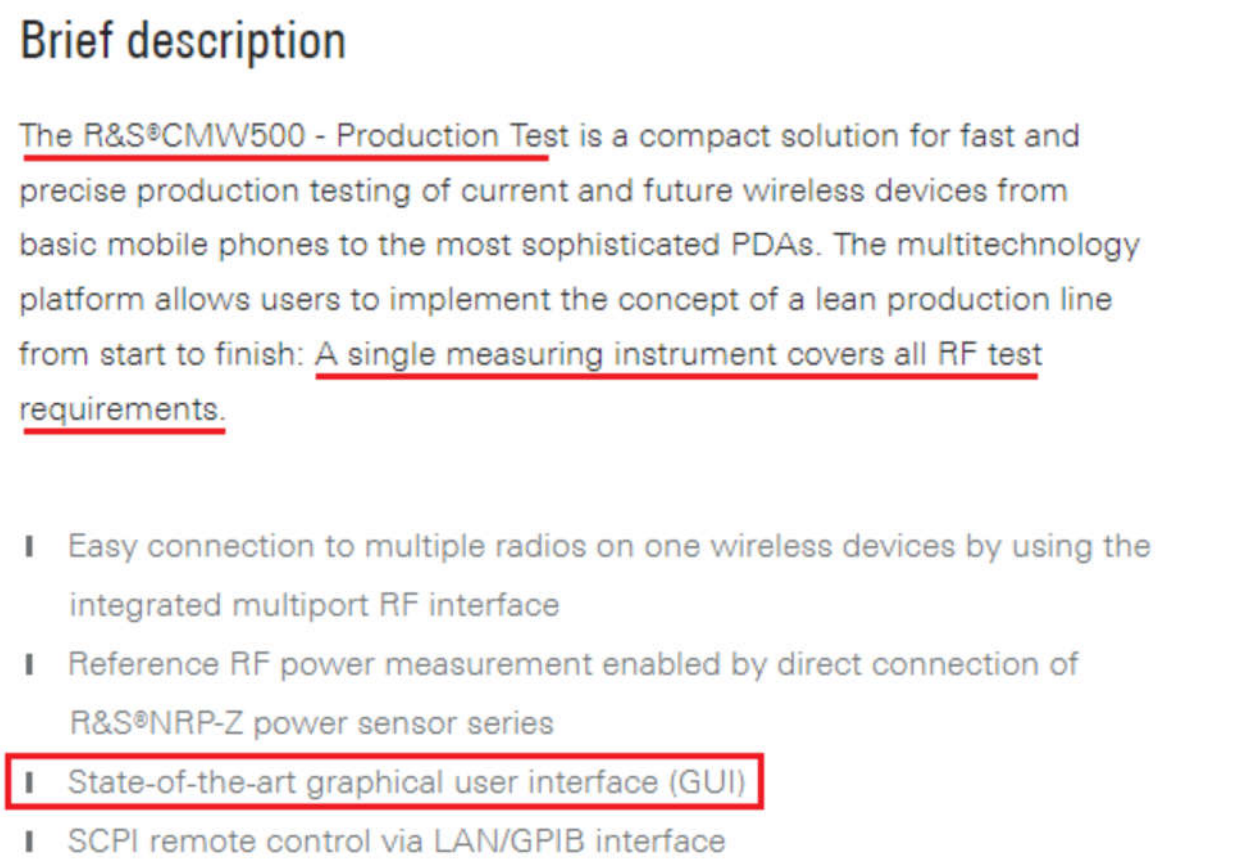
an operation interface for a user to perform a call test setup (setting various parameters for call test), receives call test result data (*e.g.,* result report) transmitted by the front call control process module (*e.g.,* user equipment (UE)), and displays the result on the display of the Accused Instrumentality. The front call control process module receives call test setup parameters provided by the R&SCMWrun software, controls the hardware subsystem (Hardware Units in the Accused Instrumentality) to perform a call test, and reports a result of the call test to R&SCMWrun software. The hardware subsystem comprises function process units (*e.g.*, hardware subsystem units as shown in below evidence) of the switch to receive instructions from the user equipment (UE), perform tests comprising performing a call, handover between LTE and WLAN; and report test results to the front call control process module.



(*E.g.*, https://www.rohde-schwarz.com/in/products/test-and-measurement/wireless-tester-network-emulator/rs-cmw500-wideband-radio-communication-tester_63493-10844.html).



(*E.g.*, https://www.rohde-schwarz.com/cz/faq/evs-bandwidth-indicator-volte-and-vowifi-call-on-cmw500-cmw290-user-interface-faq_78704-1185664.html).



Brief description

The R&S®CMW500 - Production Test is a compact solution for fast and precise production testing of current and future wireless devices from basic mobile phones to the most sophisticated PDAs. The multitechnology platform allows users to implement the concept of a lean production line from start to finish: A single measuring instrument covers all RF test requirements.

- Easy connection to multiple radios on one wireless devices by using the integrated multiport RF interface
- Reference RF power measurement enabled by direct connection of R&S®NRP-Z power sensor series
- State-of-the-art graphical user interface (GUI)
- SCPI remote control via LAN/GPIB interface

(*E.g.*, https://www.rohde-schwarz.com/us/products/test-and-measurement/wireless-communications-testers-systems/wireless-communication-testers-systems/r-s-cmw500-production-test_255791.html).

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Optimized handling for production test systems

Minimum user risk owing to all-in-one architecture

Comprehensive RF frontend eliminating the need for external hardware

Optimum handling through Press & Go applications

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T&M solution

When the test focus is on preconformance RF testing in line with the specification rather than validation testing, the right choice is the R&S®CMW500 RF tester, remotely controlled by R&S®CMWrun

Using a standalone R&S®CMW500, and with just a few configuration clicks for bands, channels and bandwidth, the tool provides a comprehensive result report that gives the user a first impression of in-band compliance. This provides beneficial knowledge in the very early stage of verification, before doing more complex system tests or validation.

(*E.g.*, https://www.rohde-schwarz.com/in/applications/r-s-cmwrun-rf-preconformance-testing-solution-application-card_56279-106882.html).

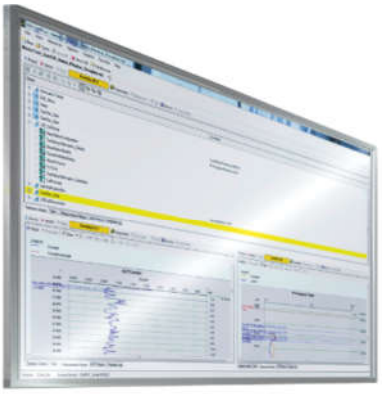
At a glance

The automation tool for the R&S®CMW platform

Today the R&S®CMW is the leading, most popular multistandard platform for UE testing. It is used by network operators, test houses, handset vendors and chipset manufacturers alike. The R&S®CMWrun automation software meets all requirements for executing remote control test sequences on the R&S®CMW in R&D, quality assurance, production and service for both current and future wireless equipment.

The software engine is based on the execution of test DLLs (plug-in assemblies). This architecture allows easy and straightforward configuration of test sequences without requiring specific programming knowledge of how to remotely control the instrument. It also provides full flexibility when configuring parameters and limits for the test items provided in the standard-specific R&S®CMWrun package options.

Intuitive and easy to use



Intuitive digital user interface

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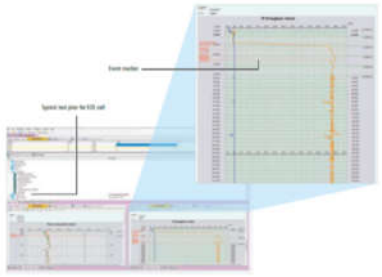
The R&S®CMW callbox is a base station emulator. It generates the signaling messaging and connects directly to the DUT. Depending on the IP data throughput (E2E performance), additional IP analyses across different layers are possible. These analyses reveal who generates how much and what E2E traffic, and how the traffic can be optimized for the various applications. The stability of the IP application can also be tested with specific IP impairments.

In parallel with the E2E performance measurements, the R&S®CMW can analyze the PHY and MAC layer throughput and measure RF parameters such as EVM and UL power.

R&S®CMWrun controls the R&S®CMW data application unit's (DAU) built-in IP services such as iPerf and FTP. All E2E setups are supported: with the DUT in a modem role, connected to client PC or as standalone DUT running the R&S®CMWrun APP for Android DUT automation with iPerf and FTP services.

This allows full automation when running E2E throughput tests. In the R&S®CMWrun graphical monitor, the same signaling and IP event markers described in the solution for battery life are also available for IP throughput testing and are time synchronized if both monitors, for current drain and IP throughput, are enabled in the test plan.



IP throughput testing with IP analysis, fully automated with R&S®CMWrun

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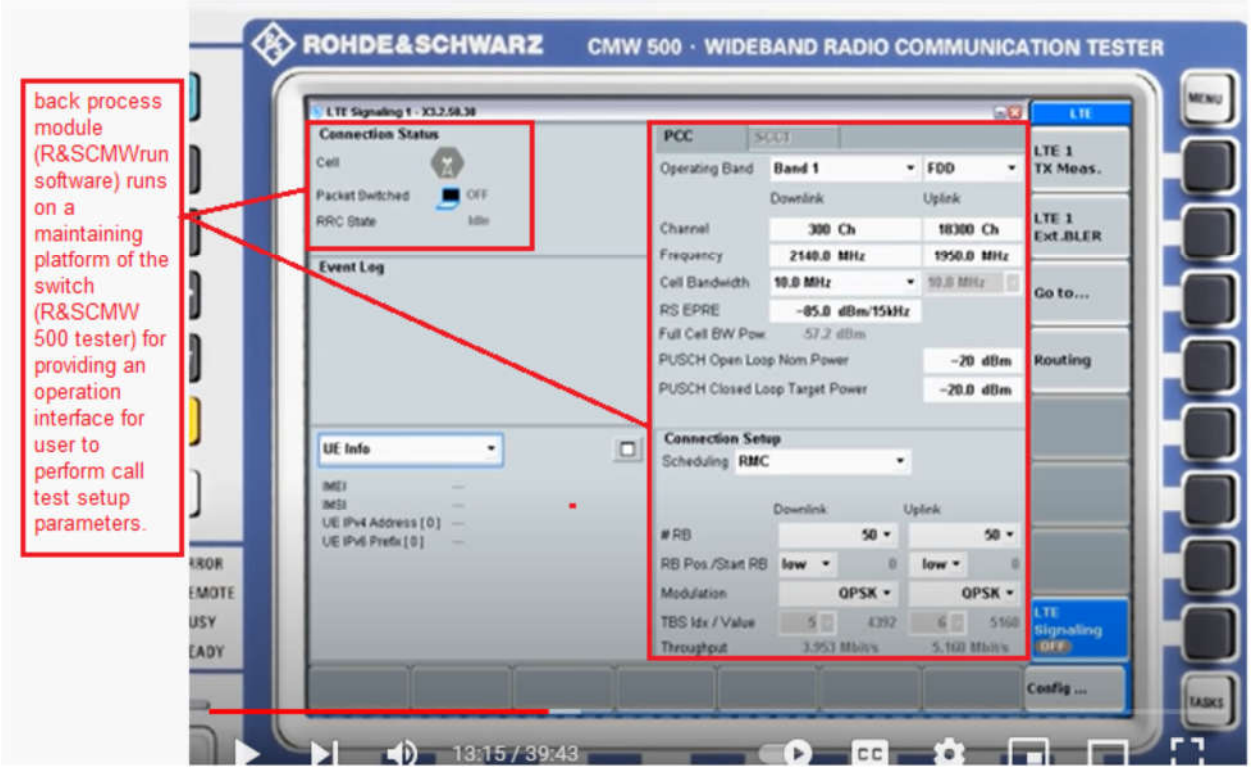

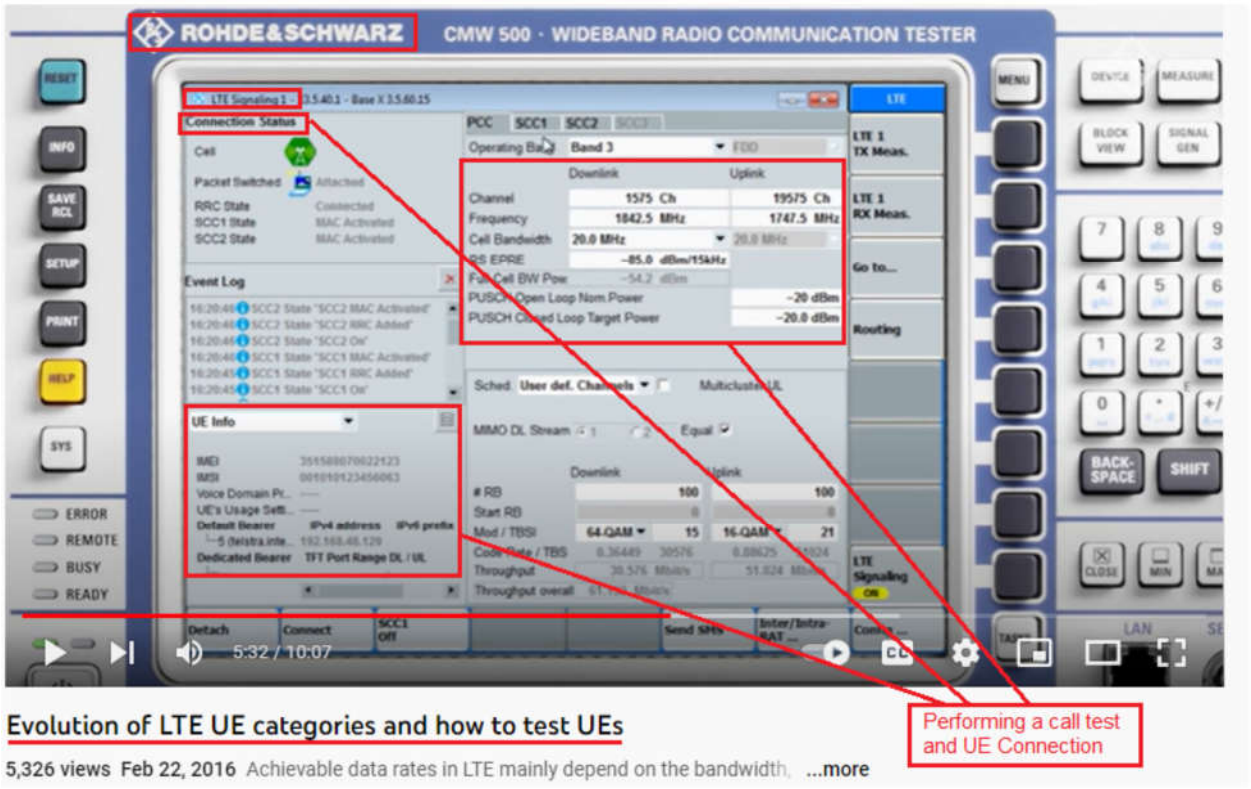

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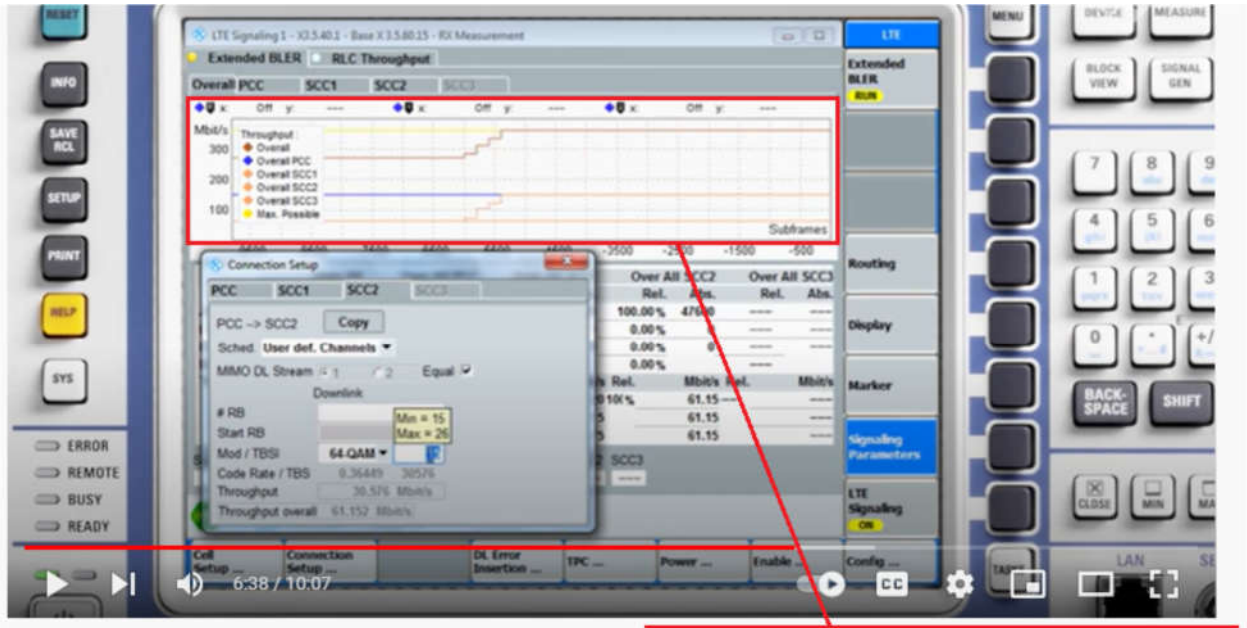

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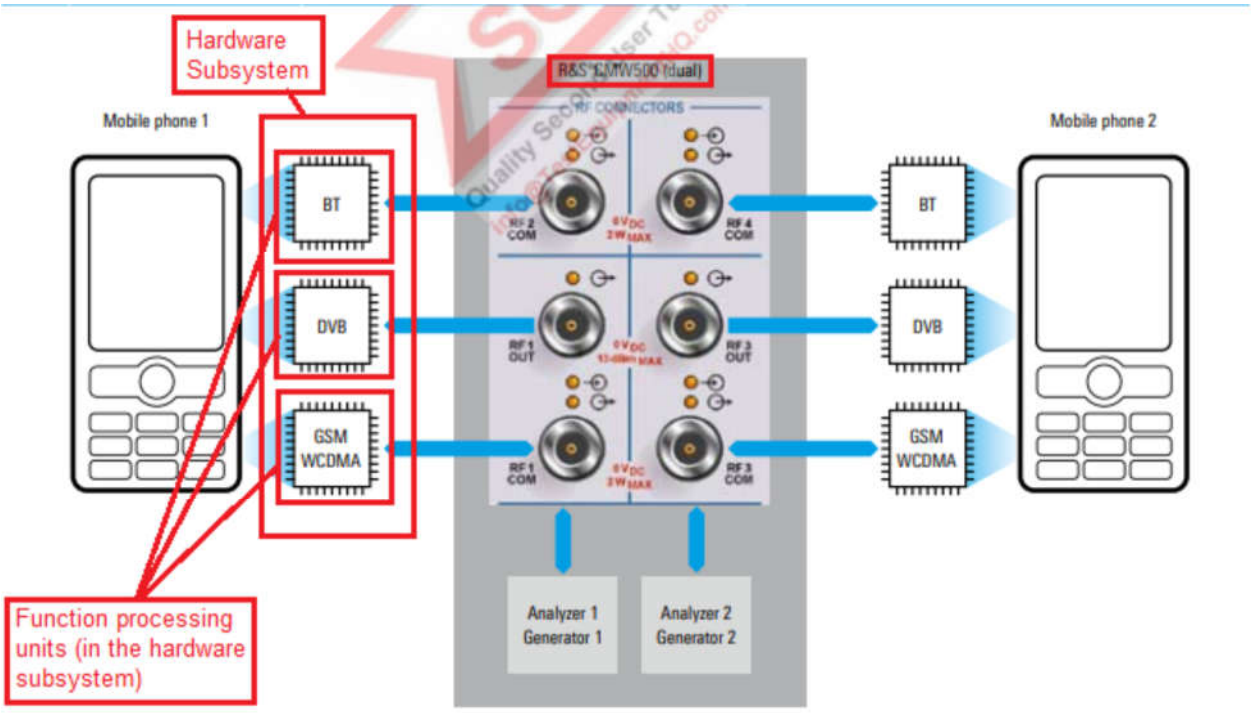

(*E.g.*, https://www.testequipmenthq.com/datasheets/Rohde-Schwarz-CMW500-Datasheet.pdf).

The R&S®CMW500 wideband radio communication tester comes with everything needed for testing VoLTE, VoWLAN and WLAN traffic offload functions on consumer devices. On the Data Application Unit, the tester provides all access technologies and all necessary servers, such as an ePDG and an IMS server.

It tests the handover between LTE and WLAN as well as single radio voice call continuity (SRVCC), i.e. the handover between LTE and legacy networks such as GSM and UMTS.

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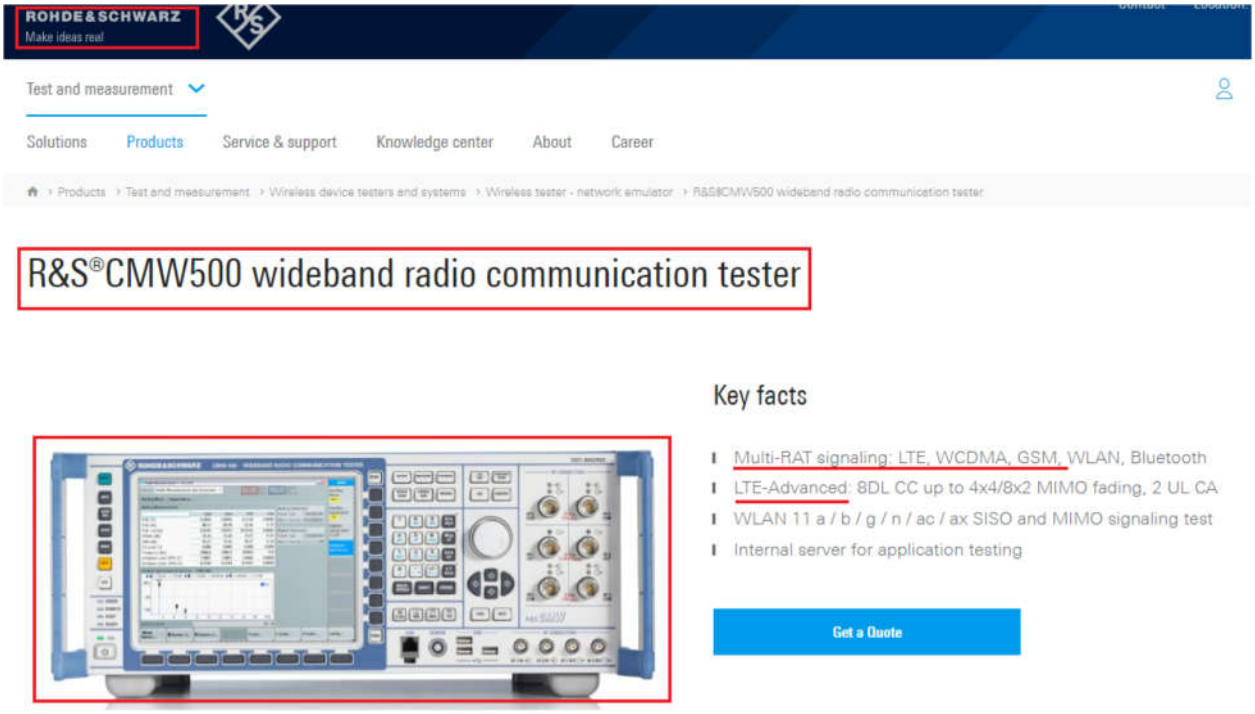
17. The Accused Instrumentality is a simulated user call test system that comprises the back process module (*e.g.,* a GUI-based R&SCMWrun software) runs on a maintaining platform (*e.g.,* R&SCMW Platform) of the switch (*e.g.,* the Accused Instrumentality) for providing an operation interface (*e.g.,* GUI) for a user to perform a call test setup (*e.g.,* to set various parameters such as frequency changes, control status, etc.), receives call test result data (*e.g.,* Overall status waveforms) transmitted by the front call control process module (*e.g.,* user equipment (UE)), and performs display and statistical processes (*e.g.,* display the result and statistical data on the display of the Accused Instrumentality). As shown below, the Accused Instrumentality is a part of the simulated user call test system which is a GUI-based R&SCMWrun software with the R&SCMW 500 tester. The Accused Instrumentality comprises back process module (*e.g.,* GUI-based R&SCMWrun software), a front call control process module (*e.g.,* user equipment (UE)) and a hardware subsystem (*e.g.,* Hardware) for performing a call test (*e.g.,* LTE signaling test). The back process module (*e.g.,* R&SCMWrun software) provides an operation interface for a user to perform a call test setup (setting various parameters for call test), receives call test result data (*e.g.,* result report) transmitted by the front call control process module (*e.g.,* user equipment (UE)), and displays the result on the display of the Accused Instrumentality. The front call control process module receives call test setup parameters provided by the R&SCMWrun software, controls the

hardware subsystem (Hardware Units in the Accused Instrumentality) to perform a call test, and reports a result of the call test to R&SCMWrun software. The hardware subsystem comprises function process units (hardware subsystem units as shown in below evidence) of the switch to receive instructions from the user equipment (UE), perform tests comprising performing a call, handover between LTE and WLAN; and report test results to the front call control process module.



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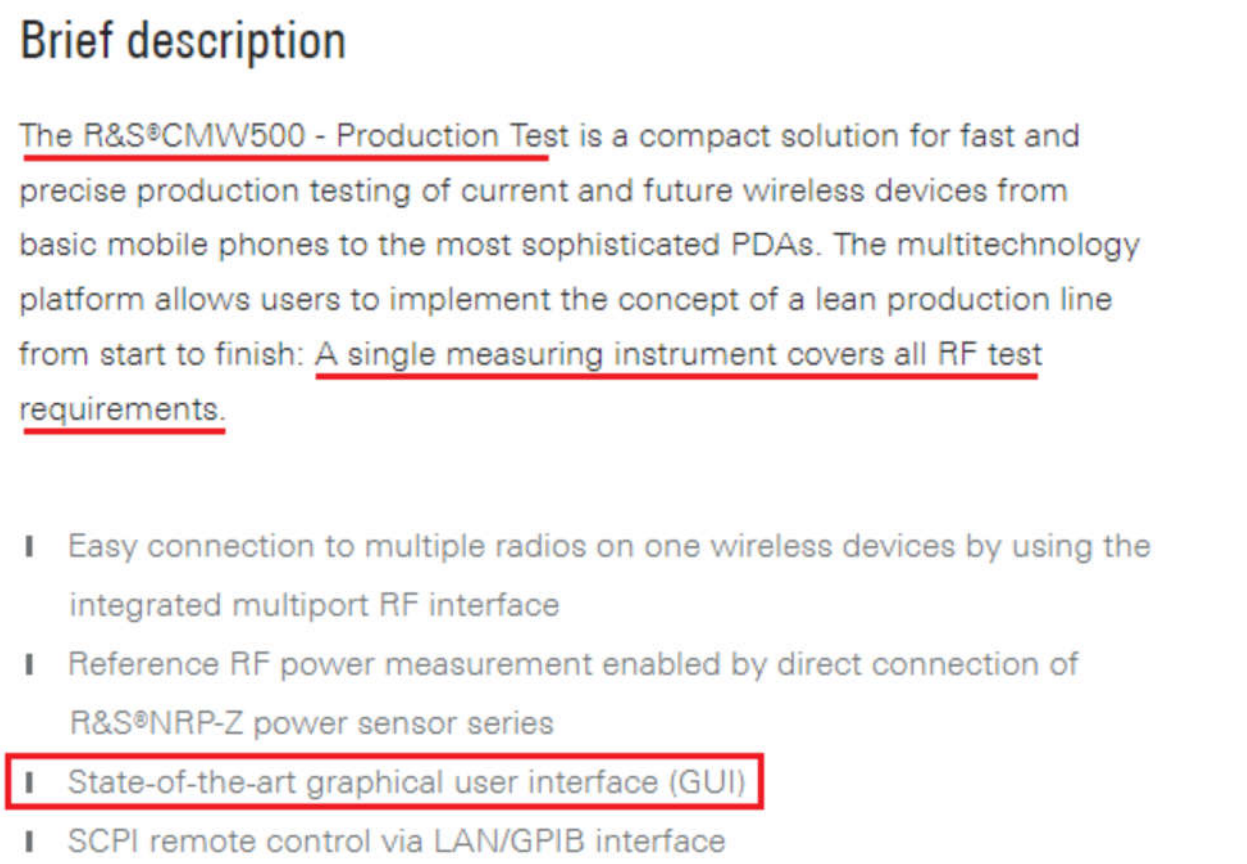

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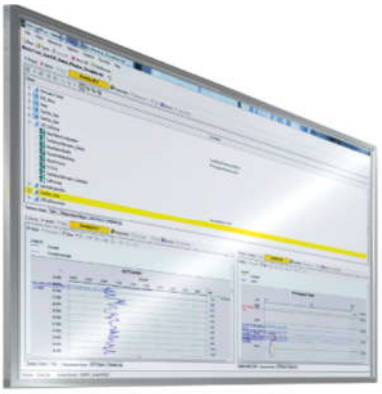

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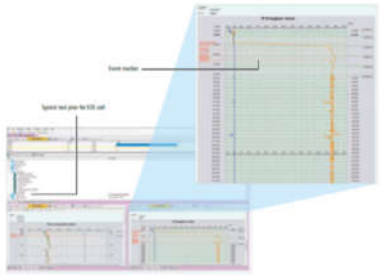

IP throughput testing with IP analysis, fully automated with R&S®CMWrun

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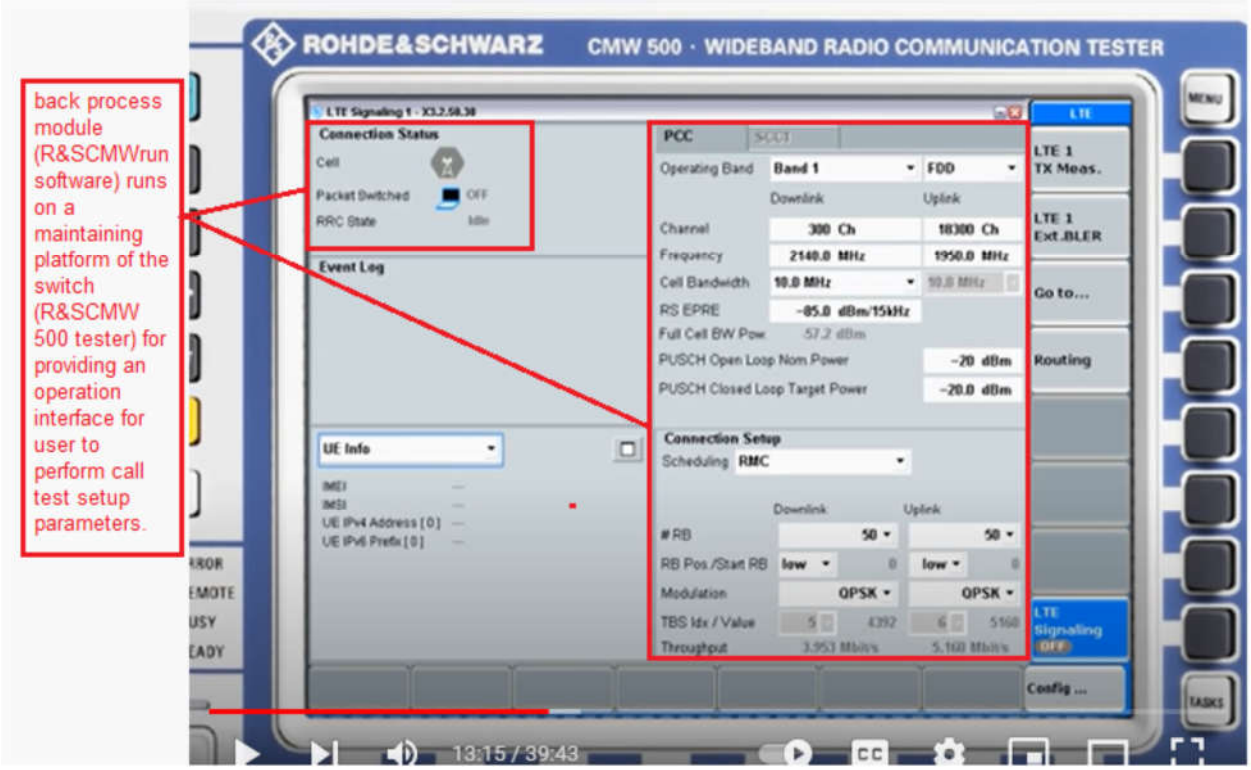

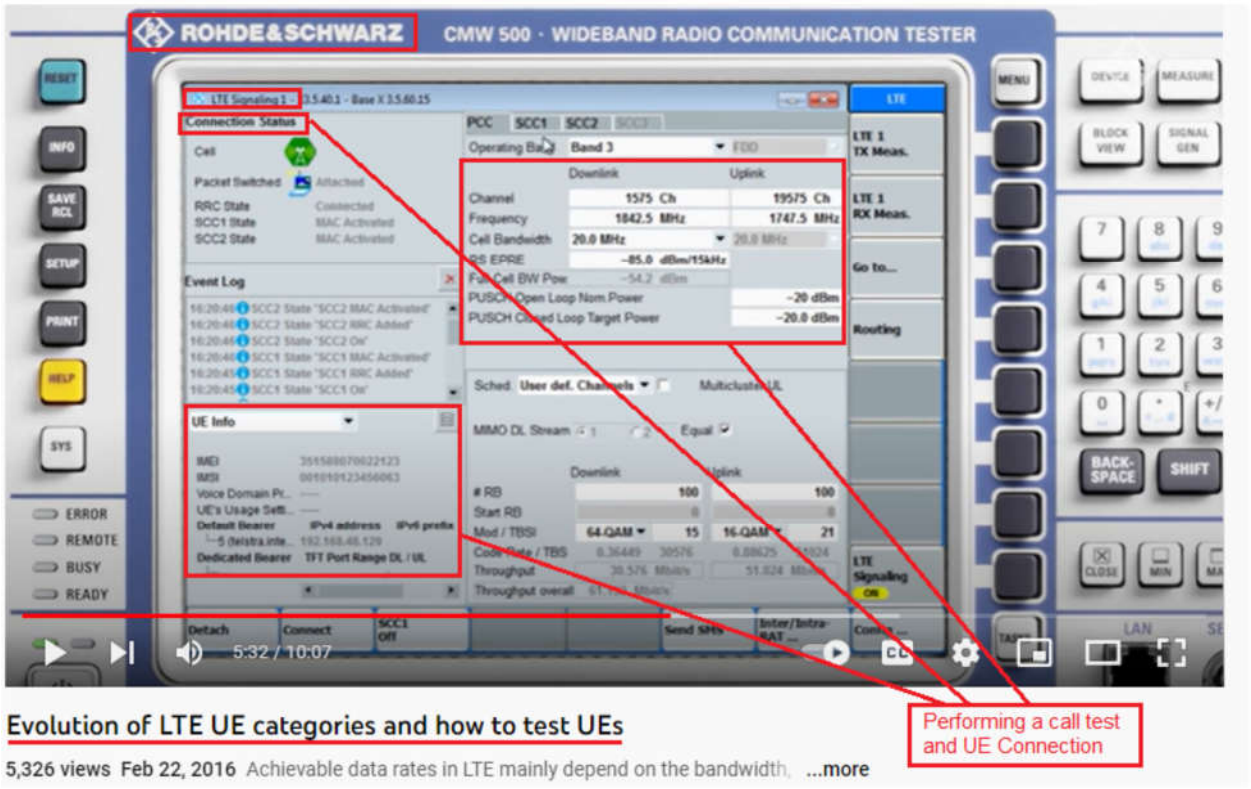

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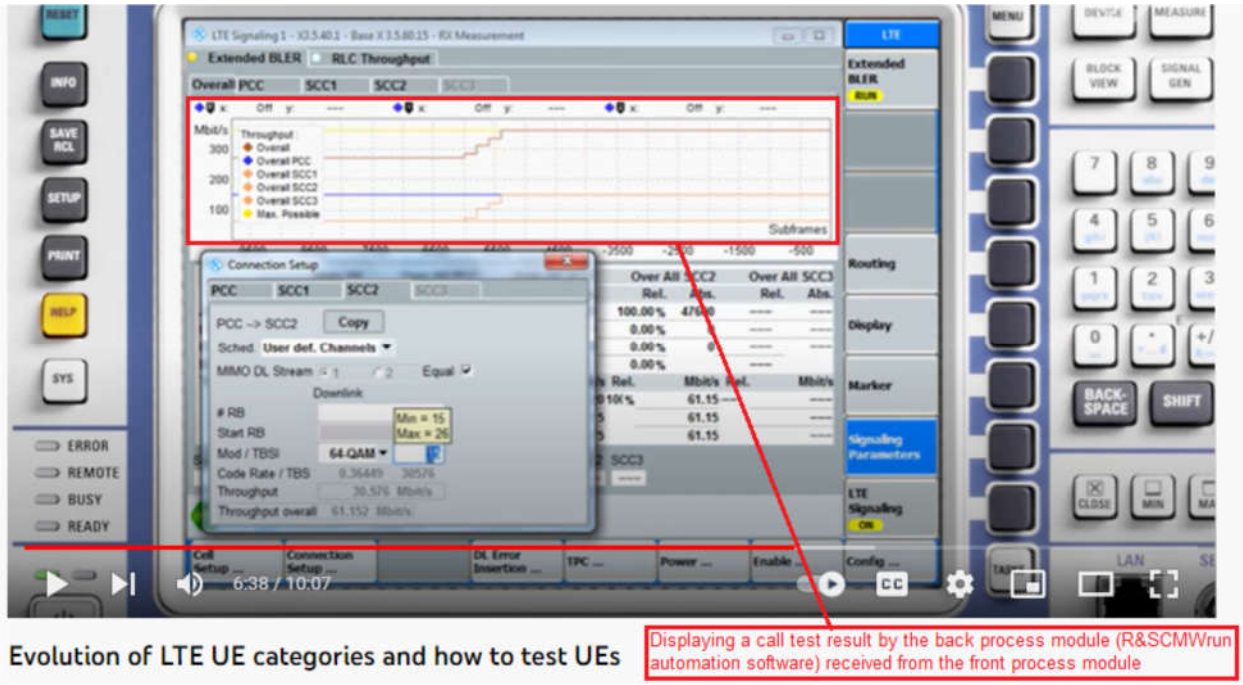

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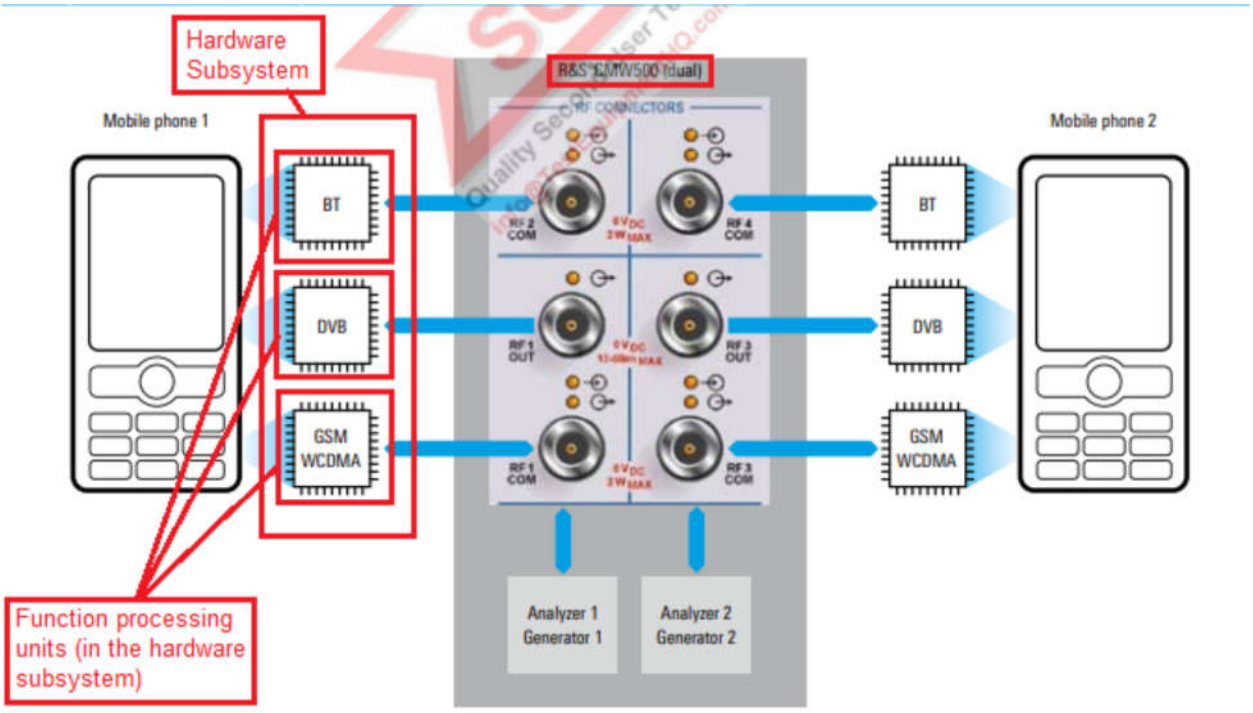

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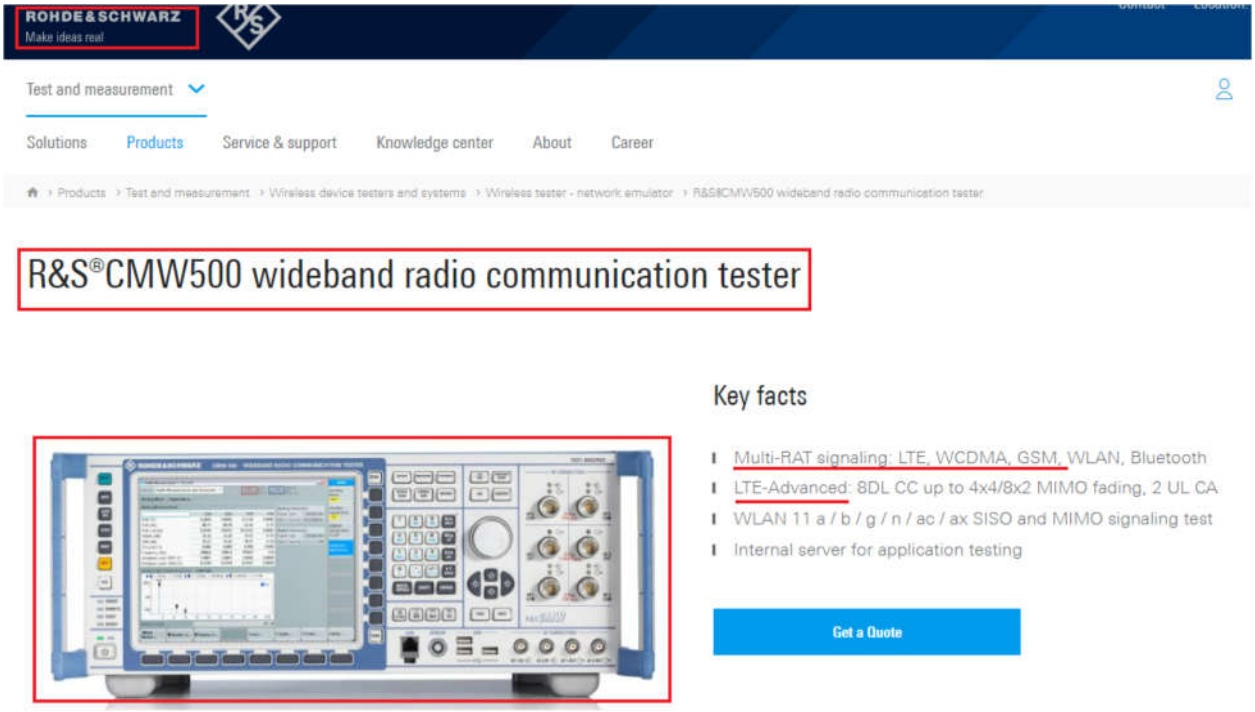
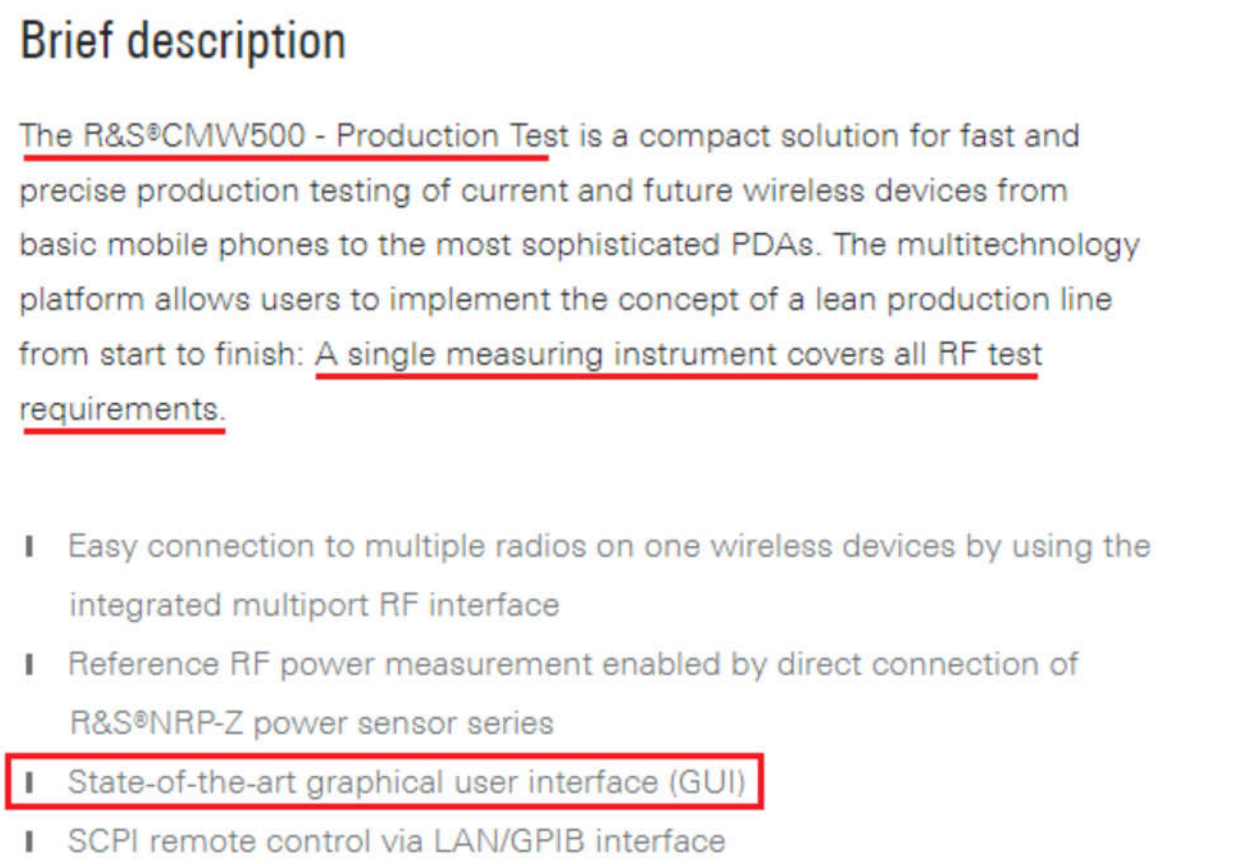
18. The Accused Instrumentality is a simulated user call test system that comprises the front call control process module (*e.g.,* user equipment (UE)) is included in a main control module of the switch (*e.g.,* the Accused Instrumentality) to receive call test setup parameters (*e.g.,* call test data containing various parameters, such as frequency changes, control status, etc.) provided by the back process module (*e.g.,* GUI-based R&SCMWrun software), control the hardware subsystem (*e.g.,* Hardware) to perform a call test process (*e.g.,* LTE call test) according to a flowchart and user parameters set (*e.g.*, various parameters, such as frequency changes, control status, etc.), and report a result of the call test to the back process module (*e.g.,* GUI-based R&SCMWrun software). As shown below, the Accused Instrumentality is a part of the simulated user call test system which is a GUI-based R&SCMWrun software with the R&SCMW 500 tester. The Accused Instrumentality comprises back process module (*e.g.,* GUI-based R&SCMWrun software), a front call control process module (*e.g.,* user equipment (UE)) and a hardware subsystem (*e.g.,* hardware) for performing a call test (*e.g.,* LTE signaling test). The back process module (*e.g.,* R&SCMWrun software) provides an operation interface for a user to perform a call test setup (setting various parameters for call test), receives call test result data (*e.g.,* result analysis) transmitted by the front call control process module (*e.g.,* user equipment (UE)), and displays the result on the display of the Accused Instrumentality. The front call control process

module receives call test setup parameters provided by the R&SCMWrun software, controls the hardware subsystem (Hardware Units in the Accused Instrumentality) to perform a call test, and reports a result of the call test to R&SCMWrun software. The hardware subsystem comprises function process units of the switch to receive instructions from the user equipment (UE), perform tests comprising performing a call, handover between LTE and WLAN; and report test results to the front call control process module.



(*E.g.*, https://www.rohde-schwarz.com/in/products/test-and-measurement/wireless-tester-network-emulator/rs-cmw500-wideband-radio-communication-tester_63493-10844.html).



Brief description

The R&S®CMW500 - Production Test is a compact solution for fast and precise production testing of current and future wireless devices from basic mobile phones to the most sophisticated PDAs. The multitechnology platform allows users to implement the concept of a lean production line from start to finish: A single measuring instrument covers all RF test requirements.

- Easy connection to multiple radios on one wireless devices by using the integrated multiport RF interface
- Reference RF power measurement enabled by direct connection of R&S®NRP-Z power sensor series
- State-of-the-art graphical user interface (GUI)
- SCPI remote control via LAN/GPIB interface

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T&M solution

When the test focus is on preconformance RF testing in line with the specification rather than validation testing, the right choice is the R&S®CMW500 RF tester, remotely controlled by R&S®CMWrun

Using a standalone R&S®CMW500, and with just a few configuration clicks for bands, channels and bandwidth, the tool provides a comprehensive result report that gives the user a first impression of in-band compliance. This provides beneficial knowledge in the very early stage of verification, before doing more complex system tests or validation.

(*E.g.*, https://www.rohde-schwarz.com/in/applications/r-s-cmwrun-rf-preconformance-testing-solution-application-card_56279-106882.html).

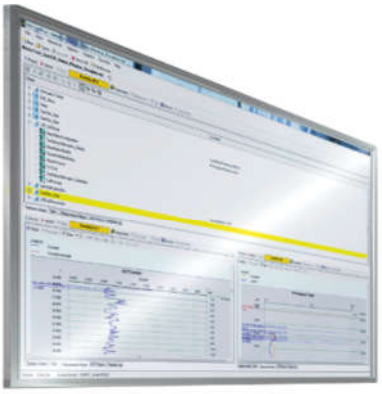
At a glance

The automation tool for the R&S®CMW platform

Today the R&S®CMW is the leading, most popular multistandard platform for UE testing. It is used by network operators, test houses, handset vendors and chipset manufacturers alike. The R&S®CMWrun automation software meets all requirements for executing remote control test sequences on the R&S®CMW in R&D, quality assurance, production and service for both current and future wireless equipment.

The software engine is based on the execution of test DLLs (plug-in assemblies). This architecture allows easy and straightforward configuration of test sequences without requiring specific programming knowledge of how to remotely control the instrument. It also provides full flexibility when configuring parameters and limits for the test items provided in the standard-specific R&S®CMWrun package options.

Intuitive and easy to use



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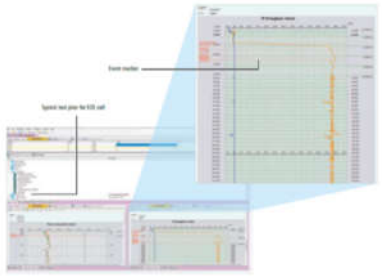
The R&S®CMW callbox is a base station emulator. It generates the signaling messaging and connects directly to the DUT. Depending on the IP data throughput (E2E performance), additional IP analyses across different layers are possible. These analyses reveal who generates how much and what E2E traffic, and how the traffic can be optimized for the various applications. The stability of the IP application can also be tested with specific IP impairments.

In parallel with the E2E performance measurements, the R&S®CMW can analyze the PHY and MAC layer throughput and measure RF parameters such as EVM and UL power.

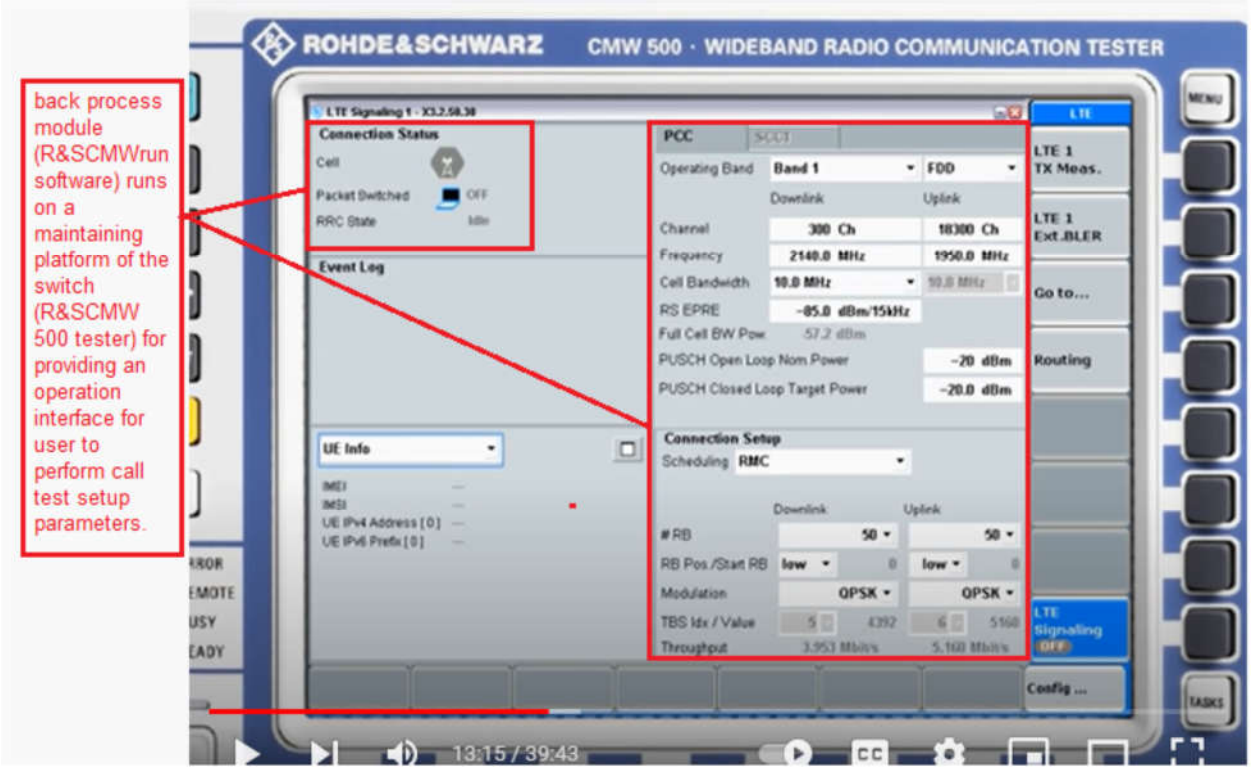
R&S®CMWrun controls the R&S®CMW data application unit's (DAU) built-in IP services such as iPerf and FTP. All E2E setups are supported: with the DUT in a modem role, connected to client PC or as standalone DUT running the R&S®CMWrun APP for Android DUT automation with iPerf and FTP services.

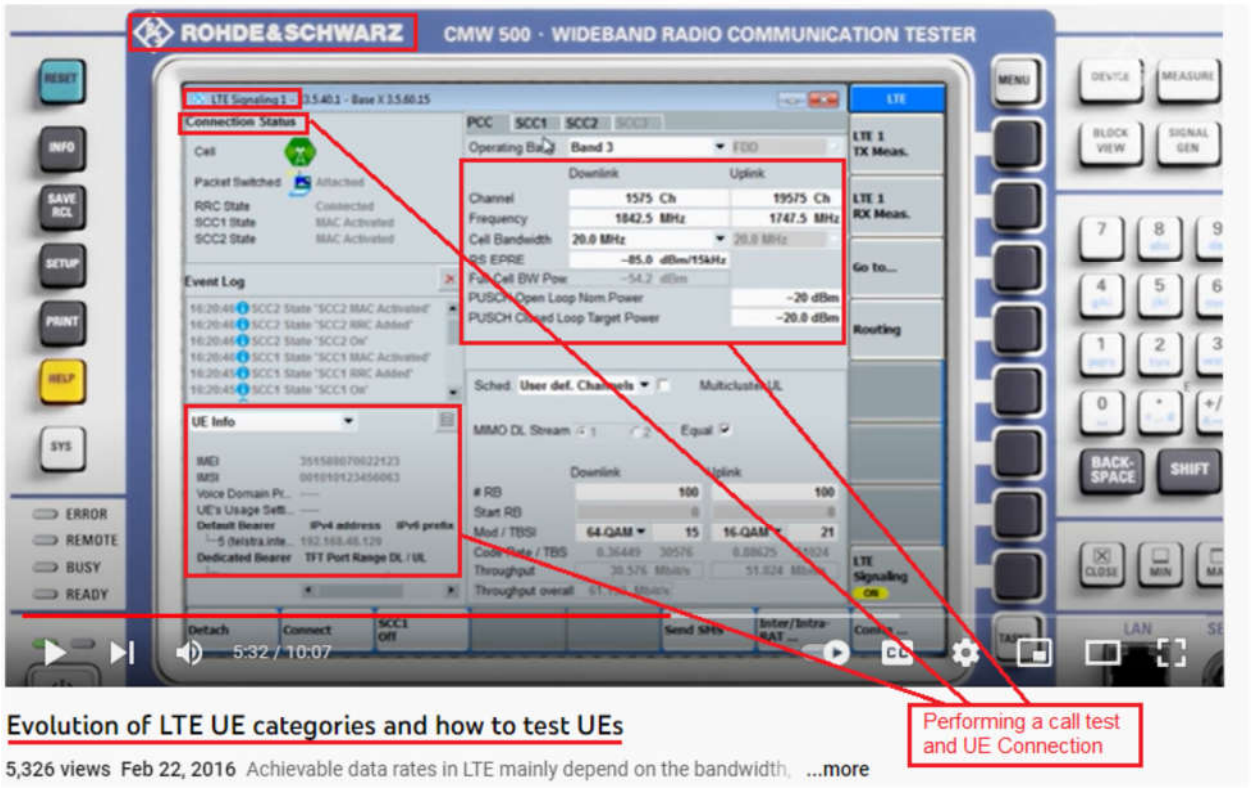
This allows full automation when running E2E throughput tests. In the R&S®CMWrun graphical monitor, the same signaling and IP event markers described in the solution for battery life are also available for IP throughput testing and are time synchronized if both monitors, for current drain and IP throughput, are enabled in the test plan.



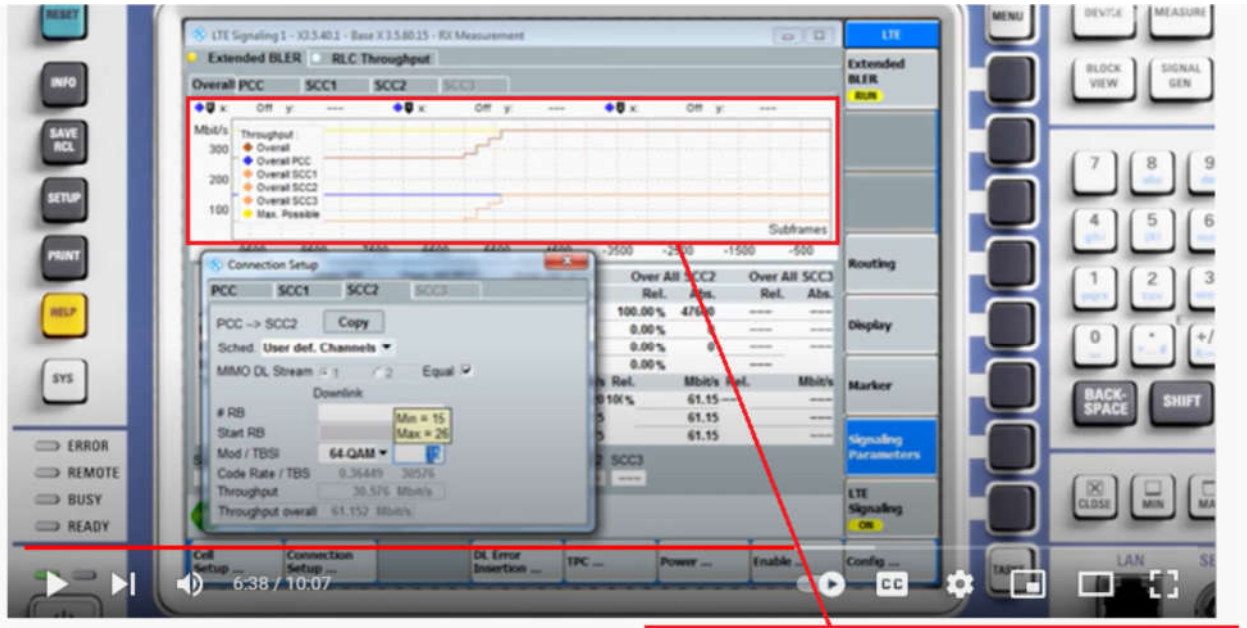
IP throughput testing with IP analysis, fully automated with R&S®CMWrun

(*E.g.*, https://www.rohde-schwarz.com/in/applications/r-s-cmwrun-ip-throughput-testing-application-card_56279-201024.html).

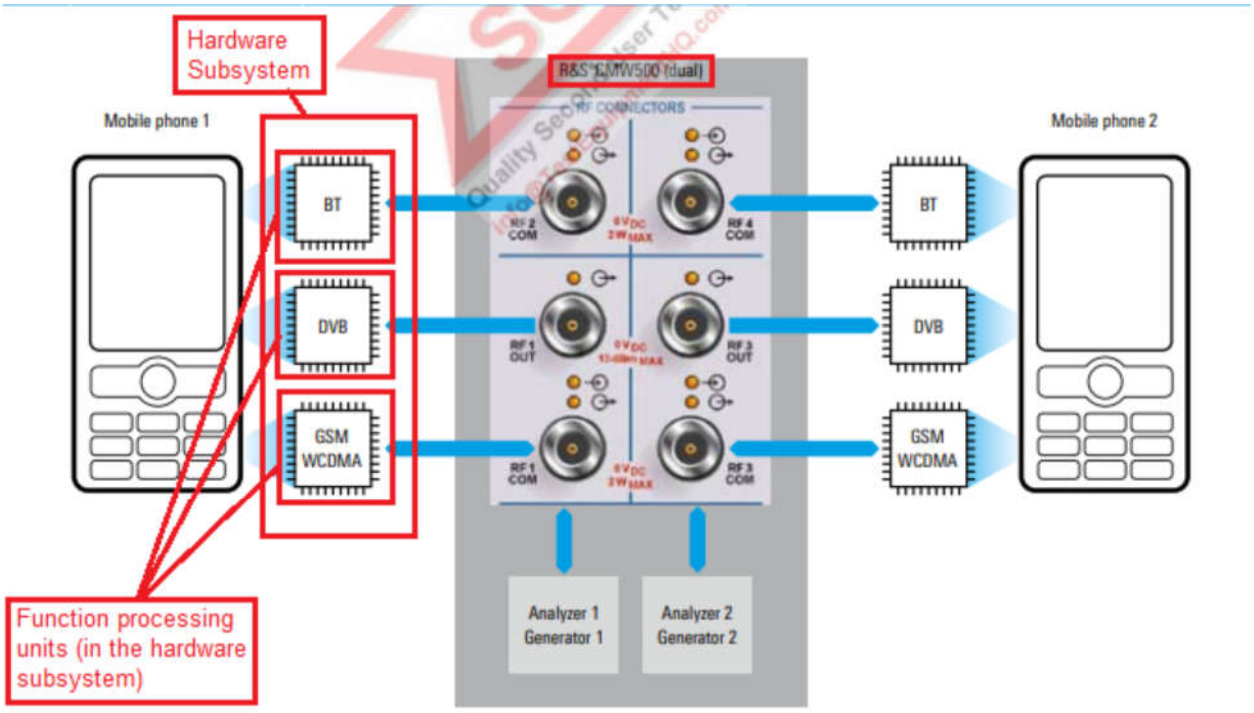




(*E.g.*, https://www.youtube.com/watch?v=SrBKna0w2WM).



(*E.g.*, https://www.youtube.com/watch?v=1l8T_E72rRc).



(*E.g.*, https://www.testequipmenthq.com/datasheets/Rohde-Schwarz-CMW500-Datasheet.pdf).

The R&S®CMW500 wideband radio communication tester comes with everything needed for testing VoLTE, VoWLAN and WLAN traffic offload functions on consumer devices. On the Data Application Unit, the tester provides all access technologies and all necessary servers, such as an ePDG and an IMS server.

It tests the handover between LTE and WLAN as well as single radio voice call continuity (SRVCC), i.e. the handover between LTE and legacy networks such as GSM and UMTS.

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19. The Accused Instrumentality is a simulated user call test system that comprises a hardware subsystem (*e.g.,* Hardware) that comprises function process units of the digital stored program control switch (*e.g.,* the Accused Instrumentality) to receive instructions from the front call control process module (*e.g.,* user equipment (UE)), perform tests comprising at least one of the following: picking-up or hanging-up phones, detecting signaling tone, dialing, sending a test tone, or talking (see below evidence of use showing handover configuration); and report test results (*e.g.*, result report) to the front call control process module (*e.g.,* user equipment (UE)), and wherein the hardware subsystem further comprises a loop relay panel (*e.g.,* display of the R&SCMW 500 tester) used for simulating picking-up or hanging-on a phone in a calling (*e.g.,* handover) or called user terminal and dial function of dial pulse form by the calling user. As shown below, the Accused Instrumentality is a part of the simulated user call test system which is a GUI-based R&SCMWrun software with the R&SCMW 500 tester. The Accused Instrumentality comprises back process module (*e.g.,* GUI-based R&SCMWrun software), a front call control process module (*e.g.,* user equipment (UE)) and a hardware subsystem (*e.g.,* Hardware) for performing a call test (*e.g.,* call tests for LTE signalling test). The back process module (*e.g.,* R&SCMWrun software) provides an operation interface for a user to perform a call test setup (setting various parameters for call test), receives call test result data (*e.g.,* result report) transmitted

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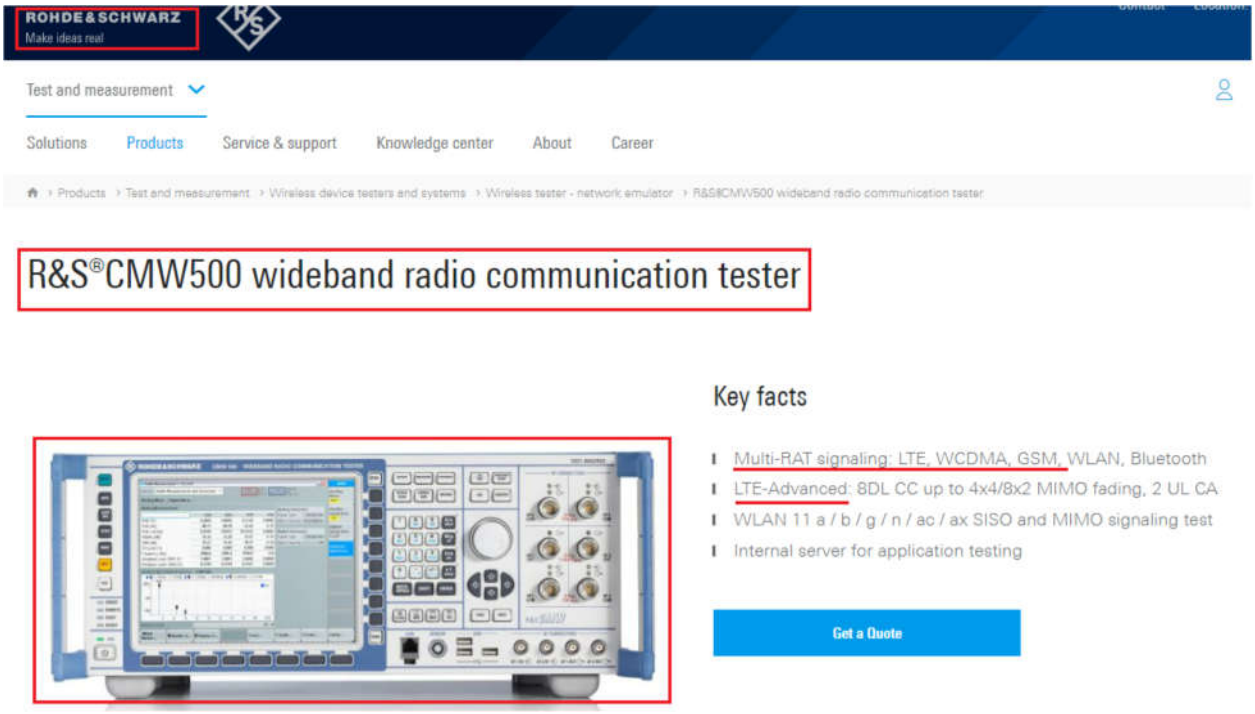

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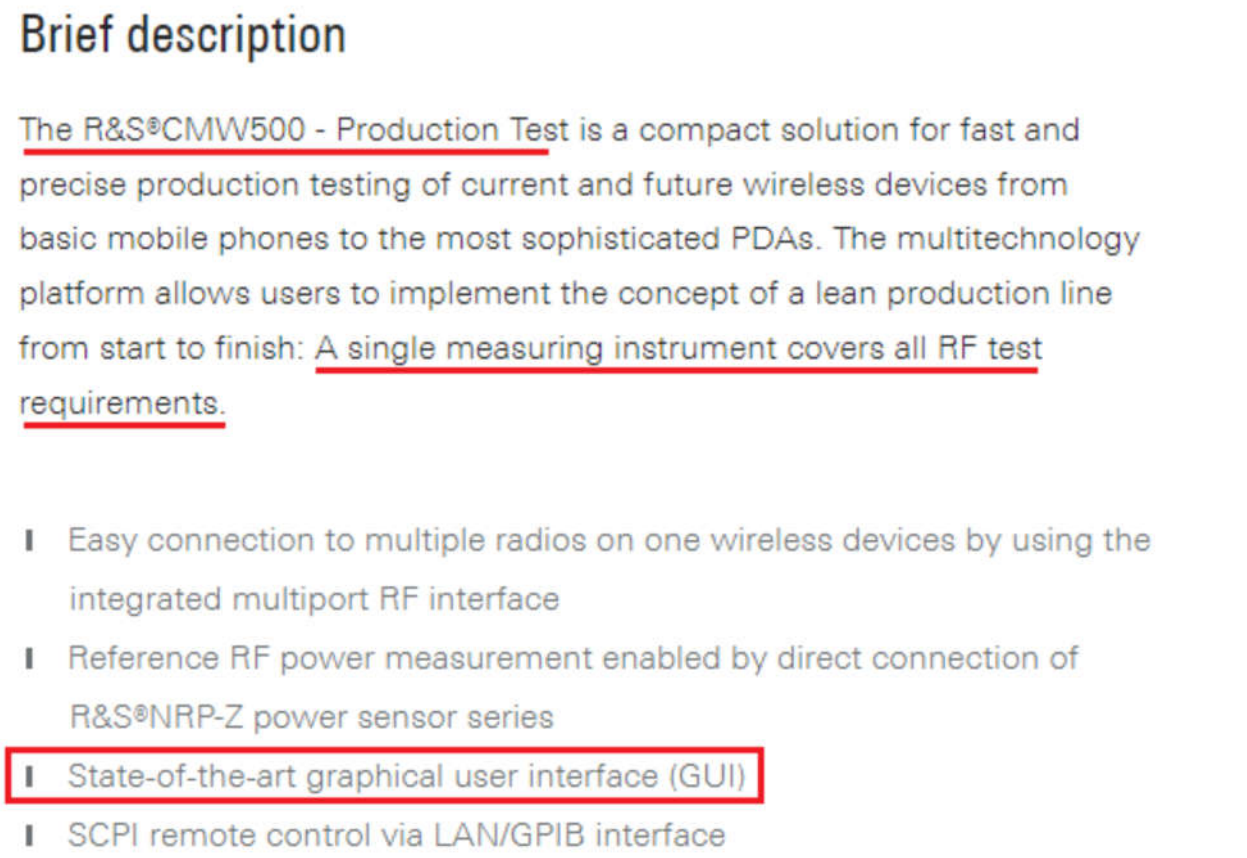

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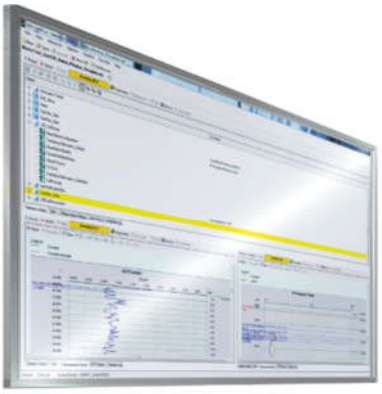

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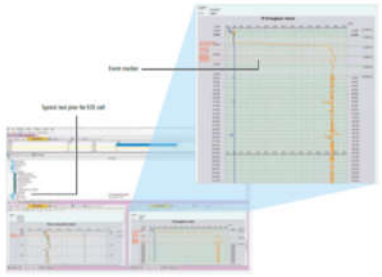

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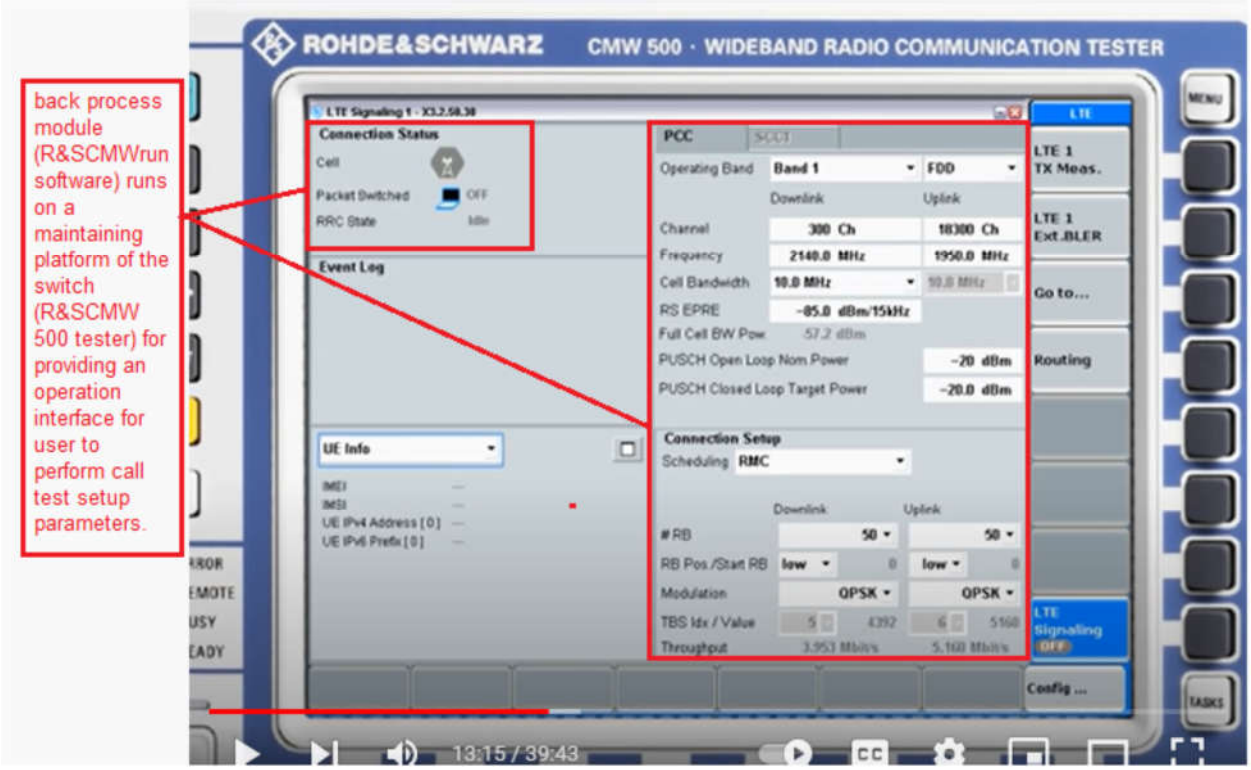

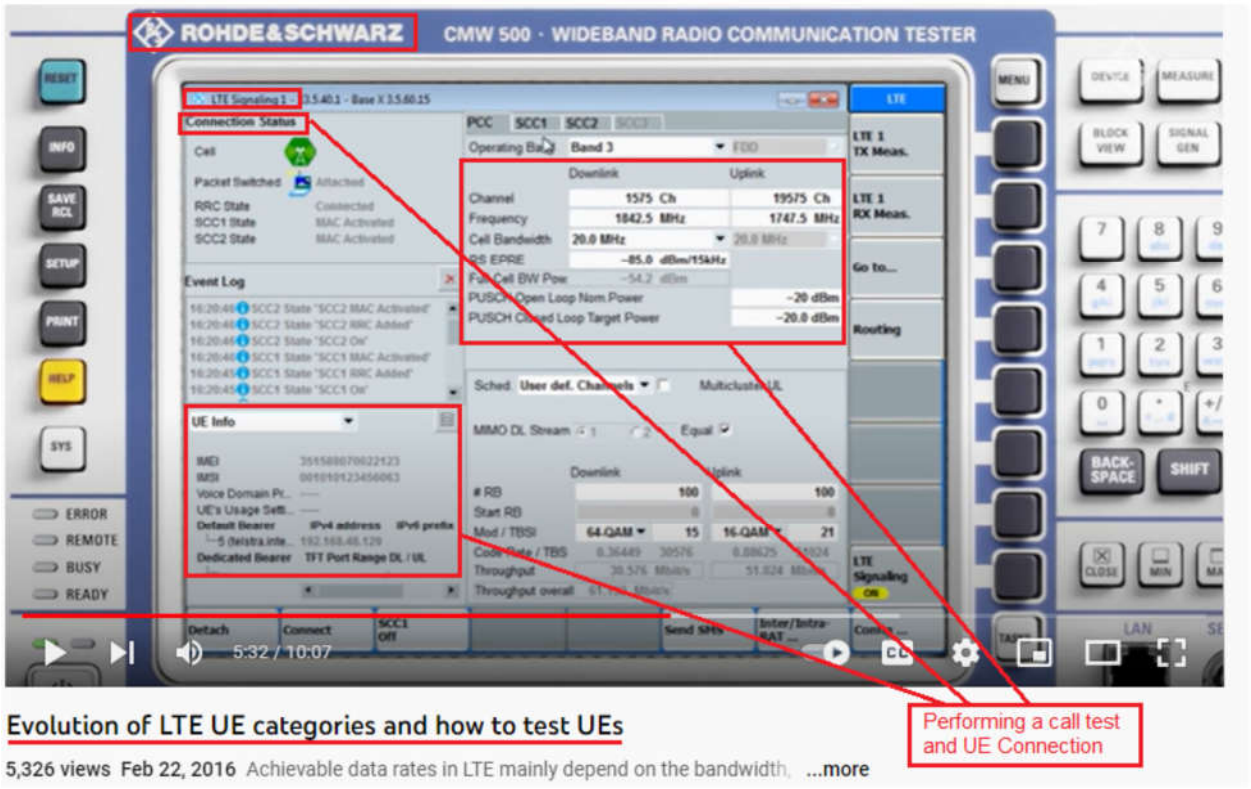

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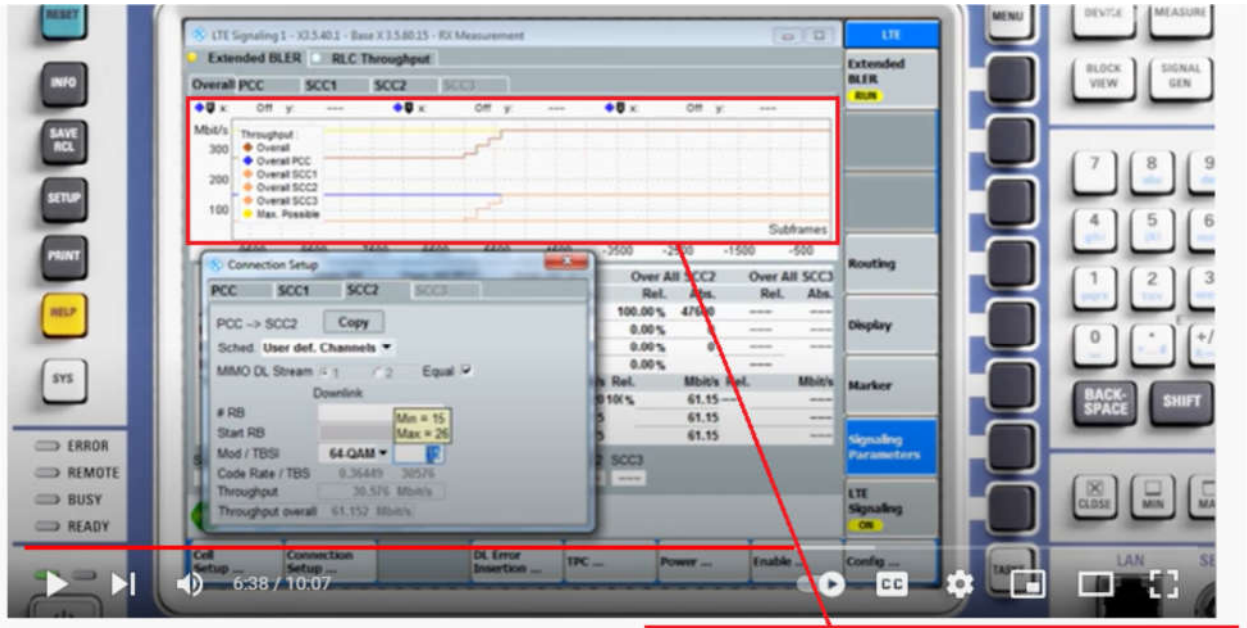

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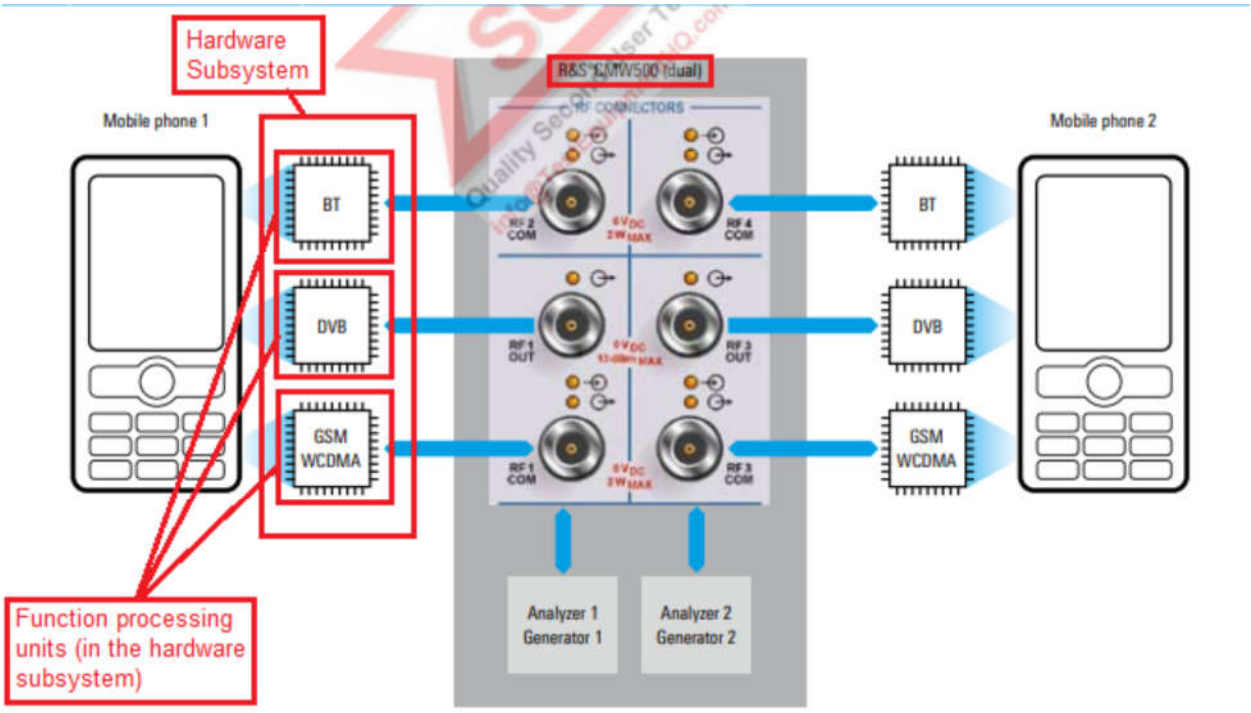

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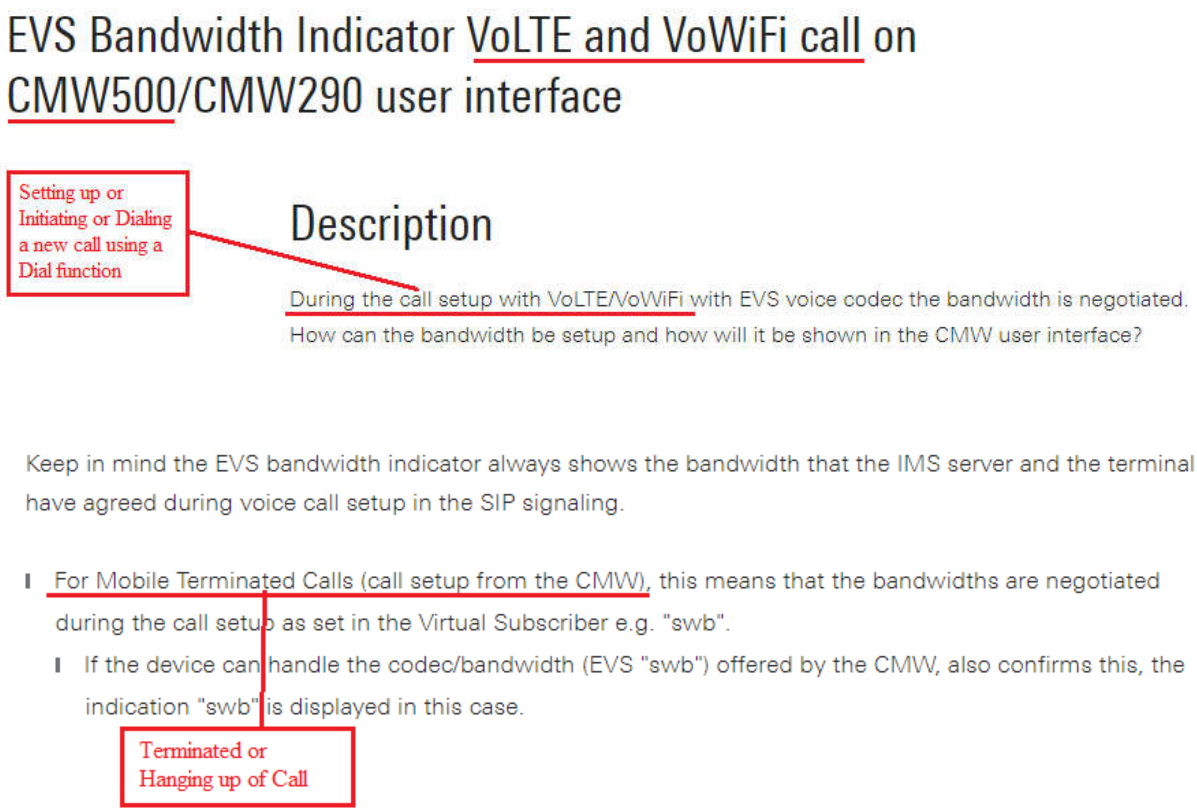
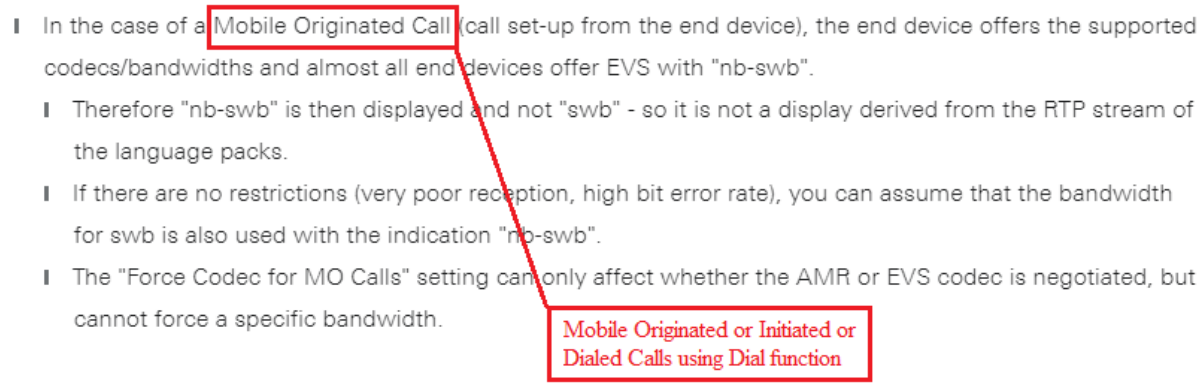


(*E.g.*, https://www.rohde-schwarz.com/cz/faq/evs-bandwidth-indicator-volte-and-vowifi-call-on-cmw500-cmw290-user-interface-faq_78704-1185664.html).



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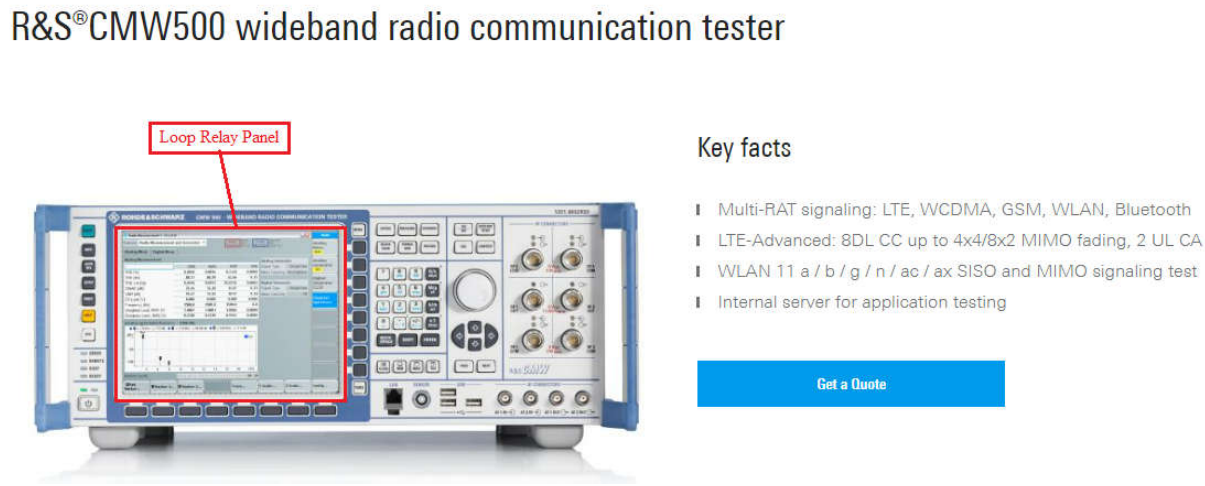


(*E.g.*, https://www.rohde-schwarz.com/in/products/test-and-measurement/wireless-tester-network-emulator/rs-cmw500-wideband-radio-communication-tester_63493-10844.html).

IV. COUNT II
(PATENT INFRINGEMENT OF UNITED STATES PATENT NO. 9,179,339)

20. Plaintiff incorporates the above paragraphs herein by reference.

21. On November 3, 2015, United States Patent No. 9,179,339 ("the '339 Patent") was duly and legally issued by the United States Patent and Trademark Office. The '339 Patent is titled "Method and System for Testing the Wireless Signal Propagation Model of the Cellular Network."

A true and correct copy of the '339 Patent is attached hereto as Exhibit B and incorporated herein by reference.

22. Prestwick is the assignee of all right, title, and interest in the '339 patent, including all rights to enforce and prosecute actions for infringement and to collect damages for all relevant times against infringers of the '339 Patent. Accordingly, Prestwick possesses the exclusive right and standing to prosecute the present action for infringement of the '339 Patent by Defendant.

23. The invention in the '339 Patent relates to the field of communication and more particularly to a method and system for testing the wireless signal propagation of the cellular network. (Ex. B at 1:17-19).

24. Cellular networking is one of the most common networking mode in the wireless communication. (*Id.* at 1:23-24). A cellular network is constructed of base stations in which the coverage area of a base station is called a cell. (*Id.* at 1:24-32). In the coverage area of the cell, a terminal can establish a wireless communication link with the base station. (*Id.* at 1:32-34). Multiple base station transceivers form a network to continually cover an area so to provide a user terminal with seamless wireless communication service within the network. (*Id.* at 1:34-36). When planning a network, the provider looks at the user requirements, including designed capacity, coverage range and rate, and network performance. (*Id.* at 1:37-41). When the designed requirement is clear, it comes to the requirement analysis of the wireless network design, including the prediction of the coverage radius of the coverage area and the analysis of the distribution of the user capacity. (*Id.* at 1:41-45). The capacity distribution of the coverage area means to determine the equipment configuration and the size of the coverage radius of the cell according to the potential of the user development in the network coverage area. (*Id.* at 1:45-48). The original

design 206 of the network topology structure is completed on the map by combining the two factors, *i.e.*, the network coverage and the user distribution. (*Id.* at 1:48-51).

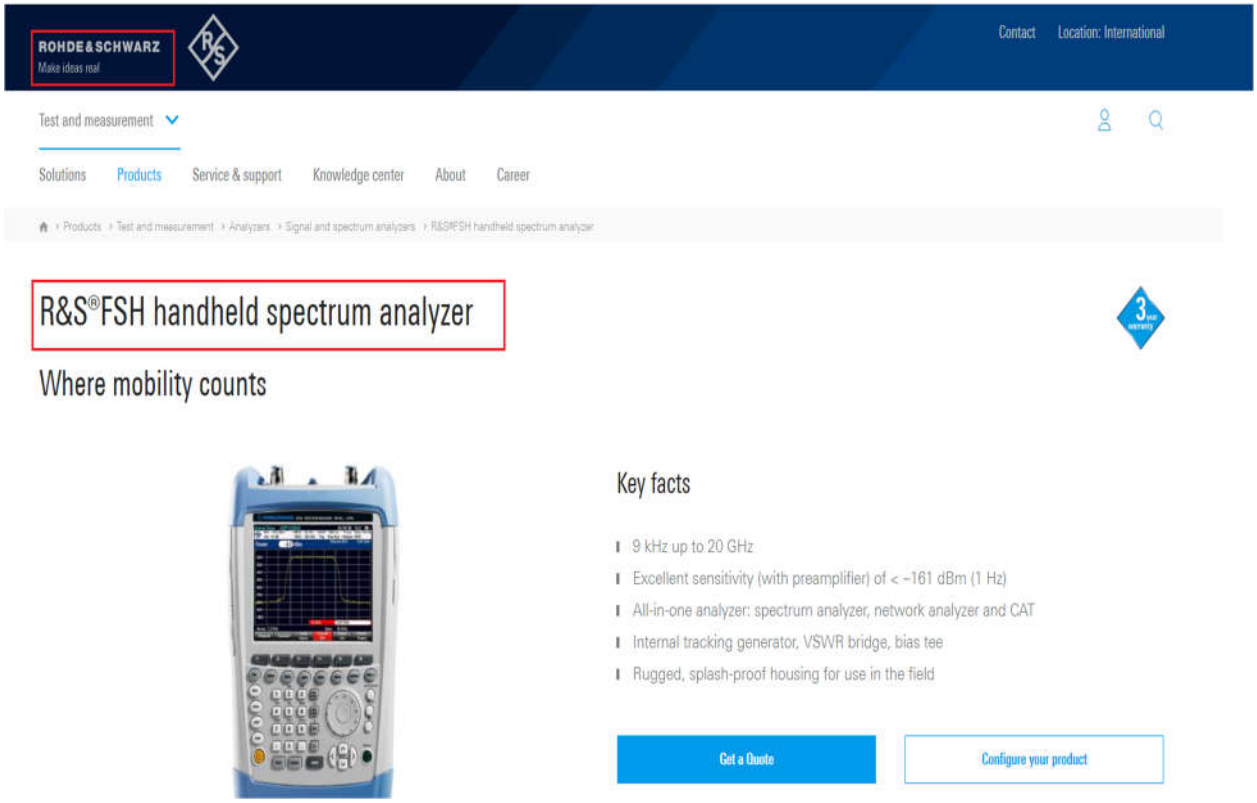
25. A site survey is then performed to help select the appropriate base station sites in the actual coverage environment. (*Id.* at 1:52-54). After the site survey, the provider has basically ascertained which sites possess the essential conditions for establishing the base stations. (*Id.*at 1:57-61).

26. After the sites are selected, it is necessary to use a network simulation to verify whether the network design requirement is satisfied and adjust the site parameters on the simulation platform to find the appropriate site places. (*Id.* at 1:61-67). A signal propagation model is used for the traditional cell coverage prediction and is usually needed to correct for typical topographic and geomorphologic environments. (*Id.* at 2:2-11). A propagation model correction is also used, which corrects the wireless propagation model by collecting sufficient field strength testing data through selecting the typical sites with respect to the typical topography and geomorphology (multiple testing sites are usually needed to be selected such that the testing data covers various topography, geomorphology, and site heights). (*Id.* at 2:2-5, 12-14, 38-44). The more testing sites in an area, the better the model correction effect is (multiple parameters in the model are corrected and the parameters corresponding to various geomorphology are corrected). (*Id.* at 2:45-49). When testing the wireless signal field strength, transmission apparatus need to be installed in sequence at each testing site in the testing area, and the receiving field strength of the wireless signal is tested for the coverage area of each site in sequence. (*Id.* at 2:50-54). If n sites are to be tested, the apparatus installation and the testing need to be performed n times, which results in quite large workload. (*Id.* at 2:54-56).

27. In view of this problem, the inventors therefore invented a system for testing the wireless propagation model to address the problem of the heavy workload caused by repeated installing of the transmission apparatus and testing the receiving field strength at each testing site in the testing area in the prior art. (*Id.* at 2:60-65).

28. **Direct Infringement.** Upon information and belief, Defendant has been directly infringing claim 4 of the '339 Patent in Texas, and elsewhere in the United States, by making, using, selling, and or offering to sell the Rohde & Schwarz R&S®FSH Handheld spectrum analyzer ("Accused System").

29. The Accused System is a system for testing wireless signal field strength of a cellular network (*e.g.,* GSM, LTE, CDMA, etc.).



(*E.g.*, https://www.rohde-schwarz.com/products/test-and-measurement/handheld/rs-fsh-handheld-spectrum-analyzer_63493-8180.html?change_c=true).

R&S®FSH4 Order number 1309.6000.04	9 kHz - 3.6 GHz	–127 dBc (1 Hz) (f = 500 MHz, 1 MHz offset)	–163 dBm	-	Signal and spectrum analyzer	Price On Request	Get a Quote
R&S®FSH4 Order number 1309.6000.14	9 kHz - 3.6 GHz	–127 dBc (1 Hz) (f = 500 MHz, 1 MHz offset)	–163 dBm	-	Signal and spectrum analyzer	Price On Request	Get a Quote
R&S®FSH4 Order number 1309.6000.24	100 kHz - 3.6 GHz	–127 dBc (1 Hz) (f = 500 MHz, 1 MHz offset)	–163 dBm	-	Combinati on analyzer	Price On Request	Get a Quote

Multi-purpose analyzer

The R&S®FSH handheld spectrum analyzer has all the essential functions for indoor and outdoor applications:

- Installation and maintenance of transmitter stations
- Analysis of transmit signals (LTE, NB-IoT, TD-SCDMA, WCDMA, CDMA, GSM, etc.)
- Channel power and spurious emission measurements
- Cable and antenna measurements
- Scalar or vector network analysis
- Interference analysis
- Field strength measurements
- EMI diagnostics in the lab or in service

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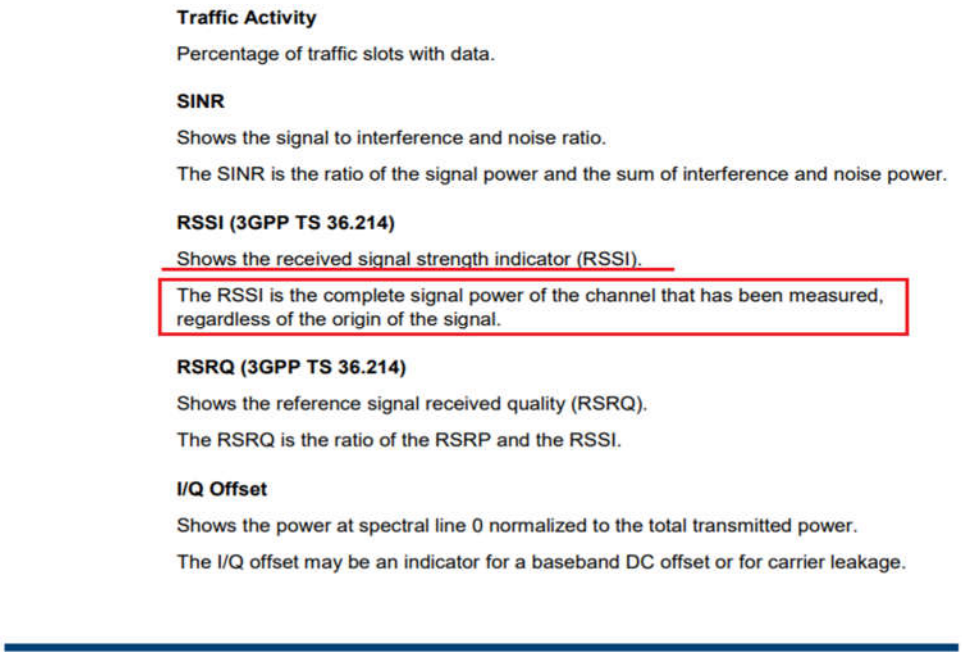


Traffic Activity

Percentage of traffic slots with data.

SINR

Shows the signal to interference and noise ratio.

The SINR is the ratio of the signal power and the sum of interference and noise power.

RSSI (3GPP TS 36.214)

Shows the received signal strength indicator (RSSI).

The RSSI is the complete signal power of the channel that has been measured, regardless of the origin of the signal.

RSRQ (3GPP TS 36.214)

Shows the reference signal received quality (RSRQ).

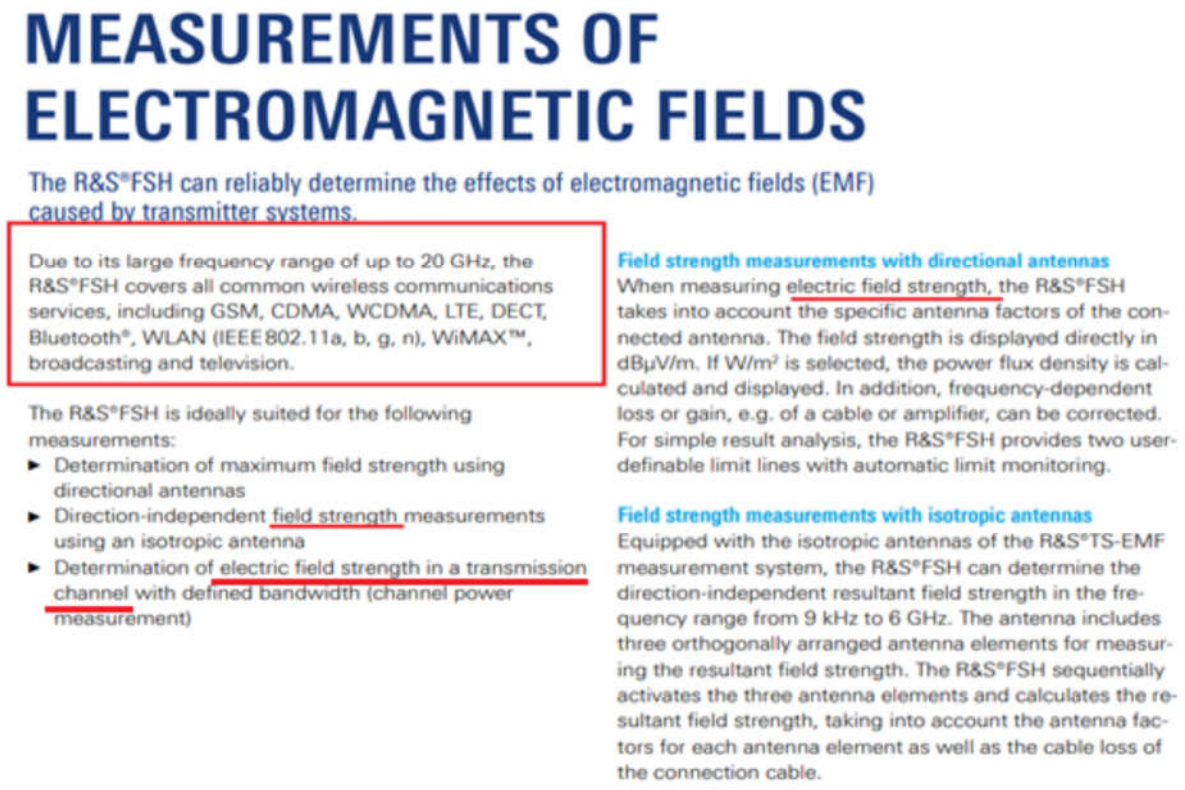
The RSRQ is the ratio of the RSRP and the RSSI.

I/Q Offset

Shows the power at spectral line 0 normalized to the total transmitted power.

The I/Q offset may be an indicator for a baseband DC offset or for carrier leakage.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).



MEASUREMENTS OF ELECTROMAGNETIC FIELDS

The R&S®FSH can reliably determine the effects of electromagnetic fields (EMF) caused by transmitter systems.

Due to its large frequency range of up to 20 GHz, the R&S®FSH covers all common wireless communications services, including GSM, CDMA, WCDMA, LTE, DECT, Bluetooth®, WLAN (IEEE 802.11a, b, g, n), WiMAX™, broadcasting and television.

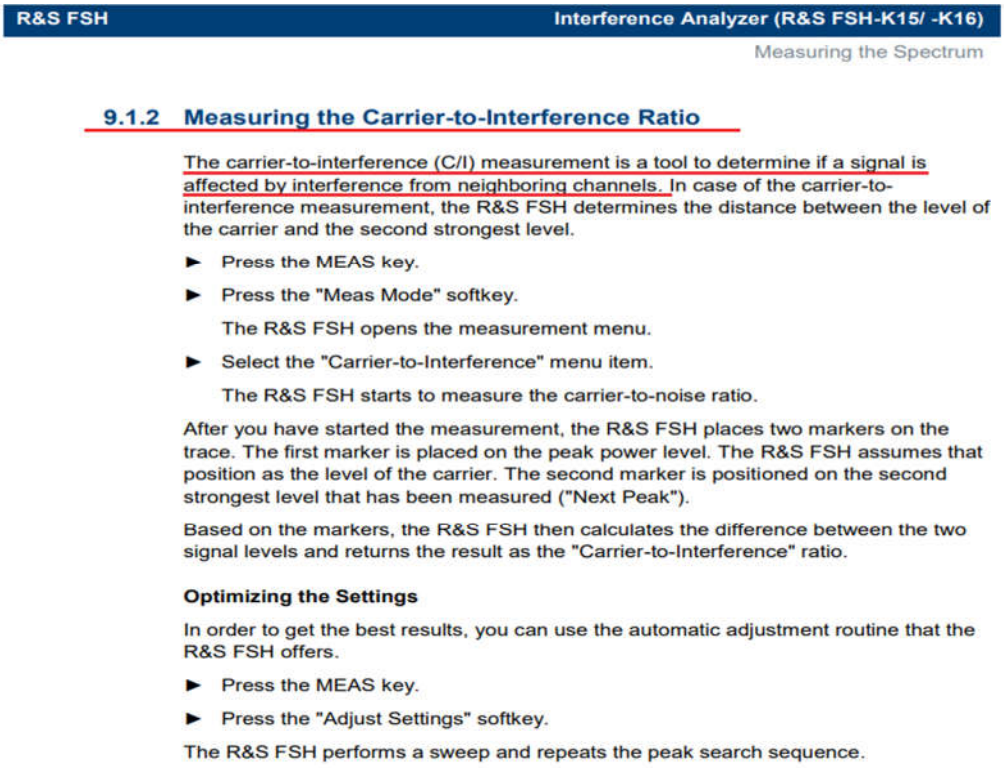
The R&S®FSH is ideally suited for the following measurements:

- Determination of maximum field strength using directional antennas
- Direction-independent field strength measurements using an isotropic antenna
- Determination of electric field strength in a transmission channel with defined bandwidth (channel power measurement)

Field strength measurements with directional antennas
When measuring electric field strength, the R&S®FSH takes into account the specific antenna factors of the connected antenna. The field strength is displayed directly in dBµV/m. If W/m² is selected, the power flux density is calculated and displayed. In addition, frequency-dependent loss or gain, e.g. of a cable or amplifier, can be corrected. For simple result analysis, the R&S®FSH provides two user-definable limit lines with automatic limit monitoring.

Field strength measurements with isotropic antennas
Equipped with the isotropic antennas of the R&S®TS-EMF measurement system, the R&S®FSH can determine the direction-independent resultant field strength in the frequency range from 9 kHz to 6 GHz. The antenna includes three orthogonally arranged antenna elements for measuring the resultant field strength. The R&S®FSH sequentially activates the three antenna elements and calculates the resultant field strength, taking into account the antenna factors for each antenna element as well as the cable loss of the connection cable.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).



R&S FSH Interference Analyzer (R&S FSH-K15/ -K16)

Measuring the Spectrum

9.1.2 Measuring the Carrier-to-Interference Ratio

The carrier-to-interference (C/I) measurement is a tool to determine if a signal is affected by interference from neighboring channels. In case of the carrier-to-interference measurement, the R&S FSH determines the distance between the level of the carrier and the second strongest level.

- ► Press the MEAS key.
- ► Press the "Meas Mode" softkey.

  The R&S FSH opens the measurement menu.
- ► Select the "Carrier-to-Interference" menu item.

  The R&S FSH starts to measure the carrier-to-noise ratio.

After you have started the measurement, the R&S FSH places two markers on the trace. The first marker is placed on the peak power level. The R&S FSH assumes that position as the level of the carrier. The second marker is positioned on the second strongest level that has been measured ("Next Peak").

Based on the markers, the R&S FSH then calculates the difference between the two signal levels and returns the result as the "Carrier-to-Interference" ratio.

Optimizing the Settings

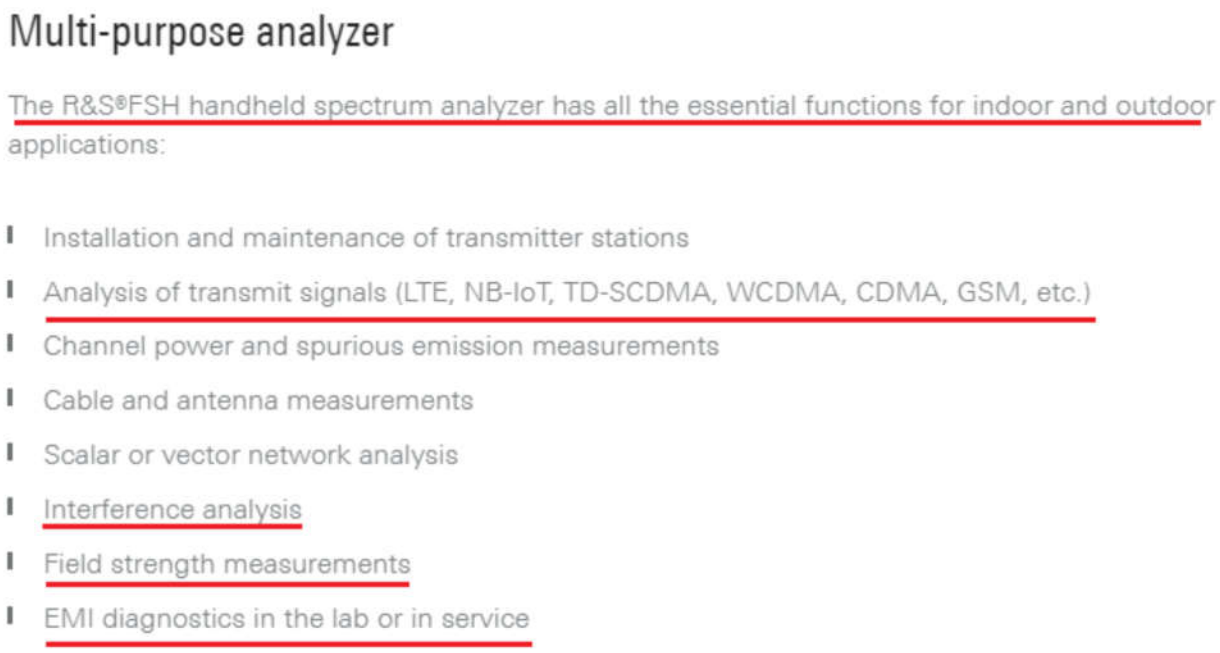
In order to get the best results, you can use the automatic adjustment routine that the R&S FSH offers.

- ► Press the MEAS key.
- ► Press the "Adjust Settings" softkey.

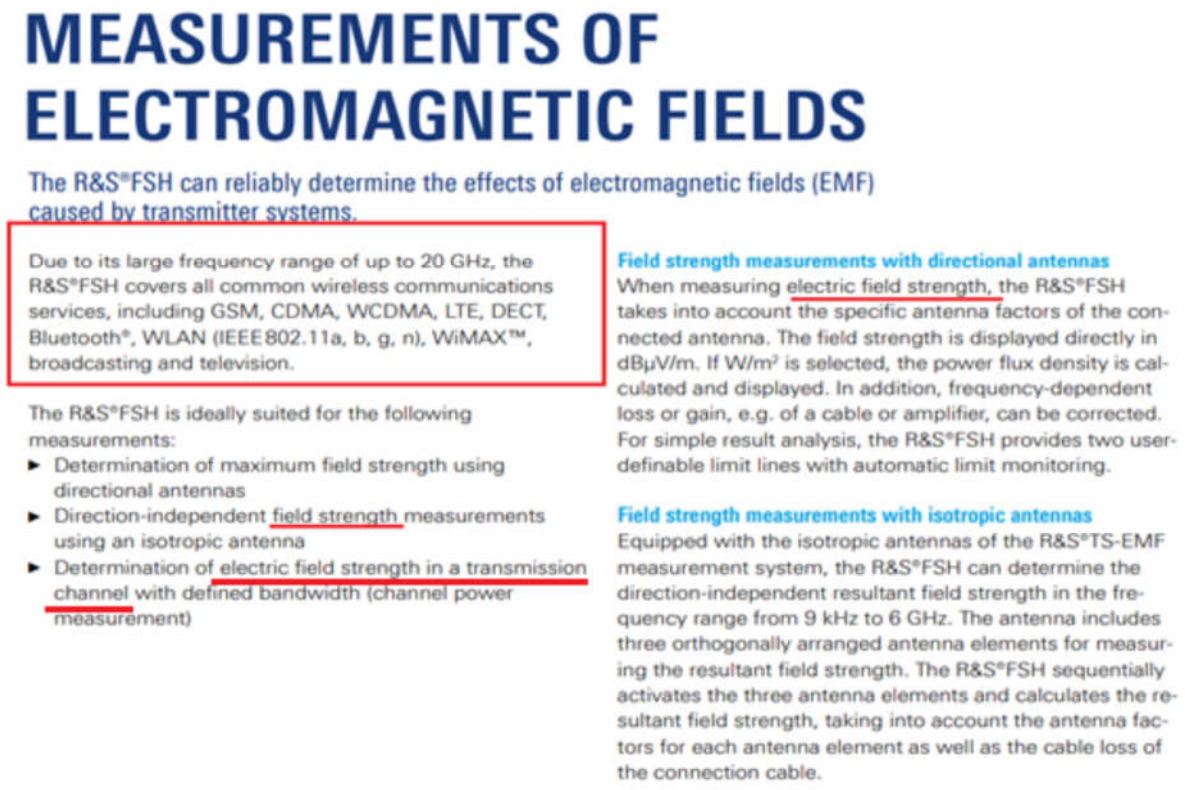
The R&S FSH performs a sweep and repeats the peak search sequence.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

30. The Accused System is a system comprising a transmitting apparatus (*e.g.,* a base station transmitter for testing), configured to transmit a testing signal upon moving along a testing route (measures signal level at particular location, indoor coverage, outdoor, etc.).



(*E.g.*, https://www.rohde-schwarz.com/products/test-and-measurement/handheld/rs-fsh-handheld-spectrum-analyzer_63493-8180.html?change_c=true).



MEASUREMENTS OF ELECTROMAGNETIC FIELDS

The R&S®FSH can reliably determine the effects of electromagnetic fields (EMF) caused by transmitter systems.

Due to its large frequency range of up to 20 GHz, the R&S®FSH covers all common wireless communications services, including GSM, CDMA, WCDMA, LTE, DECT, Bluetooth®, WLAN (IEEE 802.11a, b, g, n), WiMAX™, broadcasting and television.

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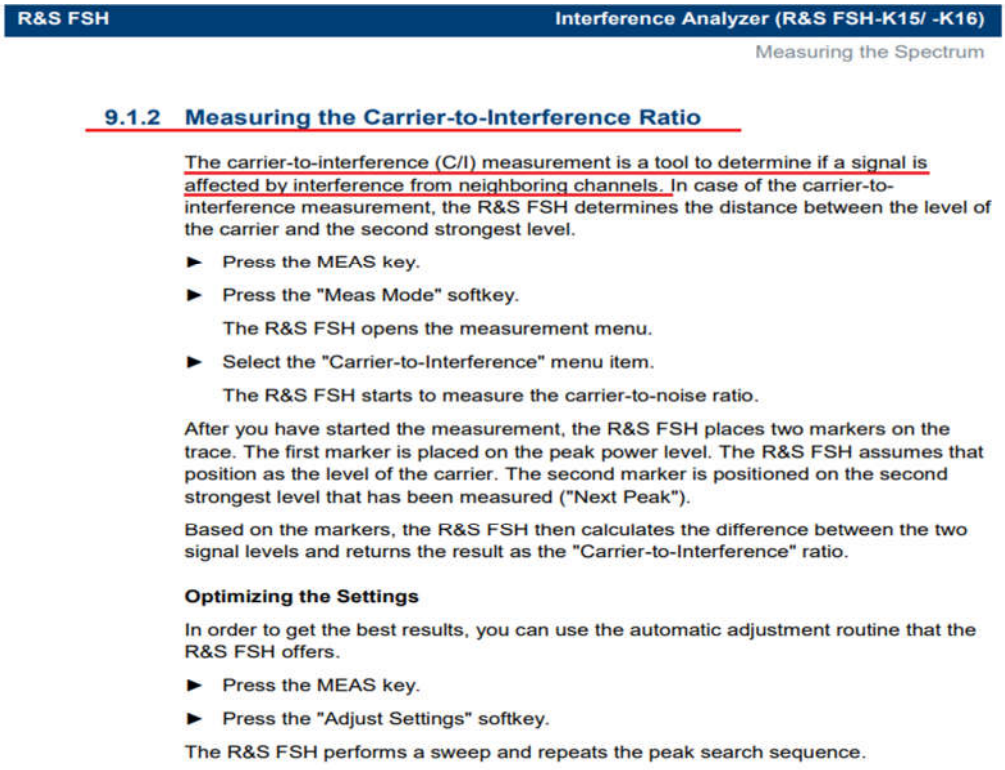
- Direction-independent field strength measurements using an isotropic antenna
- Determination of electric field strength in a transmission channel with defined bandwidth (channel power measurement)

Field strength measurements with directional antennas
When measuring electric field strength, the R&S®FSH takes into account the specific antenna factors of the connected antenna. The field strength is displayed directly in dBµV/m. If W/m² is selected, the power flux density is calculated and displayed. In addition, frequency-dependent loss or gain, e.g. of a cable or amplifier, can be corrected. For simple result analysis, the R&S®FSH provides two user-definable limit lines with automatic limit monitoring.

Field strength measurements with isotropic antennas
Equipped with the isotropic antennas of the R&S®TS-EMF measurement system, the R&S®FSH can determine the direction-independent resultant field strength in the frequency range from 9 kHz to 6 GHz. The antenna includes three orthogonally arranged antenna elements for measuring the resultant field strength. The R&S®FSH sequentially activates the three antenna elements and calculates the resultant field strength, taking into account the antenna factors for each antenna element as well as the cable loss of the connection cable.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).



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The carrier-to-interference (C/I) measurement is a tool to determine if a signal is affected by interference from neighboring channels. In case of the carrier-to-interference measurement, the R&S FSH determines the distance between the level of the carrier and the second strongest level.

- ► Press the MEAS key.
- ► Press the "Meas Mode" softkey.

  The R&S FSH opens the measurement menu.
- ► Select the "Carrier-to-Interference" menu item.

  The R&S FSH starts to measure the carrier-to-noise ratio.

After you have started the measurement, the R&S FSH places two markers on the trace. The first marker is placed on the peak power level. The R&S FSH assumes that position as the level of the carrier. The second marker is positioned on the second strongest level that has been measured ("Next Peak").

Based on the markers, the R&S FSH then calculates the difference between the two signal levels and returns the result as the "Carrier-to-Interference" ratio.

Optimizing the Settings

In order to get the best results, you can use the automatic adjustment routine that the R&S FSH offers.

- ► Press the MEAS key.
- ► Press the "Adjust Settings" softkey.

The R&S FSH performs a sweep and repeats the peak search sequence.

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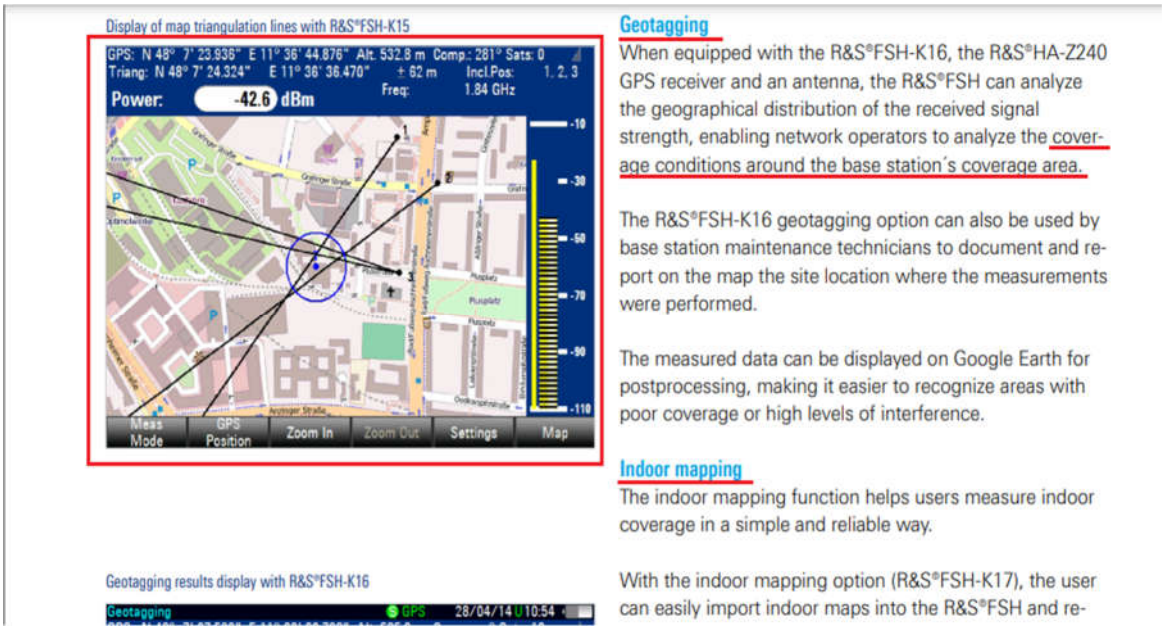
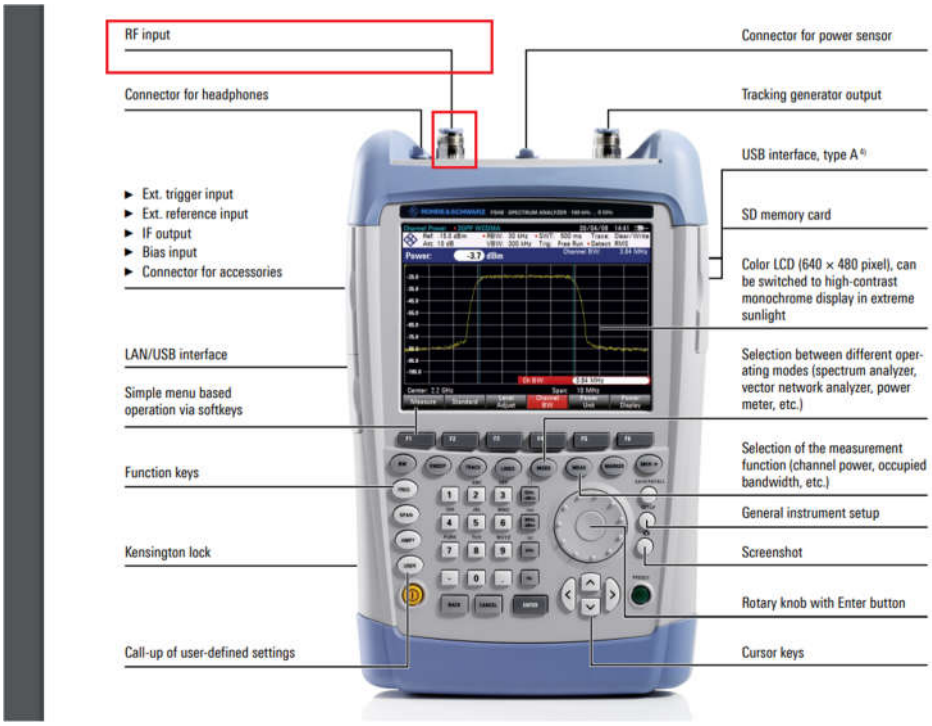


(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).

31. The Accused System is a system comprises a receiving testing apparatus (*e.g.,* a receiver, RF IN, etc.), installed at more than one selected testing sites (*e.g.,* multiple locations), configured to receive the testing signal and to detect the strength (RSSI, field strength, etc.) of the received signal.



(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).

MEASUREMENTS OF ELECTROMAGNETIC FIELDS

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The R&S®FSH is ideally suited for the following measurements:

- Determination of maximum field strength using directional antennas
- Direction-independent field strength measurements using an isotropic antenna
- Determination of electric field strength in a transmission channel with defined bandwidth (channel power measurement)

Field strength measurements with directional antennas

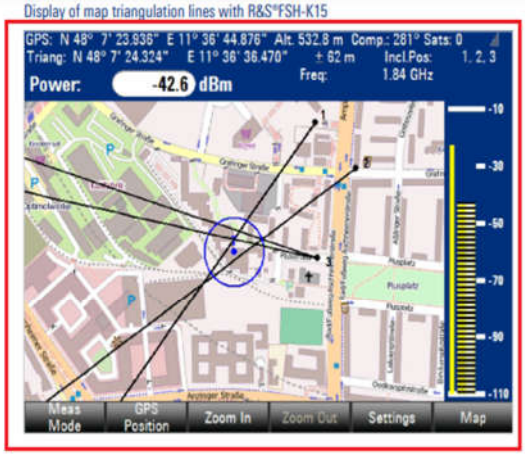
When measuring electric field strength, the R&S®FSH takes into account the specific antenna factors of the connected antenna. The field strength is displayed directly in dBµV/m. If W/m² is selected, the power flux density is calculated and displayed. In addition, frequency-dependent loss or gain, e.g. of a cable or amplifier, can be corrected. For simple result analysis, the R&S®FSH provides two user-definable limit lines with automatic limit monitoring.

Field strength measurements with isotropic antennas

Equipped with the isotropic antennas of the R&S®TS-EMF measurement system, the R&S®FSH can determine the direction-independent resultant field strength in the frequency range from 9 kHz to 6 GHz. The antenna includes three orthogonally arranged antenna elements for measuring the resultant field strength. The R&S®FSH sequentially activates the three antenna elements and calculates the resultant field strength, taking into account the antenna factors for each antenna element as well as the cable loss of the connection cable.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).

Display of map triangulation lines with R&S®FSH-K15



Geotagging results display with R&S®FSH-K16

Geotagging

When equipped with the R&S®FSH-K16, the R&S®HA-Z240 GPS receiver and an antenna, the R&S®FSH can analyze the geographical distribution of the received signal strength, enabling network operators to analyze the coverage conditions around the base station's coverage area.

The R&S®FSH-K16 geotagging option can also be used by base station maintenance technicians to document and report on the map the site location where the measurements were performed.

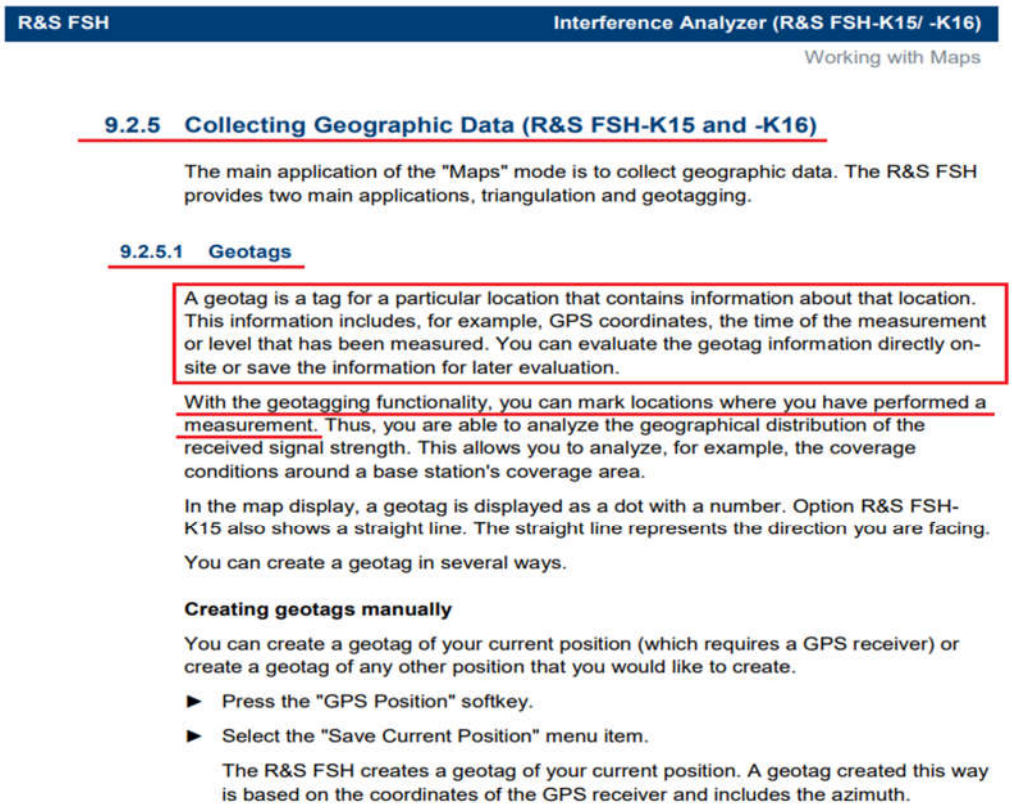
The measured data can be displayed on Google Earth for postprocessing, making it easier to recognize areas with poor coverage or high levels of interference.

Indoor mapping

The indoor mapping function helps users measure indoor coverage in a simple and reliable way.

With the indoor mapping option (R&S®FSH-K17), the user can easily import indoor maps into the R&S®FSH and re-

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).



R&S FSH Interference Analyzer (R&S FSH-K15/ -K16)

Working with Maps

9.2.5 Collecting Geographic Data (R&S FSH-K15 and -K16)

The main application of the "Maps" mode is to collect geographic data. The R&S FSH provides two main applications, triangulation and geotagging.

9.2.5.1 Geotags

A geotag is a tag for a particular location that contains information about that location. This information includes, for example, GPS coordinates, the time of the measurement or level that has been measured. You can evaluate the geotag information directly on-site or save the information for later evaluation.

With the geotagging functionality, you can mark locations where you have performed a measurement. Thus, you are able to analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map display, a geotag is displayed as a dot with a number. Option R&S FSH-K15 also shows a straight line. The straight line represents the direction you are facing.

You can create a geotag in several ways.

Creating geotags manually

You can create a geotag of your current position (which requires a GPS receiver) or create a geotag of any other position that you would like to create.

- ► Press the "GPS Position" softkey.
- ► Select the "Save Current Position" menu item.

  The R&S FSH creates a geotag of your current position. A geotag created this way is based on the coordinates of the GPS receiver and includes the azimuth.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

In addition to creating a map, you can also specify the exact geographic location of the area you are measuring. To do so, you have to specify three GPS reference points of the area. Enter the corresponding latitude and longitude data in the corresponding fields available in the "Create Map" dialog box and move the three cross-hairs displayed in the preview of the map to the corresponding locations.

When you are using this feature, the application provides some useful features:

- The map is automatically rotated in such a way that the north side faces up.
- The R&S FSH calculates and displays the distance between measurement points (in meters or feet, depending on the regional settings).
- You are able to embed the collected data into maps with a larger scale. Thus you are able to, for example, combine measurement data recorded with the Geotagging application (outdoor map) and data recorded with the Indoor Maps application in a single map. For more information about this see "Collecting Measurement Data (R&S FSH-K17)" on page 182.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

32. The Accused System is a system that obtains field strength testing data (*e.g.,* RSSI, field strengths, interference strengths, etc.) along the testing route (*e.g.,* a test route for indoor/outdoor mapping, etc.) according to a synchronization established between the transmission apparatus and the receiving testing apparatus (*e.g.,* synchronization between the transmitter and the base station), wherein the more than one selected testing sites (*e.g.,* field strength, RSSI values, etc. are collected from multiple locations) to install the receiving testing apparatus comprise at least one height (*e.g.,* altitude) selected in each of the testing sites to mount at least one said receiving testing apparatus, the at least one receiving testing apparatus being respectively oriented in at least one direction (*e.g.,* isotropic or directional antenna).

Multi-purpose analyzer

The R&S®FSH handheld spectrum analyzer has all the essential functions for indoor and outdoor applications:

- Installation and maintenance of transmitter stations
- Analysis of transmit signals (LTE, NB-IoT, TD-SCDMA, WCDMA, CDMA, GSM, etc.)
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Shows the received signal strength indicator (RSSI).

The RSSI is the complete signal power of the channel that has been measured, regardless of the origin of the signal.

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Shows the reference signal received quality (RSRQ).

The RSRQ is the ratio of the RSRP and the RSSI.

I/Q Offset

Shows the power at spectral line 0 normalized to the total transmitted power.

The I/Q offset may be an indicator for a baseband DC offset or for carrier leakage.

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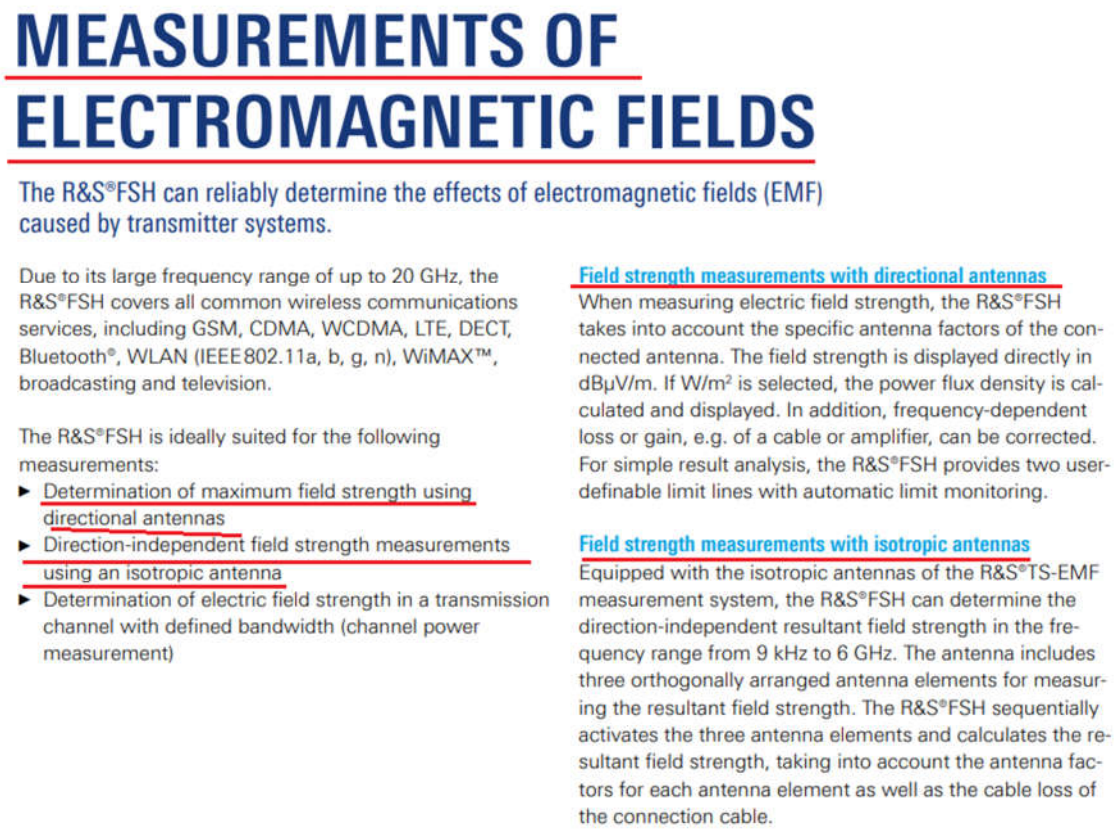

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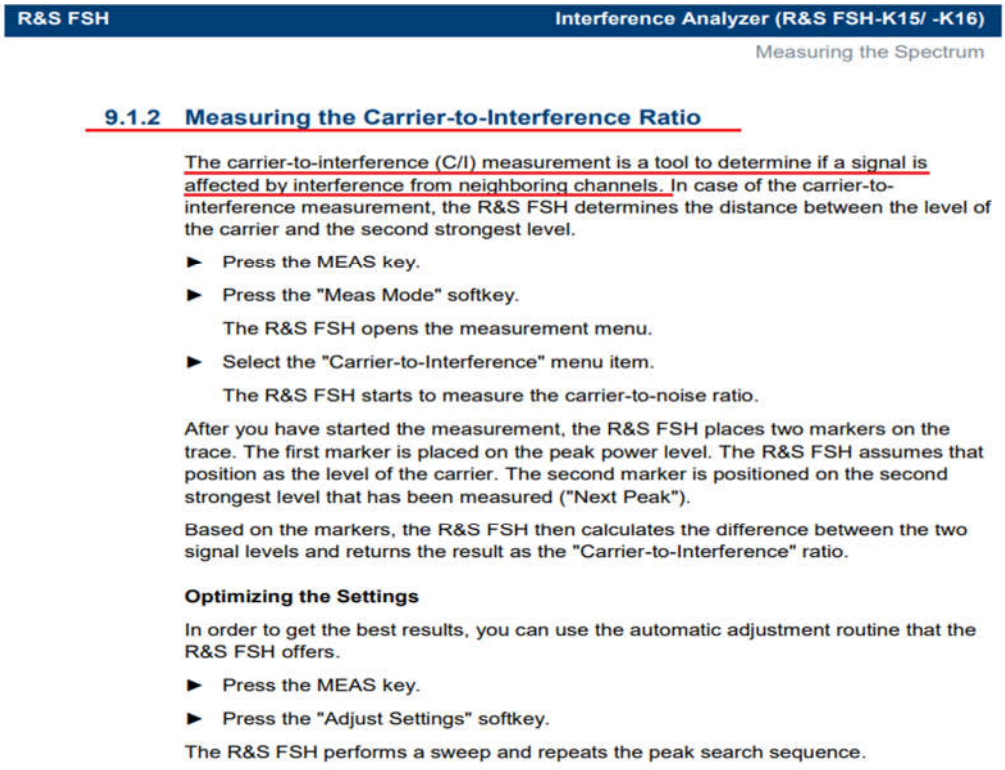

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The carrier-to-interference (C/I) measurement is a tool to determine if a signal is affected by interference from neighboring channels. In case of the carrier-to-interference measurement, the R&S FSH determines the distance between the level of the carrier and the second strongest level.

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- ► Press the "Meas Mode" softkey.

  The R&S FSH opens the measurement menu.
- ► Select the "Carrier-to-Interference" menu item.

  The R&S FSH starts to measure the carrier-to-noise ratio.

After you have started the measurement, the R&S FSH places two markers on the trace. The first marker is placed on the peak power level. The R&S FSH assumes that position as the level of the carrier. The second marker is positioned on the second strongest level that has been measured ("Next Peak").

Based on the markers, the R&S FSH then calculates the difference between the two signal levels and returns the result as the "Carrier-to-Interference" ratio.

Optimizing the Settings

In order to get the best results, you can use the automatic adjustment routine that the R&S FSH offers.

- ► Press the MEAS key.
- ► Press the "Adjust Settings" softkey.

The R&S FSH performs a sweep and repeats the peak search sequence.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

9.2 Working with Maps

Options R&S FSH-K15 and -K16 allow you to work with maps, for example view and save the position of measurements. With option R&S FSH-K15 you are also able to determine the source of interference (through triangulation). The options also provide several other tools that make it easier to locate interference.

To make full use of the functions available in map mode, you will need a GPS receiver and an antenna (for example R&S HL300, which already contains a GPS receiver).

Option R&S FSH-K17 ("Indoor Maps") allows you to work with small scale maps (for example floor plan). This option provides functionality to measure the signal strength indoors using an antenna (for example R&S HL300).

9.2.1 Transferring Maps (R&S FSH-K15 and -K16)

Before you can use any features based on maps, you have to download and install the maps on the R&S FSH. The R&S FSH supports the map material supplied by the Open Street Maps project (http://www.openstreetmaps.org)

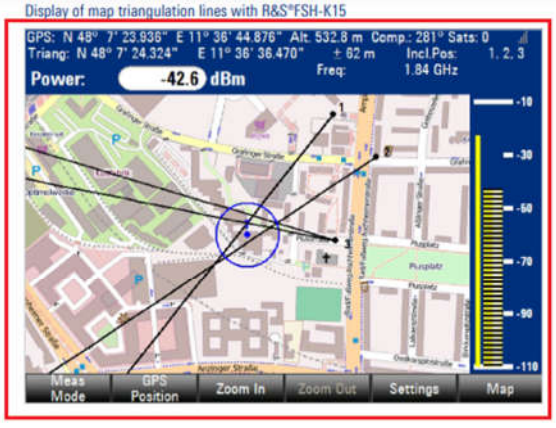
The easiest way for you to transfer the maps to the R&S FSH is to use the R&S Open Street Map Wizard (OSM Wizard). The OSM Wizard is available for download on the R&S FSH product homepage (http://www.rohde-schwarz.com/product/fsh.html).

The OSM wizard establishes a connection to the Open Street Maps database and thus needs a connection to the internet. The tool allows you to select the area that you need for your measurements and download the corresponding maps.

For more information on how to download and save maps refer to the documentation of the OSM Wizard. The documentation is part of the software.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

Display of map triangulation lines with R&S®FSH-K15



Geotagging results display with R&S®FSH-K16

Geotagging

When equipped with the R&S®FSH-K16, the R&S®HA-Z240 GPS receiver and an antenna, the R&S®FSH can analyze the geographical distribution of the received signal strength, enabling network operators to analyze the coverage conditions around the base station´s coverage area.

The R&S®FSH-K16 geotagging option can also be used by base station maintenance technicians to document and report on the map the site location where the measurements were performed.

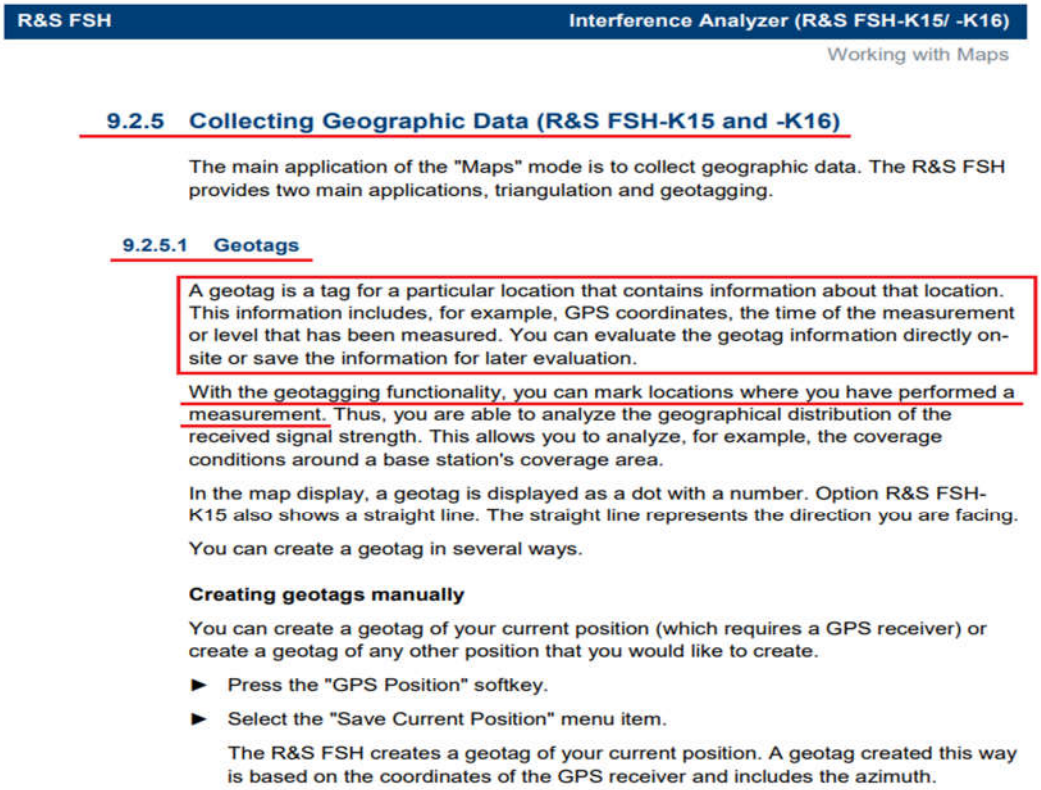
The measured data can be displayed on Google Earth for postprocessing, making it easier to recognize areas with poor coverage or high levels of interference.

Indoor mapping

The indoor mapping function helps users measure indoor coverage in a simple and reliable way.

With the indoor mapping option (R&S®FSH-K17), the user can easily import indoor maps into the R&S®FSH and re-

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).



R&S FSH Interference Analyzer (R&S FSH-K15/ -K16)

Working with Maps

9.2.5 Collecting Geographic Data (R&S FSH-K15 and -K16)

The main application of the "Maps" mode is to collect geographic data. The R&S FSH provides two main applications, triangulation and geotagging.

9.2.5.1 Geotags

A geotag is a tag for a particular location that contains information about that location. This information includes, for example, GPS coordinates, the time of the measurement or level that has been measured. You can evaluate the geotag information directly on-site or save the information for later evaluation.

With the geotagging functionality, you can mark locations where you have performed a measurement. Thus, you are able to analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map display, a geotag is displayed as a dot with a number. Option R&S FSH-K15 also shows a straight line. The straight line represents the direction you are facing.

You can create a geotag in several ways.

Creating geotags manually

You can create a geotag of your current position (which requires a GPS receiver) or create a geotag of any other position that you would like to create.

- ► Press the "GPS Position" softkey.
- ► Select the "Save Current Position" menu item.

  The R&S FSH creates a geotag of your current position. A geotag created this way is based on the coordinates of the GPS receiver and includes the azimuth.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

Position finding and increased measurement accuracy using the GPS receiver

Using the R&S®HA-Z240 GPS receiver, the R&S®FSH documents where a measurement is carried out. The longitude, latitude and altitude of the position are shown on the display. If required, the position can be stored together with the measurement results. Moreover, the GPS receiver increases the frequency measurement accuracy by synchronizing the internal reference oscillator to the GPS frequency reference. One minute following position finding, the frequency accuracy of the R&S®FSH is 25 ppb (25×10^{-9}). To fasten the GPS receiver on the roof of a car, for example, the GPS receiver is equipped with a magnet and a 5 m cable.

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In addition to creating a map, you can also specify the exact geographic location of the area you are measuring. To do so, you have to specify three GPS reference points of the area. Enter the corresponding latitude and longitude data in the corresponding fields available in the "Create Map" dialog box and move the three cross-hairs displayed in the preview of the map to the corresponding locations.

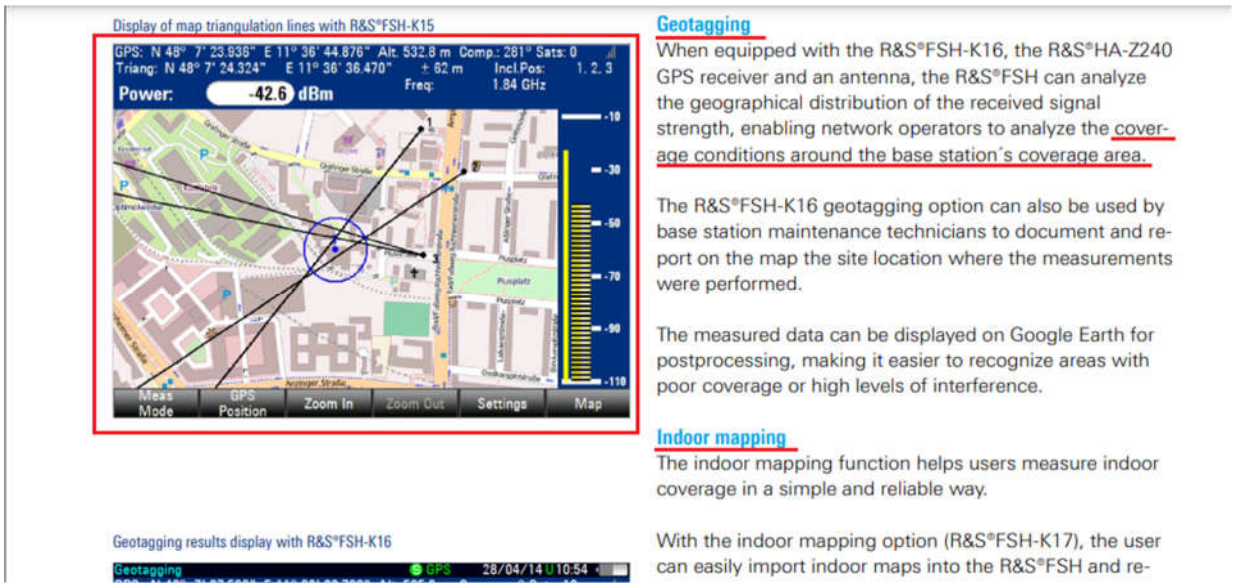
When you are using this feature, the application provides some useful features:

- The map is automatically rotated in such a way that the north side faces up.
- The R&S FSH calculates and displays the distance between measurement points (in meters or feet, depending on the regional settings).
- You are able to embed the collected data into maps with a larger scale. Thus you are able to, for example, combine measurement data recorded with the Geotagging application (outdoor map) and data recorded with the Indoor Maps application in a single map. For more information about this see "Collecting Measurement Data (R&S FSH-K17)" on page 182.

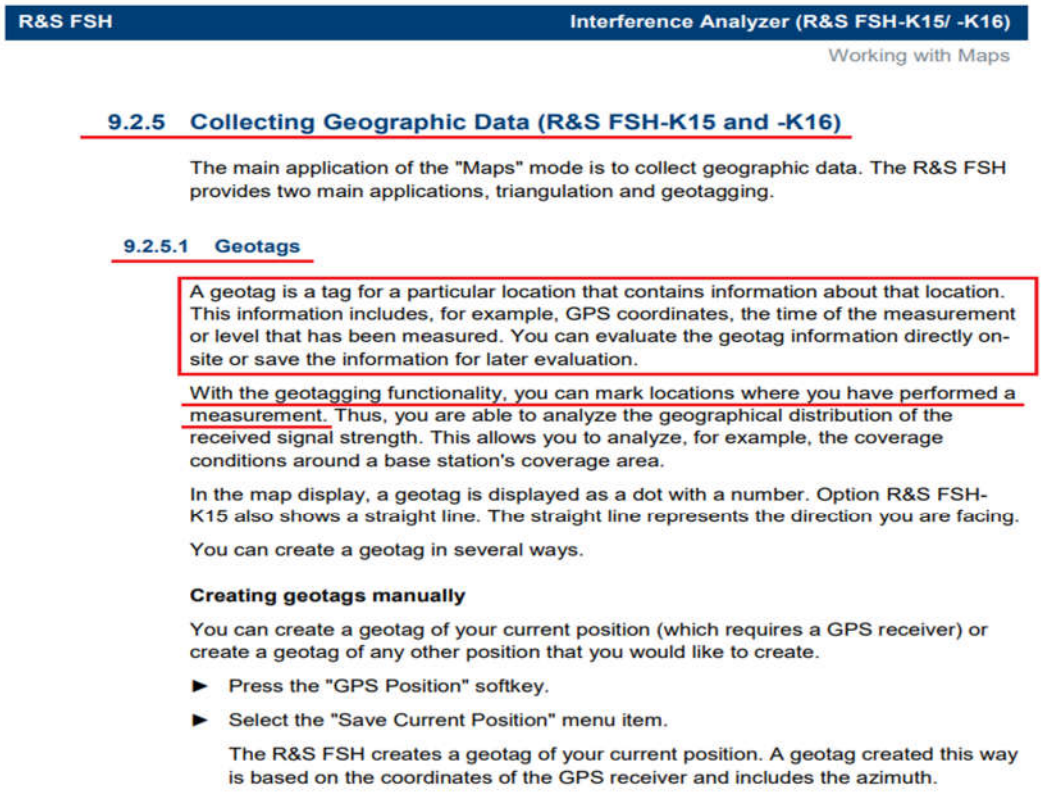
(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

33. The Accused System is a system that comprises a model analyzing apparatus (*e.g.,* Mapping apparatus comprising antennas, GPS receivers, maps, etc.), configured to analyze the field strength testing data (*e.g.,* RSSI, signal strength, interference, etc.) to obtain a wireless

propagation model about an area of the testing route (*e.g.,* coverage mapping, interference mapping, etc.).



(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).



R&S FSH Interference Analyzer (R&S FSH-K15/ -K16)

Working with Maps

9.2.5 Collecting Geographic Data (R&S FSH-K15 and -K16)

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9.2.5.1 Geotags

A geotag is a tag for a particular location that contains information about that location. This information includes, for example, GPS coordinates, the time of the measurement or level that has been measured. You can evaluate the geotag information directly on-site or save the information for later evaluation.

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In the map display, a geotag is displayed as a dot with a number. Option R&S FSH-K15 also shows a straight line. The straight line represents the direction you are facing.

You can create a geotag in several ways.

Creating geotags manually

You can create a geotag of your current position (which requires a GPS receiver) or create a geotag of any other position that you would like to create.

- ► Press the "GPS Position" softkey.
- ► Select the "Save Current Position" menu item.

  The R&S FSH creates a geotag of your current position. A geotag created this way is based on the coordinates of the GPS receiver and includes the azimuth.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

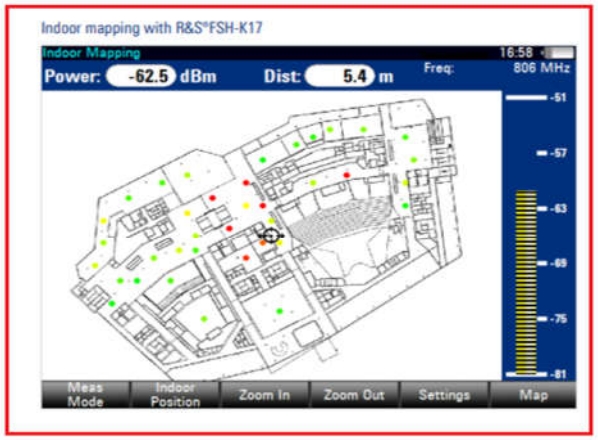
Indoor mapping

The indoor mapping function helps users measure indoor coverage in a simple and reliable way.

With the indoor mapping option (R&S®FSH-K17), the user can easily import indoor maps into the R&S®FSH and record the signal strength distribution in environments where a GPS signal is not available, such as buildings or tunnels, while keeping the information of the location where measurements have been done.

Measured data can be converted to .csv format for analysis with Microsoft Excel. Export to the .kmz format is also possible, to analyze the data and superimpose the indoor map in Google Earth.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).



OpenStreetMap (OSM)

OpenStreetMap (OSM) is a user-editable world map that is available at the following Internet address: http://www.openstreetmap.org/

OSM is a wiki project in which users can participate by uploading and editing geographical information such as GPS tracking data or the course of a road or river. This world map is growing daily.

OpenStreetMap data can be used freely under the terms of the Creative Commons Attribution-ShareAlike 2.0 license.

(*E.g.*, https://scdn.rohde-schwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).

In addition to creating a map, you can also specify the exact geographic location of the area you are measuring. To do so, you have to specify three GPS reference points of the area. Enter the corresponding latitude and longitude data in the corresponding fields available in the "Create Map" dialog box and move the three cross-hairs displayed in the preview of the map to the corresponding locations.

When you are using this feature, the application provides some useful features:

- The map is automatically rotated in such a way that the north side faces up.
- The R&S FSH calculates and displays the distance between measurement points (in meters or feet, depending on the regional settings).
- You are able to embed the collected data into maps with a larger scale. Thus you are able to, for example, combine measurement data recorded with the Geotagging application (outdoor map) and data recorded with the Indoor Maps application in a single map. For more information about this see "Collecting Measurement Data (R&S FSH-K17)" on page 182.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

Traffic Activity

Percentage of traffic slots with data.

SINR

Shows the signal to interference and noise ratio.

The SINR is the ratio of the signal power and the sum of interference and noise power.

RSSI (3GPP TS 36.214)

Shows the received signal strength indicator (RSSI).

The RSSI is the complete signal power of the channel that has been measured, regardless of the origin of the signal.

RSRQ (3GPP TS 36.214)

Shows the reference signal received quality (RSRQ).

The RSRQ is the ratio of the RSRP and the RSSI.

I/Q Offset

Shows the power at spectral line 0 normalized to the total transmitted power.

The I/Q offset may be an indicator for a baseband DC offset or for carrier leakage.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

9.1.2 Measuring the Carrier-to-Interference Ratio

The carrier-to-interference (C/I) measurement is a tool to determine if a signal is affected by interference from neighboring channels. In case of the carrier-to-interference measurement, the R&S FSH determines the distance between the level of the carrier and the second strongest level.

- ► Press the MEAS key.
- ► Press the "Meas Mode" softkey.

  The R&S FSH opens the measurement menu.
- ► Select the "Carrier-to-Interference" menu item.

  The R&S FSH starts to measure the carrier-to-noise ratio.

After you have started the measurement, the R&S FSH places two markers on the trace. The first marker is placed on the peak power level. The R&S FSH assumes that position as the level of the carrier. The second marker is positioned on the second strongest level that has been measured ("Next Peak").

Based on the markers, the R&S FSH then calculates the difference between the two signal levels and returns the result as the "Carrier-to-Interference" ratio.

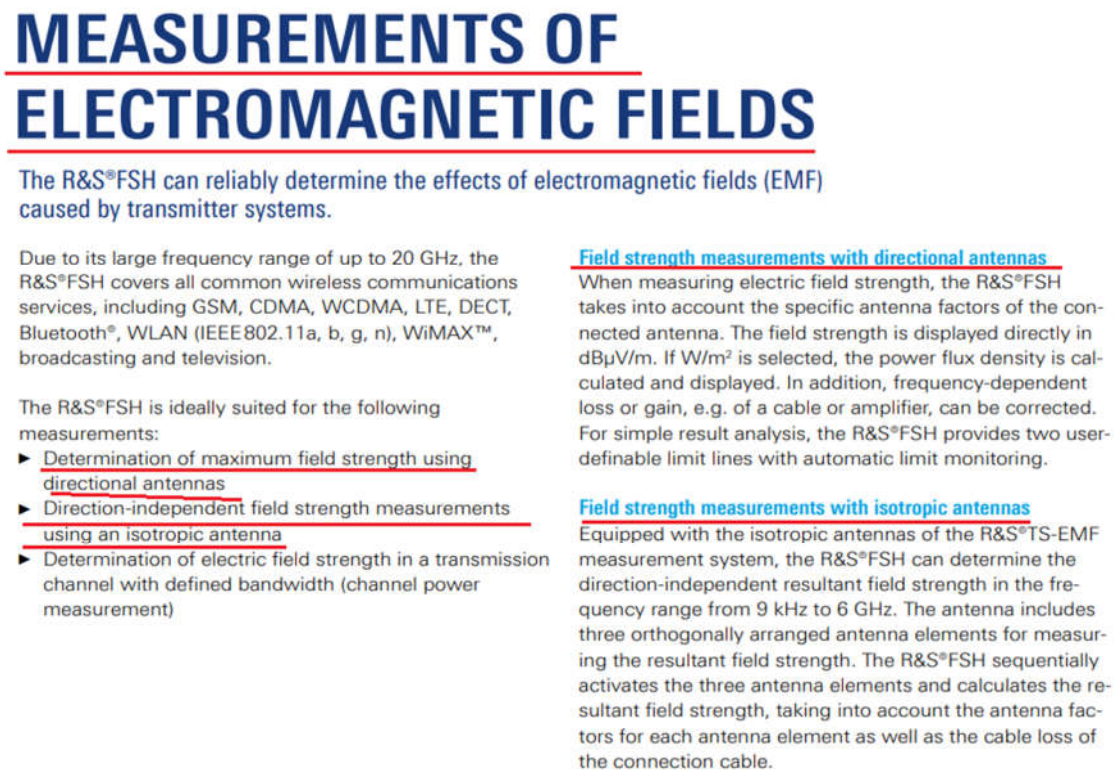
Optimizing the Settings

In order to get the best results, you can use the automatic adjustment routine that the R&S FSH offers.

- ► Press the MEAS key.
- ► Press the "Adjust Settings" softkey.

The R&S FSH performs a sweep and repeats the peak search sequence.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).



MEASUREMENTS OF ELECTROMAGNETIC FIELDS

The R&S®FSH can reliably determine the effects of electromagnetic fields (EMF) caused by transmitter systems.

Due to its large frequency range of up to 20 GHz, the R&S®FSH covers all common wireless communications services, including GSM, CDMA, WCDMA, LTE, DECT, Bluetooth®, WLAN (IEEE 802.11a, b, g, n), WiMAX™, broadcasting and television.

The R&S®FSH is ideally suited for the following measurements:

- Determination of maximum field strength using directional antennas
- Direction-independent field strength measurements using an isotropic antenna
- Determination of electric field strength in a transmission channel with defined bandwidth (channel power measurement)

Field strength measurements with directional antennas

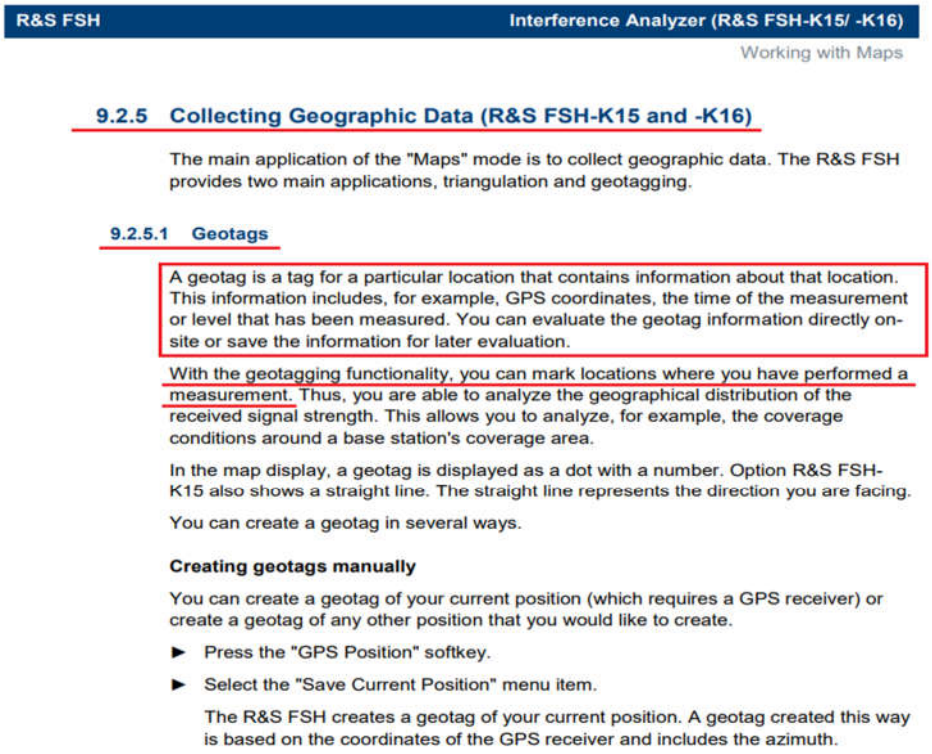
When measuring electric field strength, the R&S®FSH takes into account the specific antenna factors of the connected antenna. The field strength is displayed directly in dBµV/m. If W/m² is selected, the power flux density is calculated and displayed. In addition, frequency-dependent loss or gain, e.g. of a cable or amplifier, can be corrected. For simple result analysis, the R&S®FSH provides two user-definable limit lines with automatic limit monitoring.

Field strength measurements with isotropic antennas

Equipped with the isotropic antennas of the R&S®TS-EMF measurement system, the R&S®FSH can determine the direction-independent resultant field strength in the frequency range from 9 kHz to 6 GHz. The antenna includes three orthogonally arranged antenna elements for measuring the resultant field strength. The R&S®FSH sequentially activates the three antenna elements and calculates the resultant field strength, taking into account the antenna factors for each antenna element as well as the cable loss of the connection cable.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

34. The Accused System comprises a merging module (*e.g.,* geotags, OpenStreetMap, etc.), configured to selectively merge the field strength testing data (*e.g.,* RSSI, signal strengths, etc.) according to a topographic and geomorphologic feature along the testing route. As shown, the Accused System saves the latitude, longitude and altitude data for each location (according to a topographic and geomorphologic feature along the testing route) and merges the field strength data with the location data.



R&S FSH Interference Analyzer (R&S FSH-K15/ -K16)

Working with Maps

9.2.5 Collecting Geographic Data (R&S FSH-K15 and -K16)

The main application of the "Maps" mode is to collect geographic data. The R&S FSH provides two main applications, triangulation and geotagging.

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With the geotagging functionality, you can mark locations where you have performed a measurement. Thus, you are able to analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map display, a geotag is displayed as a dot with a number. Option R&S FSH-K15 also shows a straight line. The straight line represents the direction you are facing.

You can create a geotag in several ways.

Creating geotags manually

You can create a geotag of your current position (which requires a GPS receiver) or create a geotag of any other position that you would like to create.

- ► Press the "GPS Position" softkey.
- ► Select the "Save Current Position" menu item.

The R&S FSH creates a geotag of your current position. A geotag created this way is based on the coordinates of the GPS receiver and includes the azimuth.

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Geotagging results display with R&S®FSH-K16

Indoor mapping

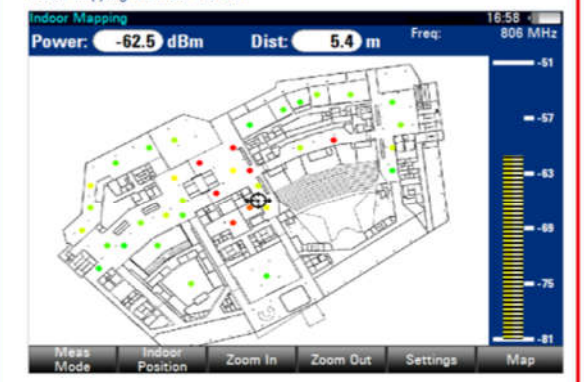
The indoor mapping function helps users measure indoor coverage in a simple and reliable way.

With the indoor mapping option (R&S®FSH-K17), the user can easily import indoor maps into the R&S®FSH and record the signal strength distribution in environments where a GPS signal is not available, such as buildings or tunnels, while keeping the information of the location where measurements have been done.

Measured data can be converted to .csv format for analysis with Microsoft Excel. Export to the .kmz format is also possible, to analyze the data and superimpose the indoor map in Google Earth.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).

Indoor mapping with R&S®FSH-K17



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- The map is automatically rotated in such a way that the north side faces up.
- The R&S FSH calculates and displays the distance between measurement points (in meters or feet, depending on the regional settings).
- You are able to embed the collected data into maps with a larger scale. Thus you are able to, for example, combine measurement data recorded with the Geotagging application (outdoor map) and data recorded with the Indoor Maps application in a single map. For more information about this see "Collecting Measurement Data (R&S FSH-K17)" on page 182.

The R&S FSH opens a list of geotags that you have saved. In this list, the R&S FSH shows some basic information about the geotag.

- Number: number of the location as displayed on the map.
- Include: checkbox to include the geotag on the map display
- Latitude, longitude and azimuth: GPS information of the location
- Name: name of the location

Traffic Activity

Percentage of traffic slots with data.

SINR

Shows the signal to interference and noise ratio.

The SINR is the ratio of the signal power and the sum of interference and noise power.

RSSI (3GPP TS 36.214)

Shows the received signal strength indicator (RSSI).

The RSSI is the complete signal power of the channel that has been measured, regardless of the origin of the signal.

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Shows the reference signal received quality (RSRQ).

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Shows the power at spectral line 0 normalized to the total transmitted power.

The I/Q offset may be an indicator for a baseband DC offset or for carrier leakage.

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- ► Press the MEAS key.
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  The R&S FSH opens the measurement menu.
- ► Select the "Carrier-to-Interference" menu item.

  The R&S FSH starts to measure the carrier-to-noise ratio.

After you have started the measurement, the R&S FSH places two markers on the trace. The first marker is placed on the peak power level. The R&S FSH assumes that position as the level of the carrier. The second marker is positioned on the second strongest level that has been measured ("Next Peak").

Based on the markers, the R&S FSH then calculates the difference between the two signal levels and returns the result as the "Carrier-to-Interference" ratio.

Optimizing the Settings

In order to get the best results, you can use the automatic adjustment routine that the R&S FSH offers.

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When measuring electric field strength, the R&S®FSH takes into account the specific antenna factors of the connected antenna. The field strength is displayed directly in dBµV/m. If W/m² is selected, the power flux density is calculated and displayed. In addition, frequency-dependent loss or gain, e.g. of a cable or amplifier, can be corrected. For simple result analysis, the R&S®FSH provides two user-definable limit lines with automatic limit monitoring.

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(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

35. The Accused System comprises a correcting module (*e.g.,* module to edit parameters, configurations of corrections values), configured to perform a wireless propagation model correction (*e.g.,* user defined corrections value like antenna anisotropy) using the field strength testing data (*e.g.,* RSSI, field strength, interference, etc.) to form the wireless propagation model under at least one type of environment (*e.g.,* current testing environment, etc.).

(*E.g.*, https://scdn.rohde-schwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).

The R&S FSH opens a dialog box to select transducer factors with the unit dB.

- ► Select the transducer factor for the extension cable.
- ► Confirm the selection with the "Select" softkey.

For more information see "Using Transducer Factors" on page 141.

You can create and edit transducer factor with the R&S InstrumentView software package and then transfer them into the internal memory of the R&S FSH. Each transducer factor may consist of up to 1000 reference values.

Display of the antenna directions

An isotropic antenna consists of three orthogonal elements. Each of these elements measures the field strength from a different direction (x-, y- and z-axis).

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

The application features a "GPS Position List" that allows you to manage and edit geotags. The "GPS Position List" contains all geotags that you have created.

- ► Press the "GPS Position" softkey.
- ► Select the "GPS Position List" menu item.

The R&S FSH opens a list of geotags that you have saved. In this list, the R&S FSH shows some basic information about the geotag.

- Number: number of the location as displayed on the map.
- Include: checkbox to include the geotag on the map display
- Latitude, longitude and azimuth: GPS information of the location
- Name: name of the location

However, a geotag consists of more information than the information displayed in the list.

(*E.g.*, *id.*).

In addition to the geographic information, the details of the geotag also contain information about the measurement. This information includes, for example, the frequency, measured level or measurement bandwidth.

The R&S FSH allows you to change the name and description anytime you want. All other geotag information is unchangeable after it has been saved.

► In the geotag information overview, press the "Edit" softkey.

The R&S FSH opens input fields to change the name and description of the location.

(*E.g.*, *id.*).

Configuration of other correction values

You can also define various other correction values, if the measurement requires them.

Note that you can also correct the results later when you analyze them in the R&S InstrumentView software. For details see, "Evaluating Results" on page 364.

► Select the "Correction" tab.

► Define correction values, if necessary. Entering a "0" means no correction is applied.

- "Antenna Anisotropy": Takes directional inequalities of an isotropic antenna into account.
- "Instrument Uncertainty": Takes an instrument uncertainty into account.
- "Extrapolation Factor" (LTE and WCDMA measurements only): Defines an extrapolation factor that is added to the measured results. This factor is defined for certain test scenarios and given in the corresponding standards.
- "Time Division Duplex" (LTE TDD measurements only).

Traffic Activity

Percentage of traffic slots with data.

SINR

Shows the signal to interference and noise ratio.

The SINR is the ratio of the signal power and the sum of interference and noise power.

RSSI (3GPP TS 36.214)

Shows the received signal strength indicator (RSSI).

The RSSI is the complete signal power of the channel that has been measured, regardless of the origin of the signal.

RSRQ (3GPP TS 36.214)

Shows the reference signal received quality (RSRQ).

The RSRQ is the ratio of the RSRP and the RSSI.

I/Q Offset

Shows the power at spectral line 0 normalized to the total transmitted power.

The I/Q offset may be an indicator for a baseband DC offset or for carrier leakage.

(*E.g.*, *id.*).

9.1.2 Measuring the Carrier-to-Interference Ratio

The carrier-to-interference (C/I) measurement is a tool to determine if a signal is affected by interference from neighboring channels. In case of the carrier-to-interference measurement, the R&S FSH determines the distance between the level of the carrier and the second strongest level.

- ► Press the MEAS key.
- ► Press the "Meas Mode" softkey.

  The R&S FSH opens the measurement menu.
- ► Select the "Carrier-to-Interference" menu item.

  The R&S FSH starts to measure the carrier-to-noise ratio.

After you have started the measurement, the R&S FSH places two markers on the trace. The first marker is placed on the peak power level. The R&S FSH assumes that position as the level of the carrier. The second marker is positioned on the second strongest level that has been measured ("Next Peak").

Based on the markers, the R&S FSH then calculates the difference between the two signal levels and returns the result as the "Carrier-to-Interference" ratio.

Optimizing the Settings

In order to get the best results, you can use the automatic adjustment routine that the R&S FSH offers.

- ► Press the MEAS key.
- ► Press the "Adjust Settings" softkey.

The R&S FSH performs a sweep and repeats the peak search sequence.

MEASUREMENTS OF ELECTROMAGNETIC FIELDS

The R&S®FSH can reliably determine the effects of electromagnetic fields (EMF) caused by transmitter systems.

Due to its large frequency range of up to 20 GHz, the R&S®FSH covers all common wireless communications services, including GSM, CDMA, WCDMA, LTE, DECT, Bluetooth®, WLAN (IEEE 802.11a, b, g, n), WiMAX™, broadcasting and television.

The R&S®FSH is ideally suited for the following measurements:

- Determination of maximum field strength using directional antennas
- Direction-independent field strength measurements using an isotropic antenna
- Determination of electric field strength in a transmission channel with defined bandwidth (channel power measurement)

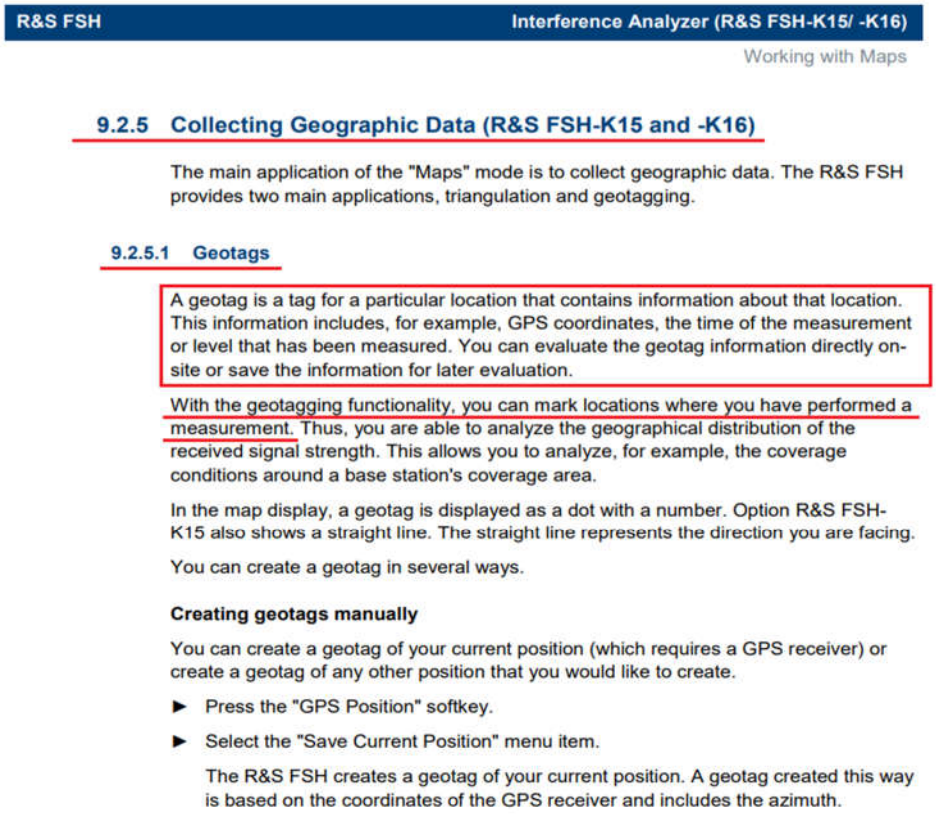
Field strength measurements with directional antennas

When measuring electric field strength, the R&S®FSH takes into account the specific antenna factors of the connected antenna. The field strength is displayed directly in dBµV/m. If W/m² is selected, the power flux density is calculated and displayed. In addition, frequency-dependent loss or gain, e.g. of a cable or amplifier, can be corrected. For simple result analysis, the R&S®FSH provides two user-definable limit lines with automatic limit monitoring.

Field strength measurements with isotropic antennas

Equipped with the isotropic antennas of the R&S®TS-EMF measurement system, the R&S®FSH can determine the direction-independent resultant field strength in the frequency range from 9 kHz to 6 GHz. The antenna includes three orthogonally arranged antenna elements for measuring the resultant field strength. The R&S®FSH sequentially activates the three antenna elements and calculates the resultant field strength, taking into account the antenna factors for each antenna element as well as the cable loss of the connection cable.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).



R&S FSH Interference Analyzer (R&S FSH-K15/ -K16)

Working with Maps

9.2.5 Collecting Geographic Data (R&S FSH-K15 and -K16)

The main application of the "Maps" mode is to collect geographic data. The R&S FSH provides two main applications, triangulation and geotagging.

9.2.5.1 Geotags

A geotag is a tag for a particular location that contains information about that location. This information includes, for example, GPS coordinates, the time of the measurement or level that has been measured. You can evaluate the geotag information directly on-site or save the information for later evaluation.

With the geotagging functionality, you can mark locations where you have performed a measurement. Thus, you are able to analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map display, a geotag is displayed as a dot with a number. Option R&S FSH-K15 also shows a straight line. The straight line represents the direction you are facing.

You can create a geotag in several ways.

Creating geotags manually

You can create a geotag of your current position (which requires a GPS receiver) or create a geotag of any other position that you would like to create.

- Press the "GPS Position" softkey.
- Select the "Save Current Position" menu item.

  The R&S FSH creates a geotag of your current position. A geotag created this way is based on the coordinates of the GPS receiver and includes the azimuth.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_manuals/gb_1/f/fsh_1/FSH_OperatingManual_en_FW3.30.pdf).

Indoor mapping

The indoor mapping function helps users measure indoor coverage in a simple and reliable way.

With the indoor mapping option (R&S®FSH-K17), the user can easily import indoor maps into the R&S®FSH and record the signal strength distribution in environments where a GPS signal is not available, such as buildings or tunnels, while keeping the information of the location where measurements have been done.

Measured data can be converted to .csv format for analysis with Microsoft Excel. Export to the .kmz format is also possible, to analyze the data and superimpose the indoor map in Google Earth.

(*E.g.*, https://scdn.rohdeschwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/FSH_bro_en_5214-0482-12_v2100.pdf).

36. Plaintiff has been damaged as a result of Defendant's infringing conduct with respect to United States Patent Nos. 7,668,301 and 9,179,339. Defendant is thus liable to Plaintiff for damages in an amount that adequately compensates Plaintiff for such Defendant's infringement of the '301 patent and the '339 patent, *i.e.*, in an amount that by law cannot be less than would constitute a reasonable royalty for the use of the patented technology, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

37. On information and belief, and to the extent required, all marking requirements have been complied with.

V. JURY DEMAND

Plaintiff, under Rule 38 of the Federal Rules of Civil Procedure, requests a trial by jury of any issues so triable by right.

VI. PRAYER FOR RELIEF

WHEREFORE, Plaintiff respectfully requests that the Court find in its favor and against Defendant, and that the Court grant Plaintiff the following relief:

a. Judgment that one or more claims of United States Patent Nos. 7,668,301 and 9,179,339 have been infringed, either literally and/or under the doctrine of equivalents, by Defendant;

b. Judgment that Defendant account for and pay to Plaintiff all damages to and costs incurred by Plaintiff because of Defendant's infringing activities and other conduct complained of herein, and an accounting of all infringements and damages not presented at trial;

c. That Plaintiff be granted pre-judgment and post-judgment interest on the damages caused by Defendant's infringing activities and other conduct complained of herein; and

d. That Plaintiff be granted such other and further relief as the Court may deem just and proper under the circumstances.

July 29, 2022

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