Versatile Shielded RF Test Fixture R&S®TS 7110

Test fixture for modules and units with radio interface

With the help of the Shielded RF Test Fixture R&S®TS 7110, users can implement individual test requirements in no time at all without facing the risks of new developments. And the best news first: The fixture can accommodate completely different tests, from initial board tests to complex final tests (function tests).

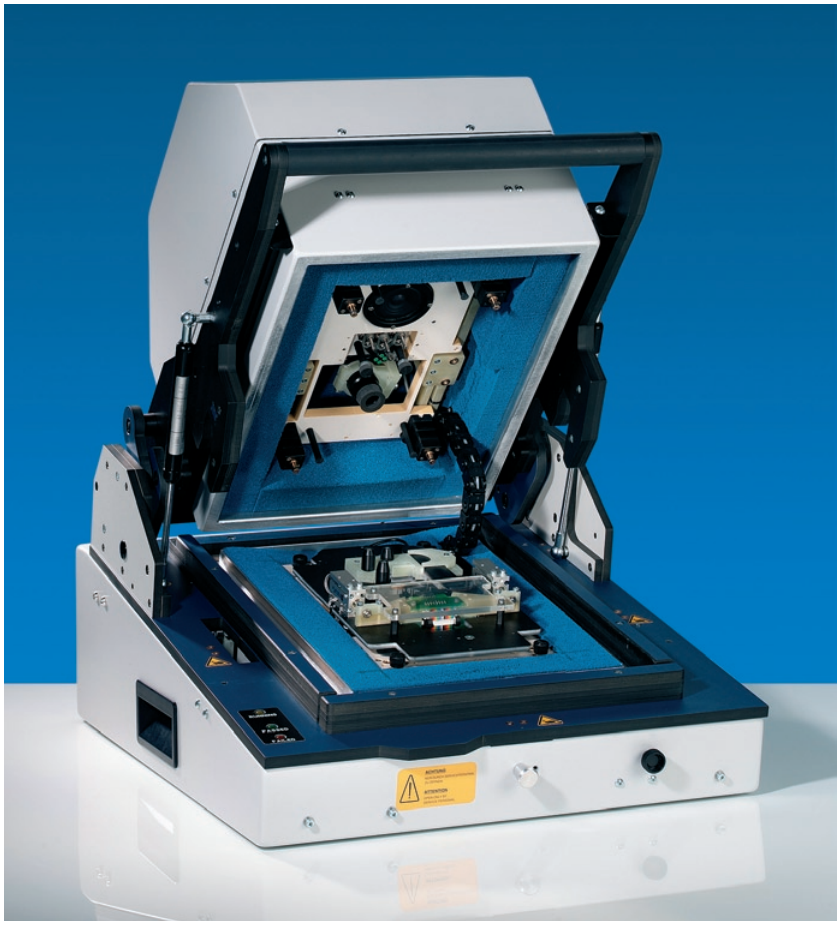

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FIG 1 Test fixture (open) for PCB and final tests.

FIG 2 Test fixture (closed) for final testing, with raised cover for the picture processing components.

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Versatile and shielded

The R&S®TS 7110 (FIGs 1 and 2) is a shielded test fixture for UUTs with a radio interface, such as mobile phones, personal digital assistants (PDA), remote keyless entry, wireless phones, etc. The UUTs can operate on the basis of diverse radio standards such as GSM, WCDMA (UMTS), *Bluetooth*™*, WLAN or Home RF.

The fixture was designed for the R&S®TS 7100 (cPCI) and R&S®TS 7180 (PC-based) production test systems [1] [2]. However, owing to its standardized USB interface and modular design, it can also be used in combination with other test systems. A DLL interface is provided on the software end to control the individual components.

The fixture is primarily used in production, but also in service, repair and quality assurance.

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Design and functions

The semi-automatic R&S®TS 7110 test fixture consists of a base and a fold-out upper part with pneumatic support for easier opening and closing (FIGs 1 and 2). The upper part includes a universal stabilizing piece for UUT positioning as well as other test fixtures for tasks that need to be performed from the upper side of the UUT (FIGs 3 and 4).

The base integrates the lower part of the RF chamber with the exchangeable test fixture including UUT mount. The test system interface is also fitted here, containing fixture control as well as additional built-ins, signal conditioning and level converters for communication with the UUT. Mechanically standardized interfaces make it easy to replace the UUT fixture for testing other units or models with similar testing tasks (FIG 5).

Shielded test chamber

When RF modules are tested, external sources of interference (nearby base stations, adjacent test systems, etc) must always be taken into account. To sufficiently suppress these signals, the test fixture is shielded against high-frequency interference. Pneumatic lines are conducted through specific wall feedthroughs, electrical signals through RF feed throughs or sub-D connectors with filters.

Absorber material on the interior walls absorbs reflections and prevents reverberating waves, permitting reproducible and reliable measurements (FIG 4). This absorber material also affects audio applications, effectively reducing ambient sound. Thus, acoustic measurements with artificial ear and mouth (loudspeaker and microphone) can be performed together with the RF tests in a single test fixture during the final testing of mobile phones.

Flexible antenna couplers are provided for testing wireless interfaces in the RF range. They are available for all common frequency ranges as are used for example with 2G and 3G mobile phones, WLAN adapters or *Bluetooth*.

Board test

A common problem that occurs when printed board assemblies are tested is that a lot of test points have to be connected to the measuring instruments.

FIG 3
Setup of the test fixture for final tests including display and camera tests.

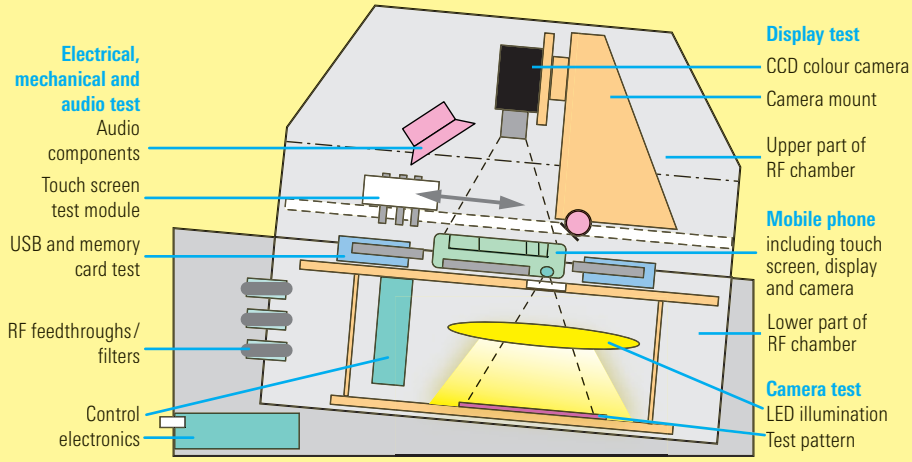
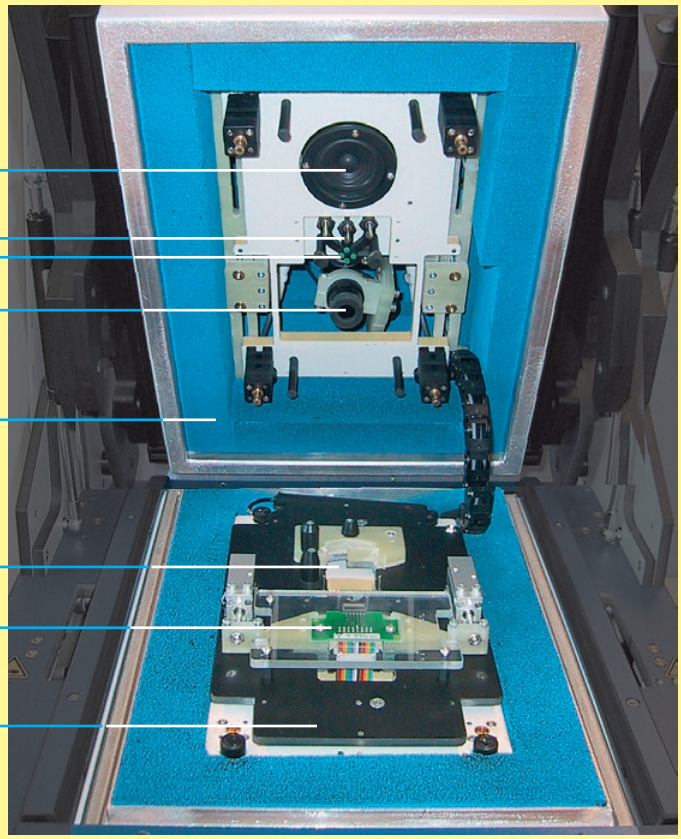


FIG 4
Interior of a final test fixture.



A multiplexer in the R&S®TS 7110 that is accommodated near the UUT ensures short lines and keeps the capacitive load of the test points low. Plus, the multitude of signal lines in the cabling of the entire test system was reduced, which is yet another advantage.

By installing a second needle board in the upper part of the fixture, the module can be contacted from both sides. Test points with electrically sensitive signals can be driven by separate pneumatic needles that are contacted only during a measurement or adjustment routine. High-frequency signals are coupled and decoupled via specific test needles that can also be operated pneumatically, if required. Pneumatically moving pins connect the module during the test by means of the standard interfaces that can be accessed by the end user (e.g. SIM card, headset, memory extension, etc).

Final test

Unlike the board test where plenty of electrical signals have to be contacted, the final test checks the ready assembled unit and, if required, performs further adjustment routines. Usually those components are submitted to a test that have been added after the board test was performed. Depending on the type and scope of the test specifications, these are various electrical tests, tests of the acoustic components, the control elements, the display, and with mobile phones of the latest generation, the testing of the built-in camera (FIG 4).

Mechanical components such as the keyboard are actuated via pneumatic fingers to test their functioning and response characteristics. **Electrical connectors** and functional extensions such as plug-in units for extension cards can usually only be tested via pneumatic control and contact since these interfaces are often located inside the UUT. **Acoustic components** must be adjusted with regard to sensitivity and sound pressure, and their frequency response measured.

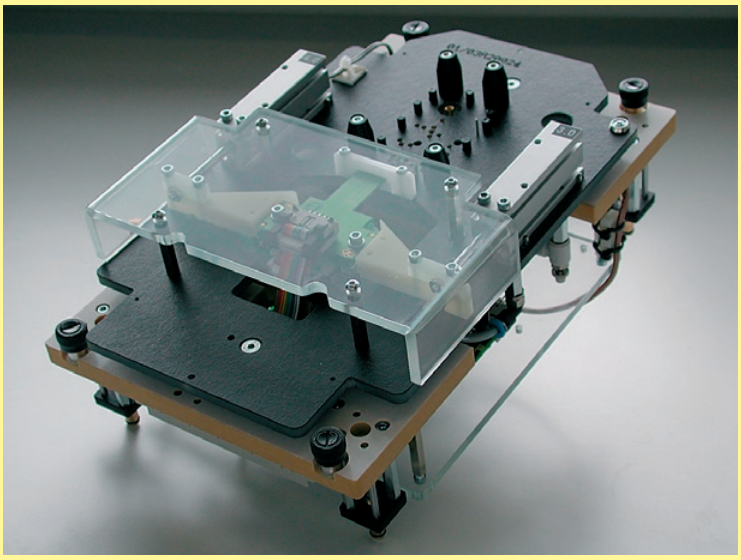


FIG 5
Exchangeable fixture for the board test.

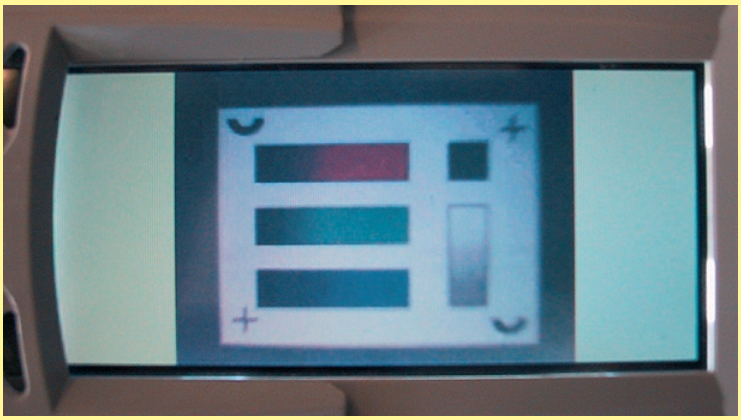


FIG 6
Display of a smart phone with an on-screen test pattern.

Display and camera test

Malfunctions of displays can be manually tested by the test personnel, or by means of an automatic optical test, which permits very reliable testing and the setting of reproducible operating conditions such as display contrast.

Display functionality, quality standards of the manufacturers and the applicable test strategy affect the focus of the optical test, including:

- Checking the fitting position
- Contrast and colour measurements
- Font and logo recognition
- Testing for rows and columns failure, and, less often,
- Testing for defects of individual display pixels

Crucial to the technical effort involved is the display resolution, whether a pixel-oriented test is required or a colour display is to be tested, and how homogeneous the display lighting is.

Applications of the Shielded RF Test Fixture R&S®TS 7110

- Production, service and quality assurance
- Tests of printed board assemblies
- RF tests via the built-in antenna
- Audio tests with artificial ear and mouth
- Keyboard test with pneumatic fingers
- Tests of black/white or colour displays
- Tests of UUT built-in cameras

Outstanding characteristics

- Overall concept for the function test (board and final test as well as testing the UUT user interface)
- RF- and audio-compliant setup of the test chamber
- Modular design
- Exchangeability of the UUT mount
- Subsequently upgradeable for new product versions
- Controllable via standardized USB interface
- Easy manual handling due to pneumatic support for fixture closing
- Status displays for user information
- Separate operating program for debug purposes and manual operation

Summary

The modular concept of the Shielded RF Test Fixture R&S®TS 7110 permits fast and project-specific provision of system components for the function tests of UUTs with radio interface such as mobile phones. The scope of applications of the fixture ranges from module test to final test, which includes the electrical, mechanical, acoustic and optical test and thus enables the testing of all currently known elements.

The modular design of the fixture is an ideal basis for quality implementation of projects in due time, either by the Rohde & Schwarz integration centers, authorized systems houses or by the users themselves.

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Additional space in the upper part of the RF chamber of the R&S®TS 7110 test fixture has been provided for the installation of cameras above the UUT so that the automatic optical display test is integrated in the final test. The focus was on minimum height of the upper fixture part and low weight to ensure easy manual handling (FIG 2).

The narrow distance between camera and display due to the small height coupled with the often very high requirements placed on measurement accuracy require software correction of geometric distortions, vignetting of the objective and inhomogeneous lighting in order to reliably detect errors and measure values exactly.

Modern smart phones and PDAs are additionally equipped with a camera that must also be tested. Unlike the display test where different samples are applied, the camera test requires only a specific test pattern for testing the position, contrast and colours of the camera (FIG 6).

Due to the diverse test requirements of the manufacturers and the strongly deviating layouts of the UUTs, significant adaptations to the specific projects must always be made. This affects UUT mounting, but also the position and extent of the mechanical, electrical and optical components.

More information and data sheets at www.rohde-schwarz.com (search term: TS 7110)

Data sheet R&S®TS 7110

Data sheet R&S®TS 7180

REFERENCES

[1] Cellular Phone Production Test Platform R&S®TS 7100: Compact, flexible and ready to go for mass production. News from Rohde & Schwarz (2000) No.169, pp 4–7

[2] Test platform for Mobile Phone Production R&S®TS 7180: Ready for mass production, incoming goods inspection and service. News from Rohde & Schwarz (2002) No.176, pp 10–13