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FIG 1 Basic configuration of the RF Test System R&S TS8965.



The new modular RF Test System R&S TS8965 for the Bluetooth communication standard has been designed for use in development, prequalification and quality assurance. The system can also be upgraded to the tried-and-tested full-compliance

Test System R&S TS8960.

RF Test System R&S TS8965

Flexible upgrading from base system to full-compliance test solution

Simple adaptation to requirements

The base system includes two measuring instruments, an RF unit and a controller (FIG 1). With this configuration, up to 12 or 16 test cases of the Bluetooth* RF test specification can be performed. The base system can be upgraded to the validated full-compliance RF Test System R&S TS8960 [*] with the aid of five options.

This flexibility allows users performing Bluetooth measurements to first choose an economical solution that fits their

budget and test requirements, and then to upgrade the system later. A main advantage of this new test system concept is that it uses the same measuring instruments and test methods as the full-compliance Test System R&S TS8960. Thus, if a DUT passes a test performed with the precompliance Test System R&S TS8965, it will most likely also pass the qualification tests in a test house.

* Bluetooth is a registered trademark of Bluetooth SIG, Inc., USA, and is licensed to Rohde & Schwarz.

Components of base system

The base configuration of the R&S TS8965 includes a Spectrum Analyzer R&S FSP3, the *Bluetooth* signalling unit, an RF unit (Signal Conditioning Unit R&S SCU) and a System Controller R&S PSM 12 (FIG 1). The SCU consists of a 4-way combiner, a directional coupler, two isolators and an attenuator.

The 12 test cases of the *Bluetooth* RF test specification that can be performed with the base system comprise the following measurements:

- ◆ Output power
- ◆ Power density
- ◆ Power control
- ◆ TX output spectrum
 - Frequency range
 - 20 dB bandwidth
 - Adjacent-channel power
- ◆ Modulation characteristics
- ◆ Initial carrier frequency tolerance
- ◆ Carrier frequency drift
- ◆ Sensitivity
 - Single slot
 - Multislot
- ◆ Maximum input level

The *Bluetooth* signalling unit includes a level control module permitting the required signalling and payload signal levels to be set by way of TCP/IP via the Ethernet interface. In the base configuration, this module also serves as a payload signal source for receiver test cases.

Gradual upgrade by options to full-compliance test system

With the aid of five options, the base system can be gradually adapted to increasing requirements (FIG 2 and 3).

Option 1 – Spurious emissions

When the base system is equipped with option 1, the test cases for spurious emissions can be performed in line with the ETS300328 and FCC Part 15.247(c) standards. The available frequency range depends on the model of the Spectrum Analyzer R&S FSP (3/7 / 12.75 GHz). Since the measurements are performed without bandstop and high-pass filters, spurious emissions in the vicinity of the carrier can only be measured to a limited extent.

Main characteristics of the RF Test System R&S TS8965

- ◆ Compact, powerful and favourably priced
- ◆ Modular design: the base system can be upgraded in five steps to the full-compliance Test System R&S TS8960
- ◆ Same measuring instruments, test methods and operating software (graphical user interface) as the R&S TS8960
- ◆ Variable test case parameters

Option 2 – C/I performance

Option 2 includes the Vector Signal Generator R&S SMIQ03B and considerably extends the test system's function range. When receiver test cases are performed, the generator acts as a payload signal generator like in the R&S TS8960. As a result, the "dirty transmitter" function of the vector signal generator can be used for sensitivity tests. ▶

Available options

Option	Hardware	Function
1 – Spurious emissions	–	◆ Test of spurious emissions up to 3/7/12.75 GHz
2 – C/I performance	◆ Vector Signal Generator R&S SMIQ03B	◆ C/I performance test ◆ "Dirty transmitter" function for sensitivity tests ◆ Blocking test up to 3 GHz
3 – Blocking performance	◆ Microwave Signal Generator R&S SMR20	◆ Blocking test up to 12.75 GHz ◆ Intermodulation test with option 2
4 – RF calibration	◆ Power Meter R&S NRVD ◆ Sensor R&S NRVD-Z1	◆ Path calibration (R&S SMIQ03B, e.g. from option 2, is required in addition)
5 – Upgrade to R&S TS8960	◆ RF Switch Matrix R&S SSCU-BT ◆ Vector Signal Generator R&S SMIQ03B ◆ RF Attenuator R&S RSP ◆ Sensor R&S NRVD-Z1	◆ All 16 validated test cases ◆ Automatic path calibration ◆ System selftest

FIG 2 Options for adapting the base system to increasing requirements.

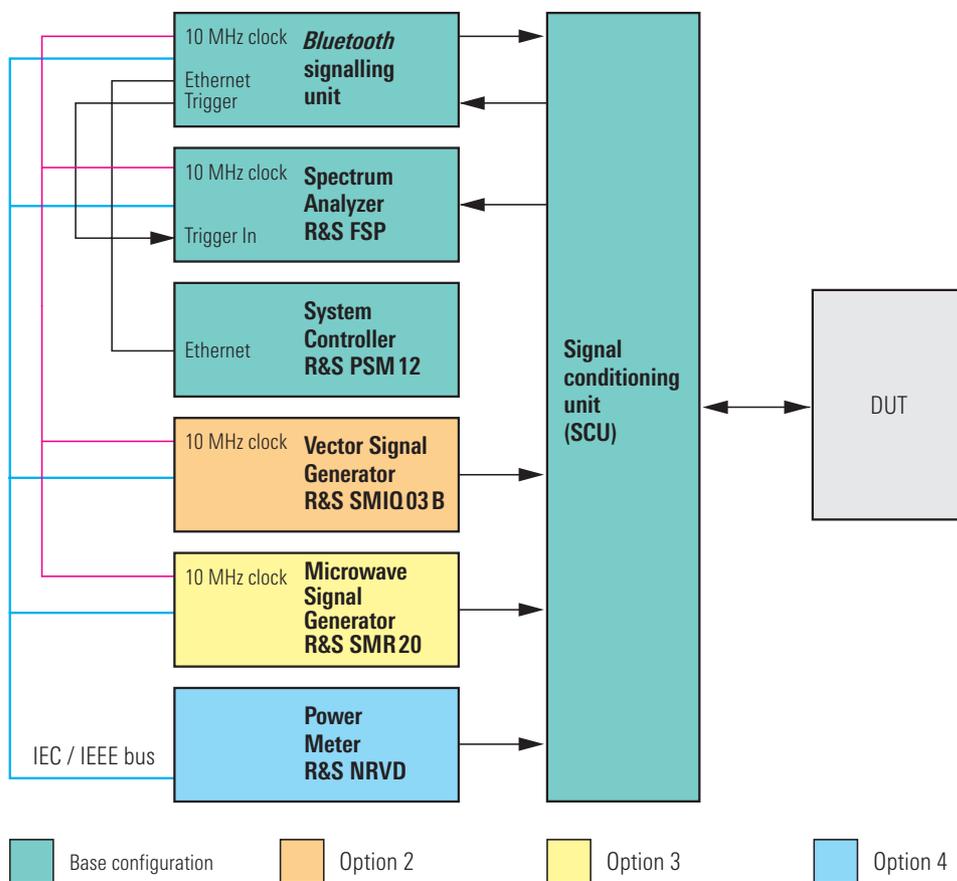


FIG 3 Options 2, 3 and 4 for the RF Test System R&S TS8965.

► Option 2 adds two test cases to those of the base configuration, the C/I performance test and the blocking test. When C/I performance tests are carried out, the *Bluetooth* signalling unit provides the payload signal and the R&S SMIQ03B a *Bluetooth* modulated RFI signal. With this option, the blocking test can only be performed up to 3 GHz because of the limited frequency range of the R&S SMIQ03B.

Option 3 – Blocking performance

If a blocking test up to 12.75 GHz is to be performed, as is prescribed by the test specification, the Microwave Signal Generator R&S SMR20 of option 3 is required. If options 2 and 3, i.e. an R&S SMIQ03B and an R&S SMR20, are available, the intermodulation test cases can also be performed.

Option 4 – RF calibration

The base configuration of the SCU is designed for 16 test cases so that it need not be updated when options are added. The SCU is calibrated prior to delivery. Calibration should be repeated once a year. This procedure ensures that measurements can be performed with an accuracy only slightly lower than that prescribed by the test specification.

If a higher measurement accuracy is required, the RF calibration option can be used. The system can be calibrated by the user with the aid of the Power Meter R&S NRVD, Sensor R&S NRV-Z1 and the associated path calibration software. With this configuration, the measurement accuracy of the *Bluetooth* test specification can be attained with only a few restrictions which mainly concern signal quality (e.g. modulation accuracy) and signal stability.

Option 5 – Upgrade to full-compliance Test System R&S TS8960

Option 5 upgrades the R&S TS8965 to the R&S TS8960. Based on a system equipped with options 1 to 4 (R&S SMIQ03B, R&S SMR20, R&S NRVD), this upgrade kit comprises an RF Switch Matrix R&S SSCU-BT, another R&S SMIQ03B, an additional Sensor R&S NRV-Z1, the RF Attenuator R&S RSP, a comprehensive calibration and selftest software as well as 16 validated test cases. With this complete solution, all test cases can be performed in line with the test specification.

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More information and test systems for *Bluetooth* at www.rohde-schwarz.com (search term: *Bluetooth*)



Flyer *Bluetooth*: Main measuring instruments and systems from Rohde & Schwarz for measurements on *Bluetooth* devices.

REFERENCES

[*] RF Test System R&S TS8960 – *Bluetooth*™ qualification in development and quality assurance. News from Rohde & Schwarz (2001) No. 172, pp 4–7

Other references:

- ◆ *Bluetooth* RF Test Specification 1.1, Revision 0.91, 2 July 2001
- ◆ *Bluetooth* Core Specification, Revision 1.1, 22 February 2001