

Bidirectional digital I/Q interface with flexible user configuration

The R&S®EX-IQ-Box is a digital interface module that provides flexible digital baseband inputs and outputs for signal generators and signal analyzers from Rohde & Schwarz.

High-end T&M equipment from Rohde & Schwarz for the digital baseband

Signal generators and analyzers from Rohde & Schwarz have exactly the features needed to meet all the requirements encountered in the research, development and production of modern, digital communications systems. Whether EUTRA/LTE, 3GPP FDD with HSPA+, WLAN or WiMAX – the instruments from Rohde & Schwarz offer extensive capabilities for testing base stations, terminal equipment and modules. The R&S®EX-IQ-Box (FIG 1) now extends measurement capabilities even further. The digital interface module provides flexible

digital baseband inputs and outputs for signal generators and signal analyzers from Rohde & Schwarz. Using this interface, a vector signal generator from Rohde & Schwarz delivers realistic digital baseband signals for testing transceivers or other components. The generator thus not only covers all state-of-the-art standards, but also provides user-defined signals and effects such as fading, AWGN and impairments. A signal analyzer from Rohde & Schwarz used together with the R&S®EX-IQ-Box can analyze digital baseband modules. Parameters can conveniently be set via the user interface of the signal generator or analyzer.

FIG 1 The R&S®AMU200A baseband signal generator and fading simulator with the R&S®EX-IQ-Box.



Standard-compliant digital baseband signals with signal generators from Rohde & Schwarz

Via the R&S®EX-IQ Box, signal generators from Rohde & Schwarz with digital baseband outputs (e.g. the R&S®SMU200A, R&S®SMJ100A or R&S®AMU200A) provide digital baseband signals for all important wireless communications standards. All functions of the generators for creating signals can also be used for generating digital baseband signals. Plus, all signal processing functions to yield effects such as fading, AWGN or impairments are also available. This allows bit and block error ratio measurements on baseband receiver modules to be performed accurately and reproducibly (FIG 2).

Simple conversion of digital baseband signals to analog RF signals

If the R&S®EX-IQ-Box is used with an R&S®SMU200A signal generator with digital baseband inputs, baseband signals from a device under test (DUT) can be upconverted to the RF (FIG 3). The generator can thus simulate the RF section of a transmitter, enabling the baseband section to be tested independently of the RF section. All the functions of the generator for introducing signal effects are also available in this configuration.

Vector signal analysis of digital baseband signals

When operated together with the R&S®EX-IQ-Box, the R&S®FSQ, R&S®FSG and R&S®FMU signal analyzers from Rohde & Schwarz can analyze digital baseband signals of all important state-of-the-art standards. The analyzers' wide range of functions, including modulation and code domain analysis, is available in this application (FIG 4). Moreover, I/Q signals can be stored for postprocessing, e.g. for BER analysis.

These Rohde & Schwarz signal analyzer in conjunction with the R&S®EX-IQ-Box can be used as realtime RF digitizers, e.g. to replace an RF frontend not yet completed, or simply to record RF signals over extended periods of time (FIG 5).

Variable signal interface and flexible data formats

The R&S®EX-IQ-Box provides a flexible interface to the DUT offering comprehensive configuration options to accommodate a wide variety of present and future interface designs. The signal interface to the DUT supports the LVTTTL, CMOS

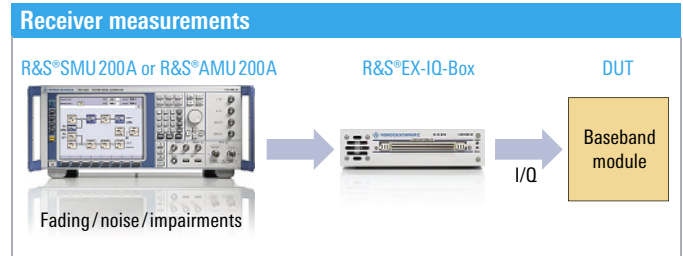


FIG 2 Receiver measurements, e.g. the determination of the BER and the BLER of a baseband module, can be performed accurately and reproducibly.

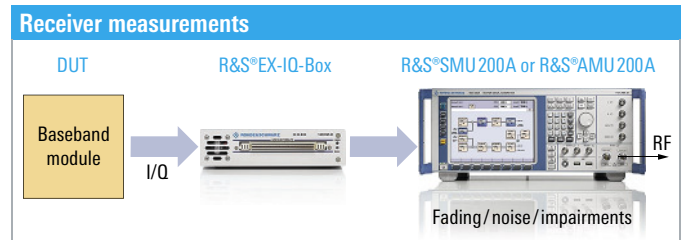


FIG 3 The generator simulates the RF section of a transmitter, enabling the baseband section to be tested independently of the RF section.



FIG 4 The analyzers' wide range of functions for analyzing digital baseband signals of all important standards is available, for example, for performing transmitter measurements on baseband modules.

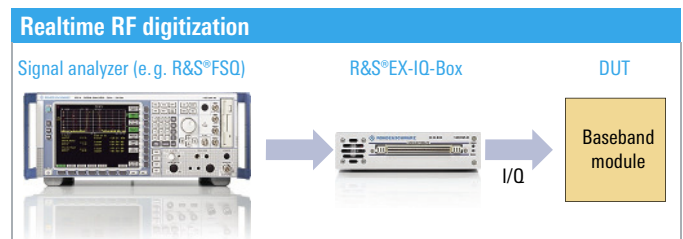


FIG 5 Signal analyzer used to replace an RF frontend or to record RF signals over extended periods of time.

and LVDS logic standards. Moreover, the R&S®EX-IQ-Box supports parallel and serial buses, single data rate (SDR) and double data rate (DDR), as well as I/Q and Q/I interleaving. The user can select the bit order and the word alignment as well as the numeric format (two's complement or binary offset). The word size for I and Q is selectable between 4 bits and 20 bits.

Variable resampling of the data rate can be performed with the Rohde&Schwarz instrument connected. This means that the user can simply use the data rate of the DUT and does not have to bother about data rate adaptation. The R&S®EX-IQ-Box comes with different breakout boards to match the most common connectors.

Flexible clock generation

Clock generation can also be flexibly adapted to the measurement task. The R&S®EX-IQ-Box can be operated with an internal clock signal and deliver the clock signal to the DUT, or it can be synchronized with a clock signal from the DUT or another external source. The phase and delay of the clock signal can be varied with respect to the data signal, e.g. to compensate for different cable lengths or to test a receiver's response to clock variations. The R&S®EX-IQ-Box supports clock rates of 1 kHz up to 100 MHz for parallel and up to 400 MHz for serial formats. It is thus possible, for example, to perform measurements on hardware emulators with I/Q signals slowed down deliberately (slow I/Q signals).

Intuitive operation

The R&S®EX-IQ-Box is operated from the Rohde&Schwarz instrument. The control of the box is integrated into the instrument software. A box connected to the instrument is

automatically detected and preconfigured as required for the instrument. All settings required for the R&S®EX-IQ-Box and the instrument – from the signal parameters to the interface format – can be made on the instrument, e.g. the R&S®AMU200A, which acts as a master. The user also benefits from the numerous convenient control and display functions offered by the graphical user interface. From the block diagram displayed by the R&S®AMU200A, for example, the user can immediately identify active digital I/Q interfaces as well as any R&S®EX-IQ-Box connected to the generator (FIG 6).

Summary

The R&S®EX-IQ-Box provides a versatile bidirectional I/Q interface that offers comprehensive configuration options for all important parameters. The R&S®EX-IQ-Box makes the wide scope of functions of the Rohde&Schwarz generators and analyzers now also available for measurements via digital I/Q interfaces. The instruments only have to be upgraded with the appropriate option for the digital baseband interface. This concept safeguards investments already made, and considerably expands the instruments' test capabilities. Specifications and detailed information about the options can be found in the data sheet on the Rohde&Schwarz website.

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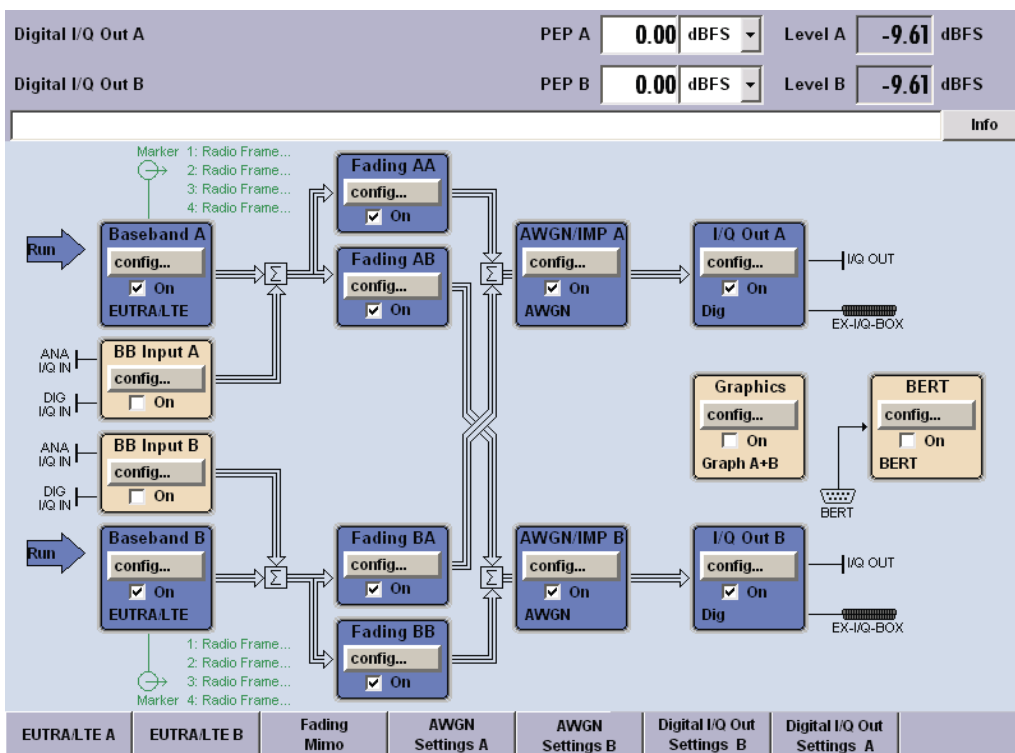


FIG 6 Convenient operation: block diagram displayed by the R&S®AMU200A baseband signal generator and fading simulator, here with an R&S®EX-IQ-Box connected to each of its digital I/Q outputs A and B.