Optional IQ and IF interfaces for new applications

The new options provide the Protocol Tester R&S CRTU-G [1] and the Universal Radio Communication Tester R&S CMU 200/300 with analog IQ and IF interfaces and thus offer new applications in the development of mobile radio modules.

Technical concept

With the options CMU-B17 and CRTU-B7, analog IQ and IF interfaces are available for the transmit and receive signal path. The module is connected between the RF section and the digital section. The IQ signals are obtained by conversion of the internal IF signals. The IF frequencies are in the range of 7.68 MHz to 13.85 MHz as required by the application. If the IQ and IF interfaces are not required, the transmit and receive signals can be looped through in the bypass mode without being affected by the interface module and without the specifications of the measuring instruments being modified.

Standards and applications

Currently, the standards GSM / GRPS / EDGE are available for the R&S CMU 200/300 with software V3.10, and IS136 mobile station tests as well as

the RF functional group are supported. Tests in accordance with WCDMA, CDMA and CDMA2000 will follow in the near future.

Fading

A fading simulator is required for development or conformance tests on mobile radio equipment for determining the receiver characteristics. If the measuring instrument and the DUT are connected with a line – which is similar to an ideal RF channel – the simulator can add the fading effects occurring under real outdoor conditions.

With the option SMIQB14 for the Signal Generator R&S SMIQ and the Baseband Fading Simulator R&S ABFS [2], Rohde & Schwarz has provided a prerequisite for the generation of fading profiles (FIGs 1 and 2). Cost-effective baseband fading can be implemented with the new IQ interfaces for the R&S CMU 200/300 or even in dual-channel configuration for the R&S CRTU-G.

An application note [3] describes the use of the R&S CMU 200 in conjunction with the Baseband Fading Simulator R&S ABFS as well as with the Signal Generator R&S SMIQ. This applies analogously to the R&S CRTU-G.

IQ generator

Another important application is the generation of IQ signals meeting the relevant standards. The user can generate complex signals that may even originate from a real signalling sequence. Most mobile radio chipsets comprise an RF chip and a baseband chip that communicate with each other via an analog IQ interface. This interface can then be used to access the two chips (FIG 3). In mobile radio development, different teams are often required for this purpose and the new testing feature via the IQ interfaces allows development work to be divided in space and time.

IQ analyzer

If IQ signals are applied to the receive section of the tester, signal analysis can be performed in the same manner as when feeding an RF signal. In this connection, modulation analysis, for example, is useful since it evaluates the quality of an IQ signal. Modulation analysis yields analysis results such as IQ offset and IQ imbalance, which directly affect IQ signals, or even more complex evaluations such as error vector magnitude (EVM) or, in the case of WCDMA, the peak code domain error (PCDE).

A useful complement to the IQ interfaces (in the WCDMA functional group which can also be used independently of the

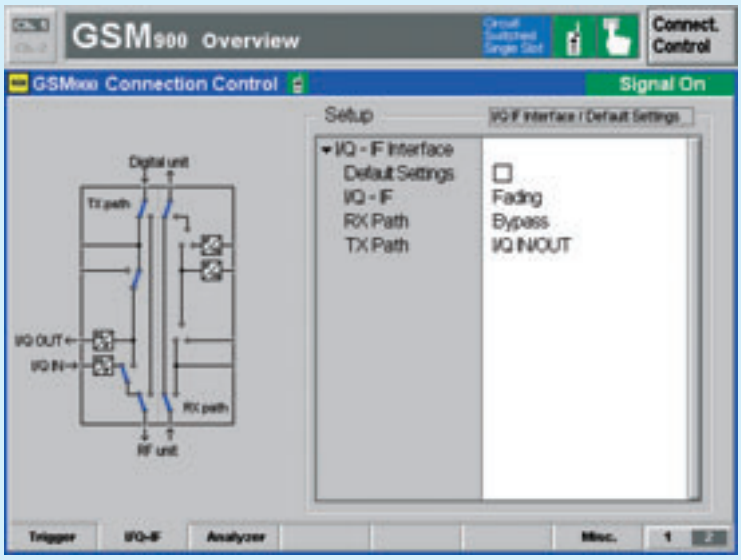

FIG 1
Menu in the R&S CMU 200 for fading applications.

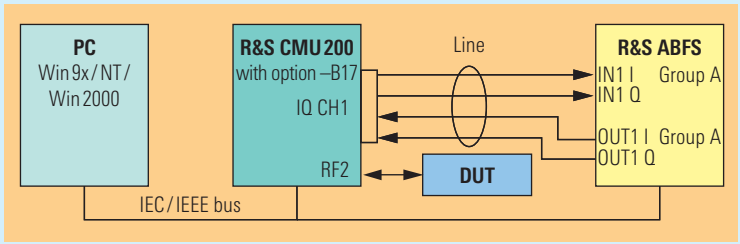

FIG 2
Fading test with the R&S CMU 200 and the R&S ABFS.

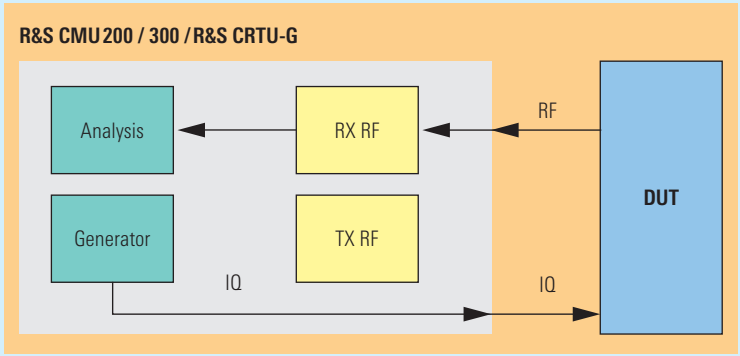

FIG 3
The DUT, e.g. an RF module, is driven with an IQ signal of the mobile radio tester. The RF signal thus generated can then be analyzed with the tester.

interfaces) is the new IQ analyzer measurement mode in the R&S CMU 200. In this mode, the modulation quality (EVM) and the constellation, vector and eye diagrams can be displayed graphically (FIGs 4 and 5). The user can thus perform a quantitative and qualitative analysis of the signal characteristic in the IQ domain.

Remote control interface

It is of course possible to query the test results and the original IQ samples via the remote control interfaces. This enables further analysis of the received signal. For example, the signal power distribution (CCDF diagram) can be calculated from the IQ samples. Another application is the statistical evaluation of a test sequence over a long period of time.

Summary

The new IQ and IF interfaces extend the range of applications of the R&S CMU 200/300 and R&S CRTU-G, particularly for the development of mobile radio modules and telephones. The complex signals of different mobile radio standards can be generated and evaluated in the IQ domain. An application of special interest is the generation of fading profiles for mobile radio signals with a baseband fading simulator.

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More information and data sheets at www.rohde-schwarz.com

REFERENCES

[1] GSM Protocol Analyzer R&S CRTU-G – Changing of the guard: after more than 10 years, a new GSM reference system. News from Rohde & Schwarz (2001) No. 171, pp 4–9

[2] Baseband Fading Simulator R&S ABFS – Reduced costs through baseband simulation. News from Rohde & Schwarz (1999) No. 163, pp 11–13

[3] 3GPP User Equipment Tests Under Condition of Fading with R&S CMU and R&S SMIQ/ABFS. Application Note 1MAA_54

Condensed data of options CMU-B17 and CRTU-B7

Standards	GSM, GPRS, EDGE, IS136 as of CMU 200 SW V3.10; planned for CDMA, CDMA2000, WCDMA (3GPP-FDD, UE test and BTS test)
IQ interfaces	analog outputs and inputs for the transmit path and receive path of a CMU/CRTU channel
IQ level	max 0.5 V, peak
Impedance	50 Ω
IQ bandwidth	up to 2.5 MHz

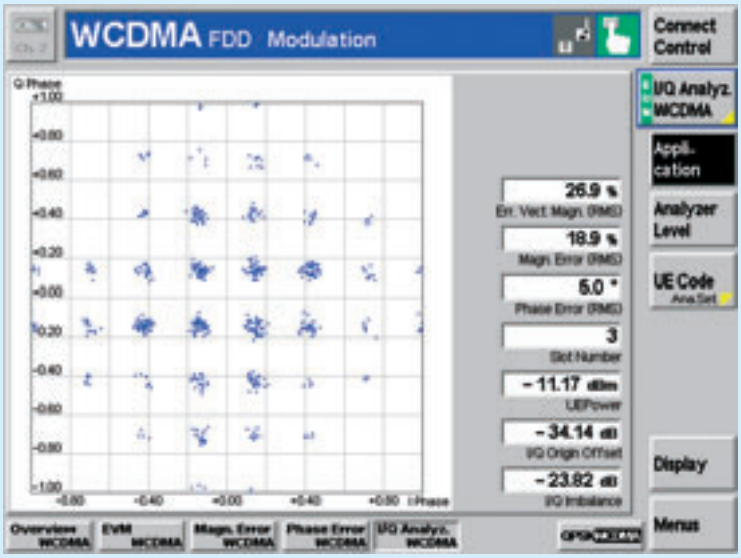

FIG 4 Constellation diagram of a WCDMA signal.

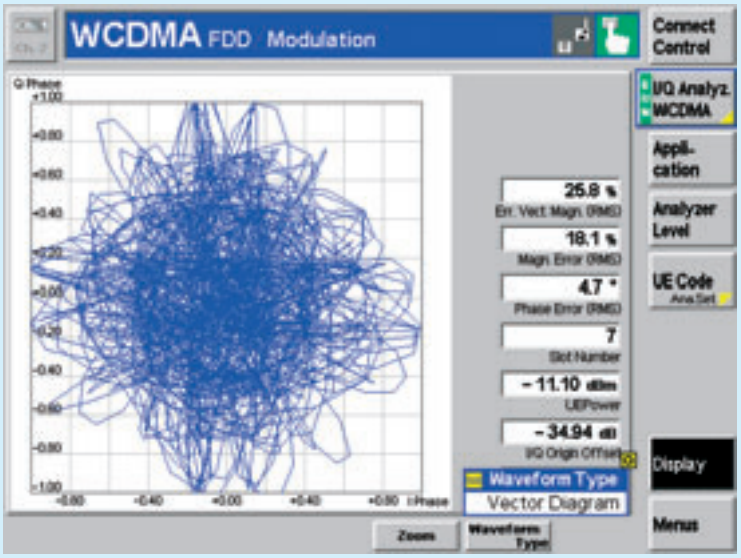

FIG 5 Vector diagram of a WCDMA signal.