

Vector Signal Generator R&S SMV

Golden devices: ideal path or detour?

Featuring a frequency range of 9 kHz to 3.3 GHz, a precise vector modulator with 100 MHz RF bandwidth, high frequency and level accuracy, short setting times and an electronic attenuator, the R&S SMV03 (FIG 1) is the ideal signal generator for automatic component and module tests in production as well as for general applications in research, development and service. It offers significant advantages over the use of golden devices as a signal source.



FIG 1 Module test using R&S SMV03, R&S AMIQ and Spectrum Analyzer R&S FSP.

Are golden devices really more economical?

Manufacturing mass-produced articles such as mobile phones or WLAN modules is inconceivable without automatic test sets. Several signal sources with vector modulation capability are, of course, required for this purpose. Golden devices are often used, and the test sets are implemented as shown in FIG 2. These golden devices usually consist of circuits taken from the modules or components that are currently being produced. The I/Q modulator of a WLAN module, for example, is basically able to generate test signals for this module. In order to obtain a useful golden device, some modifications are generally necessary, but the effort involved is usually limited.

Does this mean a golden device is more economical than purchasing a signal generator? At a first glance, the answer is yes. However, this answer does not take into consideration that several additional requirements must be met for such a golden device to be truly beneficial for use in automatic test systems.

First of all, an interface is necessary for the connection to the remote-control system of the test set. Moreover, the RF level must be settable, and this can only be accomplished if a variable attenuator is provided. Since the accuracy and stability of the RF level generated by the golden device leave a lot to be desired, a power meter with power splitter for coupling is indispensable. To prevent level drift, the power meter must be continuously queried and the variable attenuator reset, which drastically increases the setting times.

More information and data sheets at
www.rohde-schwarz.com
(search term: SMV03 or AMIQ)

REFERENCES

- [*] Vector Signal Generator R&S SMV03: All-rounder with excellent vector modulator. News from Rohde & Schwarz (2001) No. 172, pp 24–26

► The happy medium: Signal Generator R&S SMV03

All the above disadvantages can be neatly circumvented by using a Vector Signal Generator R&S SMV03 [*]. As shown in FIG 3, the variable attenuator and the power meter with associated power splitter can thus be omitted. Of course, operating these instruments is also no longer necessary, resulting in considerably shorter setting times – a factor of great importance in automatic test systems. The R&S SMV03 typically requires only 10 ms for a frequency setting and 5 ms for a level setting. Accuracy and stability are ensured by the built-in level control and the wear-free electronic attenuator in the generator. The level error is typ. 0.3 dB up to 2 GHz, and typ. 0.7 dB above 2 GHz. Owing to the built-in IEC/IEEE bus and RS-232-C interfaces, the connection to the controller of the test set is no problem either.

The use of golden devices is difficult if several different products are to be tested on the test set, which may have been devised for diverse digital communication standards. In this case, these makeshift solutions simply lack the required adaptability. The only remaining possibility would be to use several different golden devices. In contrast, the R&S SMV03 as a universal signal generator effortlessly meets the most disparate T&M tasks. If the I/Q Modulation Generator R&S AMIQ with the associated Simulation Software R&S WinIQSIM™ is used as an I/Q signal source, the generation of any conceivable signals for different digital standards is child's play.

Golden devices entail some other disadvantages as well: their specifications match those of the DUTs. This is due to the common technical relationship mentioned at the beginning of this article. The test results thus obtained rather resemble Go/NoGo tests. However, a

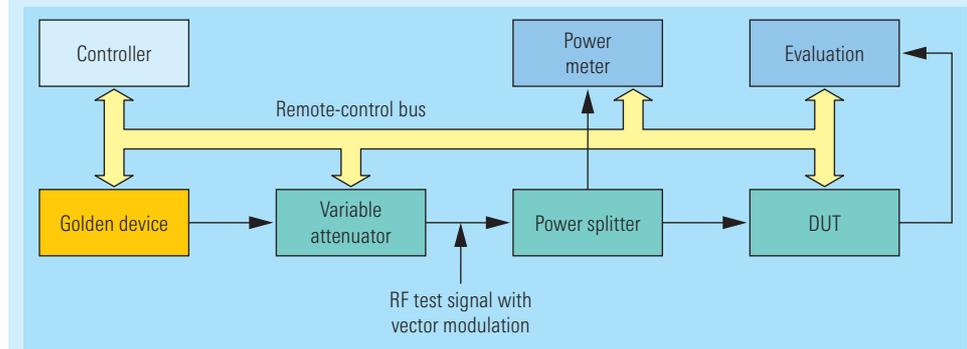


FIG 2 Test setup for tests using a golden device.

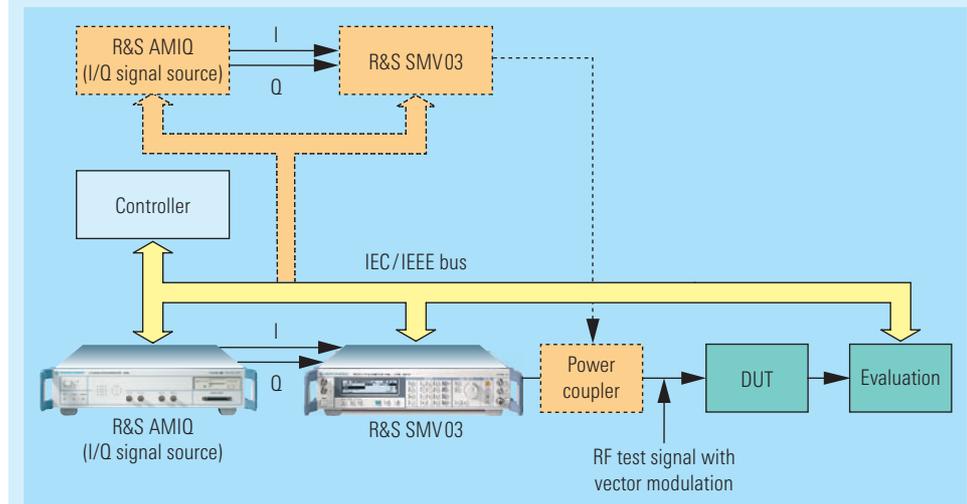


FIG 3 Test setup for tests using the R&S SMV03 and the R&S AMIQ.

rule of thumb tested in practice and verifiable also in theory says that the test setup has to be more precise by at least 10 dB than the DUT in order to obtain conclusive test results.

Owing to the outstanding technical characteristics of the R&S SMV03 in combination with the I/Q Modulation Generator R&S AMIQ, this rule can be easily fulfilled for all measurements on WLAN receiver modules for the 2.4 GHz range, for example. FIG 3 depicts the required test setup in accordance with IEEE802, allowing the following tests:

- ◆ Minimum input sensitivity
- ◆ Suppression of adjacent channels
- ◆ Suppression of non-adjacent channels
- ◆ Maximum input level

The interference sources of the adjacent-channel tests are shown as dotted lines in FIG 3.

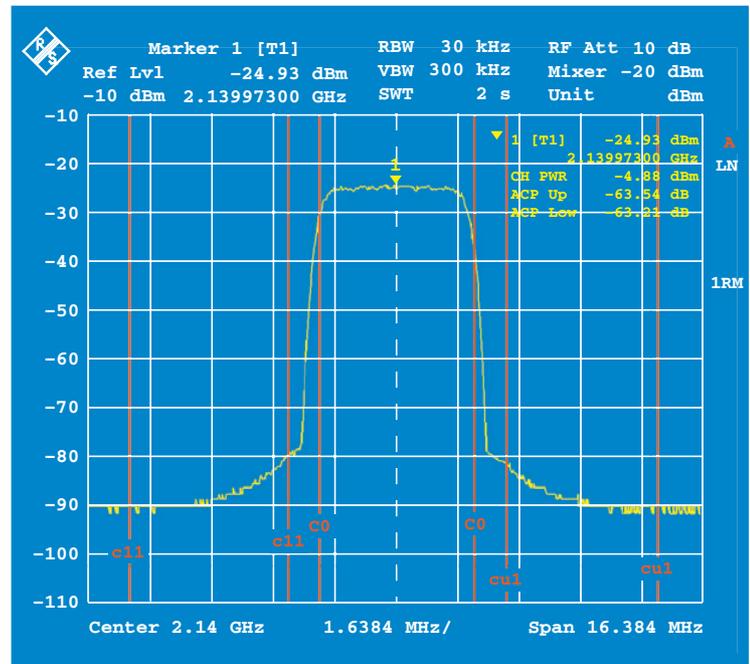
The listed measurements place considerable demands on the I/Q Modulation Generator R&S AMIQ and the signal quality of the R&S SMV03, which both instruments ideally fulfill. The R&S AMIQ is able to effortlessly generate the required OFDM signals in realtime, while the R&S SMV03 features an SSB phase noise of typ. -128 dBc (measured at 1 GHz, 20 kHz carrier offset, 1 Hz measurement bandwidth) and a broadband noise of typ. -140 dBc (measured at 1 GHz, >2 MHz carrier offset, 1 Hz measurement bandwidth). This signal quality was until recently achieved only by high-

end generators. The patented I/Q modulator of the R&S SMV03 with its RF modulation bandwidth of 100 MHz and an error vector magnitude of typ. 0.3% (for RF signals below 2.6 GHz) also surpasses the requirements.

FIG 4 shows a typical WCDMA output signal at 2.14 GHz with a measured ACLR value of 63 dB (test model 1, 64DPCH, 10.7 dB crest factor). This signal allows, for example, the measurement of ACLR values of output amplifiers for WCDM handsets without impairing the measurements, and these amplifiers exhibit ACLR values of about 45 dB at nominal power (+27 dBm at 1950 MHz). The test setup in this case is again analog to FIG 3, however without the dotted circuits. A Spectrum Analyzer R&S FSU is the ideal evaluation tool.

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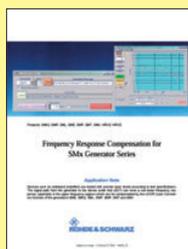
FIG 4 Typical WCDMA output signal of the R&S SMV03 at 2.14 GHz (test model 1, 64DPCH, 10.7 dB crest factor).



GENERAL PURPOSE | Test tip

Frequency response compensation for generators of the R&S SMx family

Test specifications prescribe defined input levels for equipment such as broadband amplifiers. The signal path between the generator and the device under test (DUT) may however exhibit nonlinear frequency response, especially at higher frequencies. This nonlinearity can be compensated for with the aid of the UCOR (user-specific correction) function available on the R&S SME, SMIQ, SML, SMP, SMR, SMT and SMV generators. First, the frequency response is determined, and the deviation from nominal level is entered into the generator's UCOR table for the frequency range of interest. With the UCOR function activated, the corresponding level offset will be added automatically for each frequency to which the generator is set. The R&S SMR and R&S SMP generators are capable of measuring the frequency response directly via the IEC/IEEE bus interface by means of a Power Meter R&S NRVD or



R&S NRVS, and the values are entered automatically into the UCOR table. This functionality is not provided on the other generators mentioned above. An application note available on the Rohde & Schwarz website describes in detail how to perform frequency response compensation for either type of generator. The application note comes with a free-of-charge program (SMxUCor). This program is primarily intended for generators that offer UCOR functionality but cannot be connected to an external power meter. SMxUCor imports correction values from an ASCII file and enters the data into the generator UCOR table.

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Detailed application note 1MA56 and SMxUCor program available on Rohde & Schwarz website.