Vector Signal Generator R&S®SMU 200 A

Signals for testing multicarrier power amplifiers

Featuring excellent ACLR values, an RF bandwidth of 80 MHz and a high output level, the Vector Signal Generator R&S®SMU 200 A is an unrivaled multicarrier signal source.

The R&S®SMx signal generator family has another innovation in store – an option for generating GPS signals (page 36).

New trend: multicarrier base stations

The growing number of voice and data services plus new standards such as 3GPP FDD or CDMA 2000® led to a dense occupation of available frequency resources – compared with the initial phase of mobile radio.

Due to technical and cost-saving reasons the number of single-carrier base stations is limited. Hence, multicarrier base stations with only one power amplifier must accommodate several frequency channels. The linearity and intermodulation requirements placed on these amplifiers are very high, especially for 3GPP FDD or CDMA 2000®.

The well-known multicarrier continuous wave option of the Vector Signal Generator R&S®SMU 200 A allows you to generate a multicarrier CW signal with user-definable carrier spacing and maximally 8192 unmodulated carriers. Now, the new multicarrier feature enables you to configure modulated carrier signals as well. A powerful yet easy-to-operate menu provides a multicarrier signal with up to 32 carriers and 80 MHz bandwidth. Using this signal, you can perform various transmitter and receiver tests specifically tailored to multicarrier transmission (e.g. in accordance with 3GPP TS 25.141).

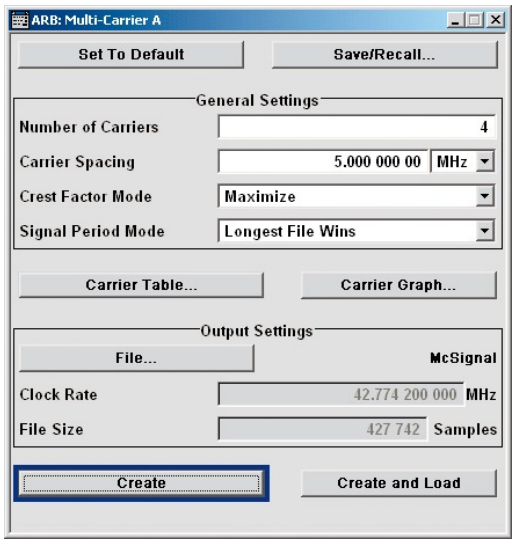

FIG 1
Main setting menu for generating multicarrier signals.

Complex signals – easy handling

First, the number of carriers and the carrier spacing are set in the main setting menu (FIG 1). The result is a multicarrier signal where the single carriers are arranged symmetrically around the RF frequency; the spacing between the carriers is equal.

Using the Crest Factor mode, you can choose between defining the phase angles of the individual carriers yourself and keeping the crest factor to a maximum or minimum by using the generator's optimization capability. Since the crest factor of a signal indicates the ratio between peak and rms voltage, a higher crest factor, for example, induces larger dynamic variations in the signal and, with transmitter tests, places stricter requirements on a power amplifier's linearity.

By calling the Carrier Table submenu, each carrier can now be configured individually with respect to phase, gain, delay and signal content. This configuration is clearly listed in a channel table. A wizard integrated in the menu ensures fast and easy settings since phase, gain, delay and signal content need not be individually entered in the channel table but can be set globally by specifying the start value and the step size (FIG 2).

To verify the settings, the Multicarrier menu also provides a symbolic representation of the set scenario (FIG 3) in accordance with the channel table in the frequency range, as would be visualized on a spectrum analyzer (FIG 4). In this example, four 3GPP FDD test signals are centered around the RF frequency, each ▶

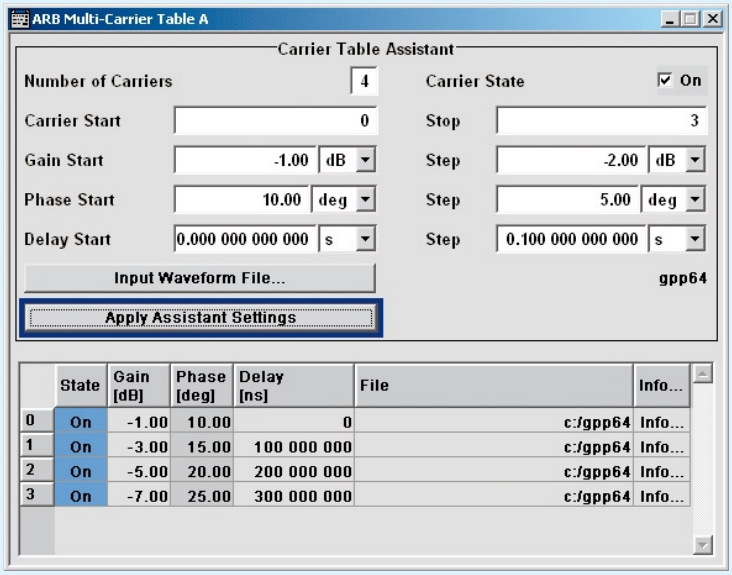

FIG 2
The Carrier Table Assistant submenu and the channel table derived from it.

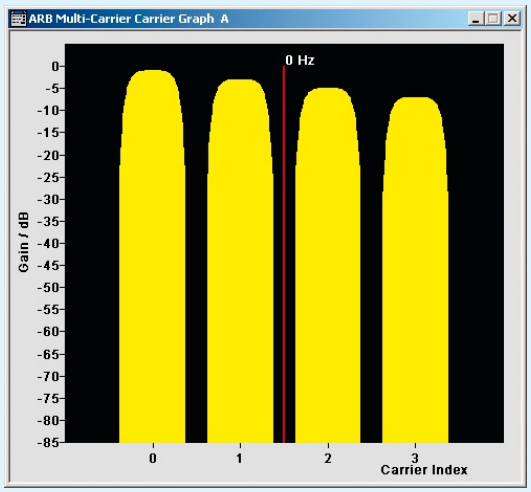

FIG 3
Visualized channel table: four 3GPP test signals, each with a level difference of 2 dB relative to the others.

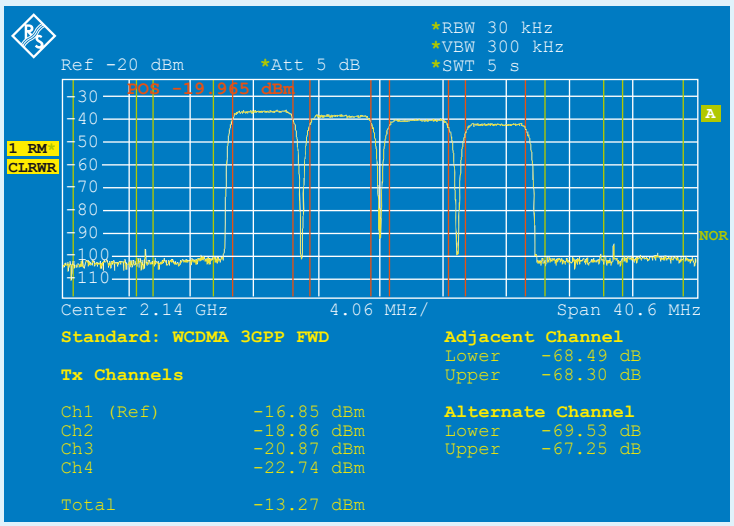

FIG 4
As a result, the multicarrier signal is made up of four 3GPP signals (test model 1) that are arranged on adjacent carriers at 5 MHz spacing.

attenuated by 2 dB relative to the others. The result of 68 dB for ACLR is far better than the 50 dB limit specified by 3GPP in TS 25.141 for spurious emissions.

Owing to the high level accuracy of internal signal processing in the R&S®SMU 200 A, the level differences of the individual carriers with regard to each other may be 30 dB to 40 dB at an acceptable error vector magnitude (EVM), if required by the test scenario. The delay of the carrier signals with respect to each other can be set to 1 ns exactly. In the TS 25.141, for example, the downlink test models of the 3GPP standards specify that the individual carriers, each shifted by one fifth of a timeslot duration, be added together.

New: interface for waveform files

All internally or externally generated waveform files can be used as input signal sources for the individual carriers. The R&S WinIQSIM™ Windows® software, for example, allows you to generate various waveforms yourself or import signals from other mathematical programs such as MATLAB® using R&S IQWizard™ [*]. Data can be loaded to the generator via the USB or IEC/IEEE bus interface.

What's new is that the software modules integrated in the R&S®SMU 200 A can now also generate waveform files for the 3GPP FDD and CDMA2000® standards; these files already include a completely modulated, i.e. pulse-shaped, waveform (FIG 5 top, Generate Waveform File). These files can be directly entered on the Multicarrier list as the input data sources. Thus, a single signal generator can generate a user-configurable multicarrier test signal for these standards without requiring further devices or external PCs.

The example in FIG 5 shows how easy it is to generate a multistandard multicarrier signal: By clicking *Generate Waveform File*, two waveform files are generated via the 3GPP FDD menu, containing a test model 1 (64 DPCHs and 32 DPCHs, respectively); a separate base station test signal is stored by the CDMA2000® menu. These three files are now entered in the channel table of the Multicarrier menu and provided as a multicarrier signal at the generator RF output.

Summary

By providing the new Multicarrier menu and a waveform file interface integrated in the software modules for the digital 3GPP FDD and CDMA2000® standards, the Vector Signal Generator R&S®SMU 200 A offers various ways to generate adequate multicarrier test signals. With its outstanding RF characteristics, the R&S®SMU 200 A is virtually indispensable for the new development of future multicarrier base stations and their broadband power amplifiers.

Dr Karlheinz Pensel

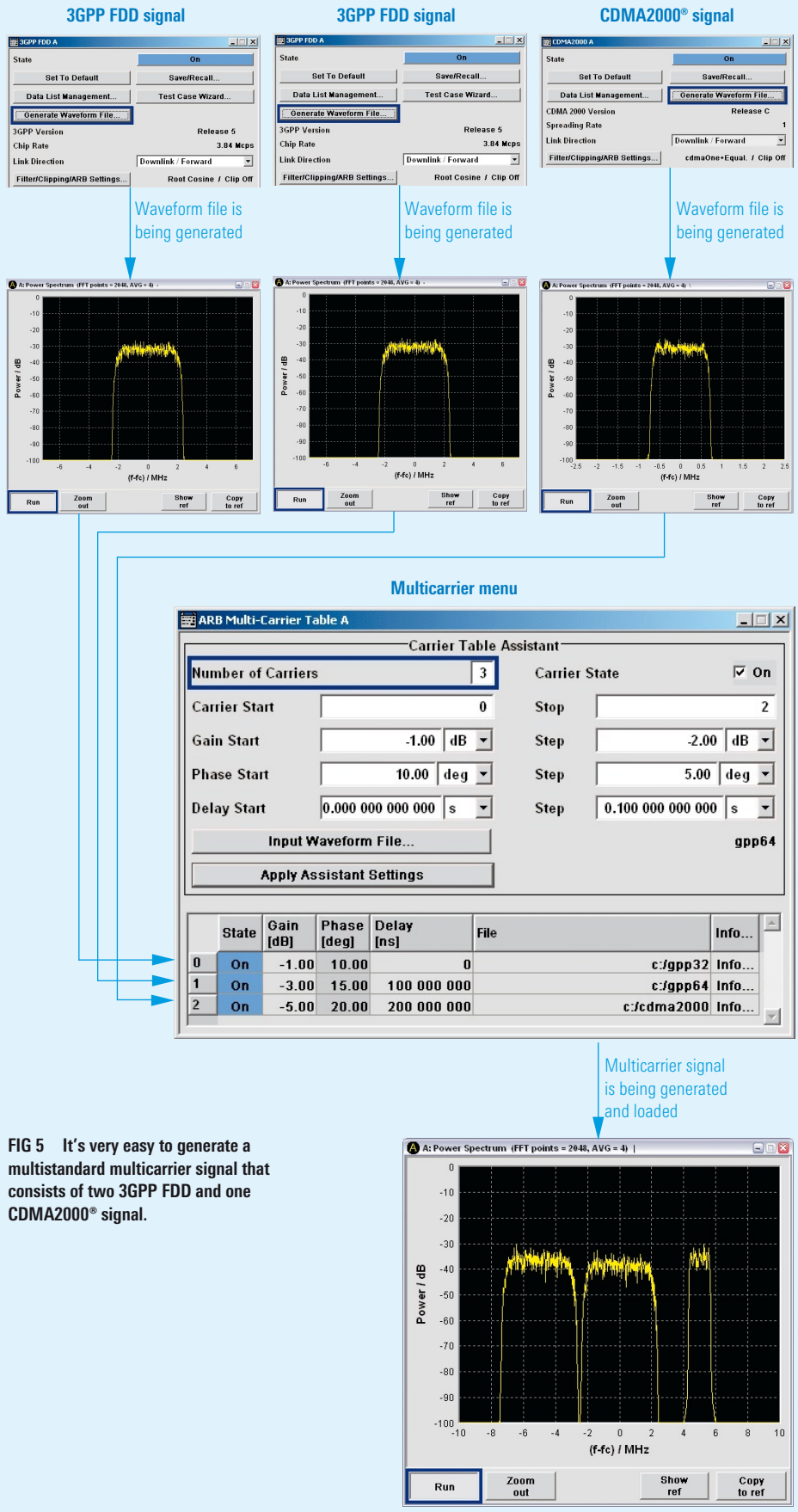

FIG 5 It's very easy to generate a multistandard multicarrier signal that consists of two 3GPP FDD and one CDMA2000® signal.

More information and data sheet at www.rohde-schwarz.com (search term: SMU200)

[*] R&S IQWizard™: I/Q signal measurement & conversion. Technical Information from Rohde & Schwarz (search term: 1MA28).