Wide dynamic range for measuring adjacent channel power

WCDMA base station amplifiers must
feature excellent spectral purity and
low intermodulation distortion to minimize interference in adjacent channels.

Measuring these characteristics calls for sources that are able to generate low-noise and low-distortion WCDMA test signals over a wide dynamic range.

The R&S SMIQ03HD (FIG 1) is designed especially for this purpose.

Optimal for testing base station amplifiers

High demands are set for adjacent channel leakage ratio (ACLR) in the development and production of base station amplifiers, especially for the upcoming mobile radio generation WCDMA / 3GPP. ACLR is the ratio of the average power measured in the transmission channel to the average power measured in the adjacent channel. Unwanted spurious is mainly caused by third-order intermodulation products in the adjacent channel and fifth-order intermodulation products in the alternate channel.

WCDMA specifications [1] stipulate a minimum ACLR of 45 dB in the adjacent channel for amplifier tests. Most producers specify an ACLR of 50 dB for their base stations. To maintain this value in the whole signal chain, the typical ACLR performance of base station components, e.g. amplifiers, must be better by another 10 dB. To provide sufficient margin for measuring these amplifiers, the adjacent channel leakage ratio of the signal generator must exceed this figure by yet another 10 dB. If the ACLR of the signal generator equalled that of the amplifier, an error of approx. 3 dB would result [2]. To keep this error below 1 dB, the ACLR of the generator must be at least 6 dB above that of the amplifier. For an error of <0.5 dB, the ACLR of the signal source must be better by at least 9 dB (FIG 2).

The R&S SMIQ03HD is the ideal partner in this case. Thanks to a newly designed I/Q modulator, the generator produces an outstanding ACLR of typically 70 dB, making it clearly superior to all instruments used before (WCDMA / 3GPP signal: test model 1, 64 DPCHs).
Integrated I/Q filters for highest ACLR

The R&S SMIQ03 HD is ideally suited for single-carrier and multicarrier signal applications. Integrated I/Q filters are one of its prime features. They allow spectrally pure multicarrier signals to be generated with an ACLR far above that specified for base stations. Using the optional Arbitrary Waveform Generator ARB SMIQB60 [3], excellent 62 dB (typical) is obtained in the adjacent channel and 64 dB in the alternate channel [4] (FIG 3) for a four-carrier WCDMA signal based on test model 1 with 64 DPCHs. The R&S SMIQ03HD can also be used with the I/Q Modulation Generator R&S AMIQ03 or R&S AMIQ04 to generate signals with a depth of 16 Msamples. The I/Q Simulation Software WinIQSIM™, supplied by Rohde & Schwarz free of charge, offers the user a variety of extra capabilities. Digital signals, e.g. 3GPP multicarrier signals, can be simulated and generated by just a few mouse clicks. The generator comprises I/Q filters for up to four WCDMA carriers. This ensures a large degree of flexibility for numerous amplifier tests. I/Q filters with bandwidths of 2.5 / 5 / 7.5 and 10 MHz for one to four WCDMA carriers are standard and selectable in the R&S SMIQ03 HD. Optimum ACLR values can thus be obtained for each of the four possible multicarrier scenarios.

For record values: High ACLR Option SMIQ B57

Not enough that the R&S SMIQ03 HD itself features superior signal quality. Signal quality for ACLR performance that no other generator has even come close to can be achieved with the optional Filter SMIQ B57, which was especially developed for the WCDMA downlink band (2110 MHz to 2170 MHz). A typical ACLR of 77 dB in the adjacent channel and 82 dB in the alternate channel is an absolute record (FIG 4). In addition, there is the high output level of up to +30 dBm PEP generated by the option in the overrange. The advantages speak for themselves. With this option integrated in the R&S SMIQ03HD, producers of base station components can make substantial cost savings, as no amplifiers or bandpass filters need be connected to the signal generator’s RF output. This...
avoids degradation caused by follow-up driver stages, which make a sizeable contribution to the noise in the output signal.

If the user wants to perform measurements with WCDMA multicarrier signals with the maximum spectral purity, up to four generators comprising the SMIQ B57 option can be combined. Using one source for each carrier in multicarrier signal generation produces an unrivalled ACLR of typically 74 dB in the adjacent channel (FIG 5) in a four-carrier WCDMA scenario (test model 1 with 64 DPCHs).

**Unbeatable in production**

Not only in development is the new generator an indispensable high-end tool. High throughput is essential for cost-effective production, so users here can also benefit from the advantages. They will look for extremely fast level and frequency setting times, another strong point of the R&S SMIQ03HD. Setting times of <3 ms for frequency and <2.5 ms for level are noteworthy enough. If the generator is operated in the list mode (<500 µs) or fast restore mode (<800 µs), setting times are even significantly shorter.

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**FIG 4** 77 dB in the adjacent channel is about 10 dB above the best figures of conventional signal generators.

**FIG 5** Multicarrier scenarios for exhaustive demands can be created by combining several R&S SMIQ03HD signal generators (each with the SMIQB57 option). In the example above, four generators are used for four carriers.

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**REFERENCES**

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2. 3GPP FDD Base Station Tests with Vector Signal Generator SMIQ. Application note 1GP41 from Rohde & Schwarz
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4. Generating and Analyzing 3GPP Multicarrier Signals with High Dynamic Range. Application note 1MA48 from Rohde & Schwarz