43 842/4

FIG 1 The R&S SMIQ 03 HD opens up new levels of performance in adjacent channel power measurement.

Vector Signal Generator R&S SMIQ 03 HD

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 SMIQ 03 HD (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 typ-
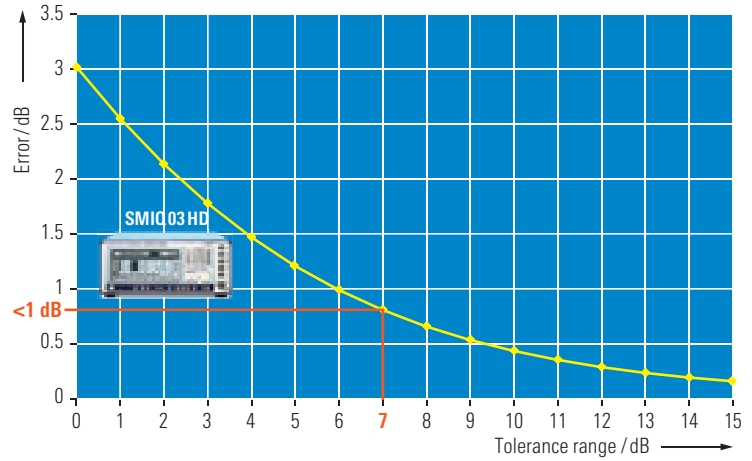
ical ACLR performance of base station components, e.g. amplifiers, must be better by another 10 dB. To provide sufficient margin for measuring these amplifiers, the adjacent channel leakage ratio of the signal generator must exceed this figure by yet another 10 dB. If the ACLR of the signal generator 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 SMIQ 03 HD 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).
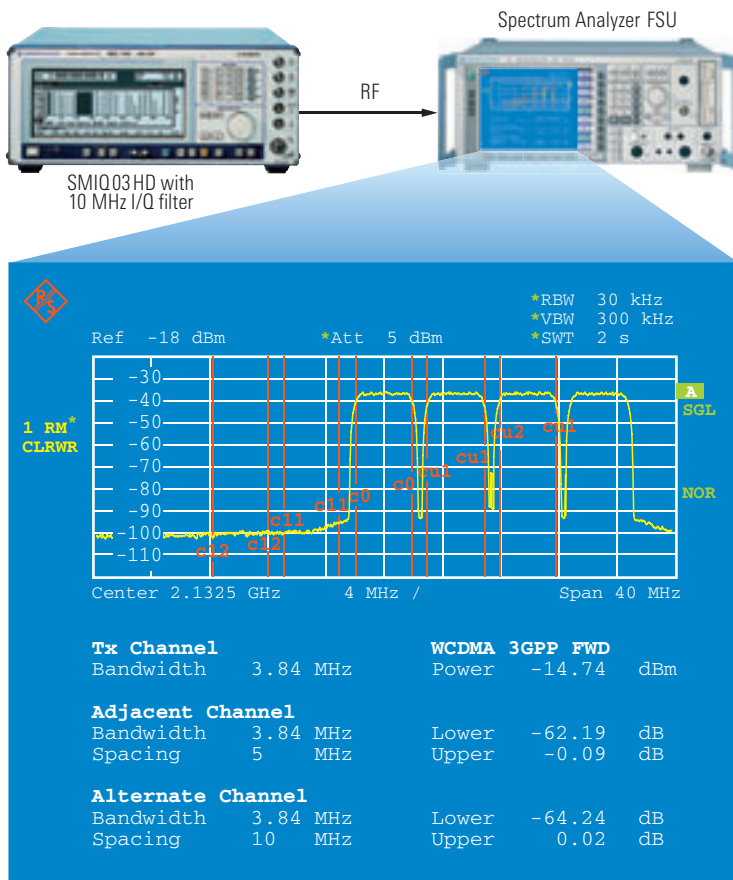
Integrated I/Q filters for highest ACLR

The R&S SMIQ 03 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 SMIQ B60 [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 SMIQ 03 HD can also be used with the I/Q Modulation Generator R&S AMIQ 03 or R&S AMIQ 04 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 SMIQ 03 HD. Optimum ACLR values can thus be obtained for each of the four possible multicarrier scenarios.

FIG 2 With 70 dB ACLR of the DUT, the error caused by the R&S SMIQ 03 HD is negligible. The tolerance limit of 7 dB produces an error of <1 dB.

For record values:
High ACLR Option SMIQ B57

Not enough that the R&S SMIQ 03 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 SMIQ 03 HD, 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
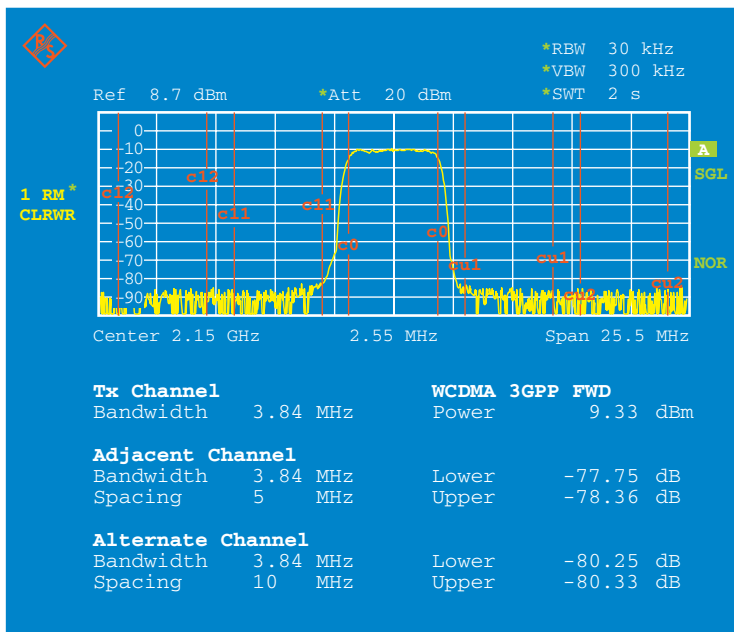
Spectrum Analyzer FSU

RF

SMIQ 03 HD with 10 MHz I/Q filter

```
Ref  -18 dBm        *Att  5 dBm     *RBW   30 kHz
                                    *VBW  300 kHz
                                    *SWT   2 s
1 RM*
CLRWR
```

Center 2.1325 GHz   4 MHz /   Span 40 MHz

Tx Channel   WCDMA 3GPP FWD
Bandwidth   3.84 MHz   Power   -14.74   dBm

Adjacent Channel
Bandwidth   3.84 MHz   Lower   -62.19   dB
Spacing   5   MHz   Upper   -0.09   dB

Alternate Channel
Bandwidth   3.84 MHz   Lower   -64.24   dB
Spacing   10 MHz   Upper   0.02   dB

FIG 3
The four-carrier WCDMA signal scenario generated by only one R&S SMIQ 03 HD yields an ACLR of 62 dB in the adjacent channel.

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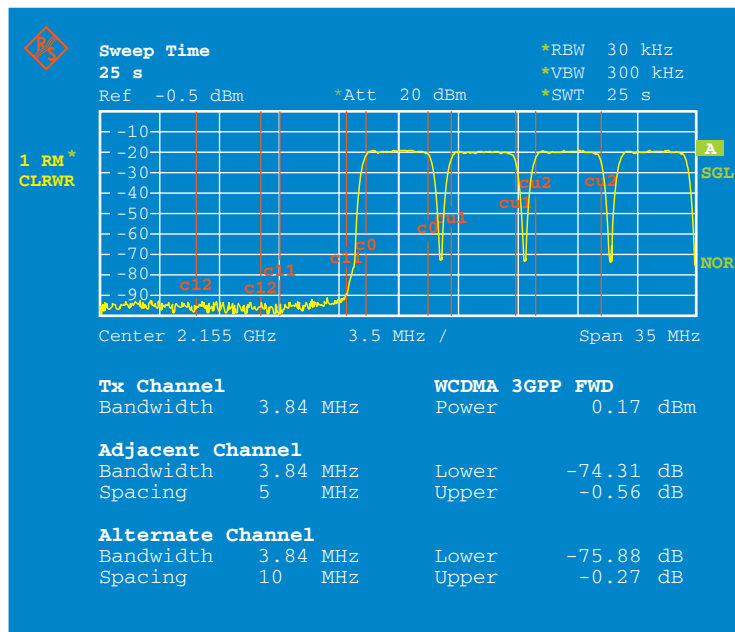

FIG 5   Multicarrier scenarios for exhaustive demands can be created by combining several R&S SMIQ 03 HD signal generators (each with the SMIQ B 57 option). In the example above, four generators are used for four carriers.

▶ 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 B 57 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 fre-

quency setting times, another strong point of the R&S SMIQ 03 HD. 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.

Dr Markus Banerjee

More information, data sheets and application notes at www.rohde-schwarz.com (search term: SMIQ)

Data sheet R&S SMIQ 03 HD

REFERENCES
[1] 3GPP Technical Specification TS 25.141 (V3.6.0 – 2001-06) 3rd Generation Partnership Project (3GPP)
[2] 3GPP FDD Base Station Tests with Vector Signal Generator SMIQ. Application note 1GP41 from Rohde & Schwarz
[3] SMIQ B60 – Arbitrary Waveform Generator for SMIQ. Application note 1GP45 from Rohde & Schwarz
[4] Generating and Analyzing 3GPP Multicarrier Signals with High Dynamic Range. Application note 1MA48 from Rohde & Schwarz