Spectrum Analyzers R3267 and R3273 from Advantest

Versatile complete solution for testing WCDMA/3GPP systems

In various European countries UMTS licenses are being auctioned off or awarded, accompanied by slogans like "mobile into the Internet, surf with your mobile, WCDMA, 3GPP", etc. What it is all about is the next, the third generation of mobile radio. The Japanese corporate group NTT led the way, being worldwide the first to put into operation a WCDMA network in line with the NTT DoCoMo standard. Advantest offers a measurement solution for the WCDMA standard which will in future also be effective in Europe.

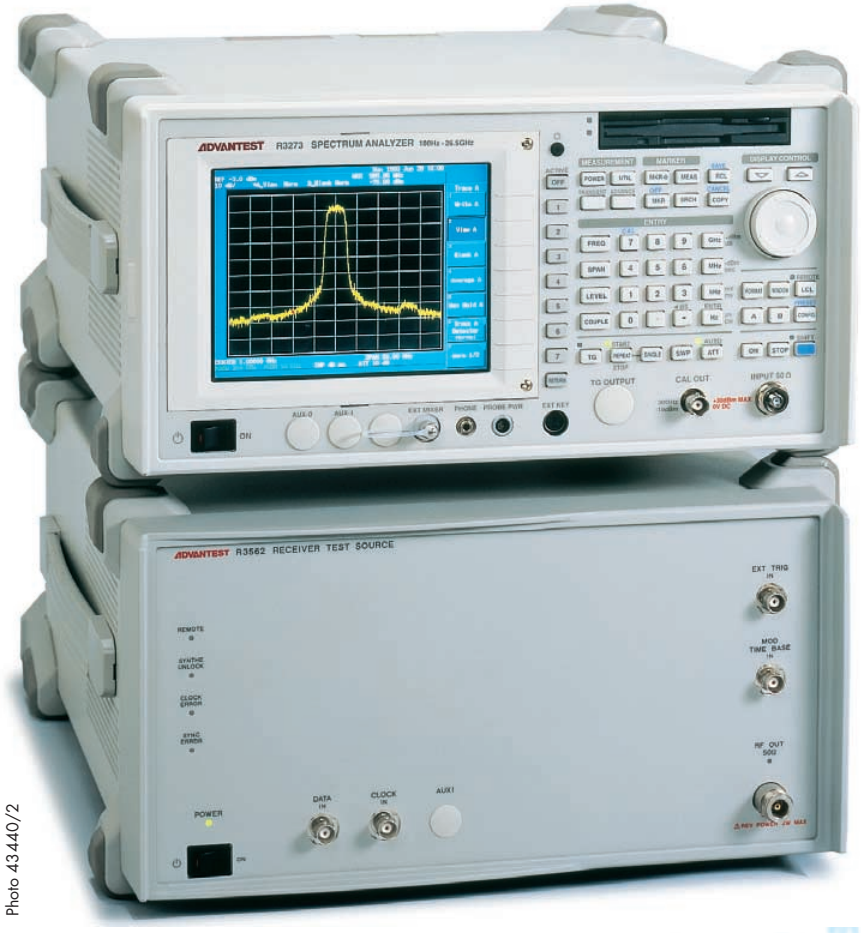

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FIG 1 Spectrum analyzer plus signal source: user-friendly complete solution for measurements on WCDMA/3GPP systems

Standard adopted and yet still in a state of flux

As early as 1997 Advantest, a cooperating partner of Rohde&Schwarz for many years, developed and supplied NTT with measuring instruments supporting this standard. Meanwhile the WCDMA standard complying with 3GPP (3rd generation partnership project) has been adopted, this process not yet being completed however, as there will still be amendments and additions. For this standard, which in future will also be effective in Europe, Advantest offers a measurement solution comprising a spectrum analyzer and a signal source. In view of the ongoing modifications of the standard, it is essential that the measuring instrument can be quickly adapted to the changes. This is easily possible by firmware updates, so the user can be sure that the measuring equipment, once purchased, will stay in tune with future requirements.

Spectrum analyzer and signal source – a versatile duo

The measurement system offered by Advantest comprises Spectrum Analyzer R3273 (100 Hz to 26.5 GHz) with modulation analysis (FIG 1, top) or R3267 (100 Hz to 8 GHz, FIG 2) plus WCDMA/3GPP Signal Source R3562 (FIG 1, bottom). This set allows testing of base stations as well as mobile phones and other future user terminals.

New mobile-radio systems and their components are tested in various phases. The first phase is product development, calling for excellent RF characteristics of the measuring equipment used. With noise level of as low as –154 dBm/Hz, phase noise of only –145 dBc/Hz and resolution bandwidths of 1 Hz to 10 MHz, to mention just a few parameters, the two spectrum analyzers have the necessary qualifications. What is more, they have I/Q inputs that allow various measurements at I/Q level in the baseband too, a feature that is especially interesting in the development of modules or components.

When it comes to production, the main emphasis is on high speed and IEC/IEEE-bus control of all measurements, requirements that are definitely in favour of the Advantest duo. Another field of application is the verification of manufactured components, eg testing a base station in line with the measurements stipulated in the standard. The Advantest concept speaks for itself: the analyzers measure all specified parameters at the push of a button since all necessary settings are internally stored. On the other hand the instruments are flexible enough to allow deviations from standard parameters. Both features are of advantage in repair stations in production. And, as already stated, all measurements can be automated.

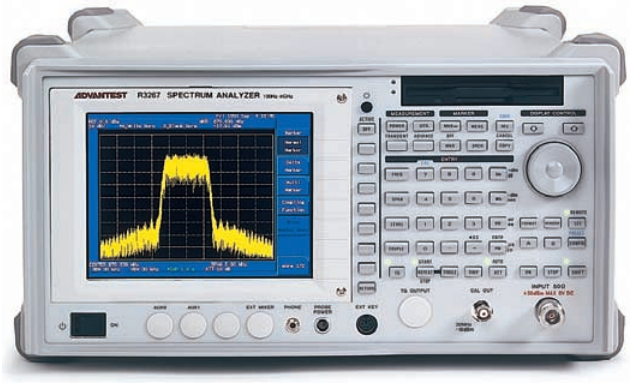

FIG 2
Spectrum Analyzer R3267 with frequency range 100 Hz to 8 GHz

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The high measurement speed and operating convenience of Analyzers R3267 and R3273 are the result of a number of automatic functions. Optimum matching of the internal attenuators to the signal level is particularly important for instance. The attenuators respond to variations of input signal level by automatic level adjustment, either upon the push of a button prior to each measurement or continuously.

For demodulation of signals a scrambling code is required, which may be unknown. In this case the analyzers detect the signals with the aid of a special mode – by searching either for the SCH channel or the primary CPICH channel – and demodulate them. Since 3GPP signals may have different data rates, automatic data-rate detection creates the prerequisites for code-domain power measurement of unknown signals, so the data rates need not be known beforehand. FIG 3 shows an example of all parameters determined for a signal.

Comprehensive channel analysis

The individual code channels are analyzed in the code-domain power display mode, where the channels are shown as different bars (FIG 4). Power, data rate, code number, EVM (error vector magnitude) and other parameters can be read for each channel. In addition to the graphical representation, results are available in tabular form.

Sometimes it is necessary to determine the power of an individual code versus time. This is possible for all 3GPP codes simultaneously over one slot. Additionally, a specific code can be analyzed over a period of up to two frames. In conjunction with Signal Source R3562 from Advantest, the power control of user terminals or base stations can be tested by sending transmitter power control (TPC) bits. The power can be increased or reduced in each slot, so 30 slots or two frames are analyzed in a measurement of maximum duration. Modulation points and transitions can be analyzed in constellation and eye diagrams (FIG 5).

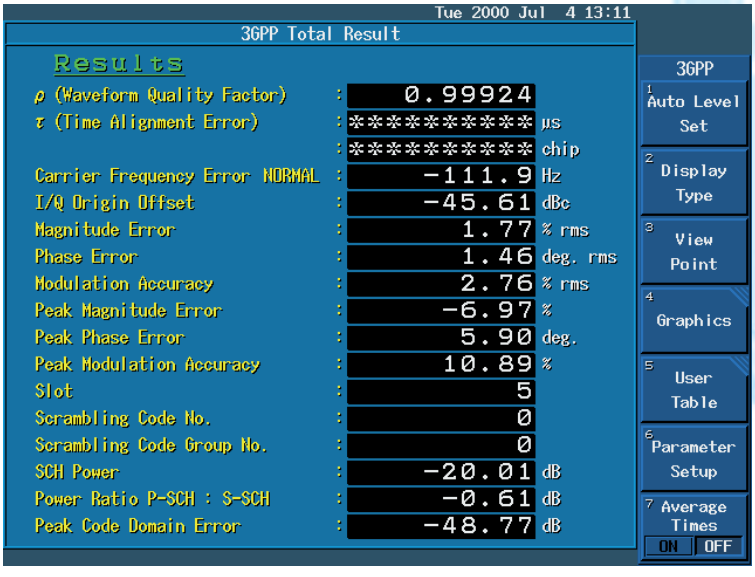

FIG 3
Measured 3GPP signal parameters

Transmitter measurements

Analyzers R3267 and R3273 are suitable for performing practically all TX measurements on base stations and user terminals with the exception of TX power control measurement. A signal source, for instance R3562 from Advantest, is always required for this type of measurement. The signal source generates the TPC information, allowing the user to check the power control.

Receiver measurements

RX measurements also require a signal source. The sensitivity of the DUTs is determined in a bit-error-rate (BER) measurement, performed by a BER counter implemented in the signal source. The signal source supplies 3GPP signals in realtime (realtime coder) and generates radio frames including convolution, interleaving and coding. PN9 as well as PN15 sequences may be used.

At home in all standards

Advantest Spectrum Analyzers R3267 and R3273 are not restricted to WCDMA/3GPP and optionally support all other major mobile radio standards like GSM, EDGE, DECT, Bluetooth, CDMA2000, IS-95, PDC, PHS, IS-136, AMPS, JTACS, NTACS. If several standards are implemented, you can change between them at a keystroke.

Andreas Henkel

Measurements to 3GPP standard in detail

Automated measurements in frequency and time domain

- Channel power
- Adjacent-channel power ratio (ACPR)
- Occupied bandwidth (OBW)
- Spurious (inband, outband)
- Peak/crest factor, complementary cumulative distribution function (CCDF)

Modulation measurements

- Code-domain power measurement with automatic code and data rate detection
- Code domain versus time, maximum of two frames
- Carrier frequency error
- ρ (waveform quality)
- Time alignment error τ
- Level and phase error (normal and peak)
- EVM (normal and peak)
- I/Q origin offset
- Constellation and eye diagrams
- Primary CPICH power

Condensed data of R3267 and R3273

Frequency range	R3267	100 Hz to 8 GHz
	R3273	100 Hz to 26.5 GHz
Resolution bandwidths		1 Hz to 10 MHz
Noise level		–154 dBm/Hz
Phase noise		–145 dBc/Hz at 5 MHz offset, 2 GHz
ACPR performance	at 5 MHz offset	–72 dBc
	at 10 MHz offset	–80 dBc
TX power measurement uncertainty		0.8 dB

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FIG 4 Code domain power: power of individual code channels

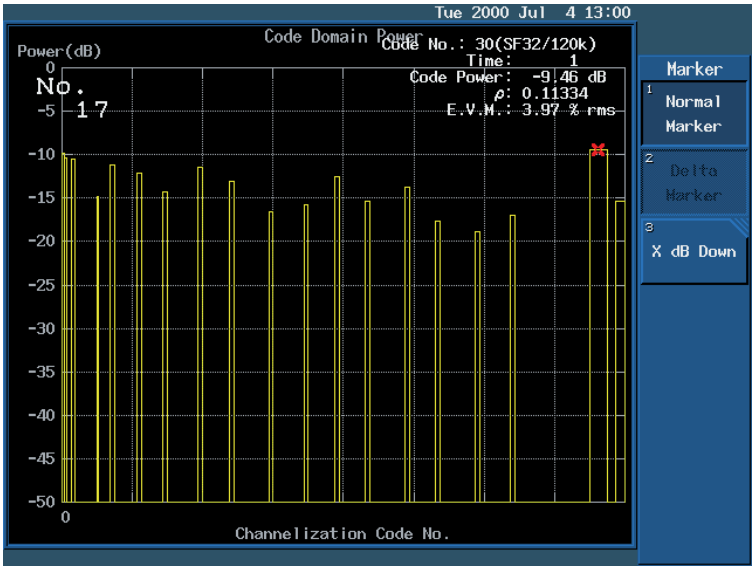

FIG 5 Example of constellation diagram