IEEE 802.11ac standard: WLANs break through the Gigabit barrier

The new WLAN IEEE 802.11ac standard achieves a data throughput of 1 Gbit/s and higher. Rohde & Schwarz vector signal generators can already generate the test signals needed for development and production.

**Higher bandwidths**

At present, the IEEE 802.11ac standard (shortened to 11ac in this article) is still being defined, with standardization expected to be complete in 2012. Much of 11ac is based on 11n, such as channel coding and MIMO modes. New are the bandwidths of 80 MHz and 160 MHz (11n offered only 40 MHz), 256QAM, up to eight antennas and multi-user MIMO.

Gross data rates of 293 Mbit/s are possible with only 80 MHz bandwidth, one antenna and 64QAM 5/6; all 11ac devices must support this mode. Optional modes using 256QAM and eight antennas under optimal conditions permit gross data rates of 3.5 Gbit/s. 11ac is designed only for license-free 5 GHz bands and will no longer include the 2.4 GHz industrial scientific medical (ISM) band previously used primarily for WLANs.

**Signals for 11ac with R&S®SMU200A and R&S®SMBV100A**

Vector signal generators of the R&S®SMU200A and R&S®SMBV100A families already support the high 11ac bandwidths. The new R&S®SMx-K86 option for internal signal generation and R&S®WinIQSIM® simulation software expand existing 11n HT modes (high throughput) offered by R&S®SMx-K54 / R&S®SMx-K254 options to include the new VHT modes (very high throughput) defined by the 11ac standard. As a result, high-quality 11ac signals are available for all receiver tests, whether for testing sensitivity, maximum input level or adjacent channel suppression. The currently available firmware handles 80 MHz 11ac signals with up to four antennas plus 256QAM. Bandwidths of 160 MHz, eight antennas and multi-user MIMO will follow shortly.

The frame block sequencer offered by the R&S®SMx-K86 option makes it possible to generate legacy (11a), HT (11n) and VHT packets (11ac) in any sequence, as needed for complex receiver tests, for example. FIG 1 shows an example with signals for 11a at 20 MHz, 11n at 20 MHz and 40 MHz and 11ac at 40 MHz; FIG 2 shows the associated spectra. The dialog box in FIG 3 contains the key parameters for configuring the signals. This example defines a frame with a bandwidth of 80 MHz using 256QAM and with four spatial streams.

FIG 4 shows an EVM measurement for each carrier of an 80 MHz VHT signal, measured using the R&S®FSQ signal and spectrum analyzer and the R&S®FS-K96 OFDM analysis software. The R&S®SMU200A signal generator generates the signal with a typical EVM of –46 dB.
Future-ready, even at 160 MHz bandwidths

The cost-effective R&S®SMBV100A signal generator offers a 120 MHz signal bandwidth with its internal baseband and is therefore perfectly suited for 80 MHz 11ac signals. By simultaneously triggering multiple devices, MIMO tests with four or even eight transmit signals are also easily handled. The future 160 MHz 11ac signals will require an external baseband modulation source such as the R&S®AFQ100A. The R&S®SMBV100A will then modulate the externally applied signal to the target frequencies in the 5 GHz bands – an easy task due to its modulation bandwidth of 500 MHz. Alternatively, an R&S®SGS100A (page 38) with 1 GHz modulation bandwidth can be used as an RF source. In combination with the R&S®WinIQSIM2™ simulation software and the R&S®SMx-K286 option, the R&S®SMBV100A / R&S®SGS100A and R&S®AFQ100A generators are inexpensive, future-ready tools for generating all required signals.

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