Remarkable low-cost RF vector signal generation for wireless communications test

Combine an Agilent 33522B waveform generator with optional IQ player and an Agilent N9310A RF signal generator with optional IQ inputs to create an RF vector signal generator for an unprecedented low price.

Agilent Technologies

IF YOU DESIGN DEVICES that use IQ modulation, you face a continual bandwidth crunch in a spectrum that is filled with interference, so testing your devices via signal simulation is critical. You need to generate a high-quality, known-good signal and be able to easily add real-world distortions to the signal to test the limitations and robustness of your designs.

Now you can combine two low-cost Agilent instruments to create an RF vector signal generator at a fraction of the cost of off-the-shelf vector signal generators. Use a 2-channel 33522B waveform generator with unique technology that offers excellent baseband IQ signal generation and a N9310A RF signal generator with optional IQ inputs as the RF modulator.

You'll spend less than a third of the cost of a typical integrated vector signal generator and get just the capability you need for testing your device's high-level functions. Use the low-cost combination RF vector signal generator for basic validation in applications like manufacturing and education.

Simulate advanced communications protocols

With 16 MB of memory, the 33522B waveform generator lets you simulate many communication protocols, such as GSM, W-CDMA and LTE with 60 MHz of bandwidth. Create the IQ signal in the baseband frequency range, then use the N9310A signal generator to upconvert your signals to RF frequency — up to 3 GHz. Although the N9310A signal generator's IQ input bandwidth is limited to 40 MHz, if you want or need higher IQ bandwidth or an RF signal frequency higher than 60 GHz, you can pair the 33522B waveform generator with the N5172B signal generator, which has an IQ input bandwidth up to 100 MHz and can upconvert your signals up to 6 GHz.

You can also generate multitone notched signals for ACPR measurements.
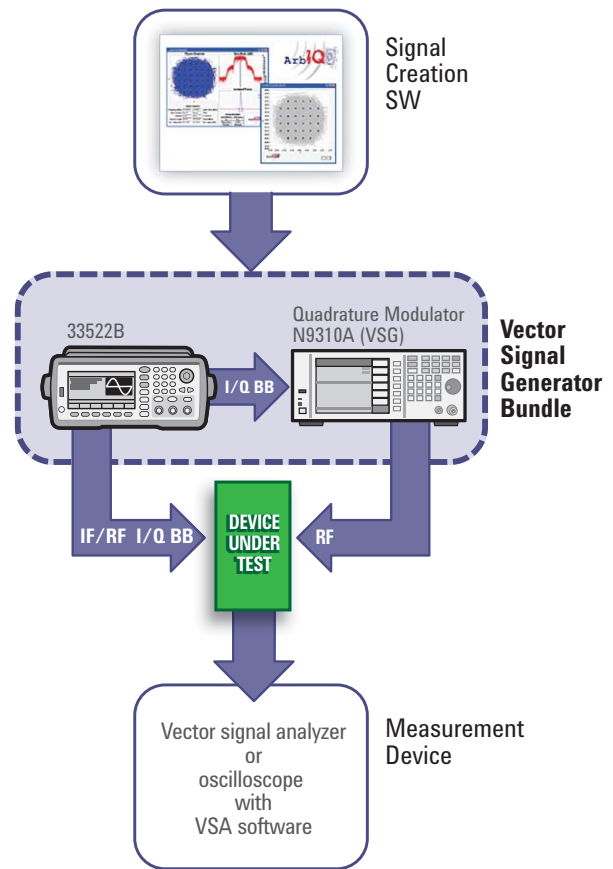

Figure 1. *Block diagram of the IQ bundle solution*

Agilent 33522B waveform generator with IQ Signal Player option

The 33500B Series waveform generators have an IQ Signal Player option that is ideal for IQ signal generation applications. The IQ Signal Player provides an easy-to-use interface that allows you to configure and control both channel 1 and channel 2 as if they were a single channel or waveform. **Figure 2** shows a 33500B Series optional IQ Signal Player display which indicates that the waveform generator is outputting a 64-QAM IQ baseband signal at a sample rate of 1 MHz.
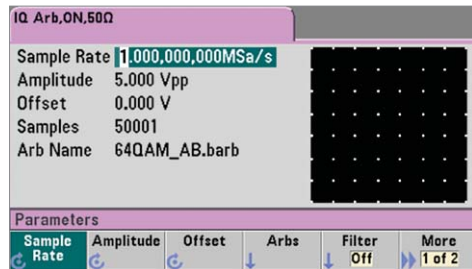

Figure 2. *33500B IQ Signal Player screen view*

The resulting example IQ baseband signal was captured with a high-performance oscilloscope running vector signal analysis software, as shown in **Figure 3**. You can see the resulting constellation diagram in the top left display and the measured error vector magnitude (EVM) in the bottom right display. The two additional displays, from left to right, show the plotted magnitude error millipercent and the phase error in millidegrees.
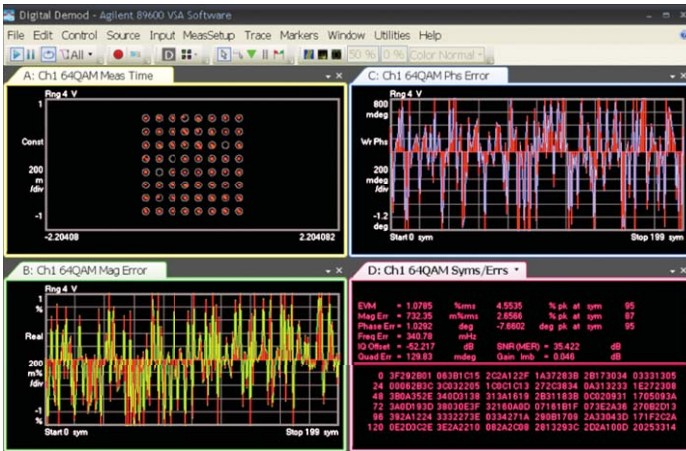

Figure 3. *Constellation diagram of a 64-QAM baseband signal*

Agilent N9310A RF signal generator

The N9310A is a general-purpose RF signal generator covering a frequency range from 9 kHz to 3 GHz. With a low price, reliable performance, and multiple built-in functions, it's well-suited for R&D, manufacturing, education, and installation/maintenance. The N9310A with Option 001 (I/Q input capability) enables you to generate vector (IQ) modulated signals commonly seen in wireless connectivity systems as a stimulus to test your devices or modules.

The external I/Q inputs from the 33522B allow you to use the N9310A vector modulation capability to modulate your baseband IP to RF frequencies up to 3 GHz. You have the flexibility to generate IQ modulated signals, such as commonly used ASK, FSK, GFSK, and QPSK, and even some complex modulated RF signals such as GSM, CDMA or WLAN up to 40 MHz RF modulation bandwidth.

See an example of how to create IQ baseband signals

The MATLAB program IQ Baseband Builder (IQBB) allows you to generate ideal and non-ideal IQ baseband signals using a GUI. See an example at **www.agilent.com/find/IQBundle**
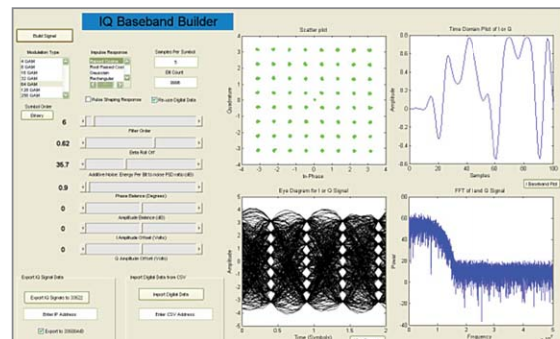

Figure 4. *Creating signals with the IQ Baseband Builder*

Ordering information

Waveform generator:

33522B waveform generator, 30 MHz bandwidth, 2-channels
33522B-MEM 16 Msamples memory per channel`
33522B-IQP IQ baseband signal player
www.agilent.com/find/33522B

RF signal generator:

N9310A RF signal generator, 9 kHz−3 GHz
N9310A-001 analog IQ input capability
www.agilent.com/find/N9310A

Learn more at **www.agilent.com/find/IQBundle**

Download a copy of the white paper,"Complex Modulation Generation with Low-Cost Arbitrary Waveform Generators" and see the MATLAB IQ signal creation example.

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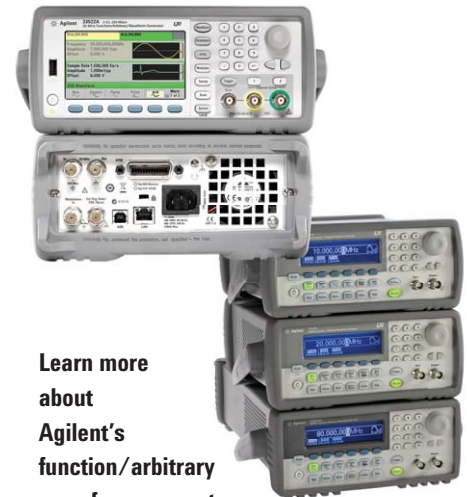
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Learn more about Agilent's function/arbitrary waveform generator solutions at
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