A PXI Signal Conditioning Solution for 
Design and Verification of Wideband MIMO Signals

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Whether you characterize new RF and microwave designs or validate wireless components, you need a reliable signal conditioning solution that provides measurement accuracy and system flexibility. Today’s wireless LAN readily enables distribution of high definition content in the home that must support high speed and high-data rate streaming, and must also be able to mirror high definition video from PC tablets to smart TVs. These requirements bring forth the need to extend RF bandwidth (up to 160 MHz), more MIMO spatial streams (up to 8), multi-user MIMO, and high-density modulation (up to 256 QAM). With this increased complexity in the corresponding test and measurement system, PXI has been one of the most rapidly adopted platforms, particularly in market segments that demand efficient but low cost-of-test solutions.

The key challenges faced by engineers today while optimizing their test solution include measurement accuracy enhancement in various scenarios such as overloading, gain compression and distortion. In such a situation, a step attenuator that ensures the lowest insertion loss at 0 dB state, lower standing wave ratio, and better linearity and stability across a wider temperature range is very much needed.

A step attenuator is a common approach to, or is generally used to, extend the attenuation range of test and measurement instruments. A common application would be to extend the output amplitude range of a microwave vector signal analyzer for wireless device signal analysis. Digital-modulation analysis is another application example. The RF modulated carrier signal needs to be demodulated into its complex components for further vector-modulation analysis, where the digital data bits will be detected and recovered. Digital demodulation provides modulation quality measurements. Ideally, the measurement system will expose very subtle signal variations to translate signal quality information. Without the right combination of test instruments and accessories which includes a step attenuator, the process of achieving accurate and precise measurements will become more elaborate and tedious, which inevitably leads to higher cost-of-test.

The PXI form factor provides the flexibly to create test and measurement solutions in a compact design. Combining multiple attenuator modules in a PXI chassis to create a MIMO test development systems, for 802.11ac, LTE advanced, multi-channel signal analysis, EW signal capture and analysis or wideband digital pre-distortion.

It is imperative that careful attention be placed when the signal conditioning portion of the wireless transceiver system is selected, as it will ultimately impact its overall accuracy, reliability, and cost-of-test. The RF attenuator is used to avoid overdriving the downconverter. With the limited dynamic range of hardware, every dB of attenuation counts. The built-in attenuators in the M9168C cover the attenuation range of 0 to 101 dB, at 1 dB step resolution. The 1 dB step size is crucial for signal demodulation, particularly for the 802.11ac standard testing which is heavily sensitive to SNR (signal-to noise ratio). With the increasing demand for high crest factors and even higher bandwidth within the wireless communication eco-systems, accurate power measurement systems may lead to steep increments in cost-of-test. By utilizing the attenuator module such as the M9168C, the receiver system can be calibrated with
a single accurate power measurement at higher power levels. The subsequent desired (lower) power levels can be sequentially controlled at a minimum of 1 dB step resolution, with calibration values provided at each attenuation value. A minimum of 0.4 dB of characterized data accuracy is provided across the frequency range of DC to 26.5 GHz.