Developing a Low-cost Automated Test Tool for Measuring Gain, Noise Figure, and Low-level Power Spectral Density

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Abstract

Today's RF systems often must process very weak signals. Noise added by the RF system further obscures these very weak signals. The goal is to develop a system to measure Noise Figure (NF) utilizing common equipment found in many RF communication labs. NF can be measured not only on an entire RF system, but it can also be measured on the RF system sub-components like the pre-amplifier, mixer, IF amplifier, etc. Thus NF test tools can be very useful in development of RF systems. The test tool being developed employs a low-cost, simple instrumentation approach for measuring NF, gain, and power spectral density (PSD). This test tool is unique in that it doesn't use either a Noise Figure meter or an ENR noise head, allowing for a sizable cost savings. The system we have developed utilizes an amplifier, a spectrum analyzer with an input pre-amplifier, and a PC running control software written in LabVIEW. The software is designed to control the spectrum analyzer, the noise amplifier, and the device under test (DUT). The cascade Noise Figure equation is implemented into the software's data processing code and the NF, gain and PSD results get saved to disk in a file specified by the user. All inputs to the spectrum analyzer such as frequency, span, bandwidth, reference point, etc. can be controlled by the user via the software graphical user interface (GUI). Our results show that we can quickly and easily measure NF, gain, and PSD at frequencies ranging from 100 MHz – 6 GHz while maintaining a low development cost of approximately $500.