OSCIUM

Fundamentals of RF Measurements Tutorials

Measure an RF signal's pulse width and duty cycle with your iPhone or iPad and Oscium WiPry-Combo Peak Power Meter

Whatever your interest level may be in RF electronics, whether you're a design engineer, an IT technician, or an amateur hobbyist, I know you'll be interested in learning how to measure a signal's pulse width and duty cycle with your iPhone, iPad or iPod.

Most of the measurements we make with RF signals are either frequency or power. This is true if we are testing a simple amplifier or a sophisticated transceiver. The power characteristics we measure are the same for most applications - just the equipment is different. To understand your transmitter's output power, for example, you must know the pulse width and duty cycle.

Did you know you could measure pulse width and duty cycle with your iPhone? Keep reading to learn how.

Let's start with frequently used naming conventions.

Pulse Width (PW) is the elapsed time between the rising and falling edges of a single pulse. To make this measurement repeatable and accurate, we use the 50% power level as the reference points.

Pulse Repetition Interval (PRI) is the time between sequential pulses. We typically measure PRI as the time from the beginning of one pulse and the beginning of the next. We use PRI to report the number of seconds per pulse.

Pulse Repetition Frequency (PRF) is the reciprocal of PRI. The basic unit of measure for PRF is hertz (Hz). Use PRF to report the number of pulses per second. Look at a 1 GHz clock signal as an example. The clock signal is a continuing stream of pulses at a PRF of 1 GHz.

Why use PRF instead of just saying Frequency?

The difference is in the types of signal we are measuring. Use Frequency for analog, continuous, waveforms, like sine and cosine waves. For digital, discrete waveforms, like clocks and pulsed signals, we use PRF for clarity. The two types of signals behave differently so it's important to avoid confusion when you are discussing them.

Duty Cycle describes the "On Time" for a pulsed signal. We can report duty cycle in units of time, but usually as a percentage. Like Pulse Width and Repetition Frequency, a signal's duty cycle is a calculated value; not directly measured. To calculate a signal's duty cycle, we need to know the signal's pulse width and repetition frequency. Use this equation for calculating a signal's duty cycle as a percentage of the repetition frequency:

Duty Cycle = Pulse Width (sec) * Repetition Frequency (Hz) * 100

Going back to our example of a 1 GHz Clock signal, for most clocks the duty cycle is 50%. From the above equation, the pulse width for a 1 GHz Clock is 0.5 nanoseconds. Wi-Fi and other wireless communication traffic operate at more than twice that frequency, so their pulse width is even shorter.

Now let's look at measuring a signal's pulse width and duty cycle using your iPhone or iPad with WiPry-Combo.

You can make fast accurate duty cycle and pulse width measurements of RF signals with you iOS device. WiPry-Combo measures peak RF power with 0.2 dBm accuracy and 12MSPS sample rate. The built-in power meter uses a silicon-based detector for measuring peak power. If you're up to your elbows doing protocol level development, then you need more resolution than averaging power meters offer.

The WiPry-Combo accessory installs on your iPhone and iPad using the connector on the base of the device. The required software, WiPry, is a free download from iTunes and the App Store.

WiPry-Combo makes radiated and conducted RF power measurements. Depending on your application, use the SMB-type RF port with an antenna for radiated RF measurements, or RF cables for measuring directly from the signal source. Oscium's Conducted Measurement Kit is a must-have for hardware designer's doing protocol level verification. You can trigger measurements off digital logic levels using the leads included in the kit, or trigger off RF power levels.

See WiPry-Combo's Peak Power Meter in action by watching a video demo here or by visiting the product page here.