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Pulsed Power Measurements

In many applications, like wireless communication and radar, pulsed (or bursted) RF signals are utilized. Not only is the level of RF power important, but the shape (RF power envelope) of the waveform can be critical as well (see Figure 1).

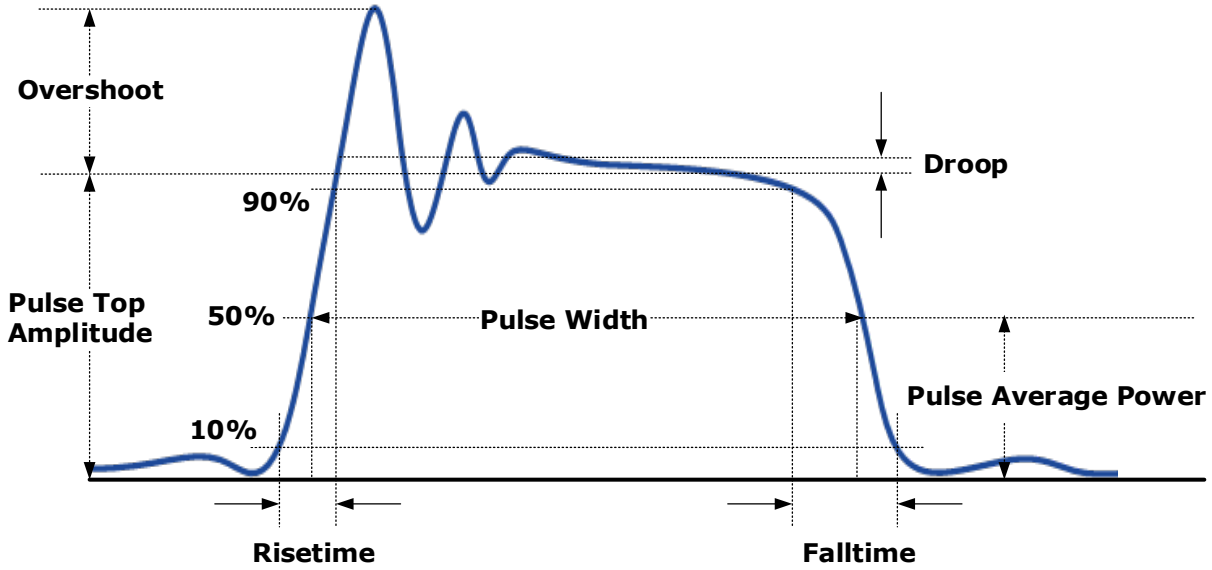

Figure 1: An example of a pulsed signal and a few related measurements.

To help have a common language with which to describe the various elements of the waveforms, organizations like the IEEE have provided essential terms related to pulsed signals, along with explanations for each. A review of some of the terms and definitions is provided below.

1. **Rise time** – The time it takes a signal to change from a specified low value to a specified high value. The low value can be characterized by the proximal line, which is a magnitude reference line located near the bottom of the pulse that is a specified percentage (normally 10%) of the pulse magnitude. Similarly, the high value can be characterized by the distal line, which is a magnitude reference line located near the top of the pulse that is a specified percentage (normally 90%) of the pulse magnitude. Therefore, rise time can also be defined as the time interval from the first crossing of the proximal line to the first crossing of the distal line.
2. **Fall time** – The time it takes a signal to change from a specified high value to a specified low value. In other words, fall time is the time interval from the last crossing of the distal line to the last crossing of the proximal line.
3. **Period** – The interval between two successive pulses measured at the same point on both pulses.
4. **Pulse Width** – The interval between the first and second signal crossings of the mesial line, which is a magnitude reference line located near the middle of the pulse that is a specified percentage (normally 50%) of the pulse magnitude.
5. **Off-time** – The time a repeating pulse is in its “off” state, which is equal to the pulse period minus the pulse width.

6. **Pulse Repetition Frequency (PRF)** – PRF is the number of pulses from a repeating signal that are transmitted per second, and therefore is typically measured in pulses per second and captured in Hz.
7. **Duty Cycle** – Duty cycle is the ratio of the pulse on-time to off-time, and is calculated by taking the ratio of the pulse width over the waveform's period.
8. **Peak Power** – The maximum power level of the captured waveform (also defined as the pulse's peak amplitude).
9. **Pulse Power** – The average power level across the pulse width.
10. **Average Power** – The average power level of a pulse period.
11. **Overshoot** – Overshoot is magnitude by which the signal exceeds the pulse top amplitude.
12. **Droop** – The magnitude of the deviation of the signal below the pulse top amplitude within the pulse top.
13. **Pulse Top Amplitude** – The amplitude of the top line, which represents the second nominal state of a pulse, as defined by IEEE.
14. **Pulse Bottom Amplitude** – The amplitude of the base line. As defined by IEEE, the base line is defined as two portions of a pulse waveform, which represent the first nominal state from which a pulse departs and to which it ultimately returns.
15. **Edge Delay** – The time between the left edge of the display and the first mesial transition level of either slope on the waveform. The mesial line is the a magnitude reference line located in the middle of a pulse at a specified percentage (normally 50%) of the pulse magnitude, while the first transition level is the major transition of a pulse waveform between the base line and the top line (commonly called the rising edge).
16. **Skew** – The time difference between the mesial level of two different pulses on two channels using two sensors.

Pulsed Power Test Equipment – Peak Power Meters

Although there are various instruments used to measure pulsed signals, peak power meters and USB peak power sensors are typically the most accurate choices. Boonton power meters like the PMX40 provide up to 16 pulse measurements automatically, covering every one of the key parameters for pulsed signals described above. You can select the right RF test instrument to capture essential pulsed signal metrics for your specific needs at www.boonton.com.