Peak vs. Average Power Measurement

Power measurements are fundamental when it comes to RF/microwave product design and production. The terms “average power” and “peak power” are often used when expressing desired power measurements, but these terms often carry different meanings for different people. Therefore, let’s take a few minutes to clarify the typical terminology used in RF measurement applications.

Peak power can refer to the peak envelope power or the envelope power itself. **Peak envelope power (PEP)** is the maximum power measured within the envelope power and is used in crest factor calculations. **Envelope power** is a time-domain function that measures the change in power due to modulation or distortion over a single or a few cycles of the carrier signal as illustrated in *Figure 1*.

Average power can also be confusing as it can have two distinct definitions. **Average power** describes the average energy transfer rate over the pulse repetition interval (PRI), which includes both the signal burst and the time interval between the next pulse. Alternatively, others may desire the average power of just the signal burst, which we refer to in *Figure 1* as **pulse average power**.

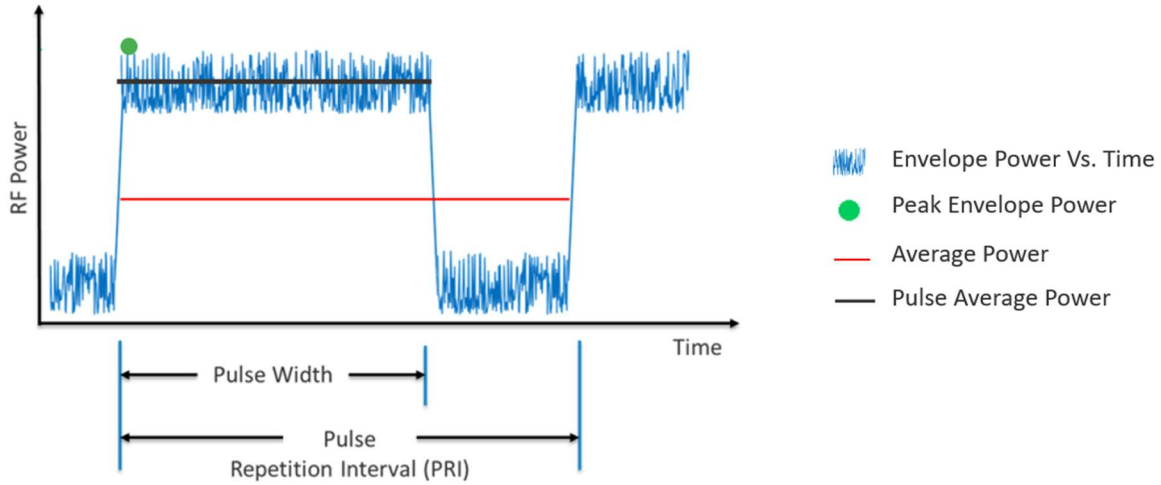

Figure 1: The distinctions between envelope power (blue), PEP (green), average power (red), and pulse average power (black).

Using agreed-upon terminology for peak and average power measurements will positively influence the accuracy of related calculations including crest factor. As mentioned earlier, **crest factor (CF)** is a parameter of interest for modulated signals and is defined as the peak-to-average power ratio (PAPR). In other words, crest factor is the ratio of the PEP to the average power over the PRI $(Crest\ Factor = \frac{PEP}{Average\ Power})$ or only the pulse $(Crest\ Factor = \frac{PEP}{Pulse\ Average\ Power})$.

Generally, average power sensors are used to calculate the average power of a signal over the entire waveform. Peak power sensors, on the other hand, have triggering capabilities, which allow them to make measurements related to the pulse, such as PEP and pulse average power.

B&K Precision enables a wide range of RF power measurements and signal analysis using the RFP3000 Series RF Peak Power Sensors with provided Power Analyzer software.

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