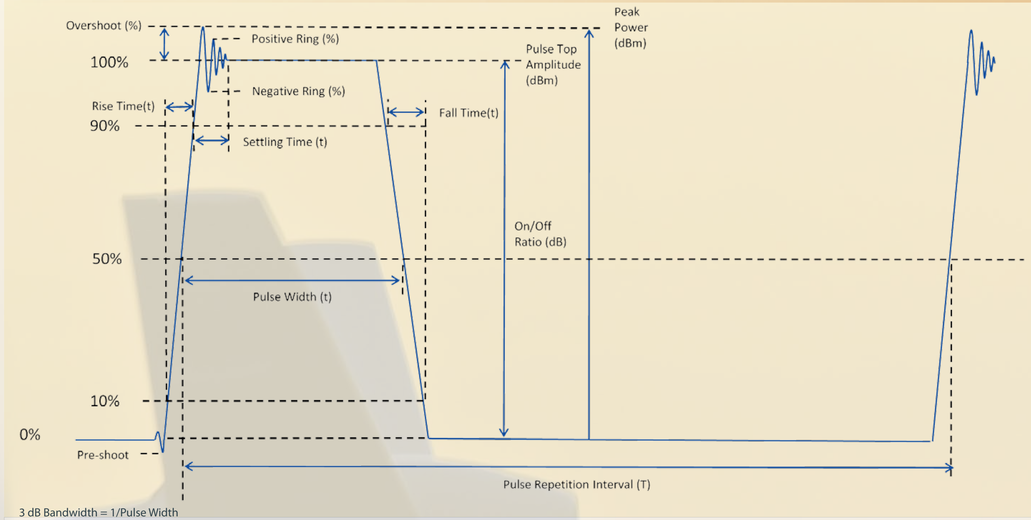
Radar Pulse Characteristics



Definitions

Pulse Repetition Interval (PRI): is the elapsed time from the beginning of one pulse to the beginning of the next pulse.
Pulse Repetition Frequency (PRF): is the reciprocal of the PRI.
Peak Power: is a measure of the maximum level of energy transferred during an observation period.
Pulse Top Amplitude: represents the stable amplitude (i.e. 100% of pulse power) of the signal.
Ringing, Overshoot, Undershoot, Pre-shoot: is defined as the change (in percent) from the intended signal, i.e. 0% of power, or 100% of power.
Average Power: is the integrated power over the time defined by the Pulse Repetition Interval.
Pulse Width: is the period of time when transmitted power is equal or greater than 50% of the Pulse Top Amplitude.
Duty Cycle: is the fraction of time that the radar is in an "active" state over the "in-active" state, and is calculated by dividing the Pulse Width by the PRI.
On/Off Ratio: compares 100% amplitude to 0% amplitude in dB's.

Giga-tronics 2500B Series Microwave Signal Generator Selector Guide

Model	2502B	2508B	2520B	2526B	2540B	2550B
Frequency Range	100 kHz to 2.5 GHz	100 kHz to 8 GHz	100 kHz to 20 GHz	100 kHz to 26.5 GHz	100 kHz to 40 GHz	100 kHz to 50 GHz
Narrow Pulse	10 ns					
Switching Speed	500 µs					
Output Power	+14 dBm	+17 dBm	+20 dBm	+11 dBm	+11 dBm	+11 dBm
Phase Noise	-109 dBc/Hz (at 10 GHz and 10 kHz offset) | -98 dBc/Hz (at 20 GHz and 10 kHz offset) | -92 dBc/Hz (at 40 GHz and 10 kHz offset)					
Harmonics	-50 dBc					
Spurious (20 GHz)	-60 dBc					
Modulation	AM, FM, Phase Modulation and Pulse Modulation including Narrow Pulse					

2500B Series Microwave Signal Generator with Automation Xpress ATE Software (100 kHz to 50 GHz)

GT-1000A Series Microwave Power Amplifiers (10 MHz to 50 GHz)

GT-8500A Series USB Power Sensor (10 MHz to 26.5 GHz)

8650B Power Meter and Power Sensors (10 MHz to 50 GHz)

Useful Conversions and Rules of Thumb

1 foot (ft) = 0.3048 meters (m)
1 inch (in) = 0.0254 meters (m)
1 yard (yd) = 0.9144 meters (m)

1 kilometer (km) = 0.54 nautical miles (nm)
1 kilometer/hr = 0.54 knots (kt)
1 kilometer/hr = 0.62 statute miles (sm)

1 stat. mile/hr = 1.61 km/hr
1 knot = 1.15 stat. mile/hr
1 ft/sec = 0.59 knot = 1.1 km/hr
1 stat. mile = 0.87 naut. mile

Speed of light = 2.9979246 x 10^8 m/s (approx 3x10^8 m/s)
Speed of sound = 343.2m/s (dry air at 20 °C (68 °F))
Speed of sound = MACH 1
Speed of sound (Sea Level) = 1235 km/hr
Speed of sound (36,000 Feet) = 1062 km/hr (TAS)

Radar Equations

The power P_r returning to the receiving antenna is given by the equation:

$$\frac{P_t\, G_t\, A_r\, \sigma F^4}{(4\pi)^2\, R^4}$$

where

- P_t = transmitter power
- G_t = gain of the transmitting antenna
- A_r = effective aperture (area) of the receiving antenna
- σ = radar cross section, or scattering coefficient, of the target
- F = pattern propagation factor (1 for a vacuum)
- R = distance from the transmitter/receiver to the target

2500B Series Pulse Modulation

Parameter	Specification	
Standard Operating Modes	Internal, External	
Pulse On/Off Ratio	> 80 dB minimum, 90 dB nominal	
Pulse Leveling Modes	Always on (closed-loop), Always off (open-loop Cal), Off for pulse widths < 1 µs	
Rise/Fall Times	500 MHz to 20 GHz 20 GHz to 50 GHz	< 10 ns maximum, 3 ns typical < 25 ns maximum, 10 ns typical
Minimum Leveled Pulse Width	Internal / External	100 ns
Minimum Unleveled Pulse Width (Option 32)	Open-Loop Calibrated Level	25 ns, 10 ns nominal
Level Accuracy	Pulse Width > 350 ns Pulse width > 100 ns to 350 ns	± 0.5 dB + 1.5 dB/ - 0.5 dB
Level Accuracy (Option 32)	Pulse Width > 25 ns to 100 ns	+ 2.5 dB/ - 0.5 dB
PRF (50% Duty Cycle)	Leveled Open-Loop Calibrated (Option 32)	< 3 MHz < 10 MHz
Pulse Fidelity	Video Feed-through, 500 MHz to 2 GHz Video Feed-through, 2 GHz to 50 GHz Compression RF Delay (skew)	< 5% < 1% < ± 5 ns < 75 ns
Sync Out Delay	External	50 ns to 10 ms
Sync Out Delay Resolution	External	10 ns

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