Application Brief

Radar Pulse Measurements Challenges

Developing the Next Generation of Radar Applications and Solutions

Next generation radar systems face a number of difficult demands. The pace and variety of new requirements call for multi-use/function/mode adaptive radars that can be used for different applications. Frequency crowding and spectral relocation require radars to have waveform and frequency agility. In addition, many radar customers are calling for more standardized radar hardware components as part of a Modular Open System Architecture (MOSA) with the objectives of cost reduction through greater competition, more manageable sustainment, as well as enabling technology insertion at the “pace of the threat”. These radar demands also create interesting challenges for the pulse measurement systems that test them.

Today’s Test Challenges:

Too Many Test Method Tradeoffs	Existing pulse test methodologies require tradeoffs to be made based on required duty cycle, pulse width, dynamic range and more. My radar system is being asked to do more without sacrificing performance. Why can’t my test solution?
Need for Better Analysis Tools	Whether you’re tracking high speed targets or detecting slow, low, and small objects – better analysis tools are needed. Next generation radar systems require greater precision to measure narrower pulse widths and/or to examine intra-pulse behavior with finer resolution – including rising/falling edge effects.
Monitoring Pulse Behavior Over Longer Times	In some applications, observing behavior over longer periods of time (without sacrificing resolution) may be important – whether it’s looking for thermal and trapping effects in devices or measuring DUTs with lower pulse repetition frequencies.
Eliminating Measurement Setup Errors	Ensuring proper measurement setup and timing alignment can be difficult, especially when measurement solutions require the user to toggle between setup and measurement screens.
Calibration Timing Issues	Calibration under pulsed conditions adds an extra degree of challenge. Timing and synchronization issues create uncertainty and can include unwanted behaviors.

Existing Test Method Tradeoffs

Narrowband Method	
Advantages	Measures narrower pulse widths
Disadvantages	Dynamic range penalty for low duty cycle pulses ($20*\log_{10}$ (duty cycle))
	Calibration most sensitive to pulse configuration changes
	On/off ratios have stronger impact on uncertainty
	No pulse-to-pulse measurement
Historic Wideband Method (5 MHz IF BW, typical)	
Advantages	Constant dynamic range
Disadvantages	Limits in measureable pulse widths
	Requires pulse trigger synchronized with PRF
Historic Triggered Method	
Advantages	No duty cycle dependence
	No receive-side modulation needed
Disadvantages	Less timing resolution, often resulting in inadequate pulse profiling accuracy
	Limits in measureable pulse widths
	Recalibrations often needed for setup parameter changes

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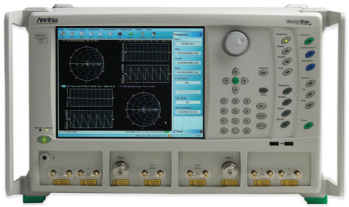
Radar Pulse Measurements Solutions

Anritsu VectorStar For Your Most Demanding Radar Applications

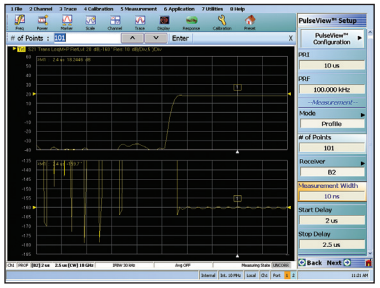
The Anritsu VectorStar® MS4640B with options 035 and 042 (PulseView™) offers the most advanced architecture available in a VNA for radar pulse measurements. It offers industry-leading performance that eliminates the tradeoffs and limitations of prior test methods. Higher resolution, greater timing accuracy, and longer record lengths coupled with a real-time display give you the performance and confidence needed to meet the most demanding radar pulse measurement requirements.

Feature	Benefit
Innovative High-Speed Digitizer Architecture	• Anritsu's 200 MHz digital IF bandwidth enables unprecedented pulse measurement performance • Eliminate the limitations and trade-offs required by narrowband, (historical) wideband, and triggered test methodologies • ≤ 5 ns of trigger resolution minimizes timing synchronization issues and uncertainty
Industry's Highest Resolution Pulse Measurement	• Superior performance provides the capability to make highly accurate measurements on the most demanding radar applications • Best available resolution (2.5 ns) without duty-cycle/dynamic range trade-offs • Combining the industries best resolution and best dynamic range enables radar designers to gain insight into the actual performance on their rising and falling pulse edges
Long Record Length	• Long record lengths (0.5 s at full resolution) enable the measurement of low repetition rate pulses without sacrificing resolution • Record time varying events, such as thermal or trapping effects, over longer periods
Real-Time Display for Setup Confidence	• See/modify pulse measurement setup parameters while viewing measured results in real-time • GUI for visual confirmation of setup parameters improves measurement confidence
Four Independent Measurement Windows/Receivers	• Improve your calibration by adjusting independent receivers to account for any path delays/ system timing issues • Correct for measurement setup transient behaviors to preserve information about DUT transients

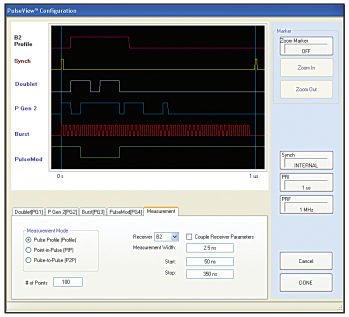
MS4640B VectorStar®
Options 035 and 042 (PulseView™)
Pulse measurements to 110 GHz (and beyond)!



Innovative high-speed digitizer architecture enables unprecedented pules measurement performance



Modify setup parameters while viewing measured results in real-time



Visually confirm your measurement setup

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