

Ultra-Wideband Spectral Analysis

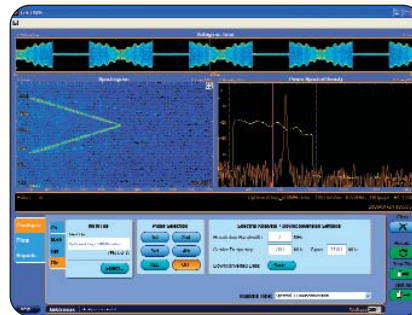
► TDS/DPO/DSA Series



Easy-to-Use Ultra-Wideband Spectral Analysis for Performance Real-Time Oscilloscopes

Analysis and verification of Ultra-Wideband microwave, optical and electrical signals require more real-time bandwidth and capture time than is possible with spectrum analyzer-based solutions. Supporting acquisitions up to 200 Mpts at 50 GS/s on four simultaneous channels, the DSA/DPO70000 series oscilloscopes provide an ideal platform for working with these signals.

DPX® and Pinpoint Triggers help you quickly discover and capture the time and amplitude variations of live data. Time gating cursors on the scope and an integrated packet/pulse finder in the application help isolate specific signals in the presence of other traffic. Real-time spectrograms spanning the full single-shot bandwidth of the instrument quickly visualize the frequency content of any signal as a function of time. A user-definable resolution bandwidth allows the spectral displays to be optimized for the signal being studied.



► Spectral + Down Conversion Analysis Mode: Ultra-Wideband Radar LFM “Chirp.”

Digital Down Conversion of captured RF data is fast and easy using visual cues from the Power Spectral Density display. The downconverted frequency span of interest, up to 20 GHz real time, may be exported for further analysis in tools with applications such as RSAVu and MATLAB.

A fully-integrated WiMedia analysis mode makes quick work of capture, analysis, verification and documentation of WiMedia MB-OFDM waveforms.

► Features & Benefits

Eliminate setup errors with automatic WiMedia modulation analysis configuration. Analyze hundreds of packet, TFC and data rate combinations without adjusting the user interface

Make quick work of WiMedia analysis and results logging using batch file processing with the “Test All” feature

Eliminate frustrating searches; isolate specific signals in the presence of other traffic using Pinpoint® Triggers, time gating cursors and packet/pulse finder with up to 200 Mpt record lengths

Visualize and debug waveforms quickly with a wide array of plots: spectrograms, power spectral density, QPSK/DCM constellations, EVM-vs-symbol, EVM-vs-subcarrier, common-phase-error-vs-symbol, voltage-vs-time

Analyze how complex wideband signals change frequency and amplitude with time using real-time spectrograms spanning 20 GHz

Correlate frequency and time domains with cursors linking amplitude vs time, frequency vs time and power vs frequency displays

Analyze analog modulation types and radar pulses using RSAVu

Analyze digital modulation types with RSAVu opt. 21 Advanced Measurement Suite

Analyze WiMedia MB-OFDM signals for all 6 band groups, all 10 TFCs and all 8 data rates according to the WiMedia 1.2 PHY specification

Perform measurements outlined in the WiMedia PHY test spec 1.2, including EVM, cross correlation, frequency tolerance, adjacent channel power ratio, spectral mask testing and relative power ratios

Document configuration information, measurement results and plot images using integrated the report generator

► Applications

Ultra-wideband communications

Ultra-wideband radar and satellite communications

Advanced analog and digital modulation

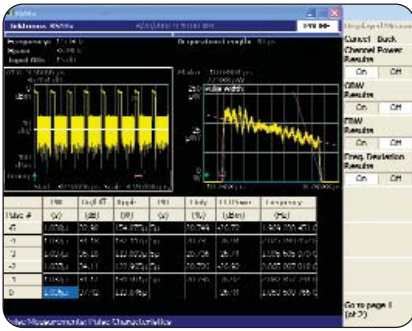
WiMedia MB-OFDM analysis

- Certified Wireless USB
- WLP
- Bluetooth SIG
- Other PC and CE applications

Modulated wide band RF electrical and optical

Ultra-Wideband Spectral Analysis

► TDS/DPO/DSA Series

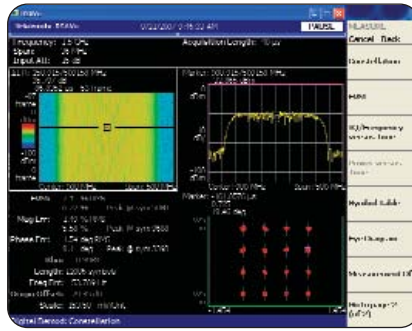


► Tektronix RSAVu Pulse Parameter Measurements of Ultra-Wideband LFM Chirp Captured by DSA70000.

RSAVu Analysis of the Ultra-Wideband Waveform

Ultra-Wideband microwave up to X band and Ku band is directly captured with the DPO/DSA70000 oscilloscope and may be analyzed using Tektronix RSAVu. Lower frequencies can be captured directly up to 3.5 GHz with the DPO7354 oscilloscope.

RSAVu offers the same demodulation and analysis capabilities included on the Tektronix RSA3408 software option suite. Analysis includes pulse parameters, frequency, phase and amplitude with the free RSAVu application vs. time in the free RSAVu base software. Analog Modulation Analysis includes IQ vs. Time, AM Depth, FM Deviation, PM and Pulse Spectrum. Time Analysis includes IQ vs Time, Power vs. Time, Frequency vs. Time, CCDF and Crest Factor. Pulse Analysis includes Pulse Width, Peak Power, Ripple, Pulse Repetition Interval, Duty Cycle, Pulse-to-Pulse Phase, Frequency Deviation, Channel Power, OWB and EWB.



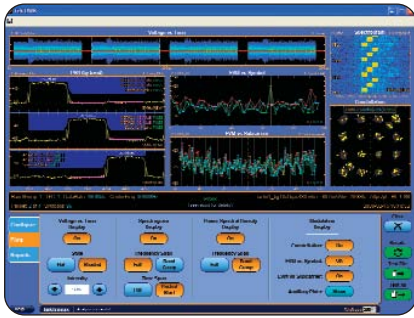
► DSA70000 waveform, RSAVu Opt. 21 Advanced Measurement Suite.

RSAVu Digital Modulation Analysis of the Ultra-Wideband Waveform

Modulation Formats	BPSK, QPSK, OQPSK, $\pi/4$ - DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, GMSK, GFSK, ASK, FSK, DSB-ASK, OOK, PR-ASK, SSB-ASK, Subcarrier OOK, Subcarrier BPSK, C4FM (Fixed symbol rate)
Parameter Presets	PDC, PHS, NADC, TETRA, GSM, CDPD, Bluetooth, IEEE 802.15.4 OQPSK (Zigbee)
Vector Diagram Display Format	Symbol/Locus Display, Frequency Error and OriginOffset Measurement
Constellation Diagram Display Format	Symbol Display, Frequency Error and OriginOffset Measurement
Eye Diagram Display Format	IQ/Trellis Display (1 to 16 symbols)
Error Vector Diagram Display Format	EVM, Magnitude Error, Phase Error, Waveform Quality (ρ), Frequency Error and Origin Offset Measurement
Coding Format	Miller, Modified Miller, Miller (M_2), Miller (M_4), Miller (M_8), Manchester, NRZ
Symbol Table Display Format	Binary, Octal, Hexadecimal
Signal Source Analysis	Phase Noise, Jitter and Frequency Settling Measurement Optional analysis packages enable general purpose, WLAN and 3G standards-based analysis. RSAVu Option 21 adds General Purpose demodulation including BPSK, QPSK, OQPSK, $\pi/4$ - DQPSK, 8PSK, D8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, GMSK, GFSK, ASK, FSK, DSB-ASK, OOK, PR-ASK, SSB-ASK, Subcarrier OOK, Subcarrier BPSK

RSAVu Opt. 21 Advanced Measurement Suite Software

Digitally modulated Ultra-Wideband microwave, electrical and optical waveforms captured with the DPO/DSA70000 series oscilloscopes may be analyzed with RSAVu Opt. 21 Advanced Measurement Suite. The suite includes a very complete set of measurements and displays similar to the RSA3000 Series Real Time Spectrum Analyzers.



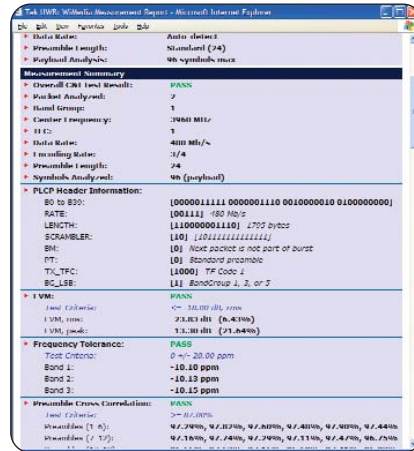
▶ Ultra-Wideband Radio: Time domain, frequency domain and modulation domain on one easy-to-use touch screen.

WiMedia PHY Test Specification 1.2 Analysis Mode

The WiMedia analysis mode provides a simple, easy-to-use interface for analyzing these complex MB-OFDM signals. Through automatic packet, TFC and data rate detection, setup is greatly simplified and analysis time is minimized. With support for all six band groups (spanning 3.1 GHz to 10.6 GHz), all 10 time frequency codes and all eight data rates, Tek UWB provides a complete solution for those working with WiMedia waveforms.

Rapid visualization and debug is supported with a wide array of plots, including Spectrograms, Power Spectral Density, QPSK/DCM Constellations, EVM-vs-Symbol, EVM-vs-Subcarrier, Common-Phase-Error-vs-Symbol and Voltage-vs-Time plots. Interactive browsing of constellation data by symbol and subcarrier using cursors provides coupling between plots and helps pinpoint signal problems.

Measurements are performed on a packet-by-packet basis according to the WiMedia PHY Test Spec 1.2 and include EVM, Preamble Sync Cross Correlation, Frequency Tolerance, Adjacent Channel Power Ratio, Spectral Mask Testing and Relative Power Ratios. PASS/FAIL test conditions are reported for each measurement, as well as for the total test suite.



▶ Generate modulation analysis reports using integrated report generation tool.

Modulation results are accumulated in a database which may be exported for quick historical documentation. In addition, a detailed report for individual waveforms can be created using the integrated report generator. These reports provide a convenient mechanism for quickly documenting configuration information, measurement results and plot images in a single file, simplifying document organization and distribution.

▶ Maximum Real-Time Frequency Span by Oscilloscope Sample Rate

Sample Rate	Real-Time Frequency Span
50 GS/s	20 GHz
40 GS/s	16 GHz
25 GS/s	10 GHz
20 GS/s	8 GHz

Choosing the Right Scope for the Job

TDS/DPO/DSA oscilloscopes with a single shot bandwidth of 7 GHz or greater are required for capturing WiMedia signals in band group one. Analysis of higher band groups requires oscilloscopes with correspondingly higher bandwidths. Coverage for all six WiMedia band groups will require a single shot bandwidth of at least 14 GHz.

Analysis of radar signals through X band and Ku band calls for real-time bandwidths beyond 16 GHz. The DSA72004 oscilloscope with single shot bandwidth of 20 GHz and deep 200 Mpts record length provides the greatest flexibility for analyzing such high-speed signals.

Measurements for all six WiMedia Band Groups, all ten Time Frequency Codes (TFCs) and all eight WiMedia Data Rates

- ▶ Error Vector Magnitude, peak and RMS
- ▶ Frequency Tolerance, by band
- ▶ Preamble Cross Correlation, by symbol
- ▶ Adjacent Channel Power Ratios (ACPR12, ACPR13, ACPR21, ACPR23, ACPR31, ACPR32) between each band within a band group
- ▶ Spectral Mask testing, by band
- ▶ Relative Power measurements, by band
- ▶ Decoded PLCP Header Information
- ▶ PASS/FAIL conditions for compliance test

Ultra-Wideband Spectral Analysis

► TDS/DPO/DSA Series

► Ordering Information

Tektronix Ultra-Wideband Option UWB

Option UWB is available for all TDS real-time oscilloscopes with 7 GHz or greater single-shot bandwidth and all DPO/DSA real time oscilloscopes 2.5 GHz or greater bandwidth.

Order Option	Description
DPO7254 UWB	Ultra-Wideband Spectral Analysis
DPO7354 UWB	
DPO70404 UWB	
DSA70404 UWB	
DPO70604 UWB	
DSA70604 UWB	
DPO70804 UWB	
DSA70804 UWB	
DPO71254 UWB	
DSA71254 UWB	
DPO71604 UWB	
DSA71604 UWB	
DPO72004 UWB	
DSA72004 UWB	
Upgrades	
TDS7BUP UWB	Upgrade TDS7704B with Ultra-Wideband Spectral Analysis
TDS6BUP UWB	Upgrade TDS6804B, TDS6124C and TDS6154C with Ultra-Wideband Spectral Analysis
DPO7UP UWB	Upgrade DPO7254, DPO7354, DPO/DSA70000 with Ultra-Wideband Spectral Analysis

Recommended Options

For RSAVu

Opt. 21 – Advanced Measurement Suite.

For the AWG7102 Ultra-Wideband Waveform Generator

Opt. 6 – 20 GS/s.

Recommended Accessories

Tektronix Z Active Probes – Highest performance probing solutions with bandwidth enhanced to the probe tip for differential and single-ended voltage signals, because accurate design verification depends on high bandwidth access to critical signals and high-fidelity signal capture.

Powered by MATLAB® software. MATLAB® is a registered trademark of The MathWorks, Inc.

Contact Tektronix:

ASEAN / Australasia (65) 6356 3900

Austria +41 52 675 3777

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777

Belgium 07 81 60166

Brazil & South America (11) 40669400

Canada 1 (800) 661-5625

Central East Europe, Ukraine and the Baltics +41 52 675 3777

Central Europe & Greece +41 52 675 3777

Denmark +45 80 88 1401

Finland +41 52 675 3777

France +33 (0) 1 69 86 81 81

Germany +49 (221) 94 77 400

Hong Kong (852) 2585-6688

India (91) 80-22275577

Italy +39 (02) 25086 1

Japan 81 (3) 6714-3010

Luxembourg +44 (0) 1344 392400

Mexico, Central America & Caribbean 52 (55) 5424700

Middle East, Asia and North Africa +41 52 675 3777

The Netherlands 090 02 021797

Norway 800 16098

People's Republic of China 86 (10) 6235 1230

Poland +41 52 675 3777

Portugal 80 08 12370

Republic of Korea 82 (2) 6917-5000

Russia & CIS +7 (495) 7484900

South Africa +27 11 206 8360

Spain (+34) 901 988 054

Sweden 020 08 80371

Switzerland +41 52 675 3777

Taiwan 886 (2) 2722-9622

United Kingdom & Eire +44 (0) 1344 392400

USA 1 (800) 426-2200

For other areas contact Tektronix, Inc. at: 1 (503) 627-7111

Updated 12 November 2007

For Further Information

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tektronix.com



Product(s) are manufactured in ISO registered facilities.

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C and with Tektronix Standard Codes and Formats.

Copyright © 2008, Tektronix. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks or registered trademarks of their respective companies.

03/08 HB/WOW

61W-20587-3