Tek UWB
Spectral Analysis
Printed Help Document

www.tektronix.com
077-0033-00

Tektronix

Tek UWB Spectral Analysis Printed Online Help Version 2.0, part number 077-0033-00.

Contacting Tektronix

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For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

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Conventions

The online help uses the following conventions:

- When steps require a sequence of selections using the software interface, the ">" delimiter marks each transition between a menu and an option. For example, File > Save.
- DUT refers to the Device Under Test.
- Three dots (...) following a menu item indicated that the menu item will open submenu.

Updates through the Web Site

Periodic software upgrades may be available.

To check for upgrades:

1. Go to the Tektronix Web site (www.tektronix.com).
2. Click Software and Drivers to link to the Software and Firmware Finder Web page.
3. Enter the product name 'Tek UWB' to find available software upgrades.

Introduction and Product Description

The excellent amplitude, phase flatness, and low phase noise make the DPO /DSA70000 series oscilloscopes the ideal tool for engineers designing Ultra Wideband radios used in Certified Wireless USB, MB-OFDM, MBOA, WiNet and Ultra Wideband Bluetooth.

The Tek UWB runs on TDS/DPO/DSA series oscilloscopes with single shot bandwidth ≥ 7 GHz.

The TekUWB automatically reads the digital information from the RFwaveform to determine the demodulation method on a packet by packet basis. The RF channel is corrected using the pilots in each packet within the optionally specified time gate. The RF signal quality measurements such as the EVM, spectral mask testing, and ACPR are performed using the methods agreed upon by WiMedia for key compliance based measurements. The WidebandRF troubleshooting insight is aided by DPX full span Real Time spectrograms, and Spectral displays. The frequency spans to 20 GHz are displayed with the Spectrum analyzer like RBW for power spectrum. The DPX makes specific RF visible in the presence of complex RF traffic. The Time gating within the DSA70000's 200 Mpt record at 50 GS/s enables the analysis of specific RF traffic separated by time, power, or frequency.

All the six Band Groups, 10 Time Frequency Codes, and eight Data Rates are correctly analyzed.

The TekUWB application analyzes all the Data Rates, Time Frequency Codes, and Band Groups on the DPO /DSA71604 or DPO/DSA72004 oscilloscopes.

Compatibility

For information on instrument compatibility, refer to the Optional Applications Software on Windows-Based Oscilloscopes Installation Manual (Tektronix part number 071-1888-XX) available as a PDF on the CD-ROM.

For software upgrades, refer to the Optional Applications Software on Windows-Based Oscilloscopes Installation Manual (Tektronix part number 071-1888-XX) available as a PDF on the CD-ROM.

Requirements and Restrictions

The following requirements are recommended for the Tek UWB:

- Available on TDS /DPO /DSA series oscilloscopes with single shot bandwidth ≥7 GHz.
- Available on oscilloscopes with single shot bandwidth 7 GHz for WiMedia band group 1 or DS-UWB lower band only and analyzes all six WiMedia band groups with single shot bandwidth ≥14 GHz.
- Available on DSA72004 oscilloscopes with single shot bandwidth 20 GHz, four 50 GS /s channels, and 200 Mpts for Radar through Xband, Ku band and into K band.

How to Start the Software

Depending on the type of oscilloscope that you have, you can start the software in one of the following ways:

- Select App > Ultra-Wideband Spectral Analysis
- Select Analyze > Ultra-Wideband Spectral Analysis

A screen appears indicating that the software is loading.

The oscilloscope displays the Tek UWB Ultra-Wideband Spectral Analysis software.

The Tek UWB sets the Analysis type to Spectral Only (no modulation) and does not show the Constellation pattern.

How to Minimize and Maximize the Software

To minimize, click  on the top-right of the software window.

To maximize, click 

on the displayed icon on the taskbar of the oscilloscope window.

Use ALT +Tab to switch between Tek UWB and the Tekscope. You can see both the oscilloscope software and the TekUWB software at the same time by using dual monitors.

Returning to the Software

To return to the software, press the ALT+Tab keys on the keyboard.

How to Exit the Software

To exit the software, click  on the top-right of the software window.

Application Data Files

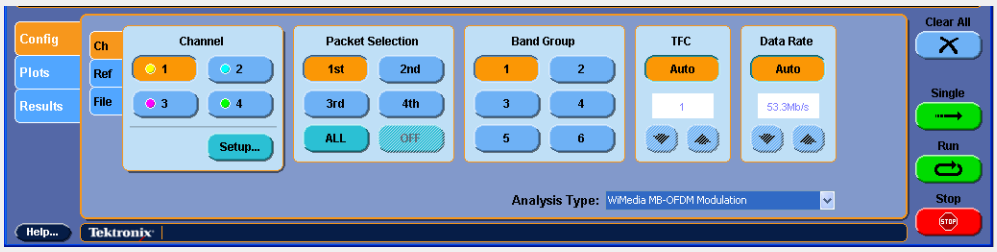
The software uses the following data files:

File name extension	Directory	Description
.wfm	TekApplications\UWB\Waveforms...	To store the sample waveforms

Selecting the Analysis Type

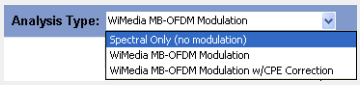
To set the Time Frequency Codes, click the Config tab.

Config tab



To set the analysis type for debugging the radios, select one of the available options in the Analysis Type: pane.

Analysis Type



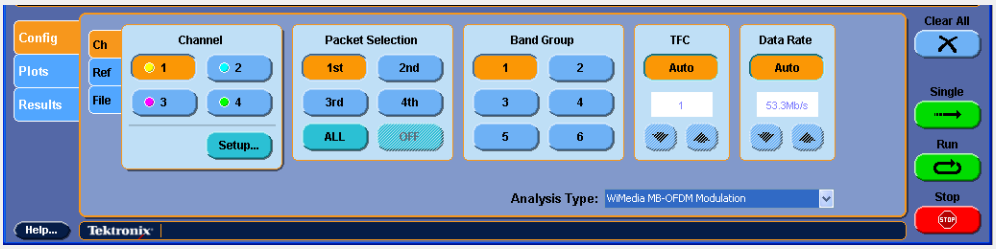
The default setting Spectral Only (no modulation) acquires the data and does some basic spectral analysis without any demodulation.

The setting WiMedia MB-OFDM Modulation performs a full modulation analysis assuming that a UWB radio signal is in accordance with the WiMedia specifications.

Loading the WFM File

To select the source of the measurement, click the Config tab.

Config tab

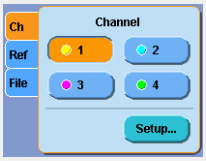


You can load the WFM file in the following ways:

Input source	Selections	Description	Default
Ch	1, 2, 3, and 4	Selects one of the four live channels as the source for acquisition.	1

Channel

In the Config tab, click "Ch" tab to display the Channel pane.

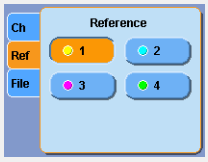


Tek UWB acquires live signals from the channel selected.

Input source	Selections	Description	Default
Ref	1, 2, 3, and 4	Selects one of the four reference waveforms as the source for acquisition.	1
File	Select	Select one or multiple files as the source of the acquisition.	N/A

Reference

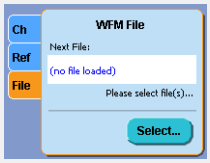
In the Config tab, click "Ref" tab to display the Reference pane.



Tek UWB acquires the reference waveforms from the oscilloscope.

WFM File

In the Config tab, click "File" tab to display the WFM File pane.



Select locates a .wfm file to be analyzed.

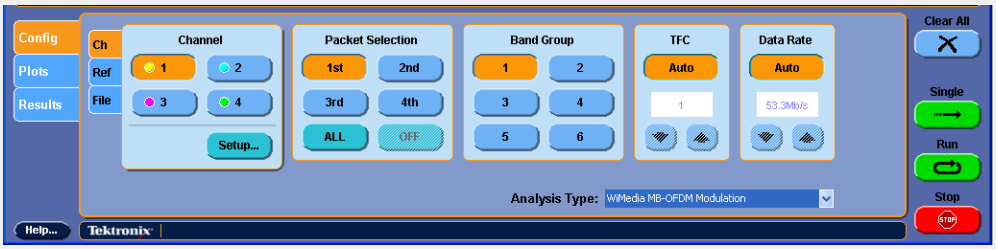
Click Select to open the "Select File(s) to Load" window.

Select one file or multiple files by using the Shift or Ctrl key with a mouse click.

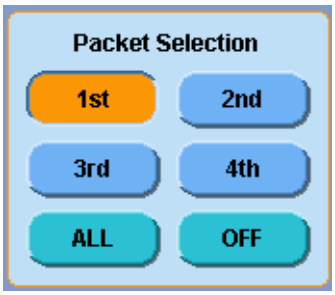
Selecting the Packet

To select the packet for performing the analysis, click the Config tab.

Config tab



In the Packet Selection pane, click one of the available selections.



The default selection is 1st. When multiple packets are selected, each one is analyzed and results are reported sequentially for each packet separately.

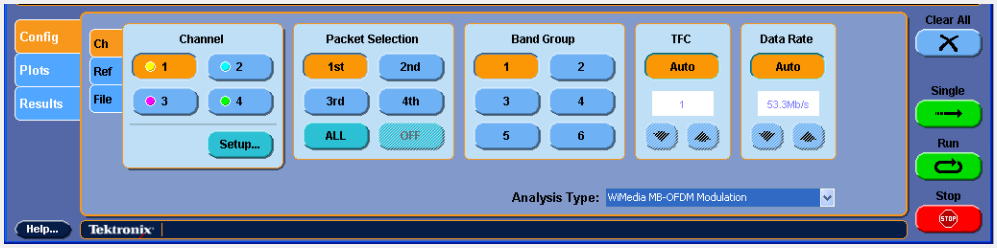
NOTE. *The OFF option is not available when the analysis type is set to WiMedia MB-OFDM Modulation or WiMedia MB-OFDM Modulation w/CPE Correction. But for the Spectral Only (no modulation) type, the OFF option is available to disable the packet search algorithm used for identifying MB-OFDM packets.*

Setting the Band Group

Six WiMedia band groups fill the Ultra Wideband spectrum from 3.1 GHz to 10.6 GHz.

To set the band group to perform the analysis, click the Config tab.

Config tab



NOTE. *The Band Group pane is not available when the analysis type is set to Spectral Only (no modulation).*

In the Band Group pane, click one of the available selections.

The default selection is 1.

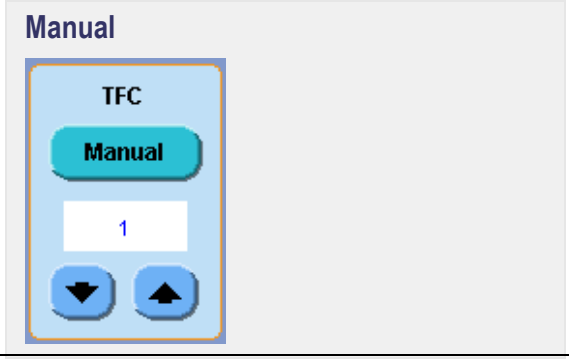
Setting the Time Frequency Codes

To set the Time Frequency Codes, click the Config tab.

Config tab

NOTE. *The Time Frequency Codes pane is not available when the analysis type is set to Spectral Only (no modulation).*

The following table gives the configuration options available in TFC:

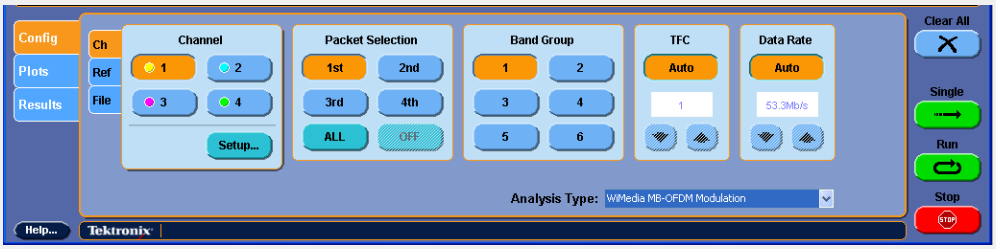
Option	Description
Auto	To configure the Time Frequency Codes automatically, select Auto in the TFC pane.
	
Manual	To configure the Time Frequency Codes manually, select Manual in the TFC pane.
	

The default selection is Auto.

Setting the Data Rate

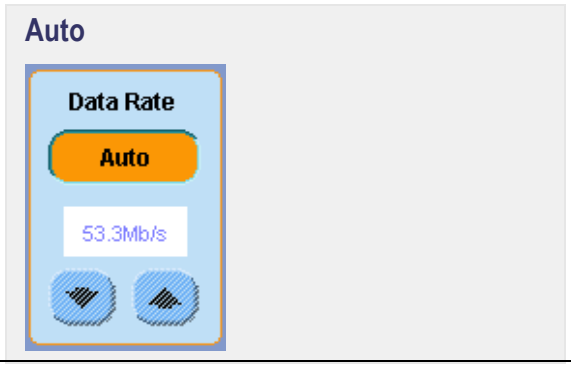
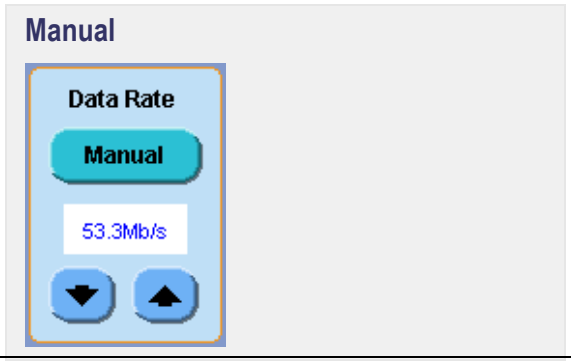
To set the Data Rate, click the Config tab.

Config tab



NOTE. *The Data Rate pane is not available when the analysis type is set to Spectral Only (no modulation).*

The following table gives the configuration options available in Data Rate:

Option	Description
Auto 	To configure the Data Rate automatically, select Auto in the Data Rate pane.
Manual 	To configure the Data Rate manually, select Manual in the Data Rate pane.

The default selection is Auto.

Analyzing the Waveform

Click Single or Run in the software to perform an analysis. The analysis depends on the state of the source. Select a control in the configuration as follows:

Option	Live channel	Reference channel	File
For live channel and reference channel options  For File Option 	The software acquires and analyzes the selected channel.	The software acquires and analyzes the selected reference channel.	The software acquires and analyzes the selected channel, reference, or file. If one file is selected, the behavior is the same as the reference waveform input. If multiple files (for example three waveforms) are selected and then you click Test File, the first waveform is loaded and analyzed (shows File 1 of 3 in the WFM File pane) and then the second waveform is loaded. When you click the Test File again, the second waveform is loaded and analyzed (shows File 2 of 3 in the WFM File pane) and then the third waveform is loaded. When you click the Test File again, the third waveform is loaded and analyzed (shows File 3 of 3 in the WFM File pane) and then the first waveform is loaded.
For live channel and reference channel options  For File Option  more information	The software sequentially acquires and analyzes the selected channel and logs results in the results window.	The software sequentially acquires and analyzes the selected reference and logs results in the results window.	The software acquires and analyzes all the selected files from the source directory. The software logs the results in the results window and stops.

To stop all the software activity immediately and regain control, click 

.

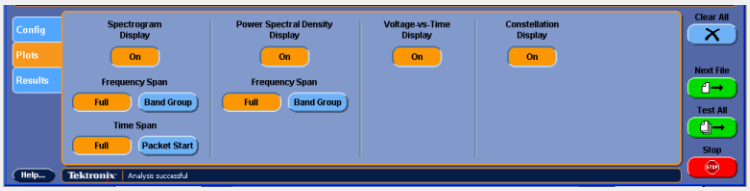
To clear all data from the Results window, click the button 

.

Voltage-vs-Time

To view the plot, click the Plots tab.

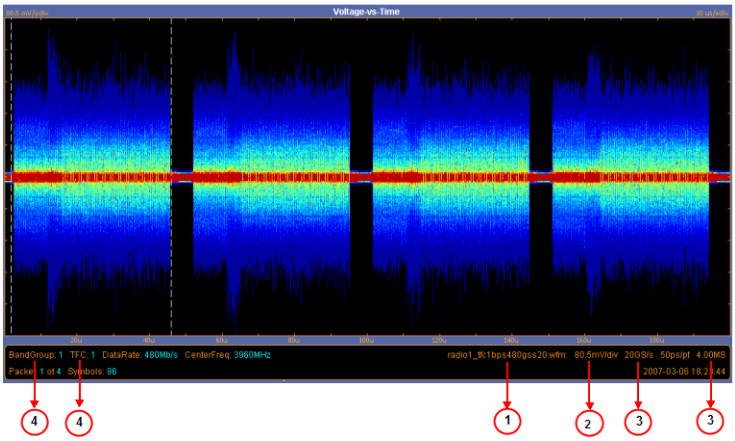
Plots tab



In the Voltage-vs-Time Display pane, click On.

Voltage-vs-Time Display pane

Voltage-vs-Time displays the acquired waveform.



The acquired waveform in the software is defined as the portion of the oscilloscope acquisition between the cursors. You can select the data that you want to analyze. The Voltage-vs-Time data is displayed as a temperature graded display similar to WfmDB mode in the oscilloscope. Cursors are used within the Plot to highlight the packet that is being analyzed.

The Voltage-vs-Time plot readout provides the following information:

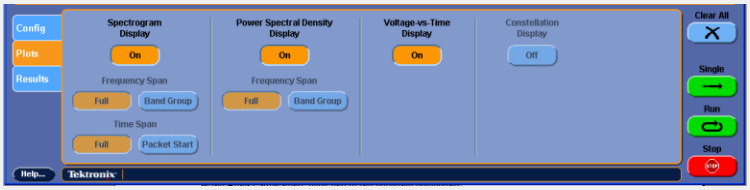
1. Source of measurement (file name or measurement channel)
2. Vertical Volts/Div Setting
3. Horizontal: Sample Rate, Resolution, and Record Length
4. Results of Bandgroup, TFC, and Bit Rate Auto-detection

Constellation

NOTE. *The Constellation Display pane is not available when the analysis type is set to Spectral Only (no modulation).*

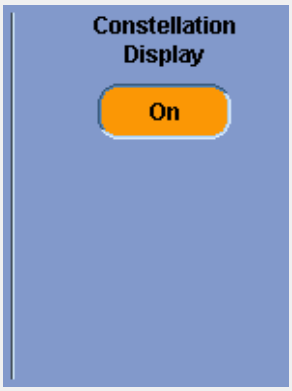
To view the plot, click the Plots tab.

Plots tab

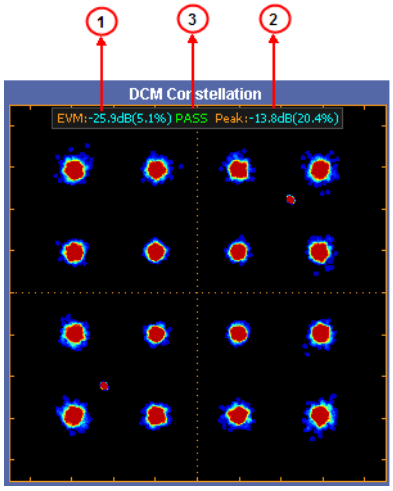


In the Constellation Display pane, click On.

Constellation EVM Display pane



The Constellation plot displays the constellation diagram of the packet being analyzed. Plots tab WiMedia Analysis type offers all plotting selections.



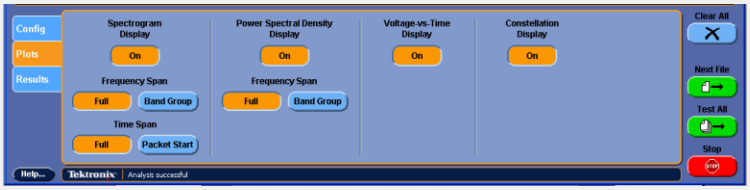
The Constellation plot readout area provides the following information:

1. EVM of the packet being analyzed in db and %
2. EVM, Peak of the packet being analyzed in db and %
3. Pass/Fail limits on EVM measurements according to data rate

Power Spectral Density

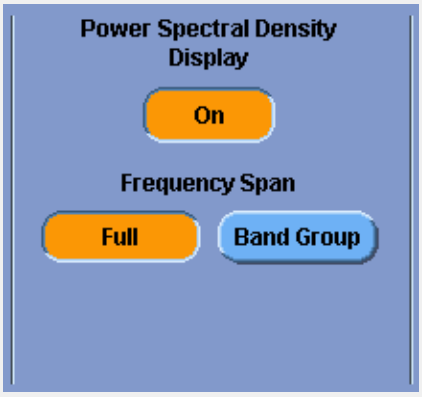
To view the plot, click the Plots tab.

Plots tab



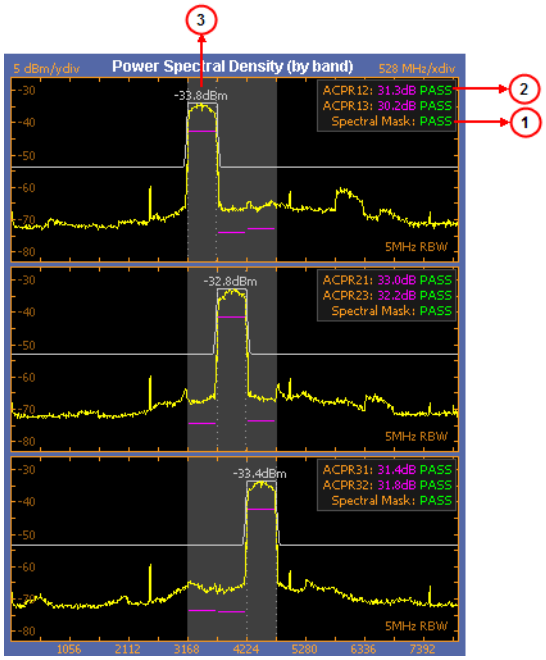
In the Power Spectral Density Display pane, click On.

Spectral Mask / ACPR Display pane



NOTE. *The Frequency Span options are not available when the analysis type is set to Spectral Only (no modulation).*

The software provides a single plot modal window of the Power Spectral Density Display.



The span of the spectrum displayed will depend on how you want to display the spectral data.

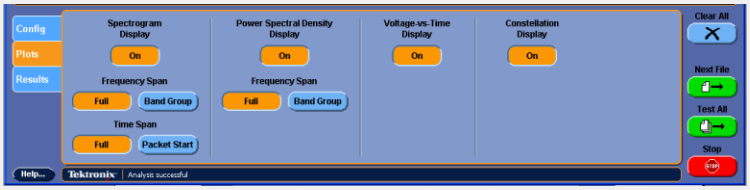
The Power Spectral Density plot readout displays the following when doing the WiMedia radio analysis:

1. Spectral Mask with Pass/Fail status
2. Two ACPR Measurements with Pass/Fail status in each band
3. Power Spectral Density Measurements in each band

Spectrogram

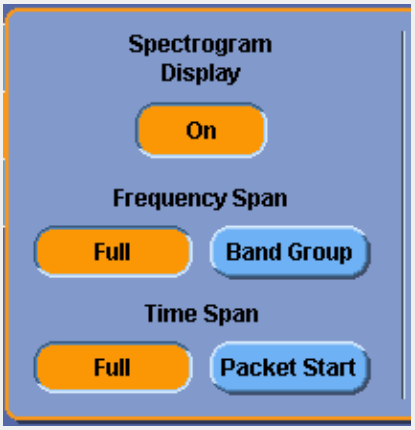
To view the plot, click the Plots tab.

Plots tab



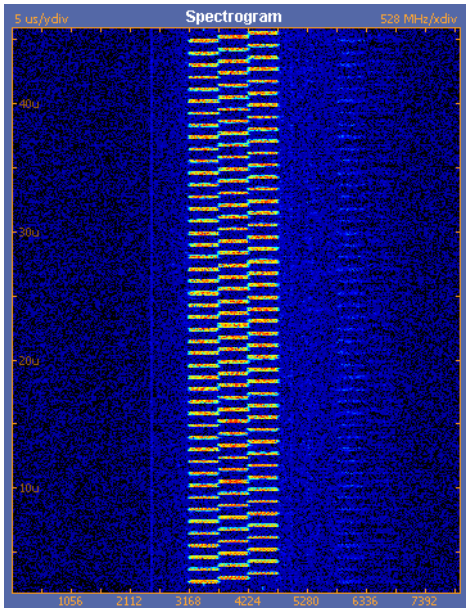
In the Spectrogram Display pane, click On.

Spectrogram Display pane



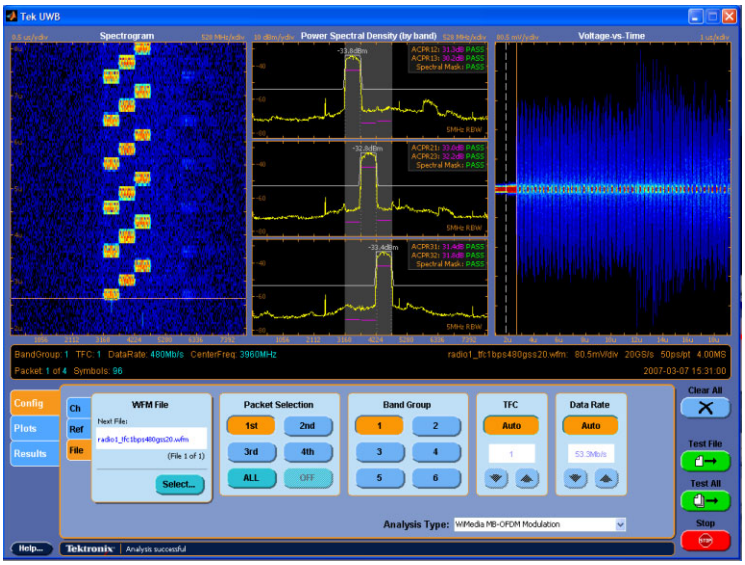
NOTE. *The options for the Frequency Span and Time Span are not available when the analysis type is set to Spectral Only (no modulation).*

The software provides a single plot window that incorporates the Spectrogram feature. The following diagram shows a Spectrogram plot:



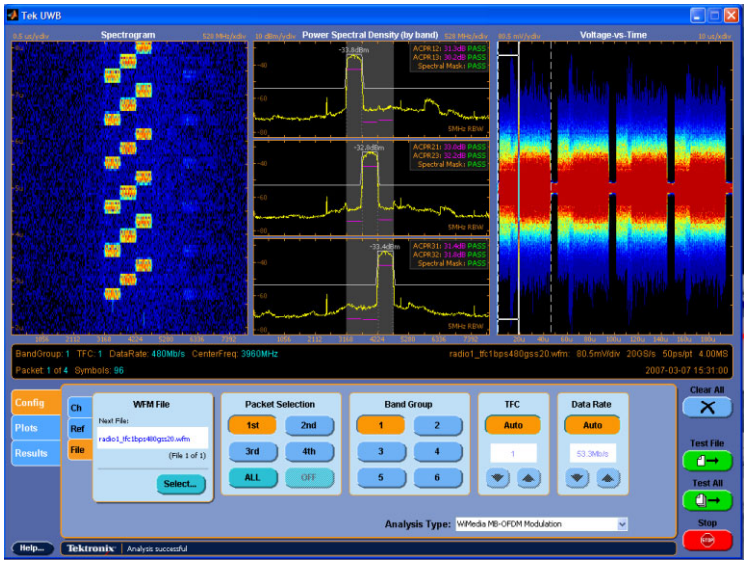
Using Plot Cursors

A cursor is established in the analysis portion of the Voltage vs. Time waveform. The cursor can be moved using mouse or finger. The cursor location in the time domain is also represented simultaneously on the spectrogram plot.



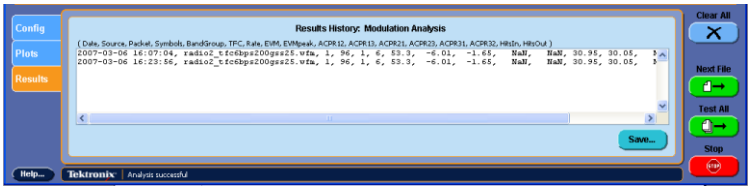
Using Plot Zoom

Within each plot window, a zoom box can be defined using the mouse or oscilloscope touch screen. To zoom in, click and drag to select a zoom area. Once the Zoom box is defined, click and release the mouse. The plot displays the signal in more detail. Double-click to return to full view. The zoom box is shown in white on the following image:



Listing Window Data

To view the results, click the Results tab.



The software provides a listing of all measurement results including the Pass/Fail Status and a means of exporting the results. Use the scroll bar to scroll through the listing window. Use the vertical scroll bar to scroll the result window.

Clearing All the Results

To clear all data from the Results window, click the button 

.

Saving the Results

To save or export results from the Results window, click 

.

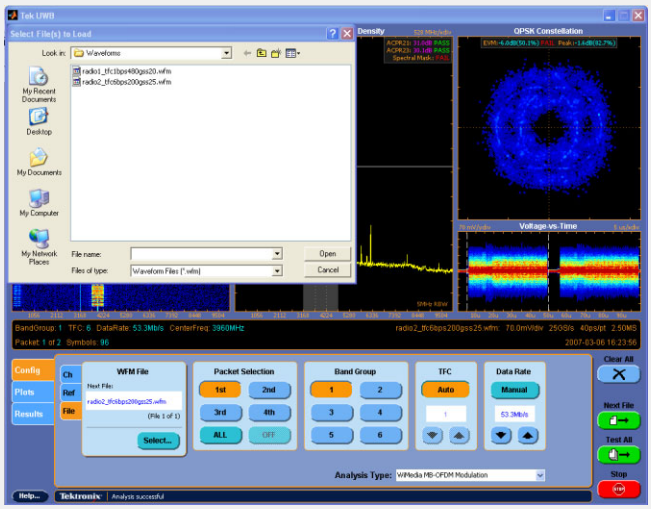
The results are in .csv format so that they can easily be imported into the Microsoft Access database used by the WiMedia PHY group at compliance workshop.

Analyzing a Sequence of Waveform Files

WiMedia radios operate at multiple Data Rates, Time Frequency Codes, Band Groups, and power levels. More than 50 waveforms may need to be captured to assure proper operation. It may be more convenient to capture and save the waveforms in rapid succession and then batch process the analysis.

In the Config tab, click File and then Select.

Select

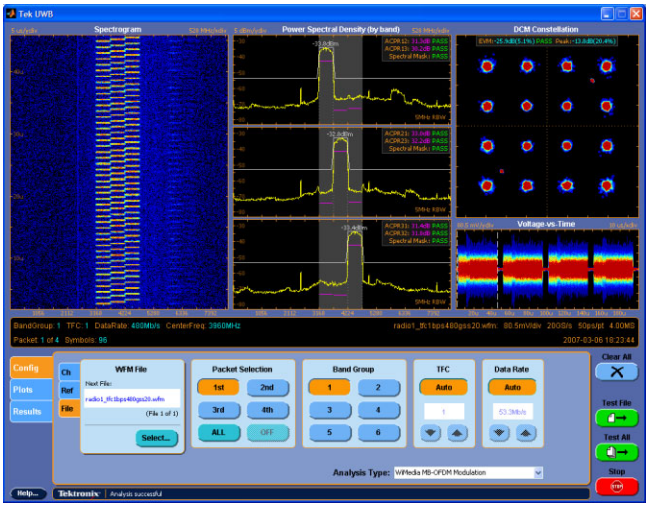


Select the files you wish to analyze.

1. Click Select to open the "Select File(s) to Load" window.
2. Select one file or multiple files by using the Shift or Ctrl key with a mouse click.

Click Test All and Tek UWB will sequence through and process all the selected waveforms. Tek UWB will analyze all waveforms, and will return status as Analysis successful.

To see the result summarized for the sequence of waveforms, click the Results tab.



Setup live Channel

Channel Setup sets the selected channel in the oscilloscope to a default setup for Wideband RF.

The settings are reported on a pop-up window and may be modified using the scope controls.

Capturing Live WiMedia RF

NOTE. *The oscilloscope must be set to 20 GS/s or greater for live capture of WiMedia RF.*

RF Signal Generation

Equipment required. DPO /DSA70804 or greater, Keyboard and mouse, AWG7102 with option 6 (20 GS /s) or WiMediaUWB radio, SMA cable, and Tekconnect SMA

Load UWB waveform. UWBwaveforms captured on the TDS6154C for playback on AWG7102 with option 6 are available at Tektronix.com.

1. Search keyword WiMedia.
2. Select AWG7102 WiMedia Radio Waveforms.
3. Load the file onto the AWG7102.
4. Open a UWB WiMedia.awg on the AWG7102.
5. Press Run on the AWG7102.
6. Press Ch1 On button and interleave “On”. Be sure the timing tab shows 20 GS /s on the AWG7102.
7. Connect the Ch1 on AWG7102 to Ch1 on DPO70000 using SMA cable or connect the antenna of TekUWB radio to Ch1 of DPO70000 with SMA cable.

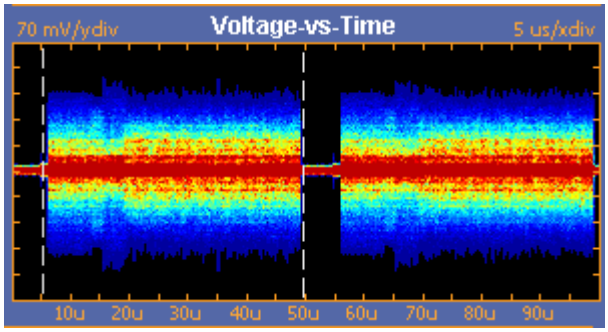
Capturing Live RF Signal

Launch Tek UWB.

1. Select Tek UWB in the DPO/DSA70000 Analyze menu.
2. Press ALT + Tab on the keyboard to return to the scope display.

Setup the DPO70804 to Capture the UWB Waveform.

1. Set the vertical sensitivity to capture the RFwaveform at about 90% of full scale. Usually this requires setting variable gain in the DPO70000 vertical setup. Here it is set to 70 mV/ div.
2. In the display menu set the record view palette temperature color grading to see the information in this complex RFwaveform.



The packets are captured here at 25 GS /s, 10 us/ div, 2.5 Mpts. The packet length in this example is about 40 us.

Set Trigger Holdoff for Stable Display with Continuous Transmission. If the radio or AWG7102 is in a mode to transmit continuously with default trigger holdoff by time, the display will be unstable. In this example since the packet length is about 40 us, setting trigger holdoff by time to about 32us, a little longer than the packet length, gives a stable display on the continuous RF waveform. If the packet length is varying from packet to packet use "single sequence" or setup Pinpoint trigger to capture a specific packet length.

Or use "Single" sequence trigger. Real Time measurements are made from a single acquisition. A single shot, "Single sequence," acquisition does not require "trigger holdoff by time" to be increased.

Adjust Trigger Position. Adjust trigger position so that the acquired record starts with a full packet. If the record starts in the middle of a packet, the software will have to search through the data in the packet with a correlation function to find the beginning of the header. By triggering on the beginning of a packet analysis time is decreased.

Use Alt + Tab to go to TekUWB. The application defaults to Ch1, Band Group 1 and analyze the first captured packet. If you want to analyze another or all captured packets change the selection.

Application Defaults

To captured waveform, click Single. Click Run and the last waveform acquired will be processed continuously.

The results of the analysis are in the results menu and may be saved and exported.

Single