PROTOCOL SOLUTIONS GROUP
3385 SCOTT BLVD
SANTA CLARA, CA 95054

LeCroy UWB*Tracer*™/Trainer™

Ultra-Wideband Protocol Analyzer

User Manual

Manual Version 3.02

For Software Version 3.02

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FCC Conformance Statement Compliance with 47 CFR 15.519 (a)(1)

This device complied with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Rule 47 CFR 15.519 (a)(1) states that “A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgement of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting. “

This equipment may only be operated indoors. Operation outdoors is in violation of 47 U.S.C. 301 and could subject the operator to serious legal penalties.

Note: This device must be installed in a location that is not accessible to the general public. Install the device so that the antenna is more than 20 cm from unsuspecting personnel. Failure to install this device as described will result in a failure to comply with FCC rules for RF exposure and is discouraged. Only antennas approved with the device may be used. This device may not be co-located with other transmitters without further approval by the FCC.

Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the operator’s authority to operate the equipment.

EU Declaration of Conformity

This equipment including all its options is in conformity with the provisions of the following EC directives(s), including all the latest amendments:

73/23/EEC Low Voltage Directive

89/336/EEC EMC Directive

Conformity with Council Directive 73/23/EEC is based on:

EN 61010-1: 2001 Safety requirements for electrical equipment for measurement, control and laboratory use

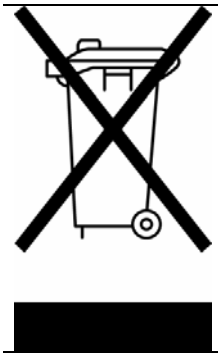
Conformity with Council Directive 89/336/EEC is based on:

EN 61326/A3: 2003 EMC requirements for electrical equipment for measurement control and laboratory use

Emissions	EN 55011/A2:2002 (Conducted and Radiated Emissions)
	EN 61000-3-2/A2:2005 (Harmonic Current Emissions)
	EN 61000-3-3/A2:2005 (Voltage Fluctuations and Flicker)
Immunity	EN 61000-4-2/A2:2001 (Electrostatic Discharge)
	EN 61000-4-3/A1:2003 (RF Radiated Electromagnetic Field)
	EN 61000-4-4:2004 (Electrical Fast Transient/Burst)
	EN 61000-4-5/A1:2001 (Surge)
	EN 61000-4-6/A1:2001 (RF Conducted Electromagnetic Field)
	EN 61000-4-11:2004 (Mains Dips and Interruptions)

Warning: This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

WEEE Program



This electronic product is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles.
For more information about proper disposal and recycling of your LeCroy product, please visit www.lecroy.com/recycle.

Part number: 730-0077-00

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Section 1. General

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Chapter 1: Overview

This chapter describes the UWB*Tracer/Trainer*™ product and Ultra-Wideband technology in general.

1.1 UWB*Tracer/Trainer* Ultra-Wideband Analyzers

The LeCroy UWB*Tracer/Trainer* is a portable Ultra-Wideband (UWB) test and debug platform that combines non-intrusive recording with extensive decoding features. The RF (wireless) recording functionality is designed to record non-intrusively off-the-air WiMedia UWB traffic from one or more devices, while the MPI recording functionality is designed to connect to the specification-defined MAC-PHY Interface (MPI) bus between the MAC and the PHY subsystems in WiMedia-compliant devices and to capture the traffic between them. The WLP protocol uses the MUX sublayer and services of the WiMedia MAC for data networking.

By leveraging years of experience in protocol analysis tools for emerging markets, UWB*Tracer/Trainer* blends sophisticated functionality with practical features to allow designers and validation engineers to easily specify multi-level, conditional trigger scenarios to pinpoint intermittent problems in the UWB connection.

System-level validation requires non-intrusive monitoring. UWB*Tracer/Trainer* ensures accurate data collection by providing transparent electrical taps. At the heart of UWB*Tracer/Trainer* is the CATC BusEngine™ protocol processor that features a real-time recording engine for UWB MAC-to-PHY traffic.

UWB*Tracer/Trainer* also supports remote operation over a LAN and unattended control of the analyzer with an Automation API. UWB*Tracer/Trainer* includes an advanced search capability that allows to search for specific fields in the recorded trace and to navigate faster to places of interest inside the trace.

UWB*Tracer/Trainer* features a real-time statistics display that continuously monitors and presents metrics for the recorded MAC-to-PHY traffic, providing a high-level view of network performance.

For complete product information, please visit **www.LeCroy.com**.

Table 1.1 summarizes key UWB*Tracer/Trainer* features.

Table 1.1 UWB*Tracer/Trainer* Features

Feature	Benefit
Wireless capturing & recording	Allows off-the-air (and non-intrusive) recording of UWB traffic
MPI capturing & recording	Probes the WiMedia specification-defined bus between the MAC and PHY layers, while remaining non intrusive. Suitable for three different popular connector types.
Simultaneous RF and MPI recording	Capable of recording one RF and one MPI channel at the same time and display a combined trace
Advanced Triggering	Robust capability of setting complex triggering and filtering sequences and act in real-time on those settings on each of the channels.
Trace View	Comprehensive viewing of the recorded traffic with convenient customization through the trace display options.
Advanced search	Fast and comprehensive trace searches.
Collapsible/expandable header	Increased drill-down on exchanges, sequences, or individual frames.
Real-time performance monitoring and statistics	Allows easy identification of throughput problems and anomalies.
Dynamically-allocated memory pool	(2 GB) Captures long time-windows for analysis and problem-solving.
Interchangeable Radios and room for future expansion	The modular design of the UWB*Tracer/Trainer*™ and the CATC 5K platform permits interchanging modules and radios
WLP protocol	Uses the MUX sublayer and services of the WiMedia MAC for data networking

1.2 Ultra-Wideband Technology

UWB technology was available for over 40 years for military and civilian applications and was originally called either impulse radio or carrier-free communications. Today, the FCC definition for UWB is any radio technology with a spectrum that occupies greater than 20 percent of the center frequency or a minimum of 500MHz.

In 2002, the FCC allocated unlicensed radio spectrum from 3.1 GHz to 10.6 GHz expressly for enterprise and consumer applications. The FCC defined a specific minimum bandwidth of 500 MHz at a -10dB level. As current UWB implementations allow communication that requires high data rates over short distances, one immediate UWB application is WPAN (Wireless Personal Area Network).

The Multi-band OFDM technology, promoted by the WiMedia Alliance, is one of the technologies that can utilize the allocated band for UWB. The MB-OFDM transmits data simultaneously over multiple carriers spaced apart at precise frequencies. This approach provides benefits like high spectral flexibility and resiliency to RF interference and multi-path effects.

The WiMedia UWB specifications are available from the WiMedia Alliance. The URL for the WiMedia website:

http://www.wimedia.org

1.3 WiMedia UWB Specification Ecosystem

The WiMedia Alliance has developed specifications for ultra-wide-band (UWB) devices. The main goal of the WiMedia UWB specifications is to create a UWB “ecosystem” that allows easy and secure operation of UWB devices.

The WiMedia UWB specifications have a first-generation data rate of 480 Mbps, which enables a multitude of innovative wireless devices. UWB devices that follow the WiMedia UWB specifications can co-exist in the same physical environment, even if they have unrelated applications.

Markets for two major application types are emerging:

- Certified Wireless-USB (WUSB)
- WLP

1.3.1 Certified Wireless USB Overview

The WiMedia UWB specification first-generation data rate of 480 Mbps provides a basis for delivering WUSB devices that can perform comparably with USB 2.0 devices.

The Certified Wireless-USB protocol maintains the same host-device model as the wired USB protocol, but the Certified Wireless-USB protocol makes many optimizations for operating efficiently on a wireless medium.

The first Certified Wireless-USB-protocol products are various Wire Adapter devices, which operate as wired-to-wireless bridges. Host Wire Adapters (HWA) enable any PC with USB 2.0 to become a WUSB Host. Device Wire Adapters (DWA) are wireless hubs that can connect wired USB 2.0 devices to a WUSB Host.

For Certified Wireless-USB-protocol devices, UWB*Tracer/Trainer* provides full protocol decoding from low-level packets to high-level Wire Adapter transfers.

The WUSB specification is available from the USB Implementers Forum (USB-IF). The URL for the USB-IF website is:

http://www.usb.org/home

1.3.2 WLP Overview

WLP is a protocol that uses the services of the WiMedia MAC for data networking.

The WLP protocol uses the MUX sublayer and service defined in the WiMedia MAC specification. The MUX sublayer combined with the WLP protocol corresponds to the logical link control sublayer of the standard ISO/OSI IEEE 802 reference model.

For more information about the WLP protocol, MUX sublayer and service, and WiMedia MAC specification, see the WLP specification at **www.WiMedia.org**.

Chapter 2: Hardware Description

This chapter describes the CATC 5K-based UWB*Tracer/Trainer*™ Analyzer and Exerciser and other components and accessories that accompany it.

2.1 CATC 5K Platform

CATC 5K Platform

The CATC 5K is a lightweight and modular platform, designed to be mobile and flexible. The two front slots can accommodate up to two plug-in modules with a variety of options. The CATC 5K platform is powered by a small external power supply. Quiet built-in fans provide all the necessary cooling.

Connection to Host Machine

The CATC 5K platform connects to a Windows®-based PC (the host machine) through a single USB cable. Though the system can operate over USB 1.1 protocol data rates, it is advisable to use a USB 2.0 connection between the Analyzer and the host machine to obtain faster upload of traffic.

2.2 UWB*Tracer/Trainer* Analyzer and Exerciser

The basic UWB*Tracer/Trainer* analyzer configuration includes a CATC 5K platform and a UWB Analyzer plug-in module (UW002MA or UW003MA) that is inserted into the right-side slot.

In addition, the USB Analyzer plug-in module (US007MA) can be inserted into the left-side slot and be used for capturing USB Association traffic, retrieving the information required for pairing two WUSB devices. See “USB Cable Association for Certified WUSB” on page 220 for more information.

The UWB Exerciser plug-in module can be inserted into the left-side slot and be used for traffic generation.

2.3 System Components

Basic Components

The UWB*Tracer/Trainer*™ basic package includes the following components:

- Installation CD-ROM, with the installation program and all documents
- *UWBTracer/Trainer Getting Started* manual, to help set up the system quickly
- CATC 5K Platform: See photograph on front cover. Also see “CATC 5K Front Panel with the UWB Analyzer Plug-in” on page 14 and “CATC 5K Rear Panel” on page 18.
- CATC 5K Power Supply and Power Cord
- Carrying case
- Vertical Stand

Figure 2.1 Vertical Stand

- UWB Analyzer Module and RF Antenna

Figure 2.2 UWB Analyzer Plug-in Module with Antenna (UW002MA or UW003MA)

- RF Coaxial Cable (SMA) [in Standard Cable Kit]
- USB cable for connecting the analyzer to a host machine

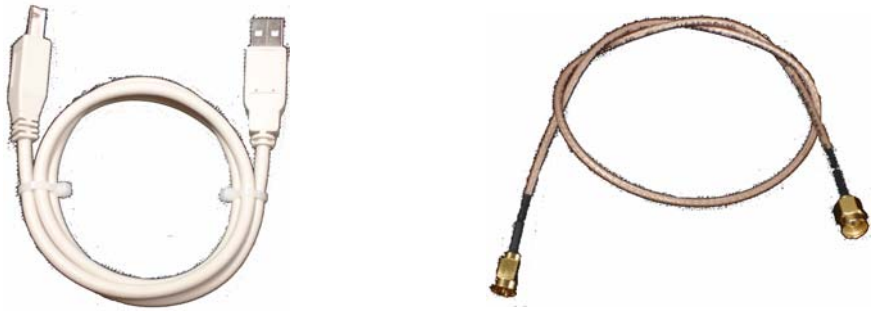

Figure 2.3 USB cable and RF Coaxial Cable (SMA)

- Synchronization Cable for synchronizing multiple analyzers. The Synchronization Cable connects to the SYNC IN and SYNC OUT connectors located on the UWB*Tracer/Trainer* rear panel (Figure 2.15). (For more information about setting up multiple analyzers, see Section 10.3, “Multiple Analyzer Synchronization” on page 158.)

Figure 2.4 Synchronization Cable and Trigger Cable

- Trigger Cable (TRIG-IN/TRIG-OUT BNC Y-cable) for connecting to external equipment (for example, for triggering capturing in a LeCroy oscilloscope).

Optional Components

In addition to the basic package, optional components are available:

- USB Analyzer plug-in module for capturing USB Cable Association traffic (US007MA)

Figure 2.5 USB Analyzer Plug-in Module (US007MA)

- UWB Analyzer plug-in module with PHY (radio) from a different vendor (UW002MA or UW003MA)
  [see Figure 2.2]
- MPI Kit (please refer to the Data Sheet for detailed information)
  [see next page]

- UWB*Trainer* Exerciser plug-in module and RF Antenna

Figure 2.6 UWB Exerciser Plug-in Module with Antenna (UW005MGA)

Note: To meet FCC requirements, the UWB*Trainer* exerciser and some models of the UWB*Tracer* analyzer have reverse-polarity radio and antenna connectors. This configuration does not affect RF behavior in any way but does require that you configure a customer-supplied antenna with reverse-polarity connectors.

MPI Kit

The MPI kit is designed for hooking to the MPI bus in two types of setups:

1. PHY subsystem connects to the MAC subsystem through a short (ribbon) cable.
2. PHY subsystem piggybacks directly on the MAC subsystem. The two subsystems connect through an adapter board without the use of cables.

Three types of connectors are common for current designs:

1. IDE 40-pin connector
2. Hirose 68-pin Connector
3. Hirose 60-pin Connector

The optional MPI Kit includes:

Figure 2.7 MPI Kit

- Cable Adapter for Hirose 68-pin or IDE 40-pin Connectors

Figure 2.8 Cable Adapter for Hirose 68-pin or IDE 40-pin Connectors

- Probe Cable for IDE 40-pin Connectors and Hirose 68-pin Connectors (2)

Figure 2.9 Probe Cable for IDE 40-pin Connectors and Hirose 68-pin Connectors

- Adapter Cable

Figure 2.10 Adapter Cable (with external SCSI type connectors)

- Board Adapter for IDE 40-pin Connectors, Board Adapter for Hirose 68-pin Connectors, and Board Adapter for Hirose 60-pin Connectors

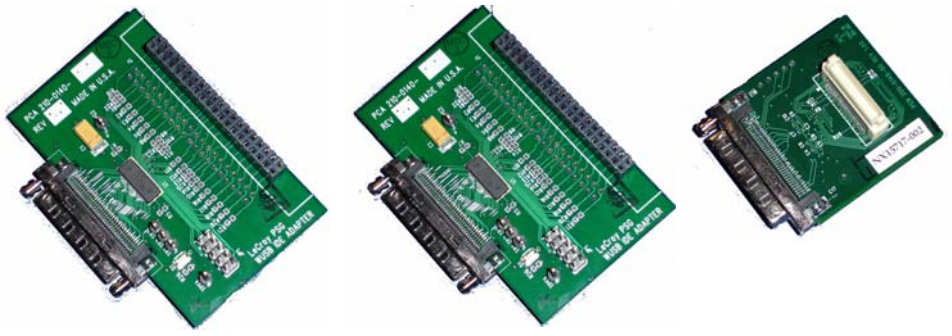

Figure 2.11 Board Adapter for IDE 40-pin Connectors, Board Adapter for Hirose 68-pin Connectors, and Board Adapter for Hirose 60-pin Connectors

2.4 UWB*Tracer/Trainer* Front Panel Description

When powered ON, the CATC 5K Analyzer activates user-accessible controls and LEDs on front and rear panels of the platform. This section covers front panel features. The next section covers rear panel features.

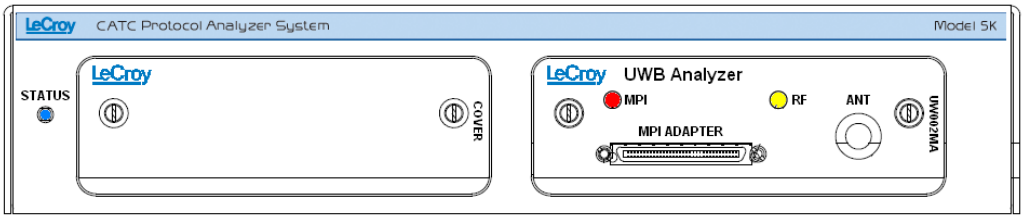

Figure 2.12 CATC 5K Front Panel with the UWB Analyzer Plug-in

CATC 5K Platform

The indicators on the CATC 5K platform (Figure 2.12) are:

STATUS (status of the platform)

LED	Description
No light	System is not powered on
Green Blink Slow	Initializing
Blue	System is operational
Red Blink Fast	System fault (contact Support)

UWB Analyzer Plug-in Module

LEDs (status of the MPI or RF channel)

LED	State	MPI Channel	RF Channel
No light	Idle	Does not detect PCLK or PHY_ACTIVE	Does not detect wireless frames
Yellow Blink Fast	Synching	Trying to synchronize to MPI traffic and waiting for PCLK and PHY_ACTIVE	Trying to synchronize to RF traffic and waiting for wireless traffic
Yellow	Synched	Synchronized: Capturing MPI traffic with PHY_ACTIVE signal high	Synchronized: Capturing wireless frames
Red Blink Slow	Recording Pre-Trigger	Recording Pre-Trigger traffic	Recording Pre-Trigger traffic
Red	Recording Post-Trigger	Recording Post-Trigger MPI traffic	Recording Post-Trigger wireless traffic

Connectors

The connectors are:

- **MPI ADAPTER**: Connector to MPI Adapter
- **ANT**: SMA Connector for Antenna

USB Analyzer Plug-in Module for the USB Cable Association

In the UWB*Tracer/Trainer*™ setup, the USB Analyzer plug-in module is used to capture USB Association traffic between pairs of WUSB devices that support the USB Cable Association Model described in the Certified Wireless USB specifications.

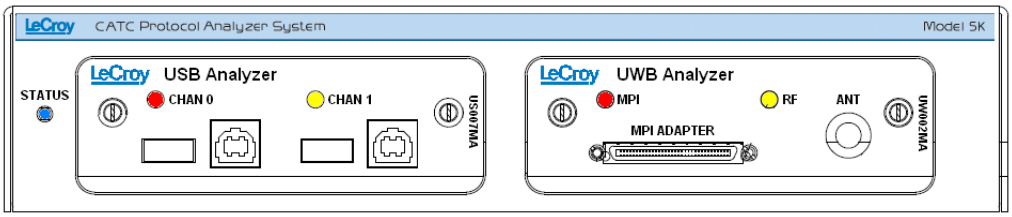

Figure 2.13 CATC 5K Front Panel with the UWB Analyzer and USB Analyzer Plug-in

USB Cable Association traffic capture uses CHAN 0 of the module. The second channel, marked CHAN 1, is for future expansion.

For instructions on how to set up and capture USB Cable Association traffic and use it for UWB traffic recording, see “USB Cable Association for Certified WUSB” on page 220.

LEDs (status of the USB Chan 0 channel)

LED	State
No light	Idle
Yellow Blink Slow	Synched to Full/Low speed USB traffic
Yellow Blink Fast	Synched to High speed USB traffic
Red Blink Fast a few times	Connection Context traffic detected

Note: For USB Chan 1, the LEDs are turned off because they are not used for the USB Cable Association traffic capture.

Connectors

The connectors are:

- **CHAN 0 USB PORTS:** For capturing USB Cable Association traffic
- **CHAN 1 USB PORTS:** Not currently used

UWB Exerciser Plug-in Module

When powered ON, the UWB Exerciser activates user-accessible controls and LEDs on front and rear panels of the platform. This section covers front panel features. The next section covers rear panel features.

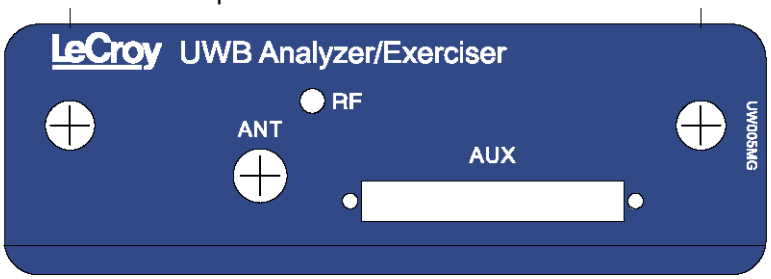

Figure 2.14 UWB Exerciser Plug-in Module

LEDs (status of the Exerciser RF channel)

LED	State
No light	Idle
Yellow Blink Fast	Scenario running
Yellow Blink Slow	Scenario waiting for condition
Yellow Solid	Scenario paused
Red Solid	Scenario error

Connectors

The connectors are:

- **ANT**: SMA Connector for Antenna
- **AUXILIARY**: Connector

2.5 UWB*Tracer/Trainer* Rear Panel Description

From left to right, the rear panel contains the following components:

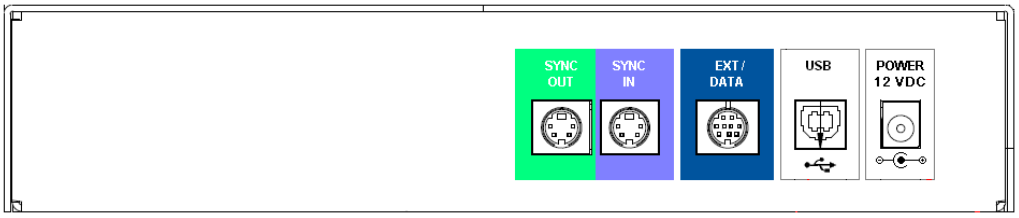

Figure 2.15 CATC 5K Rear Panel

- **SYNC IN/OUT**: For synchronized multi-analyzer operation, the analyzers must be connected in a daisy-chain topology to each other using the green/purple cable.
- **EXT DATA**: For attaching the TRIG-IN/TRIG-OUT BNC Y-cable (Trigger Cable) to external instruments
- **HOST**: For connecting the analyzer through USB to the host machine
- **POWER 12 VDC**: For connecting the external power supply to the analyzer.
  Note: There is no power switch on the analyzer.

Warning! Do not open the CATC 5K enclosure. No operator serviceable parts are inside. Refer servicing to LeCroy.

2.6 Interchangeable Radios

Because WiMedia UWB specifications and technology are still evolving, a UWB*Tracer/Trainer*™ analyzer (with its CATC 5K platform) can use interchangeable plug-in modules, each incorporating different PHYs (radios).

Currently there are two UWB Analyzer plug-in modules that can be used with the UWB*Tracer*: model UW002MA and model UW003MA.

Please note that each UWB Analyzer plug-in module requires different initialization sequences that are executed according to a script that must be downloaded to the analyzer using the Analyzer Setup menu and window, as described in Section 16.4, “BusEngine, Firmware, and Plugin Init Updates” on page 276.

After you plug the module into the correct slot and check that you have the correct BusEngine, Firmware, and initialization script installed, you can record traces.

Section 2. UWB*Tracer/Trainer* Analyzer Software

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Chapter 3: Software Overview

The UWB*Tracer/Trainer*™ software can:

- Control recording of UWB traffic.
- Manage one or more Analyzers, which can be connected directly to the host machine or connected through the Analyzer network.
- View, analyze, and create reports about recorded traces.

3.1 Installing the Software

For instructions about installing the software, refer to the *UWBTracer/Trainer Getting Started* manual.

3.2 Starting the UWB*Tracer/Trainer /Trainer* Program

You can use the *UWBTracer/Trainer /Trainer* with or without the analyzer unit. When used without an analyzer, the program works as a trace viewer to view, analyze, and print trace files.

To start the *UWBTracer/Trainer /Trainer* Program from the PC Start menu:

Step 1 Select **Start** > **Programs** > **LeCroy** > **UWBTracer** > **LeCroy UWBTracer** to display the application main window (Figure 3.1).

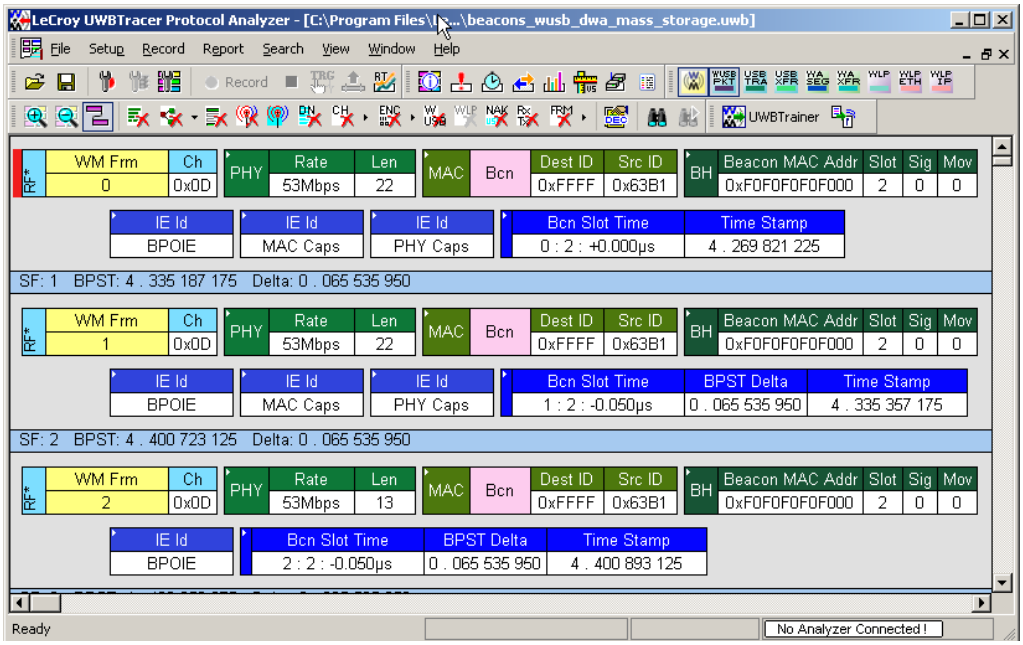

Figure 3.1 UWB*Tracer/Trainer* Main Window

3.3 Opening Sample Traces

A good way to gain familiarity with UWB*Tracer/Trainer* is to open some of the provided sample files and explore the menus, pop-up menus, and reports. See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

3.4 Opening Older Trace Files

The UWB*Tracer/Trainer* software has the capacity to open trace files created with earlier software versions. When an older trace file is opened, the program prompts you to convert the file to the current software version. See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

3.5 Tool Tips

Throughout the application, Tool Tips provide useful information about buttons on the toolbar.

To display a Tool Tip, position the mouse pointer over an item of interest such as part of the trace or a button (Figure 3.2).

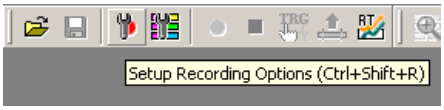

Figure 3.2 Tool Tip

3.6 Trace Tool-Tips

Many fields within the Trace display tool-tips when the mouse pointer is suspended over them. These tips may provide a simple legend for the cell or may give substantial added details about the field (Figure 3.3).

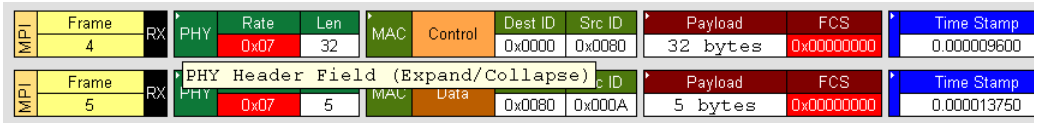

Figure 3.3 Trace Tool Tip

3.7 Menu Bar

Table 3.1 lists menus available from the Main window menu bar. Some menus and options are available only when a file is open.

Table 3.1 Menu Bar Menus

Menu/Option	Function
File	
Open	Opens a trace file or traffic generation file.
Close	Closes the current trace or generation file.
Save As	Saves all or a specified range of frames with a specified name.
Print	Prints part or all of the current trace or traffic generation file.
Print Preview	Produces an on-screen preview before printing.
Print Setup	Sets options for the current or new printer.
Edit Comment	Opens a dialog for entering a brief comment about the trace.
Export	**Packets to Text** (Packet View Format): Saves all or part of a trace to a text file. Used to save traces to floppy disk and to send in e-mail. **Packets to CSV Text**: Saves trace as a comma-separated-values text file for use with Microsoft® Excel. **Packets to Ethereal/WireShark format**: Exports WLP data frames in Ethereal/Wireshark format and opens the exported file in the Ethereal/WireShark application (free Ethernet analyzer software). **Packets to UWBTrainer script**: Exports WLP data frames to a **.uwbg** file for use in UWB*Trainer*.
Decrypt Trace File	Uses decryption parameters to decrypt trace file.
Remove Identifying Info from Trace Files	Allows you to select trace files from which to remove identifying information and save them with the names **<original_name>_clean.uwb**.
Exit	Exits the UWB*Tracer/Trainer* program.
Setup	
Display Options	Opens a window that controls the recording process.
Recording Options	Opens a window that controls display options.
Update Device	Update BusEngine™ and Firmware manually
Analyzer Network	Opens a dialog box for browsing to local and networked analyzers. Within the dialog, click Add to browse. The dialog lists PCs that are on the LAN. If a PC has an analyzer attached to it, and if DCOM permissions have been set on the selected PC, clicking Select establishes a connection.
All Connected Devices	Opens a dialog box with a list of analyzers connected to the host PC. Lets you select an analyzer and update the BusEngine, Firmware, and licensing information.

Menu/Option	Function
Record	
Start	Causes the Analyzer to begin recording.
Stop	Causes the Analyzer to stop recording.
Reupload	Opens a window that controls partial uploading.
Report	
File Information	Displays information about the recording such as the number of frames and triggering setup.
Error Summary	Displays the Errors report of the Traffic Summary, listing the numbers of each error type.
Timing Calculations	Calculates timing between two frames.
Traffic Summary	Summarizes the numbers and types of errors, packets, transactions, split transactions, and transfers that occurred in the open trace.
Device List	Lists the DUTs, active devices, archive devices, and wireless USB in the Device List window by DUTs, Type, EUI-48, Address, Alias, Last Updated, and User Notes.
Beacon/WUSB Timing Analysis	Opens the Timing Analysis window with a Beacon Period and/or WUSB Detail View.
Run Verification Script	Opens a window to allow you to run verification scripts over the open trace.
Search	
Go to Trigger	Positions the display to show the triggering event at the top.
Go to Frame/ Packet/Transaction/ Transfer	Positions the display to show a specific frame or decode level.
Go to Marker >	Positions the display to the selected marked frame.
Go to >	Positions the display to the specified item.
Find	Allows searches by multiple criteria.
Find Next	Looks for the next instance of an event specified with Goto or Find.
Search Direction	Allows the search direction to be changed from Forward to Backward or Backward to Forward.
Search Channel	MPI or RF

Menu/Option	Function
View	
Toolbars	Displays list of available Tool bars.
Analyzer Network Chat Bar	Opens a dialog that allows users to conduct chat sessions over an IP LAN. In order to send and receive electronic text messages, each user must be working with a PC that is on an IP LAN and also attached to an analyzer.
Status Bar	Switches display of the Status Bar ON or OFF.
Hide Traffic on Channels	Hides traffic on the channel (MPI or RF) selected from the popup list.
Hide Dec/Orig Traffic	Hides Decrypted or Original traffic, as selected from the popup list.
Hide Frame Types	Hides Beacon, Control, Command, Data, and/or Agg Data frames.
Hide Reserved Field Warnings	Hides fields that have a Reserved Field Warning.
Unhide Cells	Unhides the cells (hidden by Display Options) selected from the popup list.
Zoom In	Increases the size of the displayed elements.
Zoom Out	Decreases the size of the displayed elements.
Wrap	Wraps displayed Frames within the window.
Apply Decoding Scripts	Decoding scripts set the values of the display and recording options for optimum views of trace information from specific vendors or classes of data. The menu allows you to select the vendor or class of data for the request recipients and endpoints listed in the Request Recipients and Endpoints menu. You can keep the settings across recordings.
Real-Time Statistics	Displays trace statistics.
Window	
New Window	Opens another instance of the Main Window.
Cascade	Displays all open Main windows in cascaded format.
Tile Horizontal	Displays all open Main windows in tiled horizontal format.
Tile Vertical	Displays all open Main windows in tiled vertical format.
Arrange Icons	Arranges Main window icons at bottom of display area.
Windows	Displays a list of open windows.
Help	
Help Topics	Opens online help.
Update License	Opens a dialog box for entering license key information for the analyzer.
Display License Information	Opens a dialog box with information about the current status of the analyzer's license
About	Displays version information about UWB*Tracer/Trainer* .

3.8 Tool Bar

The Main window Tool bar provides quick access to most UWB*Tracer/Trainer* software functions. You can learn the function of each button by passing the mouse pointer over it. Button descriptions appear on the Status bar at the bottom of the window and as tooltips above each button.

Figure 3.4 Main Window Toolbar

General Buttons

	Open file		Zoom In
	Save As		Zoom Out
	Setup Recording Options		Wrap
	Setup Generation Options		Find
	Setup Display Options		Next
	Start Recording		Find Next. Repeats last find.
	Stop Recording		Apply Decoding Scripts
	Manual Trigger		Repeat Upload (Reupload/Partial Upload)
	Real-Time Statistics. Opens a window that shows realtime information on links activity.		Apply Decoding Scripts

UWB*Trainer* Buttons

UWBTrainer	UWBTrainer		Export To Script

Hide Buttons

	Hide Unassociated Traffic		Hide Beacon Frames
	Hide Devices		Hide Empty MMC Intervals
	Hide Empty Super Frame		Hide Channels (MPI or RF)
	Show Only Beacons		Hide Decoded/Original Traffic
	Hide WLP		Hide WUSB
	Hide Nak's		Hide Rx/Tx W/O Data
	Hide Frame Types		

Reports Buttons

	File Information Report. Opens a summary of general information about the trace file.		Traffic Summary. Opens a summary of protocol-related information in the trace file.
	Error Report. Opens a summary of error information in the trace file.		Bus Utilization. Opens a window that shows packet length by time.
	Timing and Bus Usage Calculations. Opens a calculator for measuring timing between frames		Device List Window
	Run verification scripts. Opens a window to allow you to run verification scripts over the open trace.		Timing Analysis

Decode Buttons

	View WiMedia Frame Level		View WUSB Transaction Level
	View WUSB Packet Level		View WUSB Transfer Level
	View Wire Adapter Segment Level		View Wire Adapter Transfer Level
	View WLP Frames		View WLP Ethernet Protocol Units
			View WLP IP Protocol Units

3.9 Floating the Decode Toolbar

You can float any of the toolbars by dragging them from their current location at the top of the screen. If you float the decode toolbar, it arranges the decode buttons in their hierarchical order. Click the triangle to add or delete buttons.

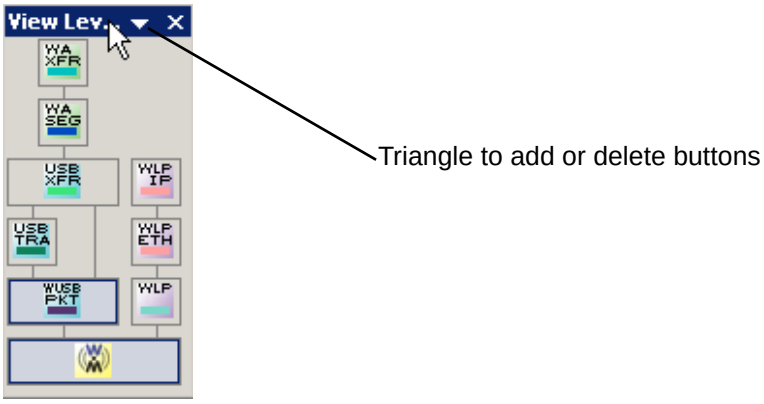

Figure 3.5 Decode Toolbar in Hierarchal Arrangement

3.10 Pop-Up Menus

Pop-up menus within the trace provide options for formatting the trace.

Left Mouse Button

Left-clicking a header opens a menu for expanding fields, viewing data fields, and formatting the trace. The menu is context-sensitive and changes, depending on what part of the trace you have clicked. Figure 3.6 shows three examples.

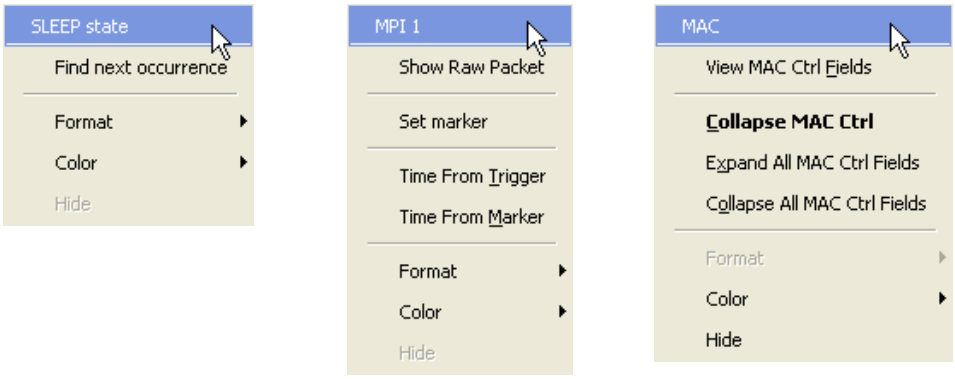

Figure 3.6 Trace Pop-Up Menus

Common options appear on most menus:

- **Format**: Presents choices for changing the numerical formatting of the data fields throughout the trace.
- **Color**: Presents choices for changing the color of the data fields throughout the trace.
- **Hide**: Hides data fields throughout the trace. To re-display hidden fields, right-click anywhere in the trace and select **Unhide Cells** and then one of the options from the sub-menu.

Left-clicking the small triangle in the upper left corner of the PHY, MAC, Payload, or Timing data block expands the data block to show all fields.

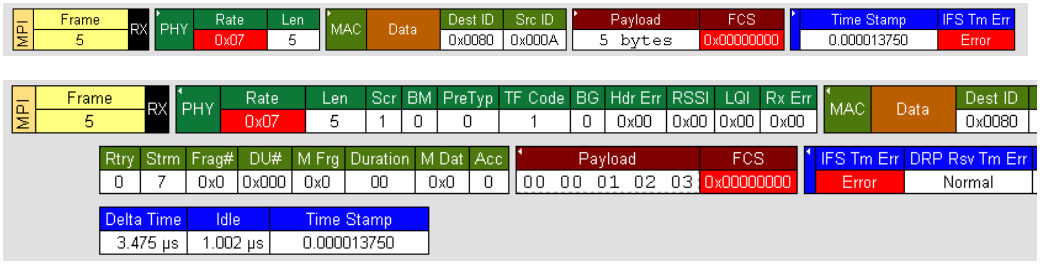

Figure 3.7 Expanded Data Block

If you double-click a cell of a PHY, MAC, Payload, or Timing data block, the trace displays all the fields of the block (see Figure 3.7). If you double-click a cell of an expanded block, the trace displays the truncated block

Right Mouse Button

If you right-click a cell in the trace, a pop-up menu allows changing display options, zooming in or out, wrapping the display, unhiding hidden cells, hiding the MPI or RF channel, hiding decrypted or original traffic, hiding fields with reserved field warnings, applying decoding scripts, and calculating real-time statistics (Figure 3.8).

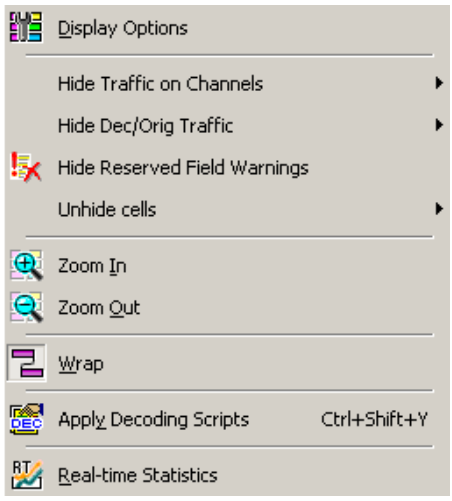

Figure 3.8 Trace Cell Pop-up Menu

3.11 View Settings Tools

You can zoom in and out, and wrap the trace to fit within the screen by using the following buttons:

Zoom In

Increases the size of the displayed elements, allowing fewer (but larger) Frame fields per screen.

- Click on the Tool bar.

Zoom Out

Decreases the size of the displayed elements, allowing more (but smaller) Frame fields per screen.

- Click on the Tool bar.

Wrap

Adjusts the Trace View so that frames fit onto the next line if they are longer than the size of the window. Without wrap, you can use the horizontal scroll bar to see the hidden part of a frame.

- Click on the Tool bar.

In Figure 3.9, the timestamp extends off the right edge of the screen.

Figure 3.9 Trace With Wrap Turned OFF

In Figure 3.10, the entire frame appears in the window.

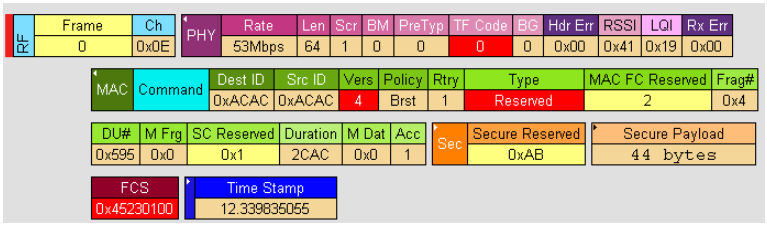

Figure 3.10 Trace With Wrap Turned ON

3.12 Adding Comments to the Trace

You can create, view, or edit the 100-character comment field associated with each Trace file.

Step 1 From the **File** menu, select **Edit Comment** to display the **Edit Trace Comment** dialog box.

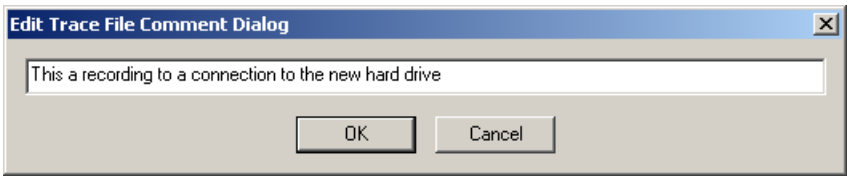

Figure 3.11 Edit Trace File Comment Dialog Box

Step 2 Create, view, or edit the comment.

Step 3 Click **OK**.

3.13 Set Marker

The Set Marker feature allows frames to be marked so you can navigate back to events of interest. Markers also provide you with a way of tagging events so you can perform timing calculations between them. A marker can be applied to any display entity (frame, WUSB packet, WUSB transfer, and so on).

The Set Marker command works in conjunction with the Go to Marker feature. Once you have marked a frame, you can navigate back to it by selecting **Search** > **Go to Marker**, and then selecting the marker of interest from the list.

To set a marker on a frame:

Step 1 In the trace, click the **MPI** field for the frame number you wish to mark.

Step 2 From the pop-up menu that appears, Select **Set Marker** (Figure 3.12).

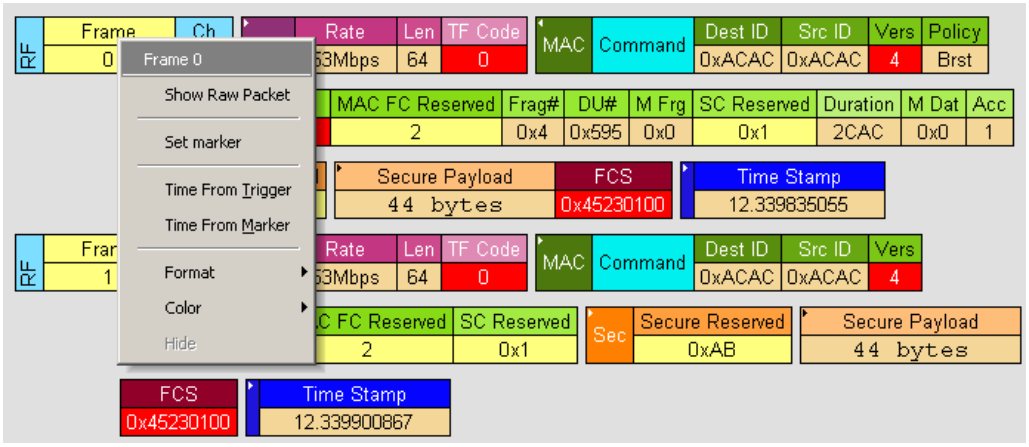

Figure 3.12 Setting a Frame Marker

Step 3 The **Edit Marker for Frame #** dialog box appears (Figure 3.13).

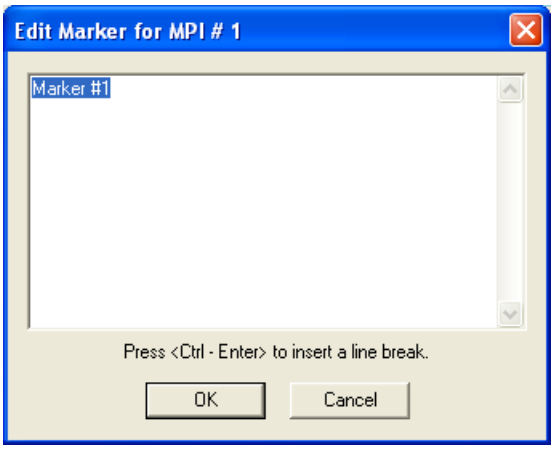

Figure 3.13 Edit Marker for Frame Dialog Box

Step 4 Enter your comment.

Step 5 Click **OK**.

Step 6 A marked frame is indicated by a vertical red bar along the left edge of the Frame # block (left side of Figure 3.14).

MPI	SLEEP state	Delta Time	Time Stamp
1	2.398 µs	2.400 µs	0.000002400

Figure 3.14 A Marked Frame

3.14 Edit or Clear Marker

To clear a marker or edit comments associated with a Frame marker:

Step 1 Click **Frame #** for the chosen packet to display a pop-up menu (Figure 3.15).

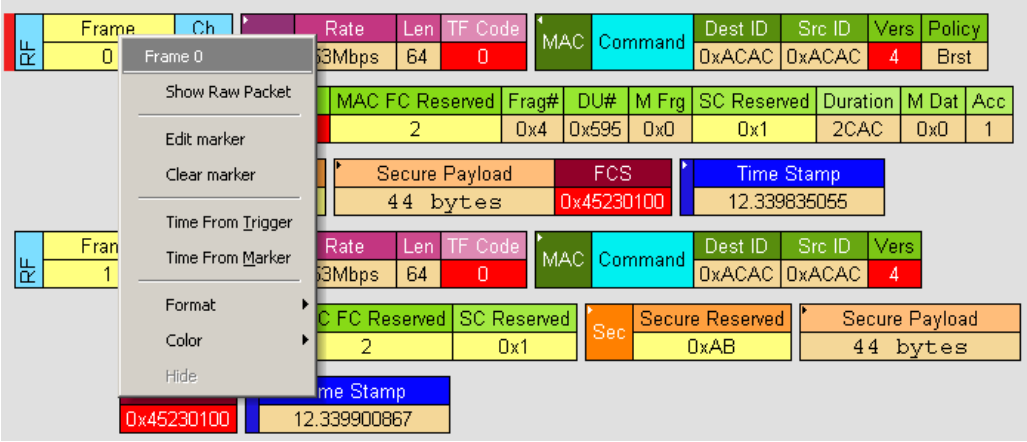

Figure 3.15 Editing a Frame Marker

Step 2 To edit the marker comment, select **Edit Marker**.to display the **Edit Marker for Frame #** comment window (Figure 3.13).

Step 3 Edit the comment.

Step 4 Click **OK**.

Step 5 To clear a marker, click **Clear marker** in the frame pop-up menu (Figure 3.15). The vertical red Marker bar disappears.

3.15 Timing Calculations on Markers

You can use markers as reference points to calculate timing between events. To do a timing calculation:

Step 1 Click the **MPI** field of the frame number that you want to use as the first point of reference in the time calculation.

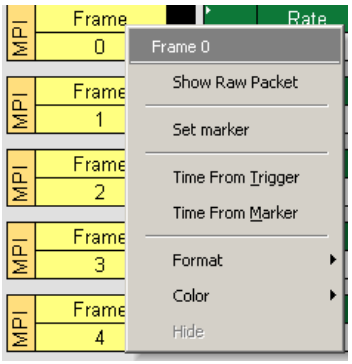

Figure 3.16 MPI Field Options

Step 2 In the pop-up that appears (Figure 3.15), select **Time from Marker** to display the Timing and Bus Usage Calculator. The first point is in the From Frame field.

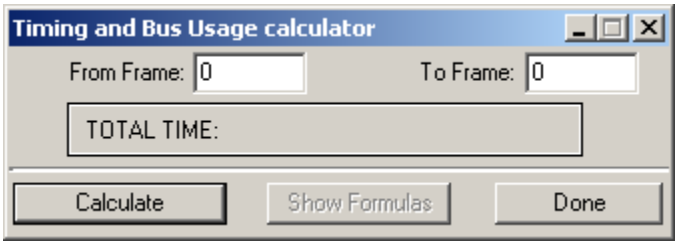

Figure 3.17 Timing Calculator Dialog Box

Step 3 In the All Markers window, select the marker that you want to use as the second (To MPI) point of reference in the time calculation.

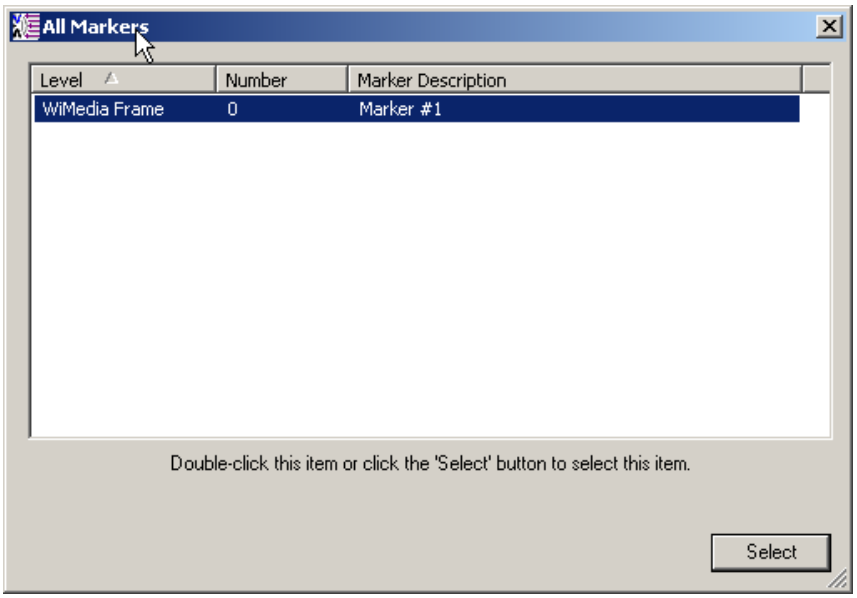

Figure 3.18 All Markers Window

Step 4 The time between the two markers appears in the Timing Calculator dialog box.

3.16 Status Bar

The Status bar is located at the bottom of the Main window. Depending on the current activity, the bar can be divided into as many as four segments (see Figure 3.20):

1. Notifications and Help (connection, disconnection, and other messages)
2. Progress Bar and Progress Report (see “Recording Progress” on page 38)
3. Status (of the MPI and RF channels)
4. Search Direction (Forward or Backward)

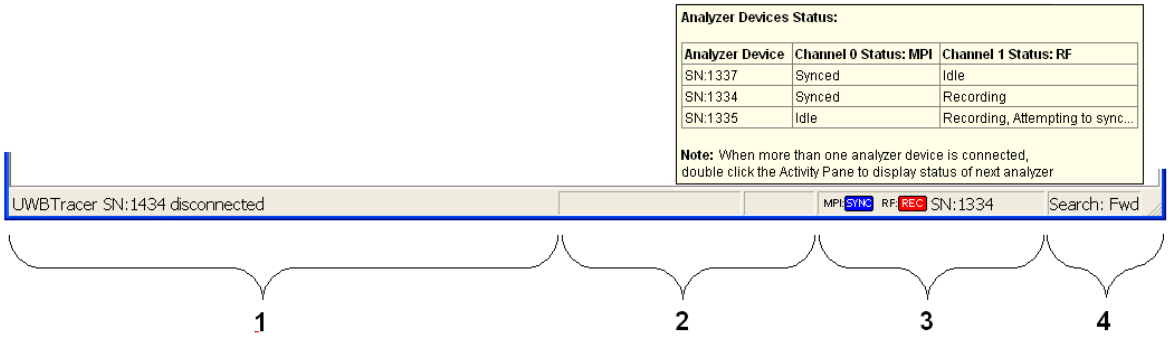

Figure 3.19 Status Bar Segments

The left-most segment shows a message that an Analyzer with serial number 1434 was disconnected from the application

The status bar shows only the status of a single analyzer. If you **place the cursor on the status bar**, a tooltip pops up (Figure 3.20) and displays the status of all the analyzers connected to the application. In this example, three analyzers are connected to the application.

To select a different device from the list in the tooltip and display its status in the status bar, double-click **Segment 3**, the **Status** segment. The Status bar then displays information about the next device displayed in the tooltip list. Double-click **Segment 3** again to cycle through all the devices displayed in the tooltip list.

Figure 3.20 shows six examples of the Status bar, each displaying different states of the analyzer devices:

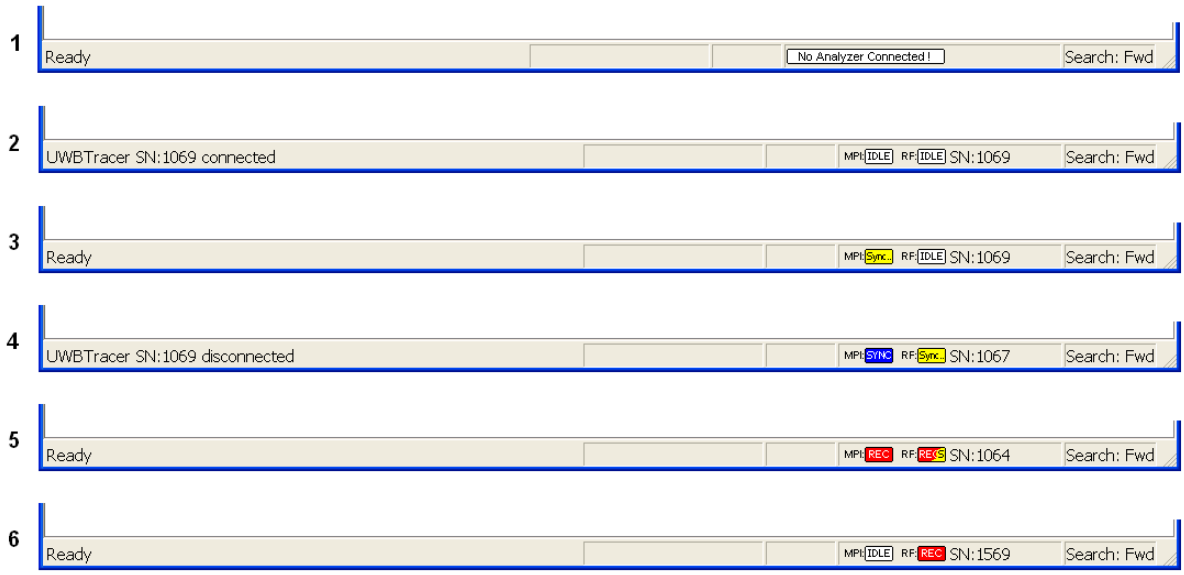

Figure 3.20 Status Bar Examples

Status Bar Example 1: No analyzer is connected to the application.

Status Bar Example 2: An analyzer with serial number 1069 was connected to the application and has both its MPI and RF recording channels in the IDLE state.

Status Bar Example 3: An analyzer with serial number 1069 is Ready. The MPI channel detects PCLK and is attempting to synchronize to the data. The RF channel is in the IDLE state.

Status Bar Example 4: An analyzer with serial number 1067 was disconnected from the application. Its MPI Channel is synchronized to the MPI data and PCLK. Its RF channel is attempting to synchronize to wireless traffic.

Status Bar Example 5: An analyzer with serial number 1064 is Ready. The MPI channel is synchronized to the MPI traffic and is recording. The RF channel is recording but has lost synchronization and is attempting to regain synchronization.

Status Bar Example 6: An analyzer with serial number 1569 is Ready. The MPI channel is in the IDLE mode, not synchronized to PCLK. The RF channel is synchronized to wireless traffic and is recording.

Recording Progress

When you begin recording, the left-most segment of the Status bar displays a recording Progress Indicator (left side of Figure 3.21).

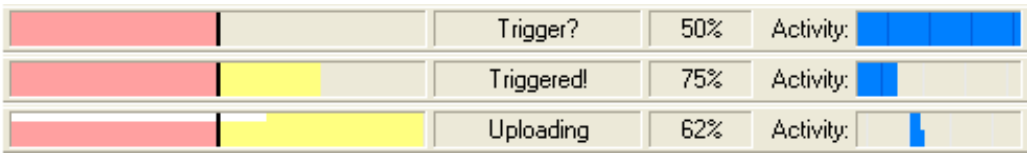

Figure 3.21 Example: Status Bar at Different Recording States

Keep the following in mind when reading the Progress Indicator:

- A black vertical line illustrates the location of the trigger position you selected in the Recording Options window. The pre-trigger progress is displayed in the field to the left of the trigger position.
- When the trigger position is reached, the progress indicator wiggles as it waits for the trigger.
- After the trigger occurs, the field to the right of the trigger fills in the post-trigger color specified in the Display Options window.
- When recording is complete, the upper half of the Progress Indicator fills in white, indicating the progress of the data upload to the host computer.

Some other key points about the Progress Indicator:

- If a trigger event occurs during the before-trigger recording, the before-trigger color changes to the after-trigger color to indicate that not all the expected data was recorded pre-trigger.
- When you click **Stop** before or after a trigger event, the Progress Indicator adjusts to begin uploading most recently recorded data.
- If you wish to abort an upload that is in progress, click the **Stop** button again.
- The Progress Indicator fills with color in proportion to the specified size and actual rate at which the hardware is writing and reading the recording memory. However, the Progress Indicator is normalized to fill the space within the Status bar.

Recording Status

During recording, current recording status is displayed in the next segment of the Status bar (Figure 3.21). When recording is begun, one of the following messages flashes (depending on options selected in the Recording Options window):

- Trigger?
- Triggered!
- Uploading

After recording stops, the following occurs:

- Flashing message changes to **Uploading data–x% done** (**x%** indicates the percentage completion of the data uploading process).
- Traffic data is copied to disk (overwriting any previous version of this file) using the default file name **data_xxx.uwb**, where **xxx** is derived from the unit's serial number. You can specify the file name in the Recording Options window.

When the data is saved, the Recorded Data file appears in the Main display window, and the Recording Status window is cleared.

- If the recording resulted from a trigger event, the first frame following the trigger (or the frame that caused the trigger) is initially positioned second from the top of the display.
- If the recording did not result from a trigger event, the display begins with the first frame in the traffic file.

Recording Activity

During recording, the next segment of the Status bar (Figure 3.21) displays recording activity as a series of vertical bars.

The more vertical bars that are displayed, the greater the amount of activity being recorded. If there are no vertical bars, there is no recorded activity.

During uploading, the percent of the completed upload is displayed.

Search Status

The rightmost segment of the Status bar (Figure 3.21) displays current search direction: Fwd (forward) or Bwd (backward).

3.17 Exporting Trace File Information

See Chapter 3, See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

Exporting Packets to Text (Packet View Format)

You can save all or part of a trace to a text file. This option enables you to save traces to removable storage devices and to send traces as e-mail attachments.

Step 1 When a trace has WUSB frames, select **File > Export > Packets to Text**.

Step 2 Save the exported file.

Exporting Packets to CSV Text

You can save a trace as a comma-separated-values text file for use with Microsoft® Excel.

Step 1 When a trace has WUSB frames, select **File > Export > Packets to CSV Text**.

Step 2 Save the exported file.

Exporting Packets to Ethereal/WireShark Format

You can export WLP data frames in Ethereal/Wireshark format and open the exported file in the WireShark/Ethereal application (free Ethernet analyzer software).

Step 1 When a trace has WLP frames, select **File > Export > Packets to Ethereal/Wireshark format**.

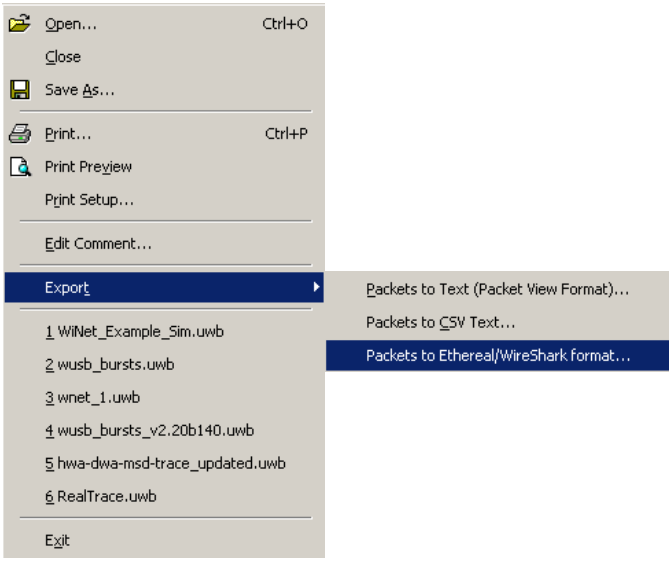

Figure 3.22 Export Packets to Ethereal/Wireshark format

Step 2 Enter parameters in the Export to WireShark/Ethereal format dialog box.

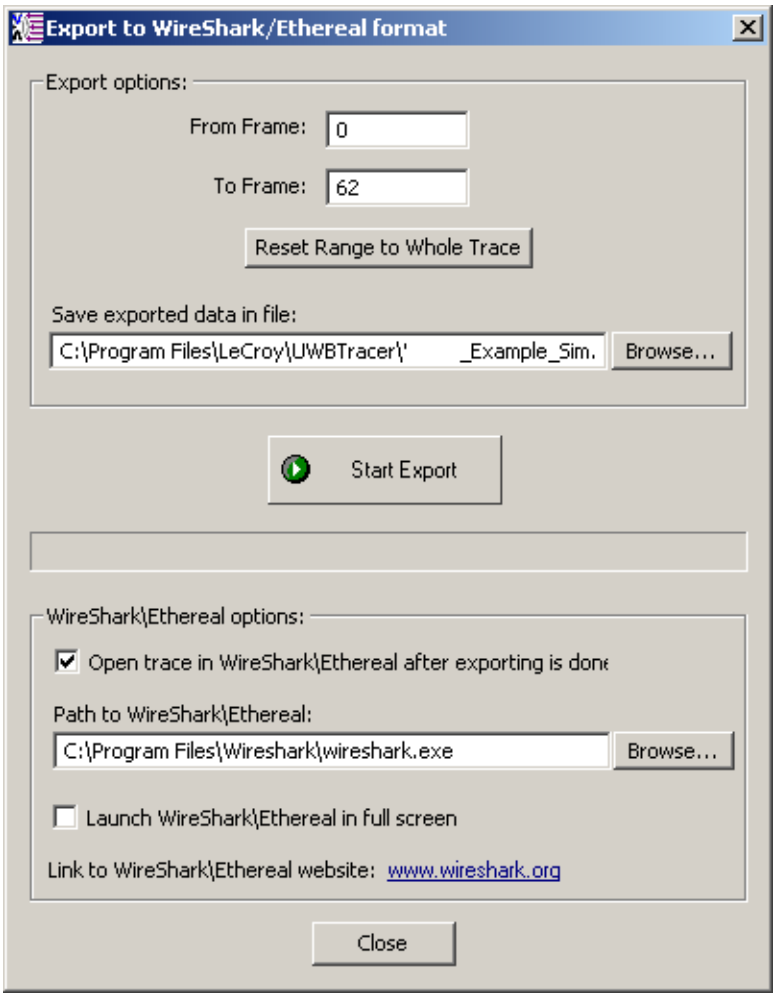

Figure 3.23 Export to Wireshark/Ethereal format

Step 3 In the Export Options section, enter the frame numbers **From Frame To Frame**.

You can **Reset Range to Whole Trace**.

Step 4 Enter or Browse for the export file name in the **Save exported data in file** field.

Step 5 In the WireShark/Ethereal Options section, select whether or not to **Open trace in WireShark/Ethereal after exporting is done**.

Step 6 Enter the **Path to WireShark/Ethereal**.

Step 7 Select whether or not to **Launch WireShark/Ethereal in Full Screen**.

Step 8 Click **Start Export** to export and save the file.

If you selected that option, the WireShark/Ethereal application opens with the exported file displayed.

Exporting Packets to UWBTrainer Script

You can export data frames to a **.uwbg** file for use in UWB*Trainer*. In the export dialog box, you can select the frame range and the channel (if more than one channel is in use).

Note: Only frames visible in the Trace View are exported.

To restrict the exported frames, you may use any of the Hiding mechanisms to hide the frames you do not want to export. These mechanisms include:

- Executing a Find All search
- Using the quick filters from the application toolbar

To export frames from a specific source (such as a WUSB Host):

Step 1 Open a trace file, then open the Find dialog.

Step 2 In the Search For field (at the top), select **WiMedia Frames**.

Step 3 In the Event Groups section, select **MAC: Source Addresses**.

Step 4 In the MAC: Source Addresses (Hex) section, select the address of the WUSB Host to be exported.

Step 5 Check the **Find All** box.

Step 6 In the Combining Specified Event Groups section, select the **Intersection** option.

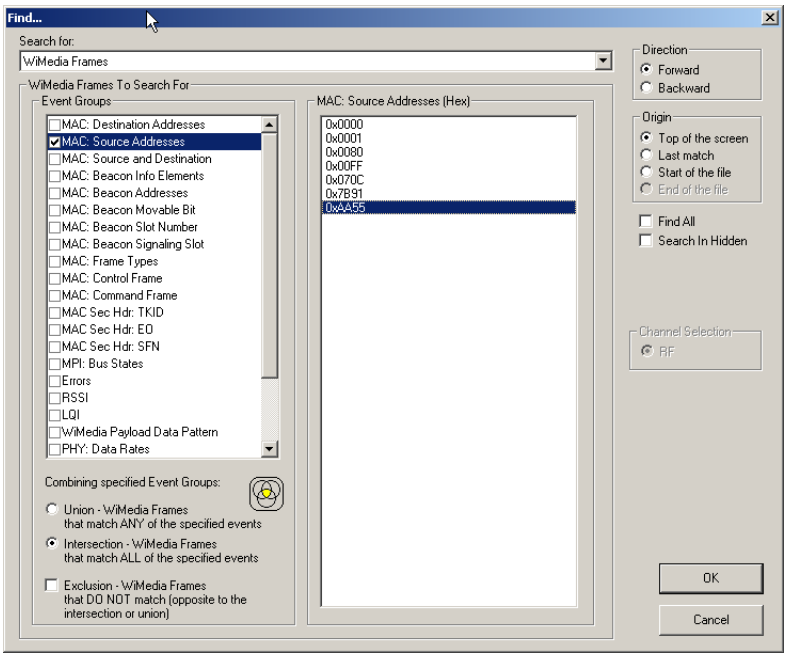

Figure 3.24 Example Find Dialog for Exporting to a UWBTrainer Script

Step 7 Click **OK** to open a new window showing only the matching frames.

Step 8 To export the displayed frames, click the Export To Script button , or select **File > Export > Packets to UWB Trainer script**.

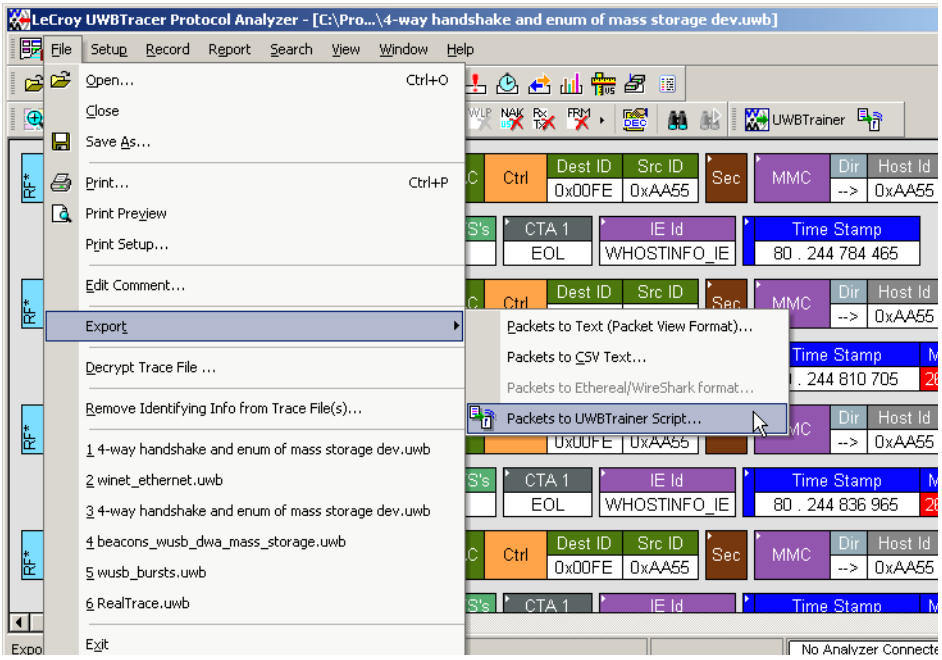

Figure 3.25 Export Packets to UWBTrainer Script Command

Step 9 Enter parameters in the Export to UWB*Trainer* Exerciser Script dialog box.

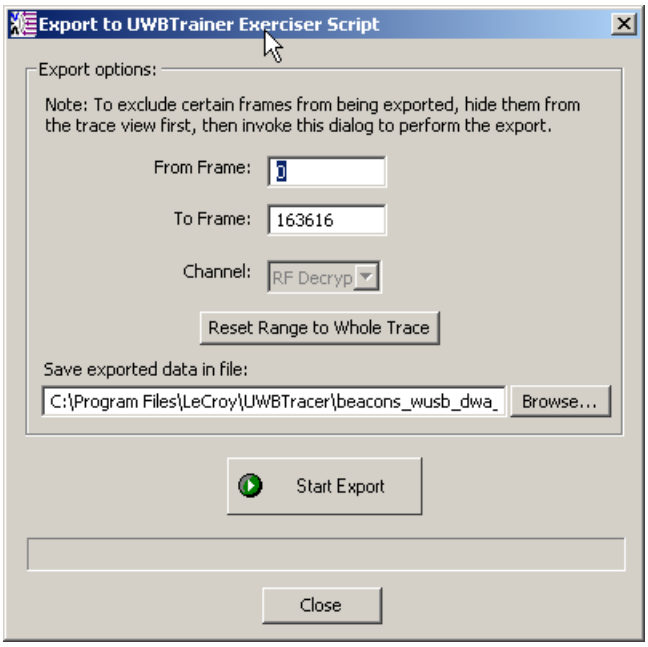

Figure 3.26 Export to UWBTrainer Exerciser Script Dialog

Step 10 In the From Frame field, enter the starting frame number.

Step 11 In the To Frame field, enter the ending frame number.

Note: If the trace has few frames, you can click **Reset Range to Whole Trace** to use all the frames.

Step 12 If the trace has more than one channel, in the Channel field, select the channel or use the default channel.

Step 13 Enter or Browse for the export file name in the **Save exported data in file** field.

Step 14 Click **Start Export** to export and save the file.

3.18 Directory Structure on Windows XP and Vista

The UWB*Tracer/Trainer* application stores files in a specific directory structure under the **C:\Program Files\LeCroy\UWBTracer** directory. It also stores files in Windows-specific locations that differ for Windows® XP and Windows Vista (which uses UAC).

In particular, Windows XP has a **Documents and Settings\All Users** folder, and Windows Vista has a **Users\Public** folder, which are not equivalent.

The Windows XP **All Users** folder is not readily available to users and is for storing shared files, to which normal user folders point using shortcuts.

The Windows Vista **Users\Public** folder and its subdirectories:

- Are available to all users logged onto a system (not just the person who installed the application).
- Are not hidden.
- Are always present, because it is provided by the Windows Vista OS installation.
- Are readable and writable by all users.
- Do not require Administrator privileges.

Methods of using shared folders differ for the two operating systems, so the UWB*Tracer/Trainer* application stores files on them differently, as described in the next two sections.

Windows XP

All Files

For UWB*Tracer/Trainer* on Windows XP, all application and user files (such as sample files, user files, default files, and scripts) are in the **<drive>\Program Files\LeCroy\UWBTracer** directory folder and its subdirectories:

- Automation
- Documents
- Generation
- Sample Files
- Scripts (and versioned Scripts directories, such as Scripts3.00.307)
- x64
- x86

Windows Vista

User-modifiable Files

For UWB*Tracer/Trainer* on Windows Vista, user-modifiable files are in the Windows Explorer **<drive>\Users\Public\Public Documents\LeCroy\UWBTracer** folder, which is the same as the Command Tool **<drive>\Users\Public\Documents\LeCroy\UWBTracer** folder.

The Command Tool name is the correct folder name when using scripts.

The **Users\Public\Public Documents\LeCroy\UWBTracer** folder contains files that the user can modify, such as **default.rec** and **default.opt**, or the application creates at runtime, such as debug files and device lists. It also has the directories:

- Automation
- Generation
- Sample Files
- Scripts (and versioned Scripts directories, such as Scripts3.00.307)

Application Files

For UWB*Tracer/Trainer* on Windows Vista, read-only application files (like the application, bus engines, firmware, user manuals, help files, and read-me) are in the **<drive>\Program Files\LeCroy\UWBTracer** folder. It has the directories:

- Documents
- x64
- x68

Chapter 4: Reading Traces

This chapter describes how to read and manipulate trace displays.

4.1 Trace Display Overview

UWB*Tracer/Trainer* trace viewing software makes extensive use of color and graphics to fully document the captured (decoded) traffic (Figure 4.1).

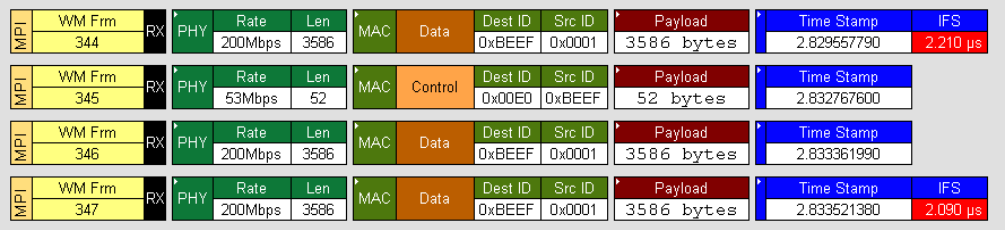

Figure 4.1 Trace Display Example

Frames are shown on separate time-stamped rows, with their individual fields both labeled and color coded. You can collapse data fields to save space in the display, and you can zoom in and out in the display. Pop-up Tool Tips annotate fields with detailed information about their contents.

The display software can operate independently of the hardware and so can function as a stand-alone trace viewer that may be freely distributed.

4.2 Changing Trace Level Views

You can select the trace viewing level in the Display Options window General tab Trace Viewing Level section (see Chapter 6, “Display Options”) or with the Trace Viewing Level icons in the Tool bar (Figure 4.2).

Figure 4.2 Trace Viewing Level Buttons

Note: To find frames, packets, transactions, segments, or transfers, scroll through the trace or use the **Search > Find** command (see Chapter 9, “Searching Traces”).

4.3 Trace Level Views for WUSB

You can display traces at these viewing levels, listed from lowest to highest:

- Frame (WiMedia Frame or MAC-PHY Interface equivalent) [default] (WM)
- WUSB Packet (WUSB PKT)
- WUSB Transaction (USB TRA)
- WUSB Transfer (USB XFR)
- WUSB Wire Adapter Segment (WA SEG)
- WUSB Wire Adapter Transfer (WA XFR)

Frame Level

The Frame view is the default decode level. It shows the WiMedia Frame Raw Payload and PHY/MAC Headers. An example MPI Frame level is in Figure 4.3.

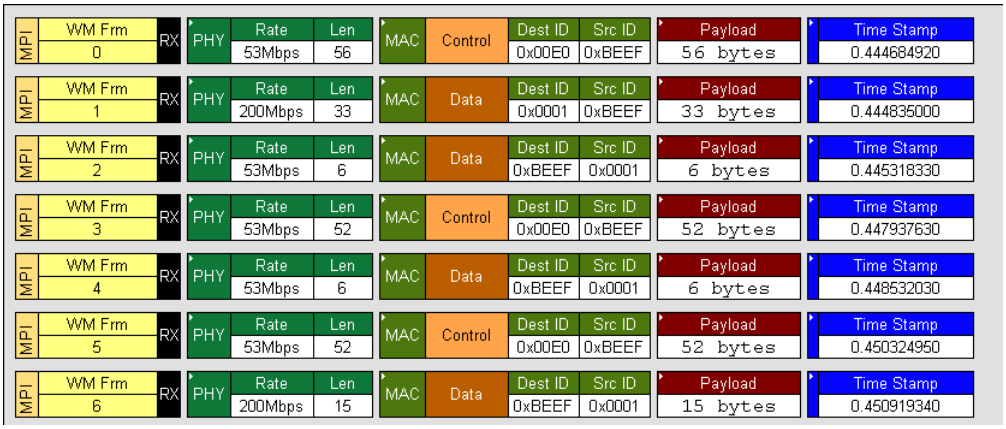

Figure 4.3 Trace View: Frame Level

WUSB Packet Level

Click the **WUSB PKT** button to show the WUSB Packet Level view. An example packet level is in Figure 4.4.

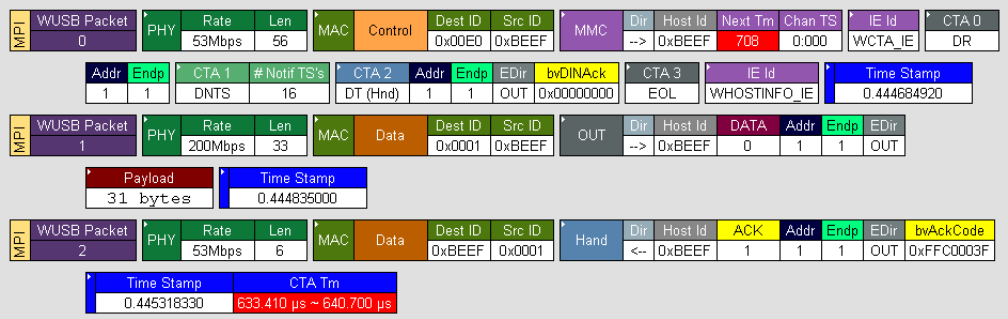

Figure 4.4 Trace View: WUSB Packet Level

The WUSB Packet Level is now a special way to decode the Frame Level. You can show or hide MAC Frame raw payload PHY/MAC headers when WUSB Packets are displayed. You cannot expand WUSB packets.

WUSB Transaction Level

Click the **USB TRA** button to show the WUSB Transaction Level view. An example transaction level is in Figure 4.5.

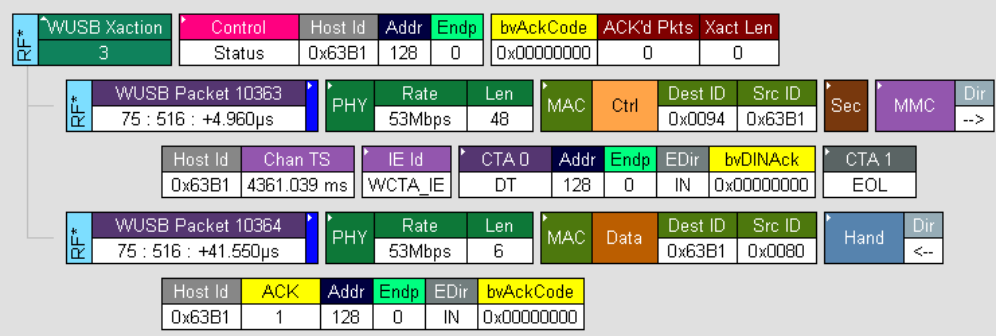

Figure 4.5 Trace View: WUSB Transaction Level

WUSB Transfer Level

Click the **USB XFR** button to show the WUSB Transfer Level view. An example transfer level is in Figure 4.6.

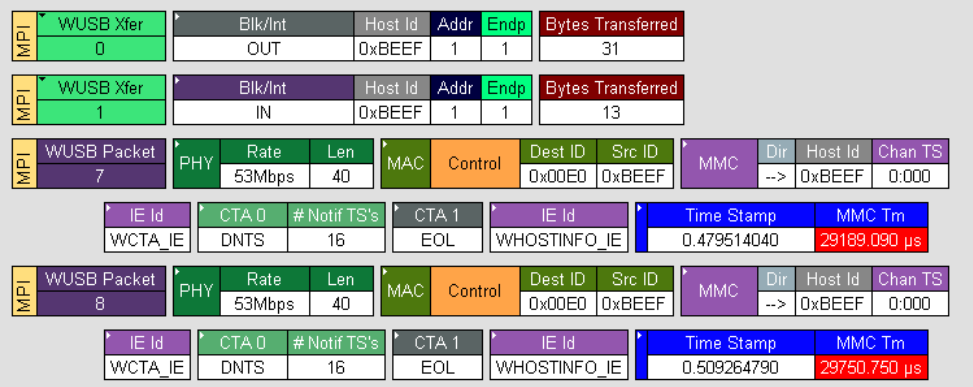

Figure 4.6 Trace View: WUSB Transfer Level

WUSB Wire Adapter Segment Level

Click the **WASEG** button to show the WUSB Wire Adapter Segment Level view. An example wire adapter segment level is in Figure 4.7.

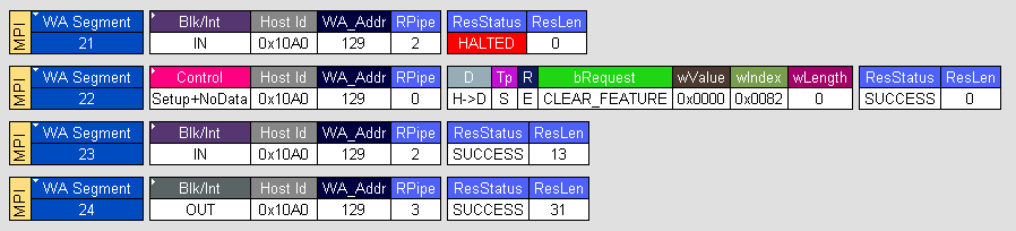

Figure 4.7 Trace View: WUSB Wire Adapter Segment Level

WUSB Wire Adapter Transfer Level

Click the **WAXFR** button to show the WUSB Wire Adapter Transfer Level view. An example wire adapter transfer level is in Figure 4.8.

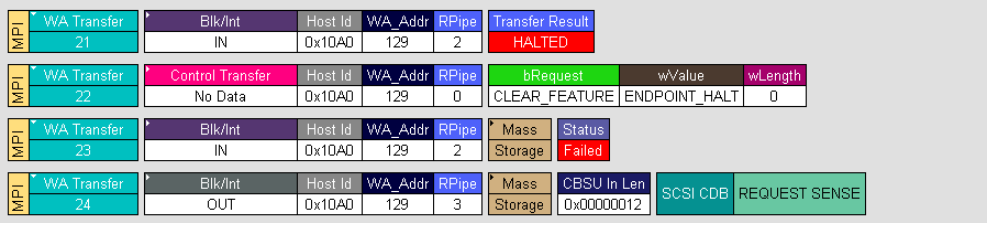

Figure 4.8 Trace View: WUSB Wire Adapter Transfer Level

4.4 Trace Level Views for WLP

You can display traces at these viewing levels, listed from lowest to highest:

- WiMedia Frames [default]
- WLP Frames (WLP)
- WLP Ethernet Protocol Units (WN ETH)
- WLP IP Protocol Units (WN IP)

WiMedia Frame Level

The WiMedia Frame view is the default decode level. It shows the WiMedia Frame Raw Payload and PHY/MAC Headers. An example WiMedia Frame level is in Figure 4.9.

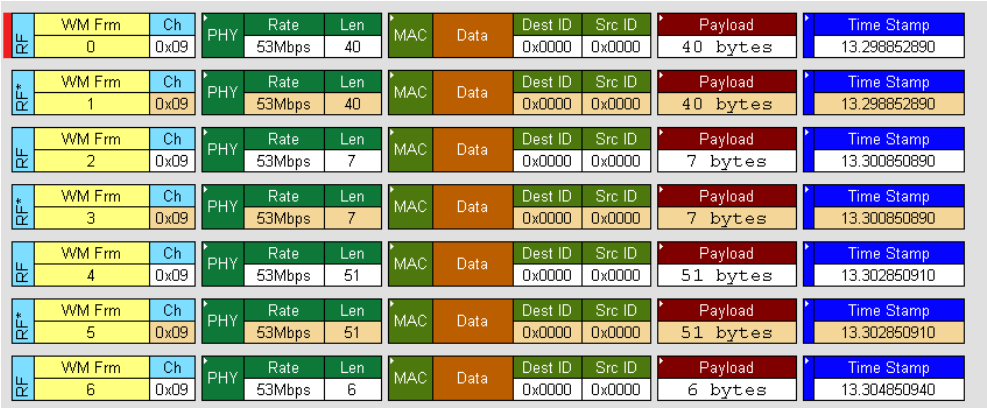

Figure 4.9 Trace View: WiMedia Frame Level

WLP Frame Level

Click the **WLP** button to show the WLP Frame view. An example WLP Frame level is in Figure 4.10.

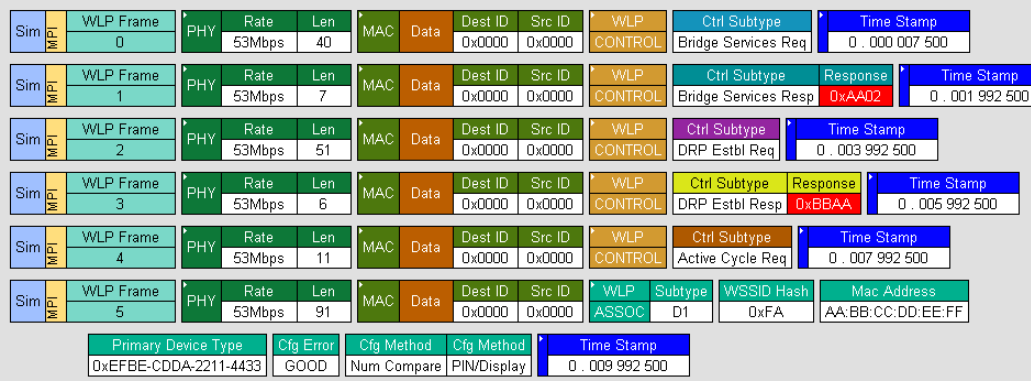

Figure 4.10 Trace View: WLP Frame Level

WLP Ethernet Protocol Unit Level

Click the **WN ETH** button to show the WLP Ethernet Protocol Unit Level view. An example WLP Ethernet Protocol Unit Level is in Figure 4.11.

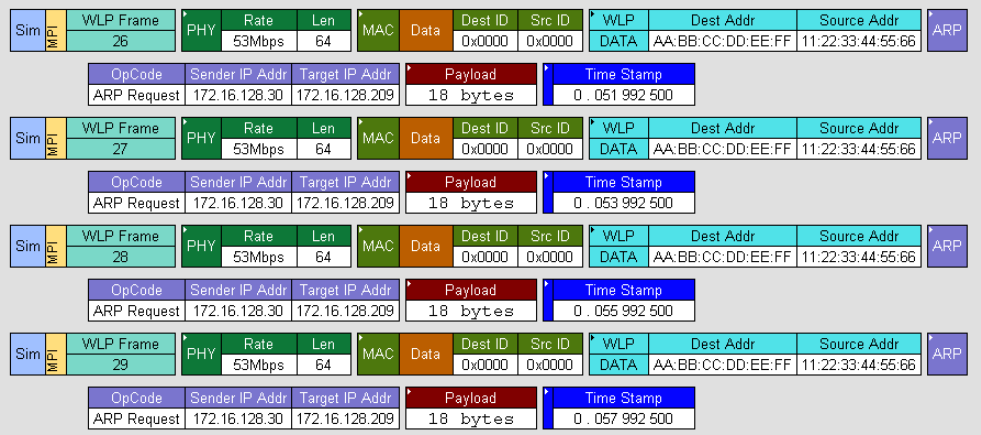

Figure 4.11 Trace View: WLP Ethernet Protocol Unit Level

WLP IP Protocol Unit Level

Click the **WN IP** button to show the WLP IP Protocol Unit Level view. An example transaction level is in Figure 4.12.

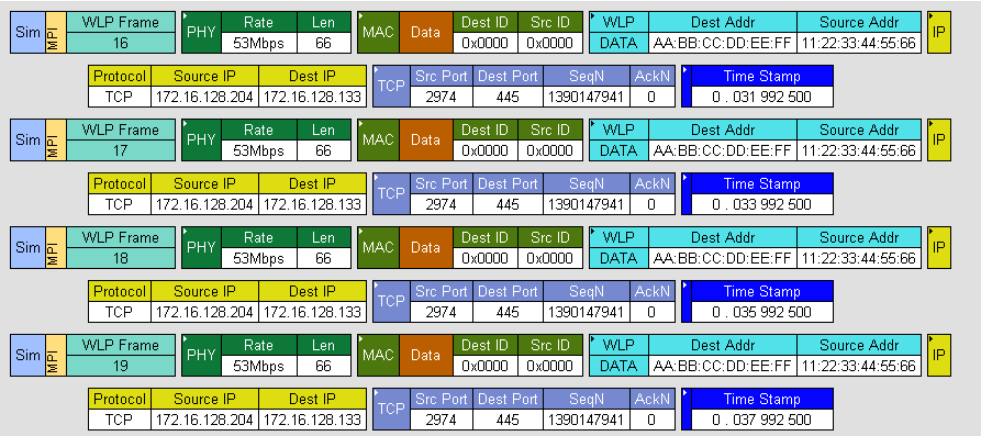

Figure 4.12 Trace View: WLP IP Protocol Unit Level

Chapter 5: Searching Traces

This chapter describes how to search for trace events.

5.1 Trace Search Overview

UWB*Tracer/Trainer*™ has several search commands that let you navigate a trace view to search for key events, such as errors and triggers. The commands are on the Search menu (Figure 5.1).

To view the search options, click **Search** in the Menu bar.

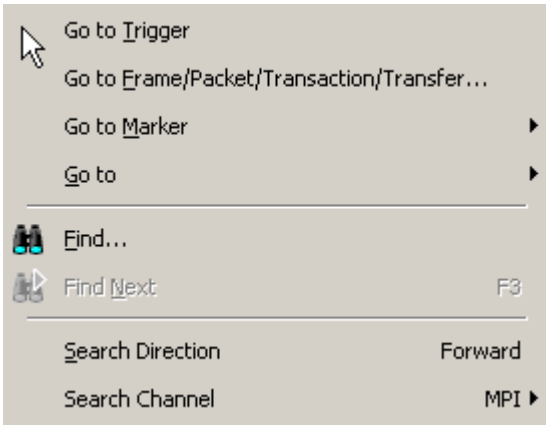

Figure 5.1 Search Menu

You can:

- Change the Search Direction to Forward or Backward
- Select the MPI Channel, RF Channel, or All Channel

5.2 Go to Trigger

To display a trigger event, select **Go to Trigger** from the Search menu.

The trace view is repositioned with the first frame following the trigger event (or the frame that caused the trigger) at the top of your screen.

5.3 Go to Frame/Packet/Transaction/Transfer

To display a specific frame or decode level, follow these steps:

Step 1 From the Search menu, select**:**

Go to Frame/Packet/Transaction/Transfer

to display the Go to PLCP/Packet/Transaction/Transfer dialog box (Figure 5.2):

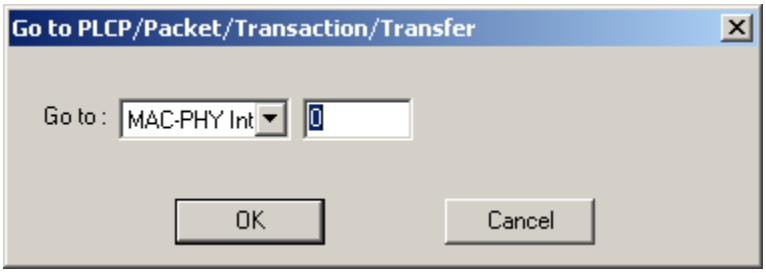

Figure 5.2 Go To PLCP/Packet/Transaction/Transfer Dialog Box

Step 2 Select the trace level view in the Go to field from the drop-down list.

Step 3 Enter the number of the frame, packet, transaction, segment, or transfer.

Step 4 Click **OK.**

The trace view shows the selected item at the top of the main window.

5.4 Go to Marker

To instruct the analyzer to display a marked frame, follow these steps:

Step 1 From the Search menu**,** select **Go to Marker** (Figure 5.3).

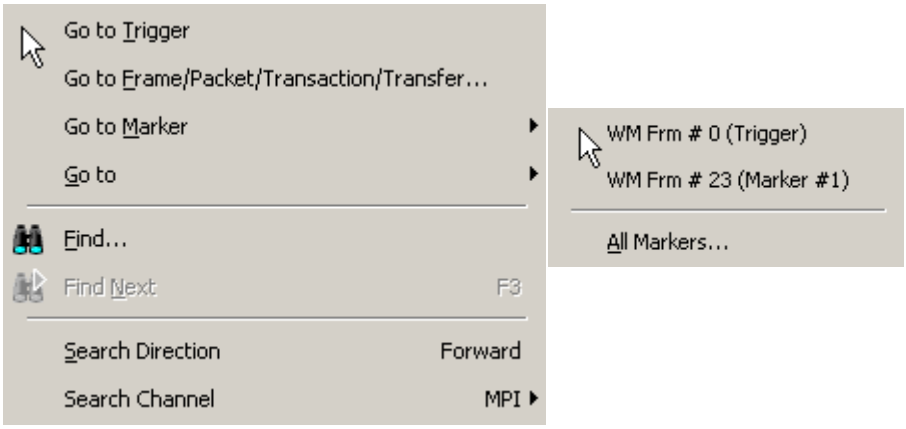

Figure 5.3 Selecting Go to Marker

Step 2 Select a frame or packet number from the listed markers. Alternatively, select **All Markers** to open the All Markers dialog box (see figure 5.17, “All Markers Window”), select a marker, and then click **Select**.

The trace view displays the selected item at the top of the main window.

Note: The **Go to Marker** feature functions in conjunction with the **Set Marker** feature. The comments within the parentheses following each marked Frame are added or edited with the **Set Marker** feature.

5.5 Go to

The **Go to** feature takes you directly to an item in the trace. After you select Go to, select the item from the listed items (Figure 5.4).

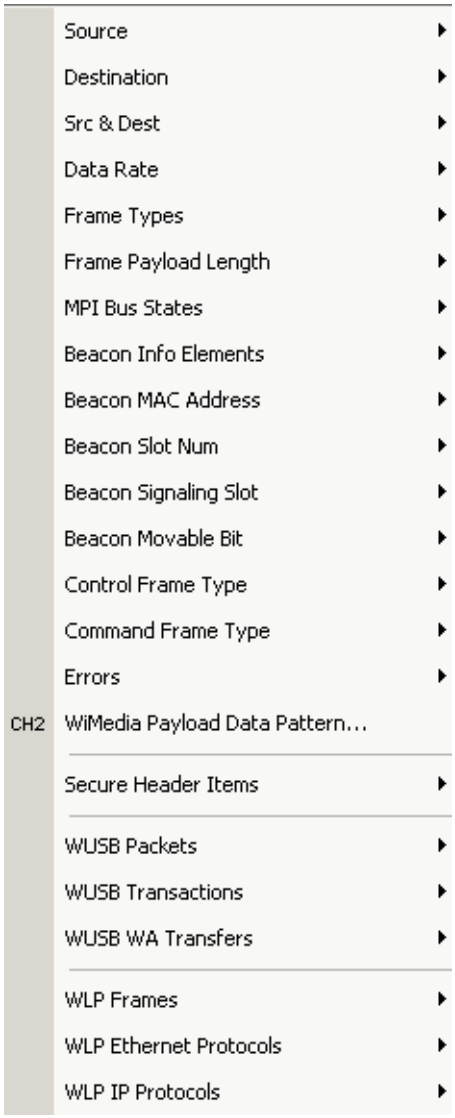

Figure 5.4 Go to Items List

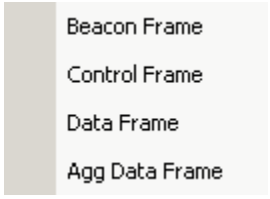

Figure 5.5 Go to Frame Types List

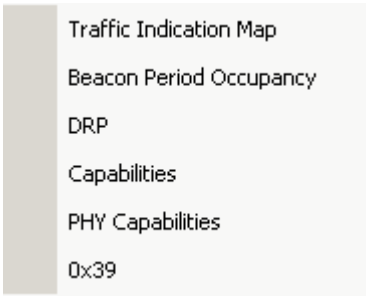

Figure 5.6 Go to Beacon Info Elements List

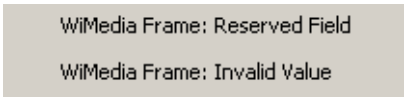

Figure 5.7 Go to Errors List

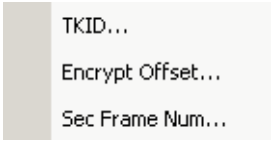

Figure 5.8 Go to Secure Header Items List

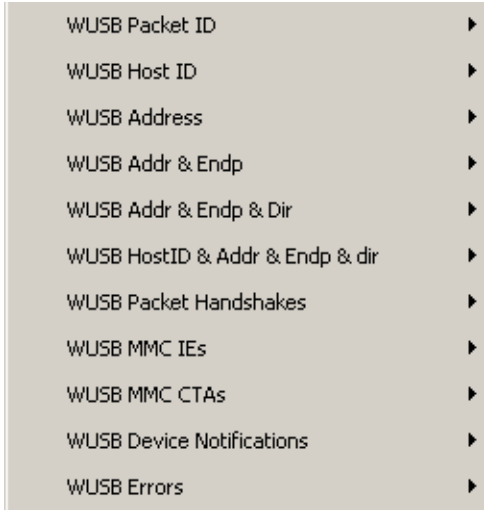

Figure 5.9 Go to WUSB Packets List

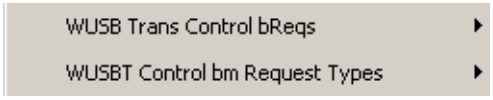

Figure 5.10 Go to WUSB Transactions List

Figure 5.11 Go to WUSB WA Transfers List

Figure 5.12 Go to WLP Frames List

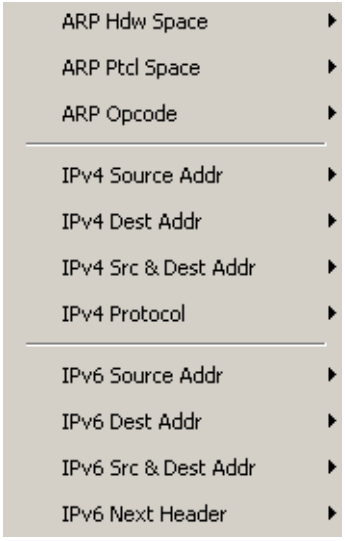

Figure 5.13 Go to WLP Ethernet Protocols List

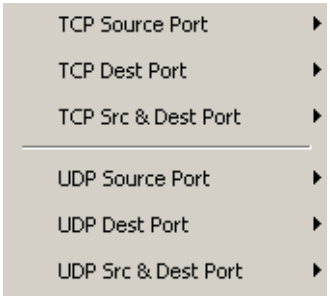

Figure 5.14 Go to WLP IP Protocols List

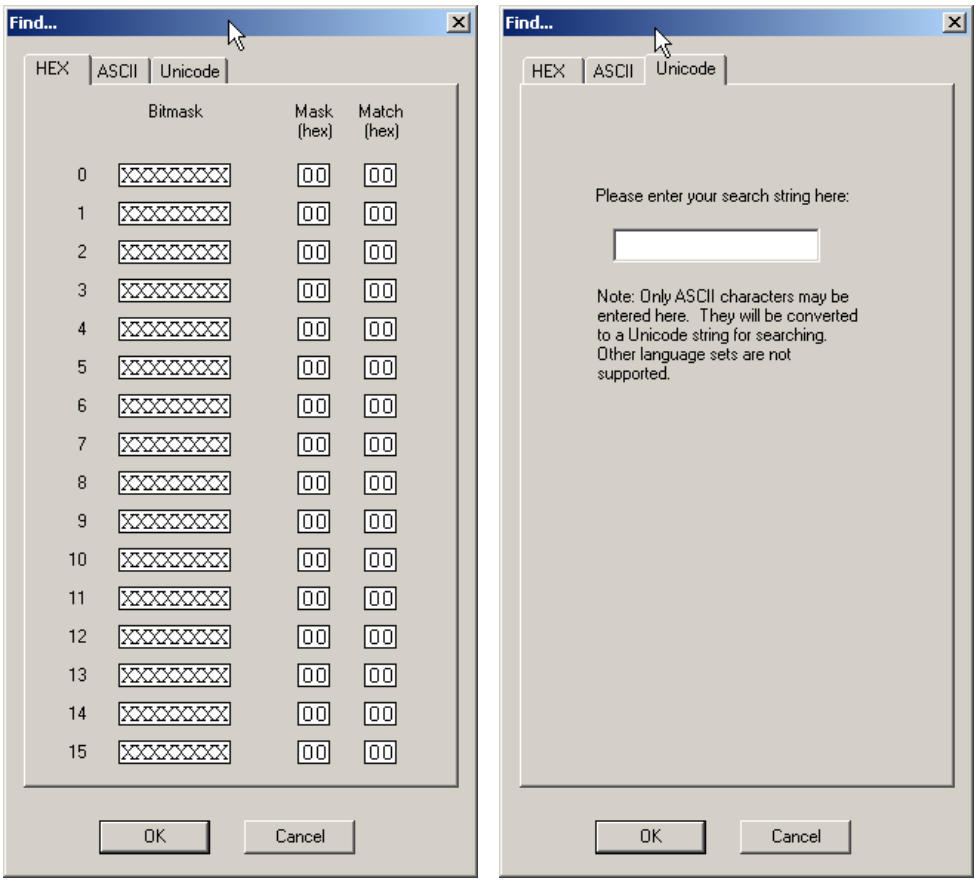

Figure 5.15 Go to WiMedia Payload Data Pattern List

You can enter an ASCII or Unicode (as ASCII characters) search string. For HEX, you can select a Bitmask, Mask (in hexadecimal), and Match (in hexadecimal) for each of 16 bits.

5.6 Find

Find is a utility that allows you to conduct searches of one or more events in a trace. Find allows you to search for any of the WUSB and WLP hierarchical levels within the trace.

To use Find:

- Select **Find...** under Search on the Menu bar

  OR

- Click in the Tool Bar.

You see the Find window (Figure 5.16).

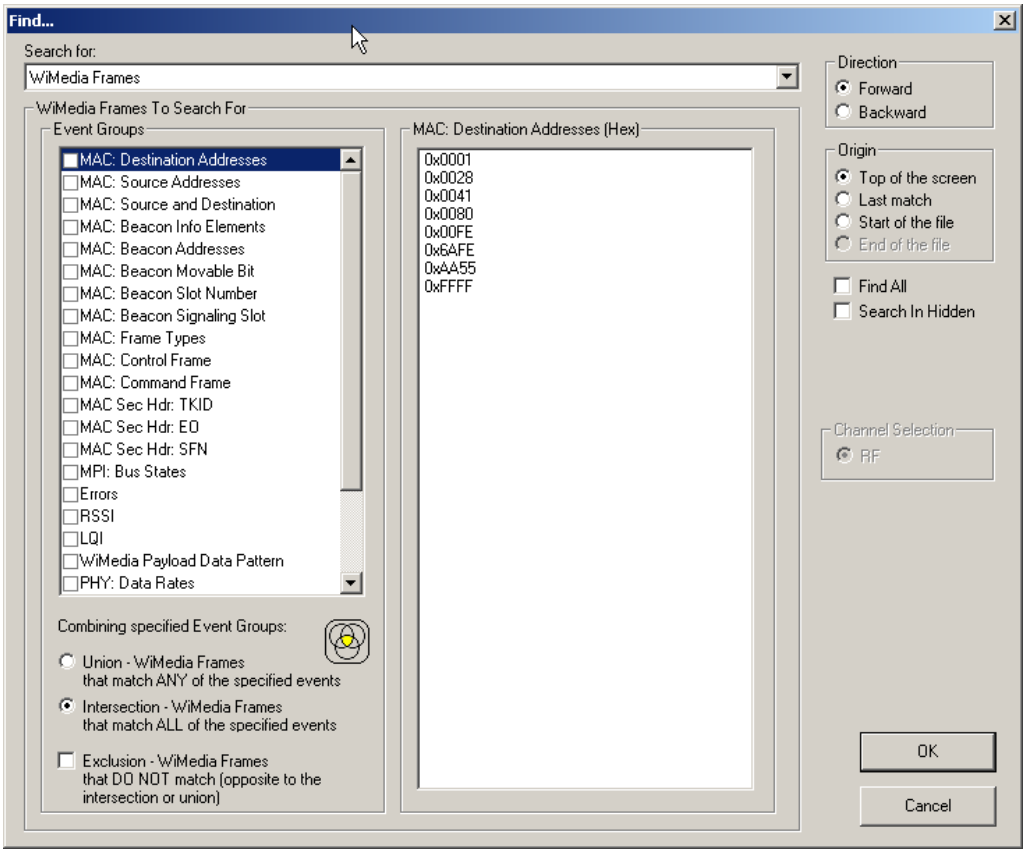

Figure 5.16 Find Window, Frames Checkboxes

Areas in Find Window

The **Find** window has three areas: Event Groups pane, a Context area to the right of the Event Groups pane (whose contents vary depending on items in the pane), and a Direction/Origin area at the right in the window.

Event Groups Pane

The left area allows you to specify the events to find in the search.

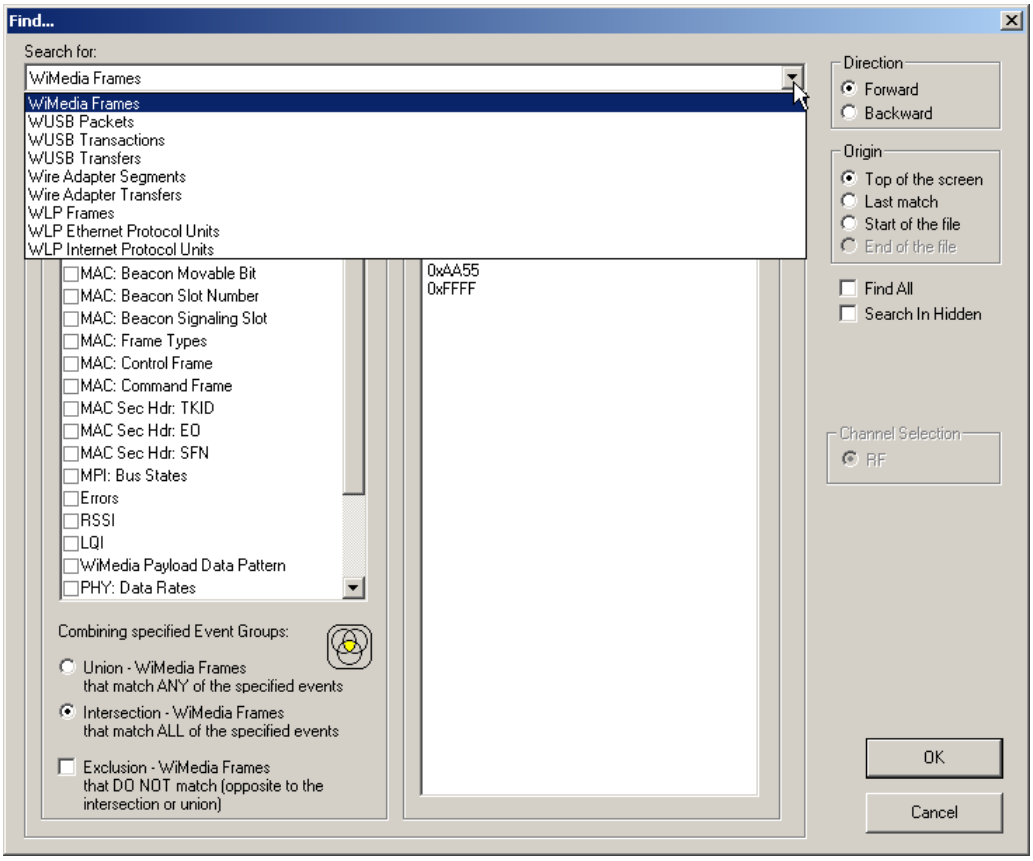

Figure 5.17 Find Events Window, Search For Drop-down List

Use the Search For drop-down list to select the event type:

- WiMedia Frames
- WUSB Packets
- WUSB Transactions
- WUSB Transfers
- Wire Adapter Segments
- Wire Adapter Transfers
- WLP Frames
- WLP Ethernet Protocol Units
- WLP Internet Protocol Units

For each Search For event, you can select as many checkboxes as desired (for multiple search events).

For WLP Frames:

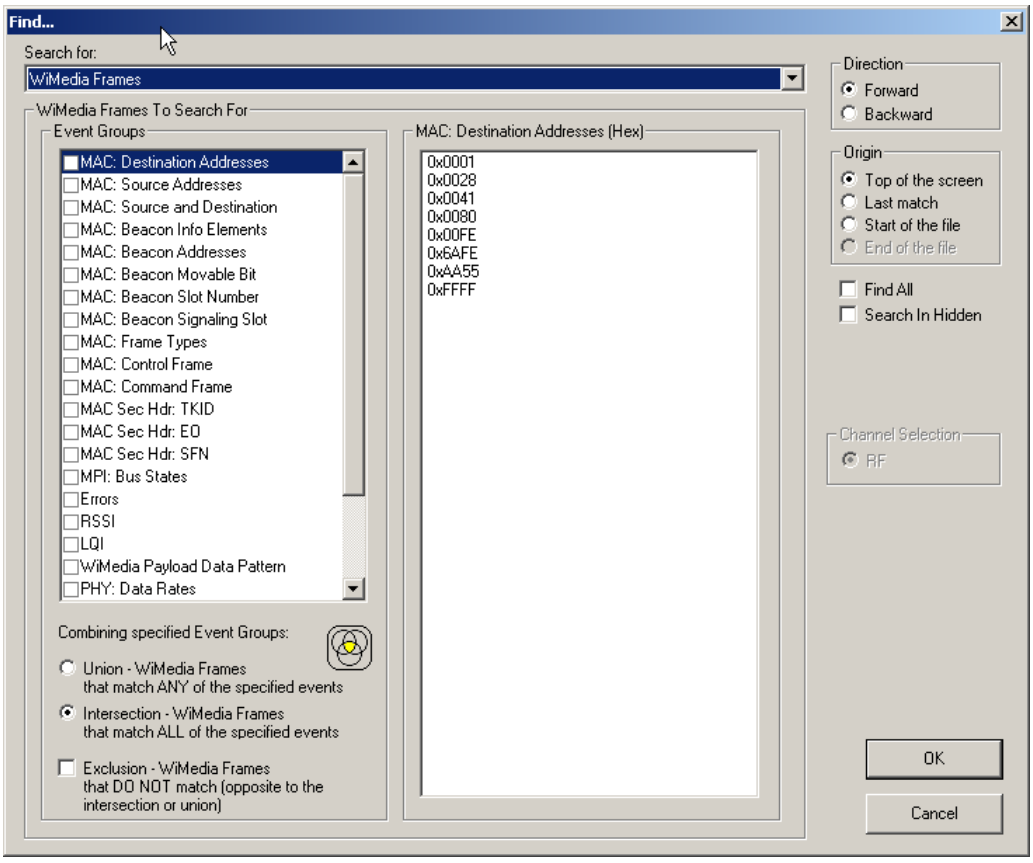

Figure 5.18 Find Events Window, WLP Frames Checkboxes

For WUSB Packets:

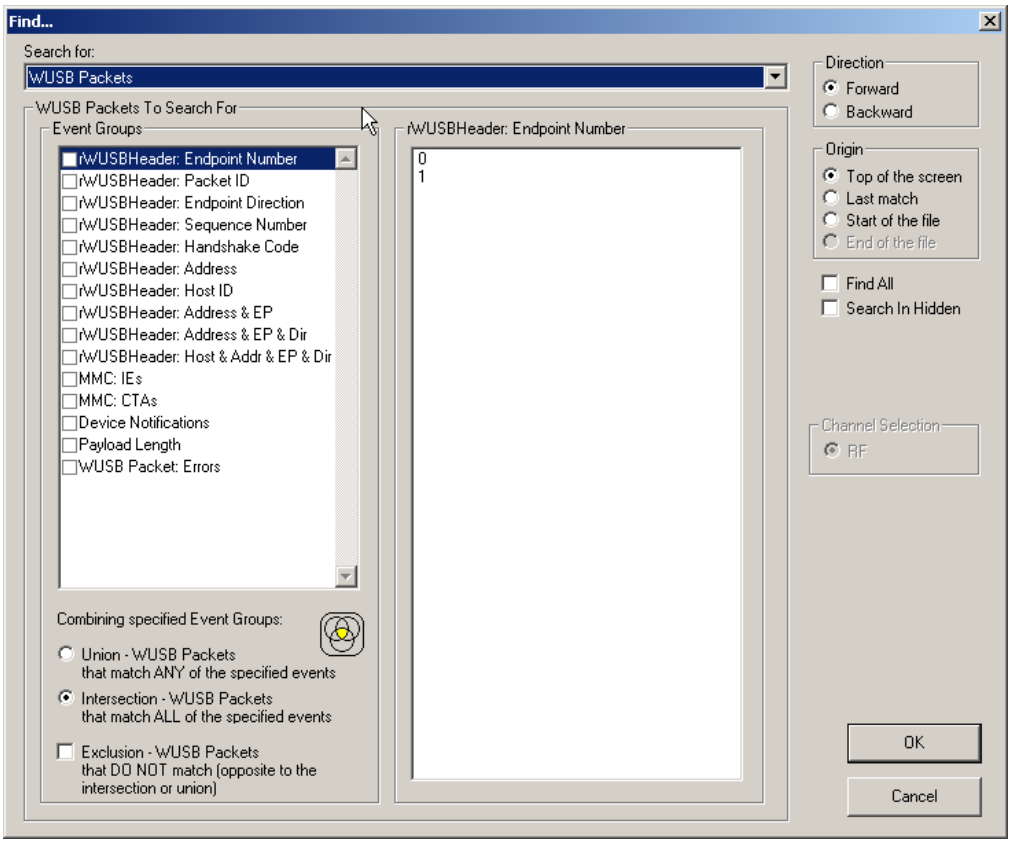

Figure 5.19 Find Events Window, WUSB Packets Checkboxes

For WUSB Transactions:

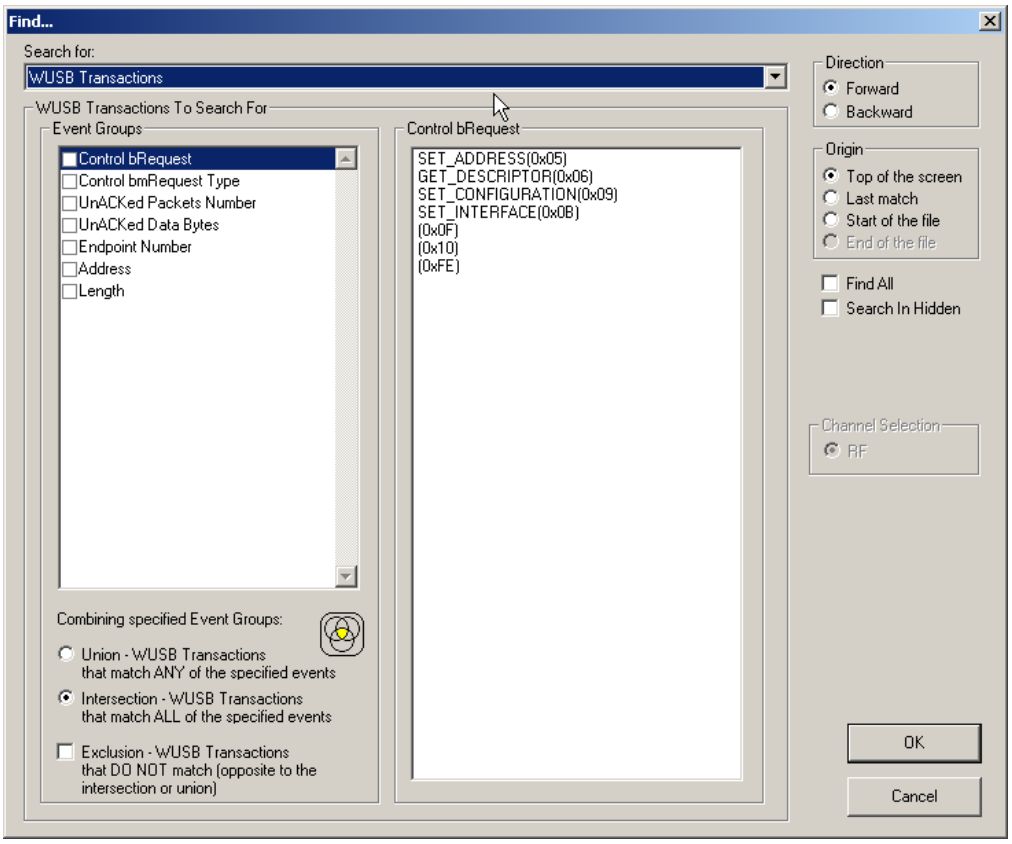

Figure 5.20 Find Events Window, WUSB Transactions Checkboxes

For WUSB Transfers:

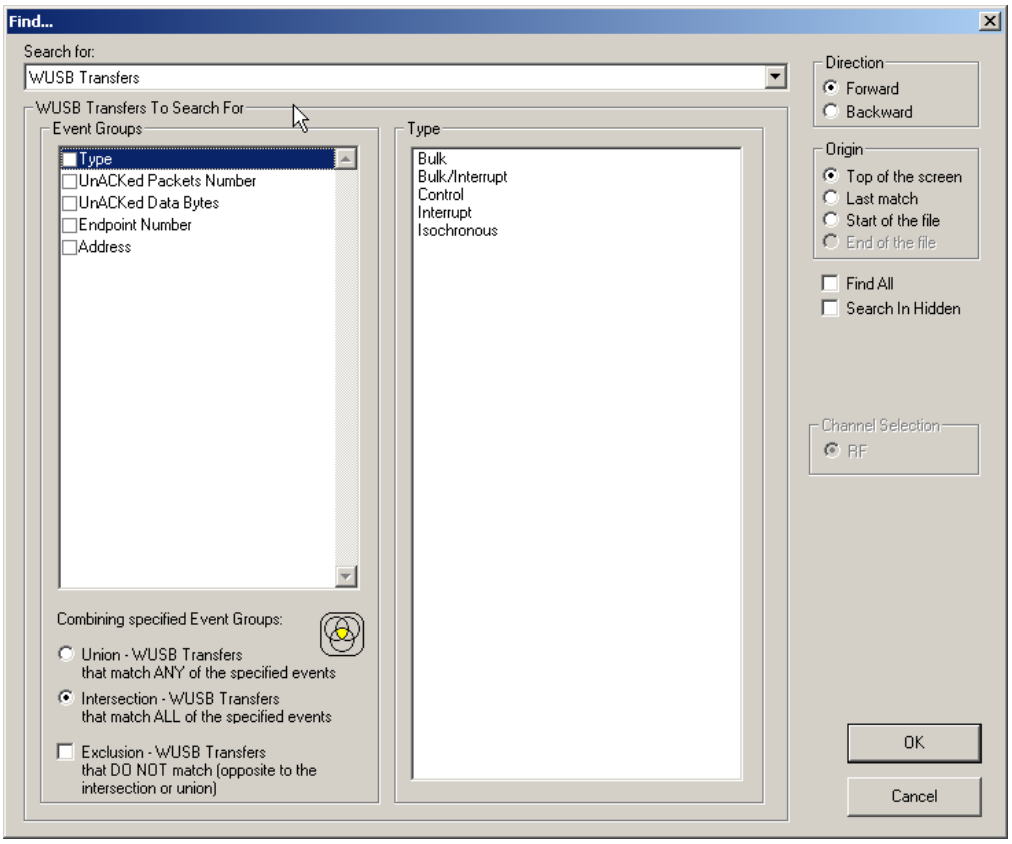

Figure 5.21 Find Events Window, WUSB Transfers Checkboxes

For Wire Adapter Segments:

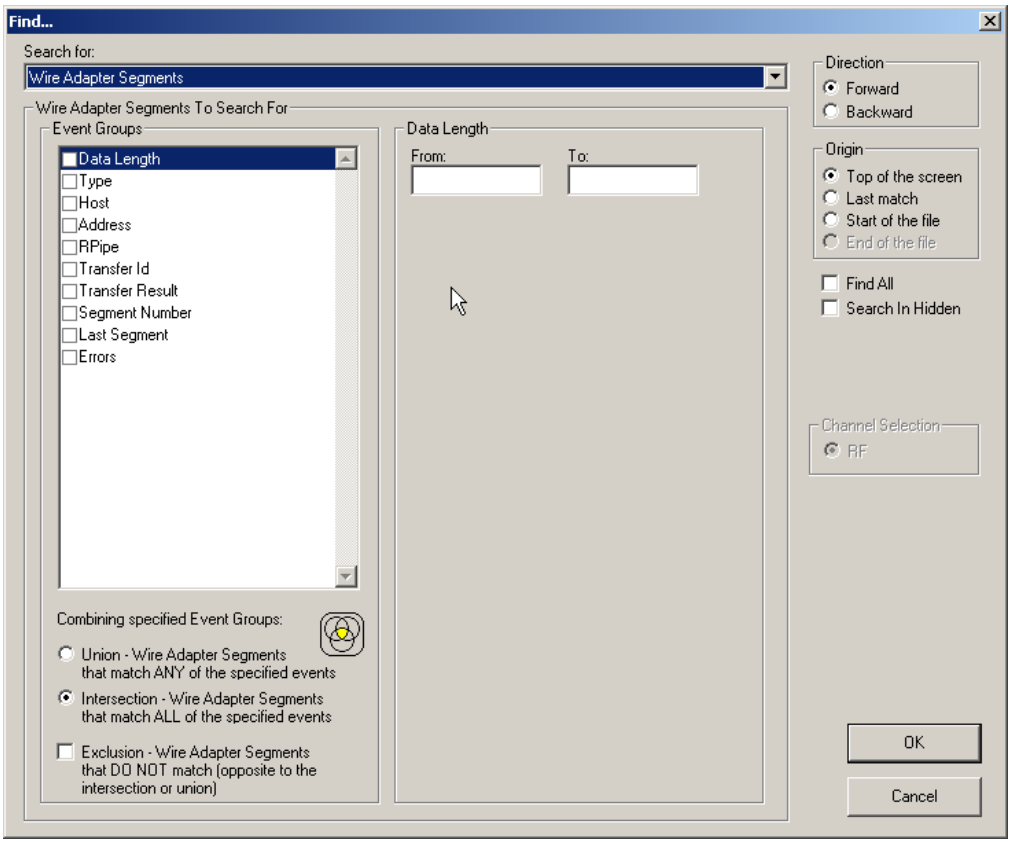

Figure 5.22 Find Events Window, Wire Adapter Segments Checkboxes

For Wire Adapter Transfers:

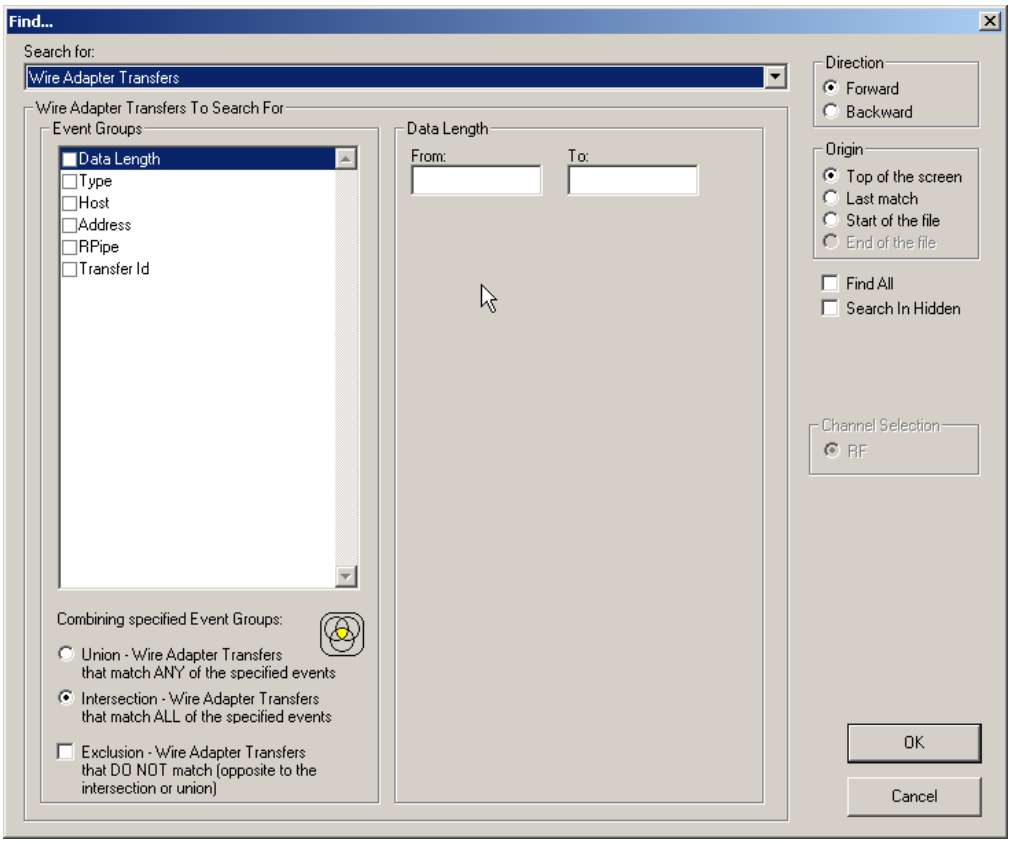

Figure 5.23 Find Events Window, Wire Adapter Transfers Checkboxes

For WLP Frames:

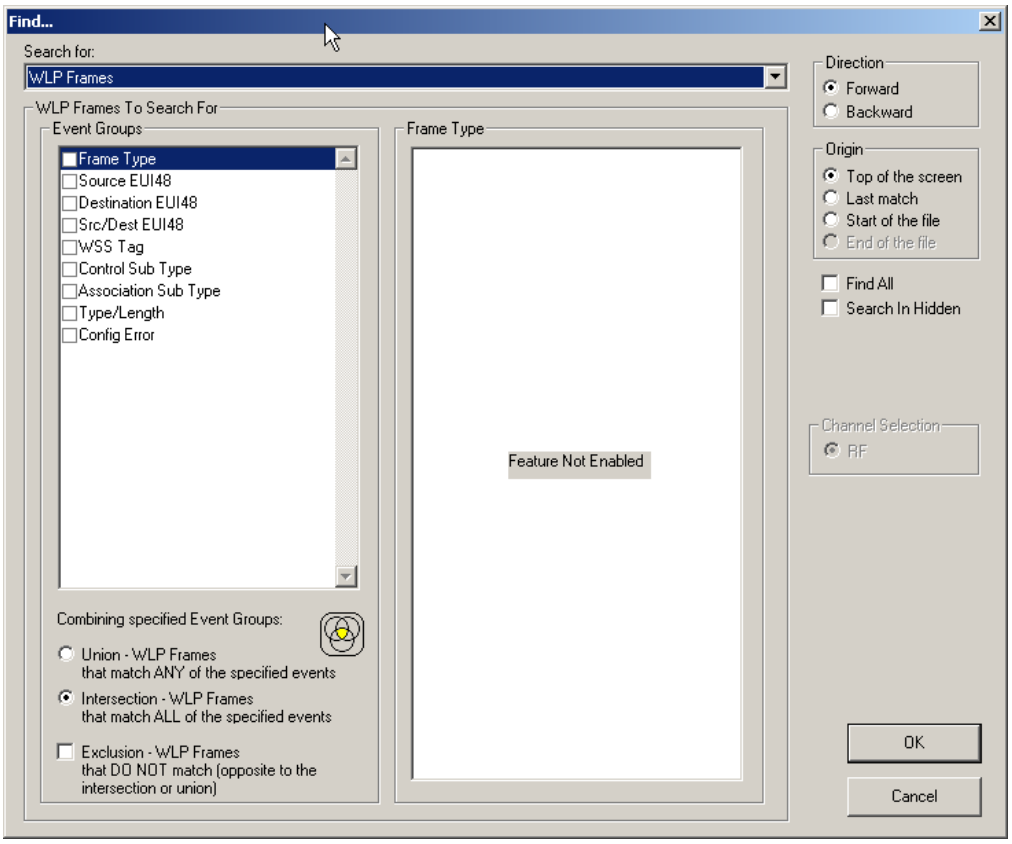

Figure 5.24 Find Events Window, WLP Frames Checkboxes

For WLP Ethernet Protocol Units:

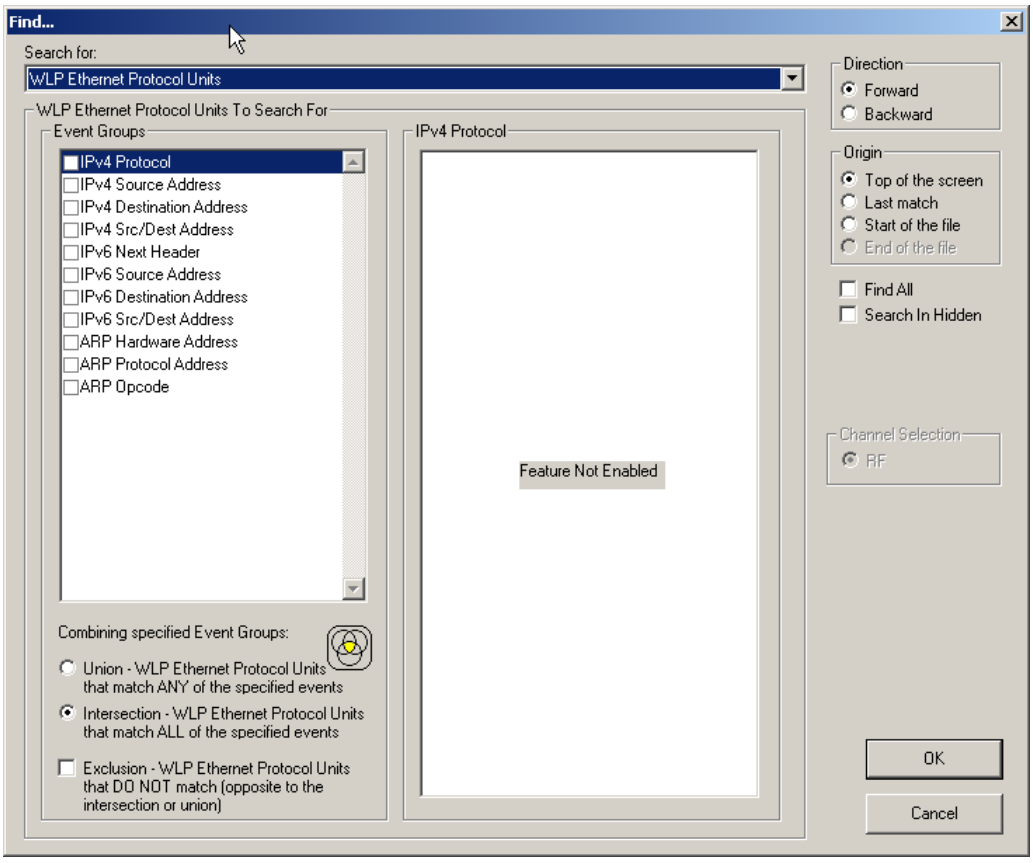

Figure 5.25 Find Events Window, WLP Ethernet Protocol Units Checkboxes

For WLP Internet Protocol Units:

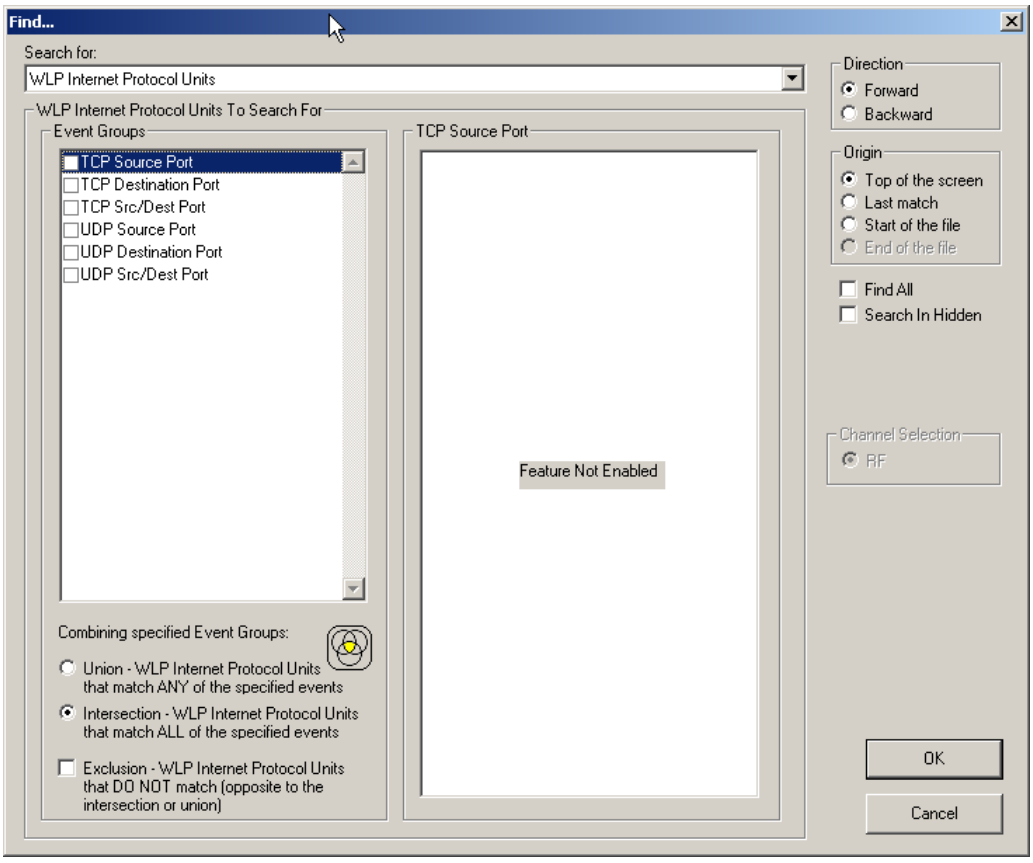

Figure 5.26 Find Events Window, WLP Internet Protocol Units Checkboxes

You also can combine specified event groups, meaning you can use logical relationships in your search: OR, AND, and NOT:

- **Union:** OR relationship. A Find operation searches for frames that include any of the items selected in the Event Groups pane.
- **Intersection:** AND relationship. A Find operation searches for only those frames that match all the items selected in the Event Groups pane.
- **Exclusion:** NOT relationship. A Find operation searches for frames that do not match any of the items selected in the Event Groups pane.

Context area

The central area provides further selection criteria for the Event Group active in the Event Groups pane. For example, in Figure 5.16, the MAC Destination Addresses Event Group is currently active (selected). The context area lets you select a range of MAC addresses. In Figure 5.27, the PHY Data Rates is the active Event group. A different display appears in the context area.

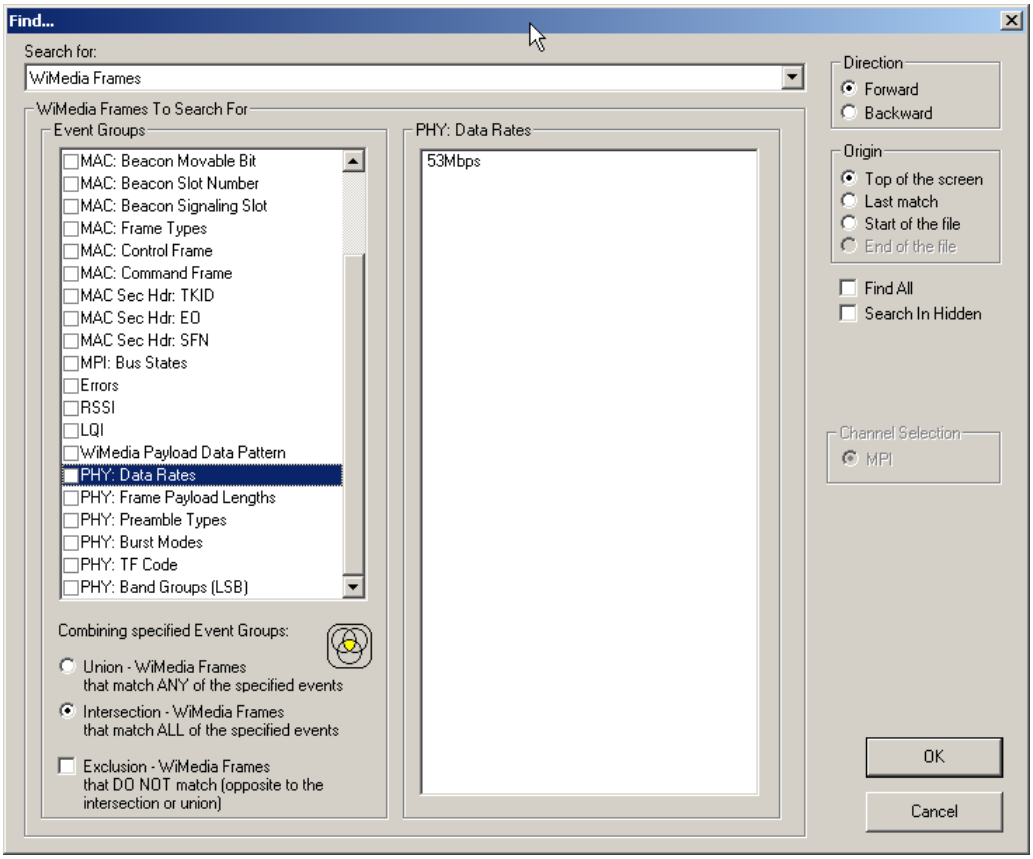

Figure 5.27 Find Events Window: PHY Data Rates Active

Direction/Origin

The radio buttons and checkboxes in the right part of the Find window let you specify where you want to start the search and search direction:

- **Direction:** You can search forward or backward in the file.
- **Origin:** You can choose the point-of-origin for the search: Top of the screen, Last match, Start of file, or End of file.
- **Find All:** You can extract every instance of the search criteria into a separate view.
- **Search in Hidden:** You can search in frame elements that are hidden in the display as well as frame elements that are visible.
- **Channel Selection**: If available, choose the MPI Channel, RF Channel, or Both.

Chapter 6: Display Options

You can select what information to display in Trace Views using the **Display Options** window or the display options buttons on the Tool bar (see Section 3.8, “Tool Bar” on page 26).

To open the **Display Options** window:

- Select **Display Options** under **Setup** on the Menu Bar.
  OR
- Click on the Tool Bar.

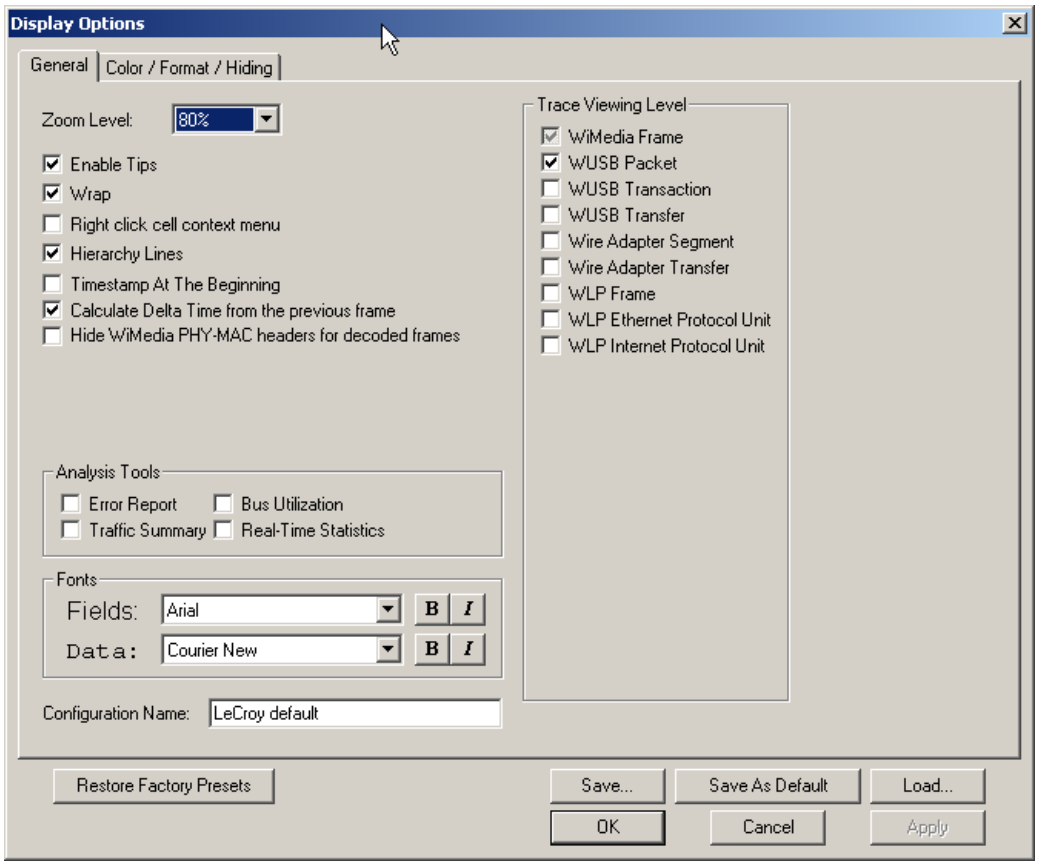

Figure 6.1 Display Options Window: General Page

You can select General and Color/Format/Hiding display options. The following sections describe these display options.

6.1 Display Options: General

You specify the main Trace View information types and settings using General tab of Display Options (see figure on previous page):

- **Zoom Level**: Zooms out from 100% (default) to 10% or zooms in from 100% to 200%.
- **Enable Tips**: Pops up text when you position the cursor over a field.
- **Wrap**: Wraps lines of traffic information instead of truncating lines at the right edge of the display.
- **Right click cell context menu**: By default, clicking the left mouse button on a field heading displays a context-sensitive pop-up menu providing commands about the field and clicking the right mouse button pops up a menu with display options. After selecting this option, clicking the right mouse button on a field heading displays the context-sensitive pop-up menu and clicking the left mouse button does nothing.
- **Hierarchy Lines**: Displays lines on the left side of Trace View showing the hierarchy from Packets to Transactions to Transfers if you show higher-level decodes.

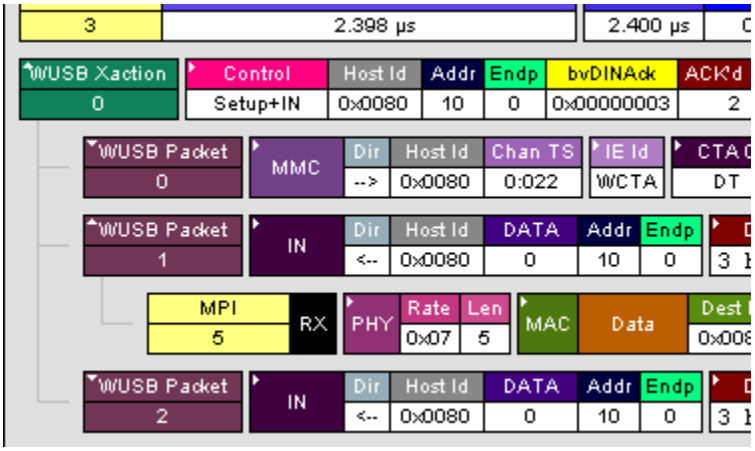

Figure 6.2 Hierarchy Lines

- **Timestamp At The Beginning**: Aligns the Timestamp field in a column on the left side of the Trace View. Selecting this option allows easier comparison with previous or following timestamps.
- **Calculate Delta Time from the Previous Frame**: Compute the time difference from the previous frame.
- **Hide WiMedia PHY-MAC headers for decoded frames**: Hide the headers of decoded frames.
- **Trace Viewing Level**: Displays WiMedia Frame, WUSB Packet, WUSB Transaction, WUSB Transfer, Wire Adapter Segment, Wire Adapter Transfer, WLP Frame, WLP Ethernet Protocol Unit, and WLP Internet Protocol Unit.
- **Error Report**: Displays the Errors section of the Traffic Summary window.
- **Traffic Summary**: Displays the Traffic Summary window, showing all reports, including Packets, Transactions, Transfers, and Errors.

- **Bus Utilization**: Displays the Bus Utilization window, including Packet length, Bus usage, and Bus usage by device.
- **Real-Time Statistics**: Displays the Real-Time Statistics window, including Data Packet Count, Data Payload Throughput, and Bus Usage.
- **Fonts**: Sets the font type and bold or italic style for Fields and Data.
- **Configuration Name**: You can name the current set of Display Options values for use with an **.opt** file. (The options file can have a different name.)
- **Restore Factory Presets**: Sets all Display Options values to the installed values.

6.2 Display Options: Color, Format, and Hiding

To modify the colors, formats, and hiding options, select the Color/Format/Hiding tab.

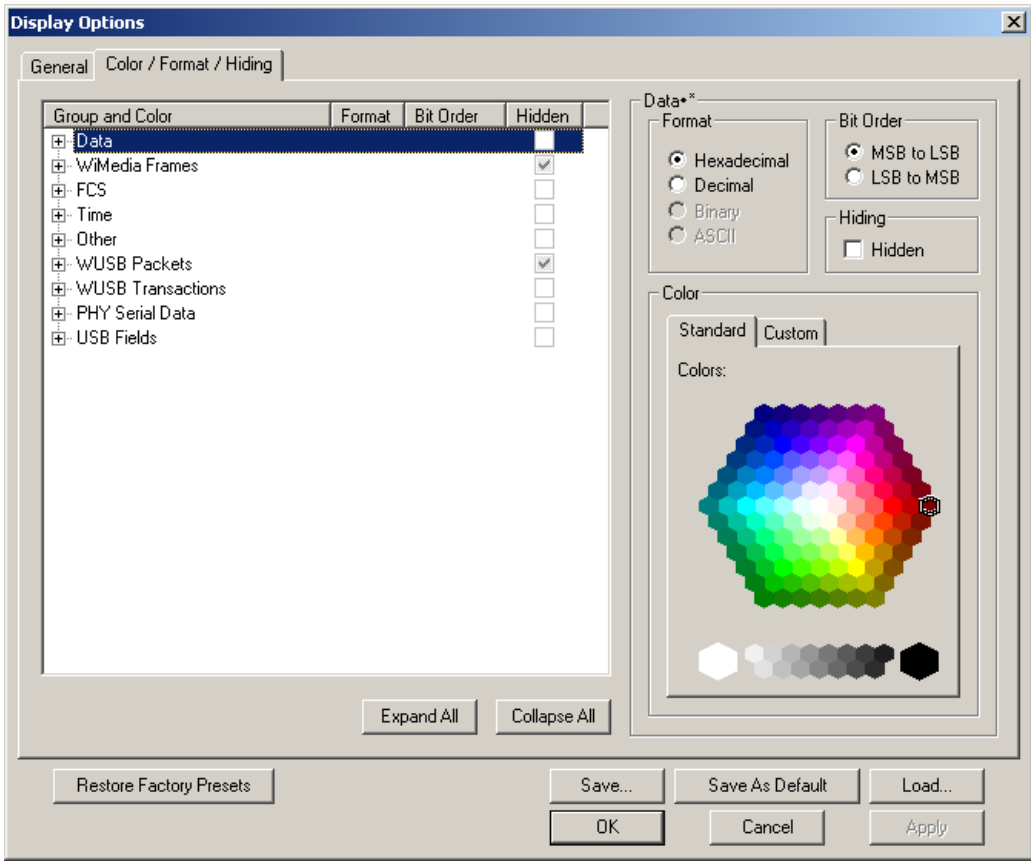

Figure 6.3 Display Options Window: Color, Format, and Hiding Page

Setting Colors

The program uses a default set of colors for each type of data in each group of data. The colors and color combinations are appropriate for most graphic systems. You can alter any color.

To specify a color for an information type, in the Color/Format/Hiding tab, select a row (such as Data) in the Group and Color column and expand it (see Figure 6.2).

Select a data type (such as Data Length) in the Group, then select a color in the Color section, using Standard or Custom colors. Use a bright color for each important field

To customize colors, use the Custom tab.

Note: You cannot change color of an Invalid Data (packet error) field. It is permanently set to red.

Changing Field Formats

For each type of data in each group of data, the program has a default data format. Examples of number data formats are Bin (binary), Dec (decimal), and Hex (hexadecimal). Examples of date and time data formats are Hex uFrame, Dec uFrame, Date & Time, Time, Bit Time, seconds, microseconds, and nanoseconds. An example of a text data format is ASCII. You can alter some data formats.

To specify a data format for an information type, in the Color/Format/Hiding tab, select a row (such as Data) in the Group and Color column and expand it.

Select a data type (such as Payload) in the Group:

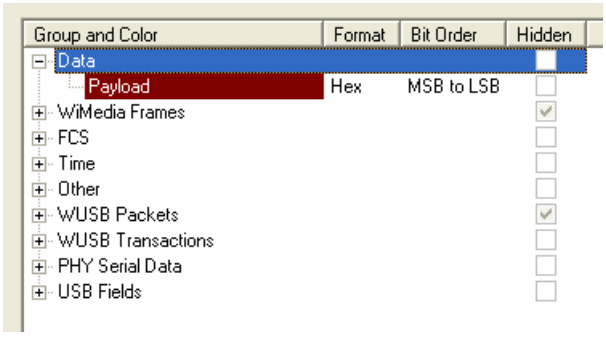

Figure 6.4 Group and Color Pane: Display Units Selected

Select a format in the Format section. The following formats are available for Payload:

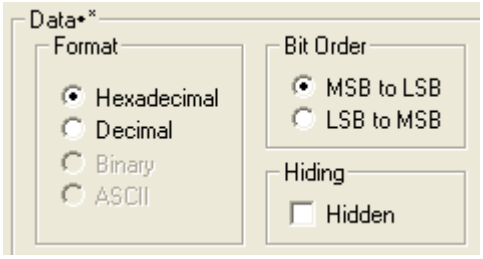

Figure 6.5 Formats for Payload

If available, select Bit Order in the Format section. The options are MSB to LSB or LSB to MSB.

Hiding Fields

To hide one or more fields, select the Group and Data type in the Group and Color column, then click the Hidden checkbox in the display or the Hidden checkbox in the Hiding section of the Format section.

Figure 6.6 Hidden Check Box

6.3 Saving Display Options

You can save a set of Display Options values, make a set the default settings, or use a saved set of values with the commands at the bottom of the **Display Options** window:

- To save the current Display Options values in an options file for use in future sessions, click **Save**. Enter a file name without a file name extension. The program adds the **.opt** extension. (The file must have an **.opt** file name extension.)
- To load a previously saved **.opt** file, click **Load** and select a file name.
- To save the current Display Options values in the **default.opt** options file for use as the default display options, click **Save as Default**. (Do not delete the **default.opt** file.)
- To apply the current Display Options values, click **Apply**. The Display Options window remains open.
- To apply the current Display Options values and close the Display Options window, click **OK**.
- To cancel unsaved changes to display values and exit the Display Options window, click **Cancel**.

See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45

[blank page]

Chapter 7: Decoding USB/WUSB Requests

7.1 Class and Vendor Definition Files

LeCroy analyzers use script files to decode class and vendor requests. The script files are read when the application is initialized. After reading, the Analyzer decodes class and vendor requests as instructed by the files.

Decoding uses **.dec** decoder files, which describe Class or Vendor requests in a C-like language. Each **.dec** file stores an endpoint or request decode. When the application starts, these files are loaded dynamically. Subdirectories are supported.

For information about legacy script decoding, see Appendix C “Legacy Script Decoding” on page 287.

Note: The **.dec** files listed in the following table are in the **Scripts** directory under the installation directory. See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45:

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	Sub Class	Proto-col ID
Audio Class decoding 2.0 AudioClass\Audio1.0Requests.dec AudioClass\Audio2.0Requests.dec	Audio	**01h**		
Communications and CDC Control	CCID	**02h**		
Direct Line Control Model	CCID	**02h**	01h	
Abstract Control Model	CCID	**02h**	02h	
Telephone Control Model	CCID	**02h**	03h	
Multi-Channel Control Model	CCID	**02h**	04h	
CAPI Control Model	CCID	**02h**	05h	
Ethernet Networking Control Model	CCID	**02h**	06h	
ATM Networking Control Model	CCID	**02h**	07h	
Wireless Handset Control Model	CCID	**02h**	08h	
Device Management Model	CCID	**02h**	09h	
Mobile Direct Line Model	CCID	**02h**	0Ah	
OBEX Model	CCID	**02h**	0Bh	
Communication Device Subclass/EEM Communications\CommRequests.dec Communications\CommInterrupt.dec Communications\CommCDCEEM.dec	CCID	**02h**	0Ch	

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	Sub Class	Proto-col ID
HID (Human Interface Device) HUT (HID extension) Monitor (HID extension) Physical Interface (force-feedback extension to HID) Point of Sale Devices (HID extension) Power (HID extension) Hid\hid.dec Hid\Hid_Req.dec	HID HID HID HID HID HID	**03h** Extension Extension Extension Extension Extension		
Physical Hid\hid.dec Hid\Hid_Req.dec	HID	**05h**		
Still Imaging Class StillImageClass\PTPStillImageBulkIn.dec StillImageClass\PTPStillImageBulkOut.dec StillImageClass\PTPStillImageRequests.dec StillImageClass\PTPStillInterrupt.dec	PTP Still Image	**06h**	01h	01h
Printer Printer\Printer_req.dec	Printer	**07h**	01h	xxh
Mass Storage	Mass Storage	**08h**		
SCSI/Bulk Protocol MassStorageClass\MS_BulkOnly_Requests.dec MassStorageClass\MS_BulkOnlySCSIInEndpoint.dec MassStorageClass\MS_BulkOnlySCSIOutEndpoint.dec MassStorageClass\MS_BulkOnlySCSIOutEndpoint.dec	Mass Storage SCSI Bulk	**08h**		
UFI (floppy)/CBI Protocol MassStorageClass\MS_UFI_CBI_Requests.dec MassStorageClass\MS_UFI_CBI_BulkInEndp.dec MassStorageClass\MS_UFI_CBI_BulkOutEndp.dec MassStorageClass\MS_UFI_CBI_InterruptEndp.dec	MassStrg Class UFI CBI	**08h**		
Hub support HubClass\HubClassRequests.dec HubClass\HubClassStatusEndpoint.dec	Hub Class	**09h**		

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	Sub Class	Protocol ID
Picture Transfer Protocol (**PTP)** [Photographic and Imaging Manufacturers Association (PIMA) 15740 and ISO 15740] StillImageClass\PTPStillImageBulkIn.dec StillImageClass\PTPStillImageBulkOut.dec StillImageClass\PTPStillImageRequests.dec StillImageClass\PTPStillInterrupt.dec	PTP Still Image	Extension		
Communications Device Class (CDC) Data Communications\CDCDataBulkIn_wCTE.dec Communications\CDCDataBulkIn_wPW.dec Communications\CDCDataBulkIn_wPW_wCTE.dec Communications\CDCDataBulkOut_wCTE.dec Communications\CDCDataBulkOut_wPW.dec Communications\CDCDataBulkOut_wPW_wCTE.dec Communications\CDCDataIsochIn_wCTE.dec Communications\CDCDataIsochIn_wPW.dec Communications\CDCDataIsochIn_wPW_wCTE.dec Communications\CDCDataIsochOut_wCTE.dec Communications\CDCDataIsochOut_wPW.dec Communications\CDCDataIsochOut_wPW_wCTE.dec		**0Ah**	00h	
Smart Card (CCID) SmartCard\CCIDBulkIn.dec SmartCard\CCIDBulkOut.dec SmartCard\CCIDInterrupt.dec SmartCard\CCID_req.dec SmartCard\ICCDBulkIn.dec SmartCard\ICCDBulkOut.dec SmartCard\ICCDInterrupt.dec SmartCard\ICCD_req_Ver.A.dec SmartCard\ICCD_req_Ver.B.dec	CCID and ICCD	**0Bh**		
Video Class (UVC) decoding 1.1 (currently at 1.0)		**0Eh**		
VIDEO CONTROL	Video	**0Eh**	01h	00h
VIDEO STREAMING	Video	**0Eh**	02h	00h
VIDEO INTERFACE COLLECTION VideoClass\VideoBulkIn.dec VideoClass\VideoBulkOut.dec VideoClass\VideoInterrupt.dec VideoClass\VideoIsochIn.dec VideoClass\VideoIsochOut.dec VideoClass\Video1.0Requests.dec VideoClass\Video1.1Requests.dec	Video	**0Eh**	03h	00h

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	Sub Class	Protocol ID
Wireless Controller		**E0h**		
BT	HCI	**E0h**	01h	01h
UWB	WA Radio Control	**E0h**	01h	02h
Remote Network Driver Interface Specification (RNDIS)	Remote NDIS	**E0h**	01h	03h
Host Wire Adapter	Wire Adapter Class	**E0h**	02h	01h
Device Wire Adapter	Wire Adapter Class	**E0h**	02h	02h
Device Wire Adapter isochronous interface WireAdapter\WA_DataInEndpoint.dec WireAdapter\WA_DataOutEndpoint.dec WireAdapter\WA_NotifEndpoint.dec WireAdapter\WA_Requests.dec WireAdapter\WA_Radio_Requests.dec WireAdapter\WA_RadioNotifEndpoint.dec	Wire Adapter Class	**E0h**	02h	03h
Miscellaneous Device Class		**EFh**		
Interface Association Descriptor	Standard, so no decoder method needed	**EFh**	02h	01h
Wire Adapter Multifunction Peripheral programming interface	Wire Adapter Class	**EFh**	02h	02h
Cable Based Association Framework (CBAF) Requests Standard\StandardRequests.dec IEEE\IEEECompanies.dec Virtual\VirtualDATAIn.dec Virtual\VirtualDATAOut.dec Virtual\VirtualUARTIn.dec Virtual\VirtualUARTOut.dec AssociationFrameworks\ WUSB_CableBasedAssociation.dec	Association Frameworks	**EFh**	03h	01h

You can create your own **.dec** file for a Class or Vendor Request. For more information on the format of these Script Decoder files and the Script Decoding language, read the ***Script Decoder Manual***.

You can show or hide the full MAC Payload or MAC/PHY headers (see See Section 4.3 "Trace Level Views for WUSB" on page 48).

7.2 Class/Vendor Decoding Options

You can permanently assign a class or vendor decoding for an address and/or endpoint or interface in a trace file. Once assigned, the decoding occurs automatically when you display transactions.

Mapping Request Recipient to Class/Vendor Decoding

To assign a decoding group to a request recipient:

Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Control Transfer** field to display the USB/WUSB Device Request menu.

Step 2 Select **Map Request Recipients to Class/Vendor Decoding** to display the Request Recipient and Endpoints dialog box:

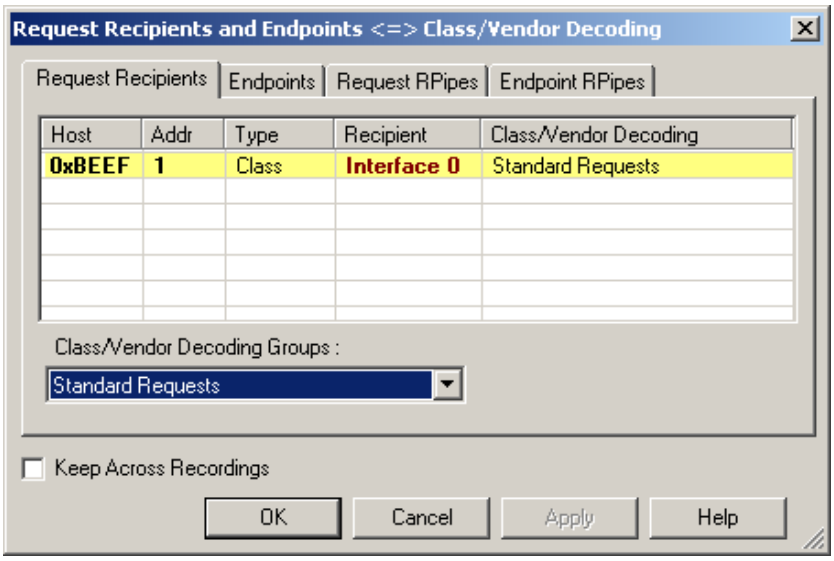

Figure 7.1 Request Recipient and Endpoints Dialog Box

The Recipient field shows all Class and Vendor Request Recipients found in the trace file. The display shows the Host, Address, and Type (Class or Vendor) for the recipient. On the right are the names of Class/Vendor Decoding groups currently assigned to recipients. If blank, no decoding is assigned for a recipient.

Step 3 Select a recipient.

Step 4 Display the **Class/Vendor Decoding Groups** drop-down menu.

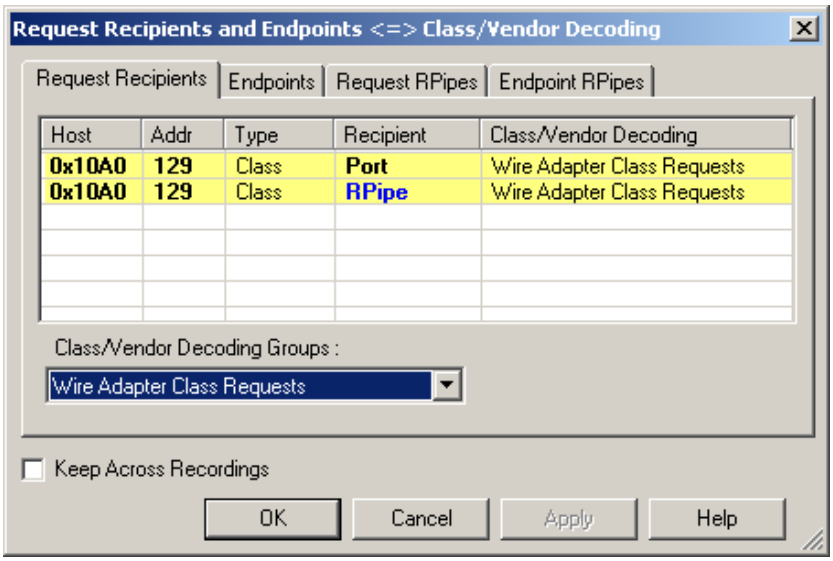

Figure 7.2 Class/Vendor Decoding Groups Menu

The drop-down menu lists the defined Class/Vendor request decoding groups. The Class/Vendor Decoding Groups are:

- No Decoding
- Audio 1.0 Class Requests
- Audio 2.0 Class Requests
- Audio Class Requests
- Communication Class Requests
- HID Class Requests
- Hub Class Requests
- Mass-Strg Bulk-Only Requests
- Mass-Strg Class UFI CBI Requests
- Printer Class Requests
- Still Image/PTP/MTP/PictBridge Class Requests
- Standard Requests
- Video Class Requests
- Wire Adapter Radio Control Requests
- Wire Adapter Class Requests

Step 5 Select a decoding group.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 6 Repeat the previous steps for additional recipients.

Step 7 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 8 Click **OK**.

Mapping Endpoint to Class/Vendor Decoding

To assign a Class/Vendor Endpoint decoding:

Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Bulk/Int Transfer** field to display the USB/WUSB Device Request menu.

Step 2 Select **Map Endpoint to Class/Vendor Decoding** to display the Request Recipients and Endpoints dialog box.

Step 3 Click the **Endpoints** tab to display the Endpoints dialog box:

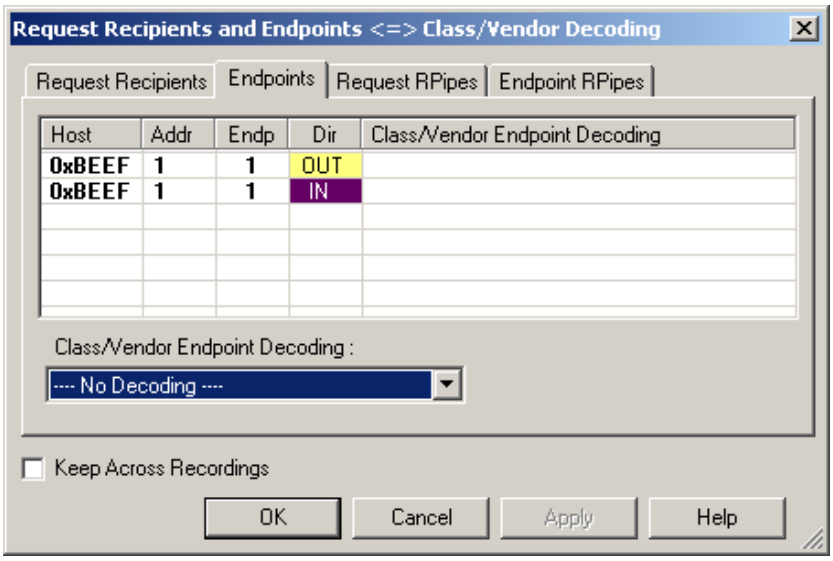

Figure 7.3 Endpoints Dialog Box

The Endpoint field (Endp) shows all Endpoints found in the trace file. The displays shows the Host, Address, and Direction for the recipient. On the right are the names of Class/Vendor Endpoint Decoding groups currently assigned to endpoints. If blank, no decoding is assigned for a recipient.

Step 4 Select an endpoint.

Step 5 Display the **Class/Vendor Endpoint Decoding** drop-down menu:

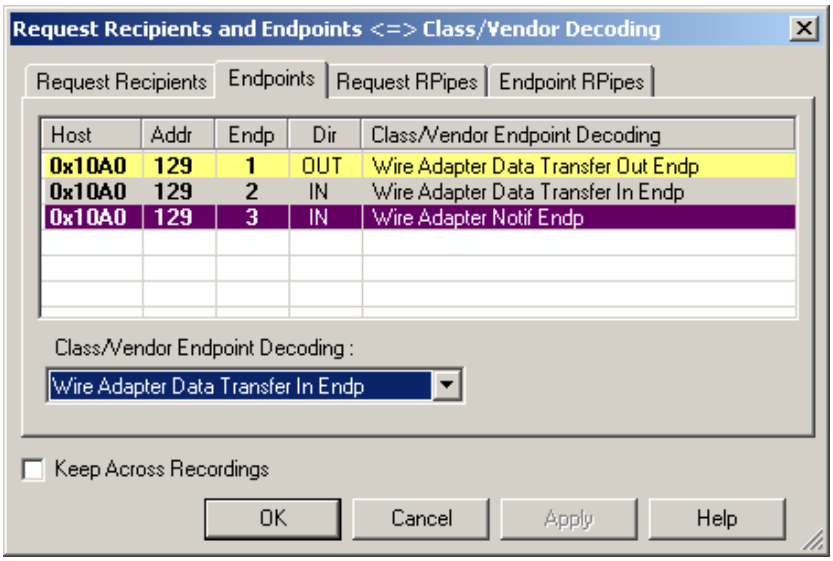

Figure 7.4 Class/Vendor Endpoint Coding Menu

The Class/Vendor Endpoint Decoding options for an OUT endpoint are:

- No Decoding
- CCID Bulk Out Message
- Display DATA
- Mass Strg Bulk-Only SCSI Out Endp
- Mass Strg UFI_CBI Bulk Out Endp
- Still Image/PTP/MTP/PictBridge Bulk Out
- Video Bulk Out
- Video Isoch Out
- Virtual UART
- Wire Adapter Data Transfer Out Endp

The Class/Vendor Endpoint Decoding options an IN or Interrupt endpoint are:

- No Decoding
- CCID Bulk In Message
- Communication Class Interrupt Notification
- Display DATA
- HID In Endp
- Hub Class Status Change Endp
- Mass Strg Bulk-Only SCSI In Endp
- Mass Strg CBI Interrupt Endp
- Mass Strg UFI_CBI Bulk In Endp
- Mass Strg UFI_CBI Interrupt Endp
- Still Image/PTP/MTP/PictBridge Bulk In
- Still Image/PTP/MTP/PictBridge Interrupt
- Video Bulk In
- Video Interrupt
- Video Isoch In
- Virtual UART
- Wire Adapter Radio Notif Endp
- Wire Adapter Data Transfer In Endp
- Wire Adapter Notif Endp

Step 6 Select the type of decoding.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 7 Repeat the previous steps for any additional endpoints you would like to map.

Step 8 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 9 Click **OK**.

Mapping Request RPipe to Class/Vendor Decoding

Before mapping Request RPipes to Class/Vendor Decoding, you must first assign the following endpoint decoders:

- Wire Adapter Data Out
- Wire Adapter Data In
- Wire Adapter Notif

To assign a decoding group to a Request RPipe:

Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Control Transfer** field to display the USB/WUSB Device Request menu.

Step 2 Select **Map RPipe to Class/Vendor Decoding** to display the Request Recipient and Endpoints dialog box.

Step 3 Click the **Request RPipes** tab to display the Request RPipes dialog box:

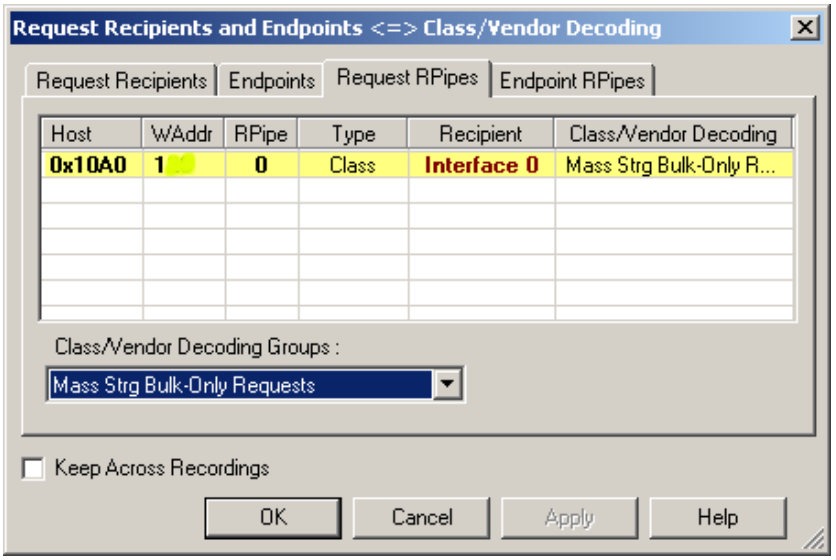

Figure 7.5 Request RPipes Dialog Box

The Recipient field shows all Class and Vendor Request recipients found in the trace file. The RPipe field shows all Class and Vendor Request RPipes found in the trace file. The displays shows the Host, WAddress, and Type (Class or Vendor) for the recipient. On the right are the names of Class/Vendor Decoding groups currently assigned to recipients. If blank, no decoding is assigned for a recipient.

Step 4 Select a recipient.

Step 5 Display the **Class/Vendor Decoding Groups** drop-down menu. The Class/Vendor Decoding Groups are the same as for Request Recipients.

Step 6 Select a decoding group.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 7 Repeat the previous steps for additional recipients.

Step 8 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 9 Click **OK**.

Mapping Endpoint RPipe to Class/Vendor Decoding

To assign a Class/Vendor Endpoint RPipes decoding:

Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Bulk/Int Transfer** field to display the USB/WUSB Device Request menu.

Step 2 Select **Map Endpoint RPipe to Class/Vendor Decoding** to display the Request Recipients and Endpoints dialog box.

Step 3 Click the **Endpoint RPipes** tab to display the Endpoint RPipes dialog box:

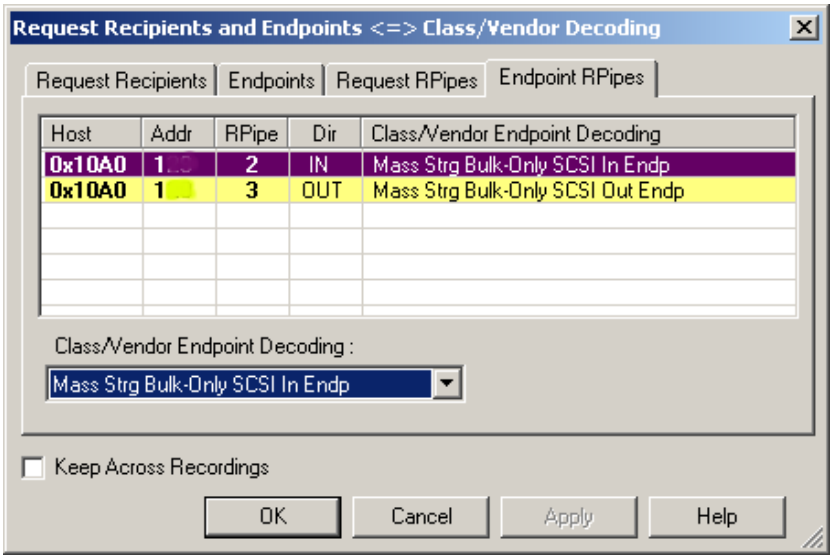

Figure 7.6 Endpoint RPipes Dialog Box

The RPipe field shows all RPipes found in the trace file. The displays shows the Host, Address, and Direction for the recipient. On the right are the names of Class/Vendor Endpoint Decoding groups currently assigned to endpoints. If blank, no decoding is assigned for a recipient.

Step 4 Select an endpoint RPipe.

Step 5 Display the **Class/Vendor Endpoint Decoding** drop-down menu. The Class/Vendor Endpoint Decoding options are the same as for Endpoints.

Step 6 Select the type of decoding.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 7 Repeat the previous steps for any additional RPipes you would like to map.

Step 8 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 9 Click **OK**.

7.3 General Options

Decoding uses control transfers called USB/WUSB Device Requests. Device Requests depend on the Device Class and Vendor specifications.

Decoding USB/WUSB Device Requests

To decode a USB/WUSB Device Request:

Step 1 Left-click the **Control Transfer** field of the USB/WUSB Device Request to display the USB/WUSB Device Request menu:

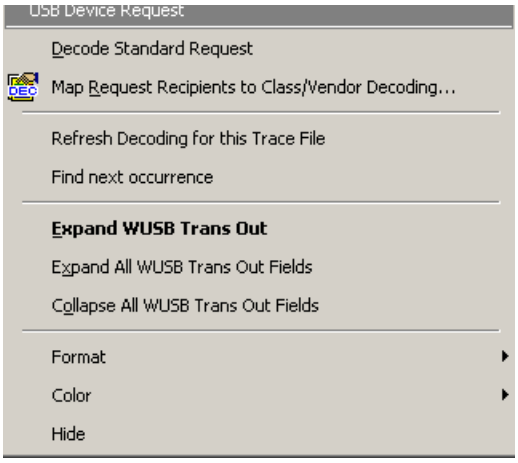

Figure 7.7 UWB Device Request menu

Note The menus shown in this section are context-sensitive. You may see slightly different menus.

Step 2 To refresh decoding, click **Refresh Decoding for this Trace File**. Use this option to reanalyze all transactions.

Step 3 To move to the next Control Transfer field, click **Find Next Occurrence**.

Step 4 To expand data fields for one row, use **Expand WUSB Trans Out, Expand WUSB Trans In**, **Expand This WUSB Transfer,** or **Expand WUSB Xfer**.

Step 5 To collapse data fields for one row, use **Collapse WUSB Trans Out, Collapse WUSB Trans In**, **Collapse This WUSB Transfer,** or **Collapse WUSB Xfer**.

Step 6 To expand all data fields of the same type, use **Expand All WUSB Trans Out Fields, Expand All WUSB Trans In Fields**, **Expand All WUSB Transfers,** or **Expand All WUSB Xfer**.

Step 7 To collapse all data fields of the same type, use **Collapse All WUSB Trans Out Fields, Collapse All WUSB Trans In Fields**, **Collapse All WUSB Transfers,** or **Collapse All WUSB Xfer**.

Note: You can also change the format, color, and hidden status of fields, using the same methods as in Display Options. (See Chapter 6, Display Options.)

Decoding Standard Requests

To decode a standard request:

Step 1 From the USB/WUSB Device Request menu, select **Decode Standard Request** to display the View Fields for Standard Request text box:

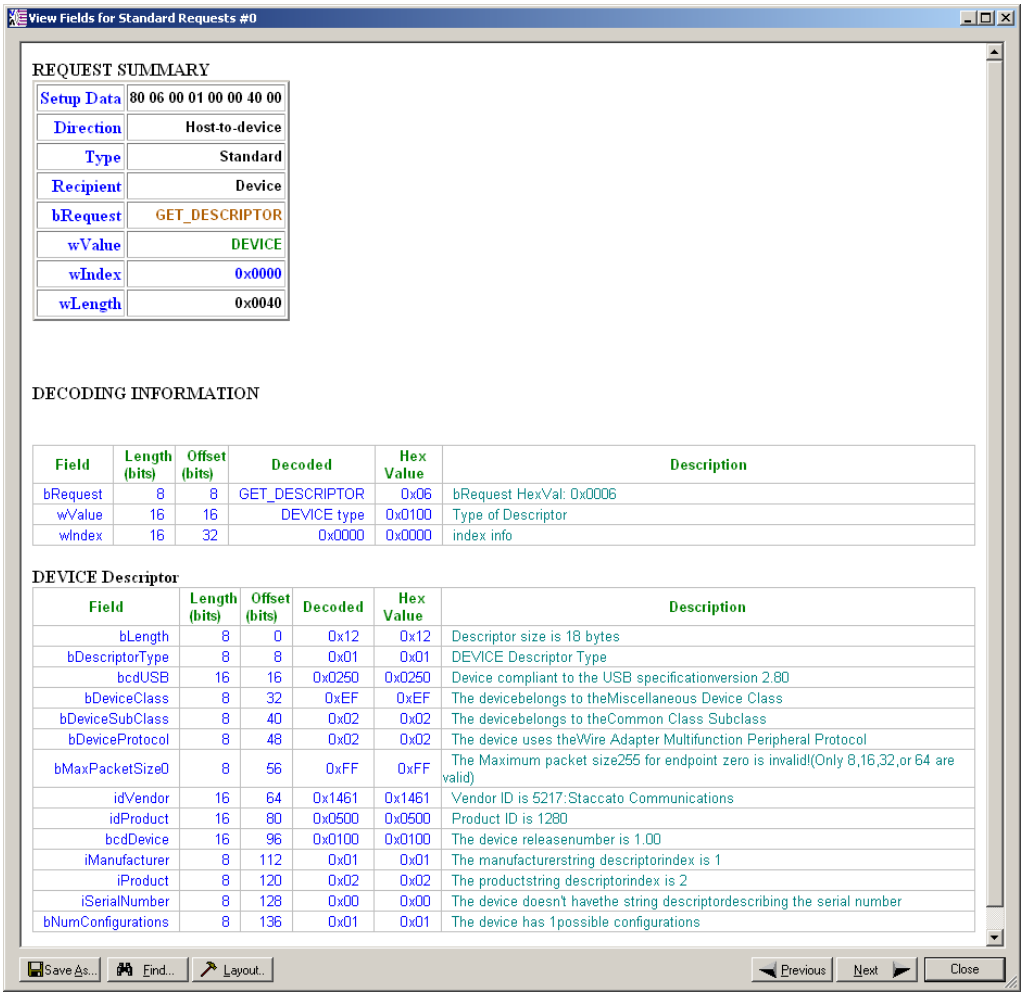

Figure 7.8 Standard Request Text Box

Step 2 To find a word in the text box, click the **Find** button. Enter the word in the Find What field. To use a case-sensitive search, check **Match Case**. To find only the exact word, check **Match Whole Word Only.** You can search **Up** or **Down**. To search, click **Find Next.**

Step 3 To save the View Fields text box as an HTML file, click the **Save As** button, enter a file name in the Save As dialog box, then click **Save**.

Step 4 To view the previous or next Transfer Control field request of the same request type, click **Previous** or **Next**.

The View Fields for Standard Request dialog box displays field definitions and values of the Standard Request.

For field definitions, please refer to the *Universal Serial Bus Specification, version 2.0.* The USB specification is available from the USB Implementers Forum (USB-IF) at:

USB Implementers Forum
1730 SW Skyline Blvd.
Suite 203
Portland, OR 97221

Tel: +1/503.296.9892
Fax: +1/503.297.1090
Web: http://www.usb.org/

Decoding Class Requests

Examples of a class request are Mass-Strg Class UFI CBI Requests, PTP Still Image Class Requests, Video Class Requests, and Wire Adapter Class Requests.

To decode a class request:

Step 1 From the USB/WUSB Device Request menu, select **Decode ... Request** to display the View Fields for ... Class Requests text box.

Figure 7.9 shows a Wire Adapter Class Requests decoding:

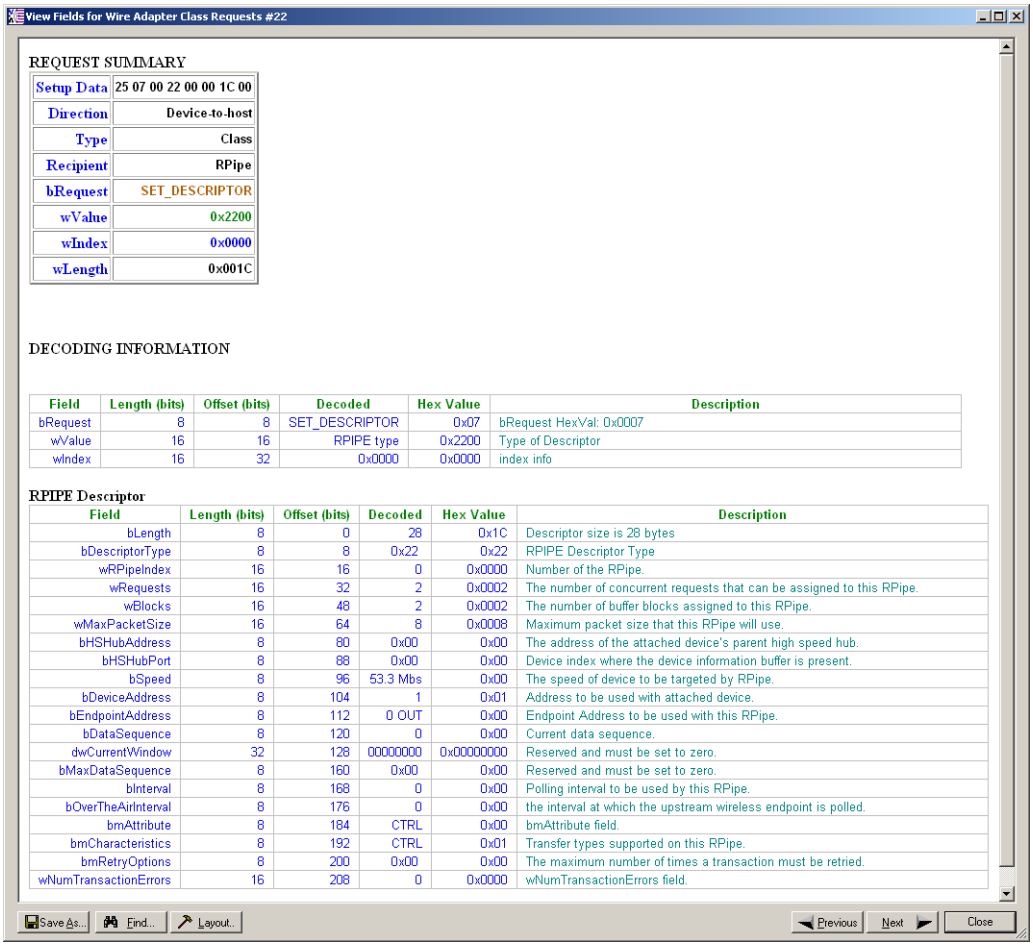

Figure 7.9 View Fields for Wire Adapter Class Requests Request Text Box

Figure 7.10 shows a Mass Storage Bulk-only Request:

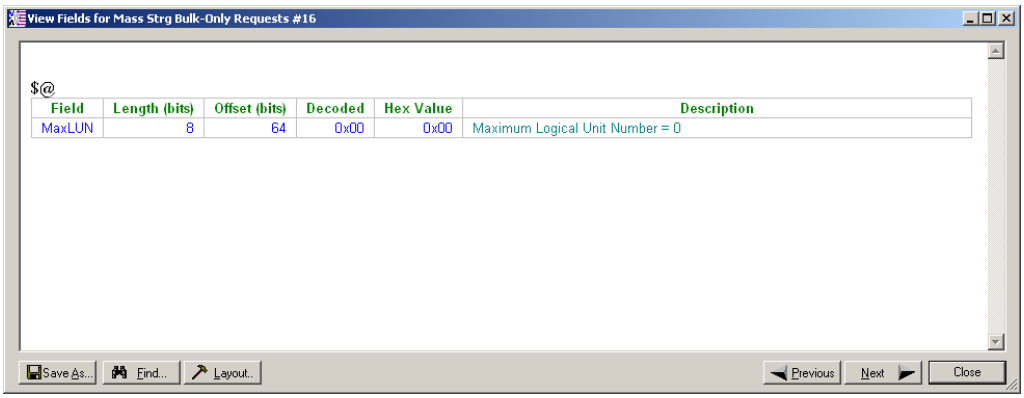

Figure 7.10 View Fields for Mass Storage Bulk-only Class Requests Text Box

Decoding Vendor Requests

To decode a vendor request:

- Select **Decode ... Request** to display the View Fields for ... Vendor Requests text box.

An example of a vendor request is UWBTracer™ Command Set.

Decoding Undefined USB/WUSB Device Requests

A Decoding Request may not belong to any of the defined decoding groups (Standard, Class, or Vendor).

Decoding using Endpoint Information

To decode using the endpoint information:

Step 1 Left-click the **Bulk/Int Transfer** field to display the Bulk/Int Transfer (IN/OUT transaction with data) menu.

Step 2 Select **Decode as ... Endp** to open a View Fields for ... Endp text box.

Figure 7.11 shows a Wire Adapter Data Transfer In Endp decoding:

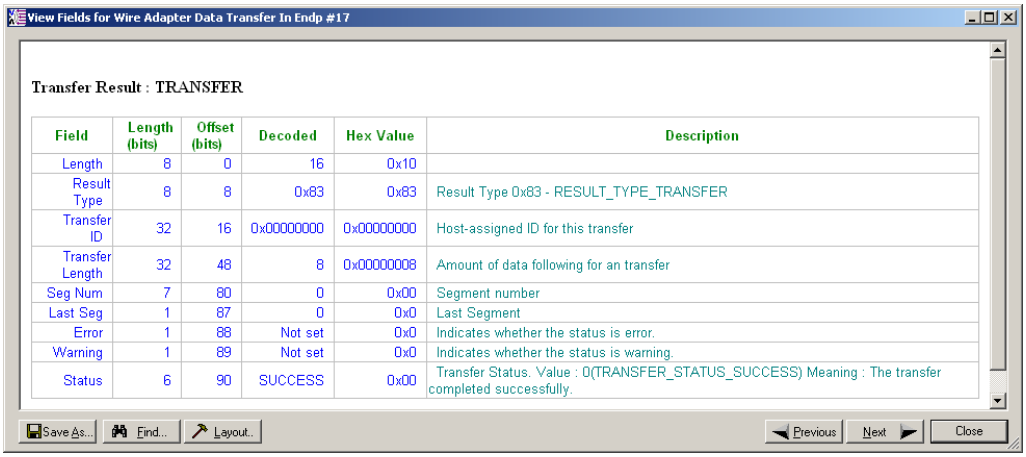

Figure 7.11 View Fields for Wire Adapter Data Transfer In Endp Text Box

Figure 7.12 shows a Wire Adapter Data Transfer Out Endp decoding:

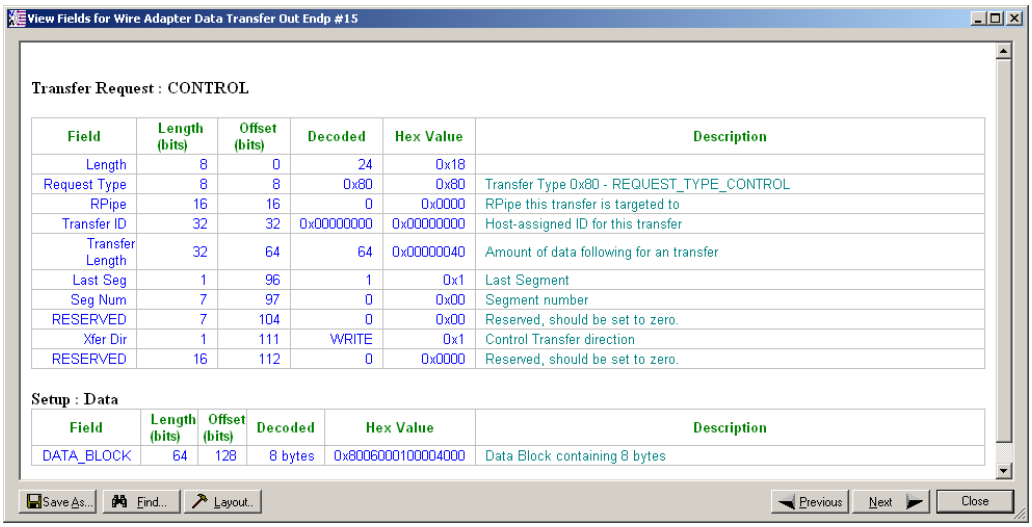

Figure 7.12 View Fields for Wire Adapter Data Transfer Out Endp Text Box

Figure 7.13 shows a Wire Adapter Data Transfer Out Endp decoding:

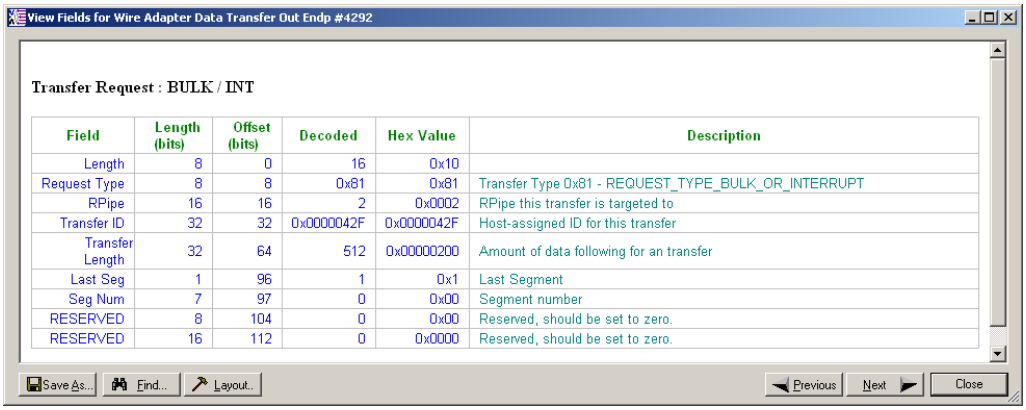

Figure 7.13 View Fields for Wire Adapter Data Transfer Out Endp Text Box

Figure 7.14 shows a Wire Adapter Notif Endp decoding:

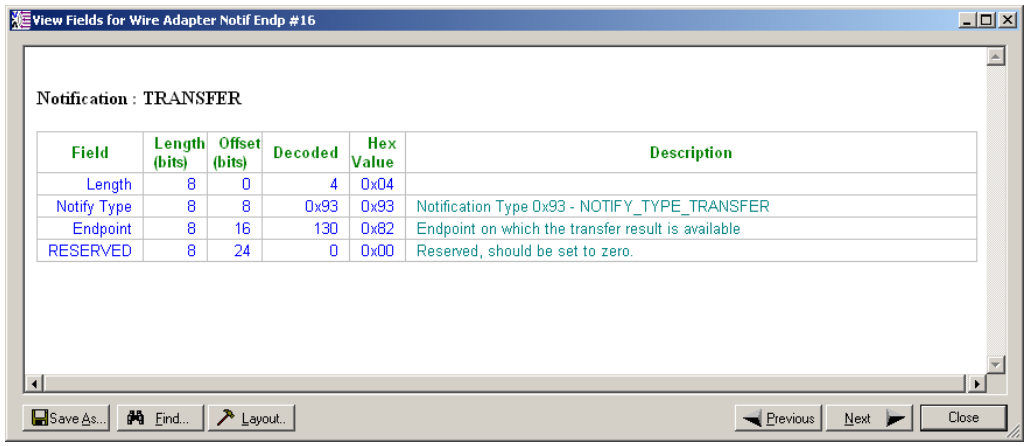

Figure 7.14 View Fields for Wire Adapter Notif Endp Text Box

Figure 7.15 shows a Mass Storage Bulk-only SCSI In Endpoint decoding:

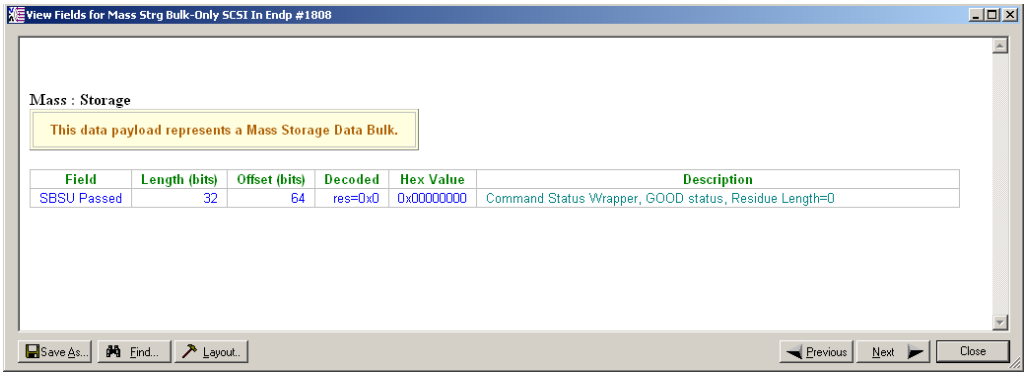

Figure 7.15 View Fields for Mass Storage Bulk-only SCSI In Endp Text Box

Figure 7.16 shows a Mass Storage Bulk-only SCSI Out Endpoint:

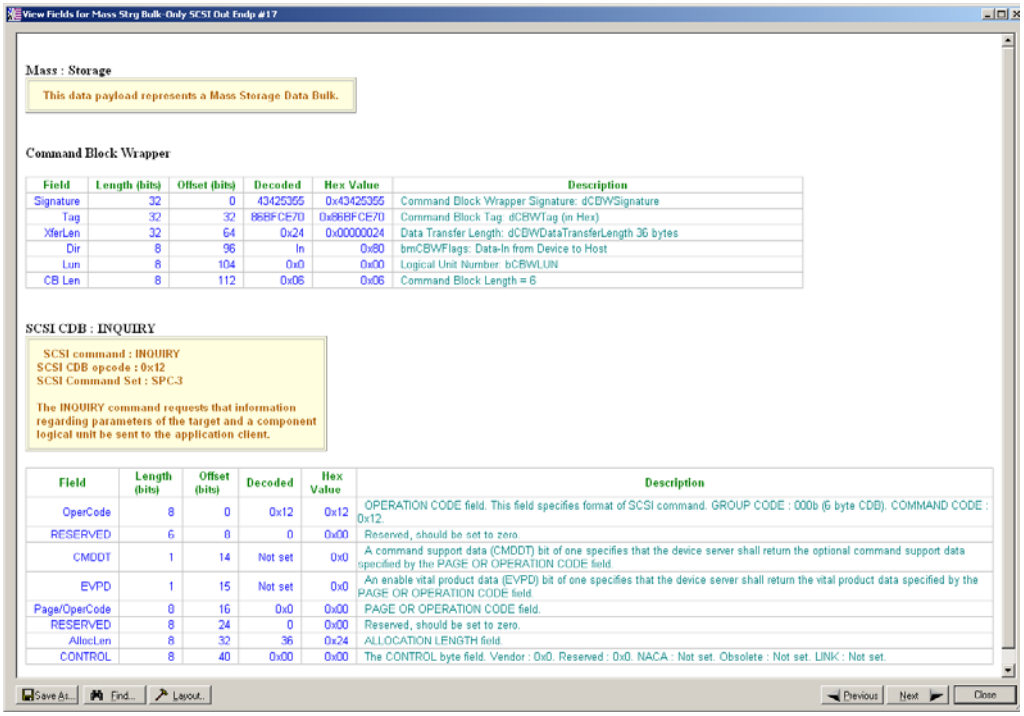

Figure 7.16 View Fields for Mass Storage Bulk-only SCSI Out Endp Text Box

Changing the Layout of Decode Requests

In the View ... Fields windows, the Decoding Information and the Descriptor information blocks (following the Request Summary information) have the following columns:

- **Field**: such as bRequest, wValue, wIndex, bLength, bDescriptorType, wTotalLength
- Length in bits
- Offset in bits
- **Decoded**: hex value typically equal to Hex Value
- **Hex Value**: hex value typically equal to Decoded
- **Description**: short description of field

To change the layout of decode requests display:

Step 1 Click **Layout** to display the View ... Fields Dialog Layout dialog box:

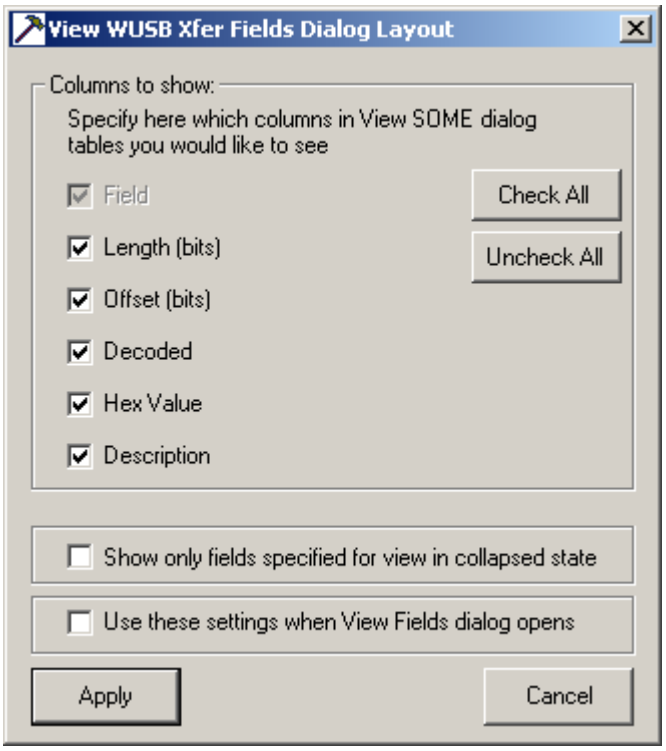

Figure 7.17 View WUSB Xfer Fields Dialog Layout Dialog Box

Step 2 To display the available columns of data, use the checkboxes for **Length, Offset, Decoded, Hex Value**, and **Description**.

You can **Check All** or **Uncheck All**.

Step 3 To show only the fields of Collapsed mode, check **Show only fields specified for view in collapsed mode**.

Step 4 To retain settings for future viewing of Decode Request fields, check **Use these settings when View Fields dialog opens**.

Chapter 8: Decoding WLP Frames and Protocols

8.1 Overview

The WLP protocol defines four types of frames, each identified by a frame type field:

- Data frames
  - Standard data frames
  - Abbreviated data frames
- Control frames
- Association frames

Data frames can carry high-level protocol data payloads, such as IP, ARP, and TCP.

The LeCroy UWB*Tracer/Trainer* software can decode:

- All the WLP frame types at the WLP level (using the WLP button on the transaction toolbar)
- IP and ARP Ethernet protocol data units carried inside WLP data frames (using the WI ETH button on the transaction toolbar)
- TCP and UDP Internet Protocol (IP) protocol units carried inside WLP data frames (using the WI IP button on the transaction toolbar)

The WLP levels are a special way to decode WiMedia frames, so you cannot expand the WLP levels.

You can show or hide the full MAC Payload or MAC/PHY headers
(see “Trace Level Views for WLP” on page 51).

8.2 Decoder Script Files

The UWB*Tracer/Trainer* analyzer software uses script files to decode WLP frames. The script files are read when the application is initialized. Once read, the Analyzer then decodes WLP frames using script-based decoders.

Script-based decoders are compiled from **.dec** decoder files, which describe a decoding program in a C-like language. The **.dec** files are in the **Scripts** directory under the application directory.

Each **.dec** file stores a decoding routine that is used to decode some kind of recorded traffic. When the application starts, these files are loaded dynamically.

See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

The WLP protocol script folder tree starts in the **MUXProtocols** folder in the **C:\Program Files\LeCroy\UWBTracer\Scripts** directory.

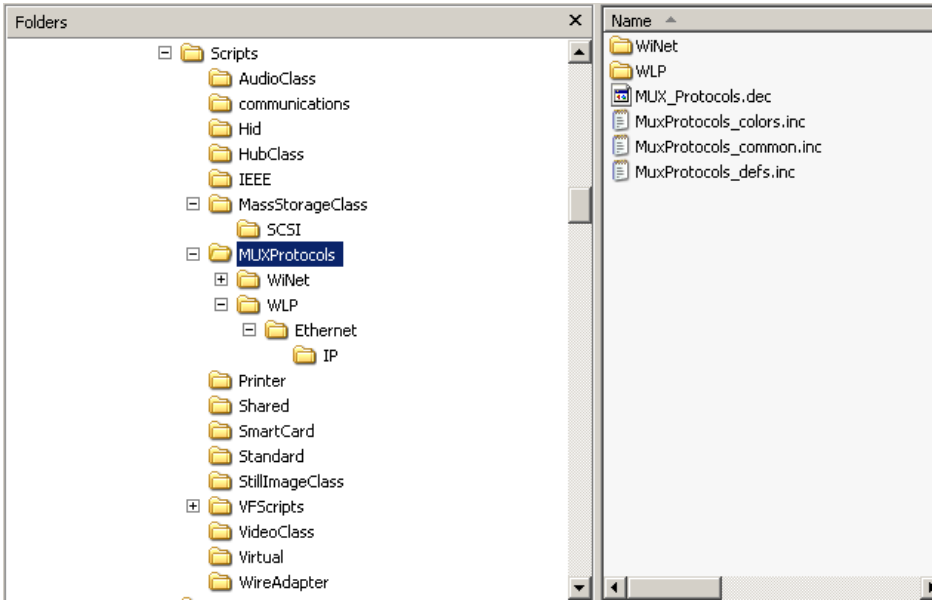

Figure 8.1 WLP Script Folder

Subdirectories are supported.

The **WLP** subfolder contains all script files necessary to decode the WLP protocol and the high-level protocols based on WLP.

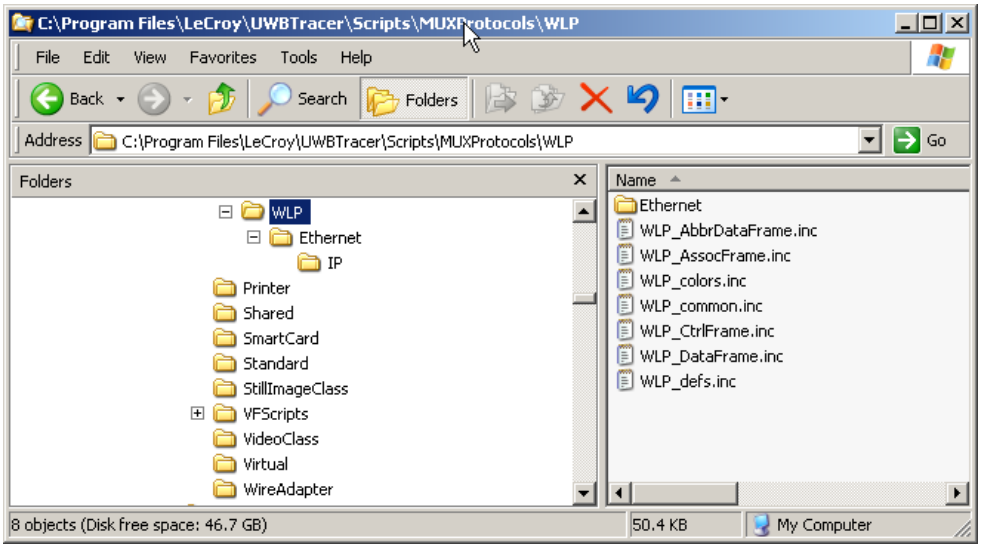

Figure 8.2 WLP Subfolder

The **Ethernet** subfolder contains the script files necessary to decode IP and ARP Ethernet-based protocols.

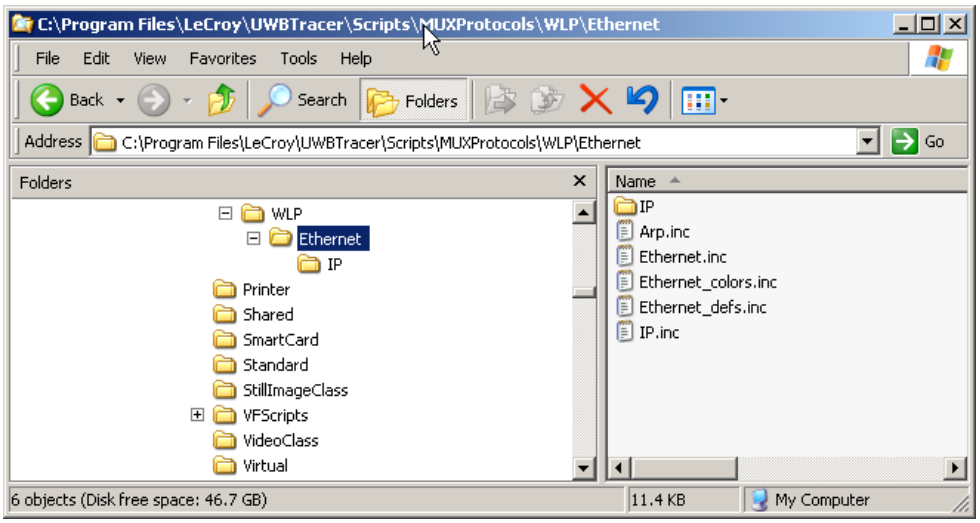

Figure 8.3 Ethernet Subfolder

The **IP** subfolder contains the script files necessary to decode the TCP and UDP IP-based protocols.

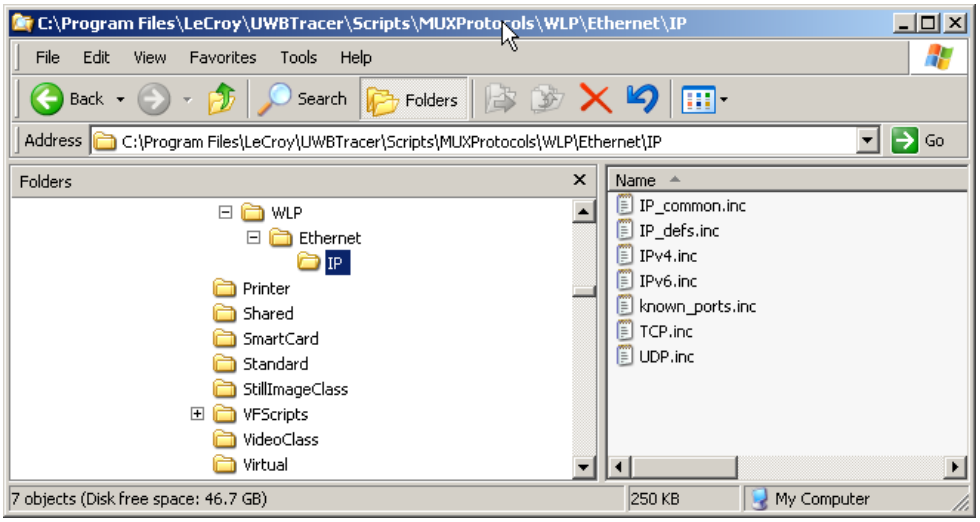

Figure 8.4 IP Subfolder

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Chapter 9: Reports

Reports assist you in analyzing traffic recorded by the analyzer. The available reports are:

- **File Information**: To view general information about the trace file.
- **Error Summary**: To view a count of errors in a trace file.
- **Timing Calculations**: To view timing measured between two markers or counters set within the trace file.
- **Traffic Summary**: To view a summary of protocol-related information in the trace file summary information about a selected group of items in the trace file (such as a count of particular frame or packet types).
- **Device List:** Lists the DUTs, active devices, archive devices, wireless USB, and WLP devices by DUTs, Type, EUI-48, Address, Alias, Last Updated, and User Notes
- **Timing Analysis Views**: Analyzes Beacon, WUSB, and Superframe timing.
- **Run Verification Scripts**: To run verification scripts over the open trace, perform custom trace analysis, and create custom reports. (Fore more information, see the *LeCroy UWBTracer Verification Script Engine Manual*.)

See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

Reports are available from the Report menu and from buttons on the Tool bar.

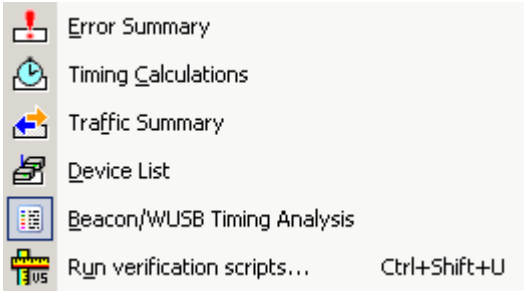


Figure 9.1 Report Menu

This chapter also describes:

- **Real Time Statistics**: Summarizes the occurrences of frame types and error types in a trace file for all connected devices.
- **Bus Utilization**: Displays information on bandwidth use for the recording channels.

9.1 File Information

To view general trace information, such as time a trace was made, version of the analyzer firmware, and BusEngine™ used, select **Report** > **File Information** to display the File Information window (Figure 9.2).

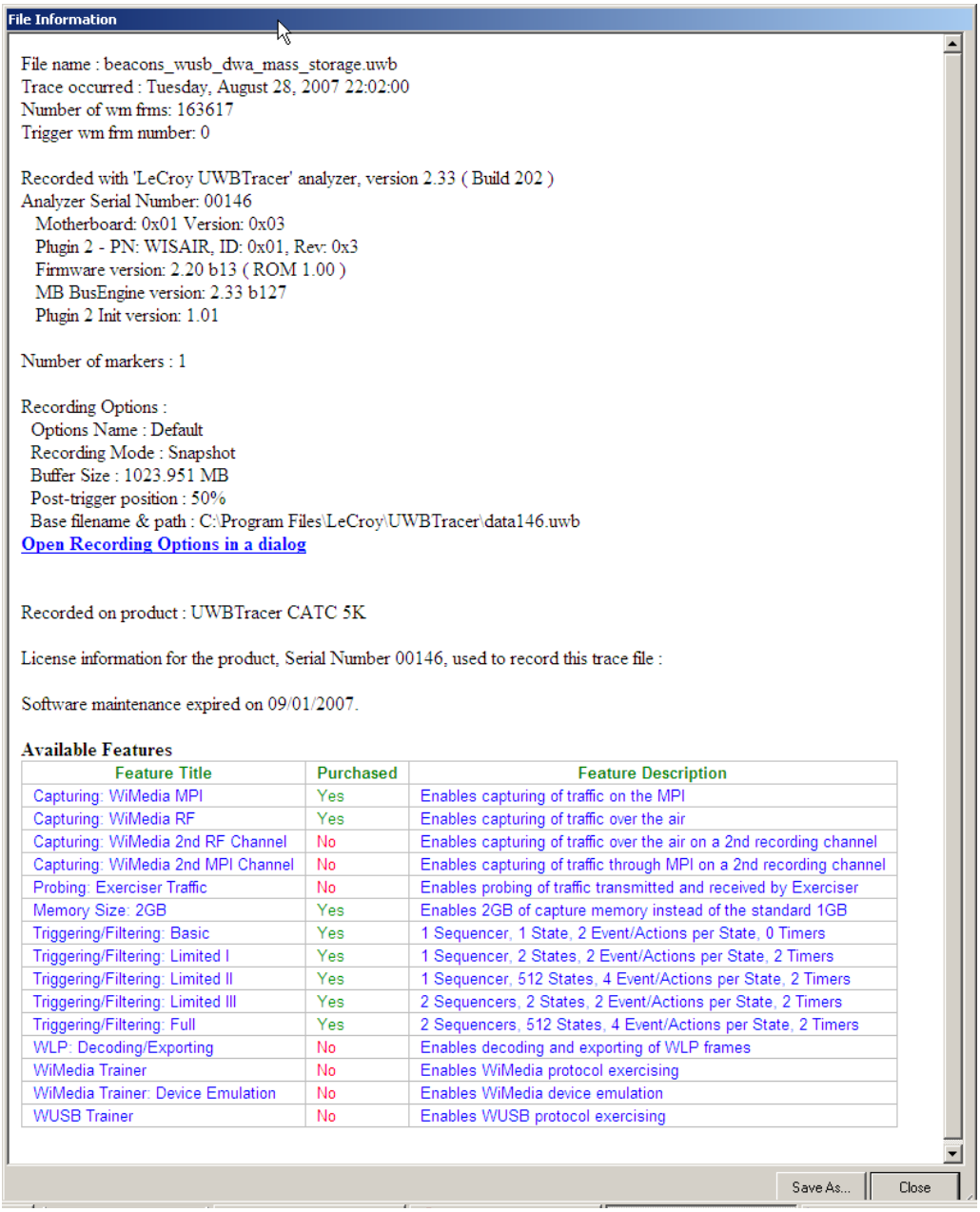


Figure 9.2 File Information Window

To view the Recording Options settings, select the **Open Recording Options in a dialog** link to display the Recording Options window.

9.2 Error Summary

To view a count of errors, select **Report** > **Error Summary** to display the Traffic Summary window (Figure 9.3).

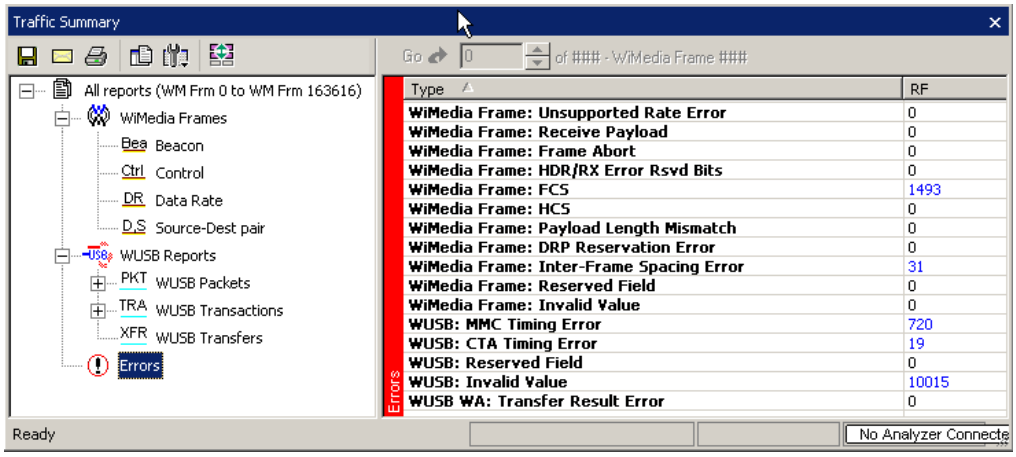


Figure 9.3 Error Summary Display

The right pane displays the error counts.

Note: You cannot change the types of errors included in the summary.

9.3 Timing Calculations

The timing calculator measures timing between any two specified frames. To run the Timing Calculator:

Step 1 From the Report menu, select **Timing Calculations**.

Step 2 Select the range From Frame To Frame, and then click the **Calculate** button to display the results.

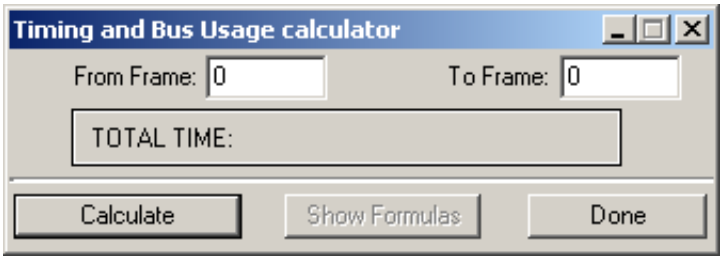


Figure 9.4 Timing and Bus Usage Calculator

9.4 Traffic Summary

To view a summary of protocol-related information, select **Report** > **Traffic Summary** to display the Traffic Summary window (Figure 9.5).

In the left pane, select or expand a WiMedia or WLP report or Errors to display the items and counts of the report in the right pane.

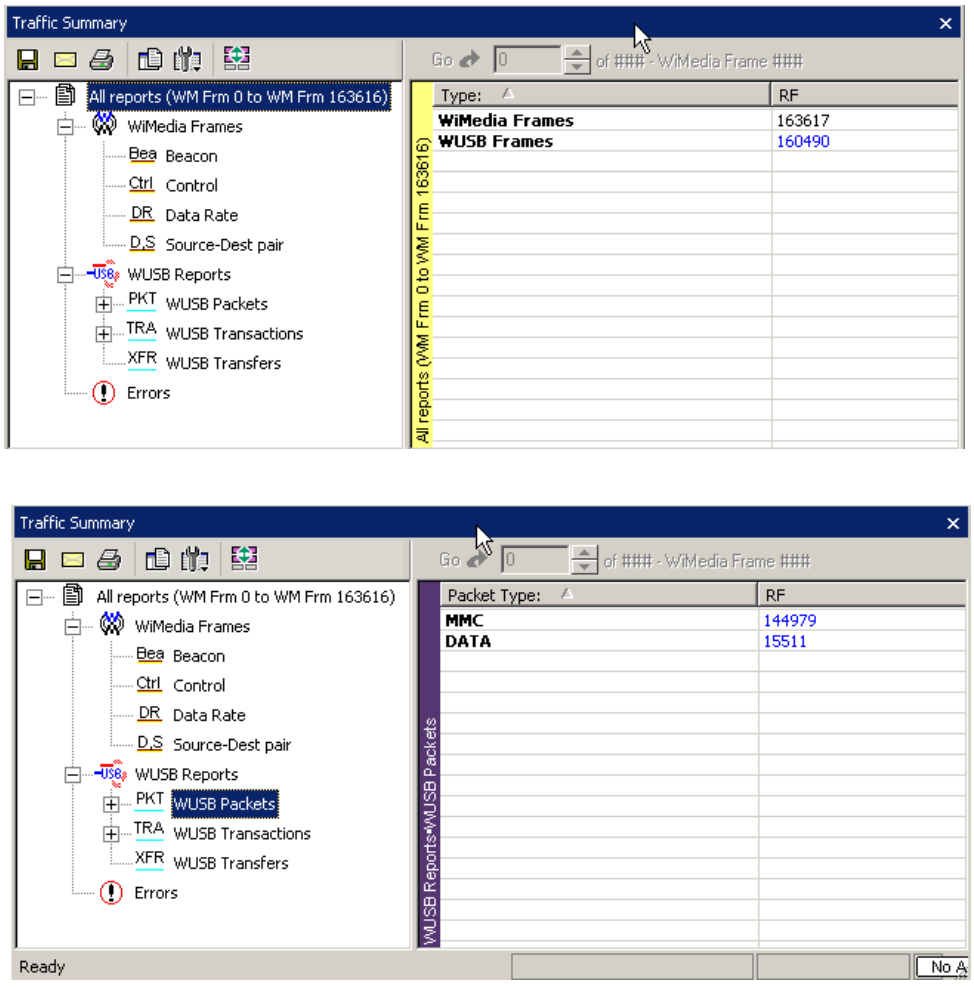


Figure 9.5 Traffic Summary Window

Traffic Summary Buttons

The Traffic Summary toolbar provides a shortcut to commands that control the traffic summary (Figure 9.6).

Figure 9.6 Traffic Summary Toolbar

Table 9.1 describes the Traffic Summary buttons.

Table 9.1Traffic Summary Buttons

	Save. Saves the traffic summary to a file in HTML format.		Text. Displays the traffic summary in text format.
	Email/Send. Sends the traffic summary in HTML format via an email.		Options/View. Opens a menu that allows you to set the way trace file items are counted for the traffic summary.
	Print. Prints the traffic summary.		Select Range. Sets a range of items to be counted in the trace file.

Using the Traffic Summary

To use the traffic summary window, you need to know how to select the items for which you want a summary, to set a range for the summary, and to use navigational features.

Selecting Traffic Summary Items

As described, you use the left pane of the Traffic Summary window to select the item for which you want to show a summary in the right pane.

For example, suppose you want to show the count of all MPI Frames in the trace. To do so, select MPI frames in the left pane (Figure 9.7). A count of the number of MPI frames appears in the right pane. In this example, there are three MPI Control frames and three MPI Data frames.

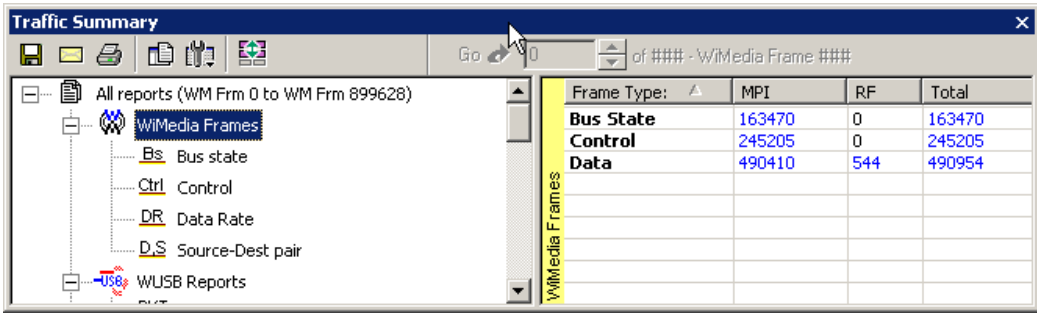


Figure 9.7 Selecting an Item for the Traffic Summary

You can select multiple items in the left pane, each resulting in a separate summary in the right pane (the summaries follow each other sequentially) (Figure 9.8). To select more than one item, hold down the CTRL key as you select items in the left pane.

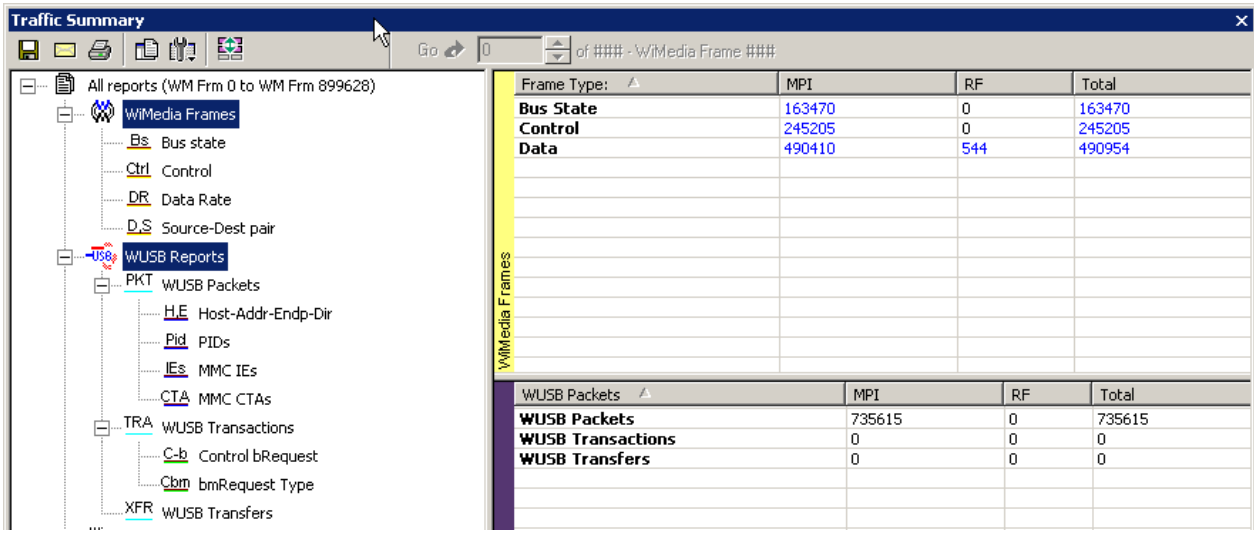


Figure 9.8 Selecting Multiple Items for the Traffic Summary

Setting Traffic Summary Display Options

You can control the appearance of the traffic summary display using the Options button on the Traffic Summary tool bar. When you click the button, the Options drop-down menu appears (Figure 9.9).

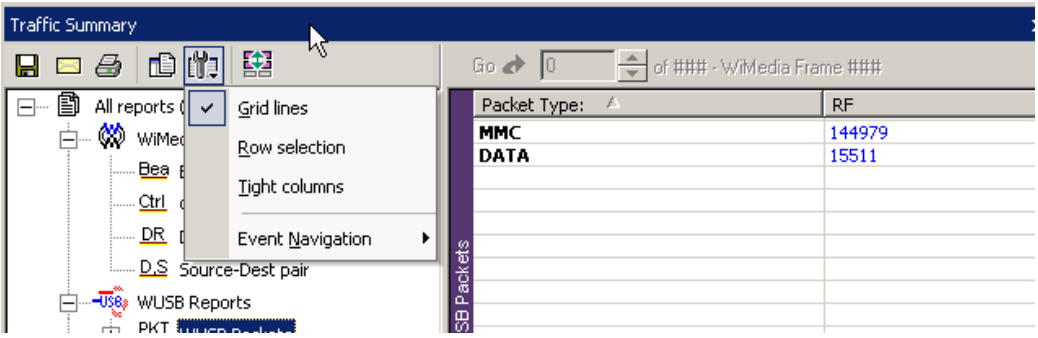


Figure 9.9 Traffic Summary Options Menu

Grid Lines: Enables/disables grid lines to the display.

Row Selection: Enables/disables row highlighting in the right pane.

Tight Columns: Enables/disables narrow columns in the display.

Event Navigation: Displays a menu that allows you to set parameters for using traffic summary to navigate in the trace (trace navigation is described later in this section) (Figure 9.10).

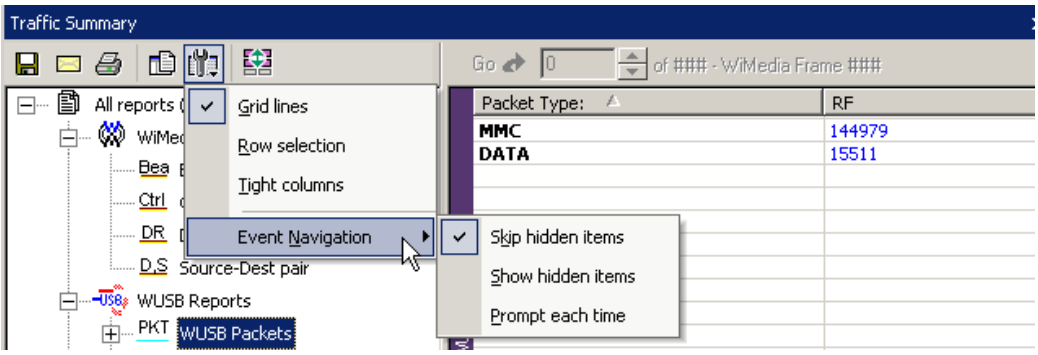


Figure 9.10 Event Navigation Submenu

In the Event Navigation menu, the **Skip hidden items** option means you cannot navigate to hidden items in the trace. **Show hidden items** means if you navigate to a hidden item, the item is shown in the trace. **Prompt each time** means you can navigate to a hidden item, but UWB*Tracer/Trainer*™ prompts you to indicate whether or not you want the item to appear in the trace.

Setting Traffic Summary Range

You can select a range within the trace file for which items are displayed in the traffic summary. All occurrences of the item outside of the range are not included in the summary. You can set the range with respect to particular frame or packet types. Your choice of these types is context-sensitive and is determined by the current trace decode level (MPI trace level view, WUSB packet level view, and so on).

In the following example, suppose you have trace decode level set to WUSB packet level view and suppose the trace contains six MPI frames.

To collect statistics from the third through fifth MPI frames (inclusive):

Step 1 With the trace file open, select **Traffic Summary** from the Report menu (or click the **Traffic Summary** button on the Main tool bar). The Traffic Summary window appears.

Step 2 Select **MPI** frames in the left pane of the Traffic Summary window. The summary for MPI frames appears in the right pane.

Step 3 Click the **Select Range** button on the Traffic Summary tool bar (Figure 9.11).

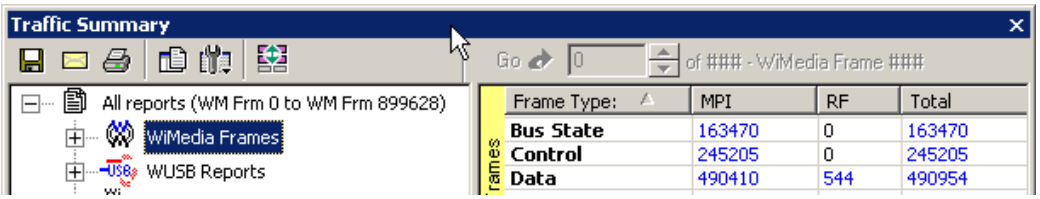


Figure 9.11 Selecting Traffic Summary Range

Step 4 The Select Range dialog box appears (Figure 9.12).

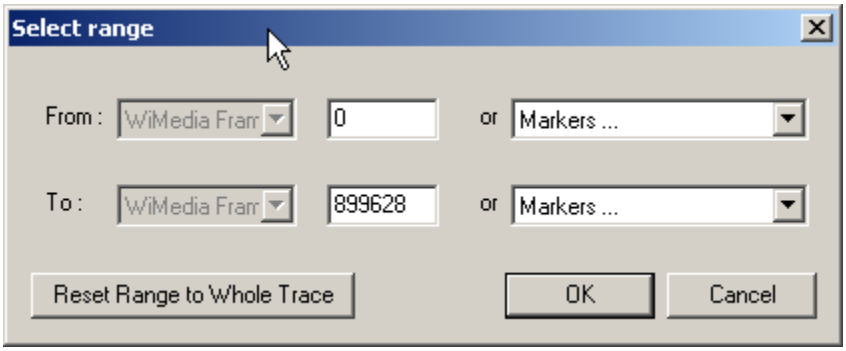


Figure 9.12 Select Range Dialog Box

Step 5 In the Select Range dialog box, select **WiMedia Frame** as the protocol unit. Enter 3 as the start point of the range (Figure 9.13).

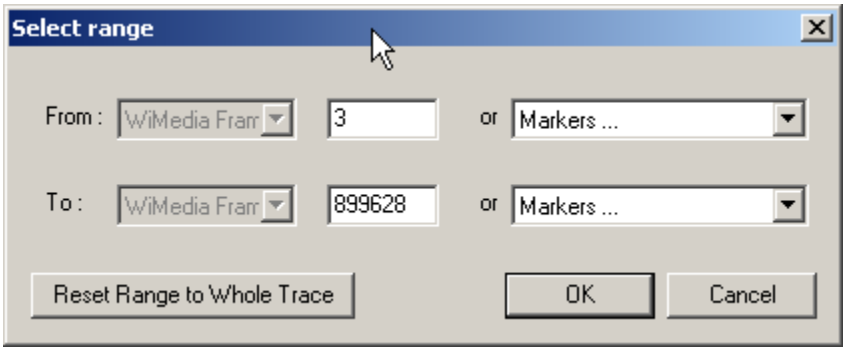


Figure 9.13 Setting Range to Start on Third Frame

Step 6 The Traffic Summary window now shows statistics for Frame 3 through

Frame 16876 of the trace (Figure 9.14).

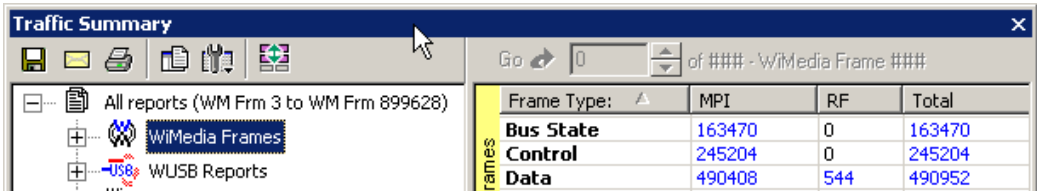


Figure 9.14 Traffic Summary for Three MPI Frames

Using the Display to Navigate Within the Trace File

You can use the Traffic Summary window to navigate to a specific frame or packet in the trace file. For example, suppose you want to go to the second MPI Data frame.

To navigate:

Step 1 With the trace file open, select **Traffic Summary** from the Report menu (or click the **Traffic Summary** button on the Main tool bar). The Traffic Summary window appears.

Step 2 Select **MPI** frames in the left pane of the Traffic Summary window. The summary for MPI frames appears in the right pane.

Note: In this example, the trace contains three MPI Control frames and three MPI Data frames.

Click the count in the total column for Data frames (Figure 9.15).

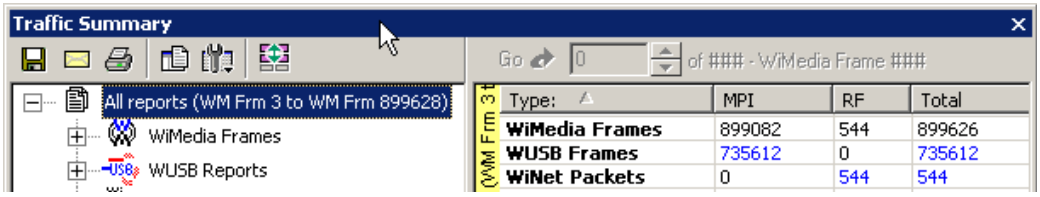


Figure 9.15 Selecting the Row for Data Frames

Step 3 The Go box becomes active at the top of the right pane (Figure 9.16). By default, it is set at the first MPI Data frame (MPI 1), shown at the top in the trace.

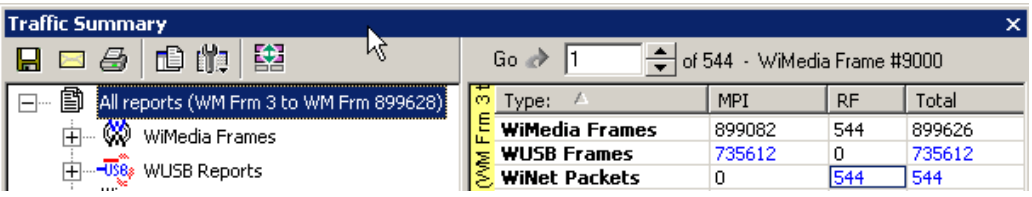


Figure 9.16 First MPI Data Frame at Top of Display

Step 4 In the Go box, enter 2 to indicate that you want to go to the second MPI Data frame in the trace (Figure 9.17).

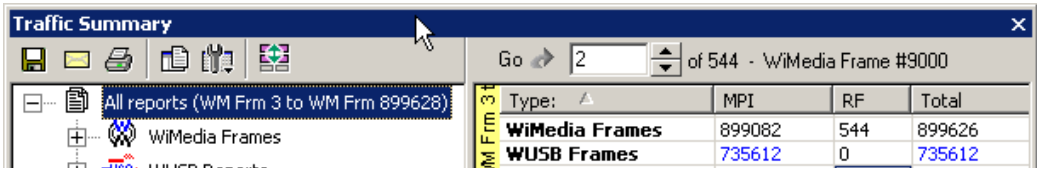


Figure 9.17 Set Go Box to Second MPI Data Frame

The trace display adjusts so that the second Data frame appears at the top of the display (MPI 3), shown at the top of the trace (Figure 9.18).

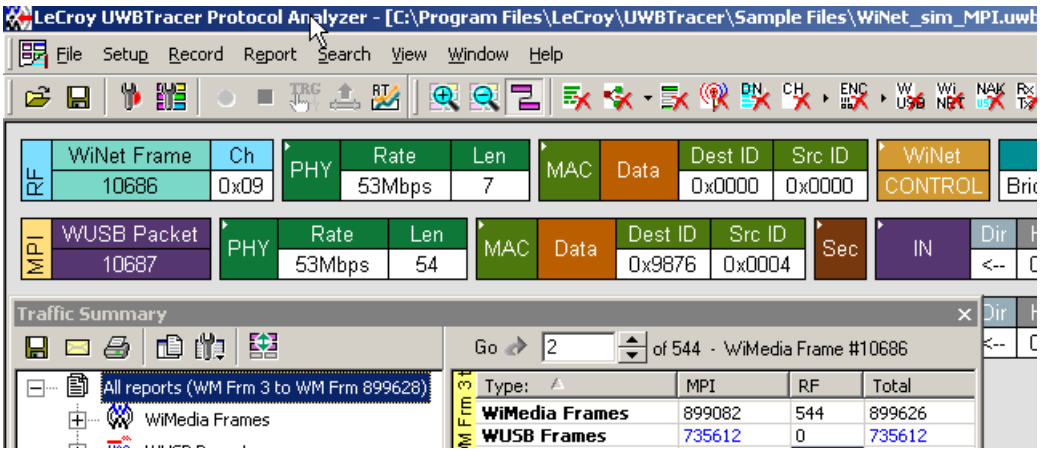


Figure 9.18 Set Go Box to Second MPI Data Frame

9.5 Real-Time Statistics

To display a summary of the occurrence of various types of protocol units in a trace file, select **Report** > **Traffic Summary** from the Report menu. A Traffic Summary window appears, showing the traffic data (Figure 9.5).

To display information on links activity in real-time, select **Report** > **Real-Time Statistics** from the Report menu. The Real-Time Statistics window shows frames, errors, and events occurrences (Figure 9.19).

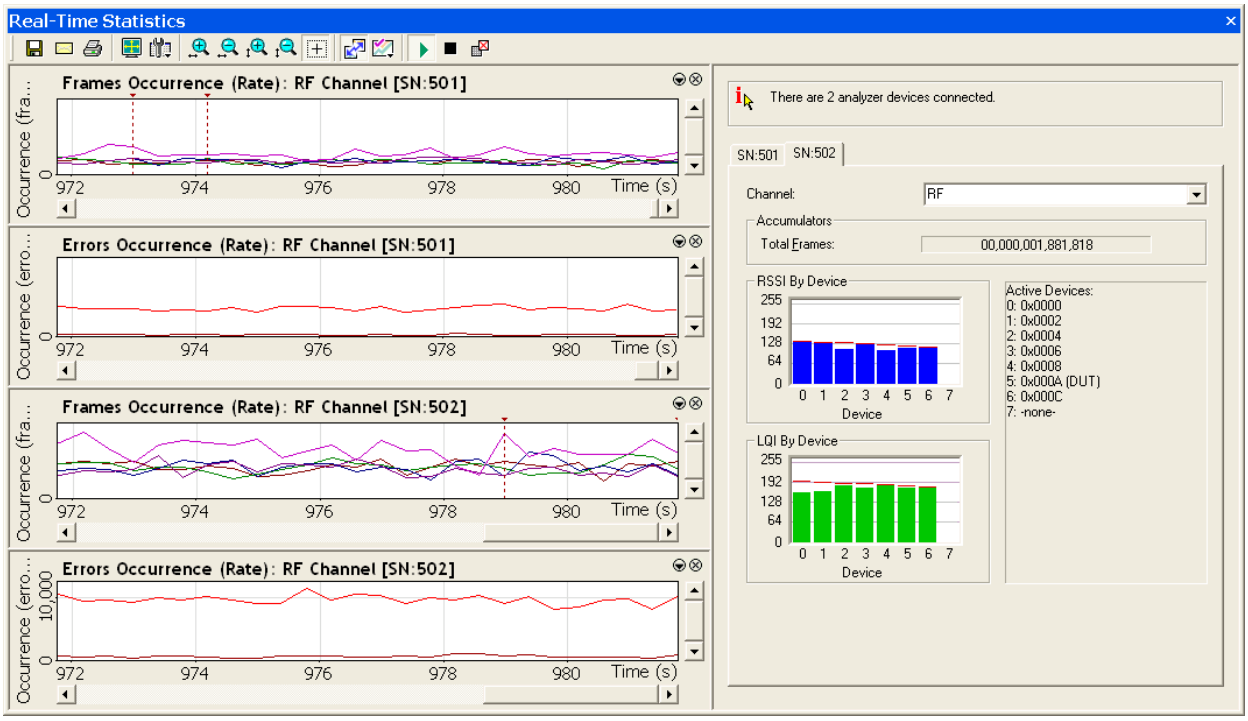


Figure 9.19 Real-Time Statistics window

The window has two areas:

- **Graph Area** (left side of window)**:** Provides graphs that show occurrences of particular frames, errors, and events.
- **General Statistics Area** (right side of window): Provides displays that show signal strength, link quality, number of frames, and signal status. All data that is displayed is calculated as averages over a sampling period.

Changing Devices

The window can display information from multiple analyzer devices. You toggle displays for each device by clicking on tabs in the General Statistics area. For example, as shown in Figure 10.19, the SN567 tab is selected. The display currently shows information for the SN567 device. To switch the display to information for the SN566 device, click the **SN566** tab.

Changing Channels

The window can display information from the MPI or RF channel. In the Channel field at the top of a device tab, select **MPI** or **RF** from the drop-down list. Figure 9.19 shows the MPI channel of the SN566 device.

Tool Bar

The Real-Time Statistics window tool bar provides quick access to key functions of the window (Figure 9.20).

Figure 9.20 Real-Time Statistics Tool Bar

Table 9.2 describes the Real-Time Statistics buttons.

Table 9.2Real-Time Statistics Toolbar Buttons

	Save		Vertical Zoom out
	E-mail		"Click and Drag" Zoom Area
	Print		Synchronize Graph Areas
	Full Screen		Graph Areas
	View Settings		Start Real-Time Statistics
	Horizontal Zoom in		Stop Real-Time Statistics
	Horizontal Zoom out		Reset Graphs and Counters Display
	Vertical Zoom in		

Graph Area

The graph area displays two graphs: occurrences of frames and occurrences of errors. You can set the properties of each through a Graph Area Properties dialog box. To bring up the dialog box for either of the two graph types:

Step 1 Place the cursor in a graph area, then right-click to display a pop-up menu (Figure 9.21).

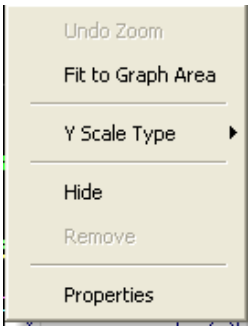


Figure 9.21 Real-Time Graphs Pop-Up Menu

Step 2 Click **Properties** to display the Graph Area Properties dialog box for the graph.

Graph Properties for Frame Occurrences

Figure 9.22 shows the Graph Properties dialog box for the Frame Occurrences graph, at the Data Frames panel. You can select from graphs that show statistics about different frame types: Beacons, Control Frames, Command Frames, Data Frames, Aggregated Data Frames, and Device-specific and General Events.You can change the Appearance and Color. Graphs for each analyzer in the analyzer network (SN566, SN567 and so on) are listed separately. When you add a new analyzer to the analyzer network, a new set of graphs is added to the list.

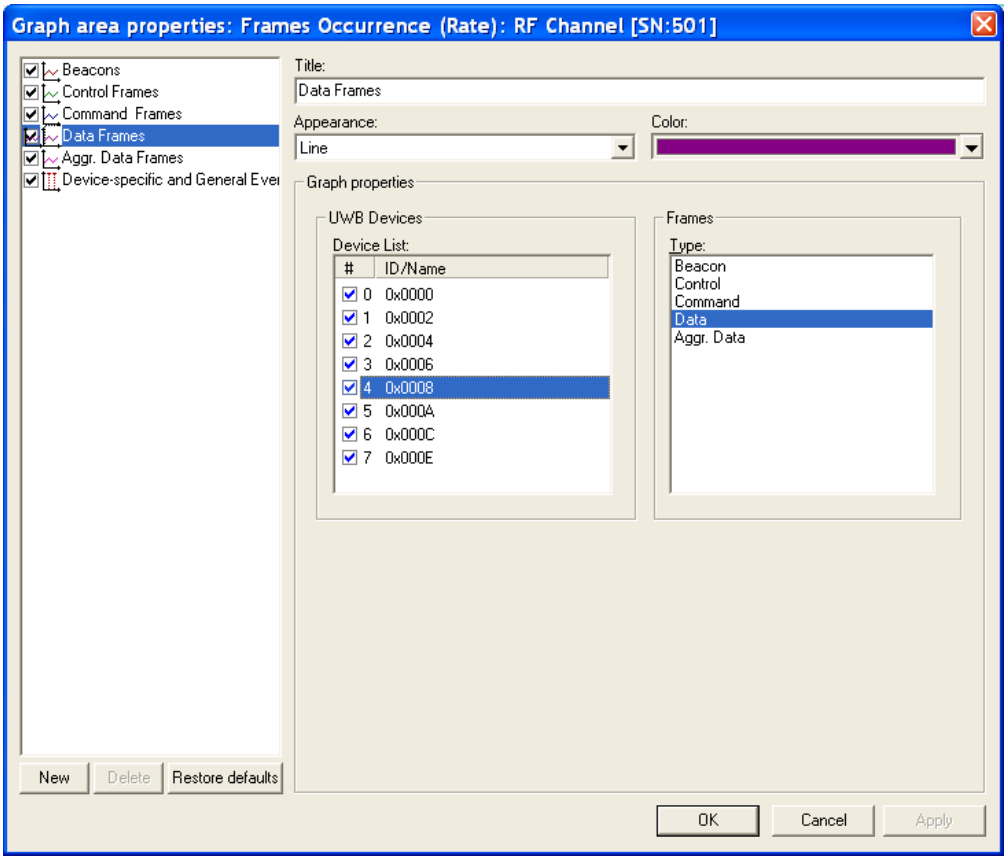


Figure 9.22 Graph Area Properties for Data Frames

Buttons

By default, all checkboxes are selected.

To remove a frame type from the display, deselect the frame type checkbox.

To add a frame type for a device, click **New** and select the device and frame type.

To delete a frame type for a device, highlight the frame type, then click **Delete**.

To restore the default settings for all frames, click **Restore defaults**.

Device-specific and General Events

Figure 9.23 shows the Graph Properties dialog box for the Frame Occurrences graph at the Device-specific and General Events panel.

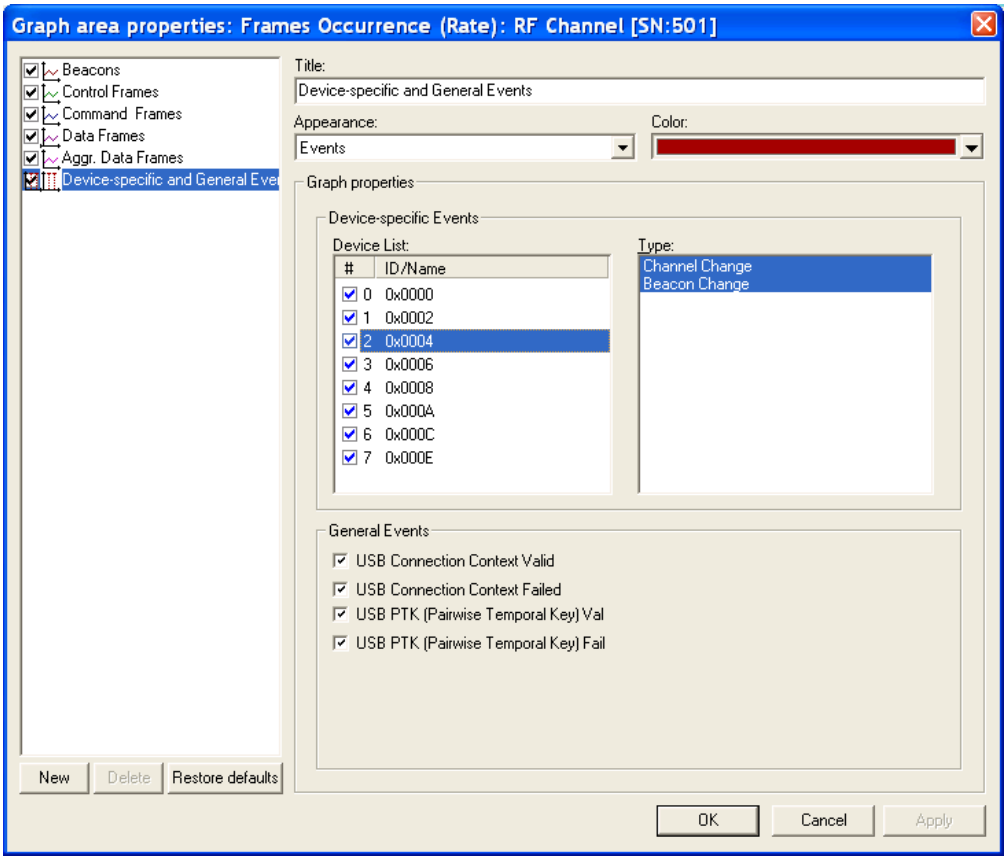


Figure 9.23 Graph Area Properties for Device-specific and General Events

You can change the Appearance and Color.

For Device-specific Events, the panel shows the device number and ID or Name. Events can be Channel Change or Beacon Change.

For General Events, the events can be USB Connection Context Valid, USB Connection Context Failed, USB Pairwise Temporal Key Valid, or USB Pairwise Temporal Key Failed.

Graph Properties for Error Occurrences

Figure 9.24 shows the Graph Area Properties dialog box for the Error Occurrences graph. There are two types of error graphs: Device-specific Errors and General Errors. You can change the Appearance and Color.

Device-specific Errors

Device-specific Errors can be associated with specific UWB devices.
The Device-specific Errors that you can monitor are:

- PHY Payload Error
- PHY Unsupported Rate

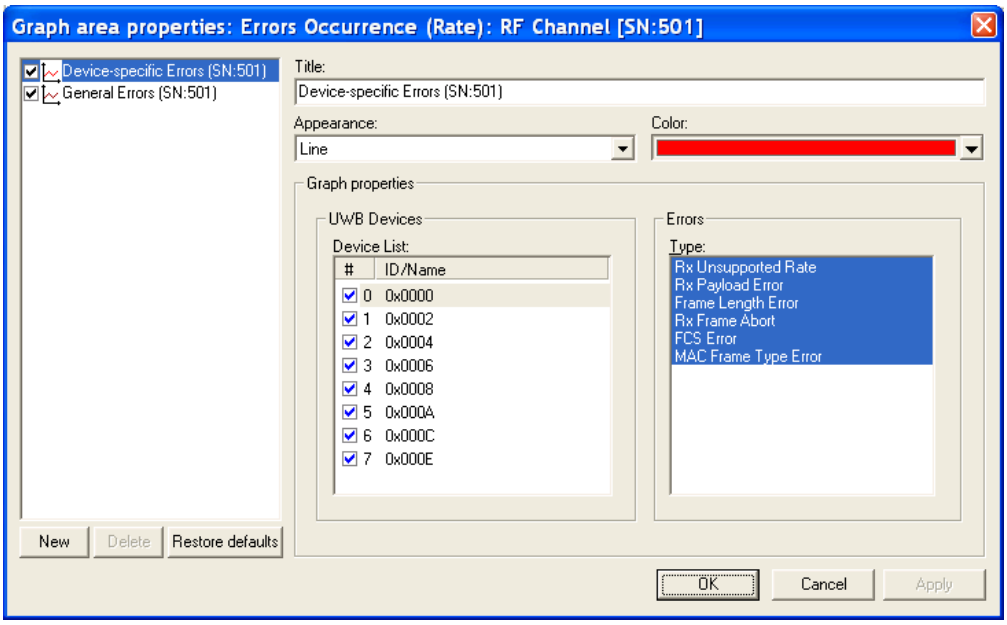


Figure 9.24 Graph Area Properties for Device-specific Errors

General Errors

General Errors cannot be associated with specific UWB devices. Currently, there is one General Error that you can monitor through this graph:

- Header Error

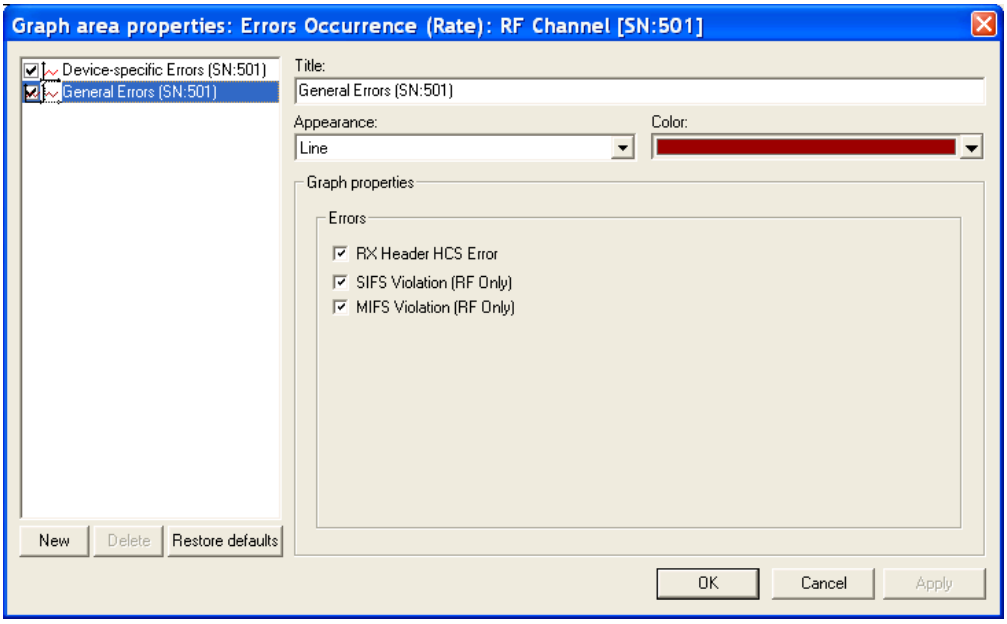


Figure 9.25 Graph Area Properties for General Errors

General Statistics Area

The right side of the Real-Time Statistics window shows the General Statistics area. The following figure (Figure 9.26) shows MPI information.

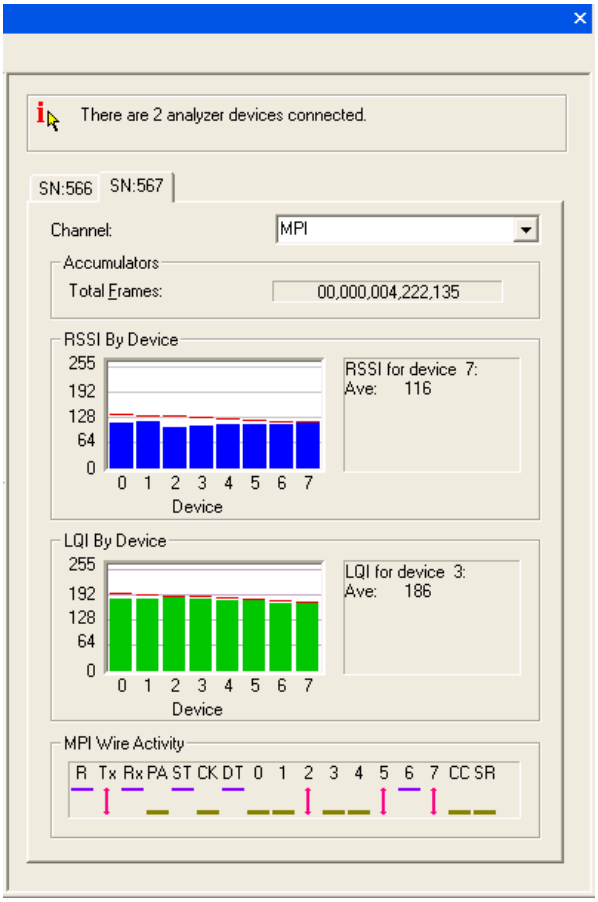


Figure 9.26 Real-Time Statistics Window: General Statistics Area for MPI Information

It has the following displays:

- Number of analyzer devices connected: Each one has a tab in the display.
- Channel: MPI or RF
- **Accumulators:** Running count of total frames displayed during the statistics collection period.
- **RSSI By Device:** Histogram showing received signal strength for UWB devices.
- **LQI By Device:** Histogram showing link quality for up to eight UWB devices.
- **MPI Wire Activity:** Signal state on the MPI bus:
  - Purple bar: Signal high
  - Green bar: Signal low
  - Red arrow: Signal toggled at least once during latest signal period

The following figure (Figure 9.27) shows MPI information.

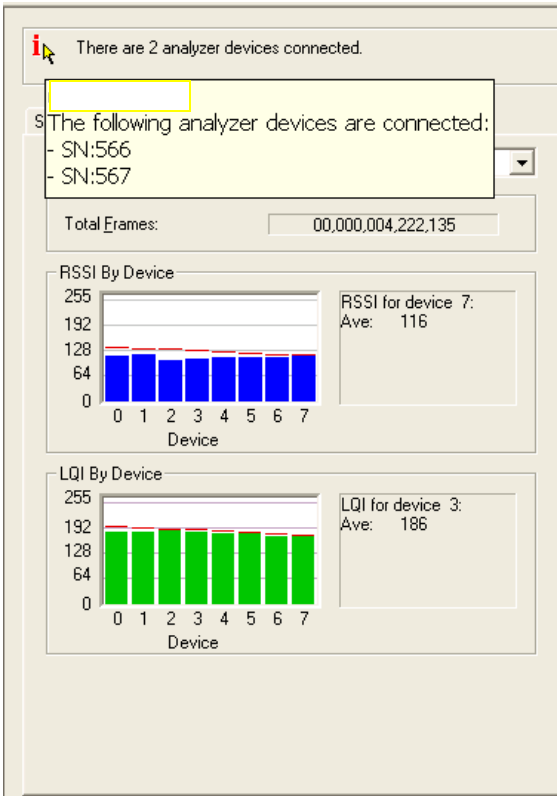


Figure 9.27 Real-Time Statistics Window: General Statistics Area for RF Information

It has the following displays:

- Number of analyzer devices connected: Each one has a tab in the display.
- Channel: MPI or RF
- **Accumulators:** Running count of total frames displayed during the statistics collection period.
- **RSSI By Device:** Histogram showing received signal strength for UWB devices.
- **LQI By Device:** Histogram showing link quality for up to eight UWB devices.

9.6 Bus Utilization

The **Bus Utilization** window displays information on bandwidth use for the recording channels.

To open the Bus Utilization window, select **Report > Bus Utilization** or click the button.

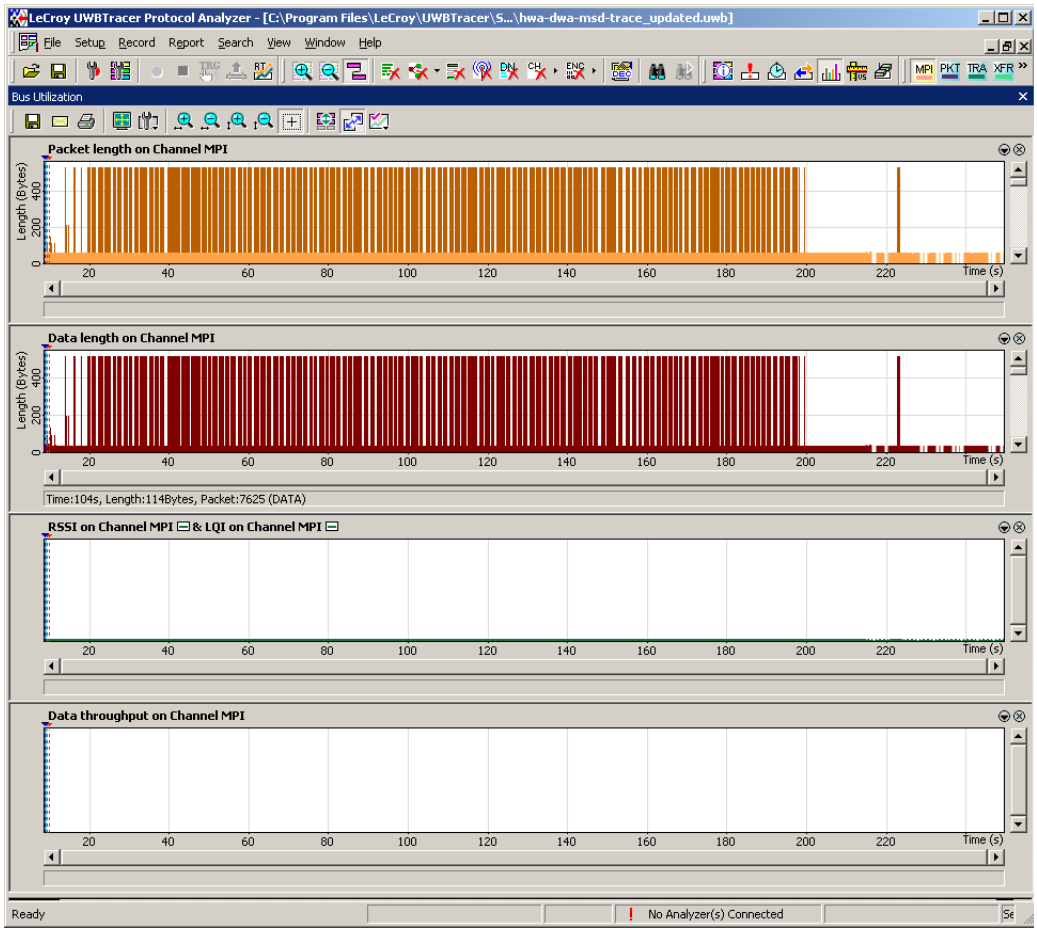


Figure 9.28 Bus Utilization Window

Bus Utilization Buttons

The Bus Utilization window has a row of buttons for changing the format of the displayed data and for exporting data:

Figure 9.29 Bus Utilization Buttons

The buttons have the following functions:

Save As - Saves the graphs as a bitmap file (*.bmp)

Email - Creates an email with a *.bmp file attachment of the graphs

Print

Full screen

View settings - opens a sub-menu with options for formatting the display. See “View Settings Menu” below.

Horizontal zoom in

Horizontal zoom out

Vertical zoom in

Vertical zoom out

"Click and Drag" zoom mode - Click diagonally to select and zoom in on part of the graph

Select Range

Synchronize graph areas - If two or more graphs are displayed, this button synchronizes the graphs to one another. Once synchronized, the positioning slider of one graph moves the other graphs.

Graph Areas - Presents options for displaying additional graphs of data lengths, packet lengths, and percentage of bus utilized.

View Settings Menu

Clicking the View settings button causes a menu to open with options for formatting the display.

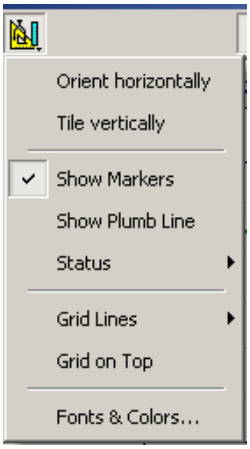


Figure 9.30 View Options: View Settings Menu

- **Orient Horizontally**: changes the orientation of bus usage to horizontal. After selecting this option, the menu has Orient Vertically.
- **Tile Vertically**: tiles the two graphs vertically (i.e., side by side). After selecting this option, the menu has Tile Horizontally.
- **Show Markers**: Places "tick" marks along the x axis of each graph.
- Show Plumb Line
- **Status**: Opens a submenu with the following options:
  - **Bar**: Displays a status bar at bottom of graph.
  - **Tooltip**: Causes a tooltip to appear if you position your mouse pointer over part of the graph and leave it there for a couple of seconds.
  - **None**: Turns off tooltips and the status bar.
- **Grid Lines**: Opens a submenu with the following options:
  - Both Axes: Displays both X and Y axis gridlines
  - X Axis: Displays X axis gridlines
  - Y Axis: Display Y axis gridlines
  - No Grid: Turns off gridlines
- **Grid on Top**: Moves the grid lines above the graph.

- **Fonts and Colors** - Opens a dialog box for setting the colors and fonts used in the graphs:

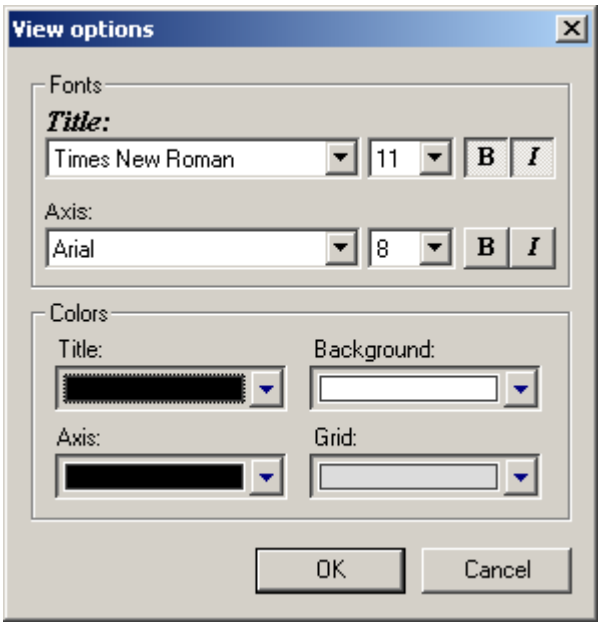


Figure 9.31 View Options: Fonts and Colors

Graph Areas Menu

The Graph Areas menu allows you to view different information types in the Bus Utilization window.

Step 1 Click the button to display the Graph Areas menu:

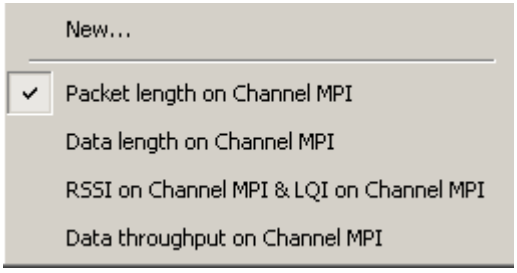


Figure 9.32 Graph Areas Menu

Step 2 Select the data you want to appear in the Graph Areas window: Packet length, Data length, RSSI & LQI, and/or Data Throughput.

To change the properties in the Bus Utilizations graph:

Step 1 In the **Graph Area**s menu, click **New** to display the Graph Area Properties dialog box.

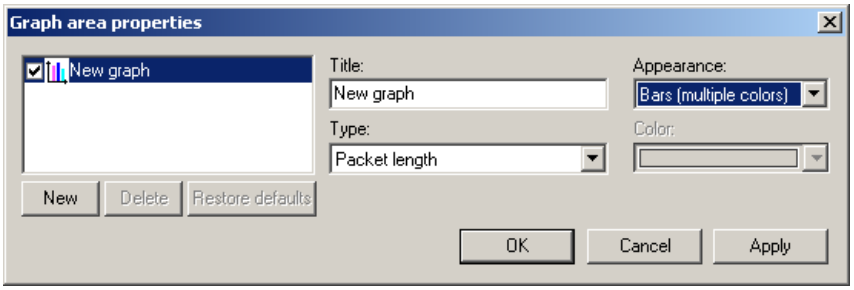


Figure 9.33 Graph Area Properties Dialog Box

Step 2 Select the graph or click **New** to make a new graph.

Step 3 Enter a graph title in the Title field.

Step 4 Select the Type: Packet length, Data Payload length, RSSI, LQI, or Data Throughput.

Step 5 Select the Appearance: single or multiple color bars or lines, or thick lines. If you selected bars, select the Color.

Step 6 Click **OK**.

9.7 Device List

The Device List window lists the DUTs, active devices, archive devices, wireless USB, and WLP devices by DUTs, Type, EUI-48, Device Address, Alias, Last Updated, Association, and User Notes.

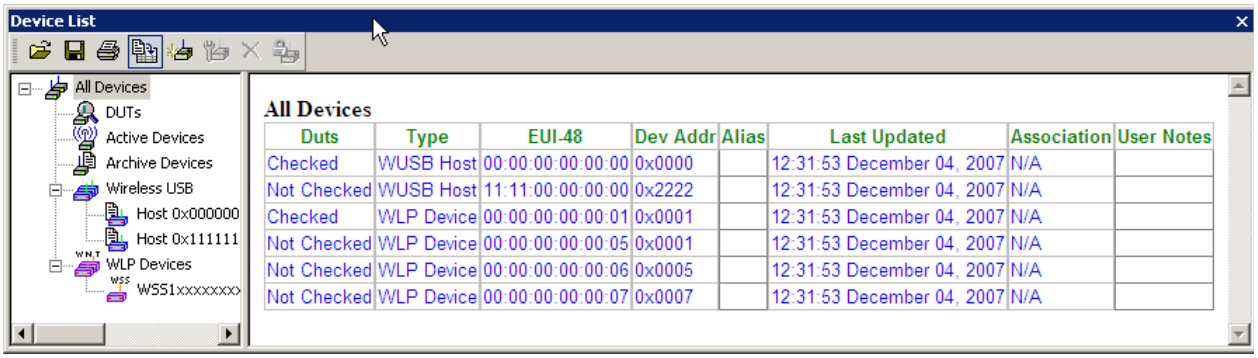


Figure 9.34 Device List Window

(For information about encryption keys, association data, and 4-way handshakes, see Section 11.5, “Secured Traffic” on page 167.)

For information about the recording options related to decryption and security, see Section 12.2, “Recording Options: RF” on page 178.

Options

You can display the list in HTML View or Grid View using the button.

If the Device List is displayed in HTML View, you can print the list. (Do not print from Grid View.)

You can import a UWB Device List Saved File (extension **.dl**).

You can save the Device List as a CSV file.

Adding a WiMedia Device

You can add a WiMedia device and change its settings, temporal key, connection context, or WSS group.

Edit General Settings

To add a WiMedia device:

Step 1 In the Device List window, click the **Add New Device** button to display the Add New Device dialog box at the General Settings tab:

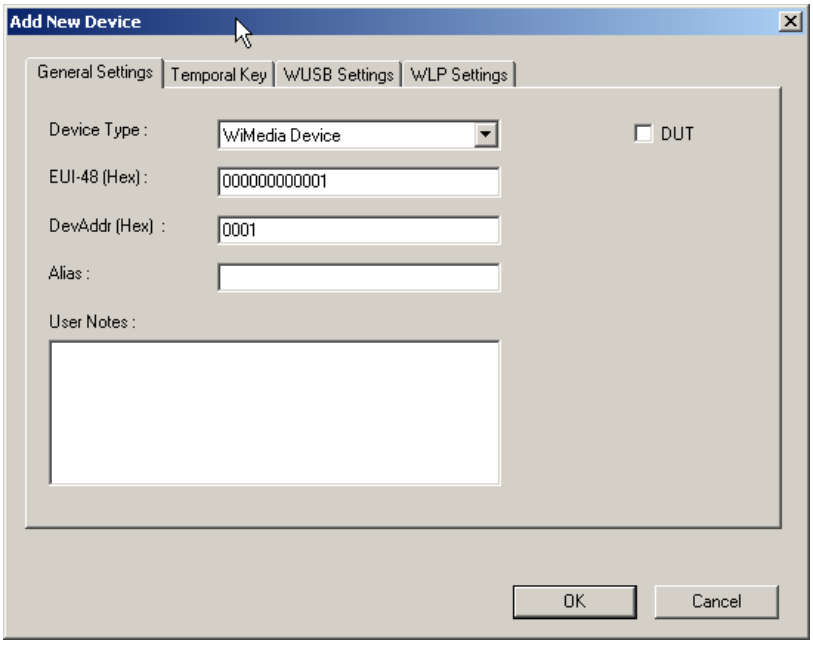


Figure 9.35 Add New Device Dialog Box General Settings Tab

Step 2 In the Add New Device dialog box, select the **Device Type** as WiMedia Device, Wireless USB Host, Wireless USB Device, or WLP Device.

Step 3 Enter the **EUI-48** in 12-digit hexadecimal.

Step 4 Enter the **Device Address** in 4-digit hexadecimal.

Step 5 (optional) Enter an **Alias** (up to 54 characters).

Step 6 (optional) Enter any **User Notes** (up to 76 characters).

Step 7 (optional) Select the **DUTs** checkbox if applicable.

Edit Temporal Keys

Because you can program the encryption keys, UWB*Tracer/Trainer* supports traffic decryption from any WiMedia device.

UWB*Tracer/Trainer* can decrypt traffic in real-time for up to 32 different PTK values.

To decrypt secured traffic using PTK values, in the Device List dialog box, program the PTK values.

If decryption is enabled in Recording Options, when an encrypted frame with a matching TKID is seen, UWB*Tracer/Trainer* decrypts the encrypted portion of the frame payload.

To add connection contexts for a WiMedia Device, use the Temporal Key tab. The WUSB Settings and WLP Settings tabs are not available.

To add temporal keys:

Step 1 Select the **Temporal Key** tab.

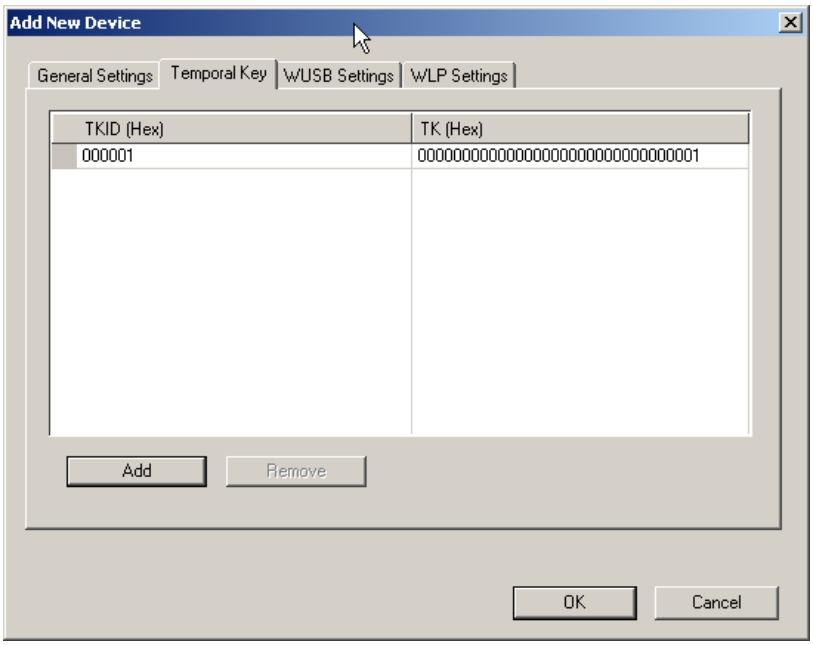


Figure 9.36 Temporal Key Tab

Step 2 Click **Add** to display the Add Temporal Key dialog box.

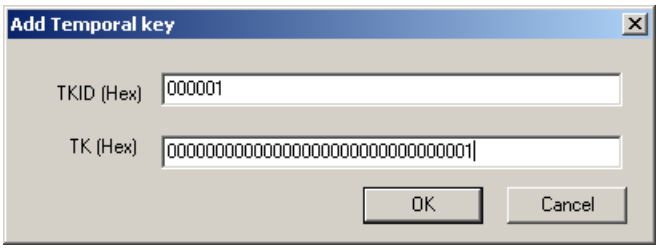


Figure 9.37 Add Temporal Key Dialog Box

Add a temporal key by specifying **TKID** (temporal key ID) in 6-digit hexadecimal and **TK** (temporal key) in 32-digit hexadecimal.

Note: To complete the settings needed to decrypt traffic with a temporal key, you must also add the Host's MAC (16-bit) Address.

Click **OK** to return to the Temporal Key tab.

Step 3 Click **OK** to exit the Add New Device dialog box.

Edit WUSB Device or Host Connection Context using WUSB Settings

For Certified WUSB, UWB*Tracer/Trainer* can derive temporal keys (PTK) in real-time from in-band WUSB Four-Way-Handshakes. UWB*Tracer/Trainer* continuously monitors the WUSB traffic and derives a new temporal key (PTK) whenever a new WUSB Four-Way-Handshake process occurs. UWB*Tracer/Trainer* can track Four-Way-Handshakes for up to 32 different WUSB Connection Contexts.

Note: If you have multiple Four-Way-Handshakes for different pairs of devices, make sure that the Host completes the Four-Way-Handshake process with one device at a time.

To decrypt secured traffic using connection context, in the Device List dialog box, program the WUSB Connection Context (CDID, CHID, CK) that exists between the WUSB Host and a WUSB Device. UWB*Tracer/Trainer* tracks the WUSB Four-Way-Handshake between the Host and the Device and derives the PTK.

Wireless USB Host
To add connection contexts for a Wireless USB Host device:

Step 1 Select the **WUSB Settings** tab.

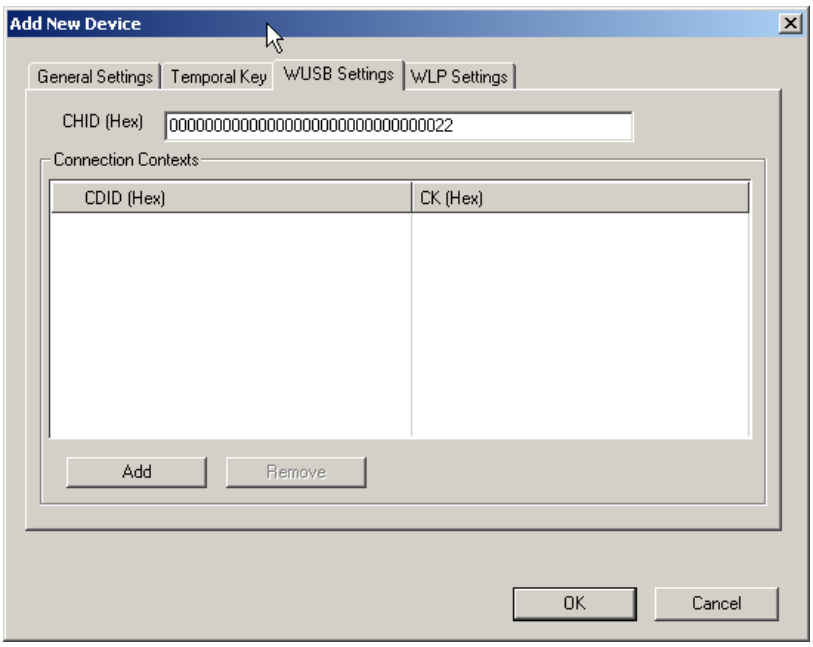


Figure 9.38 Add New Device Dialog Box WUSB Settings Tab for Wireless USB Host

Step 2 Enter the **CHID** (connection host ID) in 32-digit hexadecimal.

Step 3 Click **Add** to display the Add Connection Context dialog box.

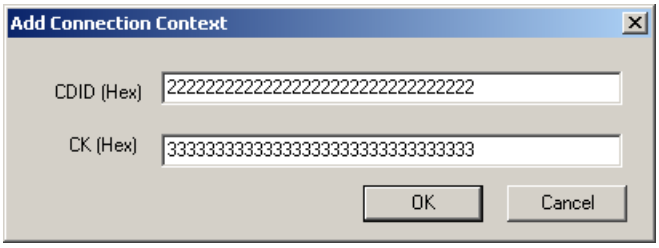


Figure 9.39 Add Connection Context Dialog Box

Step 4 Add a connection context by specifying **CDID** (connection device ID) in 32-digit hexadecimal and **CK** (connection key) in 32-digit hexadecimal.

Step 5 Click **OK** to return to the WUSB Settings tab.

Step 6 Click **OK** to return to the General Settings tab.

Wireless USB Device
To add connection contexts for a Wireless USB Device device:

Step 1 Select the **WUSB Settings** tab.

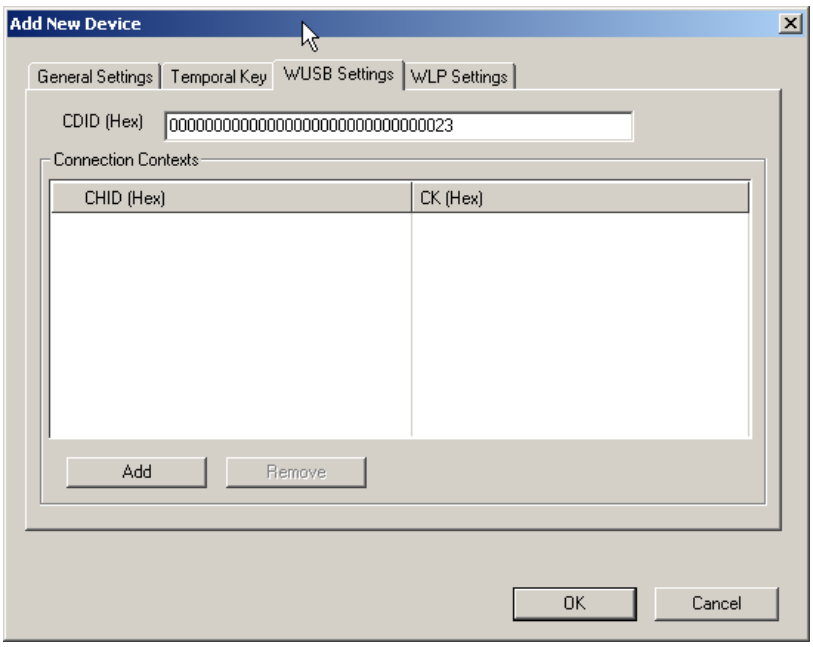


Figure 9.40 Add New Device Dialog Box WUSB Settings Tab for Wireless USB Device

Step 2 Enter the **CDID** (connection device ID) in 32-digit hexadecimal.

Step 3 Click **Add** to display the Add Connection Context dialog box (see Figure 9.39).

Step 4 Add a connection context by specifying a **CHID** (connection host ID) in 32-digit hexadecimal and a **CK** (connection key) in 32-digit hexadecimal.

Step 5 Click **OK** to return to the Device Type Specific Settings tab.

Editing a WUSB Device

To edit a WUSB device, select the device in the Device List, then click the **Edit Device** button.

You can edit only the Alias, User Notes, and DUTs checkbox of the device data in the Edit Device dialog box General Settings tab.

You can edit only the list of hosts or devices in the WUSB Settings tab. CDID and CHID are both editable.

Join or Remove WLP Device from Existing WSS Group using WLP Settings

To add connection contexts for a WLP Device:

Step 1 Select the **WLP_Settings** tab.

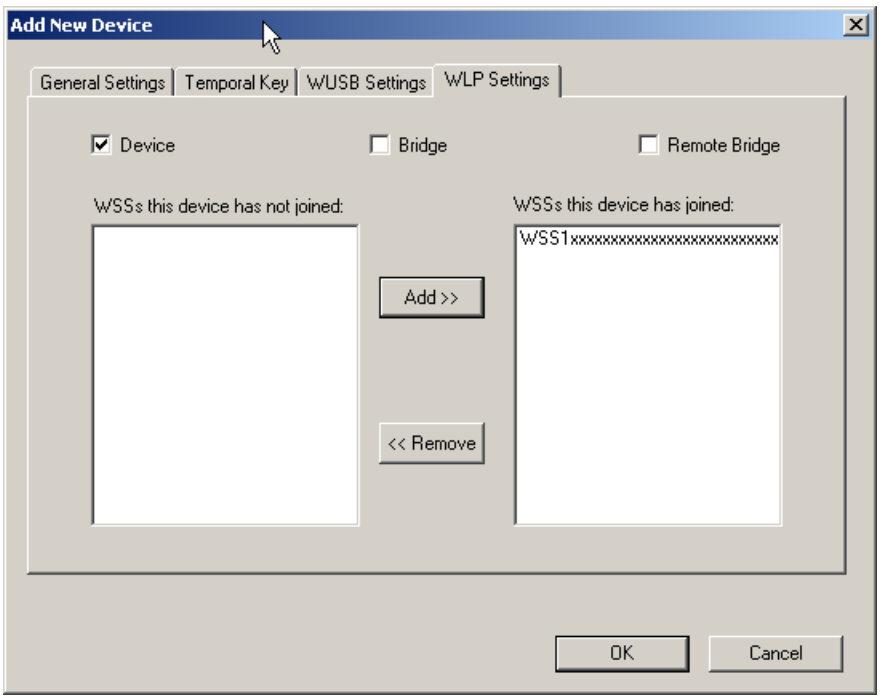


Figure 9.41 Add New Device Dialog Box WLP Settings Tab

Step 2 Use check boxes to indicate if the WLP device is a **Device, Bridge,** and/or **Remote Bridge**.

Step 3 Indicate the WSS's that the WLP device has joined and not joined, using the **Add** and **Remove** buttons.

Step 4 Click **OK** to return to the Device List.

Adding a WSS Group

To add a WSS group:

Step 1 In the Device List window, select the **WLP_Devices** line.

Step 2 In the Device List window, click the **Add New Device** button to display the Add New WSS dialog box:

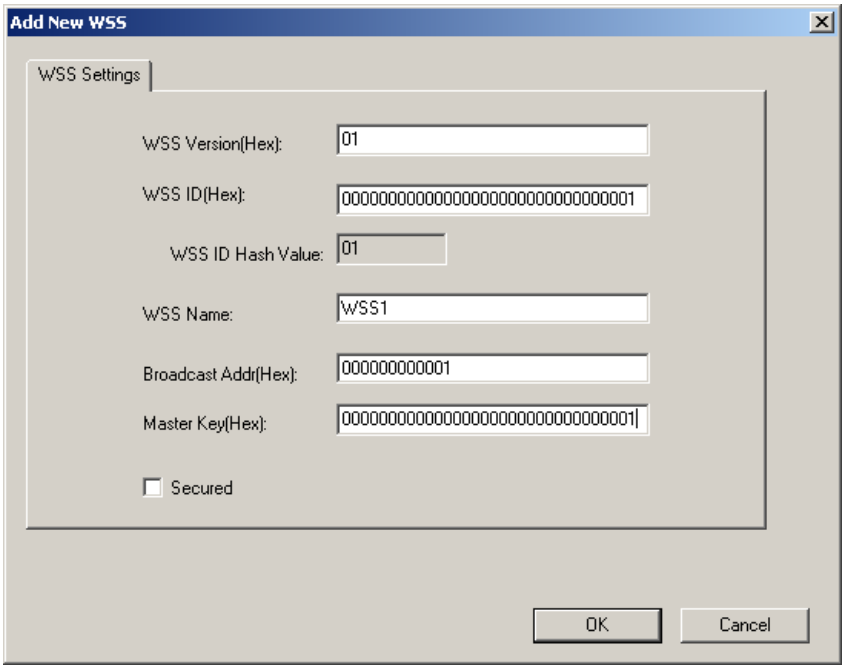


Figure 9.42 Add New WSS Dialog Box

Step 3 Enter the **WSS Version** in 2-digit hexadecimal.

Step 4 Enter the **WSS ID** in 32-digit hexadecimal. The WSS ID Hash Value is automatically calculated based on the WSS ID entered.

Step 5 Enter the **WSS Name** (up to 255 characters).

Step 6 Enter the **Broadcast Address** in EUI48 format.

Step 7 Enter the **Master Key** in 32-digit hexadecimal.

Step 8 Use the check box to indicate if the WSS is secured.

Step 9 Click **OK** to return to the Device List.

Editing a WSS Group

To edit a WSS Group, select the device in the Device List, then click the **Edit Device** button.

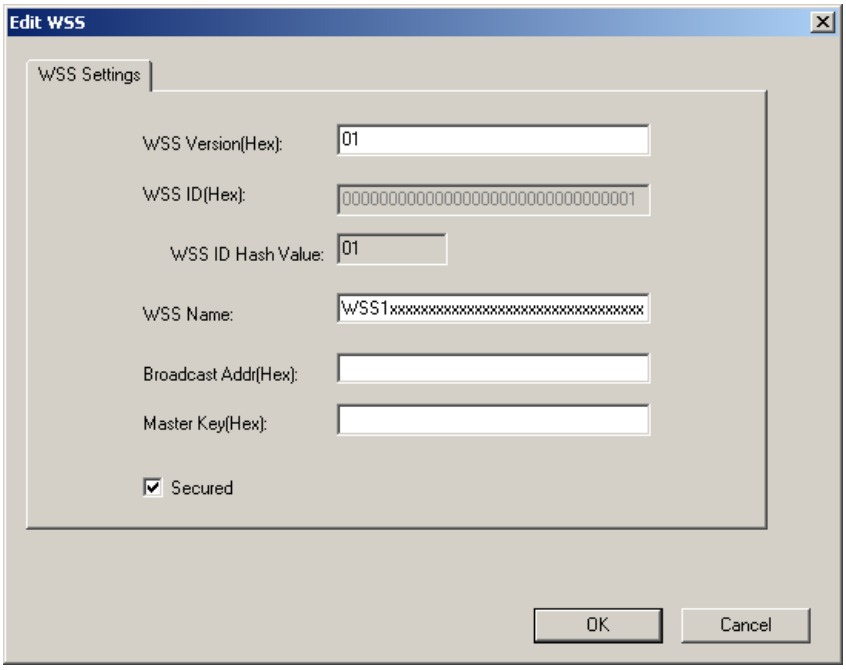


Figure 9.43 Edit WSS Device Dialog Box

You can edit only the WSS Version, WSS Name, Broadcast Address, Master Key, and Secured checkbox of the device data in the Edit WSS dialog box.

Delete Device

To delete a device, select the row in the Device List, then click the **Delete Device** button.

9.8 Running Verification Scripts

You can perform custom post-process analysis of the open trace by running a verification script over the trace. A verification script instructs the UWB*Tracer/Trainer* application to send trace and analysis information to the script. A verification script also contains script code (written using LeCroy Script Language) used to process trace data and output that data in different formats.

For information about the available scripts, see Appendix C “WiMedia Platform Compliance Tests” on page 289.

Note: You may write your own verification scripts to perform custom verification and analysis. For information on how to write a verification script, see the *UWBTracer Verification Script Engine Reference Manual*.

To run a verification script over a trace:

Step 1 Select the UWB*Tracer/Trainer*™ main menu item **Report > Run verification scripts** or click the **Run verification scripts** button on the main tool bar (if it is not hidden):

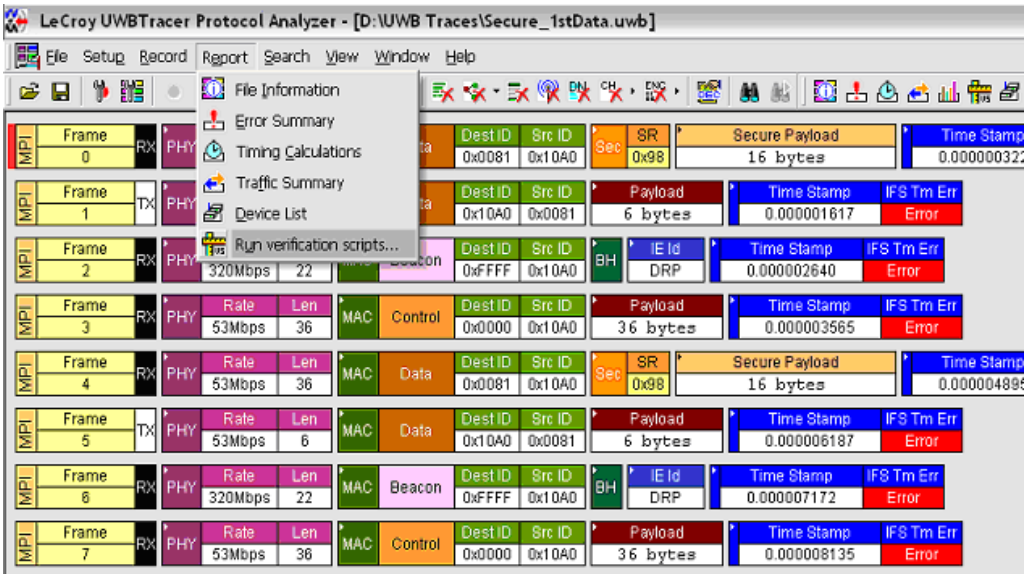


Figure 9.44 Run Verification Scripts Command

The Run verification scripts dialog opens, from which you choose, then run, one or several verification scripts:

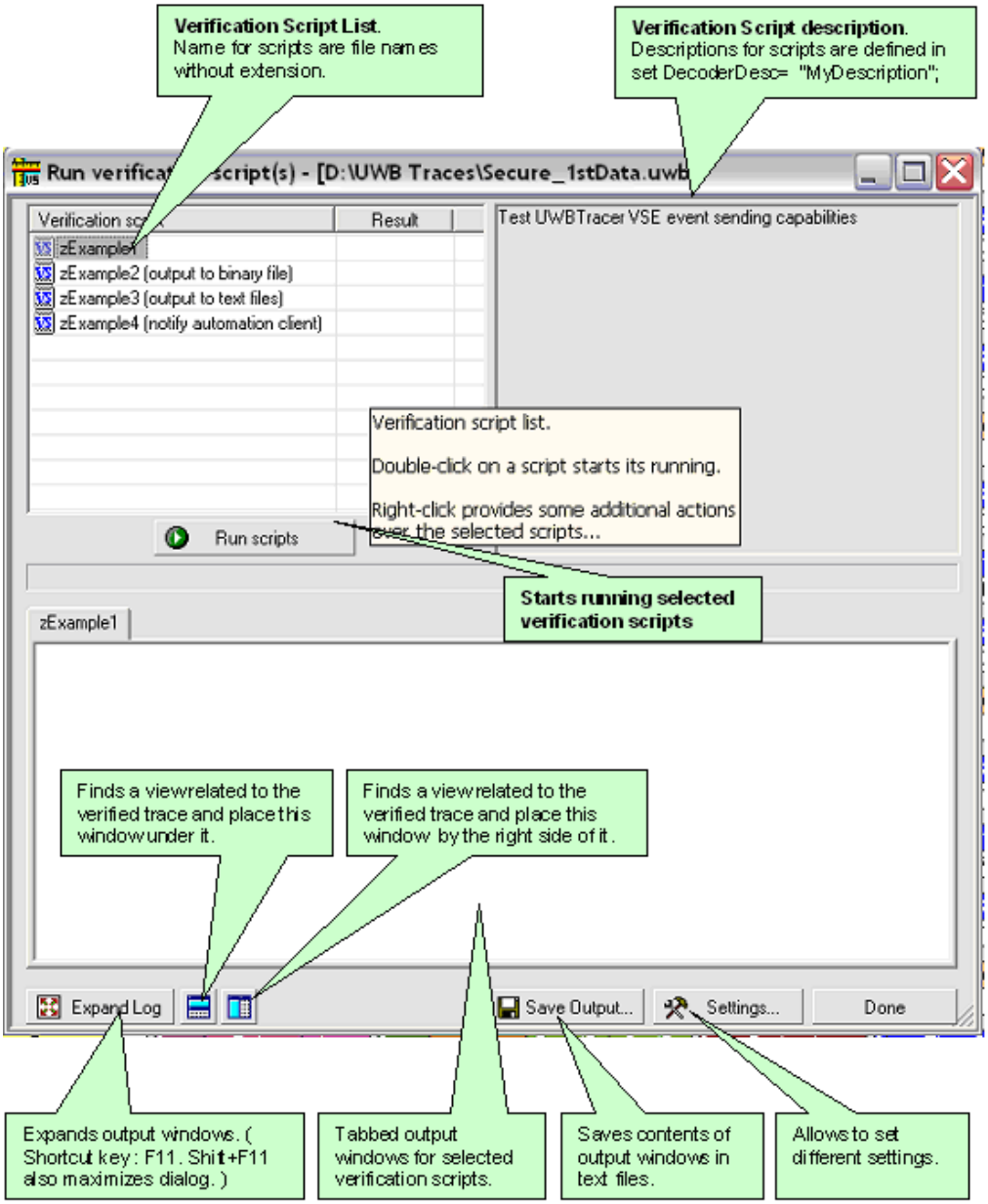


Figure 9.45 Run Verification Scripts Dialog

Step 2 Push the button **Run scripts** after you select scripts to run. VSE starts running the selected verification scripts, shows script report information in the output windows, and presents the results of verifications in the script list:

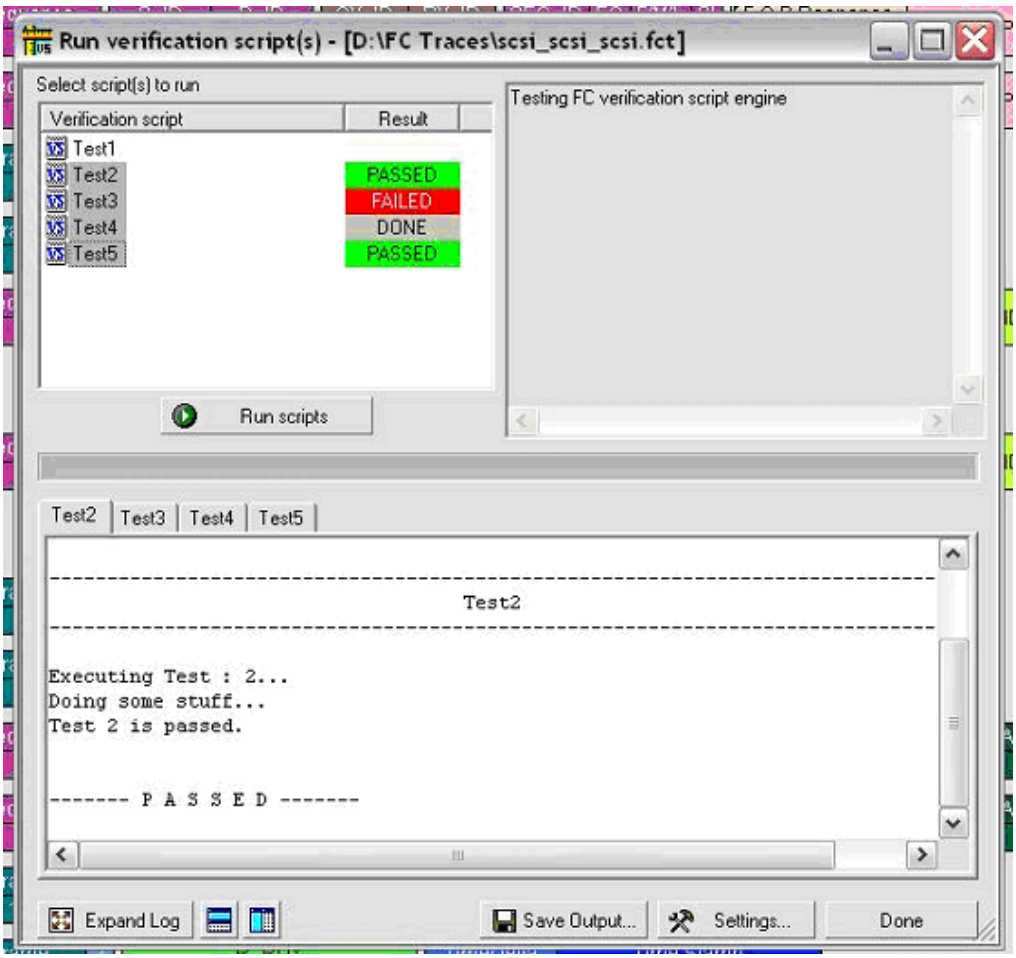


Figure 9.46 Run Verification Scripts Run

Step 3 Right-clicking in the script list displays some additional operations over selected scripts:

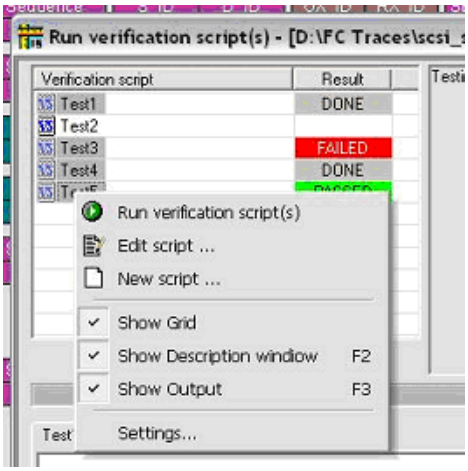


Figure 9.47 Run Verification Scripts Options

Run verification script(s): Start running selected script(s).

Edit script: Edit selected scripts in the editor application specified in Editor settings.

New script: Create a new script file using the template specified in Editor settings.

Show Grid: Show/hide a grid in the verification script list.

Show Description window: Show/hide the script description window (**Shortcut key F2**).

Show Output: Show/hide the script output windows (**Shortcut key F3**).

Settings: Open a special Setting dialog to specify different settings for VSE.

Step 4 After choosing **Settings**, the Settings dialog appears:

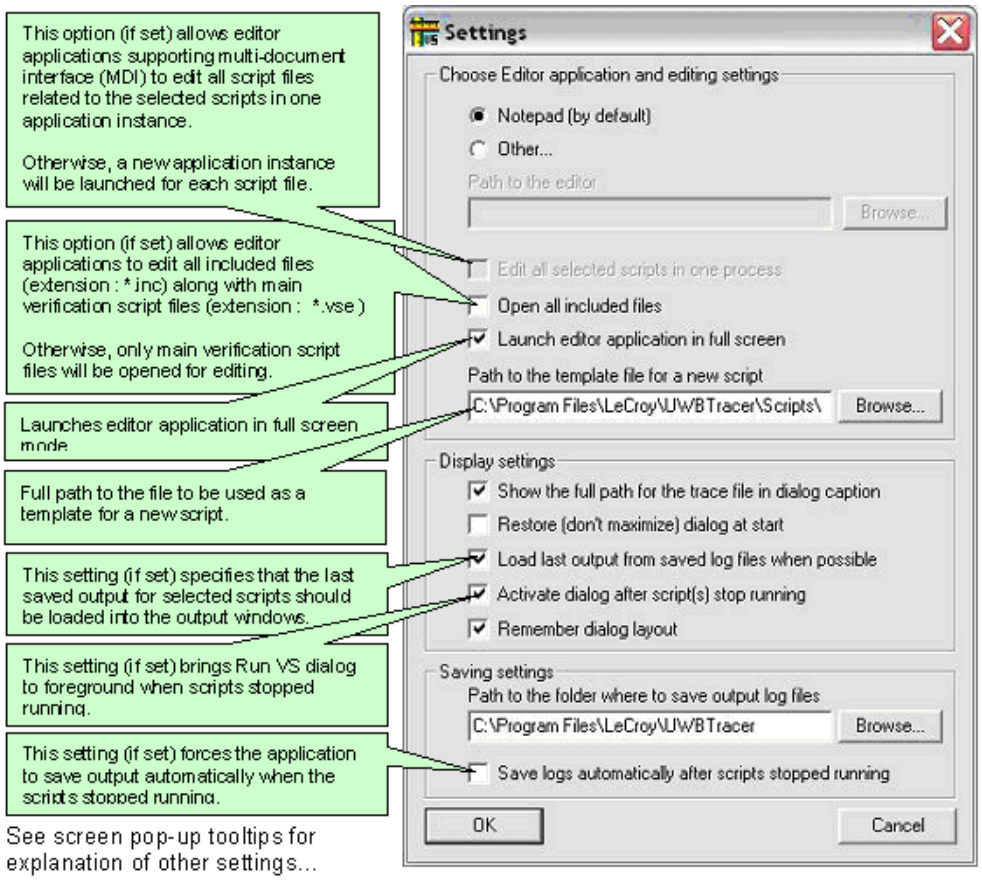


Figure 9.48 Run Verification Scripts Settings Dialog

9.9 Timing Analysis Views

You can perform a Beacon, WUSB, or Superframe timing analysis.

To display an empty Timing Analysis window,

select **Report > Beacon/WUSB Timing Analysis** or

click the **Timing Analysis** button .

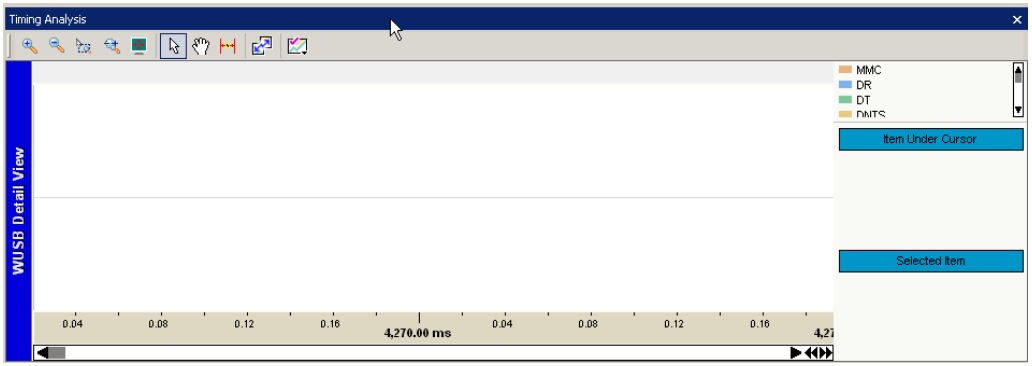


Figure 9.49 Empty Timing Analysis Window

Frame WUSB Detail View in Timing Analysis Window

To select a frame for timing analysis and display the WUSB Detail in the Timing Analysis window, left-click the frame header, such as WM Frm 0, to display a drop-down menu:

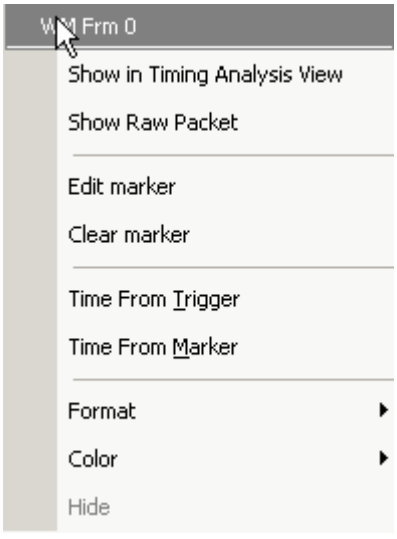


Figure 9.50 Left-Click Frame Menu

Then select **Show in Timing Analysis View** to display the WUSB Detail View.

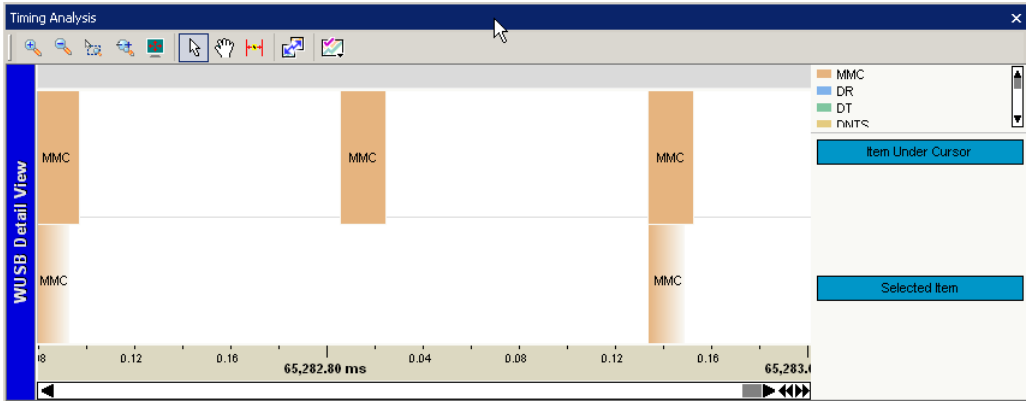


Figure 9.51 WUSB Detail View in Timing Analysis Window

Timing Analysis Buttons

The Timing Analysis toolbar has function to select, zoom, synchronize, insert, and display. To learn the function of each button, pass the cursor over it to display button descriptions on the Status bar at the bottom of the window and tooltips above each button.

	Zoom In		Zoom Out
	Zoom by Selection		Zoom by Horizontal Drag
	Pointer Mode		Hand Panning
	Insert Time Markers		Sync by Time
	Full Screen		Add/Remove Views

Zoom

Using the toolbar buttons, you can:

- Zoom in
- Zoom out
- Select an item and zoom by dragging
- Drag the horizontal axis to zoom

Synchronizing

You can synchronize views and graphs by Time using the **Sync by Time** button .

Selecting a Time

Using the toolbar buttons, you can select using a:

- **Pointer**: To select a frame and see details about it in the Text Panel.
- **Hand**: Click and drag to pan the view.

Inserting a Time Marker

To insert a time marker, click the **Insert Time Markers** button , point to a location in the view, then click and drag to display the time span between the locations of interest.

Views

Using the toolbar buttons, you can add or remove the Beacon Period, Wireless USB, and Superframe Grid Views:

Beacon Period View

The Beacon Period view provides in-depth analysis of a beacon group. Beacons are displayed in time-order, and their BPOIE contents are shown graphically. The Prior BP column allows easy comparison between what the analyzer receives and what the devices receive.

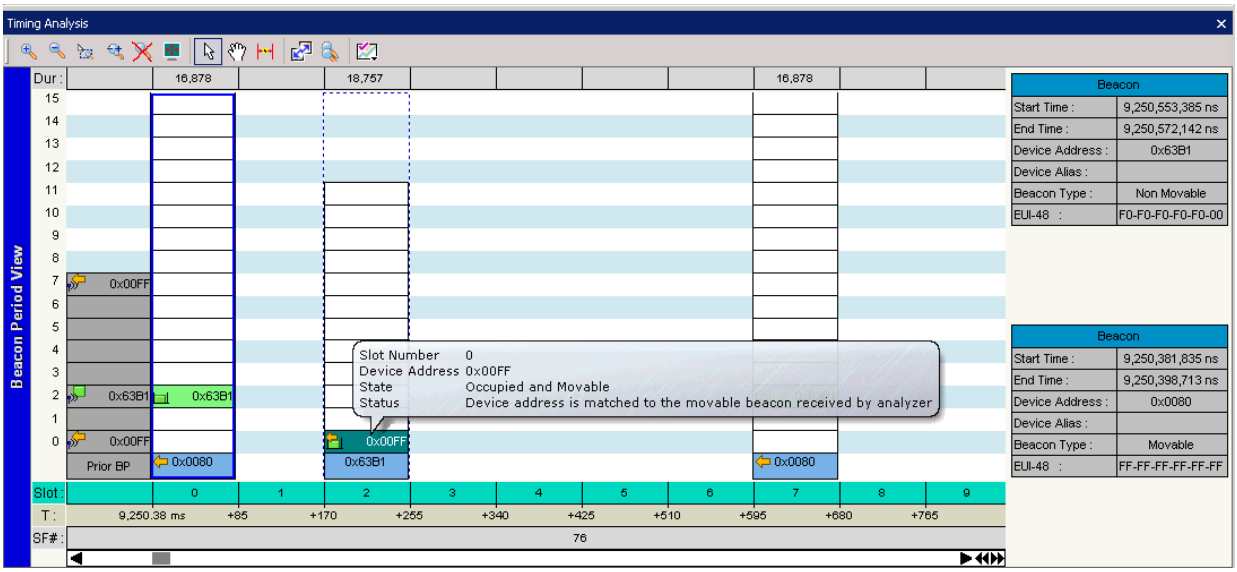


Figure 9.52 Beacon Period View

Row Descriptions

In the left column are the following row descriptions:

- **Dur:** Duration (in nanoseconds) of the beacon frame in that slot.
- **Slot:** The “calculated” beacon slot number in the superframe, derived from the timing of the slowest device, counting up to the last slot that had some activity.
- **T**: Slot start time, which is the BPST plus the microsecond offset of each slot relative to the BPST.
- **SF#**: Super Frame Number

Beacon Information

To select a beacon, click in a beacon in the view. A solid blue rectangle indicates a selected beacon frame.To display information about the selected beacon frame, display the Selected Text Panel by right-clicking in the view to display a popup menu and selecting **Selected Text Panel**.

To display information about a beacon, display the Current Text Panel by right-clicking in the view to display a popup menu and selecting **Current Text Panel**. Move the cursor over a beacon in the view. A dashed blue rectangle indicates the “under mouse” beacon frame.

You can compare the selected and current MAS information.

Display Options for Beacon Period View
Right-click the Timing Analysis window Beacon Period View to display the Timing Analysis Display Options for Beacon Period View menu:

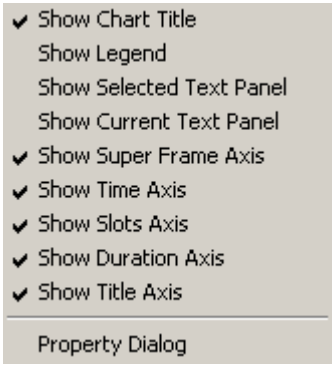


Figure 9.53 Timing Analysis Display Options for Beacon Period View Menu

The options are:

- **Show Chart Title:** Display or hide the left vertical blue bar that says WUSB Detail View or Beacon Period View.
- **Show Legend:** Display or hide the list of colors for Beacon Specification, Alien Beacon Specification, Invalid Beacon Specification, Slowest Device Indicator, Prior BP, Movable, Invalid, Unoccupied, Occupied and Invalid, Occupied and Movable, Occupied and Nonmovable
- **Show Selected Text Panel**: Display or hide the Selected Item window in the lower right corner.
- **Show Current Text Panel**: Display or hide the Item Under Cursor window in the lower right corner.
- **Show SuperFrame Axis:** Display or hide the bottom bar that shows the SuperFrame index.
- **Show Time Axis**: Display or hide the tan time axis at the bottom of the window.
- **Show Slots Axis**: Display or hide the green slots axis at the bottom of the window.
- **Show Duration Axis**: Display or hide the duration bar at the top of the window.
- **Show Title Axis**: Display or hide the Traffic and Transaction Group headings at the left of the window.
- **Property Dialog**: Allows you to set time synchronization and select the display options for the Beacon Period, WUSB Detail, and Superframe Grid views (see previous section for screenshot).

- **Property Dialog**: Allows you to set time synchronization and select the display options for the Beacon Period, WUSB Detail, and Superframe Grid views.

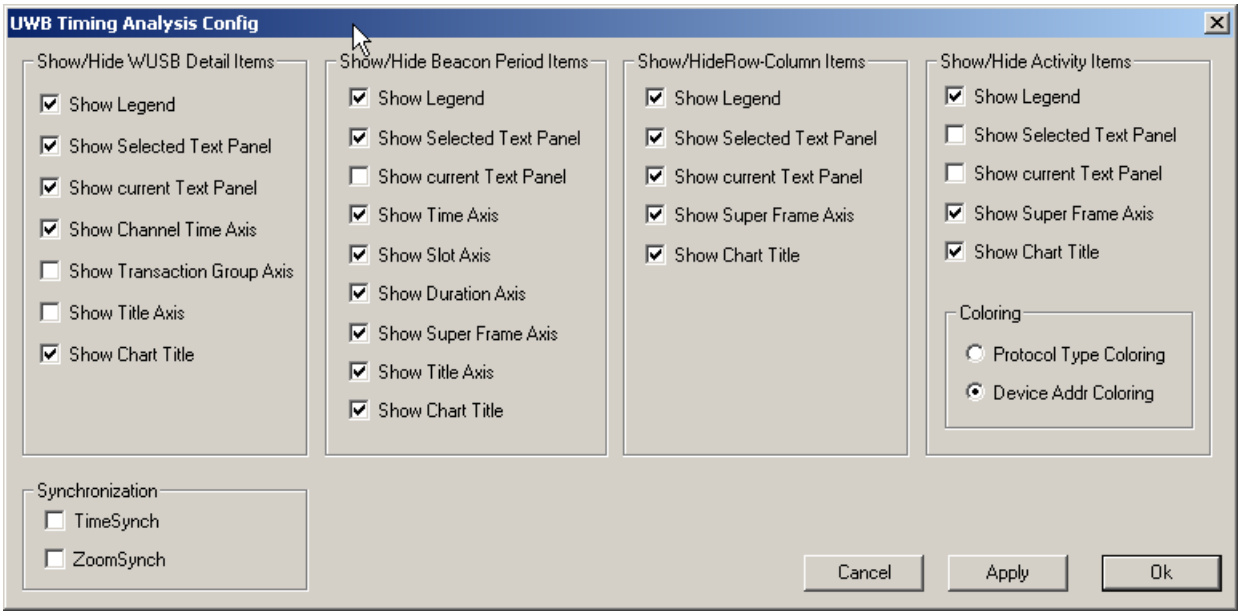


Figure 9.54 Timing Analysis Property Dialog

Wireless USB View

The Wireless USB view provides a graphical depiction of the timing between the WUSB packets in a transaction group and between transaction groups. The top row (starting with MMC and In in Figure 9.55) depicts the timing and duration of the actual received packet. The bottom row (starting with MMC, DNTS, and DT in Figure 9.55) shows the scheduled time windows (CTAs), which are extracted from the MMC packets. The bottom MMC depicts the “start time” of the top MMC, which is really very short, as a fading colored block for clarity.

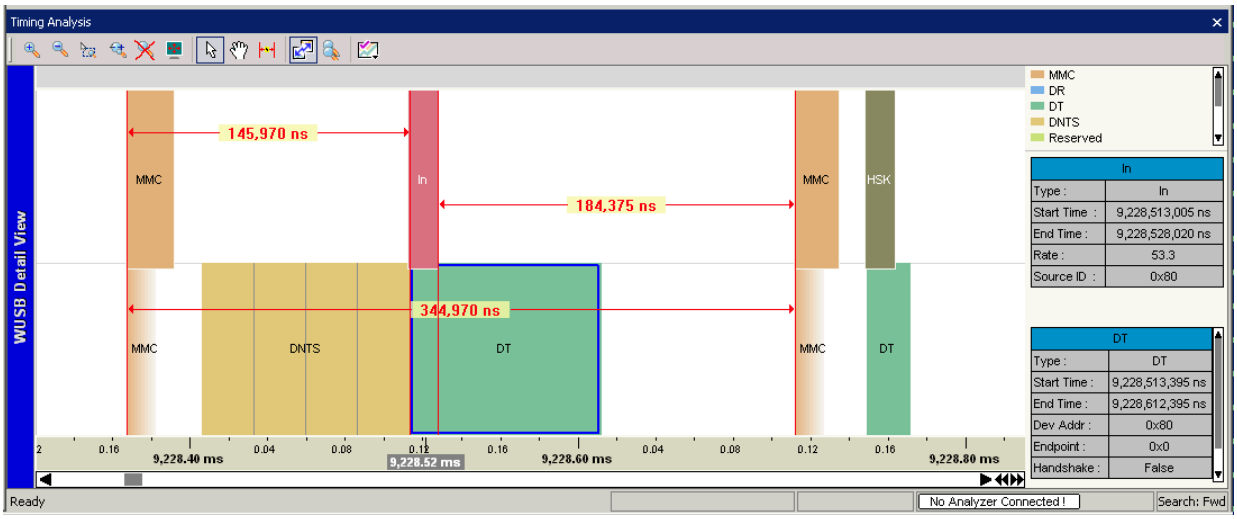


Figure 9.55 WUSB Detail View

Block Information

To select a block, click it in the view. A solid blue rectangle indicates a selected block.To display information about the selected block, display the Selected Text Panel by right-clicking in the view to display a popup menu and selecting **Selected Text Panel**.

To display information about a block, display the Current Text Panel by right-clicking in the view to display a popup menu and selecting **Current Text Panel**. Move the cursor over a block in the view. A dashed blue rectangle indicates the “under mouse” block.

You can compare the selected and current block information.

Display Options for WUSB Detail View
Right-click the Timing Analysis window WUSB Detail View to display the Timing Analysis Display Options for WUSB Detail View menu:

Figure 9.56 Timing Analysis Display Options for WUSB Detail View Menu

The options are:

- **Show Chart Title:** Display or hide the left vertical blue bar that says WUSB Detail View or Beacon Period View.
- **Show Legend:** Display or hide the list of colors for MMC, DR, DT, DNTS, Reserved, IN, OUT, DN, HSK, Unknown
- **Show Selected Text Panel**: Display or hide the Selected Item window in the lower right corner.
- **Show Current Text Panel**: Display or hide the Item Under Cursor window in the lower right corner.
- **Show Channel Time Axis**: Display or hide the time axis at the top of the window.
- **Show Trans Group Axis**: Display or hide the group axis at the bottom of the window.
- **Show Title Axis**: Display or hide the Traffic and Transaction Group headings at the left of the window.

Superframe Grid View

The Superframe Grid view provides a high-level illustration of traffic in each superframe. Each frame has a 16x16 grid. Each cell of the grid represents one MAS in the superframe. Reservation patterns are color-coded by owner/target, potential reservation conflicts, traffic patterns, and throughput characteristics within reservations.

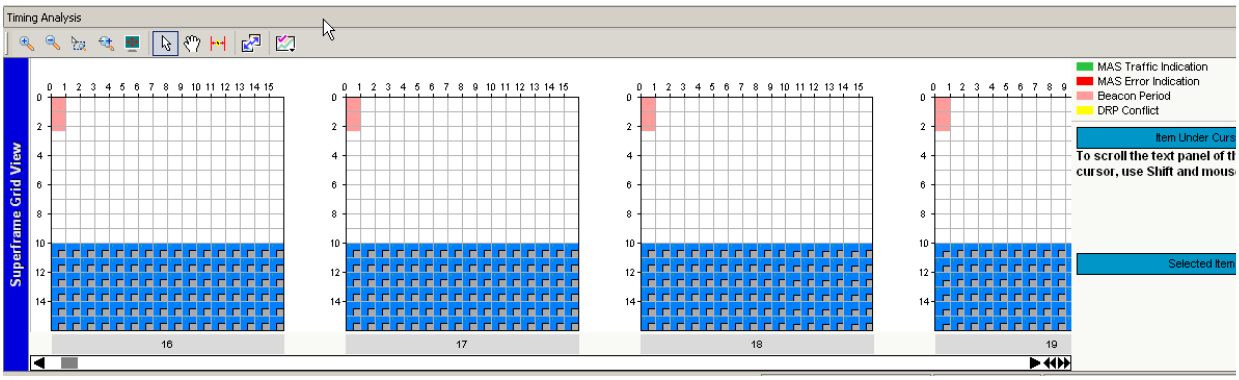


Figure 9.57 Superframe Grid View

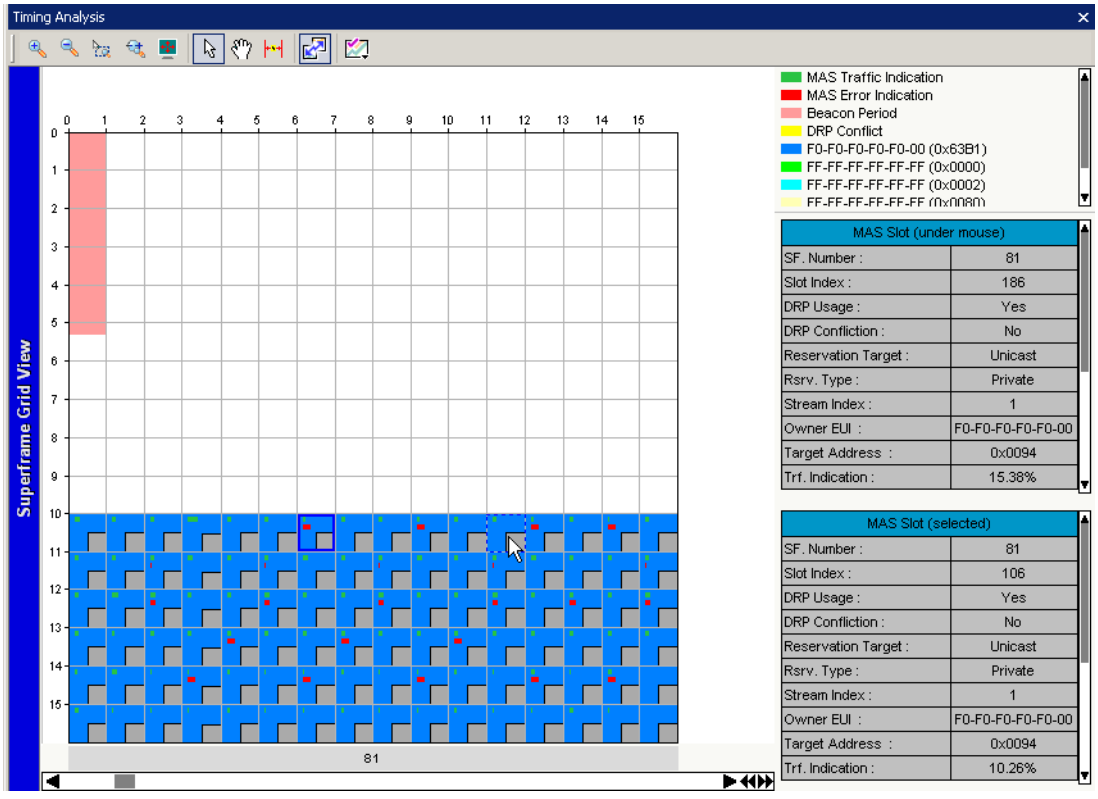


Figure 9.58 Superframe Grid View Zoomed

MAS Information

To select an MAS, click it in the view. A solid blue rectangle indicates a selected MAS. To display information about the selected MAS, display the Selected Text Panel by right-clicking in the view to display a popup menu and selecting **Selected Text Panel**.

To display information about an MAS, display the Current Text Panel by right-clicking in the view to display a popup menu and selecting **Current Text Panel**. Move the cursor over an MAS in the view. A dashed blue rectangle indicates the “under mouse” MAS.

You can compare the selected and current MAS information.

MAS Rectangle

An MAS rectangle has the following color codes:

- **Pink filling rectangle:** Indicates Beacon Period.
- **Green line**: Indicates amount of MAS traffic.
- **Red line**: Indicates number of MAS errors.
- **Yellow filling rectangle**: Indicates DRP Conflict.
- **Blue or other color filling most of rectangle**: Indicates type of MAS.

Display Options for Superframe Grid View
Right-click the Timing Analysis window Superframe Grid View to display the Timing Analysis Display Options for Superframe Grid View menu:

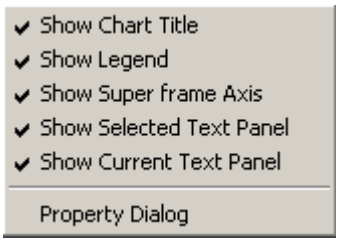


Figure 9.59 Timing Analysis Display Options for Superframe Grid View Menu

The options are:

- **Show Chart Title:** Display or hide the left vertical blue bar that says Superframe Grid View.
- **Show Legend:** Display or hide the list of colors for MAS Traffic, MAS Error Indication, Beacon Period, DRP Conflict.
- **Show Superframe Axis**: Display or hide the frame numbers.
- **Show Selected Text Panel**: Display or hide the Selected Item window at the right.
- **Show Current Text Panel**: Display or hide the Item Under Cursor window at the right.
- **Property Dialog**: Allows you to set time synchronization and select the display options for the Beacon Period, WUSB Detail, and Superframe Grid views (see previous section for screenshot).

Working with Timing Analysis Fields

The Timing Analysis fields are:

- **IFS**: Inter-frame spacing between previous frame and this frame
- **DRP Tm**: Follows DRP reservation rule or not
- **Frm Duration**: Frame duration
- **Delta Time**: Time between starts of frames on the same channel
- **Beacon Slot Frame**: SuperFrame (SF) index or Beacon Slot and Slot Offset relative to expected BPST
- **BPST Delta**: Time between BPST in previous and current SuperFrames
- **BPST**: BPST in current SuperFrame
- **Timestamp**: Time at beginning of preamble

Left-click a timing analysis field to display a drop-down menu.

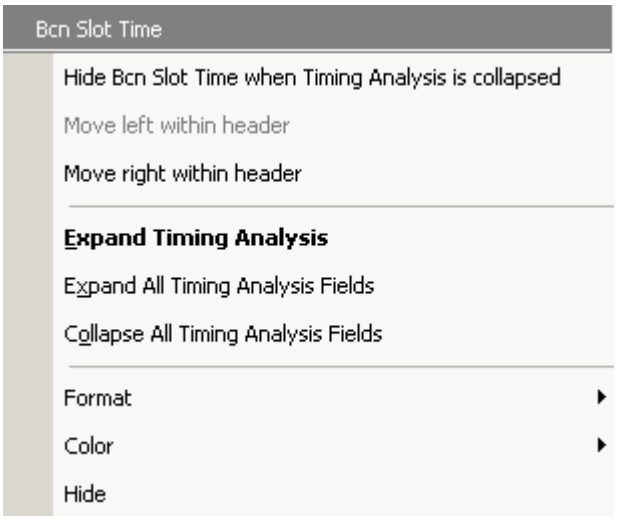


Figure 9.60 Left-Click Timing Analysis Fields Menu

To show or hide the timing analysis fields, select **Expand Timing Analysis, Expand All Timing Analysis Fields**, or **Collapse All Timing Analysis Fields**.

To show or hide the selected field, select
Show/Hide ... when Timing Analysis is Collapsed.

To change the position of the field, select **Move left or Move right within header.**

Chapter 10: Connecting to Analyzers

If you have one or more analyzers, you can link them directly to the host machine through USB connections or through an IP LAN connection to a remote host machine.

If you have more than one analyzer, you must synchronize the analyzers. You must synchronize local and remote analyzers using the SYNC IN and SYNC OUT cable connectors and SYNC cables, as described in Section 10.3, “Multiple Analyzer Synchronization” on page 158.

Note: UWB*Tracer/Trainer*™ will not work with unsynchronized multiple analyzers.

10.1 Direct USB Connections

You can control multiple analyzers from a single UWB*Tracer/Trainer* application by connecting the analyzers to the PC using USB cables. UWB*Tracer/Trainer* lets you toggle among the analyzers.

Attach USB cables between each analyzer and the host PC as shown in Figure 10.1.

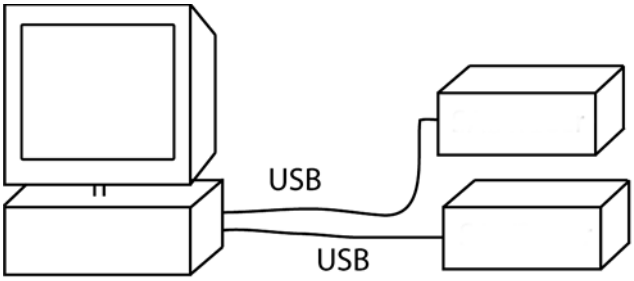


Figure 10.1 Connecting Multiple Analyzers by USB Cables

To synchronize recordings among the analyzers, connect SYNC cables to the analyzers’ SYNC IN and SYNC OUT connectors as described in Section 10.3, “Multiple Analyzer Synchronization” on page 158.

After you have connected the analyzers and started them, you can add, remove, or reconnect an analyzer using **Setup** > **Analyzer Network ...**

Note: You cannot run two copies of the UWB*Tracer/Trainer* software on simultaneously on a PC. You can only toggle among the analyzers using Setup > Analyzer Network ...

You can display information about the analyzer, update the BusEngine/Firmware (see Section 16.4, “BusEngine, Firmware, and Plugin Init Updates” on page 276), update the license (see Section 16.5, “License Information” on page 278), or go to Recording Options (see Chapter 7) using **Setup** > **All Connected Devices...**

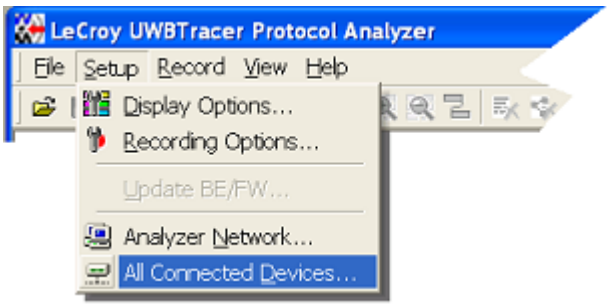


Figure 10.2 Analyzer Network’ and All ‘Connected Devices…’ menus

USB Connected Analyzers Configuration

Configuration for two or more USB connected analyzers is minimal. In the following example, two analyzers are linked via USB to a host PC. You connect to one of the two analyzers.

Step 1 Start the analyzers and the UWB*Tracer/Trainer* software.

Step 2 From the menu, select **Setup** > **All Connected Devices** to open the Analyzer Devices dialog box.

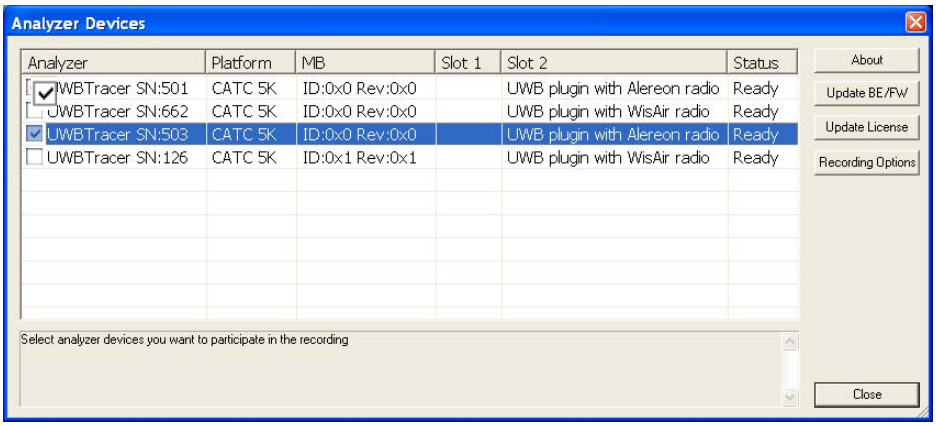


Figure 10.3 Analyzer Devices Dialog Box

Step 3 To select an analyzer, check the relevant Analyzer checkbox on the left.

Step 4 Click **Close** to close the dialog box and select the analyzer.
The UWB*Tracer/Trainer* software on your screen now controls the selected analyzer.

Note: You can update the Firmware, BusEngine, and License from this dialog by checking an analyzer and then clicking the appropriate button on the right. You can also directly open and set Recording Options for any of the analyzers by checking one or more analyzers and then clicking the Recording Options button to open the Recording Options dialog. The settings you create apply to all selected analyzers.

10.2 Remote Access over an IP LAN

You can run a UWB*Tracer/Trainer* application on a remote PC from a second UWB*Tracer/Trainer* application on a local PC if both PCs are on a network. You must install UWB*Tracer/Trainer* on both host PCs and connect the PCs using an IP local area network (LAN).

Attach a USB cable between each analyzer and its host PC, and connect the hosts PCs on an IP LAN, as shown in Figure 10.4.

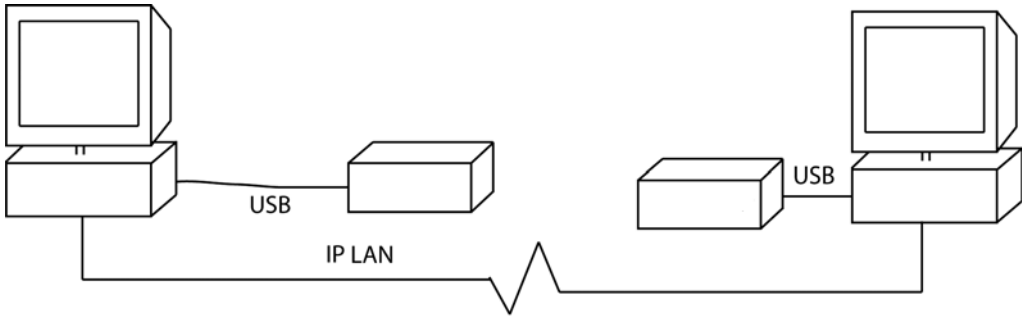


Figure 10.4 Connecting Multiple Analyzers by USB Cables on a Network

To synchronize recordings among the analyzers, connect SYNC cables to the analyzers' SYNC IN and SYNC OUT connectors as described in Section 10.3, "Multiple Analyzer Synchronization" on page 158.

After you have installed UWB*Tracer/Trainer* on both PCs, connected the analyzers, and started everything, you can toggle to the remote analyzer using **Setup** > **Analyzer Network ...**

Note: You cannot run two copies of the UWB*Tracer/Trainer* software on simultaneously on a PC. You can only toggle among the analyzers using Setup > Analyzer Network ...

Remote Analyzers Over an IP Network Configuration

To configure UWB*Tracer/Trainer* to remotely control an analyzer over an IP LAN, you use the Analyzer Network dialog to browse to the host controlling the analyzer and add both the host and its PC to the dialog.

Step 1 From the menu, select **Setup** > **Analyzer Network** to open the Analyzer Network dialog box and list host PCs and their analyzers. The listed devices are either currently connected or were connected before.

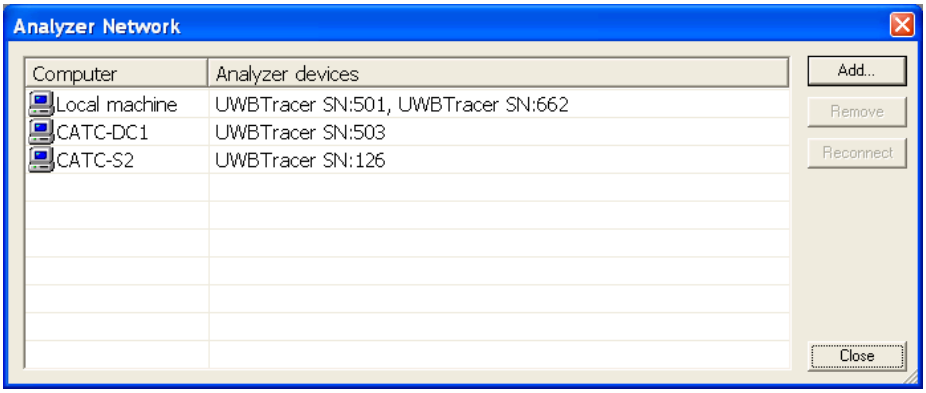


Figure 10.5 Analyzer Network Dialog Box

Step 2 Remove any host (other than the Local Machine) from the list by selecting the host and then clicking **Remove**. You should keep in the list only the host(s) that you are planning to immediately use.

Step 3 To add a host and analyzer to the list, click **Add** to open a Add Analyzer Network Node dialog box.

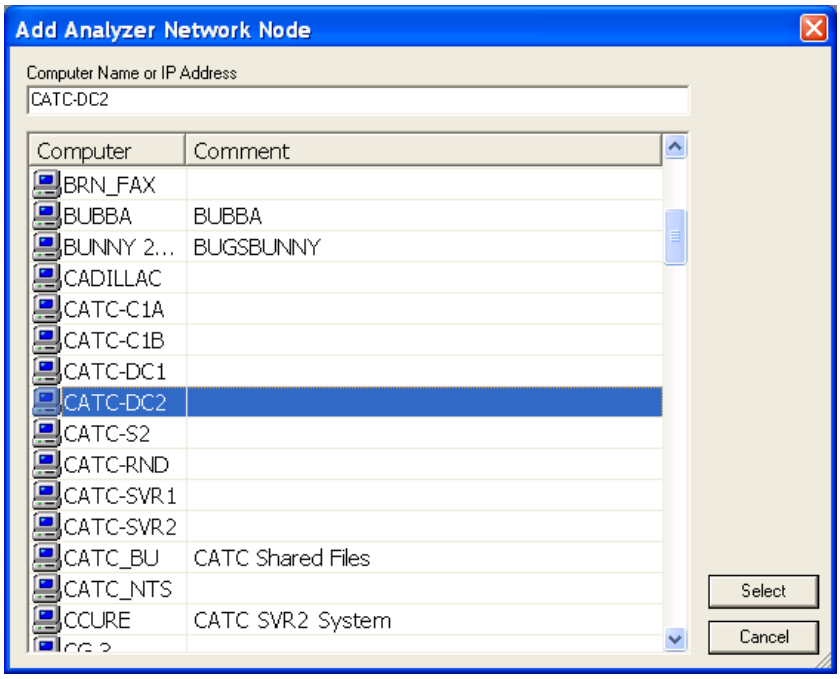
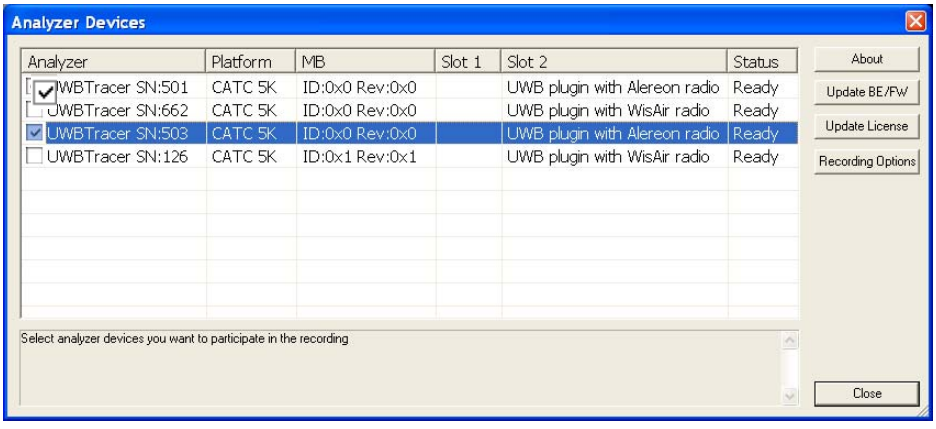


Figure 10.6 Add Analyzer Network Node Dialog Box

Step 4 Browse to the host that has an analyzer attached to it and double-click it to add the host to the Analyzer Network dialog.

Step 5 Click **Close** to close the dialog box.

Step 6 Select **Setup > All Connected Devices ...** to open the Analyzer Devices dialog box.



Step 7 Uncheck all boxes except the one for the remote analyzer to which you wish to connect.

Step 8 Click **Close** to close the dialog box and establish a connection to the selected analyzer.

10.3 Multiple Analyzer Synchronization

A single UWB*Tracer/Trainer*™ software application instance can record from multiple analyzers. You can connect the analyzers locally to the host machine running the UWB*Tracer/Trainer* application or connect them to remote host machines running the UnitAgent application. These sections describe how to configure the analyzer network and choose parameter settings for multiple analyzers.

Connecting Analyzers for Synchronized Recording

To merge traces from different channels and analyzers into a single trace file when you view the traces from multiple analyzers, you must synchronize the timestamps for the analyzers. Configuring each analyzer for multiple channel recording using multiple analyzers, and setting up the analyzer network as shown below, allows timestamp synchronization.

To synchronize timestamps across analyzers, you must connect the analyzers in a ring network. A ring allows transmission of clock information and commands between CATC 5K analyzers that have the CATC 5K protocol (UnitAgent) for communicating between analyzers. This protocol allows two or more analyzers connected in a ring to function like a single multichannel analyzer. A ring of analyzers with this protocol can perform:

- **Timestamp synchronization**: All analyzers count time from the same time value at the beginning of recording.
- **Cross triggering**: If one analyzer finds a triggering event, it can trigger all the other analyzers synchronously.

To make a ring network, connect SYNC cables to the SYNC IN and SYNC OUT connectors on the backs of the CATC 5K analyzer platforms by matching the color codes (and text labels) on the cable ends and the connectors, as shown in Figure 10.7.

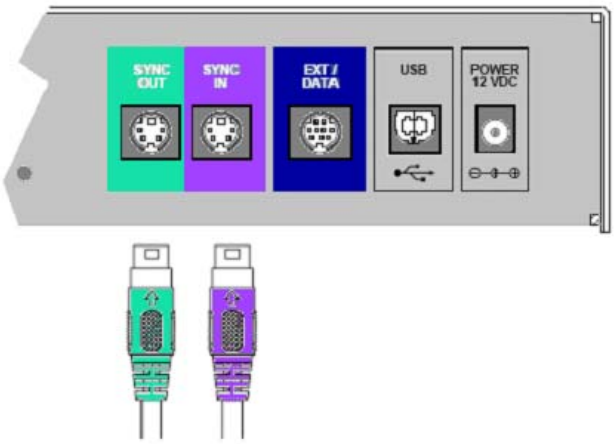


Figure 10.7 SYNC IN and SYNC OUT Connector/Cable Color Coding

Figure 10.8 shows how to connect two analyzers in a ring network for synchronized recording.

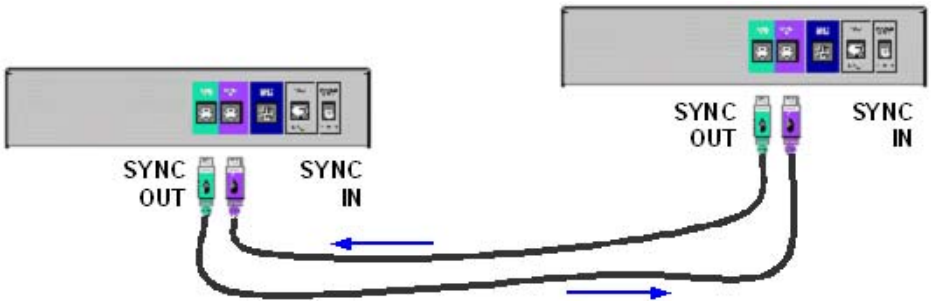


Figure 10.8 Connecting Two Analyzers for Synchronized Recording

Figure 10.9 shows how to connect three analyzers in a ring network for synchronized recording.

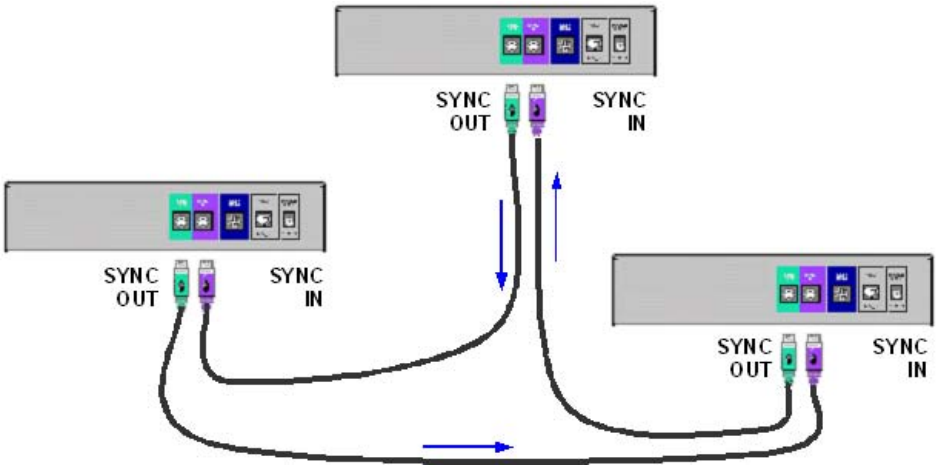


Figure 10.9 Connecting Three Analyzers for Synchronized Recording

Recording Multi-Trace Files

After you connect SYNC cables to allow synchronization, perform the following steps to record multiple trace files:

Step 1 Perform **Steps 1** and **2** as described above in “USB Connected Analyzers Configuration” on page 154 to open the Analyzer Devices dialog box.

Step 2 In the Analyzer Devices dialog box, verify that the checkboxes are checked for the cascaded analyzers.

Step 3 Click **Close** to close the dialog and select the analyzers.

Step 4 Test the setup by recording some traffic. If the analyzers are not connected by SYNC cables, an error message prompts you to correct the problem.

Step 5 The UWB*Tracer/Trainer* software displays traffic from each analyzer in adjacent windows.

10.4 Network Chat

Analyzer Network Chat is a utility that allows users to conduct chat sessions over an IP LAN.

To send and receive electronic text messages, each user must be working with a PC that is attached to an analyzer and each PC must, in turn, be connected to an IP LAN.

To start a chat session:

Step 1 Select **View** > **Analyzer Network Chat Bar** from the menu to open the Analyzer Network Chat dialog:

Figure 10.10Analyzer Network Chat Dialog Box

Step 2 Click the cell at the bottom of the window and type any text.

Step 3 Click **Send**. The sent text appears in the top of the window next to your prompt.

Chapter 11: Setting Up for Recording

This chapter describes how to connect the triggering cable for external triggering, how to connect the probe cables and their cable adapters, and how to set up for wireless recording.

11.1 External Triggering Setup

With each analyzer, LeCroy includes a TRIG-IN/TRIG-OUT BNC Y-cable (see Figure 2.4) that allows you to export a trigger signal to, and receive a trigger signal from, external equipment.

The Trigger Cable connects to the EXT DATA connector located on the UWB*Tracer/Trainer* rear panel, as shown in Figure 11.1.

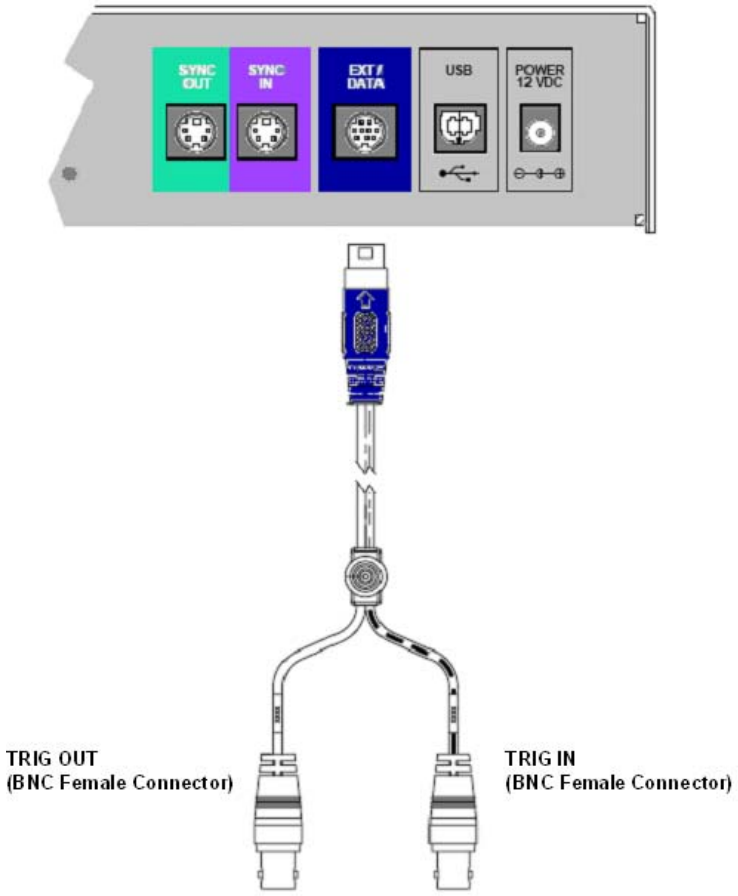


Figure 11.1 EXT DATA Connector and Cable

11.2 Connecting Cables and Adapters

Figure 11.2 shows the connections among CATC 5K, UWB Analyzer, connectors, cable adapter, and 68-pin, 60-pin, and 40-pin probe cables.

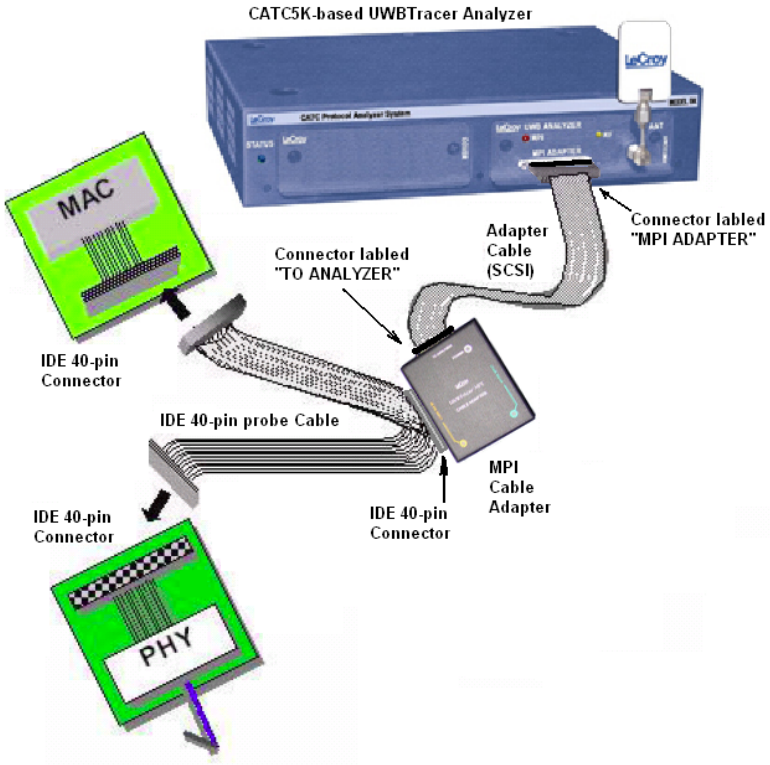


Figure 11.2 Example UWBTracer Device Connections Diagram for Recording MPI Traffic from Devices using the IDE 40-pin Cable Adapter

To use the Cable Adapter to connect with an IDE 40-pin connector:

Step 1 Turn of the power on the analyzer and the device-under-test

Step 2 Connect the middle connector on the IDE 40-pin Probe Adapter to the 40-pin connector on the Cable Adapter.

Step 3 Connect one of the end connectors on the IDE 40-pin Probe Adapter to the PHY subsystem.

Step 4 Connect the other end connector on the IDE 40-pin Probe Adapter to the MAC subsystem.

Step 5 Connect the Adapter Cable (SCSI) to the MPI ADAPTER connector on the UWB*Tracer* plug-in.

Step 6 Connect the Adapter Cable (SCSI) to the TO ANALYZER connector on the Cable Adapter unit.

Step 7 Turn on the power, then start capturing data.

To use the Cable Adapter to connect with a Hirose 68-pin connector:

Follow the same steps as for the IDE 40-pin connector, but use the Hirose 68-pin Probe Cable and the 68-pin connector on the Cable Adapter.

To use the Board Adapter to connect with a IDE 40-pin connector:

Step 1 Turn off the power on the analyzer and the device under test.

Step 2 Connect one side of the IDE 40-pin Board Adapter to the connector on the MAC subsystem.

Step 3 Connect the PHY subsystem to the other IDE 40-pin connector on the Board Adapter.

Step 4 Connect the Adapter Cable (SCSI) to the MPI ADAPTER connector on the UWB*Tracer* plug-in.

Step 5 Connect the other side of the Adapter Cable (SCSI) to the connector on the Board Adapter.

Step 6 Turn on the power, then start capturing data.

To use the Board Adapter to connect with a Hirose 68-pin connector:

Follow the same steps as for the IDE 40-pin connector, but use the Hirose 68-pin Board Adapter.

To use the Board Adapter to connect with a Hirose 60-pin connector:

Follow the same steps as for the IDE 40-pin connector, but use the Hirose 60-pin Board Adapter.

11.3 RF Recording Setup

For wireless recording, the UWB Analyzer uses the UWB radio on the UWB analyzer plug-in. The plug-in module must be inserted into the right-side slot of the CATC 5K platform.

There are two options for eavesdropping UWB traffic:

- Wireless RF recording
- Wired RF Recording

Wireless RF Recording

Using the provided RF antenna, the analyzer can capture over-the-air wireless traffic. Perform the following steps:

Step 1 Make sure the antenna provided with the UWB*Tracer* analyzer is tightly connected to the connector marked ANT.

Step 2 Position the analyzer and devices under test at an equal distance from each other, 10 inches apart (Figure 11.3).

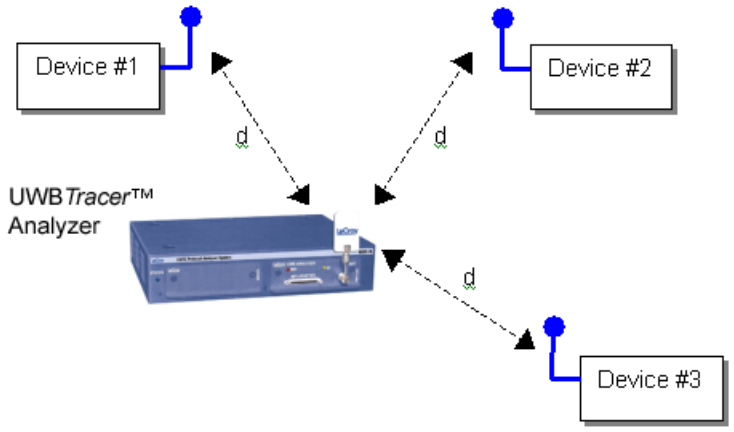


Figure 11.3 Wireless RF Recording

Note: RF signals and noise from external devices might affect wireless recording, as might the transmit and receive patterns of antennas on the analyzer and devices under test. If the recorded trace has many corrupted UWB frames, try the following:

- Try different positions of the devices and analyzer.
- Place the devices and analyzer as close as possible to each other and at equal distance (but not less than 10 inches apart).
- Remove any potential RF radiators from the test environment or find an RF-quiet location.
- Turn antenna in different directions

Wired RF Recording

Wired RF Recording can be used when the test setup requires isolation from external RF interference or when the effects of the antennas need to be negated. In this setup, coaxial cables are used to connect the analyzer to the devices under test.

To match the transmit power of the radios to the receive power ratings (because low-impedance wires are now used), use attenuators to lower the signal strength so that the input stages of the PHYs are not saturated (Figure 11.4). The –20 dB attenuators are given as an example. You might need to use different attenuators depending on the characteristics and signal strength of the radios in use.

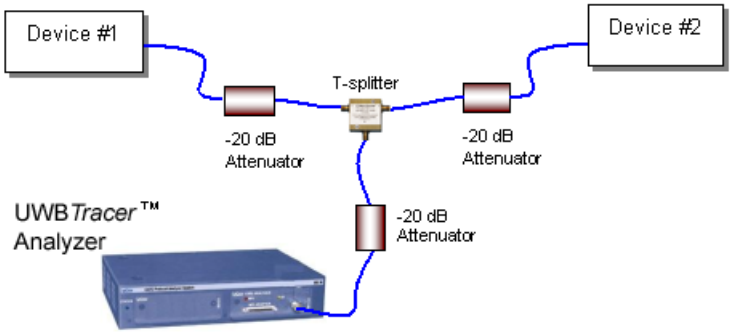


Figure 11.4 Wired RF Recording

Note: The attenuator values shown are only examples. You may need to use different values according to the PHYs used, their signal strengths, and your setup.

11.4 Preparing for Wireless Traffic Generation

For wireless traffic generation, the UWB Exerciser uses the UWB radio on the UWB Exerciser plug-in. The plug-in module must be inserted into the left-side slot of the CATC 5K platform.

There are two options for UWB traffic generation:

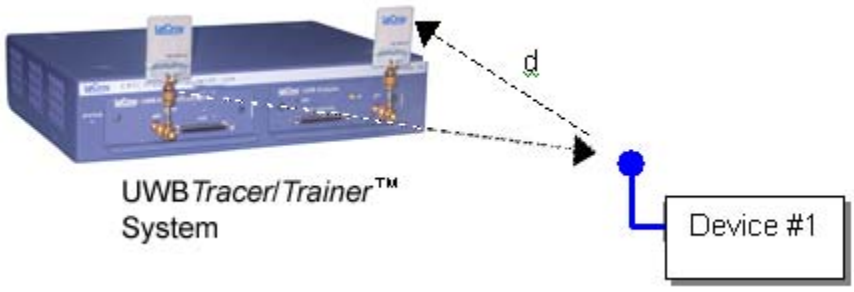
- Wireless RF traffic generation
- Wired RF traffic generation

Wireless Traffic Generation

Using the provided RF antenna, the Exerciser can capture over-the-air wireless traffic. Perform the following steps:

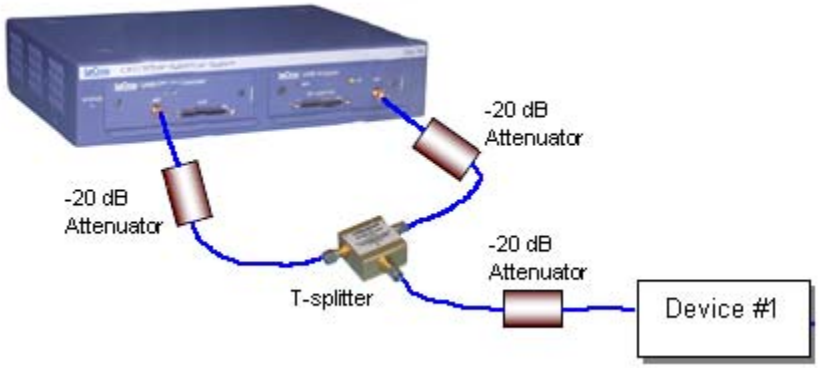
1. Make sure the antenna provided with the UWB*Tracer/Trainer* analyzer is tightly connected to the connector marked ANT.

   Note: To meet FCC Part B requirements, UWB*Trainer* is equipped with reverse polarity radio and antenna connectors. This configuration does not affect RF behavior in any way but does require that a customer-supplied antenna is configured with reverse polarity connectors.
2. Position the UWB*Tracer/Trainer* system facing the devices under test (at least 10 inches apart).



Wired Traffic Generation

You can use coaxial cabling to connect the wireless device directly to the UWB*Trainer* generator, as illustrated below. Because antennas are not used, external interference should not affect the recording.



11.5 Secured Traffic

The UWB*Tracer/Trainer*™ system can perform real-time decryption for encrypted traffic. The system can record the decrypted traffic and make real-time triggering/filtering decisions based on the decrypted traffic.

The UWB*Tracer/Trainer* system decrypts traffic using temporal keys, which it can obtain by two methods:

- Derivation Using Certified WUSB Four-Way-Handshake Protocol
- Direct Programming

You can program a combined total of 32 different Connection Contexts and Temporal Keys using these two methods.

For information about the recording options related to decryption and security, see Section 12.2, “Recording Options: RF” on page 178.

For more information about the Device List, see Section 9.7, “Device List” on page 128.

Temporal Key Derivation Using Certified WUSB Four-Way-Handshake Protocol

Certified WUSB hosts and devices allow you to derive a temporal key. To derive a temporal key from a Certified WUSB host or device, you must add a valid Connection Context to a WUSB host or device.

Note: Use the Direct Programming method to decrypt traffic between two WiMedia devices that are not running the Certified WUSB protocol.

A Connection Context includes a connection host ID (CHID), connection device ID (CDID), and connection key (CK). Entering the CHID and CDID into the analyzer memory provides the analyzer with the “numeric association” connection context keys.

The UWB*Tracer/Trainer* system uses a Connection Context to follow the Four-Way-Handshake protocol between a host and device and consequently derive a Pair-wise Temporal Key (PTK). The UWB*Tracer/Trainer* system then uses the PTK to decrypt traffic between the host and device.

The UWB*Tracer/Trainer* system derives a new PTK whenever a new Four-Way-Handshake protocol takes place between a host and device. Therefore, the UWB*Tracer/Trainer* system can only handle one Four-Way-Handshake at a time:

- If multiple Four-Way-Handshakes are interleaved, the UWB*Tracer/Trainer* system cannot track them.
- If multiple Four-Way-Handshakes are serialized, so that one finishes completely before the next one starts, the UWB*Tracer/Trainer* system can track them.

Note: The Connection Context from the USB Plug-in Module appears in the Device List.

To add a Connection Context to a WUSB host or device:

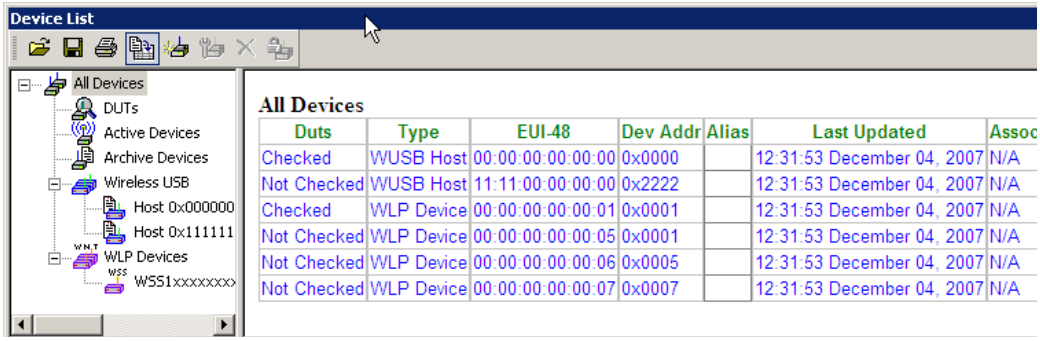


Figure 11.5 Device List Dialog Box

Step 1 If the WUSB host or device already appears in the Device List dialog box, double-click it to open the Edit Device dialog box at the General Settings tab:

Note: The Connection Context from the USB Plug-in Module will appear in the Device List.

To add a device to the Device List, click the **Add New Device** toolbar button to display the Add New Device dialog box.

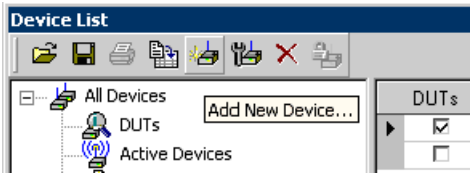


Figure 11.6 Opening the Add New Device Dialog Box

Step 2 In the Add New Device or Edit Device dialog box, set the Device Type to **Wireless USB Host** or **Wireless USB Device**.

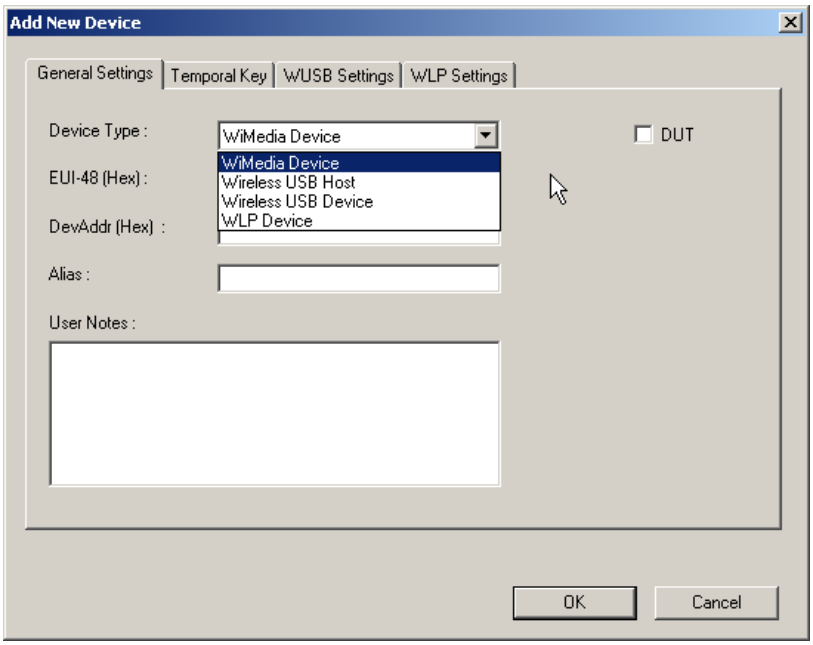


Figure 11.7 Manually Adding a New Device

Then fill in the other fields on the General Settings tab, using the correct format. Check the **DUT** checkbox for the device.

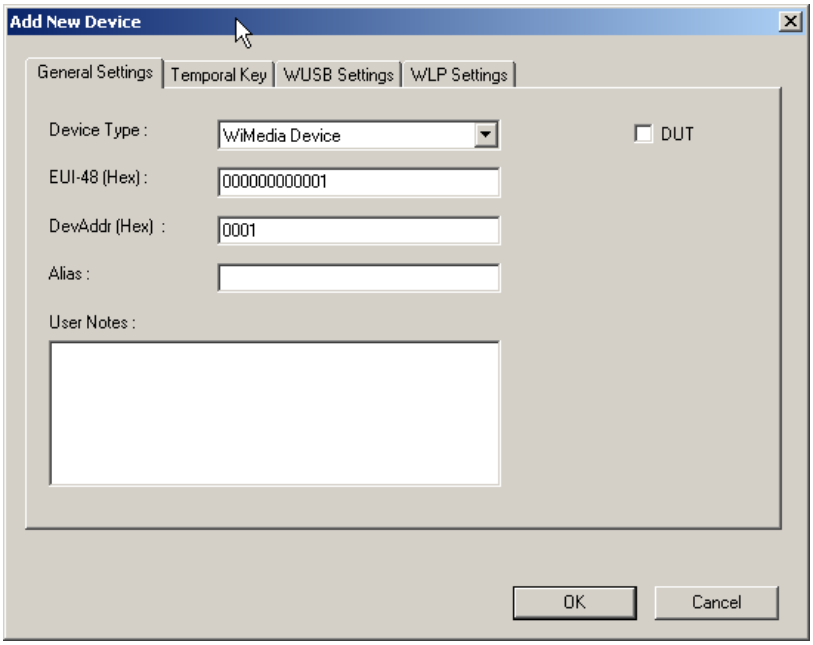


Figure 11.8 Add New Device Dialog Box General Settings Tab Fields

Step 3 Select the **WUSB Settings** tab, then enter the correct **CHID** for the WUSB host or **CDID** for the WUSB device:

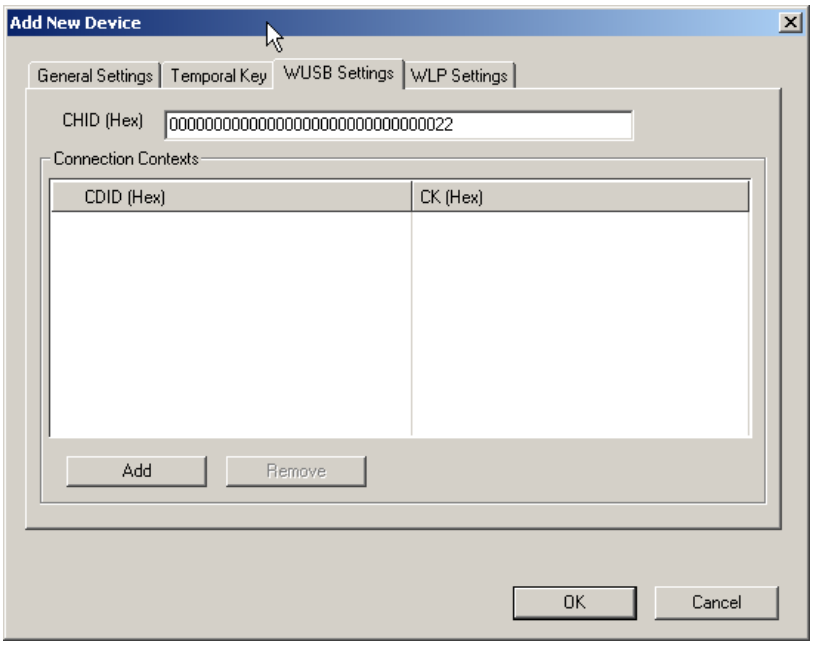


Figure 11.9 Device Type Specific Settings Tab with CHID or CDID

Step 4 Click the **Add** button to open the Add Connection Context dialog box, then enter the correct **CDID** for the WUSB host or **CHID** for the WUSB device and enter **CK**, and then click **OK**:

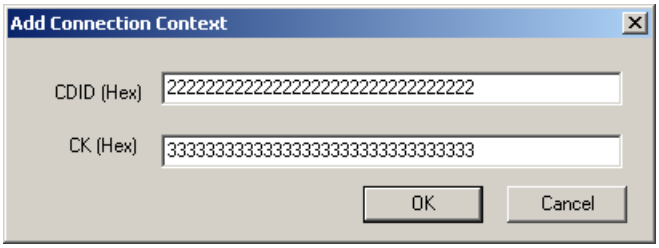


Figure 11.10 Entering CDID or CHID and CK

Step 5 Repeat Step 4 for each additional Connection Context you want to specify.

Step 6 Click **OK** to save changes and return to the General Settings tab.

Step 7 Repeat Steps 2 through 6 for each device you want to track.

Step 8 Click **OK** to save changes and exit the Add New Device or Edit Device dialog box.

Step 9 Make sure the WUSB host or device has the DUT box checked:

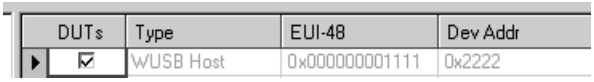


Figure 11.11 DUT Checkbox

Step 10 Click the Program Security Data toolbar button to send changes to the analyzer:

Figure 11.12 Program Security Data Toolbar Button

Temporal Key Direct Programming

In this method, you add a Temporal Key ID (TKID) and Temporal Key (TK) to the device attributes when you add or edit a device in the Device List.

The UWB*Tracer/Trainer* system decrypts traffic using the Temporal Key whenever a match is found with the TKID and the device address (DevAddr) of the device.

This method can be used for programming both Pair-wise Temporal Keys (PTK) and Group Temporal Keys (GTK).

Note: You must use the Direct Programming method to decrypt traffic between two WiMedia devices that are not running the Certified WUSB protocol.

To add a Temporal Key directly to a WUSB host or device:

Step 1 If the device already appears in the Device List (see Figure 11.5), double-click it to open the Edit Device dialog box.

If the device is not in the Device List, click the **Add New Device** toolbar button (see Figure 11.6) to display the Add New Device dialog box (see Figure 11.7).

Step 2 Enter information in the correct format in the fields on the General Settings tab (see Figure 11.8).

Check the DUT checkbox for the device.

Step 3 Select the **Temporal Key** tab:

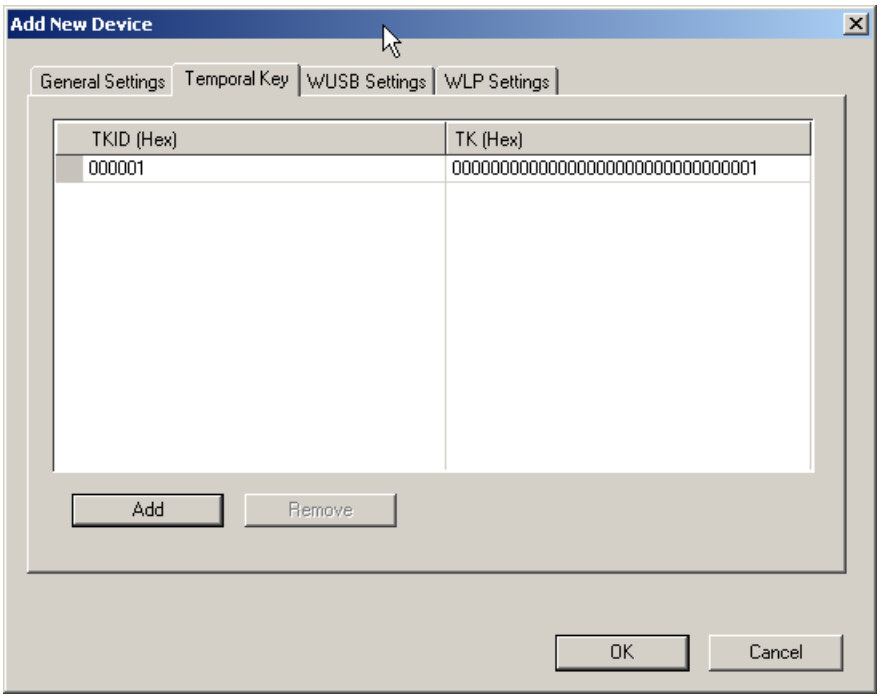


Figure 11.13 Temporal Key Tab

Step 4 Click the **Add** button to open the Add Temporal Key dialog box, then enter the correct **TKID** and **TK** for the device in the proper format, and then click **OK**:

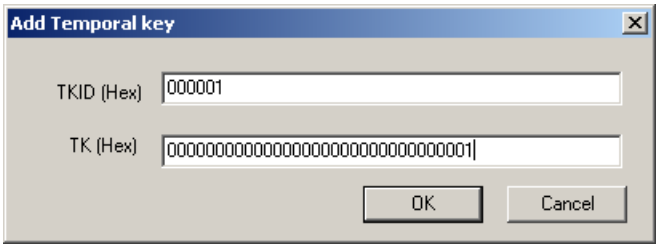


Figure 11.14 Entering TKID and TK

Step 5 Repeat Step 4 for each additional Temporal Key you want to specify.

Step 6 Click **OK** to save changes and return to the General Settings tab.

Step 7 Repeat Steps 2 through 6 for each device you want to track.

Step 8 Click **OK** to save changes and exit the Add New Device or Edit Device dialog box.

Step 9 Make sure that the device has the DUT box checked (see Figure 11.11).

Step 10 Click the **Program Security Data** toolbar button (see Figure 11.12) to send changes to the analyzer.

Chapter 12: Recording Options

The recording options are the parameters for the recording session. You set the recording options to obtain only the trace information you need.

To use the Recording Options window:

- From the Setup menu, select **Recording Options**.

  OR

- From the Tool bar, select the **Recording Options** button to display the Recording Options window (Figure 12.1).

The Recording Options window has the tabs:

- **General:** General recording characteristics, including buffer size, recording type, and Trace filename and path
- **MPI:** Specific recording characteristics
- **RF:** Specific recording characteristics
- **USB Assoc:** USB_Cable_Association traffic
- **Recording Rules:** Sets triggers and filters.

Note: The settings you configure apply to all recordings made by the analyzer.

You can save and load recording options. The following sections describe the General, MPI, RF, USB Assoc., and Recording Rules tabs.

12.1 Recording Options: General

The General page has boxes for System Operating Mode, Recording Type, Options, Options Name, Buffer, Trigger Position, and Trace Filename and Path.

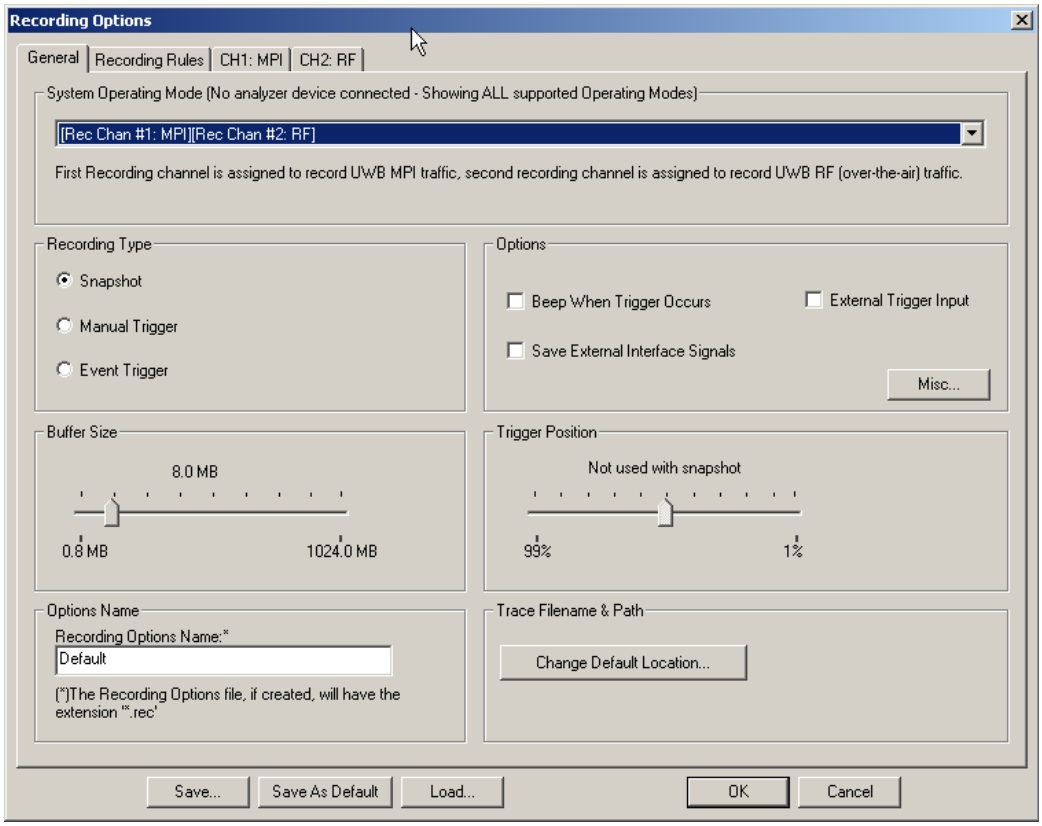


Figure 12.1 Recording Options: General Page

System Operating Mode

You can select the combination of analyzers, exerciser, and USB platforms. Selecting a mode changes the tabs presented in the Recording Options dialog.

- **[Rec. Chan #1: MPI] [Rec. Chan #2: RF]**
- **[Rec. Chan #1: MPI] [Rec. Chan #2: RF] [Supports USB Association Capturing]**
- **[Rec. Chan #1: RF] [UWBTrainer supported]**
- **[Rec. Chan #1: MPI] [UWBTrainer supported]**
- **[Rec. Chan #1: Probe UWBTrainer] [UWBTrainer supported]**
- **[Rec. Chan #1: RF]**
- **[Rec. Chan #1: RF] [Rec. Chan #2: RF]**

Note: In a two-unit setup, two separate analyzers link together by BNC on the back of the units to form a single, logical analyzer. (See Chapter 2 for the cabling for a two-unit setup.)

Recording Type

Recording begins when you click the **Start Recording** button on the Tool bar or select the **Record > Start** command. Maximum recording size is set in the Buffer Size box.

The Recording Type box options control how UWB*Tracer/Trainer* ends a recording:

- **Snapshot**: Recording ends when the length reaches the selected buffer size or you click the **Stop Recording** button .
- **Manual Trigger**: Recording continues until you press the Trigger button (on the front panel). After you press the Trigger button, recording continues until the post-trigger buffer is full or you click the **Stop Recording** button on the Tool bar.
- **Event Trigger**: Recording continues until a (user-defined) trigger event occurs. After the event occurs, recording continues until the post-trigger buffer is full.

Note: See the Readme file on the software installation CD for current information on triggering support.

Options

The options checkboxes appear on the upper right side of the Recording Options window:

- **Beep When Trigger Occurs**: Makes the computer connected to the UWB-*Tracer/Trainer* beep three times when a Trigger condition is first detected.
- **Save External Interface Signals**: Records signals from data pins on the breakout board.
- **External Trigger Input**: Allow triggers from the trigger cable.

Misc Button

To generate an additional binary file at the end of recording:

Step 1 Select the **Misc button** to display the General: Miscellaneous dialog box.

Step 2 Select the **Store into Raw Data Debug File** checkbox.

The file is stored in the root (**c:**) directory. The file name is **BusEngineRawTracexxxx.dat**, where xxxx is the serial number of the analyzer. Use the file to provide additional information if you want to report a problem to LeCroy Technical Support.

Warning! :The Raw Data Debug binary file can have a very large size.

Buffer Size

The program records the entire trace and stores it in the analyzer buffer before uploading it to the host PC. The buffer size determines the maximum size of a recording.

Use the Buffer Size slide bar to set the recording buffer size from 1.6 MB to 2048 MB (Figure 12.2).

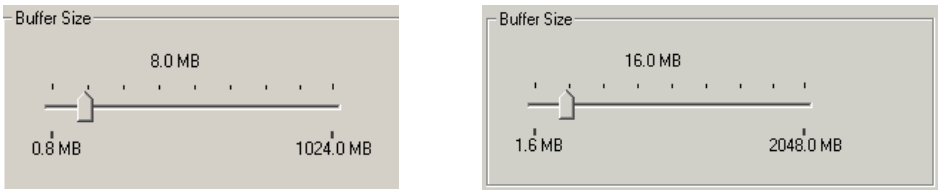


Figure 12.2 Recording Options: Buffer Size Slider

Note: With a regular license, maximum recording buffer size is 1024 MB. You need a unit with a 2-GB license to have a maximum recording buffer size of 2048 MB.

Trigger Position

The program uses Trigger Position when the recording type is **Manual Trigger** or **Event Trigger**.

Use the Trigger Position slide bar to set the percentage of the buffer size used for post-trigger recording (Figure 12.3).

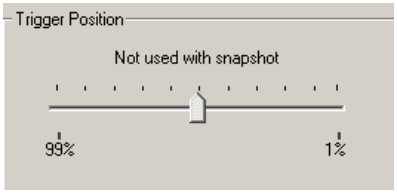


Figure 12.3 Recording Options: Trigger Position Slider

This action sets the location of the trigger within the buffer. For example, if the buffer size is 16 MB and the trigger position slide bar is at 75%, 12 MB of the buffer (75%) is post-trigger and 4 MB is pre-trigger. If the buffer size is 16 MB and the trigger position slide bar is at 5%, 0.8 MB of the buffer (5%) is post-trigger and 15.2 MB is pre-trigger.

When a trigger occurs in a recording, recording continues until the post-trigger buffer is full. The complete trace contains the most recent pre-trigger information up to the pre-trigger buffer size, followed by the post-trigger information up to the post-trigger buffer size.

Options Name

You can name the current set of recording options in the Options Name field.

By default, the UWB*Tracer/Trainer*™ application uses the `default.rec` recording options file located in the application directory. You can save the current recording options in an options file in the application directory or save the recording options as the default file by replacing the `default.rec` file.

To create a new recording options file:

Step 1 Click the **Save** button to display the Save As dialog box.

Step 2 Enter a file name. You can use the same name or a different name than the name in the Options Name field. Do not add a file name extension. The program automatically appends a **`.rec`** extension.

To save the current options as the default file:

- Click the **Save as Default** button.

Trace Filename and Path

You can save the trace file recording in the Trace Filename and Path box. See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

To create a trace file:

Step 1 Click **Change Default Location** to display the Specify Trace File Name dialog box.

Step 2 Browse to or enter a trace file path and name, then click **Save**.

12.2 Recording Options: RF

An RF tab appears if you selected any of the following system operating modes:

- **[Rec. Chan #1: MPI] [Rec. Chan #2: RF]**
- **[Rec. Chan #1: MPI] [Rec. Chan #2: RF] [Supports USB Association Capturing]**
- **[Rec. Chan #1: RF] [UWBTrainer supported]**
- **[Rec. Chan #1: RF]**
- **[Rec. Chan #1: RF] [Rec. Chan #2: RF]**

You can set RF recording options. The RF tab controls the RF recording channel.

For RF recording, select the **RF checkbox** at the top left of the RF tab in the lower left corner of the window.

Note: If you are in RF scan mode and MPI traffic is present, uncheck the MPI option to reserve a buffer for scan results.

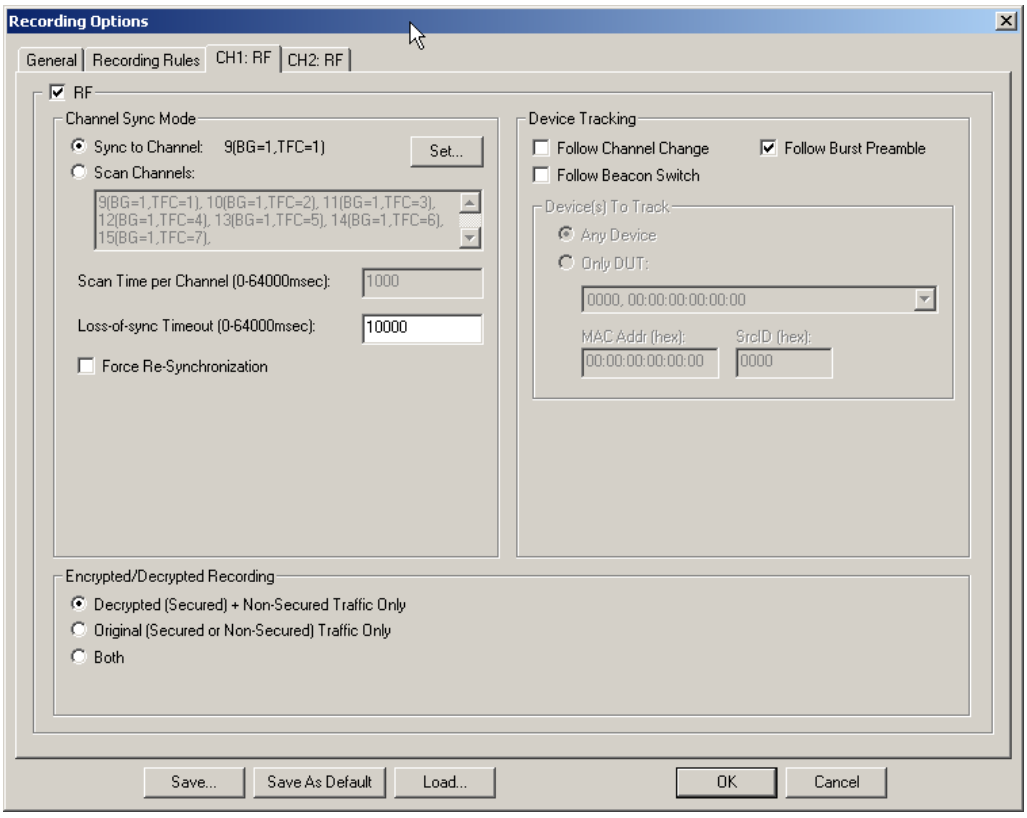


Figure 12.4 Recording Options Window: RF Tab Defaults

Channel Sync Mode

For the analyzer to capture RF traffic, you must synchronize the RF transmission of at least one device under test (DUT). Use the Channel Sync Mode section to set the parameters required for synchronizing to a device.

Two modes of operation can be set:

- **Sync to Channel**: Directs the analyzer to attempt to synchronize to a specific channel. In this mode, you can only select a single channel in the Select Sync Channel window displayed after you click the Set button.
- **Scan Channels**: Directs the analyzer to scan the first channel for a specified period of time, then repeat for the remaining channels. In this mode, you can select multiple channels in the Select Sync Channel window displayed after you click the Set button. The system stops recording automatically after all selected channels have been scanned.

To select the channel or channels, click **Set** to display the Select Sync Channel(s) dialog box:

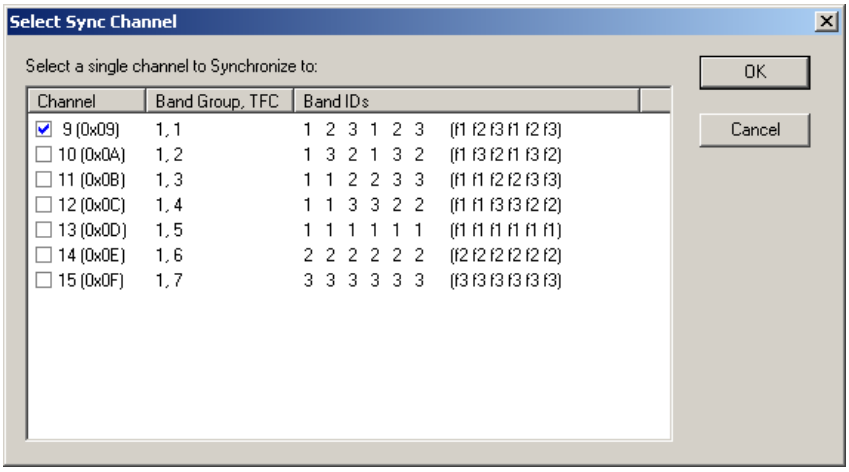


Figure 12.5 Select Sync Channels Dialog Box

The dialog box lists the Channel, Band Group/TF Code, and Band IDs.

Select a checkbox on the left to select a channel. When you are finished selecting channels, click **OK**.

Note: Empty packets may be created in either Scan mode.

Scan Time per Channel
Set the scan period for each channel. The range is 0 to 64,000 milliseconds. The default is 1000 milliseconds. You can set this option only when the Channel Sync Mode is set to "Scan Channels."

Loss-of-Sync Timeout
Set the timeout period to use when out-of-synchronization occurs. The range is 0 to 64,000 milliseconds. The default is 10,000 milliseconds.

Force Resynchronization
Resynchronizes the analyzer receiver PHY with the signal from the devices under test.

If the RF channel is already synchronized to transmitted data from a DUT, this setting forces the analyzer to terminate the synchronization and then try to resynchronize when a new recording begins.

Note: If the analyzer is in "Scan Channels" Channel Sync Mode and you modify the channel setting, the software sets the Force Resynchronization flag internally.

Device Tracking

After the analyzer is initialized/synchronized to a device on a channel, if the DUT changes channels, the analyzer can follow a specific DUT to the other channel or it can stay on the same channel and follow a beacon switch or a burst preamble of the DUT(s). The device tracking options are:

- **Follow Channel Change**: The analyzer follows the specified DUT to a different channel if the DUT changes to a different channel.
- **Follow Beacon Switch**: The analyzer stays on the same channel and follows a beacon switch of any of the DUT(s) if the specified DUT changes to a different channel.
- **Follow Burst Preamble**: The analyzer stays on the same channel and follows a burst preamble of any of the DUT(s) if the specified DUT changes to a different channel.

Devices to Track

Several DUTs may share the same channel to which the analyzer is synchronized. You can set the analyzer to follow one or a subset of those DUTs.

To select a subset of the devices, you can select from a list of DUTs. Alternatively, you can filter a subset from the set of devices by setting the MAC Address Mask and the SrcID (Source ID) Mask. Only the devices matching the properties you set will be in the subset of devices.

To set the devices to track, select **Any Device** or **Only DUT**. If you select Only Device, select the device from the list of devices. The MAC Addr (Address) Mask and the SrcID (Source ID) Mask are listed in hexadecimal.

Encrypted/Decrypted Recording

You can show secured decrypted traffic, original (secured or not secured) traffic only, or both types of traffic:

- **Decrypted (Secured) + Non-Secured Traffic Only**: Records all non-secure frames; records secure frames, and stores decrypted payload.
- **Original (Secured or Non-Secured) Traffic only**: Records all non-secure and secure frames unchanged.
- **Both**: Interleaves Decrypted and Original Traffic.

For information about setting decryption connection contexts and temporal keys, see Section 9.7, “Device List” on page 128.

(For information about encryption keys, association data, and 4-way handshakes, see Section 11.5, “Secured Traffic” on page 167.)

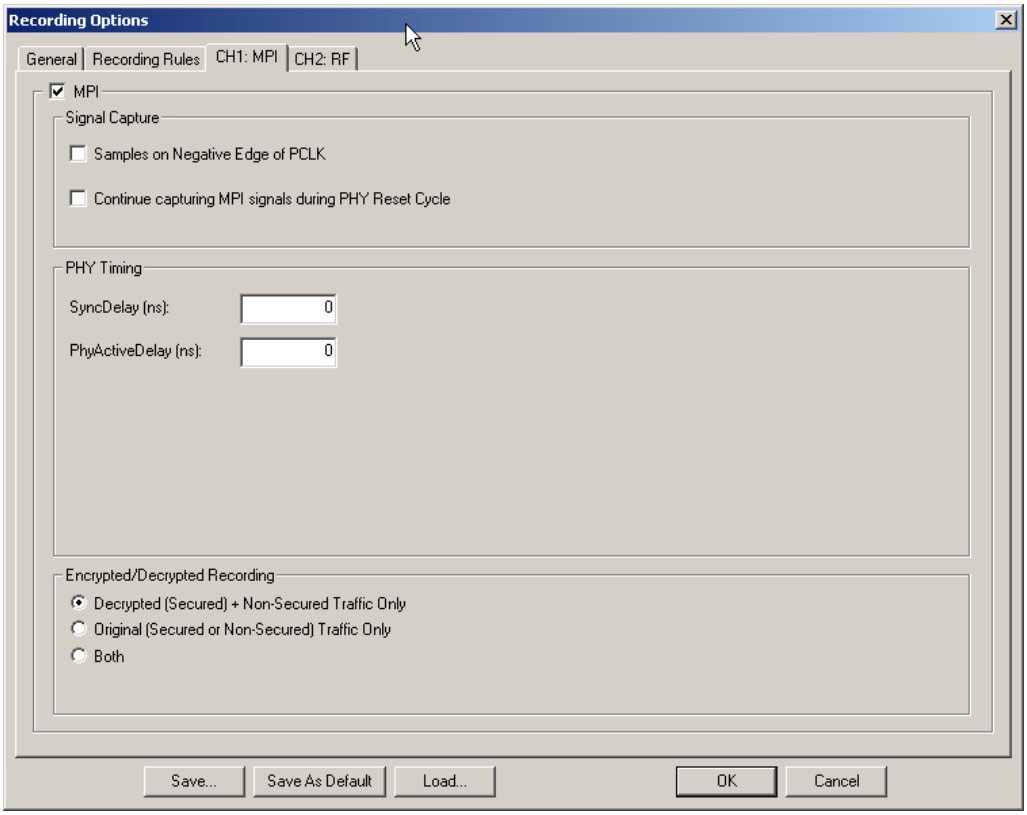
12.3 Recording Options: MPI

An MPI tab appears if you selected any of the following system operating modes:

- **[Rec. Chan #1: MPI] [Rec. Chan #2: RF]**
- **[Rec. Chan #1: MPI] [Rec. Chan #2: RF] [Supports USB Association Capturing]**
- **[Rec. Chan #1: MPI] [UWBTrainer supported]**

You can set MPI recording options.

For MPI recording, select the **MPI checkbox** at the top left of the MPI section in the lower left corner of the window.



Signal Capture

By default, a trigger occurs on the negative edge of the PCLK clock pulse. If recording data is corrupt, you can set a trigger to occur on the positive edge of the PCLK clock pulse by deselecting the **Samples on Negative Edge of PCLK** checkbox in the Signal Capture section in the lower left corner of the window.

To continue recording during reset, select the **Continue capturing MPI signals during PHY Reset Cycle** checkbox in the Signal Capture section in the lower left corner of the window.

PHY Timing

You must manually set the correct delay values for the PHY on the probed MPI. You can typically find these values on the PHY datasheet:

- **SyncDelay**: Delay from the end of the last symbol of the Frame Synchronization Sequence of the preamble waveform in the local antenna to the time when the PHY asserts PHY_ACTIVE, in nanoseconds.
- **PhyActiveDelay**: Delay from the end of the last symbol of the frame received in the local antenna and PHY_ACTIVE de-assertion, in nanoseconds.

Note: For RF, you do not need to set the PHY Timing parameters because the software knows these values for the UWB*Tracer/Trainer* PHY module.

Encrypted/Decrypted Recording

You can show secured decrypted traffic, original (secured or not secured) traffic only, or both types of traffic:

- **Decrypted (Secured) + Non-Secured Traffic Only**: Records all non-secure frames; records secure frames, and stores decrypted payload.
- **Original (Secured or Non-Secured) Traffic only**: Records all non-secure and secure frames unchanged.
- **Both**: Interleaves Decrypted and Original Traffic.

For information about setting decryption connection contexts and temporal keys, see Section 9.7, “Device List” on page 128.

(For information about encryption keys, association data, and 4-way handshakes, see Section 11.5, “Secured Traffic” on page 167.)

12.4 Recording Options: USB Assoc.

An USB Assoc. tab appears if you selected the following system operating mode:

- **[Rec. Chan #1: MPI] [Rec. Chan #2: RF] [Supports USB Association Capturing]**

Note: For capturing the USB Cable Association traffic (as defined in the Certified Wireless USB specifications) so it can be used to decrypt WiMedia UWB traffic, the USB Analyzer plug-in module (US007MA) has to be installed. For information on how to set up the system, see Section 13.2 “USB Cable Association for Certified WUSB” on page 220.

Because the USB Analyzer plug-in module is always active and ready for capture, the only setting needed is to choose the speed. Set the speed of the traffic recorded by the Analyzer in the USB Association Capture Settings recording options on the USB Assoc. page (Figure 12.6).

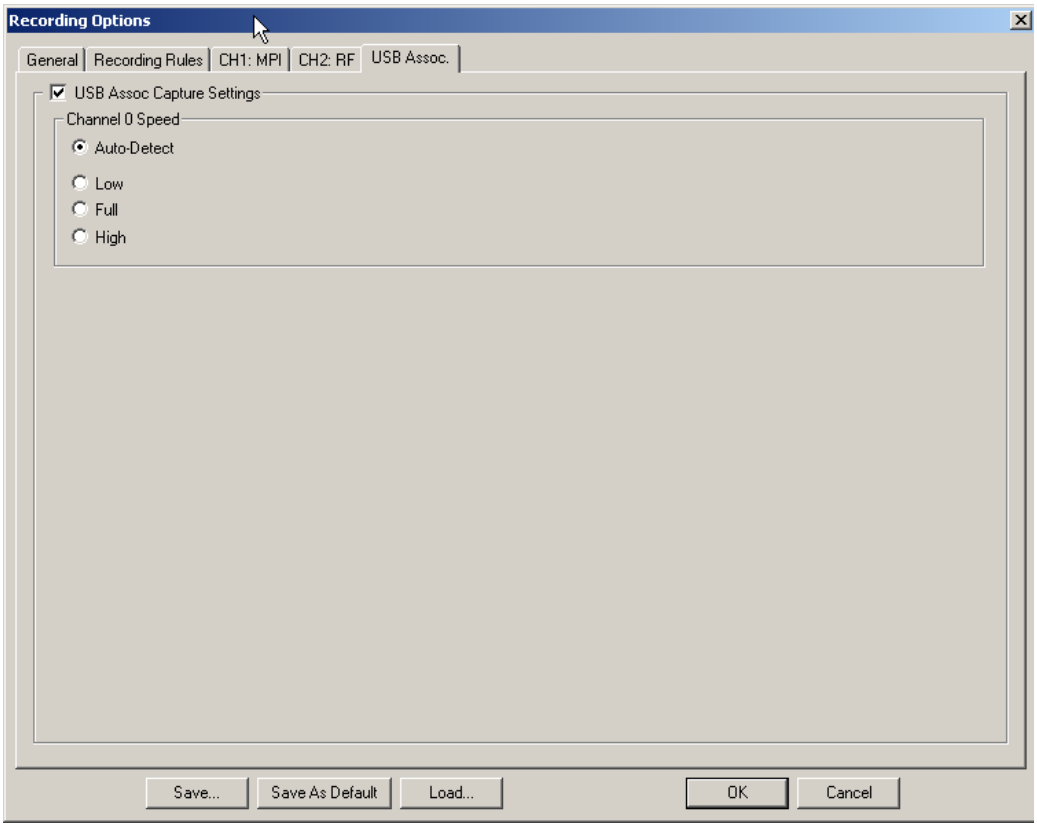


Figure 12.6 USB Assoc. Dialog Box

By default, the USB Association Capture Settings are disabled. Check the **USB Assoc Capture Settings** checkbox to enable capture.

If you enable capture, select the Channel 0 Speed:

- **Auto-Detect**: By default, the Analyzer discovers the speed at which traffic is running on the device and labels packets accordingly.
- **Low**: For use with known Low speed devices, the Analyzer records only at Low speed.
- **Full**: For use with known Full speed devices, the Analyzer records only at Full speed.
- **High**: For use with known High speed devices, the Analyzer records only at High speed.

Use the default setting **Auto-Detect** unless you have problems with your recordings.

Rarely, the auto-detection circuitry causes Full Speed devices to fail to enumerate on plug-in. To solve this problem, change the Analyzer speed to Full speed.

For other recording problems, change the Analyzer speed to Low, Full, or High to debug the problem. For example, if a device is producing numerous errors at a particular speed, set the recording to that speed to check that the Analyzer is not misreading the error packets and labeling them with the wrong speed (this possibility is highly unlikely and is used here only as an illustration of setting manual speeds).

Manually setting the recording speed guarantees that the Analyzer always records packets at that speed.

Notes on High Speed Recordings

Erroneous chirp blocks can be recorded on an idle bus when the device has its FS terminations on while the Host has HS terminations connected. This causes a small differential voltage ("tiny-J") on the USB bus that causes false chirp detection.

This condition occurs during speed negotiation:

- On an HS bus, the condition is momentary just before the device chirps.
- On a CS bus, the condition occurs both before and after the device chirp (until the end of Reset). **Do not use HIGH speed to record signals on a classic speed bus.**
- The Analyzer stops recording anything for 2.5 milliseconds following an FS_K state (which is at least 2 microseconds long). Stopping recording avoids presenting any useless information while the high-speed probe settles down.

12.5 Recording Options: Recording Rules

Use the Recording Rules page (Figure 12.7) to set triggers and filters.

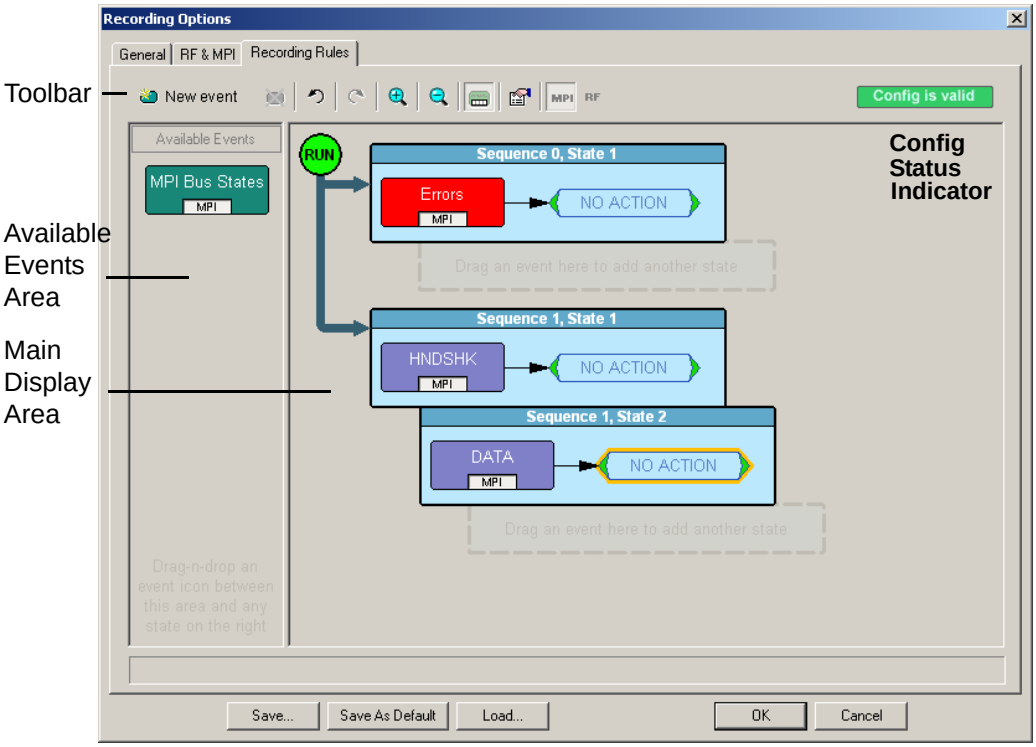


Figure 12.7 Recording Options Window: Recording Rules Page

The page has the following areas:

- **Toolbar:** Contains buttons that control the Recording Rules page.
- **Available Events Area:** Area where you can park Event buttons that you intend to use in the Main Display area.
- **Main Display Area:** Area where you configure trigger and filter rules. You configure rules by dragging Event buttons from the Available Events area and then assigning actions to those buttons.
- **Config Status Indicator:** A button that indicates if the rule is valid or invalid. If a trigger or filter rule is configured correctly, the button is green and indicates Config is Valid. If a rule is not configured correctly, the button is red and indicates Config is Invalid.

Pop-Up Menus: When you right-click a button or area in the Recording Rules page, a context-sensitive pop-up menu appears that lets you do operations that relate to that button or area.

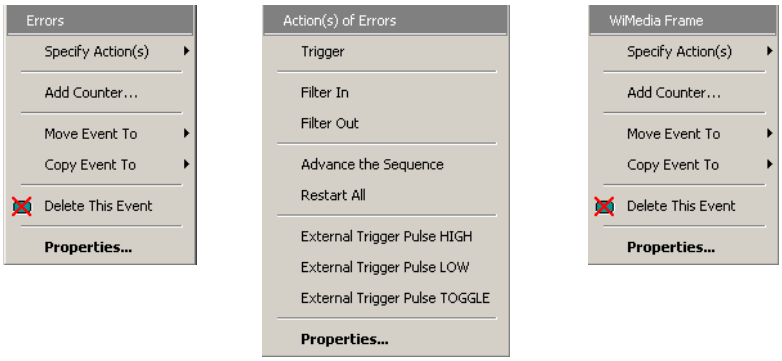


Figure 12.8 Recording Options Window: Popup Menus

Properties Dialogs: When you click the Show/Hide Properties Dialog button for an event, action, or state, a dialog allows you to perform the same operations as in the pop-up menus. (See “Events and Event Properties” on page 198 and “Actions and Action Properties” on page 199.)

Recording Rules Toolbar

The Recording Rules toolbar (Figure 12.9) buttons (Table 12.1) control the Recording Rules page.

Figure 12.9 Recording Rules Toolbar

Table 12.1 Recording Rules Buttons

New event	New Event. Creates a new event in the Available Events area.		Zoom Out. Makes the display appear smaller.
	Delete Event. Deletes the selected event.		Show/Hide Channels. Shows or hides the channel icon on the Event button.
	Undo. Undoes the change made to Recording Rules page. The Undo buffer has unlimited size.		Show/Hide Properties Dialog. Shows or hides the properties dialog of the selected event, action, or state.
	Redo. Restores changes done to the Recording Rules page.	Config is valid	This display appears when the current Recording Rules configuration can be executed by the hardware.
	Zoom In. Enlarges the display (see note). There are five zoom levels. The default level is the middle one.	Config is invalid	This display appears when the current Recording Rules configuration cannot be executed by the hardware.
MPI	Apply Recording Rules to MPI Recording Channel	RF	Apply Recording Rules to RF Recording Channel

Note: If you have a wheel on the mouse, you can zoom by holding down the CTRL key and rolling the mouse wheel.

Recording Rules Page: How It Works

You can think of the Recording Rules page as a workspace for creating recording rules (rules that determine how the analyzer records traces). Recording rules are combinations of events and actions.

In UWB*Tracer/Trainer* terms, an event and the action or actions associated with it form a rule state. One or more states are encapsulated in a sequence.

Note: There can be from one to 512 states within a sequence. You can associate one or more events with each state, and you assign each event a different action or the same action.

A sequence that has only one state is called a single-state sequence. The analyzer continuously watches for each event in the sequence and executes the corresponding action if the event is detected.

A sequence that has multiple states is a multi-state sequence. The states are arranged in a hierarchy, with a top state and successively lower states. Only one state in a multi-state sequence is active at a time. The analyzer does not go to a successive state unless it is directed to do so by the previous state.

Sequences are described in detail in "Using Sequences" later in this chapter.

Briefly, creating a rule involves the following steps:

Step 1 Creating Event buttons in the Available Events area.

Step 2 Drag-and-drop of Event buttons to the appropriate areas (cells) in the Main Display area.

Step 3 Assigning an action or actions to each Event button.

Creating Event Buttons

To create a rule, first create one or more Event buttons. As you create Event buttons, they appear in the Available Events area. You then can drag-and-drop them into the Main Display area.

To create event buttons:

Step 1 Click the **New Event** button at the left side of the toolbar to display the New Event pop-up menu (Figure 12.10) for MPI or RF.

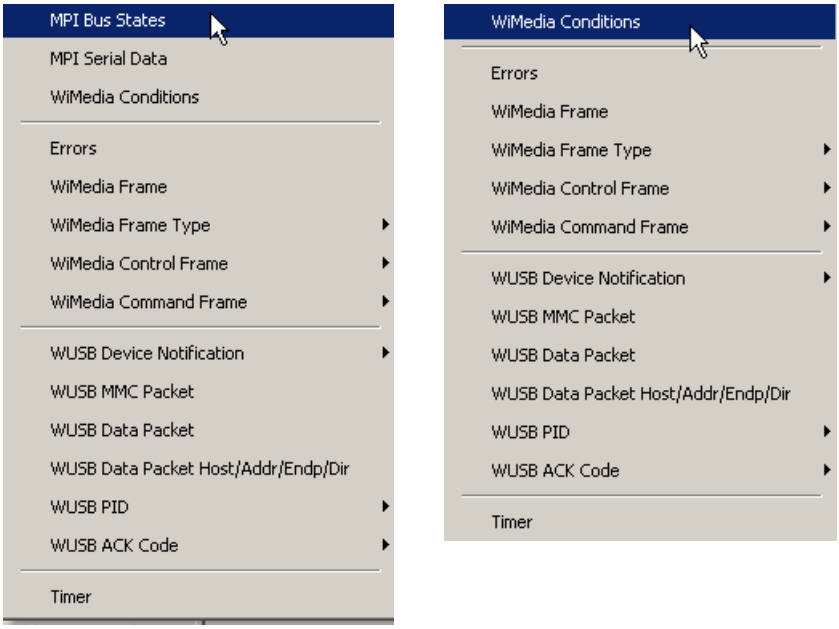


Figure 12.10 Creating a New Event

Step 2 Select an event (Figure 12.11).

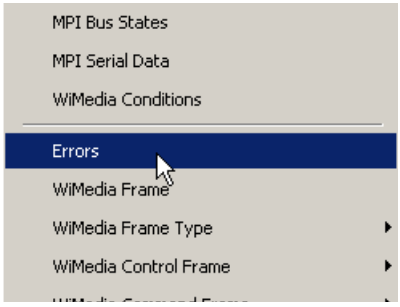


Figure 12.11 Selecting Event Type

The event appears in the Available Events area (Figure 12.12).

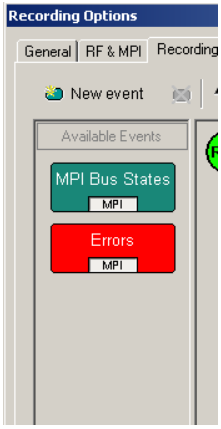


Figure 12.12 Event Button Appears in Available Events Area

Dragging a Button to the Main Display Area

After you create an Event button in the Available Events area, you can drag the button to the Main Display area and drop it in the appropriate cell (a cell is a grayed-out rectangle with a dashed line around it). You can think of each cell as a target for drag-and-drop of an Event button.

There are two types of cell that might appear: Sequence cell and State cell. In the Main Display area, they are labelled as follows:

- **Sequence cell**: Drag an event here to add a new sequence.
- **State cell**: Drag an event here to add another state.

If there currently are no events in the Main Display area, a single sequence cell appears at the top of the area (Figure 12.12).

To drag-and-drop the Event button:

Step 1 Place the mouse cursor on the Event button in the Available Events area. Click the left mouse button.

Step 2 Drag the button to the cell. When the button is in the cell, a dashed highlight line appears around the cell (Figure 12.13).

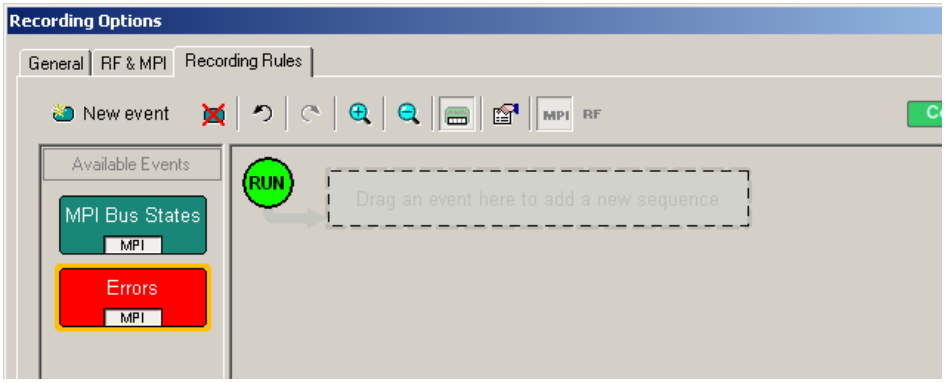


Figure 12.13 Drag-and-Drop Event Button to Cell

Step 3 Drop the button in the cell (release the left mouse button). The Event button appears in the cell (Figure 12.14).

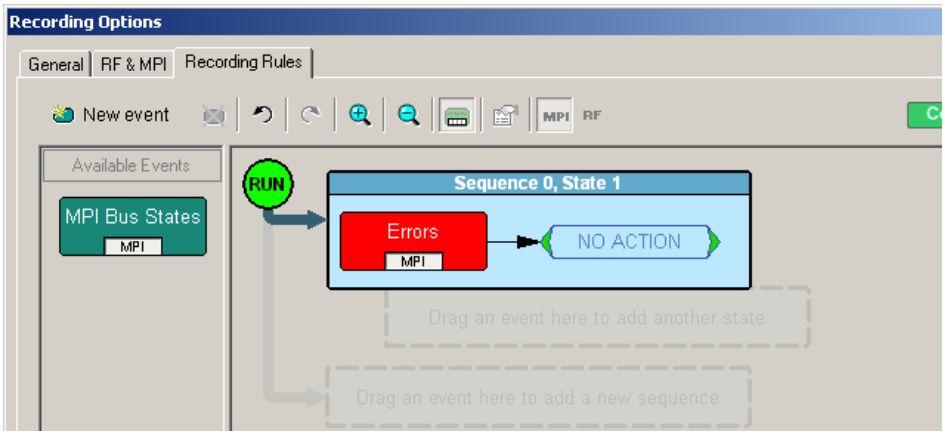


Figure 12.14 Event Button in Cell

As shown in Figure 12.14, the default label for the first cell is “Sequence 0, State 1." As described later in this section, you can change that label using the Properties pop-up for that cell.

As Figure 12.14 also shows, two new cells appear under the first cell. The first of these new cells is a state cell that allows you to create another state in rule Sequence 0 (to make Sequence 0 a multi-state sequence).

The second of the new cells is to create a separate sequence, which would be labelled Sequence 1.

Assigning an Action

After you have dropped the Event button in a cell in the Main Display area, you can assign an action to the event.

Note: If you do not assign an action to an Event button, the analyzer ignores the event.

To assign an action to an Event button:

Step 1 Right-click the Event button to display a pop-up menu (Figure 12.15).

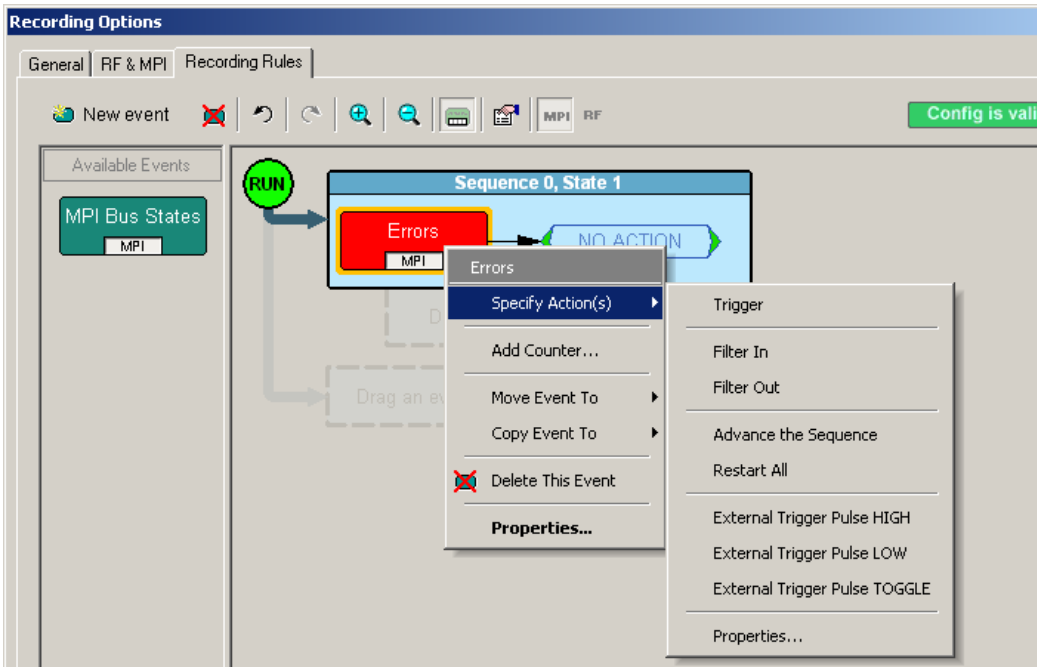


Figure 12.15 Selecting Action From Event Button Pop-Up

Step 2 Select Specify Action, and then choose an action from the submenu. The menu closes, and the action is assigned (Figure 12.16).

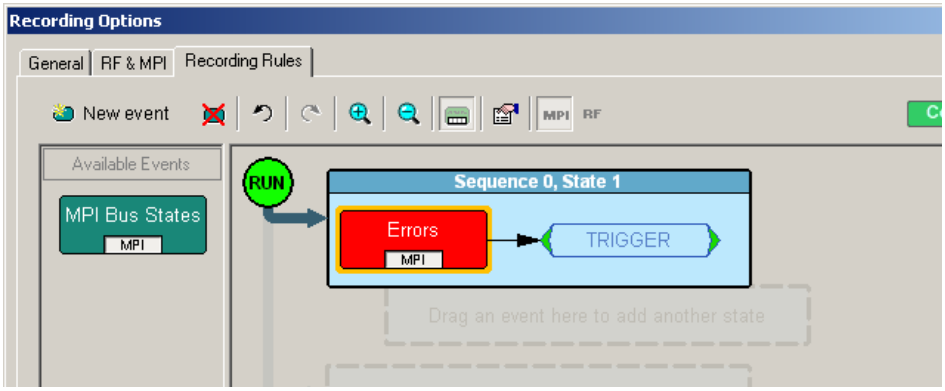


Figure 12.16 Action Assigned to Event

Note: You can also set actions within the Properties dialog for each event. Double-click the Event button to open the Properties dialog, then select the Actions tab and set your actions.

Recording Rules Pop-Up Menus

The Recording Rules window has context-sensitive pop-up menus that are associated with the following types of object: cells, events, and actions.

Cell Pop-up Menu

If you click a cell in the Main Display area that has an Event button contained in it, the Cell pop-up menu appears (Figure 12.17).

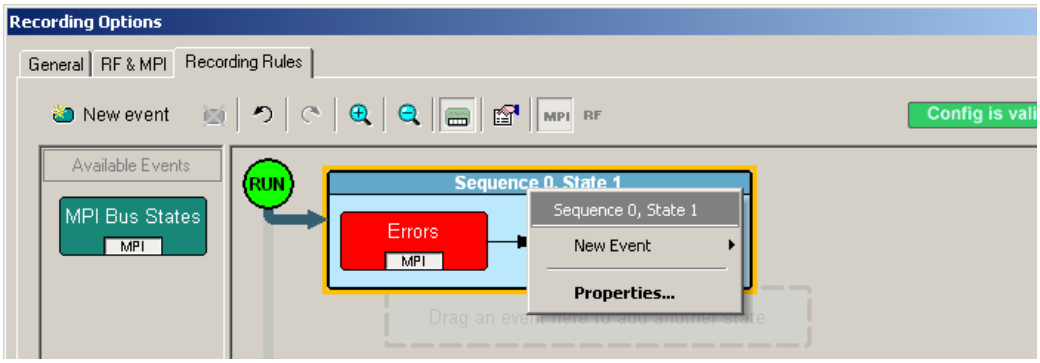


Figure 12.17 Sequence Pop-Up Menu

The Cell pop-up menu has the following options.

- **New Event**: Displays the same menu that you get when you click the New Event button on the toolbar.
- **Properties**: Displays the Properties dialog for the selected cell.

Action Pop-up Menu

If you click an Action button in the Main Display area, the Action pop-up menu appears (Figure 12.18).

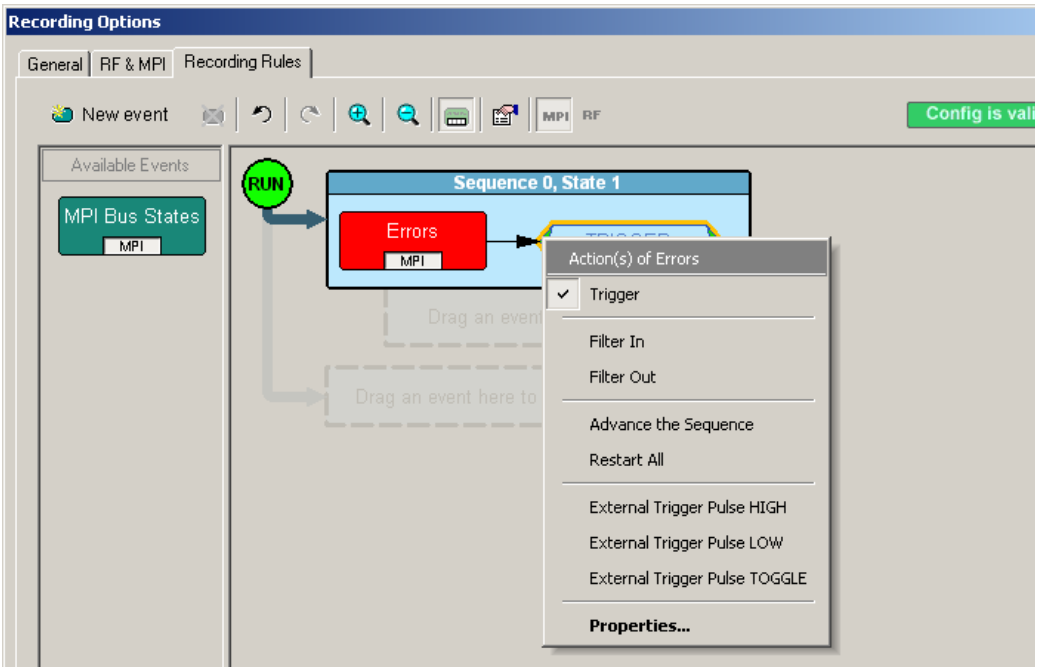


Figure 12.18 Action Pop-Up Menu

The Action pop-up menu has the following trigger and filter options:

- **Trigger**: Sets or clears Trigger action.
- **Filter In**: Sets or clears Filter In action. If Filter In is set, you cannot use Filter Out (it is disabled).
- **Filter Out:** Sets or clears Filter Out action. If Filter Out is set, you cannot use Filter In (it is disabled).

Note: Examples that show use of filters are provided later in this chapter.

Advance the Sequence: Creates an event sequence consisting of the event you clicked on and an event in a successive state of the sequence. A thick arrow appears from the selected event and points downward.

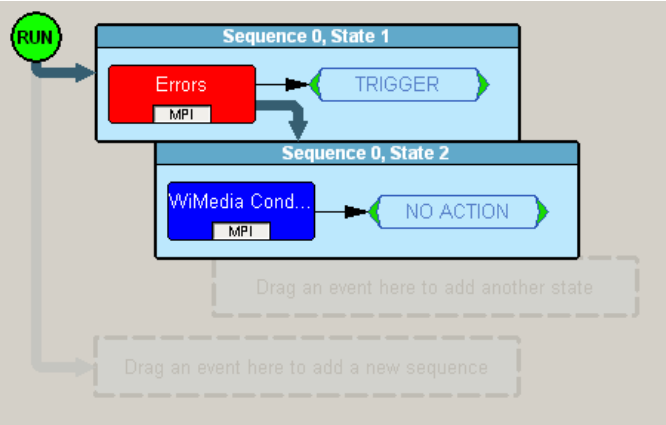


Figure 12.19 Advance the Sequence

In other words, the **Advance the Sequence** button is the link between two states in a multi-state sequence. The **Advance the Sequence** arrow tells the analyzer to go to the next state if it detects the event at the tail (origin) of the arrow.

The Action pop-up menu has the following restart and trigger options:

- **Restart the Sequence (not shown)**: Restarts the sequence. Note that this option is context-sensitive and only appears if you have created a multi-state sequence. A thick arrow appears from the selected event and point upward towards the first event in the sequence.
- **Restart All:** Restarts all rules in all sequences and in the global state and displays an arrow and a Restart All button. This action precludes selecting Advance the Sequence and Restart the Sequence.
- **External Trigger Pulse HIGH:** Sends an output signal with a Pulse High format through the output ports on the back of the UPAS. Pulse High is the default format. Pulse High causes the analyzer to transmit a 5-volt, 40-nanosecond signal.
- **External Trigger Pulse LOW:** Sends an output signal with a Pulse Low format through the output ports on the back of the UPAS. Pulse Low causes the analyzer to transmit a 0-volt, 40-nanosecond signal.
- **External Trigger Pulse TOGGLE:** Causes the analyzer to transmit a signal that toggles at a trigger event between a continuous 5 volt signal and a continuous 0 volt signal.
- **Properties**: Displays the Action Properties dialog for the selected action.

Event Pop-up Menu

If you click an Event button in the Main Display area, the Event pop-up menu appears (Figure 12.20).

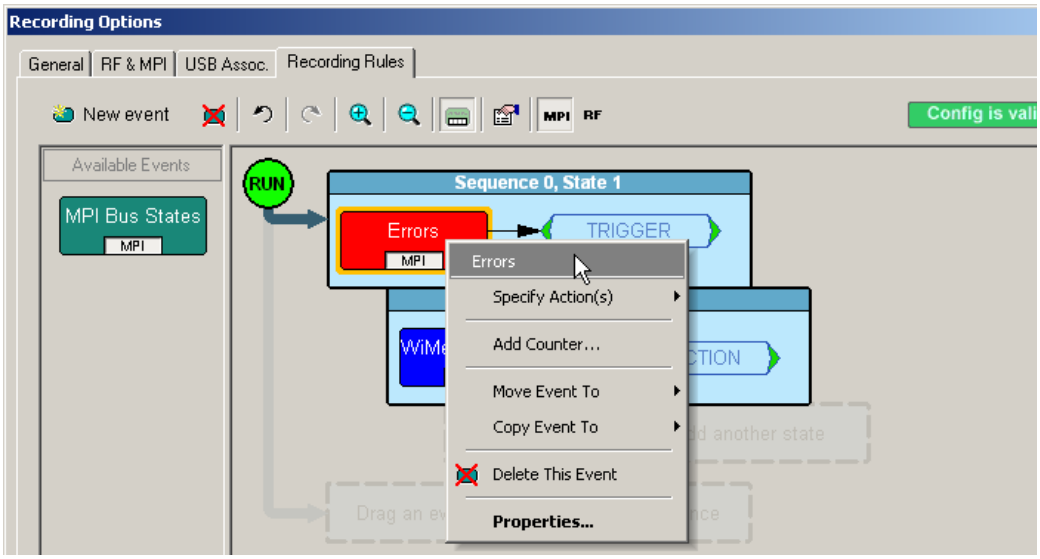


Figure 12.20 Event Pop-up Menu

The Event pop-up menu has the following options:

- **Specify Action(s)**: Opens the Actions submenu, allowing you to assign an action to the event. Options on this submenu are the same as those on the Action pop-up, described previously.
- **Add Counter:** Adds a counter to count a specified number of times the event occurs before the analyzer executes the corresponding action.
- **Move Event to:** Moves the selected event to a different position in the Recording Rules window.
- **Copy Event to:** Copies the selected event to a different position in the Recording Rules window.
- **Delete This Event:** Deletes the selected Event. Alternatively, you can use the Delete button on the toolbar or keyboard to delete events.
- **Properties**: Displays the Event Properties dialog for the selected event.

Events and Event Properties

Recording rules are associations between events and actions. These associations determine how trace recording occurs. Table 12.2 lists UWB*Tracer/Trainer* supported events for MPI.

Table 12.2 UWB*Tracer/Trainer* Events

Event	Description
MPI Bus States	Occurrence of selected MPI bus states (only for MPI channel)
MPI Serial Data	Occurrence of specified MPI serial data (only for MPI channel)
WiMedia Conditions	Occurrence of empty frames
Errors	Occurrence of RX frame errors, aborted frames, FCS, errors, or length mismatch
WiMedia Frame	Occurrence of a customizable frame pattern
WiMedia Frame Type	Occurrence of specified WiMedia frame type: Beacon, Control, Command, Data, Aggregated Data
WiMedia Control Frame	Occurrence of specified WiMedia Control frame: Imm-ACK, B-ACK, RTS, CTS, UDA, UDR, App Specific
WiMedia Command Frame	Occurrence of specified WiMedia Command frame: DRP Rsv Req, DRP Rsv Resp, Probe, PTK, GTK, Range, App Specific
WUSB Device Notification	Occurrence of specified WUSB Device Notification: DN_Connect, DN_Disconnect, DN_EPRdy, DN_RemoteWakeup, DN_MASAvailChanged, DN_Sleep, DN_Alive
WUSB MMC Packet	Occurrence of WUSB MPC packet
WUSB Data Packet	Occurrence of WUSB Data packet
WUSB Data Packet Host/Addr/Endp/Dir	Occurrence of any combination of the following fields: HOST, ADDR, ENDP, DIR
WUSB PID	Occurrence of DATA, IDATA, HNDSHK, DN
WUSB ACK Code	Occurrence of ACK, NAK, STALL
Timer	Occurrence of timer expiration

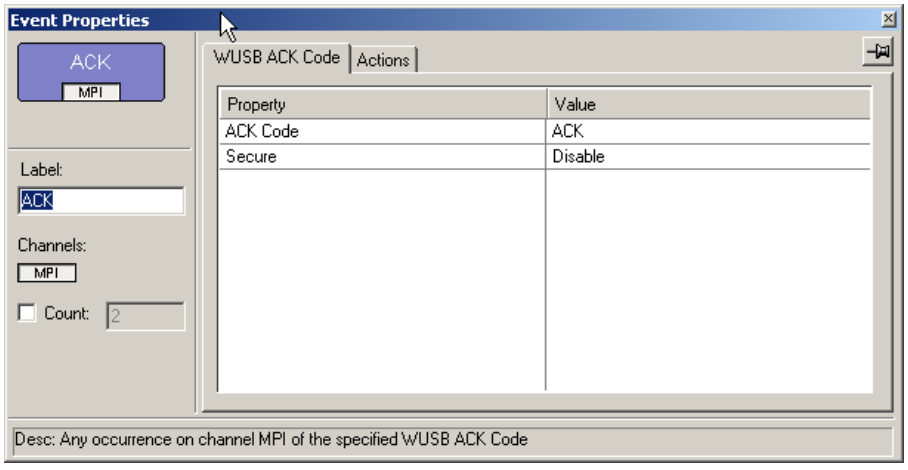


Figure 12.21 Event Properties First Tab

Actions and Action Properties

The following table lists UWB*Tracer/Trainer* supported actions.

Event	Description
Trigger	Start recording.
Filter In	Include in the trace file the event specified (and no others).
Filter Out	Exclude from the trace file the event specified.
Advance the Sequence	Go to the next state in this sequence (sequence in which this action is located).
Restart All	Restart all sequences.
External Trigger Pulse HIGH	Send HIGH pulse on external trigger output.
External Trigger Pulse LOW	Send LOW pulse on external trigger output.
External Trigger Pulse TOGGLE	Send HIGH-LOW pulse on external trigger output.
Properties	Opens the Event Properties dialog box.

The **Set External Trigger** button allows you to set the characteristics of the External Trigger signal.

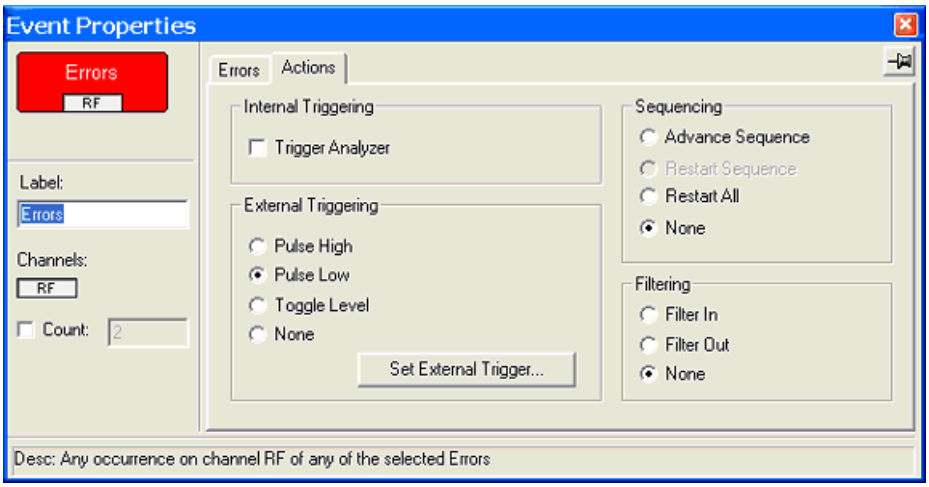


Figure 12.22 Action Properties (Event Properties Second Tab)

External Trigger Signal Setting

The **External Trigger Signal** dialog allows you to view and set characteristics of the external trigger signal for each of the connected analyzer devices.

If an analyzer device is connected to the host machine, you can:

- View the current signal level and force it to HIGH or LOW.
- View the changes to the signal, if any, when a recording session starts.
- View the signal action when a trigger event occurs.
- Set the pulse width of the signal (only if the action is set to **Pulse HIGH** or **Pulse LOW**.

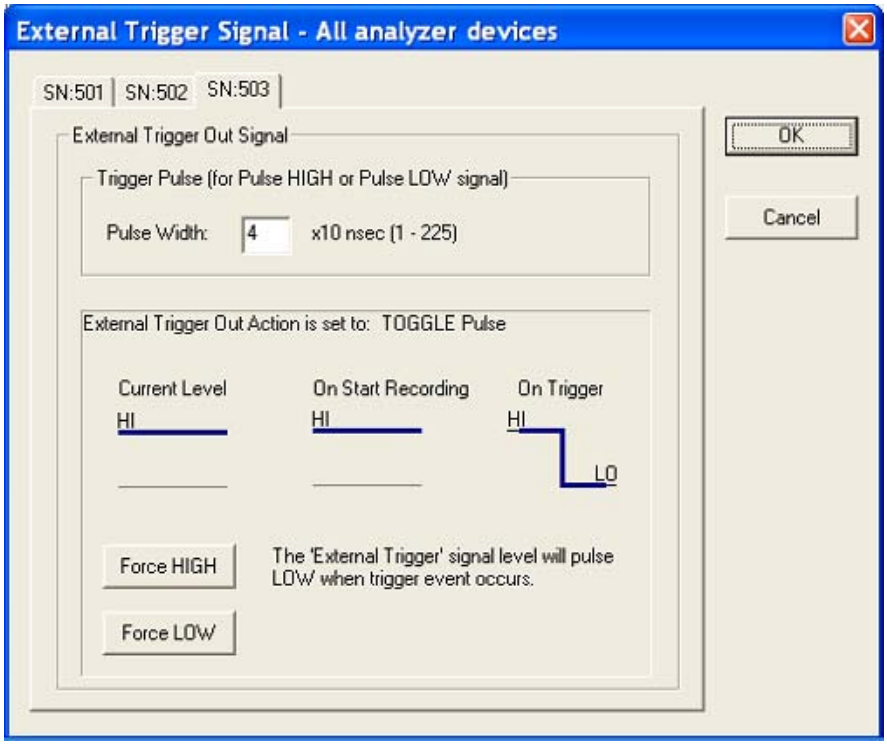


Figure 12.23 External Trigger Signal Dialog for Toggle Action and HIGH Signal Current Level

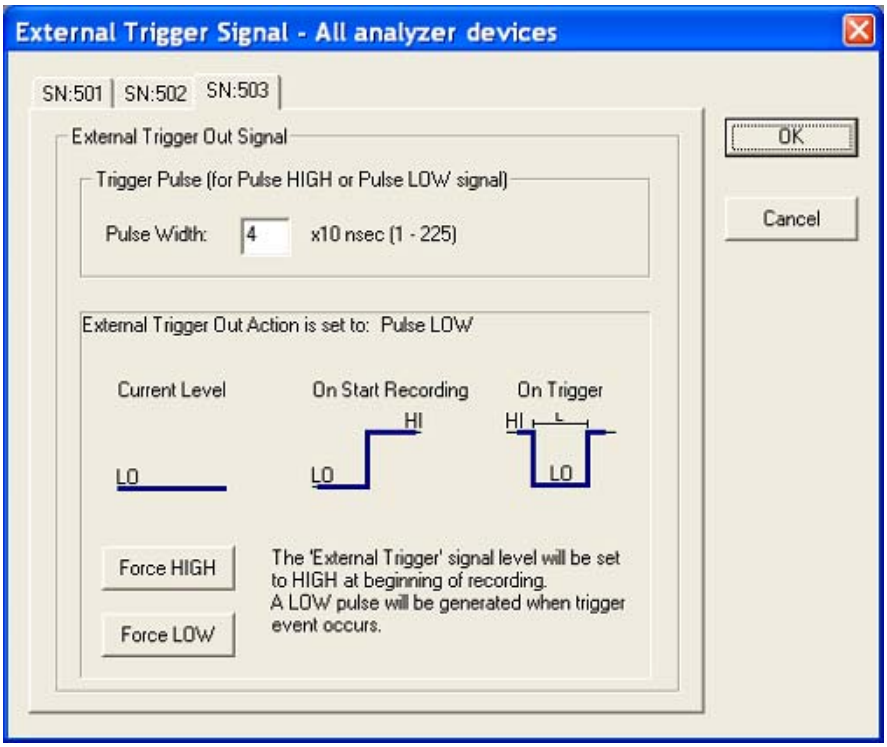


Figure 12.24 External Trigger Signal Dialog for Pulse LOW Action and LOW Signal Current Level

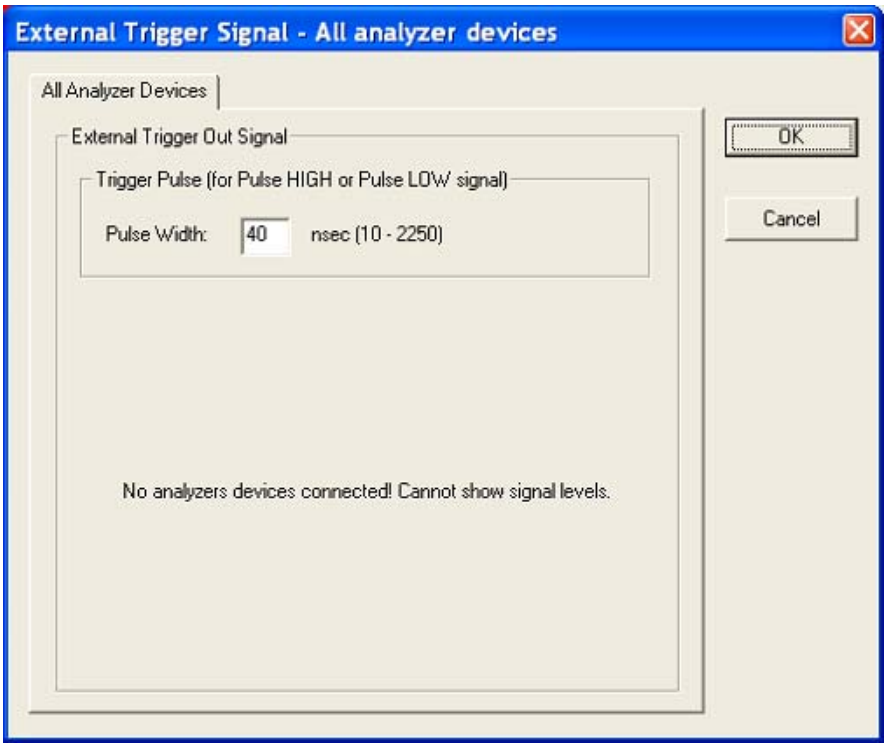


Figure 12.25 External Trigger Signal When No Analyzer Devices Are Connected to the Software

The following table describes the External Trigger Signal behavior, which depends on the selected action and the current output signal level:

	Action	Current Output Level	On start Recording	On trigger
1	**Pulse High**	LOW	-no change- LOW	N x 10 nsec LOW HIGH
2	**Pulse High**	HIGH	HIGH LOW	N x 10 nsec LOW HIGH
3	**Pulse Low**	LOW	HIGH LOW	N x 10 nsec HIGH LOW
4	**Pulse Low**	HIGH	-no change- HIGH	N x 10 nsec HIGH LOW
5	**Toggle Signal**	LOW	-no change- LOW	HIGH LOW
6	**Toggle Signal**	HIGH	-no change- HIGH	HIGH LOW
7	**None**	LOW	LOW	LOW
8	**None**	HIGH	HIGH	HIGH

Figure 12.26 External Trigger Signal Behavior Table

Using a Single-State Sequence

As described previously, a sequence can be single-state or multi-state. A single-state sequence is a simple combination of events and actions. You cannot create looping or branching conditions with this type of sequence.

A multi-state sequence allows you to branch successively to (advance to) lower states in the sequence or to loop to the front of the sequence (restart the sequence).

Following are four typical examples of single-state sequences.

Example 1: Creating a Simple Event Trigger

In this example, recording is triggered by detection of a WUSB ACK code.

Step 1 Click the **New Event** button. From the drop-down menu, select **WUSB ACK Code > ACK** (Figure 12.27).

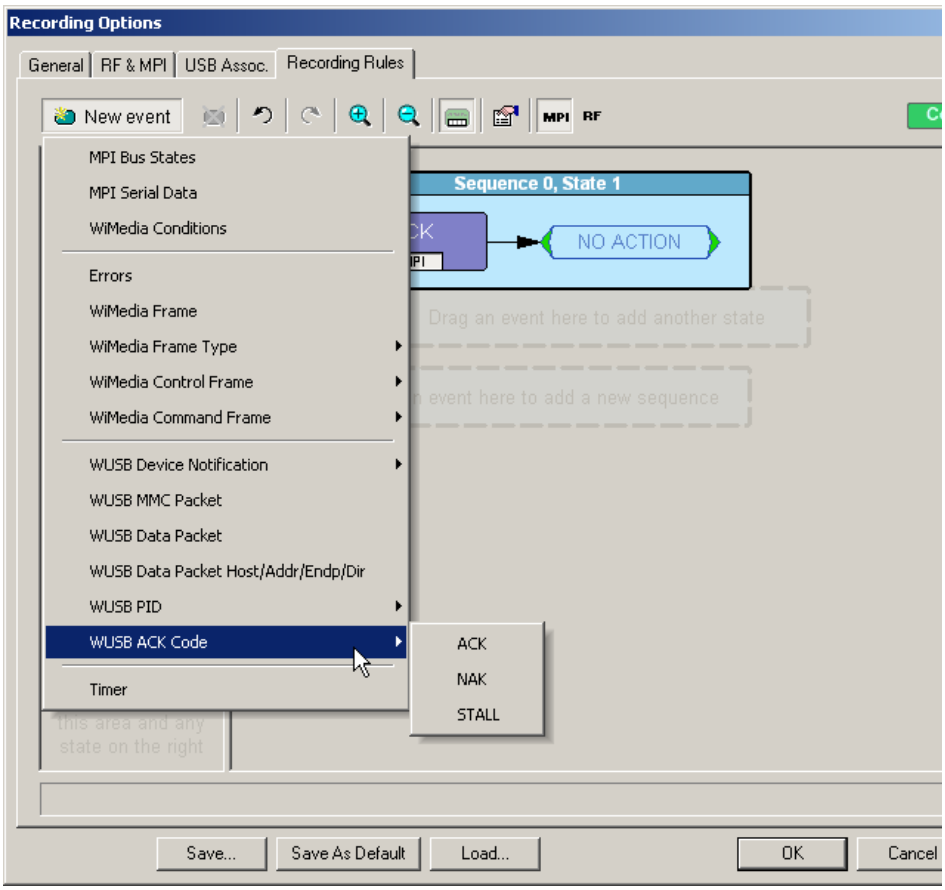


Figure 12.27 Example 1: Creating the Event

Step 2 An ACK Event button appears in the Available Events area.

Step 3 Drag the button to the sequence cell at the top of the Main Display area.

Step 4 Right-click the button. From the Action pop-up menu, select **Trigger** (Figure 12.28).

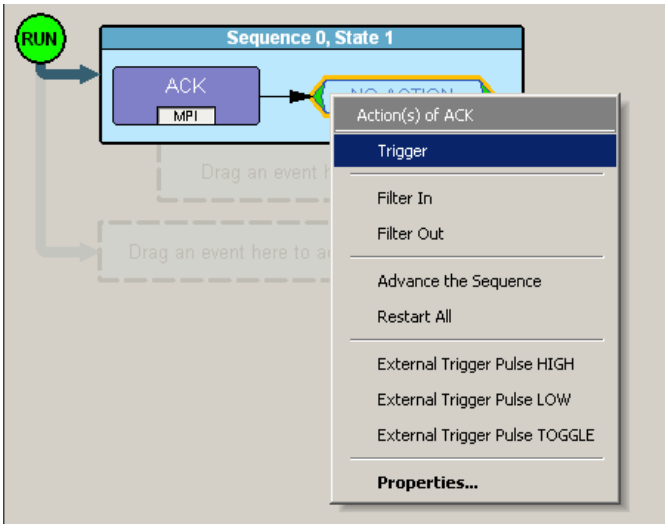


Figure 12.28 Example 1: Assigning the Action

Figure 12.29 shows the completed event-action sequence.

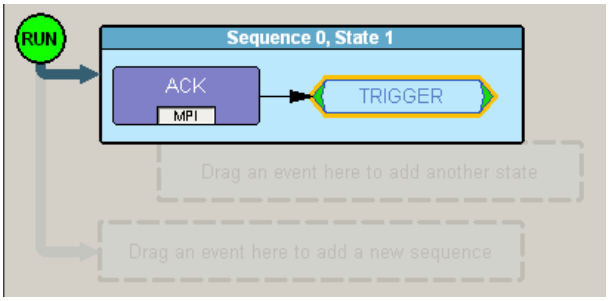


Figure 12.29 Example 1: Complete Rule

Example 2: Creating an Event Counter

In addition to setting triggers and filters, you can set counters. A counter is an action that lets you set a trigger based on a count of events. To continue the previous example, for instance, you can create a rule that triggers on the tenth occurrence of a WUSB ACK.

Step 1 From example 1, the ACK is the first event in the state (Figure 12.29).

Step 2 Right-click the **ACK** event button in the cell. The Event pop-up menu appears.

Step 3 From the Event pop-up menu, select the **Add Counter** option (Figure 12.30).

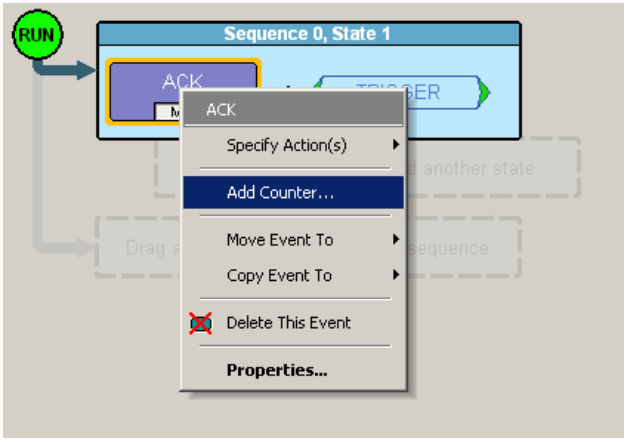


Figure 12.30 Example 2: Adding a Counter

The Event properties dialog box appears. (See “Events and Event Properties” on page 198 and “Actions and Action Properties” on page 199.). The set counter box is at the lower left.

Step 4 By default, the counter box is set to a value of 2. For this example, reset the box to 10.

Step 5 Close the Event properties dialog box. The counter value 10 now appears in the ACK Event button (Figure 12.31). The trigger occurs after the analyzer detects the tenth occurrence of an ACK.

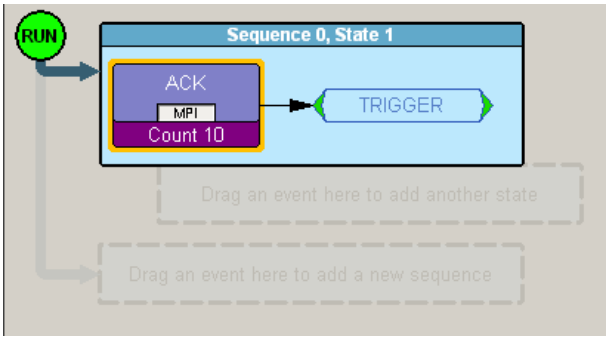


Figure 12.31 Example 2: Complete Rule

Example 3: Creating an OR Condition

When you assign two or more Event buttons in state cell to the same action, the analyzer watches for all the events and does the action for the event that the analyzer sees first. Neither event has precedence over the other. There is a logical OR association among the events.

The following example assumes you want to trigger when the analyzer detects a WUSB NAK or the tenth occurrence of a WUSB ACK.

Step 1 From example 2, the ACK with counter is the first event in the state (Figure 12.31).

Step 2 Click the **New Event** button. From the drop-down menu, select **WUSB ACK Code > NAK**.

Step 3 A NAK Event button appears in the Available Events area. Drag the button to the first cell and drop it below the ACK button (Figure 12.32).

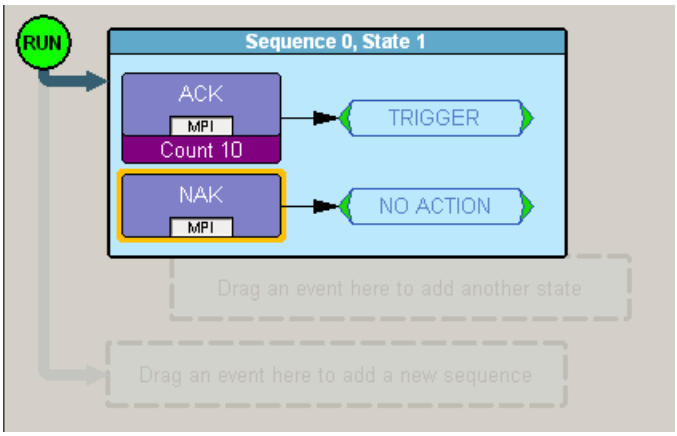


Figure 12.32 Example 3: Creating a Second Event

Step 4 Right-click the **NAK** button. From the Action pop-up menu, select **Trigger** (Figure 12.33).

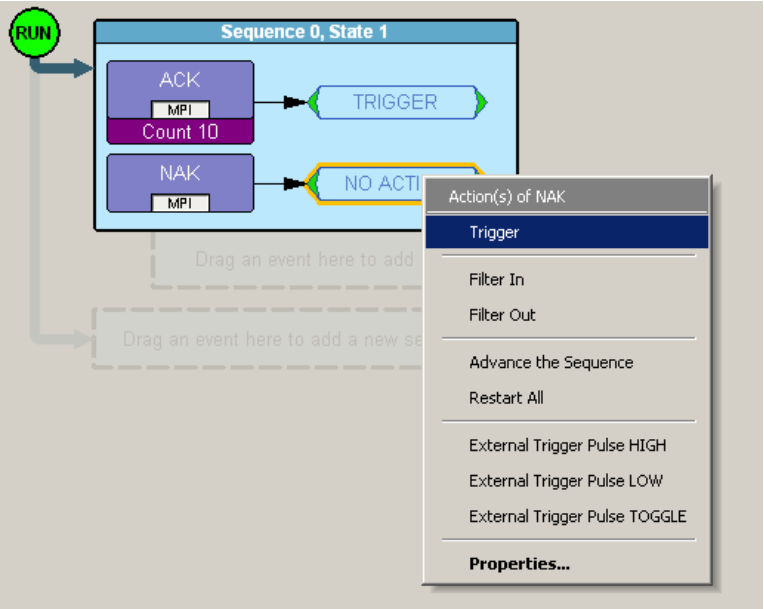


Figure 12.33 Example 3: Assigning the Action

Figure 12.34 shows the completed event-action sequence.

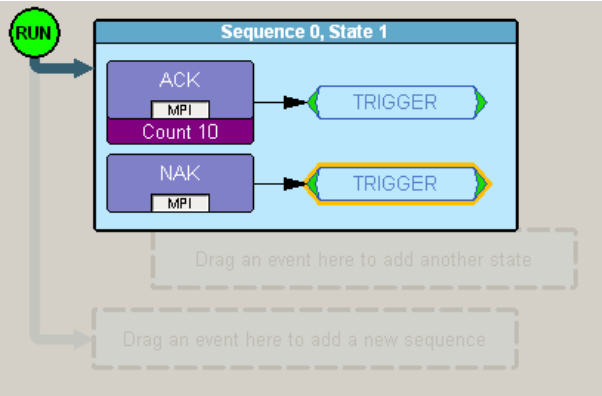


Figure 12.34 Example 3: Complete Rule

Example 4: Creating an Event Filter

A filter causes the analyzer to filter in or filter out specified events from the recording. By default, all events are filtered in. However, you might want to preserve recording memory so that you can extend recording session time. To do so, you can filter out events that do not interest you (or filter in only those events that interest you).

Note: Keep in mind that when you filter out events, they are not recorded in the trace file. It is not the case that the events are present in the file but hidden.

The following example assumes you want recording to occur only if the analyzer detects an MPI error.

Step 1 Click the **New Event** button. From the drop-down menu, select **MPI Errors** to create an MPI Errors button in the Available Events area.

Step 2 Drag-and-drop the MPI Error button into the first cell in the Main Display area.

Step 3 Right-click in the **Action** box to the right of the MPI Error button. The Action pop-up menu appears (Figure 12.35).

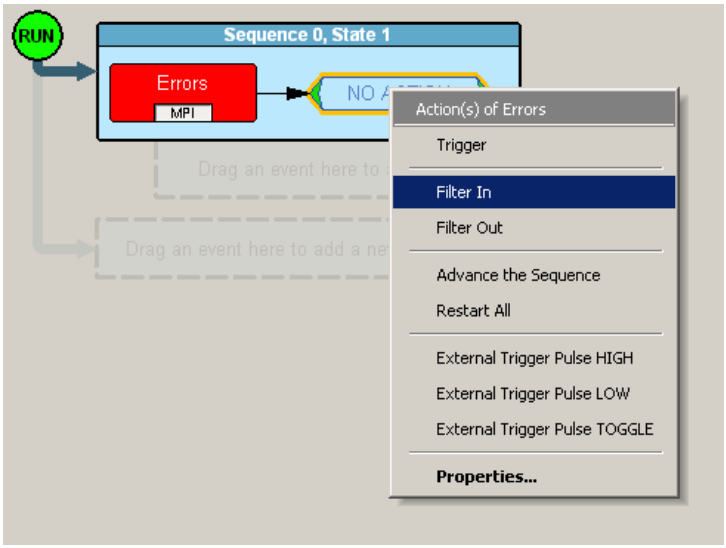


Figure 12.35 Example 4: Assigning the Action

Step 4 From the Action pop-up menu, select the **Filter In** option.

Recording is now set to only record frames with MPI errors (Figure 12.36).

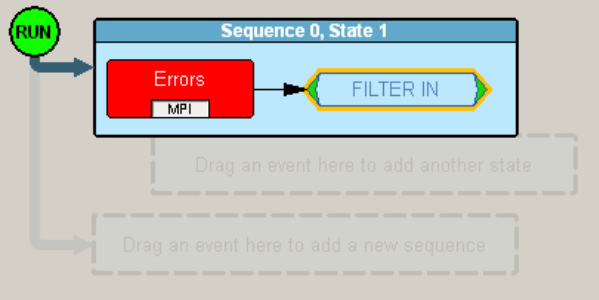


Figure 12.36 Example 4: Complete Rule

Using a Multi-State Sequences

Multi-state sequences allow you to create conditions that branch down to successive states or loop back to the beginning of the sequence. They are more complex than single-state sequences but very powerful.

Example 5: Creating a Looping Sequence

Following is a typical example of a multi-state sequence. In this example, the analyzer waits for a WUSB Data packet (first state). When it detects a Data packet, the analyzer waits for a corresponding ACK packet and starts a timer (second state).

If an ACK is received before the timer expires, the sequence restarts. If an ACK is not received before the timer expires, recording is triggered.

Step 1 Click the **New Event** button. From the drop-down menu, select **WUSB PID > DATA** to create a Data button in the Available Events area.

Step 2 Drag-and-drop the Data button into the first cell in the Main Display area.

Step 3 Right click in the **Action** box to the right of the Data button. The Action pop-up menu appears (Figure 12.37).

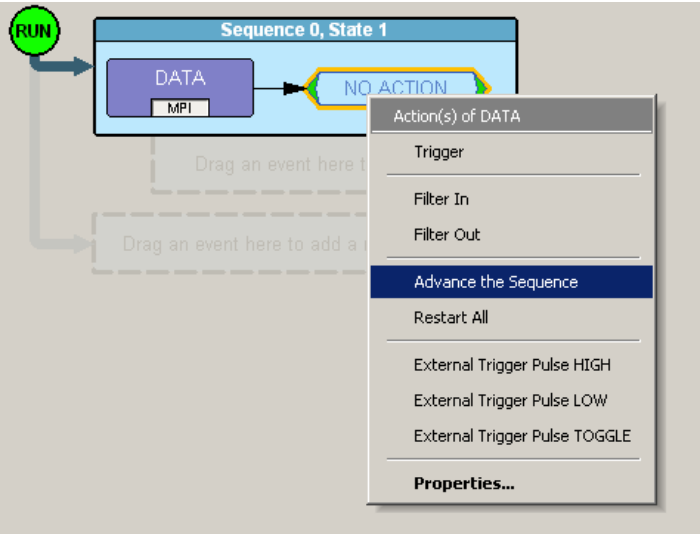


Figure 12.37 Example 5: Advancing the Sequence

Step 4 From the Action pop-up, select **Advance the Sequence**.

Step 5 An arrow appears next to the Data button (Figure 12.38). The arrow points to the cell for the second state in this sequence.

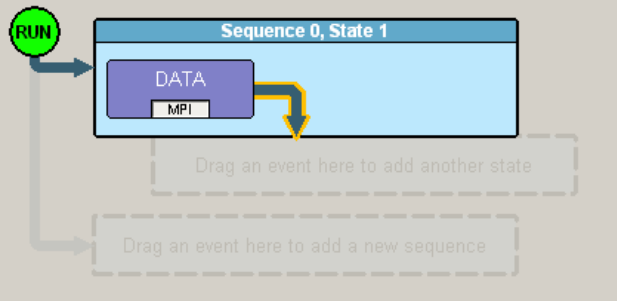


Figure 12.38 Example 5: First State Complete

Step 6 Click the **New Event** button. From the drop-down menu, select **Timer** to create a Timer button in the Available Events area (Figure 12.39).

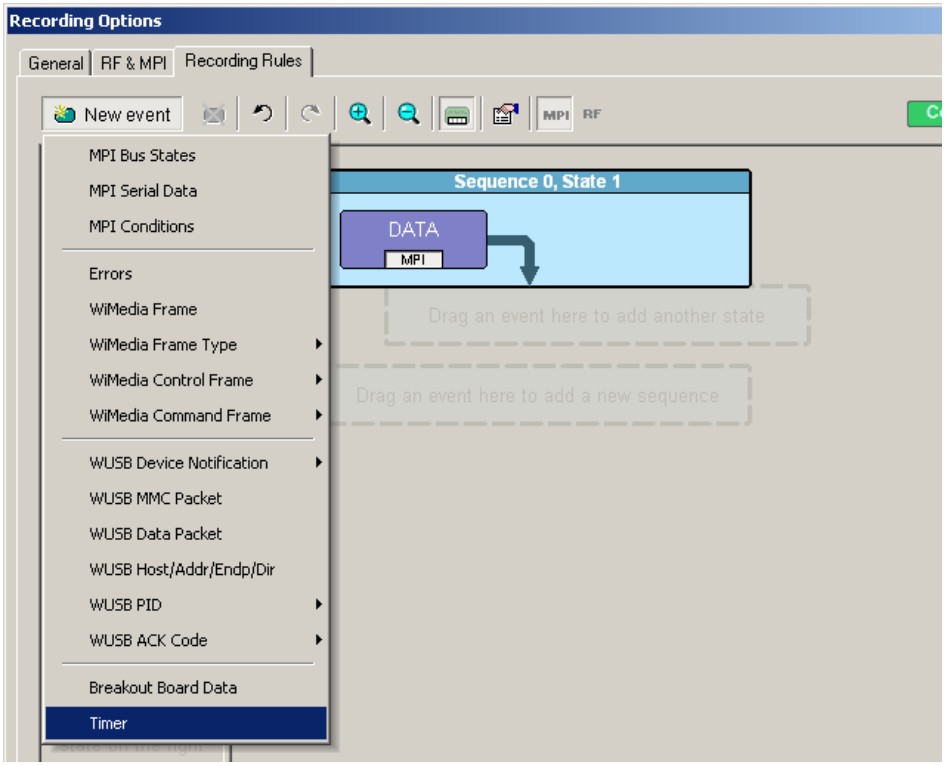


Figure 12.39 Example 5: Creating an Event, Second State

Step 7 Drag-and-drop the Timer button into the second cell in the Main Display area (Figure 12.40).

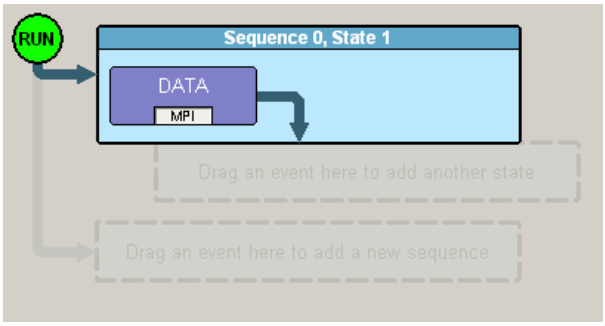


Figure 12.40 Example 5: Dragging to the Second State Cell

Step 8 Right-click the **Timer** event to open its Properties dialog box (Figure 12.41).

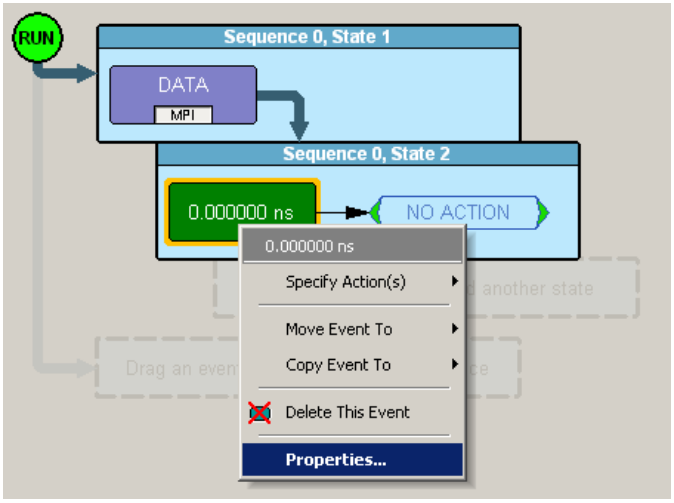


Figure 12.41 Example 5: Bringing Up the Timer Dialog Box

Step 9 In the Properties dialog box for the timer, set the timer to 100 microseconds (Figure 12.42).

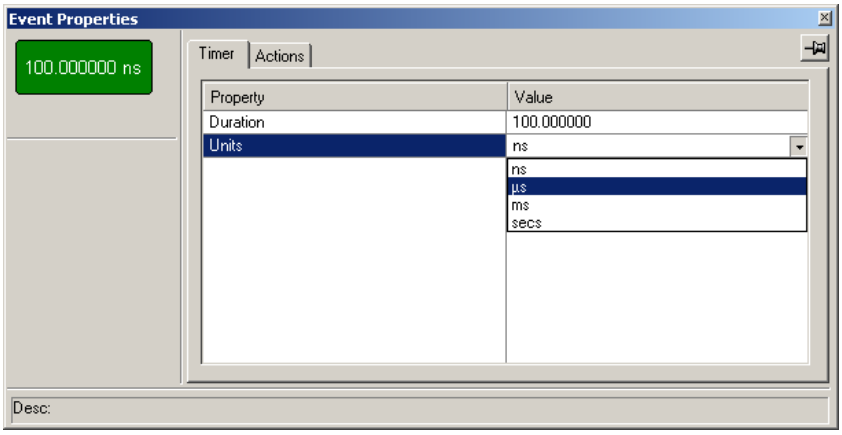


Figure 12.42 Example 5: Setting the Timer

Step 10 Click the **New Event** button. From the drop-down menu, select **WUSB ACK Code > ACK** to create an ACK button in the Available Events area (Figure 12.43).

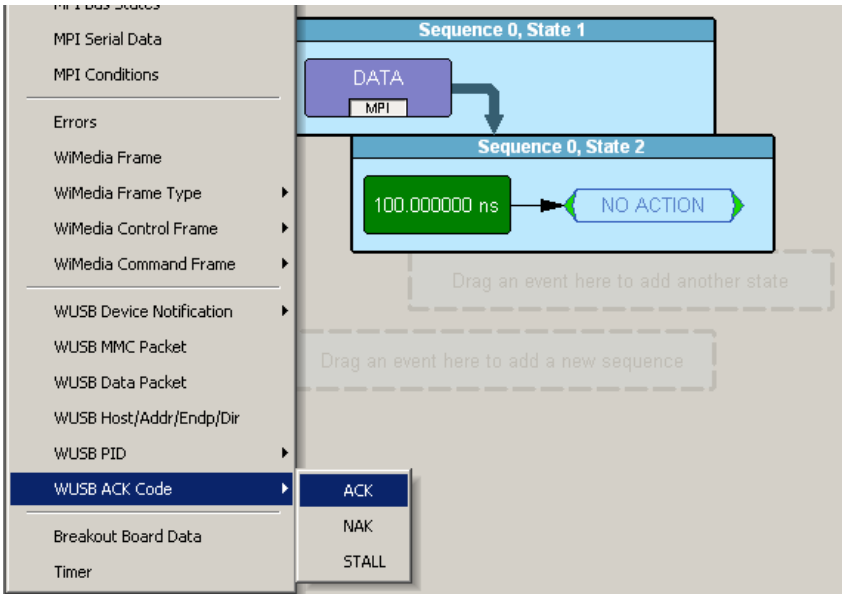


Figure 12.43 Example 5: Creating Another Event, Second State

Step 11 Drag-and-drop the ACK button into the second cell in the Main Display area.

Step 12 Assign **Restart the Sequence** as the action for the ACK event. An arrow appears that points from the ACK back to the Data event.

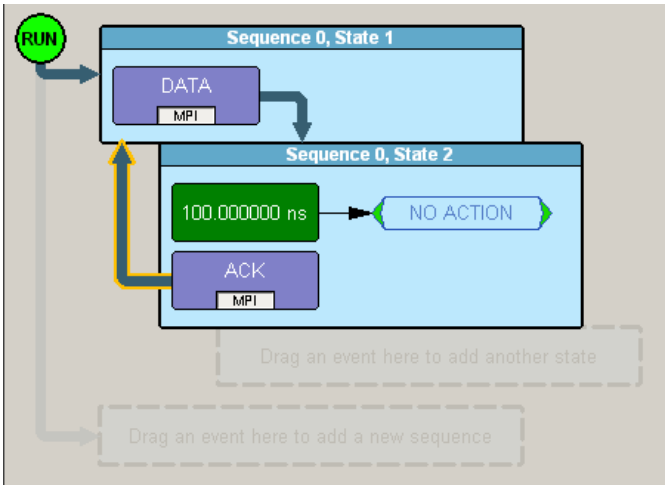


Figure 12.44 Example 5: Complete Rule

Using Independent Sequences

UWB*Tracer/Trainer* supports up to two independent sequences. By default, they are labeled Sequence 0 and Sequence 1.

The two sequences operate in parallel and have no effect on each other with the following exception. Either of the two sequences can contain the action Restart All. This action restarts both sequences in the Main Display area.

Example 6: Creating Independent Sequences

The following example adds a second sequence to Example 6. The second sequence triggers recording if any MPI error is detected.

In this example, there are two conditions that trigger recording. The first condition is defined by sequence 0. The second condition is defined by sequence 1.

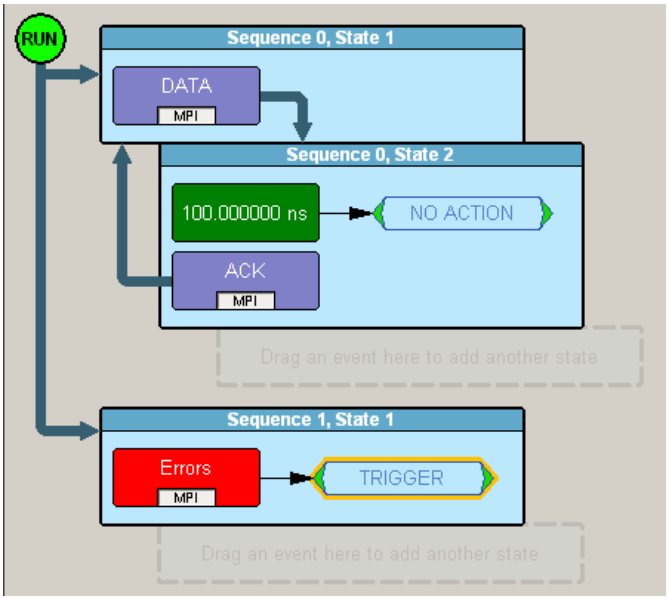


Figure 12.45 Example 6: Two Independent Sequences

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Chapter 13: Recording

This chapter describes how to conduct recording sessions.

13.1 Making a Recording

Before Starting a Recording

Before starting a recording, verify the following:

- Test environment has been set up and configured correctly.
- Latest BusEngine™ and firmware versions have been downloaded to the analyzer (Chapter 13).
- Recording Options settings are appropriate (see Chapter 11).
- Analyzers participating in the recording are linked to the software application locally or through a network (see Chapter 10).

Starting a Recording

To start a recording session manually, click the Recording button in the main tool bar or select **Record > Start**.

Stopping a Recording

To manually stop the recording process, click the Stop button or select **Record > Stop**.

> **Note:** If Recording Options is set to the Snapshot recording type, recording stops automatically when the recording buffer is full.

After stopping a recording, the recorded traffic automatically uploads from the analyzer to the host PC, where it is saved as a trace file in the default location. You can set the default location of a saved trace file in the General tab of the Recording Options window (see “Trace Filename and Path” on page 177).

Interrupting Uploading

During upload, you can interrupt the upload process by pressing the **Stop** button, or by selecting **Record > Stop**, to display the Abort or Continue Uploading dialog box:

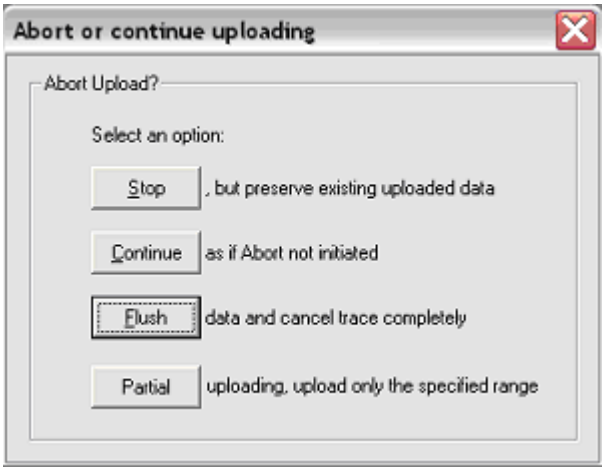

Figure 13.1 Abort or Continue Uploading Dialog Box

The Abort or Continue Uploading dialog box has the following options:

- **Stop**: Stop upload but keep the data that has been uploaded already.
- **Continue**: Continue upload.
- **Flush**: Stop upload and discard any data that has been uploaded.
- **Partial**: Reupload part of the recorded buffer.The Partial Upload button is enabled only when you have data to upload.

Reuploading

When you click **Partial Upload**, the Upload Again with New Buffer Settings dialog box appears, which allows you to select a portion of data to upload again. You can also reupload part of the recorded buffer by clicking on the Tool Bar or selecting the **Record > Reupload** command to open the Upload Again with New Buffer Settings dialog box

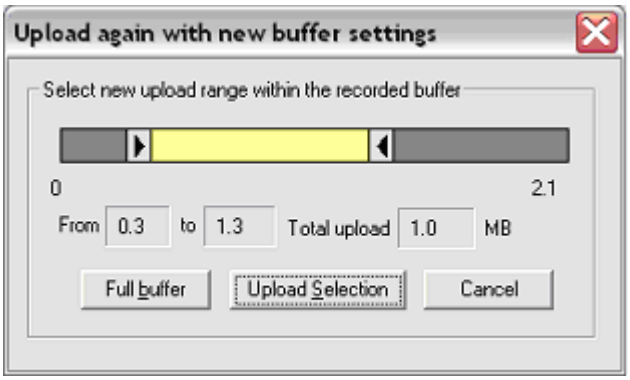

Figure 13.2 Upload Again with New Buffer Settings Dialog Box

In the Upload Again with New Buffer Settings dialog box, select the part of the recording buffer you want to upload by dragging the left and right arrow sliders, then clicking the **Upload Selection** button. You can also choose to reupload the full buffer by clicking the **Full Buffer** button.

Note: The partial uploading mechanism is not precise. In some cases, some of the last packets may be not uploaded. If you need those packets, upload the whole buffer.

13.2 USB Cable Association for Certified WUSB

The Certified Wireless USB specifications define two types of methods of associating (also known as pairing):

- **Numeric association**: Also called in-band because it uses WUSB wireless communication.
- **Cable**: Uses other means to associate two WUSB devices.Currently, only one out-of-band association method is supported in the specification. This is **USB Cable Association**, which uses a USB cable to connect two devices and allow them to associate.

The UWB*Tracer/Trainer*™ analyzer can capture and use the USB Cable Association traffic for recording and decrypting Certified Wireless USB traffic. This is done with the help of the optional USB Analyzer plug-in module (**US007MA**), which should be inserted into the left-side slot. (The right-side slot has one of the UWB Analyzer plug-in modules.)

The USB plug-in module is active and waits for USB traffic from the moment the analyzer is powered on and ready for recording. By default, the module is configured to auto-detect the USB speed. If you want to set the speed manually, you can use the recording options settings (see Section 12.4, “Recording Options: USB Assoc.” on page 184).

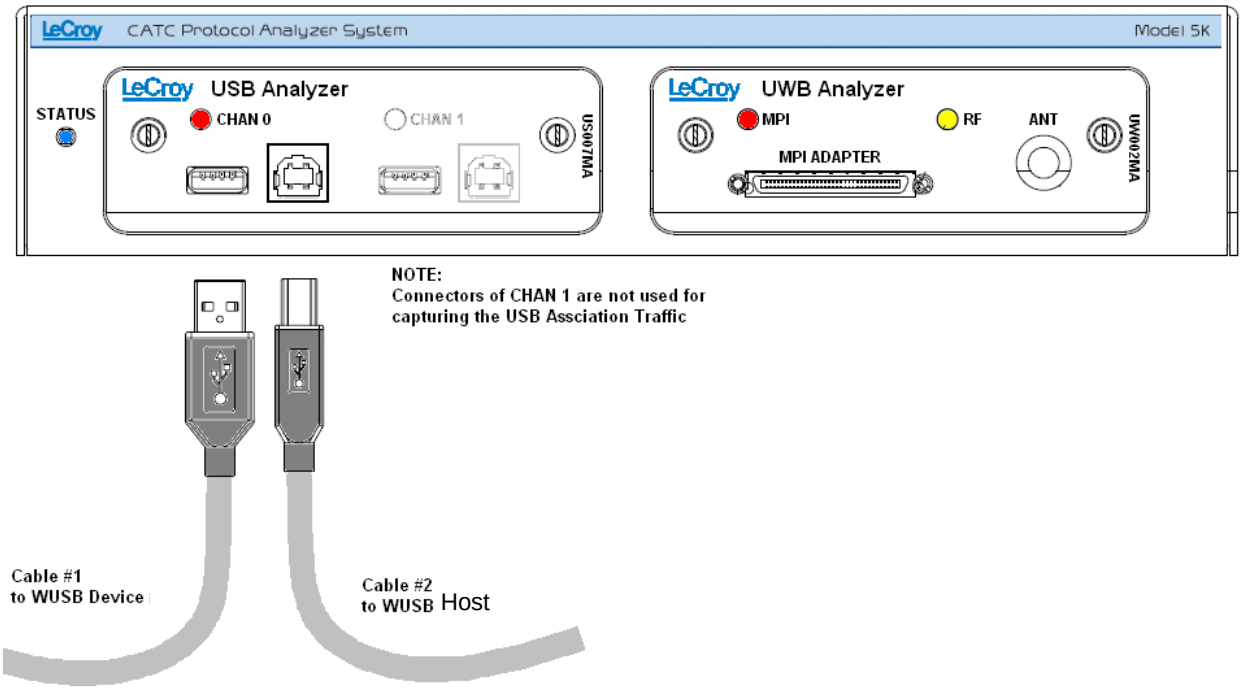

Figure 13.3 USB Cable Association Cabling

Capturing USB Cable Association Traffic

To capture the USB Cable Association traffic:

Step 1 Make sure the analyzer is in operational state.

Step 2 Hook one device to one of the USB ports marked as CHAN 0 and leave the other device not connected. (Please note that CHAN 1 is not operational for this function.)

Step 3 Make sure the devices are ready for association.

Step 4 Connect the second WUSB device to the other USB port marked as CHAN 0.

At this point the association traffic capture of USB traffic between the two devices is done automatically.

When detecting the connection context data passed between the two devices, the analyzer stores the information in a table in memory and passes it to the UWB recording channels. The analyzer can store multiple connection contexts for different pairs and use them in real-time for decrypting WUSB traffic.

When a recording is terminated, the entire connection context table is uploaded to the application software and stored in the Device List archive. This allows the analyzer to retrieve the connection context information from the application and use it in further recording sessions. If the Connection Context between two devices is already stored in the application and the devices were NOT re-associated, there is no need to repeat the association process.

Note:

- We assume here that the association procedure is done "automatically' once the two WUSB devices are connected through a USB cable. If not, you may need to initiate the association process manually.
- To capture the association traffic, the system is not required to be in a recording state. However, to allow the real-time use of the captured connection context information for decrypting the UWB traffic, the Analyzer must be at least synchronized to the devices that were associated.

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Section 3. UWB*Trainer* Exerciser Traffic Generation

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Chapter 14: Traffic Generation Overview

After the UWB*Tracer*/*Trainer*™ and DUT have been cabled and powered on, you can test the setup by generating some traffic. The following steps show how to configure the Exerciser to generate and run a training sequence.

14.1 UWB*Trainer* Overview

UWB*Trainer*™ creates and runs traffic generation files using the UWB Exerciser. You download the compiled script to the device and run the script from the UWB*Trainer*.

Using scripts, packets can be transmitted one after another or with certain timing or event-based pauses between them. This allows the UWB*Trainer* to act as a pattern generator with specific formatting and transmission rates.

The traffic generator can emulate hosts and endpoint devices. Traffic generation can be used to transmit known errors, allowing you to observe how your device handles faulty link conditions.

Script execution can be throttled using **Wait** commands inserted directly into the script. Waits can be time based, require receipt of certain packet types, or can even require **User** input from the GUI.

14.2 Traffic Generation Files

The **.uwbg** traffic generation files are text files consisting of a series of commands from a scripting language (see the *UWBTrainer Generation Script Language Reference Manual* or UWB*Trainer* Generation Script Language online help), and one or more **Include** statements linking other generation files into the current file.

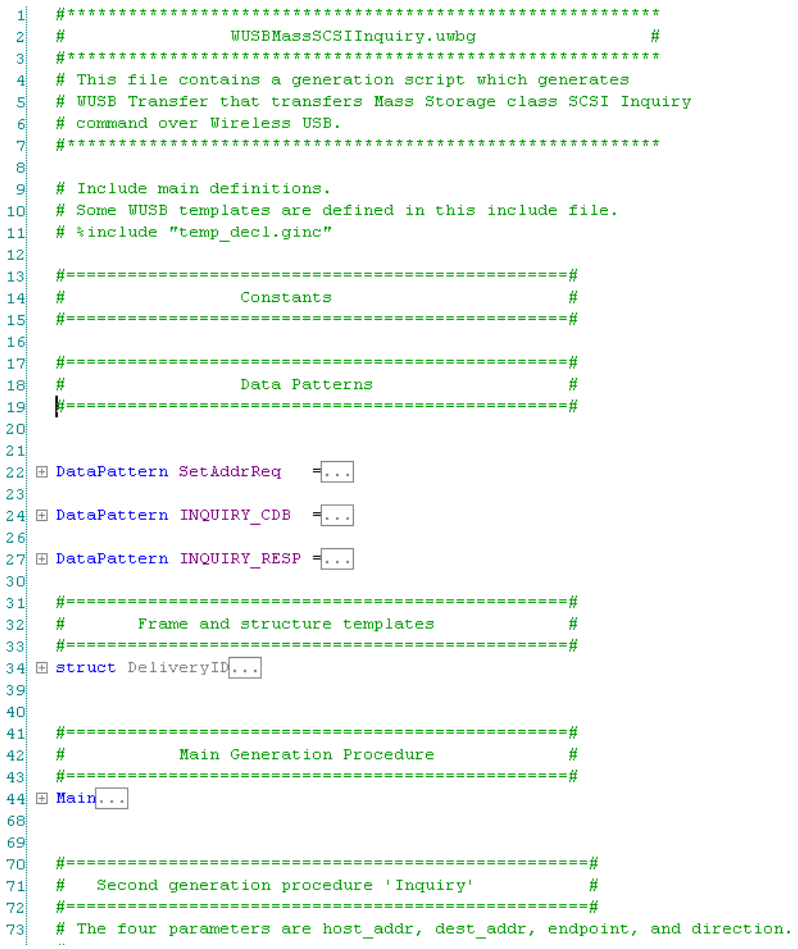


Figure 14.1 Traffic Generation File Example

UWB*Trainer* offers two mechanisms for creating traffic generation scripts:

- **Script Editor**: Allows you to create and edit a generation script (.**uwbg** extension) to define any type of traffic.
- **Graphical Scenario Editor**: Allows you to build simple scripts using elements and links. Saving the graphical scenario (**.ugg** extension) creates a generation script file (.**uwbg** extension). A graphical scenario is suitable for basic scripts.

You can also create a traffic generation file by exporting the data from a trace into a traffic generator file.

To edit a generation file, use the UWB*Trainer* Script Editor.

See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

Language Syntax

Syntax for the UWB*Trainer*™ Generator Script files is:

```
COMMAND = MODIFIER
{
  PARAM1 = VALUE1
  …
  PARAMn = VALUEn
}
```

For some commands, the list of the parameters is optional.

All literals are not case sensitive.

All default values are zeros unless otherwise noted.

Integer literals represent numeric values with no fractions or decimal points.

Hexadecimal, decimal, and binary notation are supported:

- Hexadecimal numbers must be preceded by **0x**: 0x2A, 0x54, 0xFFFFFF01
- Decimal numbers are written as usual: 24, 1256, 2
- Binary numbers are denoted with **0b**: 0b01101100, 0b01, 0b100000

It is possible to use expressions, for example, **(i - 239)**.

String literals are surrounded by double quotes.

Array data types are represented by integer or string literals surrounded by "**(**" and "**)**" characters, and separated by comma "**,**", for example, **(2,23,4)**.

Single-line comments are supported and should be preceded semicolon "**;**".

Multi-line comments are also supported. Multi-line comments begin with a "***/**" combination, and end with the reverse "***/**" combination.

Note: For command descriptions and script examples, see the *UWBTrainer Generation Script Language Reference Manual* or the UWB*Trainer* Generation Script Language online help.

14.3 Starting the UWB*Trainer* Program

You can use UWB*Trainer* with or without the analyzer unit. When used without an analyzer, the program works as a trace viewer to view, analyze, and print trace files.

To start UWB*Trainer*:

Step 1 While running UWB*Tracer/Trainer*, select the **UWBTrainer** button to display the LeCroy UWB*Trainer* Protocol Exerciser window (Figure 14.2).

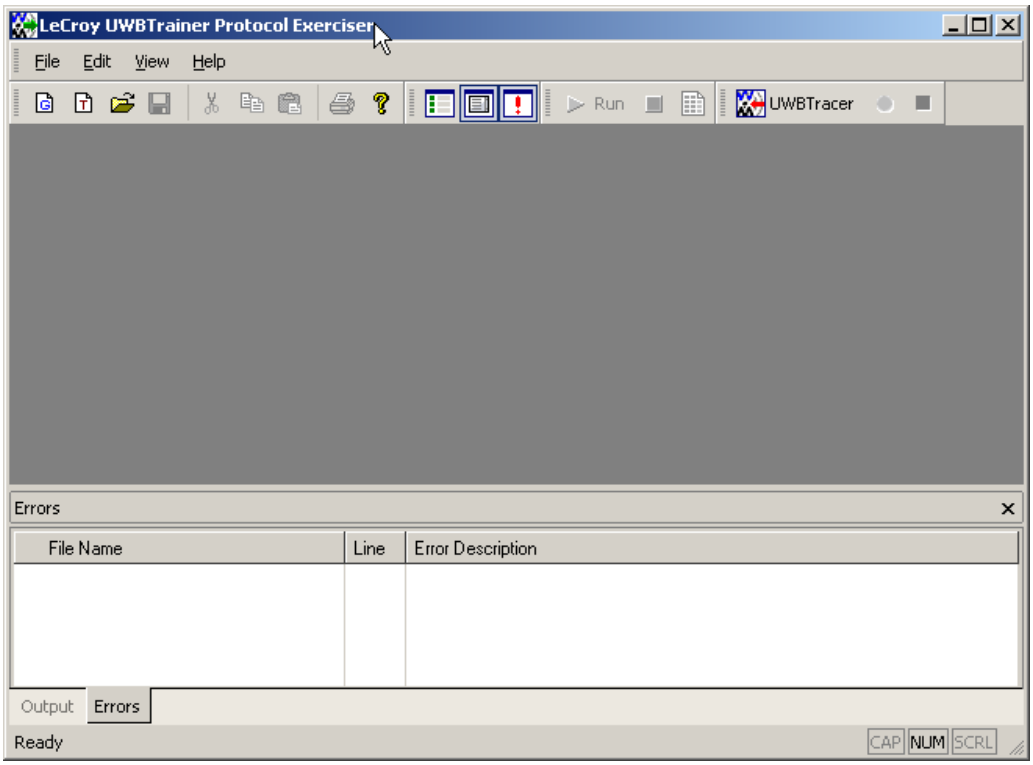


Figure 14.2 UWB*Trainer* Main Window

14.4 Menu Bar

Table 14.1 lists menus available from the UWB*Trainer* Main window menu bar. Some menus and options are available only when a file is open.

Table 14.1 Menu Bar Menus

Menu/Option	Function
File	
New Graphical Scenario	Displays a window in which you can create a graphical scenario.
New Text Scenario	Displays a window in which you can create a text scenario.
Open	Opens a trace file or traffic generation file.
Save	Saves the open file.
Save As	Saves all or a specified range of frames with a specified name.
Close	Closes the current trace or generation file.
Print	Prints part or all of the current trace or traffic generation file.
Print Preview	Produces an on-screen preview before printing.
Print Setup	Sets options for the current or new printer.
Exit	Exits the PE*Tracer* program.
Edit	
Undo	Revert to the state before the most recent action.
Redo	Cancel the most recent Undo.
Cut	Delete the selected item.
Copy	Place the selected items in a buffer for pasting later.
Paste	Insert the Copy items at the location of the cursor.
Toggle Bookmark	Show or hide the current bookmark (only for text scenarios).
Next Bookmark	Go to the following bookmark (only for text scenarios).
Previous Bookmark	Go to the preceding bookmark (only for text scenarios).
Clear All Bookmarks	Delete all bookmarks (only for text scenarios).
Find	Allows searches by multiple criteria (only for text scenarios).
Replace	Search for an item and replace it with the entered text (only for text scenarios).
Find Next	Looks for the next instance of an event specified with Goto or Find (only for text scenarios).
Go to	Positions the display to the specified item (only for text scenarios).
Select All	Selects all text (only for text scenarios)
Show Properties	Displays the properties of the object (only for graphical scenarios)
Build	(This menu is only available for text scenarios.)
Compile	Check the script for errors.

Menu/Option	Function
View	
Main Toolbar	Displays the Main toolbar.
Views Toolbar	Displays the Views toolbar.
Script Toolbar	Displays the Script toolbar (only available for text scenarios)
Graphics Toolbar	Displays the Graphics toolbar (only available for graphical scenarios).
Properties Bar	Displays the Properties window (only available for graphical scenarios).
Status Bar	Displays the Status bar.
Generation	
Run Scenario	Test the compiled script.
Stop Scenario	Immediately stop the running script.
Preview Trace	Display the trace.
Window	
New Window	Opens another instance of the Main Window.
Cascade	Displays all open Main windows in cascaded format.
Tile	Displays all open Main windows in tiled format. You can choose horizontal or vertical tiling later.
Arrange Icons	Arranges Main window icons at bottom of display area.
windows	Displays a list of open windows.
Help	
About TrainerApp	Displays version information.
Links	(This menu is only available for graphical scenarios.)
Create link	Add a link to the current Graphical Scenario at the cursor position.
Create Yes link	Add a Yes link to the current Graphical Scenario at the cursor position.
Create No link	Add a No link to the current Graphical Scenario at the cursor position.
Break link	Remove the selected link.
Flip Link Direction	Change the direction of the selected link.
Link label	Enter a label for the selected link.

14.5 Tool Bar

The Main window Tool bar provides quick access to most UWB*Trainer* software functions. You can learn the function of each button by passing the mouse pointer over it. Button descriptions appear on the Status bar at the bottom of the window and as tooltips above each button.

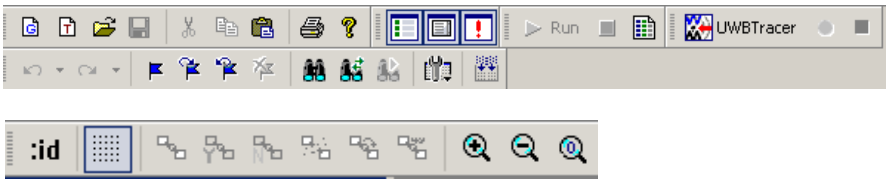


Figure 14.3 Main Window Toolbar

Main Toolbar Buttons

	Open		New Graphical Scenario
	Save		New Text Scenario
	Cut		Copy
	Paste		
	Print		About

View Toolbar Buttons

	View Toolbox window (toggle)		
	View Output window (toggle)		
	View Errors window (toggle)		

Script Toolbar Buttons

	Undo		Find
	Redo		Replace
	Toggle Bookmark		Find Next
	Next Bookmark		Options
	Previous Bookmark		Compile
	Clear All Bookmarks		

UWB*Trainer* Buttons

	UWB*Tracer*		Trace Preview
	Record		Stop Record
	Run		Stop

Graphics Toolbar Buttons

	Show or hide ID		Snap to Grid
	Create link		Create Yes link
	Link label		Create No link
	Break link		Flip link direction
	Zooming In		Zooming Out
	Set Default Zoom Level		

14.6 Beginning Traffic Generation

To begin traffic generation:

Text Scenario

To use a text file:

Step 1 Open a traffic generation script file (extension **.uwbg**) by selecting **File** > **Open** or clicking the Open button to display the script in the window.

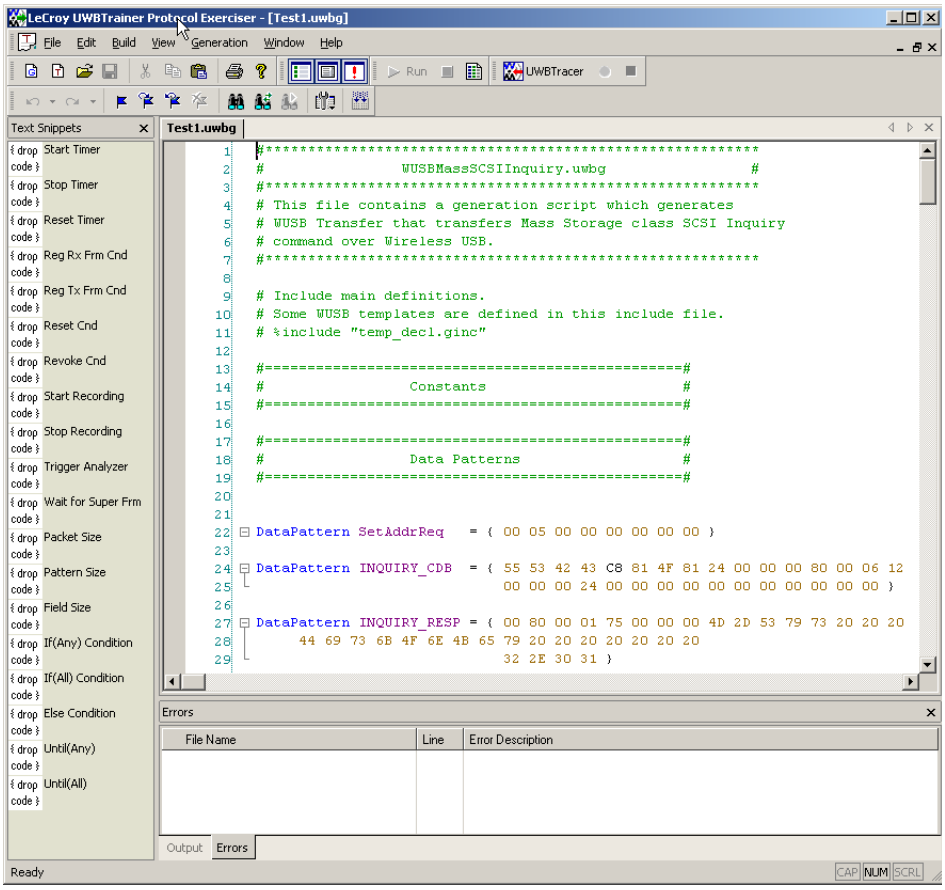


Figure 14.4 Main Window Toolbar with Traffic Generation Script

Alternatively, you can click the New Text Scenario button or select **File > New Text Scenario** to display a blank script window.

The file name appears on the tab for the file. You can open more than one file.

Step 2 Edit the script. See the next chapter for how to create and edit a traffic generation script.

Step 3 To compile the script, click the Compile button or select **Build > Compile**. The file has the **.uwbg** extension.

After you click Compile, any errors appear in the Errors tab, with the file name, line number, and error description.

Output appears in the Output tab. You can Copy or Print the output.

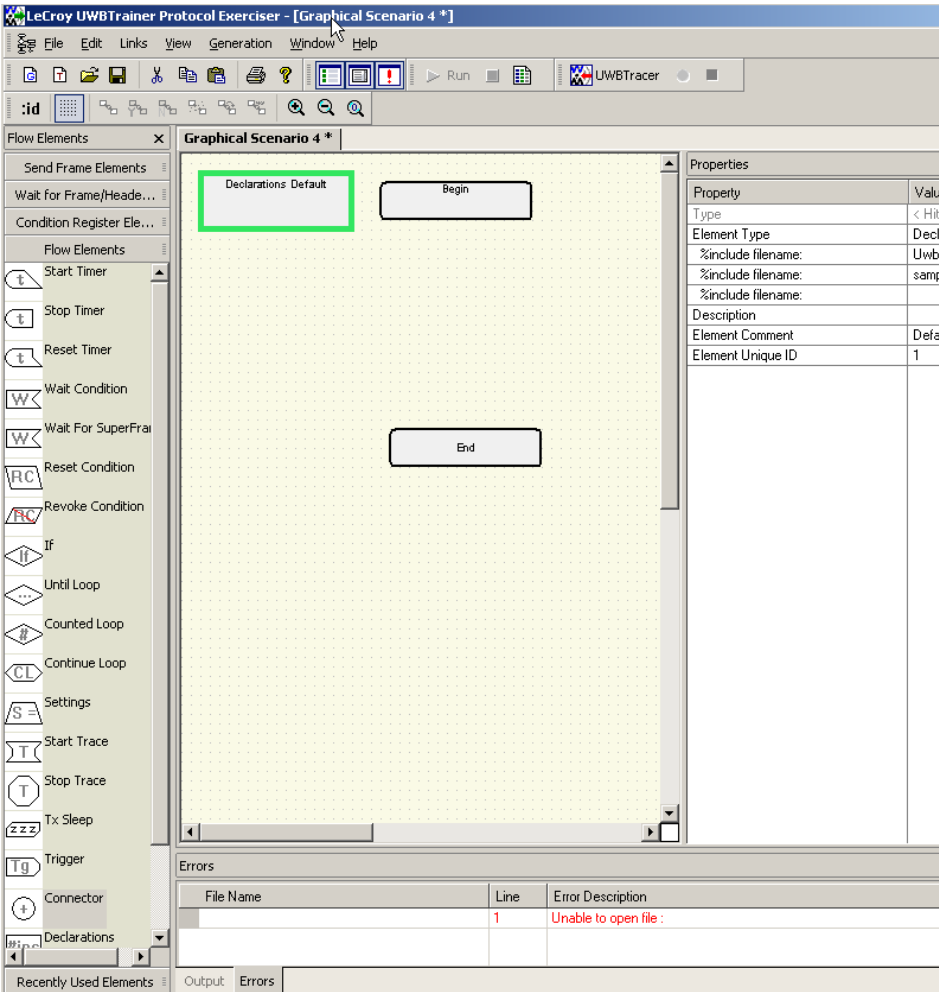
The UWB*Trainer* Status bar at the bottom of the screen shows the current state of the script run. The lower right corner shows whether the Number Lock, Caps Lock, and Scroll Lock are on or off.

Note: The next chapter describes how to create and edit text scenarios.

Graphical Scenario

To use a graphical editor:

Step 1 Click the **New Graphical Scenario** button or select **File > New Graphical Scenario** to display a graphical layout with a Declarations Default object, a Begin object, and an End object.



Step 2 Use the tools to build a graphical scenario. See the next chapter for how to create and edit a graphical scenario.

Step 3 Save the scenario.

The scenario has the **.ugg** extension.

When you save, the application makes a text script of the same name. The script file has a **.uwbg** extension.

Note: The next chapter describes how to create and edit graphical scenarios.

14.7 Generating Traffic

After you create or edit, then compile and save a script, you can run the script.

To generate traffic:

Step 1 Click

or select **Generation > Run Scenario** to start executing the script.

As the script executes, the Status bar displays the script's progress. The **Current script position** field displays the command description and trace packet number currently being generated.

Step 2 To cancel the script, click or select **Generation > Stop Scenario**.

You can also see a **Trace Preview**. Use the Trace Preview button or select **Generation > Trace Preview.**

Chapter 15: Creating and Editing Generation Files

After you open an existing generation script file or create a new text scenario in the UWB*Trainer*™ Script Editor, or open an existing graphical scenario or create a new graphical scenario in the UWB*Trainer*™ Graphical Scenario Editor, use the following steps to edit or build a script.

15.1 Script Editor

The Script Editor offers several features to simplify the process of editing.

Highlighting

All known commands and parameters are highlighted in **blue**.

All predefined values and command modifiers are highlighted in **brown**.

Comments are in **green**.

Errors are in **red**.

Text Editing Commands

The Script Editor supports standard editor commands using toolbar buttons and Edit menu commands:

- **Cut/Copy/Paste:** Also available by right-clicking a command to display a menu
- **Undo/Redo**
- **Find/Replace/Find Next**
- **Bookmarks:** Show/Hide, Previous/Next, and Clear All

Help

Right-click a command to display a menu from which you can choose Help.

Properties Window

The Properties window lists all parameters and their values for the selected script command. Parameters/values can be changed by entering text into the text boxes or by selecting items from pull-down menus.

File Tabs

At the top of the Script Editor window is a tab with the name of the open generation file.

If there are **Include** statements in the generation file that link it to other generation files, these files automatically open and display as tabs at the top of the window. You can click the tabs to toggle between the open generation files.

Errors

When you compile a script and have an error, the error appears in the Error tab at the bottom of the application window. Each error has a file name, line number, and description. Double-clicking the error jumps to the line number.

A red square appears next to the line number that contains the error.

A yellow square appears next to the line number that has a warnings.

Note: You cannot run a script that has syntax errors.

Output

When you compile a script that generates output or when the application sends you a message, the information appears in the Output tab.

Options Menu

You can set text options in the Options menu by clicking :

- **Enable Outlining:** Adds a hierarchy of levels to the script.
- **Show Line Numbers:** Displays the line numbers at the left of the window.
- **Show Tooltips:** When you place the cursor over an item, information about the item appears.
- **Enable IntelliSense:** Starts the IntelliSense program.
- **Toggle Outlining:** If Enable Outlining is checked, allows you to expand or collapse the outlining levels.

Outlining

If you enable outlining at the Options button, you can **collapse** or **expand** code blocks. You can toggle outlining at the Options button or by right-clicking a command to display a menu from which you can choose Toggle Outlining.

Line Numbers

If you enable line numbers at the Options button, each line has a line number.

Tooltips

If you show tooltips at the Options button, tooltips appear when you place the cursor over a button or command.

IntelliSense

If you enable IntelliSense at the Options button, the **Intellisense** application prompts for known predefined values/literals when you type **=** or { after a known key.

Text Snippets

Text snippets appear in the Text Snippets window. You can drag and drop a text snippet into the script. The available text snippets are:

- **Start Timer:** Enter Timeout Value, AutoReset, and TimeVar Index.
- **Stop Timer:** Has no options.
- **Reset Timer**: Has no options.
- **Reg Rx Frm Cnd**: For Register Rx Frame Condition, enter a Template Name, Condition Name, AutoReset, Counter, and TimeVar Index.
- **Reg Tx Frm Cnd**: For Register Tx Frame Condition, enter a Template Name, Condition Name, AutoReset, Counter, and TimeVar Index.
- **Reset Cnd**: For Reset Condition, enter a condition.
- **Revoke Cnd**: For Revoke Condition, enter a condition.
- **Start Recording**: Enter the Recorded Options File Path and Name and the Trace File Path and Name.
- **Stop Recording**: Enter 0 (no WaitForUpload) or 1 (WaitForUpload).
- **Trigger Analyzer:** Has no options.
- **Wait For Super Frm**: Wait For SuperFrame has no options
- **Packet Size**: Enter an integer.
- **Pattern Size**: Enter an integer.
- **Field Size**: Enter an integer.
- **If(Any) Condition**: First select one or more conditions, then require **Any** of the selected conditions.
- **If(All) Condition**: First select one or more conditions, then require **All** of the selected conditions.
- **Else Condition**: Select a condition.
- **Until(Any)**: First select one or more conditions, then require **Any** of the selected conditions.
- **Until(All)**: First select one or more conditions, then require **All** of the selected conditions.

Note: In the syntax for Text Snippets, the /* and */ stand for comment marks. Do not use either the / or * when you enter a parameter. For example in:

If_Condition(/*condition_name_1*/)

the entry might look like this:

If_Condition(Condition3)

```
37  {
38  StartTimer(/*timer_value*/, /*[auto_reset]*/,/*[Time variable index]*/)
39  StopTimer()
40  ResetTimer()
41  RegRxFrmCondition ( /*condition_name*/, /*[auto_reset]*/, /*[counter]*/,/*[Time
42  {
43   /*Mask/Match template or frame variable*/
44  }
45  RegTxFrmCondition ( /*condition_name*/, /*[auto_reset]*/, /*[counter]*/,/*[Time
46  {
47  /*Mask/Match template or frame variable*/
48  }
49  ResetCondition( /*condition_name*/ )
50  RevokeCondition( /*condition_name*/ )
51  StartRecording (/*recording_options*/ , /*trace_file*/ )
52  StopRecording ( /*[ wait_for_trace ]*/ )
53  TriggerAnalyzer()
54  WaitForNextSuperFrame( /*[number_of_superframes]*/ )
55  pkt_size (/*template*/)
56  pttn_size (/*data_pattern*/)
57  Fld_size (/*field_name*/)
58  If_Condition(/*condition_name_1*/ , /*[condition_name_2]*/, /*[...]*/ )
59  {
60  }
61  If_All(/*condition_name_1*/ , /*[condition_name_2]*/, /*[...]*/ )
62  {
63  }
64  Else_Condition
65  {
66  }
67  Until(/*condition_name_1*/ , /*[condition_name_2]*/, /*[...]*/ )
68  {
69  }
70  Until_All(/*condition_name_1*/ , /*[condition_name_2]*/, /*[...]*/ )
71  {
```

Figure 15.5 Traffic Generation Script Text Snippets

Note: For information about each command, see the *UWBTrainer Exerciser - Generation Script Language Reference Manual* or consult the UWB*Trainer* Exerciser Generation Script Language online help.

15.2 Creating a Script using the Script Editor

Before creating a script, read the *UWBTrainer Generation Script Language Reference Manual* or the UWB*Trainer* Generation Script Language online help to become familiar with all parts of a script and their order, learn about the commands and their parameters, and see an example script.

To create a script, do the following in the UWB*Trainer* window:

Step 1 Click the **New Text Scenario** button or select **File > New Text Scenario** to display a blank script.

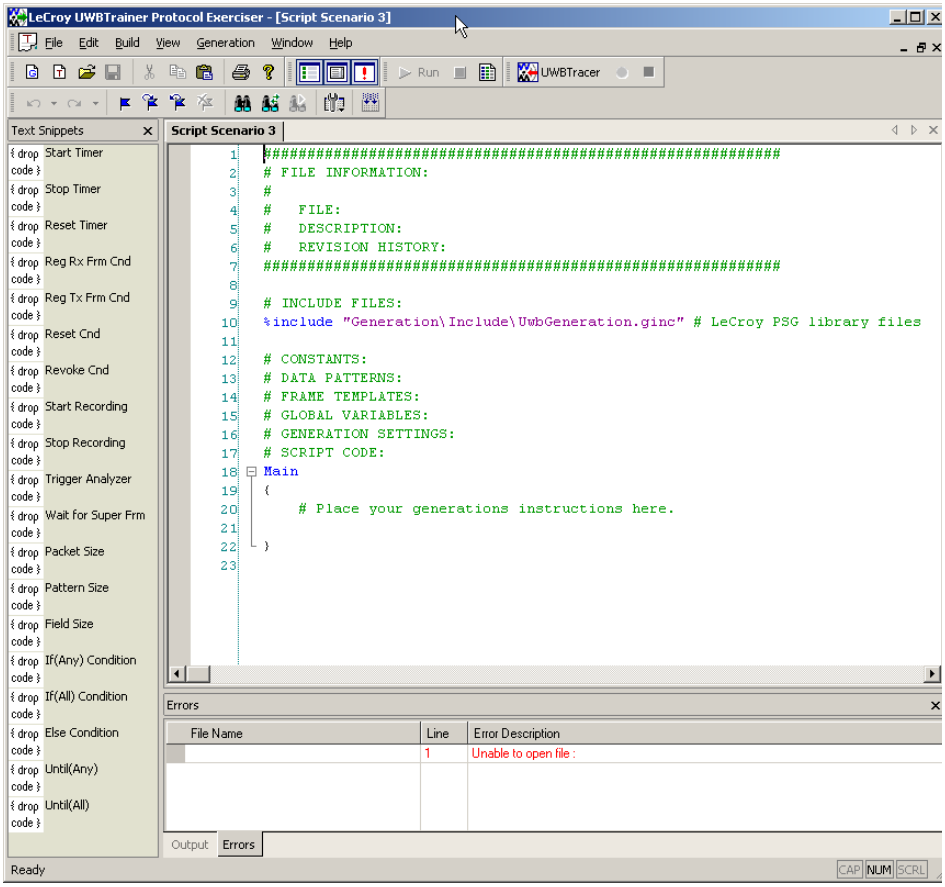


Figure 15.1 New Text Scenario for a Traffic Generation File

The file name appears on the tab for the file.

Step 2 Enter file information in the beginning comment lines:

```
##########################################################
# FILE INFORMATION:
#   FILE:
#   DESCRIPTION:
#   REVISION HISTORY:
##########################################################
```

Step 3 Add a comment line by starting the line with #:

```
# INCLUDE FILES:
```

Step 4 To include main definitions and some WUSB templates, add an include file line:

```
%include "Generation\Include\UwbGeneration.ginc"
```

Step 5 Add constants:

```
Const SOME_HEX_DATA   = 0xAABBFFEE
Const SOME_DEC_DATA   = 12
```

Step 6 Add data patterns:

```
DataPattern SetAddrReq   = { 00 05 00 00 00 00 00 00 }
```

Step 7 Add frame and structure templates:

```
struct DeliveryID
{
    Sel : 1 = 1     # Stream Index
    Val : 3
}
```

Step 8 (optional) Add global variables.

Step 9 (optional) Add generation settings.

Step 10 Add the **Main** generation procedure, such as the following example:

```
Main
{
    # parser numeric variables
    dest_address = 0x0080
    host_address = 0xBEEF
    endpoint     = 4
    direction    = IN
    # parser for loop
    for( i = 0, i < 2, i++ )
    {
        # parser If directive
        if( i == 1 )
        {
            host_address = 0xABCD
            endpoint = 5
        }
        # parser Call of another generation procedure
           Call Inquiry( host_address, dest_address,
                         endpoint, direction )
    }
}
```

Note: You can use the Text Snippets on the left Text Snippets panel to add commands and their parameters.

Step 11 Add other generation procedures, such as **Inquiry**.

For how to set up other generation procedures, see Appendix A of the *UWBTrainer Exerciser - Generation Script Language Reference Manual* or the UWB*Trainer Exerciser* Generation Script Language online help.

```
# Include main definitions.
%include "Generation\Include\UwbGeneration.ginc"
# Add constants.
Const SOME_HEX_DATA    = 0xAABBFFEE
Const SOME_DEC_DATA    = 12
# Add data patterns.
DataPattern SetAddrReq    = { 00 05 00 00 00 00 00 00 }
# Add frame and structure templates.
struct DeliveryID
{
    Sel : 1 = 1     # Stream Index
    Val : 3
}
# Add the Main generation procedure.
Main
{
    # parser numeric variables
    dest_address = 0x0080
    host_address = 0xBEEF
    endpoint     = 4
    direction    = IN
    # parser for loop
    for( i = 0, i < 2, i++ )
    {
        # parser If directive
        if( i == 1 )
        {
            host_address = 0xABCD
            endpoint = 5
        }
        # parser Call of another generation procedure
           Call Inquiry( host_address, dest_address, endpoint, direction )
    }
}
# Add other generation procedures, such as Inquiry.
Inquiry
{
}
```

Figure 15.2 Traffic Generation Script Example

Step 12 (optional) You can use the Text Snippets on the left Text Snippets panel to add commands and their parameters.

Step 13 Click the **Compile** button or select **Build > Compile** to check the file for errors. The application lists any errors in the Errors tab.

Step 14 Click the **Save** button or select **File > Save** to save the file.

Note: Saving the file automatically compiles it.

See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

15.3 Graphical Scenario Editor

The Graphical Scenario Editor offers several features to simplify the process of editing.

Highlighting

The currently selected module is highlighted.

Modules with associated errors are **red**.

Links

You can add a link using the small L in a square of an element, selecting a link from the Links menu, or clicking a link on the Graphics toolbar.

To have a valid scenario, a series of links must connect the Begin block to the End block

Each element in a scenario can receive at most one input link (inbound arrow), and the interface does not allow you to make one than one input link. This requirement makes the graphical scenario compatible with the scripting language, so that the graphical scenario .**ugg** file and its associated text scenario **.uwbg** file are always equivalent.

An If element, Else element, and Loop element have a Yes link and a No link. The Yes link must lead to a terminator element:

- The Yes link of an If element must terminate with an End If element.
- The Yes link of an Else element must terminate with an End Else element.
- The Yes link of a Loop element must terminate with a Continue Loop element.

The No link of an If element, Else element, or Loop element must not have a terminator element and must be on the path to the End block.

You can delete a link using **Links > Break link** or the **Break Link** button.

You can flip a link direction using **Links > Flip link direction** or the **Flip Link Direction** button.

You can label a link using **Links > Link label** or the **Link Label** button.

Links can only be horizontal or vertical. To make a diagonal, use two links through a Connector.

Tooltips

Tooltips appear when you place the cursor over a module.

Elements

The available elements appear in the left window:

- **Send Frame Elements:** Outputs the specified Frame in accordance with the parameters.
- **Wait for Frame/Header Elements:** Defines a condition that will be waited for. The condition is registered and later revoked automatically.
- **Condition Register Elements:** Defines a condition that will be branched on or waited for in loop and flow control.
- **Flow Elements:** About timing, waiting, conditions, loops, settings, and recording
- **Recently Used Elements:** Lists the most recently used elements.

All elements have an Element Type and an Element Unique ID, and these cannot be changed for any element.

All elements have editable Comments and Descriptions. By default, the Element Comment is **Default**. You can enter a Description of up to 30 characters. Click **Return** to store entered values.

Note: For information about each command, see the *UWBTrainer Exerciser - Generation Script Language Reference Manual* or consult the UWB*Trainer* Exerciser Generation Script Language online help.

Flow Elements

The Flow Elements are about timing, waiting, conditions, loops, settings, and recording. Figure 15.3 shows all the Flow elements.

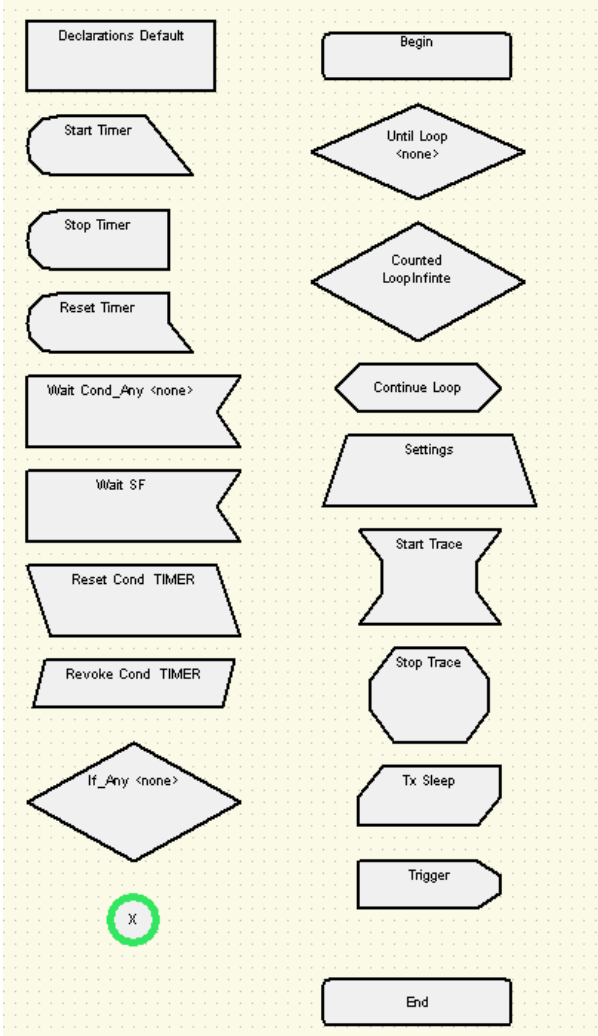


Figure 15.3 Flow Element Examples

The Flow Elements window has:

- **Timer Reg (Timer Registration)**: Defines a timer condition that will be branched on or waited for.
- **Start Timer**: Causes the Analyzer to start a timer named TIMER.
- **Stop Timer:** Causes the Analyzer to stop the timer named TIMER.
- **Reset Timer:** Causes the Analyzer to reset the timer named TIMER and continue timing.
- **Wait Condition**: Wait for condition(s) to be met before continuing scenario execution. Wait Cond_Any continues if any of the conditions is met, while Wait Cond_All continues only if all conditions are met.
- **Wait For SuperFrame**: Waits for a specific SuperFrame number before continuing scenario execution.
- **Reset Condition**: Resets a Registered Condition to the Charged (waiting for trigger) state.
- **Revoke Condition**: Removes a Registered Condition from existence, so it will no longer be monitored. This provides better performance for the Exerciser.
- **If:** Used for conditional branching. **If_Any** branches if any of the conditions is met, while **If_All** branches only if all conditions are met. The Yes link is the direction of branching if the condition is met. Otherwise, the No link path taken is taken. Optionally, you may immediately follow this element along the No link with an Else element, to provide If-Then-Else capability.
- **End If**: Terminates the Yes link of the If branch. Control will continue along the No link of the If that created this branch.
- **Else:** For conditional branching in conjunction with the If element. If it is used, it must directly follow an If_Any or If_All element, along the No link of the If. The Else path is executed along the Yes link if the preceding If_xx condition is NOT executed. Once the Else path is executed, control returns to the NO link of the If element. (If the preceding If condition is met (True), the Else Yes link path is NOT followed.) The combination of the If and Else elements provides the commonly desired If-Then-Else behavior of a structured programming language.
- **End Else**: Terminates the Yes link of the Else branch. Control will continue along the No link of the Else that created this branch.
- **Until Loop**: Executes a sequence until a condition is met. The scenario follows the Yes link until the condition is met, then continues along the No link. Until_Any loops until at least one condition is met, while Until_All loops until all the conditions are met.
- **Counted Loop**: Executes a sequence a number of times, including infinite. The scenario follows the Yes link until the count reaches the value specified, then continues along the No link. Note that defining no value implies Infinite looping.
- **Continue Loop**: Terminates the Yes branch of a Counted Loop or an Until Loop and continues execution back at the beginning of the loop until the condition is met.
- **Settings:** Allows changing the settings or overriding the global settings during scenario execution.
- **Start Trace**: Causes the Analyzer to begin capturing traced data.
- **Stop Trace:** Causes the Analyzer to quit capturing traced data.
- **Tx Sleep**: Causes the Analyzer to sleep between items in the transmit FIFO. This gives greater precision between transmitted frames.
- **Trigger**: Causes the Analyzer to be triggered.
- **Connector:** Changes link direction in the editor. It does not alter the behavior.

- **Declarations:** Contains all the **%include** statements of all the default definition files, along with global settings values. You can **%include** your own definition files. This element does not link to the rest of the scenario but is required.
- **Begin**: Is the first element in a scenario diagram. There is one and only one of these in a scenario.
- **End:** Terminates the scenario. One and only one is required.

Timer Elements

The timer elements are Start Timer, Stop Timer, and Reset Timer.

For the Start Timer element, you can enter:

- **Timeout Value:** Specifies the timer timeout in microseconds. Timeout must be set to a non-zero value to register a Timer condition. Default is UNDEFINED.
- **AutoReset:** Select ON to automatically reset the timer. Select OFF to not reset the timer. Default is OFF.
- **TimeVar Index:** Enter the index name of the Time variable in which to keep the condition timestamp when it is triggered or leave UNDEFINED. Default is UNDEFINED (timestamp is not saved).

The Stop Timer element has no specific options.

The Reset Timer element has no specific options.

Wait Elements

The wait elements are Wait Condition and Wait For SuperFrame.

For the Wait Condition element, first select one or more conditions that you previously entered. TIMER can be a condition. Then require **Any** or **All** of the selected conditions.

The Wait For SuperFrame element has no specific options.

Condition Elements

The condition elements are Reset Condition, Revoke Condition, If, End If, Else, and Else If.

For the Reset Condition element, you can select a previously entered condition.

For the Revoke Condition element, you can select a previously entered condition.

For the If element, first select one or more conditions that you previously entered. TIMER can be a condition. Then require **Any** or **All** of the selected conditions.

The Else element has no specific options.

The End If element has no specific options.

The End Else element has no specific options.

Loop Elements

The loop elements are Until Loop, Counted Loop, and Continue Loop.

For the Until Loop element, first select one or more conditions that you previously entered. TIMER can be a condition. Then require **Any** or **All** of the selected conditions

For the Counted Loop element, select the number of loops.

The Continue Loop element has no specific options.

Settings Element

For the Settings element, you can enter or select:

- **UwbTxPower:** Enter an integer to indicate the UWB transmitter power in watts. Possible values are 0 (no transmitting) to 15 (max level). Default value is 0.
- **UwbTxChannel:** Select a UWB transmitter channel from the list to specify the wireless channel that UWB*Trainer* uses to transmit WiMedia traffic. The setting value for channel mapping includes Band Group (6 bits) and TF Code (3 bits) as specified in the WiMedia PHY Specification. Default value is AUTO (UWB*Trainer* uses the currently specified channel.)
- **UwbRxChannel:** Select a UWB receiver channel from the list to specify the wireless channel that UWB*Trainer* uses to receive WiMedia traffic. The setting value for channel mapping includes Band Group (6 bits) and TF Code (3 bits) as specified in the WiMedia PHY Specification. Default value is AUTO (UWB*Trainer* uses the currently specified channel.)
- **SuperFrame Period:** Enter an integer to indicate the SuperFrame period in microseconds. Possible values are 0 to 0xFFFFFF. Default value 0.
- **FrameDelay:** Enter an integer to specify the default delay in nanoseconds between transmitted frames. Default value: 0 (Frames are transmitted without delay.) **Note:** This value can be overridden by the Delay parameter in a Send Frame instruction.
- **AddMissingFields:** Select On to instruct the script parser to add any missing frame template fields for Send Frame instructions. Missing TX frame template fields might include FCS. Missing RX frame template fields might include FCS +Rx packet end report fields (such as RSSI and LQI), which are used in conditions. Select OFF to not add fields. Select UNDEFINED to turn off this feature. Default value is ON.

Recording Elements

The recording elements are Start Trace, Stop Trace, Tx Sleep, and Trigger.

For the Start Trace element, enter the Recorded Options File Path and Name and the Trace File Path and Name. You can select to KeepOldTrace.

For the Stop Trace element, enter No (no WaitForUpload) or Yes (WaitForUpload).

For the Tx Sleep element, enter a Time in microseconds (default = 0) and (optionally) a Fine Time Adjustment in nanoseconds (default = 0).

The Trigger element has no specific options.

Connector Element

The Connector element is used only to allow a link to change direction.

Send Frame Elements

The Send Frame Elements send frames. Figure 15.4 shows all the Send Frame elements.

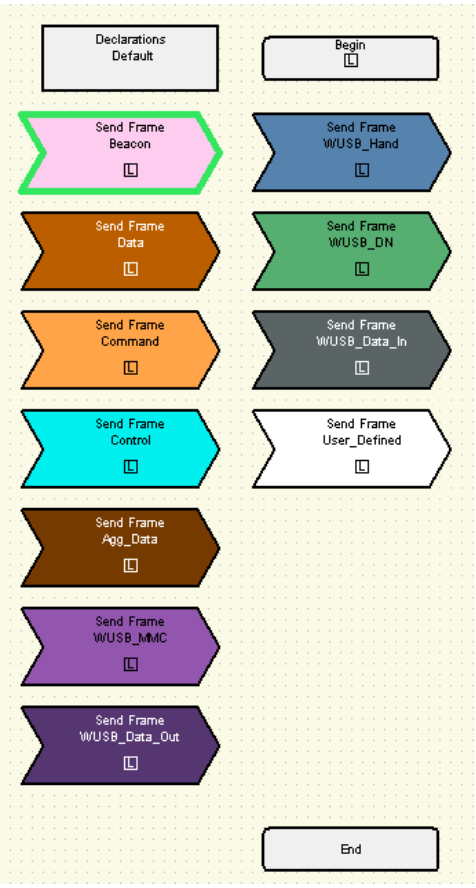


Figure 15.4 Send Frame Element Examples

The Send Frame Elements window has:

- Send Beacon
- Send Data
- Send Command
- Send Control
- Send Agg_Data
- Send WUSB_MMC
- Send WUSB_Data_Out
- Send WUSB_Hand
- Send WUSB_DN
- Send WUSB_Data_In
- Send <User_Defined>

The Send Frame Elements have the properties:

- **Frame Type:** Beacon, Data, Command, Control, Agg_Data, WUSB_MMC, WUSB_Data_Out, WUSB_Hand, WUSB_DN, WUSB_Data_In, <User_Defined>
- **Template Name:** Select first from a list of defined templates.
- **Send Time Method:** Select **Delay** to set the Delay time (in nanoseconds) to wait before sending the frame. Select **SFOffset** to set the Offset (in microseconds) of the frame to be sent, in SuperFrame. Select **AbsTime** to set the Absolute time (in microseconds) at which the frame is to be sent. **Note:** When using the AbsTime time mode parameter, make sure that the first frame sent has a time value greater than or equal to 10 microseconds, to ensure correct timing between the first few frames of the scenario.
- **Send Time Method Value (us):** Enter an integer.
- **Fine Time Adjustment (ns):** Enter an integer.
- **Burst:** BURST_BEGIN specifies the start of a burst sequence. BURST_CONTINUE specifies that the burst sequence does not end. BURST_END specifies the end of a burst sequence. IGNORE means not to use a burst sequence.
- **Overrides:** Specifies a bitmap that instructs the UWB*Trainer* to set values for the TFC/BG, FCS, Scr, and Length fields from the frame template, rather than calculating them automatically.
  - **Overrides OVR_TFC:** Check or uncheck.
  - **Overrides OVR_FCS:** Check or uncheck.
  - **Overrides OVR_SCR:** Check or uncheck.
  - **Overrides OVR_LEN:** Check or uncheck.
- **TimeVar Index:** Enter the index name of the Time variable in which to keep the condition timestamp when it is triggered or leave UNDEFINED. Default is UNDEFINED (timestamp is not saved).
- **Rate**: Select from list.
- **Reserved0**: Enter an integer. Default is 0.
- **Reserved1**: Enter an integer. Default is 0.
- **BG_Isb**: Enter an integer. Default is 0.
- **PreType**: Select from list.
- **BM**: Select from list.
- **Reserved**2: Enter an integer. Default is 0.
- **Reserved3**: Enter an integer. Default is 0.
- **RETRY**: Select from list.
- **CtrlType**: Select from list.
- **FrameType**: Enter a type.
- **AckPolicy**: Select from list.

- **SECURE**: Select from list.
- **Version**: Enter an integer. Default is 0.
- **DestAddr**: Enter an integer. Default is 0.
- **SrcAddr**: Enter an integer. Default is 0.
- **Reserved4**: Enter an integer. Default is 0.
- **MoreFrag**: Select from list.
- **SeqNum**: Enter an integer. Default is 0.
- **FragNum**: Enter an integer. Default is 0.
- **AccMthd**: Select from list.
- **MoreFrms**: Select from list.
- **Duration**: Enter an integer. Default is 0.
- **MacAddrLower**: Enter an integer. Default is 0.
- **MacAddrUpper**: Enter an integer. Default is 0.
- **SlotNumber**: Enter an integer. Default is 0.
- **SecurityMode**: Select from list.
- **Reserved_BP**: Enter an integer. Default is 0.
- **Signaling Slot**: Select from list.
- **Movable**: Select from list.
- **IE_ID**: Select from list.
- **BPOIE_IE_CODE**: Enter a code.
- **BPOIE_Len**: Enter an integer. Default is 0.
- **BPOIE_val**: Enter an integer. Default is 0.

Condition Register Elements

The Condition Register Elements set conditions that can be used in loop and condition flow control. Figure 15.5 shows all the Condition Register elements.

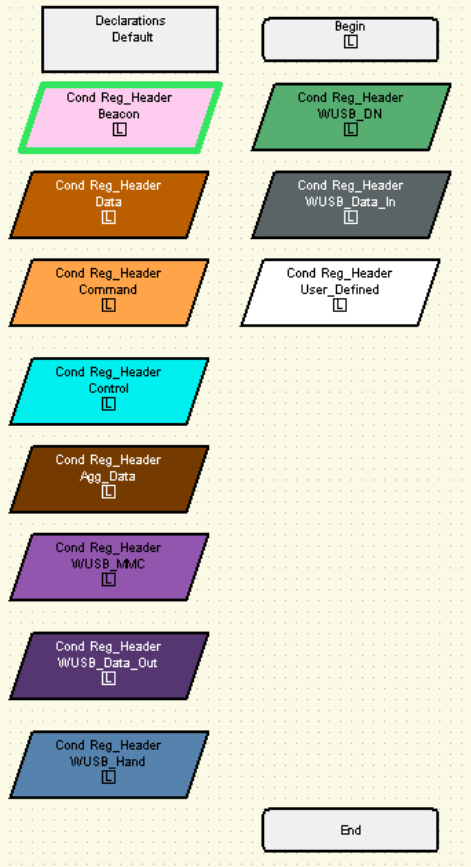


Figure 15.5 Condition Register Element Examples

The Condition Register Elements window has:

- Cnd Reg Beacon
- Cnd Reg Data
- Cnd Reg Command
- Cnd Reg Control
- Cnd Reg Agg_Data
- Cnd Reg WUSB_MMC
- Cnd Reg WUSB_Data_Out
- Cnd Reg WUSB_Hand
- Cnd Reg WUSB_DN
- Cnd Reg WUSB_Data_In
- Cnd Reg <User_Defined>

The Condition Register Elements have the properties:

- **Frame Type:** Beacon, Data, Command, Control, Agg_Data, WUSB_MMC, WUSB_Data_Out, WUSB_Hand, WUSB_DN, WUSB_Data_In, <User_Defined>
- **Template Name:** Select first from a list of defined templates.
- **Condition Name:** Enter a unique name.
- **AutoReset:** Select Yes to automatically reset the condition after it is triggered. Select No to not reset the condition after it is triggered. Select UNDEFINED to turn off AutoReset. Default is UNDEFINED.
- **Counter:** Enter an integer to specify the number of times the condition event occurs before the condition is triggered. Default is 1.
- **TimeVar Index:** Enter the index name of the Time variable in which to keep the condition timestamp when it is triggered or leave UNDEFINED. Default is UNDEFINED (timestamp is not saved).
- **Rate**: Select from list.
- **Reserved0**: Enter an integer. Default is 0.
- **Len7_0**: Enter an integer. Default is 0.
- **Scr**: Enter an integer. Default is 0.
- **Reserved1**: Enter an integer. Default is 0.
- **Len11_8**: Enter an integer. Default is 0.
- **BG_Isb**: Enter an integer. Default is 0.
- **TFCode**: Select from list.
- **PreType**: Select from list.
- **BM**: Select from list.
- **Reserved**2: Enter an integer. Default is 0.
- **Reserved3**: Enter an integer. Default is 0.
- **RETRY**: Select from list.
- **CtrlType**: Select from list.
- **FrameType**: Enter a type.
- **AckPolicy**: Select from list.
- **SECURE**: Select from list.
- **Version**: Enter an integer. Default is 0.
- **DestAddr**: Enter an integer. Default is 0.
- **SrcAddr**: Enter an integer. Default is 0.
- **Reserved4**: Enter an integer. Default is 0.
- **MoreFrag**: Select from list.

- **SeqNum**: Enter an integer. Default is 0.
- **FragNum**: Enter an integer. Default is 0.
- **AccMthd**: Select from list.
- **MoreFrms**: Select from list.
- **Duration**: Enter an integer. Default is 0.
- **MacAddrLower**: Enter an integer. Default is 0.
- **MacAddrUpper**: Enter an integer. Default is 0.
- **SlotNumber**: Enter an integer. Default is 0.
- **SecurityMode**: Select from list.
- **Reserved_BP**: Enter an integer. Default is 0.
- **Signaling Slot**: Select from list.
- **Movable**: Select from list.
- **IE_ID**: Select from list.
- **BPOIE_IE_CODE**: Enter a code.
- **BPOIE_Len**: Enter an integer. Default is 0.
- **BPOIE_val**: Enter an integer. Default is 0.
- **RSSI_Lo:** Enter an integer. Default is 0.
- **RSSI_Hi**: Enter an integer. Default is 0.
- **LQI_Lo**: Enter an integer. Default is 0.
- **LQI_Hi**: Enter an integer. Default is 0.
- **Duration_Lo**: Enter an integer. Default is 0.
- **Duration_Hi:** Enter an integer. Default is 0.
- **Reserved_0**: Enter an integer. Default is 0.
- **Errors**: Enter an integer. Default is 0.

Wait For Frame/Header Elements

The Wait For Frame/Header Elements cause a wait for the data type. Figure 15.6 shows all the Wait For Frame/Header elements.

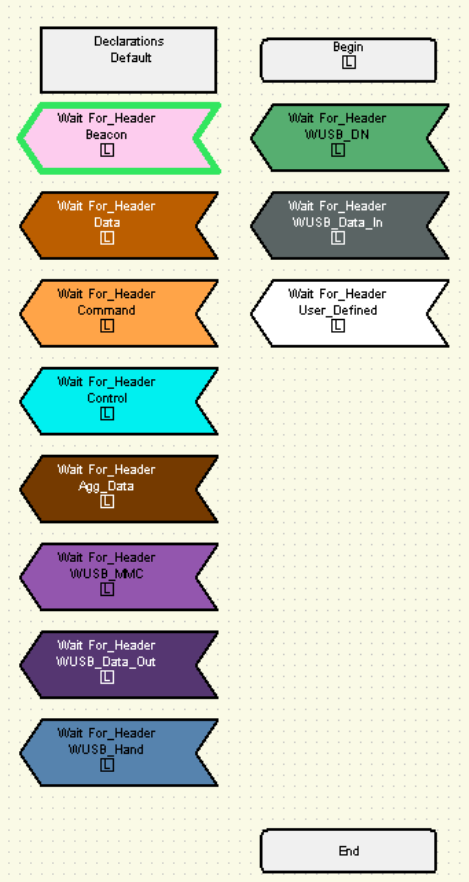


Figure 15.6 Wait For Frame/Header Element Examples

The Wait for Frame/Header Elements window has:

- Wait for Beacon
- Wait for Data
- Wait for Command
- Wait for Control
- Wait for Agg_Data
- Wait for WUSB_MMC
- Wait for WUSB_Data_Out
- Wait for WUSB_Hand
- Wait for WUSB_DN
- Wait for WUSB_Data_In
- Wait for <User_Defined>

The Wait For Frame/Header Elements have the properties:

- **Frame Type:** Beacon, Data, Command, Control, Agg_Data, WUSB_MMC, WUSB_Data_Out, WUSB_Hand, WUSB_DN, WUSB_Data_In, <User_Defined>
- **Template Name:** Select first from a list of defined templates.
- **Timeout:** Enter an integer to specify the time to wait in microseconds. Default is 0.
- **Counter:** Enter an integer to specify the number of times the condition event occurs before the wait is triggered. Default is 1.
- **TimeVar Index:** Enter the index name of the Time variable in which to keep the timestamp when it is triggered or leave UNDEFINED. Default is UNDEFINED (timestamp is not saved).
- **Match on Rx Frame Info:** Enter **Yes** to match the Rx Frame information or no to not match. Default is Yes.
- **Rate**: Select from list.
- **Reserved0**: Enter an integer. Default is 0.
- **Len7_0**: Enter an integer. Default is 0.
- **Scr**: Enter an integer. Default is 0.
- **Reserved1**: Enter an integer. Default is 0.
- **Len11_8**: Enter an integer. Default is 0.
- **BG_Isb**: Enter an integer. Default is 0.
- **TFCode**: Select from list.
- **PreType**: Select from list.
- **BM**: Select from list.
- **Reserved2**: Enter an integer. Default is 0.
- **Reserved3**: Enter an integer. Default is 0.
- **RETRY**: Select from list.
- **CtrlType**: Select from list.
- **FrameType**: Enter a type.
- **AckPolicy**: Select from list.
- **SECURE**: Select from list.
- **Version**: Enter an integer. Default is 0.
- **DestAddr**: Enter an integer. Default is 0.
- **SrcAddr**: Enter an integer. Default is 0.
- **Reserved4**: Enter an integer. Default is 0.
- **MoreFrag**: Select from list.

- **SeqNum**: Enter an integer. Default is 0.
- **FragNum**: Enter an integer. Default is 0.
- **AccMthd**: Select from list.
- **MoreFrms**: Select from list.
- **Duration**: Enter an integer. Default is 0.
- **MacAddrLower**: Enter an integer. Default is 0.
- **MacAddrUpper**: Enter an integer. Default is 0.
- **SlotNumber**: Enter an integer. Default is 0.
- **SecurityMode**: Select from list.
- **Reserved_BP**: Enter an integer. Default is 0.
- **Signaling Slot**: Select from list.
- **Movable**: Select from list.
- **IE_ID**: Select from list.
- **BPOIE_IE_CODE**: Enter a code.
- **BPOIE_Len**: Enter an integer. Default is 0.
- **BPOIE_val**: Enter an integer. Default is 0.
- **RSSI_Lo:** Enter an integer. Default is 0.
- **RSSI_Hi**: Enter an integer. Default is 0.
- **LQI_Lo**: Enter an integer. Default is 0.
- **LQI_Hi**: Enter an integer. Default is 0.
- **Duration_Lo**: Enter an integer. Default is 0.
- **Duration_Hi:** Enter an integer. Default is 0.
- **Reserved_0**: Enter an integer. Default is 0.
- **Errors**: Enter an integer. Default is 0.

Properties Window

The Properties window lists all properties and their values for the selected module. Parameters/values can be changed by entering text into the text boxes or by selecting items from pull-down menus.

For example, the Declarations Default has the properties:

- **Type:** Click **Enter** to store string entry.
- **Element Type:** Declarations.You cannot modify the number.
- **include file name list:** Default is **Uwbgeneration.Ginc** and **other_frame_templates.ginc.** You can add more **.ginc** files.
- **Description:** Enter a description.
- **Element Comment:** Default is “Default”. Enter further comments.
- **Element Unique ID:** Default is 16. You cannot modify the number.

Begin has the properties:

- **Type:** Click **Enter** to store string entry.
- **Element Type:** Begin.You cannot modify this.
- **Description:** Enter a description.
- **Element Comment:** Enter comments.
- **Element Unique ID:** Default is 3. You cannot modify the number.

End has the properties:

- **Type:** Click **Enter** to store string entry.
- **Element Type:** End.You cannot modify this.
- **Description:** Enter a description.
- **Element Comment:** Enter comments.
- **Element Unique ID:** Default is 6. You cannot modify the number.

The fields which are part of Frame Templates are shown in one of the two following ways

- **FieldName : n** (where n is the number of bits in the fixed-length field. Bit fields always have a fixed length.)
- **FieldName : m Bytes** (where m is the number of bytes that you specify. Byte fields may have from 0 to any number of blank separated hex values.)

15.4 Creating a Graphical Scenario using the Graphical Scenario Editor

Before creating a graphical scenario, read the *UWBTrainer Exerciser - Generation Script Language Reference Manual* or the UWB*Trainer Exerciser* Generation Script Language online help to become familiar with all parts of a script and their order, learn about the commands and their parameters, and see an example script.

Making graphical scenario involves:

1. Making templates before using the graphical scenario editor.

2. Making declarations

3. Using links and elements to go from the Begin block to the End block

As you add elements and link them, the Graphical Scenario Editor prompts you to add constants, data patterns, struct and frame templates, the Main generation procedure, and other generation procedures, or adds them automatically as needed.

Saving a graphical scenario (**.ugg** extension) generates a valid generation script of the same name (**.uwbg** extension).

Note: Using the Graphical Scenario Editor to create graphical scenarios provides an alternative way to build relatively simple traffic generation scripts. To build complex traffic generation scripts, use the Script Editor and emulate the methods shown in the *UWBTrainer Exerciser - Generation Script Language Reference Manual*.

To create a graphical scenario, do the following in the UWB*Trainer* window:

Step 1 Click the **New Graphical Scenario** button or select **File > New Graphical Scenario** to display the default graphical scenario.

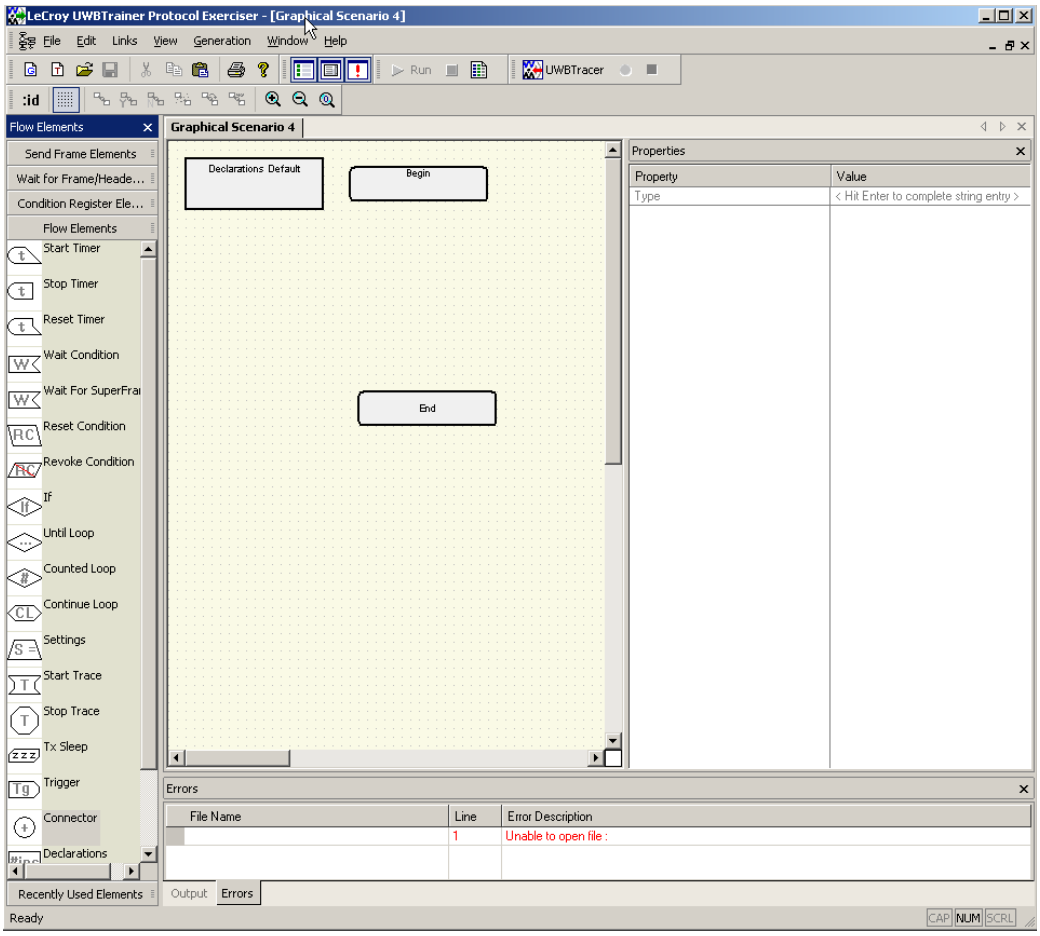


Figure 15.7 New Graphical Scenario

The graphical scenario name appears on the tab.

Step 2 (optional) Click the Declarations Default region to display its properties in the Properties window.

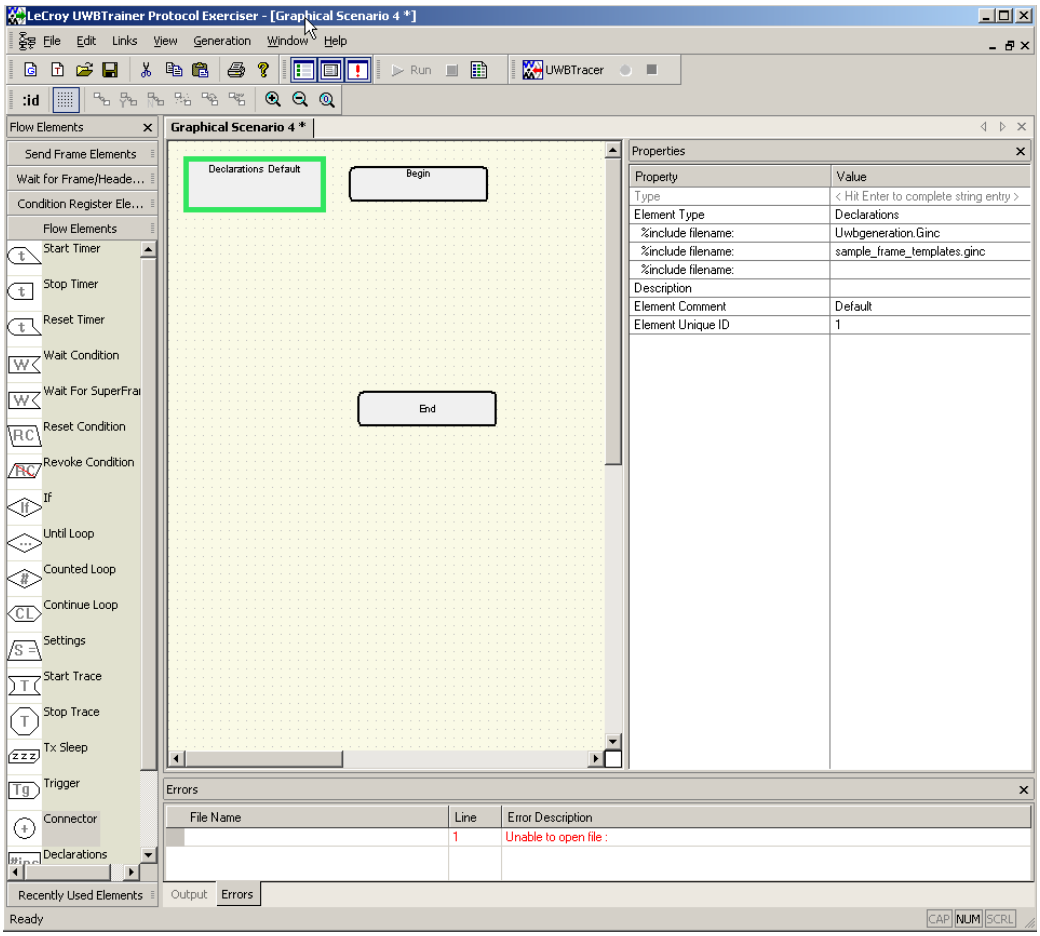


Figure 15.8 Properties Window

By default, the graphical scenario includes the **Generation\Include\UwbGeneration.ginc** and **other_frame_templates.ginc** generation include files. Enter another generation include file name to include that file.

Note: The Element Type is **Declarations**, which has Element Unique ID **16**. All elements have an Element Type and an Element Unique ID, and you cannot change them for any element.

Note: By default, the Element Comment is **Default**, which you can change. You can also enter a Description of up to 30 characters. All elements have editable Comments and Descriptions.

Click **Return** to store entered values.

Step 3 (optional) Click the **Begin** region to display its properties in the Properties window. By default, the Element Comment is blank, which you can change.You can also enter a Description of up to 30 characters. All elements have editable Comments and Descriptions. Click **Return** to store entered values.

The Begin block has a small L in a square. This indicates the start of a link. A link ends on the border of an element.

Note: You cannot edit any properties of the **End** Element.

Step 4 Select the main Wait or Send element, which is the action element. For example, select a Send element:

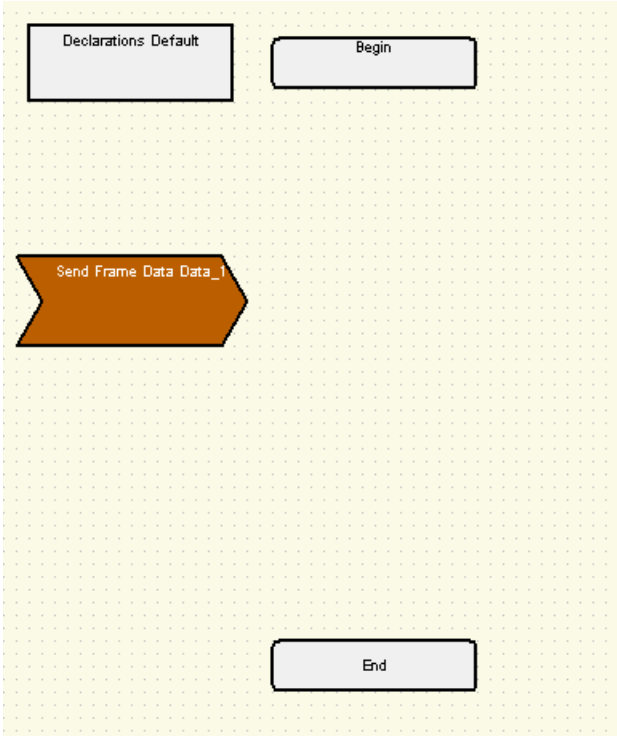


Figure 15.9 Graphical Scenario Example - Action

Set the parameters for the Wait or Send element. For example, if you use a Send element, select the **Template Name** from a list of defined templates.Optionally set the time with the **Send Time Method, Send Time Method Value**, and **Fine Time Adjustment** parameters, the **Burst** parameter, any **Overrides**, or the **TimeVar Index** parameter.

Step 5 If you will use a condition in the flow, select a Condition Register element:

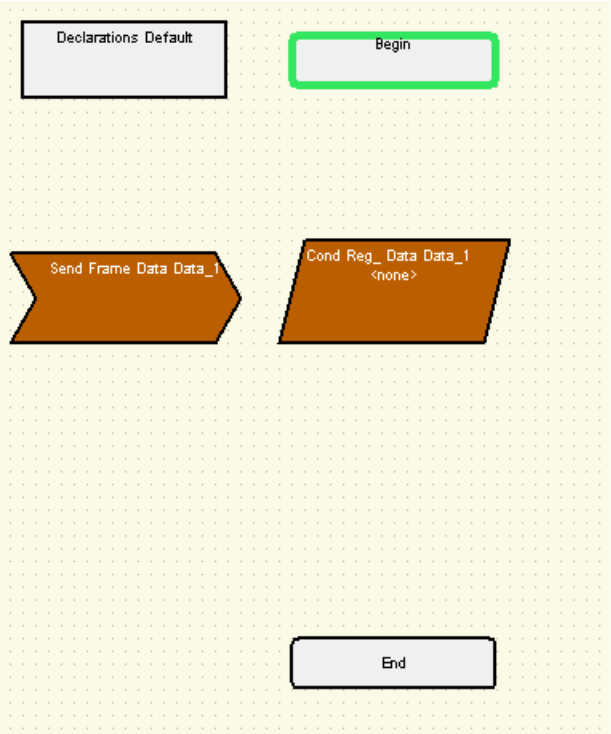


Figure 15.10 Graphical Scenario Example - Condition

Select the **Template Name** from a list of defined templates.

Enter a unique **Condition Name.**

Optionally set the **AutoReset, Counter**, or **TimeVar Index** parameter.

Step 6 If needed, select a Flow element, such as an If element.

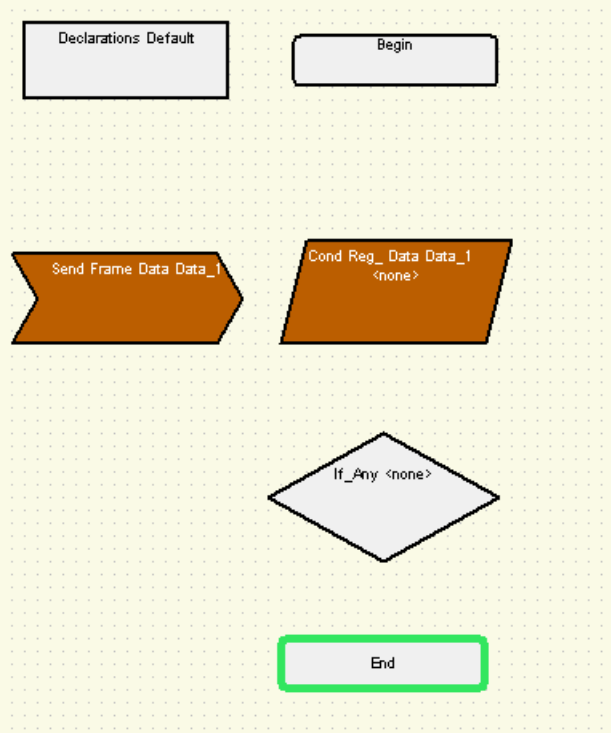


Figure 15.11 Graphical Scenario Example - Flow

For the If element, select the condition that you previously entered.

Then require **Any** or **All** of the selected conditions. (In this example, it does not matter, because there is only one condition.)

Step 7 Terminate the If element using an End If element.

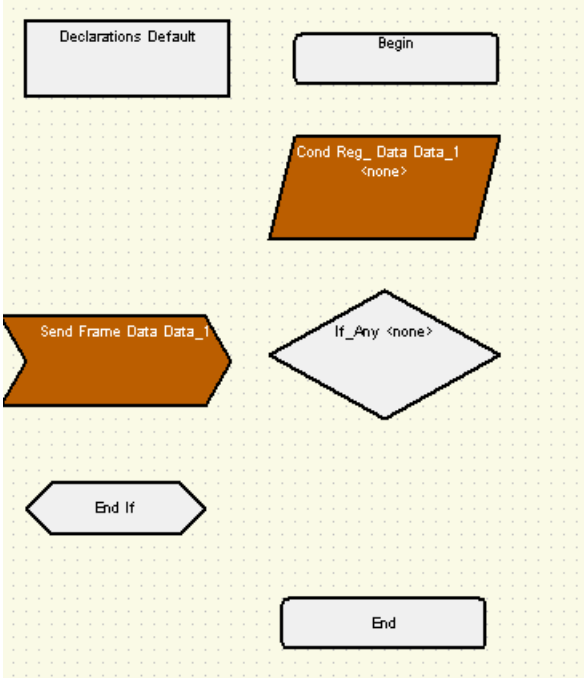


Figure 15.12 Graphical Scenario Example - Links

Step 8 Make a pathway from the Begin to the End.

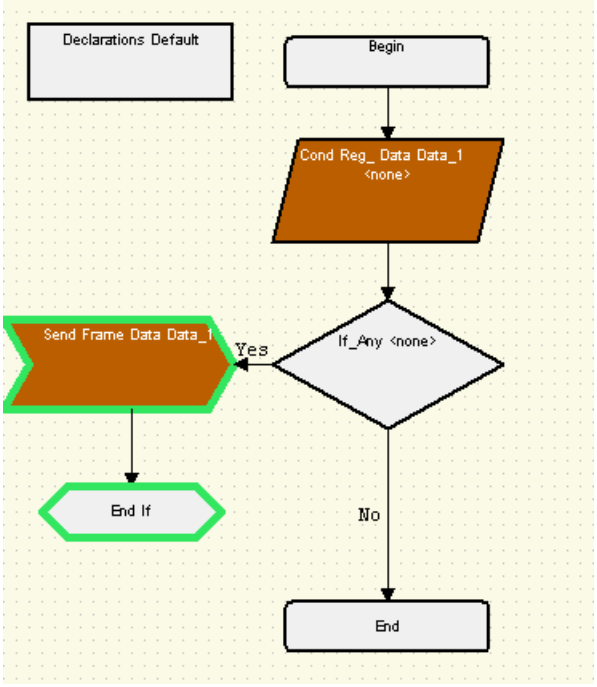


Figure 15.13 Graphical Scenario Example - Links

Make link from Begin.

Make a link from the Condition element.

Make the Yes Link and the No link of the If element.

Make a link from the Send element to the End If, so the If element has a termination.

Figure 15.14 shows a second example of a simple Looping graphical scenario. It uses a Send Frame Beacon element, Counted Loop element, and a Continue Loop element to transmit a single beacon frame 500 times.

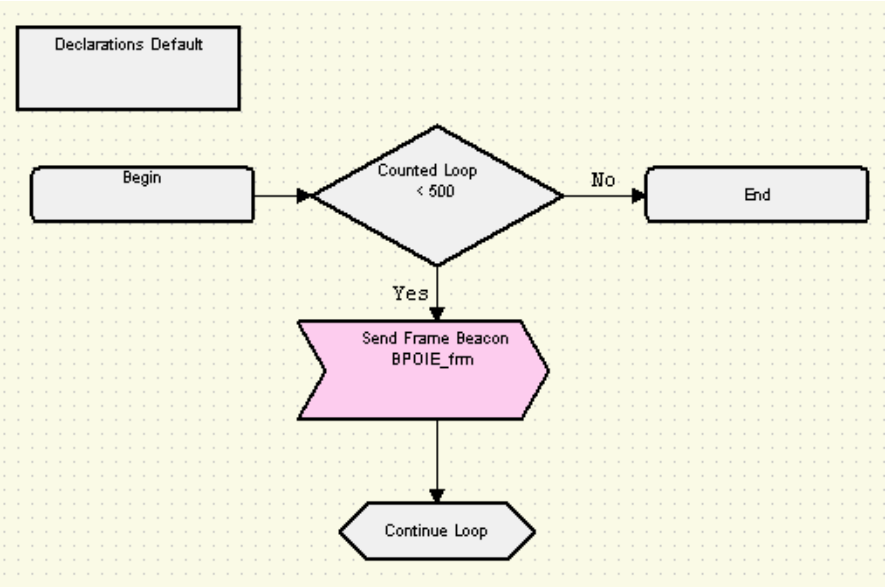


Figure 15.14 Looping Scenario Syntax

The Continue Loop element terminates the Counted Loop element.

Figure 15.15 shows how to make an If-Then-Else graphical scenario. Put an **Else** element immediately after an **If** element and link from the **No** link of the **If** element to the **Else** element.

The **Yes** link of the **If** element must terminate on an **End If** element.
The **Yes** link of the **Else** element must terminate on an **End Else** element.

The **No** link of an **If** or **Else** element must not have a terminator element and must be on the path to the End block.

If the **If** condition is met, the scenario follows the **Yes** link of the **If** element. If the **If** condition is NOT met, the scenario follows the **No** link of the **If** element to the **Else** element. If the **Else** condition is met, the scenario follows the **Yes** link of the **Else** element. If the **Else** condition is NOT met, the scenario follows the **No** link of the **Else** element.

The figure also illustrates **Loop** elements. The **Yes** link of a Loop element must terminate with a Continue Loop element. The **No** link of a Loop element must not have a terminator element and must be on the path to the End block.

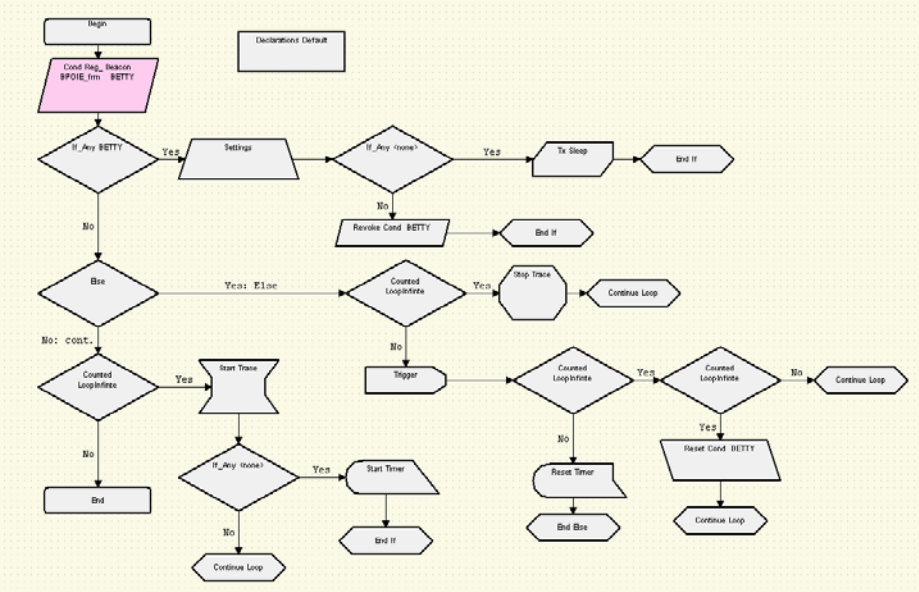


Figure 15.15 If-Then-Else Example

Step 9 To save the graphical scenario and make a generation script file, click the **Save** button or select **File > Save**. The application lists any errors in the Errors tab.

15.5 Exporting a Trace to a Traffic Generation File

A simple way to create a script file is to open a trace and then to export the trace data to a generation file.

To export WiMedia packets to a UWB*Trainer* script file (extension **.uwbg**), see the instructions in Chapter 3 in the section “Exporting Packets to UWBTrainer Script” on page 42.

Chapter 16: Updates and Licensing

This chapter describes how to update the UWB*Tracer/Trainer*™ software and how to obtain a software license key from LeCroy.

16.1 Updates Overview

From time to time as modifications are made to the UWB*Tracer* Analyzer, it may become necessary to update the UWB*Tracer*/*Trainer* software. You can obtain new software from the LeCroy website:

www.LeCroy.com

When you download new UWB*Tracer/Trainer* software, the most recent firmware, BusEngine™, and Plugin Init files are included in the software package. After software installation, you can compare the Plugin Init, firmware, and BusEngine version numbers against what is currently loaded on the analyzer. If those files do not match, you can download the latest versions using the manual or automatic process described later in this chapter.

Note: LeCroy analyzers include a Three-Year Investment Protection Agreement that entitles users to new software during that period. To update software after that period, you must renew the LeCroy Maintenance Agreement. Contact LeCroy for details.

See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

16.2 Software, Firmware, and BusEngine Versions

The Readme file on the installation CD and on the installed directory on your hard drive gives last-minute information about the current release. As mentioned, the software package for each release includes the most recent downloadable images of the firmware, BusEngine, and Plugin Init.

After the UWB*Tracer* Analyzer has completed the self diagnostics and is connected to the PC, you can check the latest versions of the firmware, BusEngine, and Plugin Init.

To check information about the current software:

- Select **About UWBTracer/Trainer…** from the **Help** menu to display the About UWB*Tracer/Trainer* window (Figure 16.1).

Figure 16.1 About UWB*Tracer/Trainer* Window

About UWBTracer/Trainer details revisions of the following software and hardware:

- UWB*Tracer*/Trainer Software Version, Build Number
- UWB*Trainer* Firmware Version, Build Number
- Platform Firmware Version, Build Number
- BusEngine Version
- Plugin Init Version
- Unit Serial Number

Note: When contacting LeCroy for technical support, please have available all the revisions reported in the **About UWBTracer/Trainer** window.

16.3 Software Updates

When a new software release is available, it is posted on the Support page of the LeCroy website at **www.LeCroy.com/support.html**.

To update the software:

Step 1 Find the latest released software version on the LeCroy website under **Support**.

If you are running the latest version of the software, no further action is needed.

If you are **not** running the latest version, continue to Step 2.

Step 2 Download the Zip file from the website.

Step 3 Unzip the files into a directory.

Step 4 Click **Start**, then **Run**, and browse to where you unzipped the files.

Step 5 Select the program named **Setup** and click **Open**.

Step 6 Click **OK** to run the Setup and begin the installation.

Step 7 Follow the on-screen instructions to complete the installation.

Step 8 Read the **Readme** file for important information on changes in the release.

16.4 BusEngine, Firmware, and Plugin Init Updates

Often you need to update BusEngine, firmware, and Plugin Init files when you update the UWB*Tracer/Trainer* software. The software **Readme** file indicates if Plugin Init, BusEngine, and/or firmware updates are necessary.

Note: Within a new software release, it might also be necessary to update the BusEngine hardware of the analyzer. The **Readme** file lets you know if this is necessary.

Automatic Update of BusEngine, Firmware, and Plugin Init

When you update UWB*Tracer/Trainer* software, the new version might not match (be compatible with) the Plugin Init, BusEngine, and firmware currently installed on the analyzer. As the software is loaded, it determines if there is a mismatch. If so, the software initiates automatic update of the Plugin Init, firmware, and BusEngine.

A dialog box appears to confirm that you want to proceed with the update. If so, click **OK**. The update is executed.

Manual Update of BusEngine, Firmware, and Plugin Init

You also can manually load Plugin Init, firmware, and BusEngine files using the Update Device command on the Setup menu.

To update manually:

Step 1 From the Setup menu, select **Update Device** to display the Update UWB*Tracer/Trainer* dialog box:

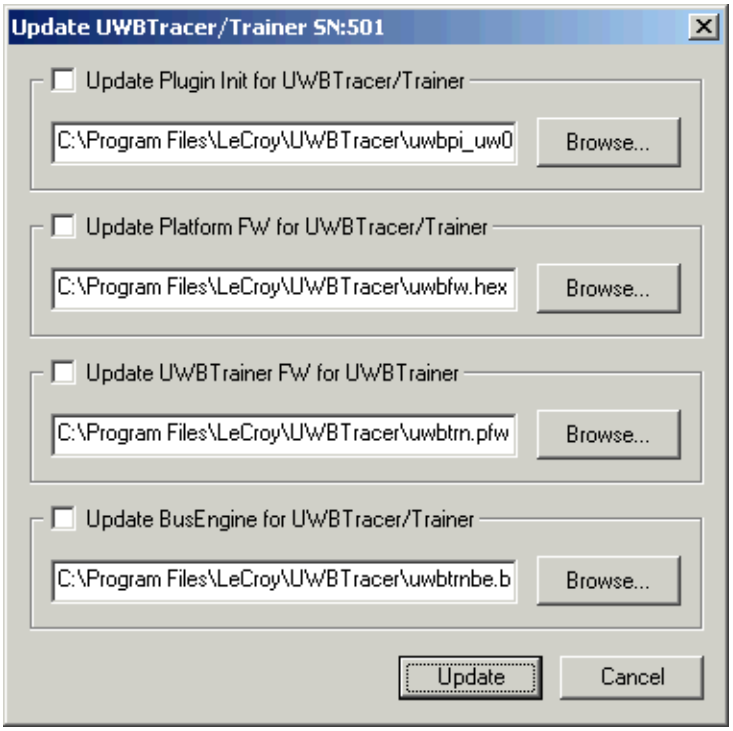


Figure 16.2 Update UWB*Tracer/Trainer* Dialog Box

You can update the Firmware, BusEngine, and/or Plugin Init (PHY Initialization data).

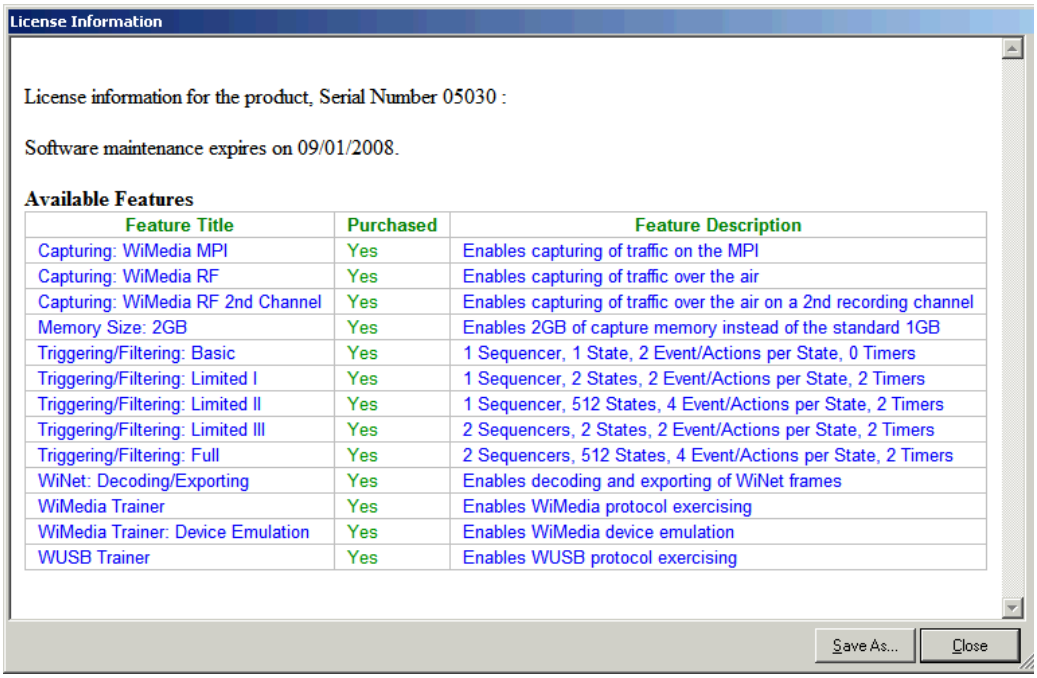
Step 2 Select whether to update Firmware, BusEngine, and/or Plugin Init, and browse to the file if necessary.

Step 3 Click **Update** to confirm that you want to proceed with the update. The update is executed.

16.5 License Information

You can view license information for UWB*Tracer/Trainer* by selecting **Display License Information** from the Help menu. The License Information window indicates the maintenance expiration data for UWB*Tracer/Trainer*. It also provides a list of the named features supported by the current software version.

Named features enabled on your PC are indicated by **Yes** in the Purchased column. Named features that are not enabled on your PC are indicated by **No** in the Purchased column. Whether or not named features are enabled depends on the license key stored in your analyzer.



Feature Title	Purchased	Feature Description
Capturing: WiMedia MPI	Yes	Enables capturing of traffic on the MPI
Capturing: WiMedia RF	Yes	Enables capturing of traffic over the air
Capturing: WiMedia RF 2nd Channel	Yes	Enables capturing of traffic over the air on a 2nd recording channel
Memory Size: 2GB	Yes	Enables 2GB of capture memory instead of the standard 1GB
Triggering/Filtering: Basic	Yes	1 Sequencer, 1 State, 2 Event/Actions per State, 0 Timers
Triggering/Filtering: Limited I	Yes	1 Sequencer, 2 States, 2 Event/Actions per State, 2 Timers
Triggering/Filtering: Limited II	Yes	1 Sequencer, 512 States, 4 Event/Actions per State, 2 Timers
Triggering/Filtering: Limited III	Yes	2 Sequencers, 2 States, 2 Event/Actions per State, 2 Timers
Triggering/Filtering: Full	Yes	2 Sequencers, 512 States, 4 Event/Actions per State, 2 Timers
WiNet: Decoding/Exporting	Yes	Enables decoding and exporting of WiNet frames
WiMedia Trainer	Yes	Enables WiMedia protocol exercising
WiMedia Trainer: Device Emulation	Yes	Enables WiMedia device emulation
WUSB Trainer	Yes	Enables WUSB protocol exercising

Figure 16.3 License Information Window

If you try to use a feature for which you do not yet have a license, the program displays the License Protection Message (Figure 16.4). Named features that are not enabled on your PC are indicated by **No** in the Purchased column. To use the feature, you must purchase a license.

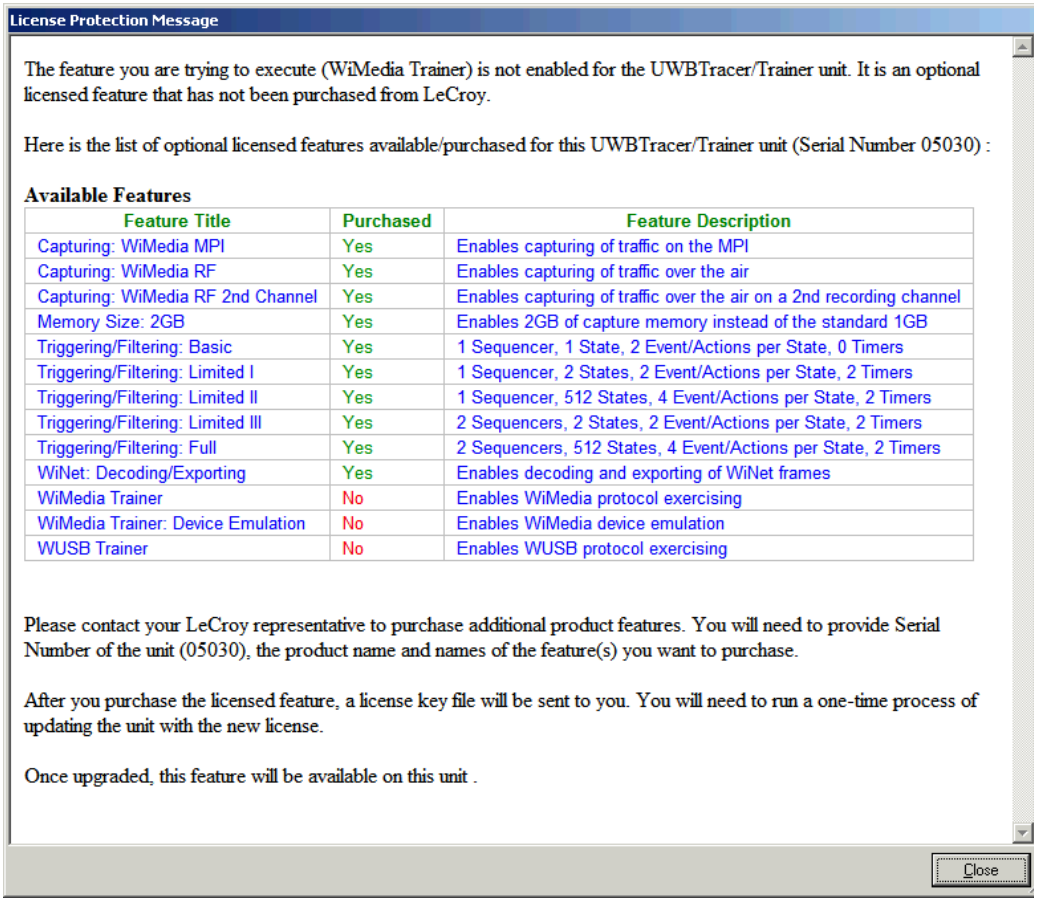


Figure 16.4 License Protection Message

16.6 Updating the Software License

A current license agreement with LeCroy entitles the Analyzer owner to continued technical support and access to software updates as they are published on the LeCroy website.

If your license expires, you must obtain a license key from LeCroy (refer to the contact information at the back of this manual.)

After you obtain a license key, follow these steps to install it:

Step 1 From the Help menu, select **Update License** to display the Update License dialog box.

Step 2 Enter the path and filename for the license key.

OR

Use the Browse button to navigate to the directory that contains the license key and select the ***.lic** file.

Step 3 Click **Update**.

Section 4. Appendices

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Appendix A: MPI

This appendix describes the pin assignments for the MPI Cables and connectors supported in the LeCroy MPI Kit.

The tables in this appendix describe only the pins used for the MPI signals specified in the WiMedia specifications. Other pins are marked as **Reserved, Not Used**, or **NA** (Not Applicable).

Note: Pins marked as **Reserved, Not Used**, or **NA** (Not Applicable) may be used by PHY and MAC vendors to implement additional propriety data and control protocols. The following tables do not specify such proprietary signals. For more information about such pins, refer to vendor documentation.

A.1 Cable Adapter Pin Assignments

Table A.1, Table A.2, and Table A.3 show connector pin assignments for the 68-pin, 60-pin, and 40-pin probe cables.

Section 11.2, “Connecting Cables and Adapters” on page 162 shows how the cables are connected to the analyzer and adapter.

Table A.1 Adapter Pin Assignments: 68-Pin Probe Cable

Pin	Definition	Pin	Definition
A1	N/C	B1	N/C
A2	GND	B2	GND
A3	DATA[0]	B3	PHY_RESET
A4	GND	B4	GND
A5	DATA[1]	B5	N/C
A6	GND	B6	GND
A7	DATA[2]	B7	MCTL
A8	GND	B8	GND
A9	DATA[3]	B9	SERIAL_DATA
A10	GND	B10	GND
A11	DATA[4]	B11	CCA_STATUS
A12	GND	B12	GND
A13	DATA[5]	B13	CCA_REQ
A14	GND	B14	GND
A15	DATA[6]	B15	N/C
A16	GND	B16	GND
A17	DATA[7]	B17	N/C
A18	GND	B18	GND
A19	PCLK	B19	N/C
A20	GND	B20	GND
A21	N/C	B21	N/C
A22	GND	B22	GND
A23	TX_EN	B23	N/C
A24	GND	B24	GND
A25	RX_EN	B25	N/C
A26	GND	B26	GND
A27	FSYNC	B27	N/C
A28	GND	B28	GND
A29	PHY_ACTIVE	B29	N/C
A30	GND	B30	GND
A31	DATA_EN	B31	+5V
A32	GND	B32	GND
A33	EOF	B33	+V5
A34	GND	B34	GND

Table A.2 Adapter Pin Assignments: 60-Pin Probe Cable

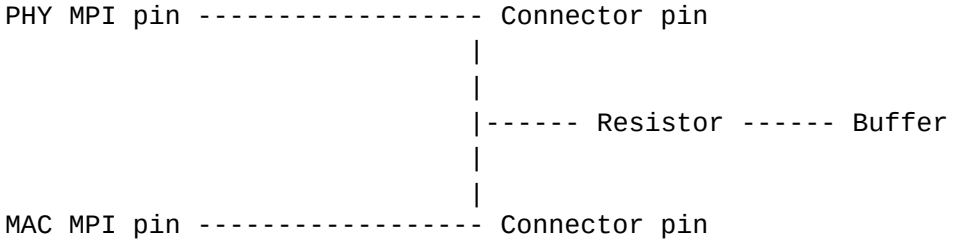
Pin	Definition	Pin	Definition
1	CCA_STATUS	2	Reserved
3	Reserved	4	SERIAL_DATA
5	PCLK	6	DGND
7	PHY_RESET	8	PHY_TX_EN
9	SLEEP	10	+3.3V
11	DATA[0]	12	PHY_RX_EN
13	DATA[2]	14	DGND
15	DGND	16	DATA_EN
17	DATA[4]	18	DATA[1]
19	DATA[6]	20	DATA[3]
21	+3.3V	22	DATA[5]
23	PHY_ACTIVE	24	DATA[7]
25	Reserved	26	DGND
27	NA	28	NA
29	NA	30	NA
31	NA	32	DGND
33	NA	34	+3.3V
35	NA	36	NA
37	NA	38	NA
39	NA	40	NA
41	NA	42	NA
43	DGND	44	NA
45	+3.3V	46	NA
47	NA	48	NA
49	NA	50	NA
51	+3.3V	52	DGND
53	Reserved	54	NA
55	Reserved	56	NA
57	DGND	58	Reserved
59	NA	60	NA

Table A.3 Adapter Pin Assignments: 40-Pin Probe Cable

Pin	Definition	Pin	Definition
1	RESET	2	GND
3	DATA0	4	NC
5	DATA1	6	PWR
7	DATA2	8	PWR
9	DATA3	10	PWR
11	DATA4	12	PWR
13	DATA5	14	PWR
15	DATA6	16	PWR
17	DATA7	18	NC
19	GND	20	KEY
21	PCLK	22	GND
23	TX_EN	24	GND
25	RX_EN	26	GND
27	PHY_ACT	28	NC
29	DATA_EN	30	GND
31	CCA_ST	32	GND
33	SE_DAT	34	GND
35	STOP_C	36	GND
37	RSVD1	38	GND
39	RSVD2	40	GND

A.2 Input Load of UWB*Tracer/Trainer* MPI

Each MPI signal pin has a 220 ohm tapping resistor followed by a CMOS buffer with 10pF of input capacitance. The resistor and buffer are within 2 inches of the connector on the Cable Adapter or Board Adapter.



Appendix B: Legacy Script Decoding

Earlier LeCroy USB Analyzers used **.REQ** and **.DSC** script files to decode class and vendor requests.

- **.REQ** stands for Requests.
- **.DSC** stands for Descriptors.

This method uses fixed definitional structures.

LeCroy provided **.req** files for the following requests and classes:

- Standard Requests (standard.req)
- Hub Class (hub.req)
- HID Class (hid.req)
- Printer Class (printer.req)
- Communications Class (communication.req)
- Audio Class (audio.req)
- Bluetooth USB HCI commands and events (bluetooth.req)
- Vendor Request definition file (vendor.req)

Note: .req files are no longer used in LeCroy USB Analyzers and are not compatible with the UWB*Tracer/Trainer* application.
The new script decoding for LeCroy USB Analyzers uses Script Decoder version .dec files.
Only .dec files are compatible with the UWB*Tracer/Trainer* application.
For information about .dec files and the new script decoding, see “Class and Vendor Definition Files” on page 79.

See Section 3.18 "Directory Structure on Windows XP and Vista" on page 45.

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Appendix C: WiMedia Platform Compliance Tests

This appendix describes the UWB*Trainer*™ TX-only Test System Exerciser scenarios and UWB*Tracer*™ VSE Compliance scripts for test cases from the WiMedia Compliance and Interoperability (C&I) Platform Test Specification 1.1.

For information about running UWB*Trainer* exerciser scenarios, see Chapter 14 “Traffic Generation Overview” on page 225.

For information about running verification scripts, see See Section 9.8 "Running Verification Scripts" on page 137.

C.1 UWB*Trainer* TX-only Exerciser Scenarios

All TX-only tests from the WiMedia Platform Test Specification 1.1 are available.

Note: The current LeCroy implementation of Test Case 6 differs slightly from the test specification. However, it still invokes the correct responses from compliant devices.

C.2 UWB*Tracer* VSE Compliance Scripts

The following VSE compliance scripts are available:

- **Background Checks.vse**: This script implements the Beacon Format checks (BFC) and Beacon Protocol checks (BPC) of the WiMedia Platform Test Specification 1.1. In addition, this script checks for DevAddr collisions, beacon slot collisions, and HCS error slot collisions.
- **Verify Test Case [nn].vse:** This set of scripts verifies the Test System output for TX-only test cases, as defined in the WiMedia Platform Test Specification 1.1. **Note:** These scripts are not designed to verify behaviors of a DUT or INTD.

The following scripts, which were included in previous versions of UWB*Tracer*, are obsolete and are superseded by the **Background Checks.vse** script:

- Beacon Format Test.vse
- Beacon Period Synchronization.vse
- Beacon Protocol Observation Background Tests.vse
- Beacon Slot Collision Test.vse
- Clock Accuracy.vse
- Generated DevAddr Conflict Test.vse

[blank page]

Appendix D: Specifications

The following specifications describe a combined CATC 5K Analyzer and UWB Analyzer Plug-in.

D.1 Package

Dimensions	**CATC 5K:** 9.8 x 6.5 x 2.0 inches (24.9 x 16.5 x 5.1 cm) **UWB Analyzer Plug-in:** 4.0 x 5.0 x 1.3 inches (10.2 x 12.7 x 3.3 cm)
Connectors	**CATC 5K:** 12 VDC power connection External I/O and trigger connection (Mini DIN-9) External Sync IN connection (Mini DIN-4) External Sync OUT connection (Mini DIN-4) Antenna RF SMA Connector PC connection (USB2.0, type “B”) **UWB Analyzer Plug-in:** MPI Adapter port
Weight	**CATC 5K:** Approximately 2 lbs. 9 oz. (1.2 kg) **UWB Analyzer Plug-in:** Approximately 3 oz. (0.1 kg)

D.2 Power Requirements

12 VDC, 60 W maximum

D.3 Environmental Conditions

Operating Temperature	0 to 40°C (32 to 104°F)
Storage Range	-20 to 80°C (-4 to 176°F)
Operating Humidity	10 to 90%, non-condensing
Operating Altitude	Up to 6560 feet (2000 meters)

D.4 China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:

	有毒有害物质和元素					
部件名称	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr^{6+})	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电源	X	X	X	O	X	X
电源线	X	O	X	O	X	X
保护外壳(如有)	O	O	O	O	X	X
电缆组件(如有)	X	O	X	O	X	X
风扇(如有)	X	O	X	O	X	X
交流滤波器和熔丝组件(如有)	X	O	X	O	O	O
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件：参阅本手册“规范”部分规定的环境条件。

	Toxic or Hazardous Substances and Elements					
Part Name	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr^{6+})	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Power Supply	X	X	X	O	X	X
Power Cord	X	O	X	O	X	X
Protective Case (if present)	O	O	O	O	X	X
Cable Assemblies (if present)	X	O	X	O	X	X
Fans (if present)	X	O	X	O	X	X
AC Filter/Fuse Assy (if present)	X	O	X	O	O	O
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.						

EFUP (Environmental Friendly Use Period) Use Conditions: refer to the environmental conditions stated in the specifications section of this Manual.

How to Contact LeCroy

Type of Service	Contact	
Call for technical support…	US and Canada:	1 (800) 909-2282
	Worldwide:	1 (408) 727-6600
Fax your questions…	Worldwide:	1 (408) 727-6622
Write a letter…	LeCroy Customer Support 3385 Scott Blvd. Santa Clara, CA 95054	
Send e-mail…	support@catc.com	
Visit LeCroy's web site…	http://www.lecroy.com/	

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