AirCom UWB Analyzer

AirCom Ultra-Wideband Protocol Analyzer and Frame Generator

User's Manual

Version 1.22

CATALYST ENTERPRISES INC.

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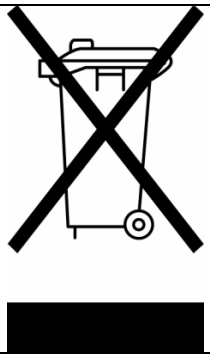
WEEE Program



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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.

Table of Contents

Introduction

What's In this Manual

This manual describes the installation and operation of your Catalyst AirCom UWB Analyzer. Examples of some typical applications are included.

Analyzer Overview

The Catalyst AirCom UWB Analyzer is capable of capturing and analyzing UWB traffic.

The analyzer supports the following:

- Capture and Trigger of UWB events such as transactions and packets
- Pre and Post Trigger pattern capture
- Real time Protocol Error detection
- Integrated Frame Generator to send user defined UWB frames over the air
- Comprehensive Statistical Report

Interface

- Power In
- USB Port
- Ethernet Port
- External trigger Input
- External trigger Output

LEDs

Each link is supported by 4 LEDs with the following functionality:

Green	This LED is illuminated indicating an active link.
Yellow	This LED is illuminated when there is traffic on a link.
Red	This LED illuminates when an error occurs.
Blue	This LED is illuminated when a trigger occurs.

Receiving Your Analyzer

Your analyzer package includes the following components:

AirCom UWB Analyzer unit

UWB Antenna

Power Cable

USB Cable (1.8m)

Ethernet Cable (10')

Software CD for AirCom UWB Analyzer

Carrying Case

SMB to BNC External Trigger Cables (24")

Unpacking Your Analyzer

Inspect the received shipping container for any damage. Unpack the container and account for each of the system components listed on the accompanying packing list. Visually inspect each component for absence of damage. In the event of damage notify the shipper and Catalyst Enterprises. Retain all shipping materials for shipper's inspection.

Installing Your Analyzer

Hardware Setup

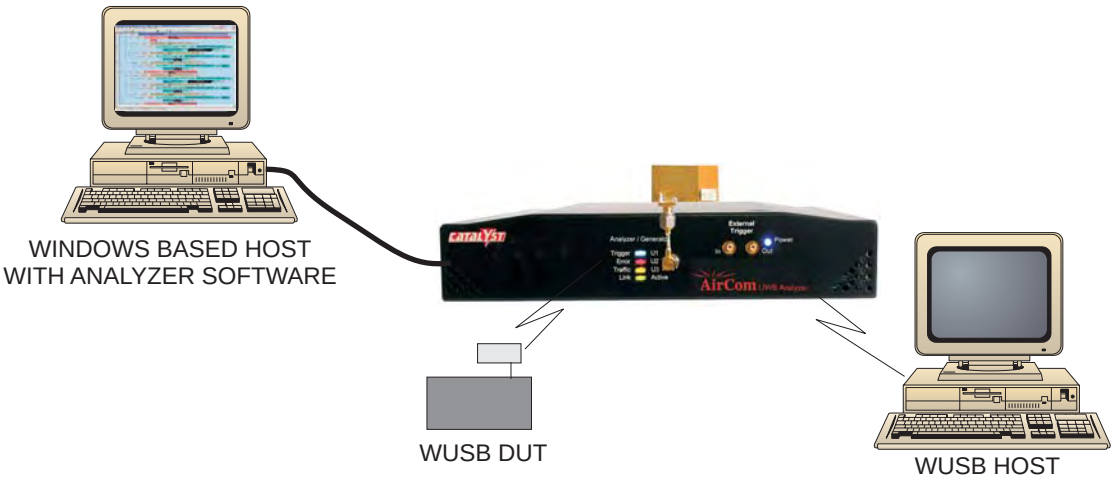


Figure 1 Typical WUSB Test Setup of Analyzer

Software Installation

On systems operating under Windows® 2000 and Windows® XP.

Do not connect Analyzer Do not connect the Analyzer to your host system until the software installation is complete.

1. Insert the CD ROM with the Analyzer software in the CD ROM drive.
2. The installation will automatically start unless the Auto Run is turned off. In this case select the CD ROM from “My Computer” and double-click autorun.exe.
3. From the CD ROM autorun application, choose the Install Software menu item and then choose UWB AirCom Software.

System restart You must restart your computer before you can use your Analyzer software.

Error Message If you get an error message during installation of the drivers for Windows 2000 or XP consult your system administrator. Your system may be setup to only allow an administrator level to copy such driver files.

Connecting via Ethernet

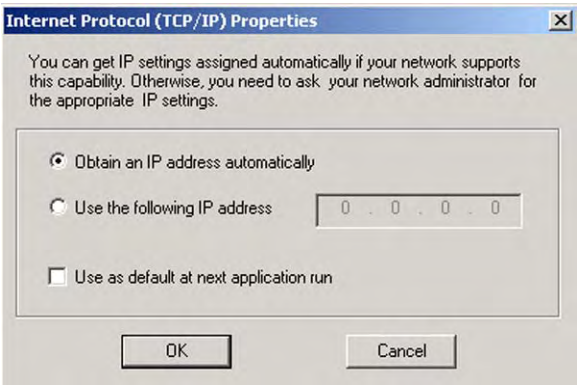
You may use the ethernet connection using any one of the following 3 supported configurations:

1. The Analyzer connected to a network via a hub, switch, or similar device.
2. The Analyzer connected to the host computer (machine running the application software), via a hub, switch or similar device.
3. The Analyzer connected directly to the host computer using a crossover cable.

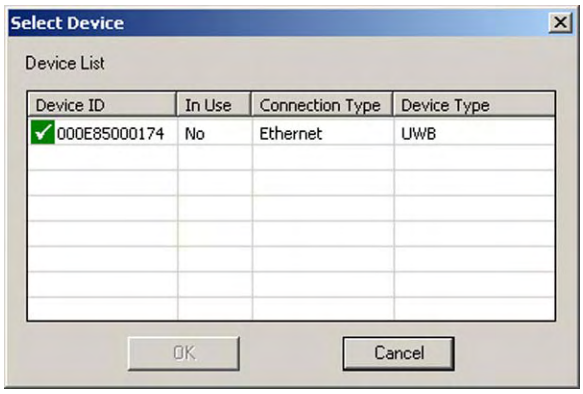
Connecting to a Network

When connected to a network the Analyzer must communicate with the DHCP server to establish a connection. The DHCP server will continually send the next available IP address to the Analyzer until the Analyzer software is started.

When the user starts the software, the user may be prompted if they wish the software to automatically use the offered IP address or if they wish to assign a specific IP address (the assigned IP address needs to be on the same network segment as the host computer). The menu also allows the user to save the selected option (automatic or specific address). If the assigned IP address is not available, the OS will notify the user of an IP address conflict.



After the user clicks ‘OK’ the software will search for all Analyzer units connected to the network, and will display a list of available Analyzer units. After the user selects the desired Analyzer unit, the software will assign the IP address to the selected unit, completing the connection and will launch the software.



Connecting via Hub, Switch or Similar device

When connected to the host machine via a hub, switch or other similar device or directly using a crossover cable the Catalyst board must communicate with the host computer to establish a connection. The host computer will continually broadcast the next available IP address to the Catalyst Board until the Catalyst software is started.

When the software starts, the user may be prompted if they wish the software to automatically use the offered IP address or if they wish to assign a specific IP address (the assigned IP address needs to be on the same network segment as the host computer). The menu also allows the user to save the selected option (automatic or specific address). If the assigned IP address is not available, the OS will notify the user of an IP address conflict.

After the user clicks ‘OK’ the software will search for all Catalyst boards connected to the network, and will display a list of available Catalyst boards, after the user selects the desired Catalyst board, the software will assign the IP address to the selected board, completing the connection and will launch the software.

Launching Your Analyzer

Analyzer

To launch the **Analyzer** software, double-click the AirCom icon on your Windows desktop. You can also launch the Analyzer software from the start menu by choosing Programs, Catalyst, AirCom and then Aircom.

When you run your software it will display the Device selection Dialog. You must make a Local device selection or Hardware Not Installed to run the Analyzer software in Simulation mode and click OK. If you choose one of the Local devices and click OK a Select Device Dialog will display a list of available devices. Choose the device to be connected to and click **OK** to launch the software. If no devices are available you may choose to run in simulation mode. To run in simulation mode check the **Hardware Not Installed [Simulation Mode]** option button and click **OK**.

The next time you run the software, it will connect to the last used device if it is still available.

Software Launched

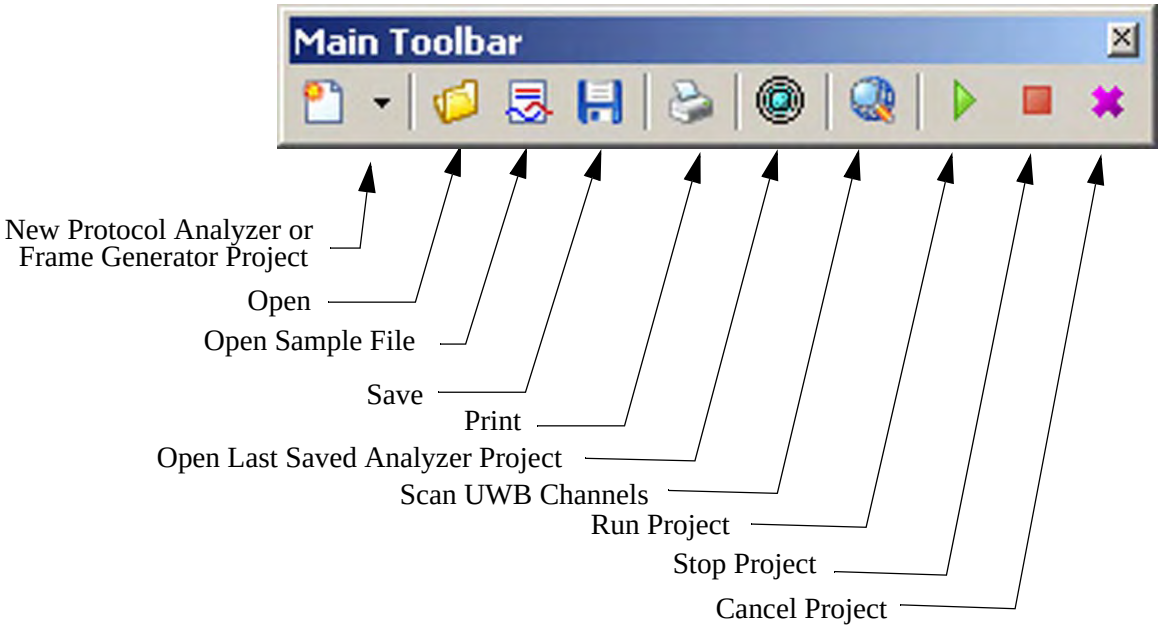


Figure 2 Analyzer Main Toolbar

Operating in Simulation Mode

If you selected the Analyzer software to run in the Simulation Mode, the Analyzer software will launch and display the appropriate tool bar, but with the limitation that the Analyzer will operate only on static, previously captured, bus data.

Limitations

The Simulation mode lets you try all of the available functions, but keep in mind that **the system is not capturing any real data and is displaying only pre-captured results.**

Protocol Analyzer Projects

Protocol Analysis is performed by defining and running a Protocol Analysis Project, which defines what will be captured, what the analyzer will trigger on and capture memory settings. Defined projects may be saved as project *.wac files for later use.

Quick Start

To get a comprehensive overview of your analyzer's capabilities:

1. Install the Analyzer software. See "Software Installation" on page 4.
2. Set up your Analyzer. See "Hardware Setup" on page 4.
3. Launch your Analyzer software. See "Launching Your Analyzer" on page 7 for launching instructions.
4. On the Analyzer Menu Bar click **File, New** to open a Protocol Analyzer dialog

.

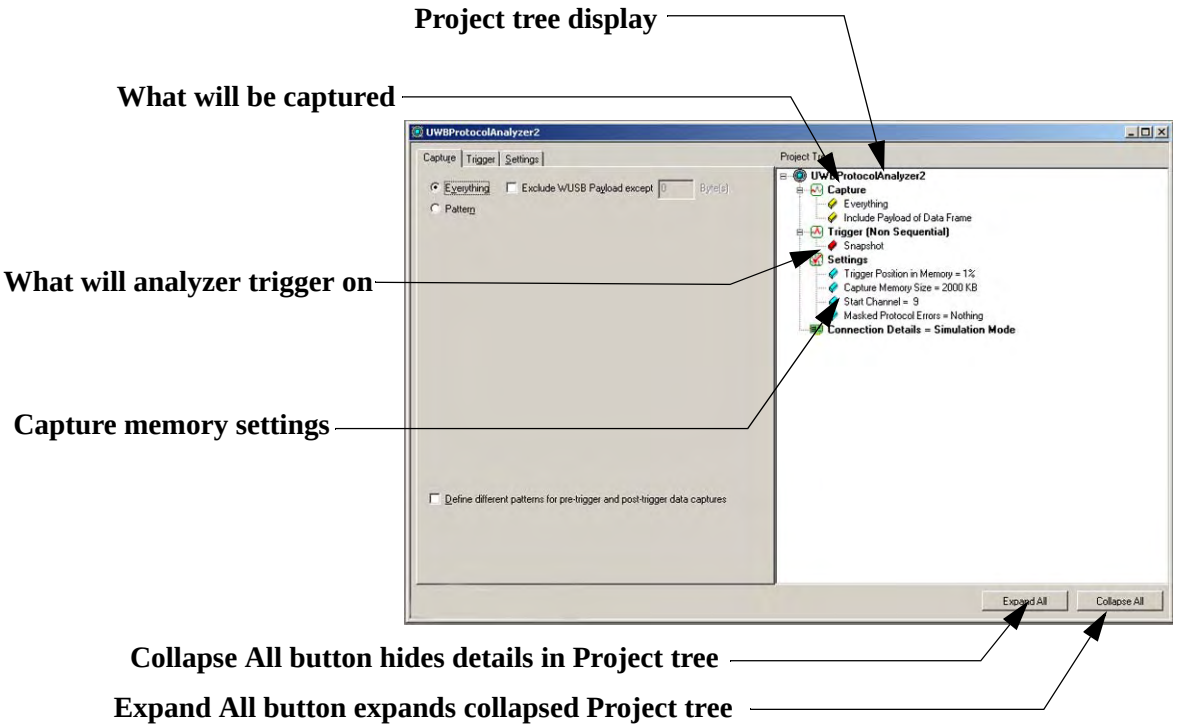


Figure 3. New Protocol Analyzer Project Dialog

The New Project dialog opens with default settings to capture **Everything** on the bus and to **Trigger On** on **Snapshot.** (Meaning that the analyzer captures everything immediately without triggering on anything in particular).

Project Overview

A comprehensive tree structured overview of the project is displayed in the **Project Tree display**. The project tree shows what is to be captured, what the analyzer will trigger on and capture memory settings.

5. To get an immediate overview of the traffic to and from your Analyzer, click the

Run Project button.

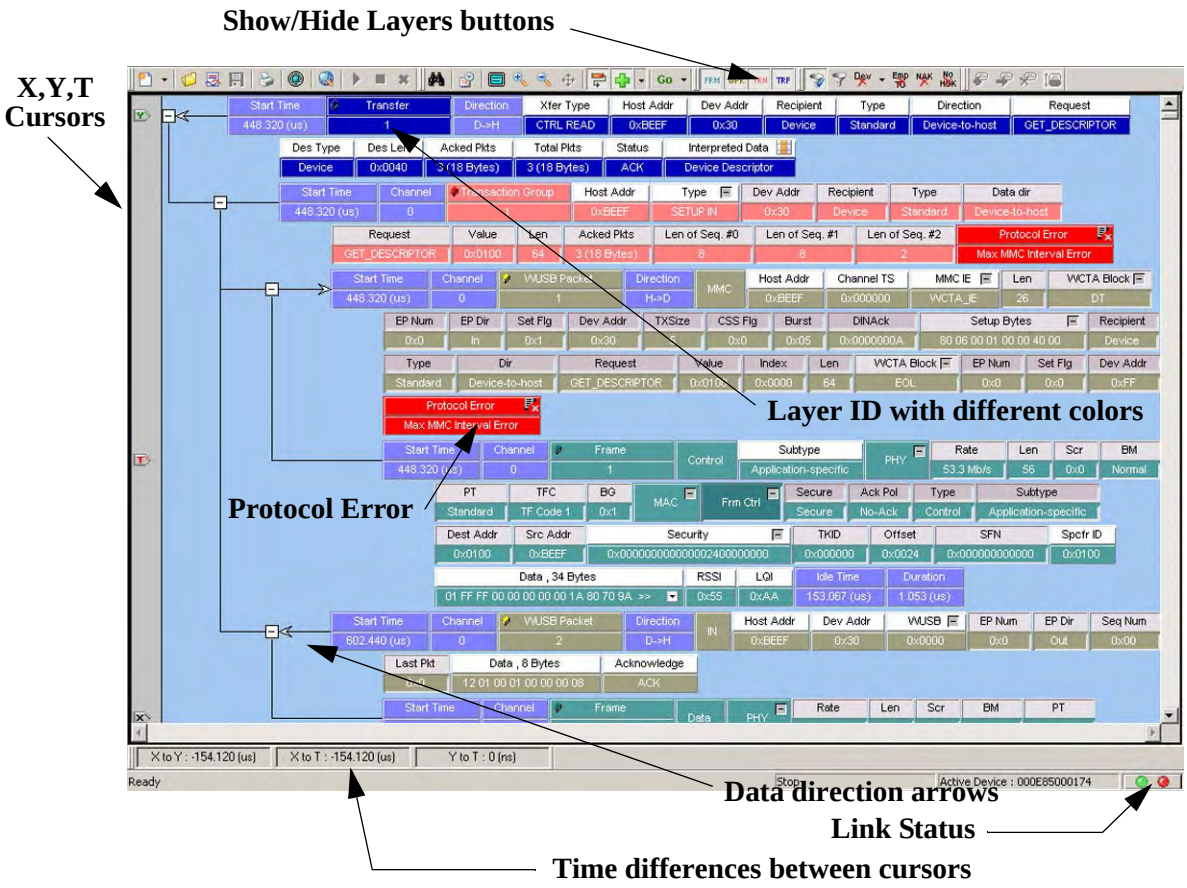
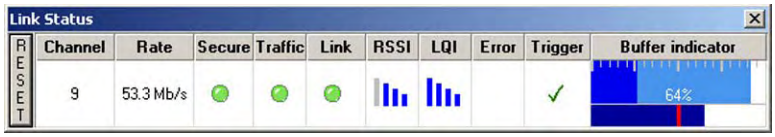


Figure 4. Typical Packet View Results Display

The results display shows each transaction for every layer identified in a different color and the data direction identified with data direction arrows. Upstream traffic is identified with the arrow from right to left. This arrow direction ⇐ indicates upstream traffic. Downstream traffic is identified with the arrow left to right. This arrow direction ⇒ indicates downstream traffic.

Link Status

Link status displays general link activity. To display Link Status click the **Link Status** bus indicator in the Status bar.



You may hide any layer by clicking the corresponding **Show/Hide** button on the menu bar. All captured data is retained, but the display is limited to the layer data of interest for simpler viewing.

You may configure the viewer display for your individual test and viewing preferences. See “Data Display Manipulation” on page 32 for details about configuring the viewer display.

The Protocol Analyzer Project dialog offers you a comprehensive set of choices to create a trigger and capture project satisfying some specific need. You may set the Analyzer to:

- Capture specific patterns. (See "Data Capture Setup" on page 16)
- Capture different patterns pre and post trigger.
- Exclude parameters from capture.
- Trigger on a Pattern or sequence of patterns. (See "Triggering Setup" on page 23)
- Configure trace capture memory. (Settings)
- Select file to save trace capture in memory. (Settings)
- Include a Project Note.

Run a Sample Project

Before setting up your own custom project you may wish to run one or more of the sample projects included with your analyzer software. See "Example Projects" on page 12.

Example Projects

Your Analyzer includes a number of pre-defined example projects that you may use to perform an immediate analysis without any setup.

The Analyzer system software comes with a pre-defined folder (Directory) structure for storing all files. All pre-defined example files are stored in the following Folder:

c:\Program Files\Catalyst\AirCom\Examples

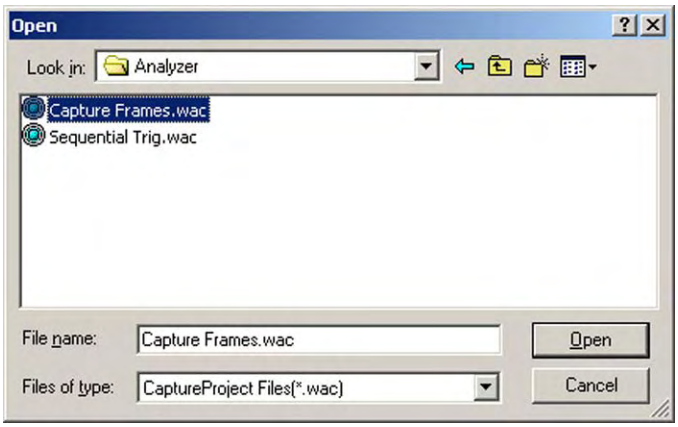
It is strongly recommended that you open some of these files to get an introduction to the types of projects that can be created for the Analyzer.

Project file type definition

*.wac	Protocol Analyzer file
*.was	Sample file
*.wpg	Frame Generator Pattern file

Run an Example Protocol Analyzer Project

1. Click **File** on the main menu bar and then choose **Open.**



2. Locate available example Protocol Analyzer Projects by looking in: c:\Program Files\Catalyst\AirCom\Examples.
3. Choose an example *.wac file and click **Open** to display the example project dialog.

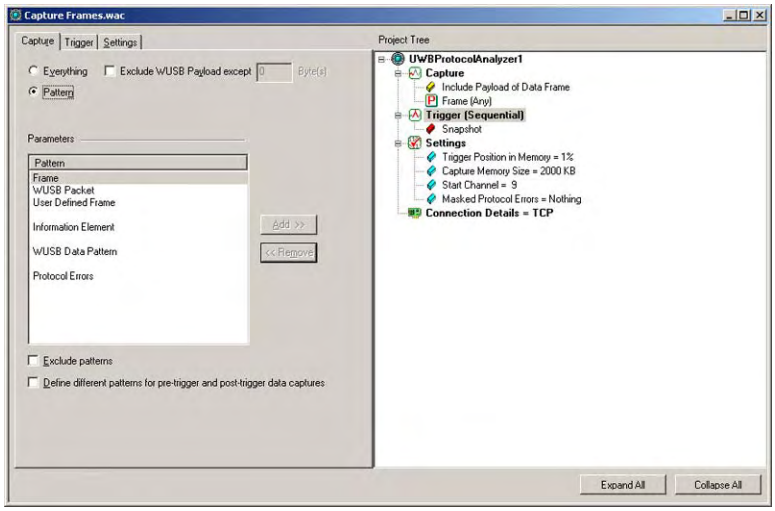


Figure 5. Sample Protocol Analysis Project

4. Click the **Run Project** button to execute the pre-defined example.
5. Once the project runs you will see an analyzer trace capture display similar to the one shown in Figure 6.

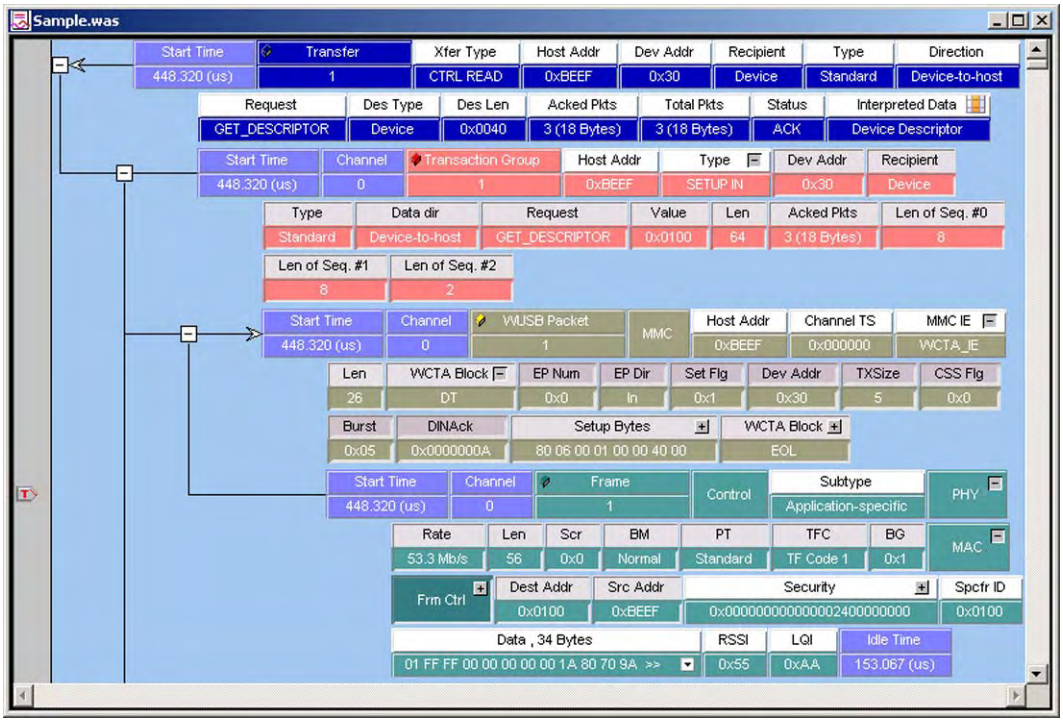
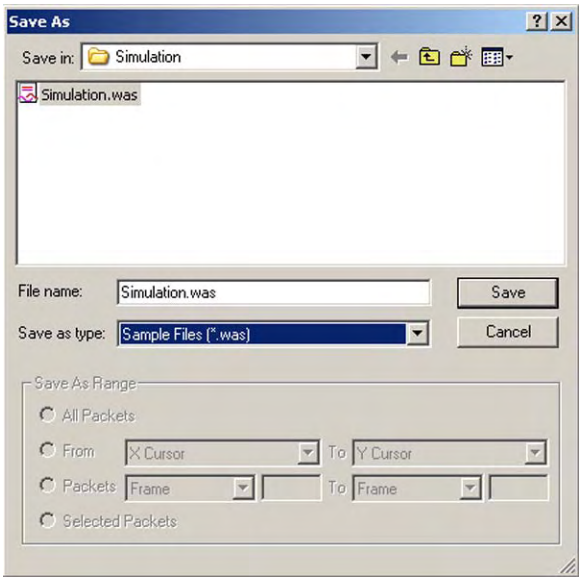


Figure 6. Analyzer Trace Capture Display

See "Data Display Manipulation" on page 32 and "Display Configuration" on page 66 for details about the results display.

Saving a Trace Capture

You may save a Trace Capture for review at a later time.



Protocol Analyzer Project Setup

You may define a new project starting with the default project definition, or modify the settings for the last project run.

Default Project Clicking **File, New** opens a new project with default settings that you can modify as required.

Last Project Clicking the **Green** button  opens the last project saved.

You may modify this project as required.

New Project To start a **New** project, click **File** on the main menu bar and choose **New**.

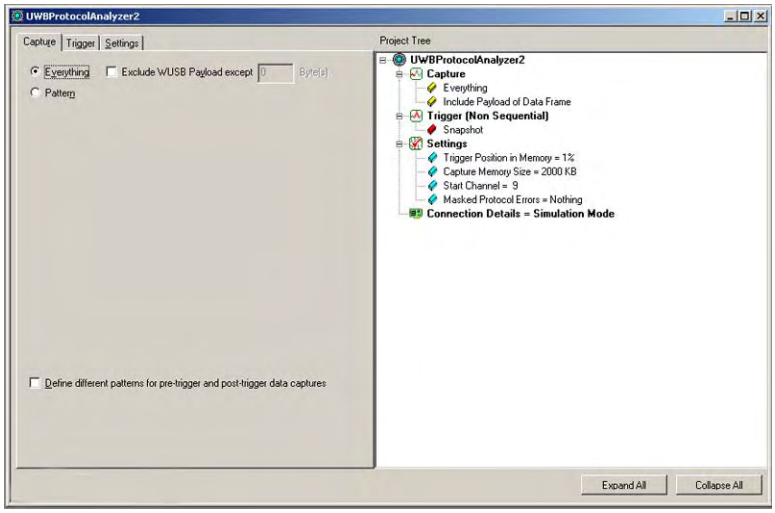


Figure 7. New Trigger and Capture Project Dialog

Data Capture Setup

Capture Everything

The default Capture Tab opens with capture **Everything** selected and the corresponding default Trigger On tab with **Don't care (Snapshot)** selected. Clicking run with these default settings will immediately start a data capture to give the user a quick view of bus activity.

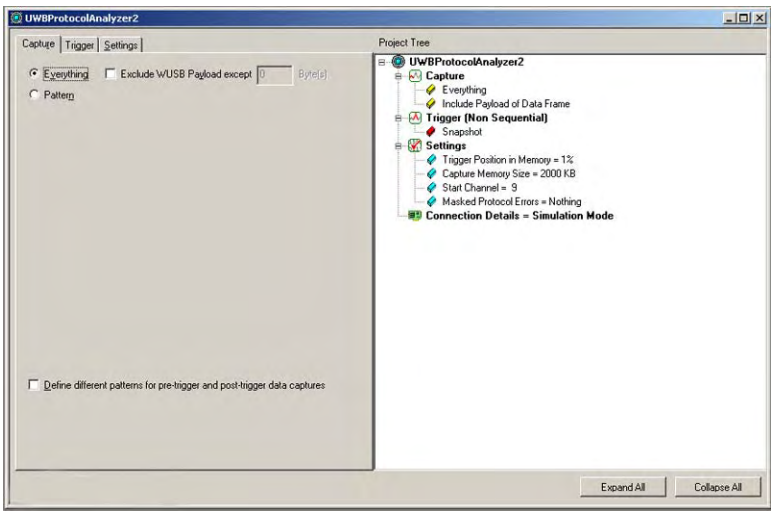


Figure 8. Capture Everything (Default)

You may elect to exclude the Payload from the capture by checking **Exclude Payload except** and if desired specify the number of bytes of the payload to be included.

The data capture may be refined by choosing **Pattern** and then selecting a specific pattern(s) for capture. Additionally you may define a different set of patterns to capture after trigger.

Capture Pattern

To define specific patterns for capture, click the **Pattern** button.

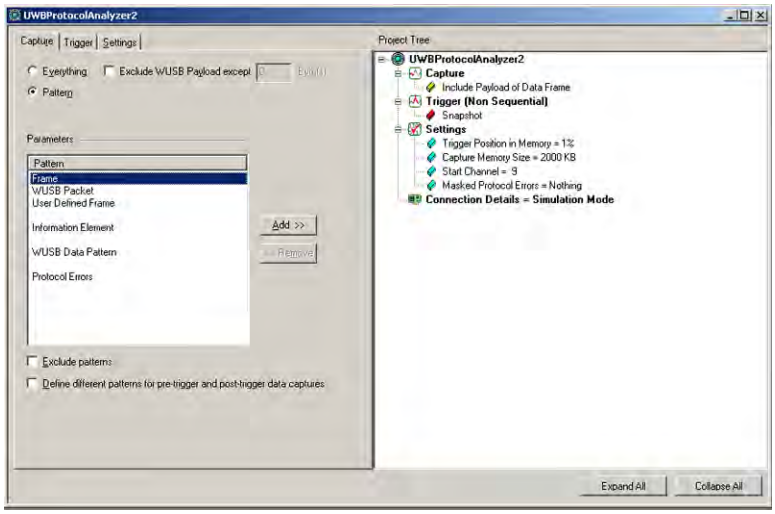


Figure 9. Choosing Capture Patterns

The **Parameters** window displays the following pattern capture choice categories:

- Frame
- WUSB Packet
- User Defined Frame
- Information Element
- WUSB Data Pattern
- Protocol Errors

Choose a parameter To choose a parameter for capture from any of these categories, highlight the category in the parameter window and click the **Add>>** button. This will open selection dialogs for each of the categories displaying all of the parameters for that category. All of the patterns added will appear in the project tree.

Exclude patterns Check this box to allow for the capture of everything **except** the patterns that have been added to the Project Tree. When this box is checked, the **Primitive** category is added to the parameter window and Exclude Idle choice is enabled.

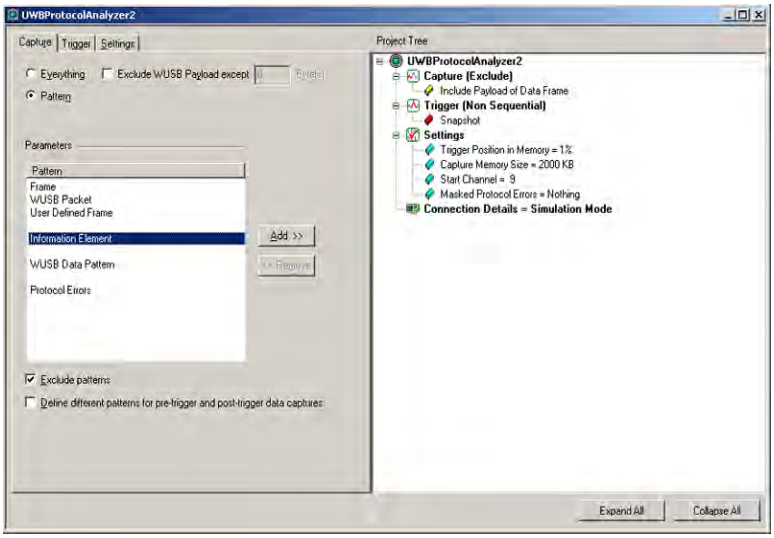


Figure 10. Exclude Patterns Checked

To remove an item from capture, highlight it in the Project tree and click the **<<Remove** button.

Pre and Post Trigger Data Capture

You may define one set of patterns for capture prior to the occurrence of a trigger and another set of patterns for capture after the occurrence of a trigger. The selections and setup procedure is the same for both, the Pre-Trigger capture and the Post-Trigger capture. Check Define different patterns for pre-trigger and post-trigger data capture to enable the **Post-Trigger Capture** tab.

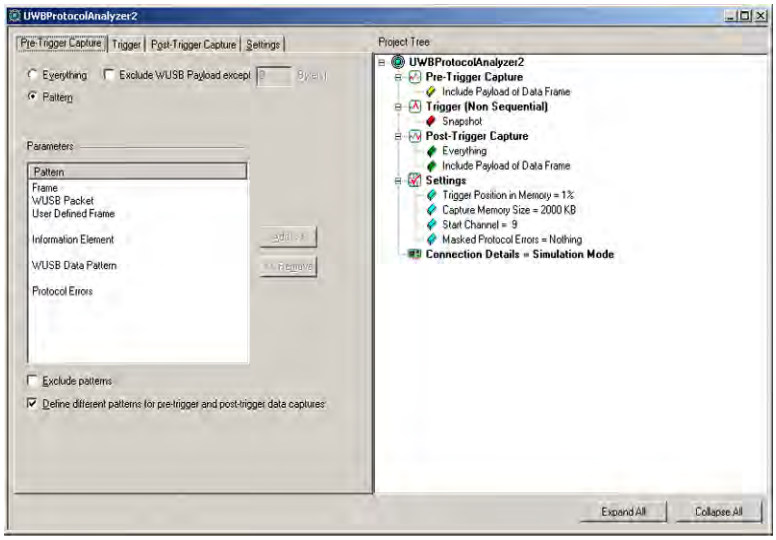


Figure 11. Post-trigger Capture Dialog Enabled

Defining Patterns

To select an item for capture, either highlight the category and click the **Add>>** button or double-click the category to open a corresponding definition dialog.

Frame Double-click **Frame** to display the Frame specification dialog.

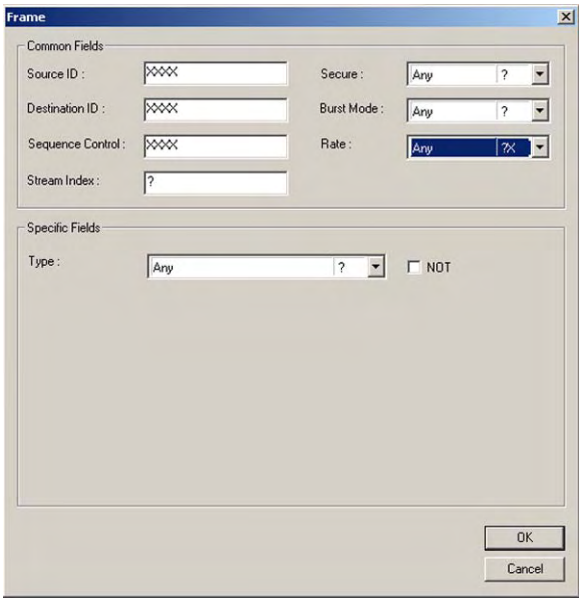


Figure 12. Frame Common Fields Setting

1. Enter values in the Common Fields area for **Source ID**, **Destination ID**, **Sequence Control** and **Stream Index**.
2. Click the down arrow next to the **Secure** drop-down combo box and choose **Any**, **Plain Text** or **Secure**.
3. Click the down arrow next to the **Burst Mode** drop-down combo box and choose **Any**, **Normal** or **Burst**.
4. Click the down arrow next to the **Type** drop-down combo box and choose a **Specific Field** Type for capture.

Note: You may exclude the Specific Field by checking the **Not** check box

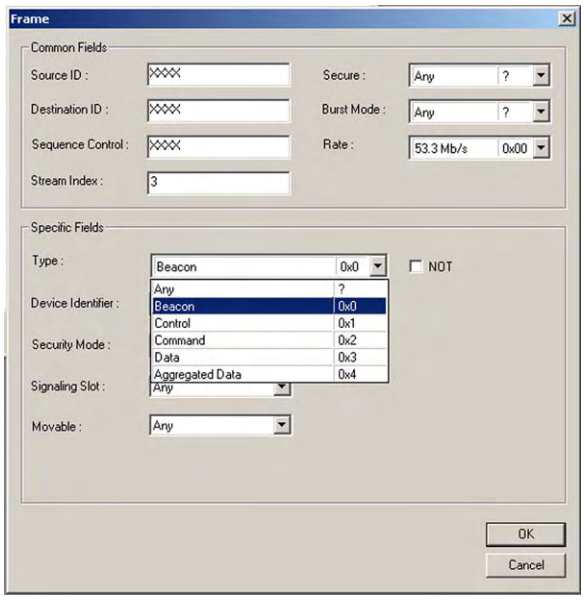
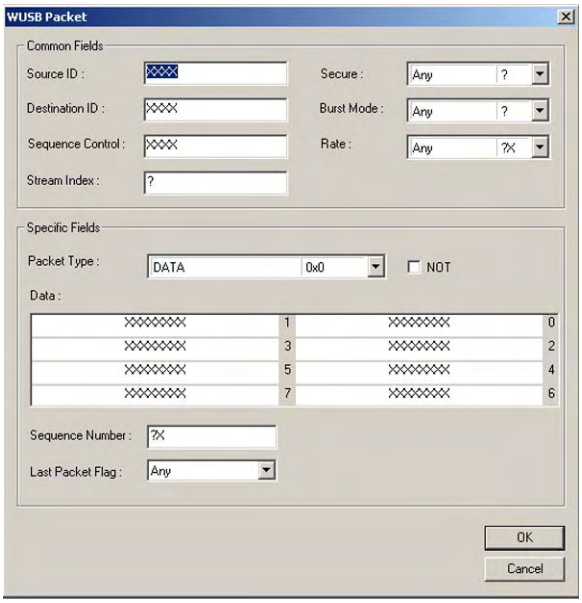


Figure 13. Choosing a Specific Field

Note: Beacon, Control, Command and Data specific fields offer additional options.

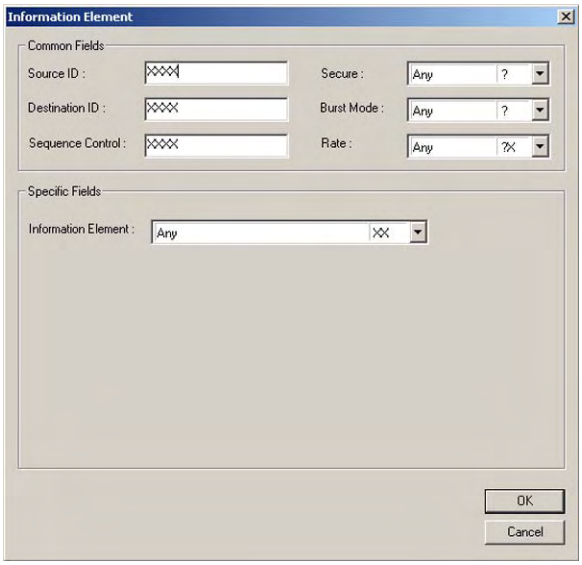
WUSB Packet

Double-click **WUSB** packet to display the WUSB packet specification dialog.



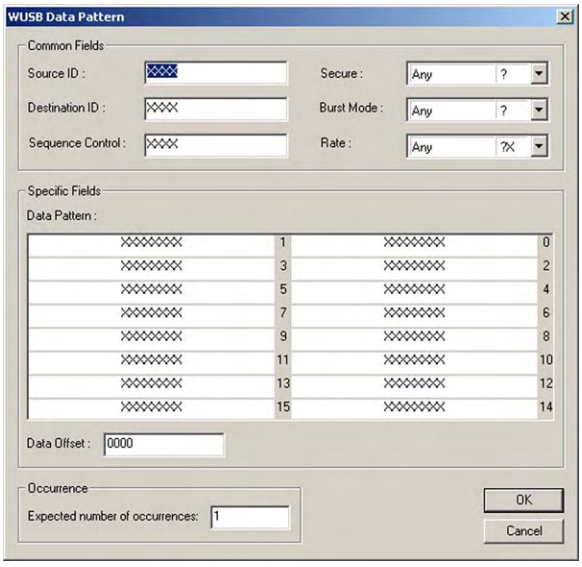
1. Enter values in the Common Fields area for **Source ID**, **Destination ID**, **Sequence Control** and **Stream Index**.
2. Choose the **Specific Fields** similarly to the way described for Frames.

Information Element Double-click **Information Element** to display the Information Element specification dialog



1. Enter values in the Common Fields area for **Source ID**, **Destination ID**, **Sequence Control** and **Stream Index**.
2. Click the down arrow next to the **Information Element** drop-down combo box and choose an **Information Element** Type for capture.

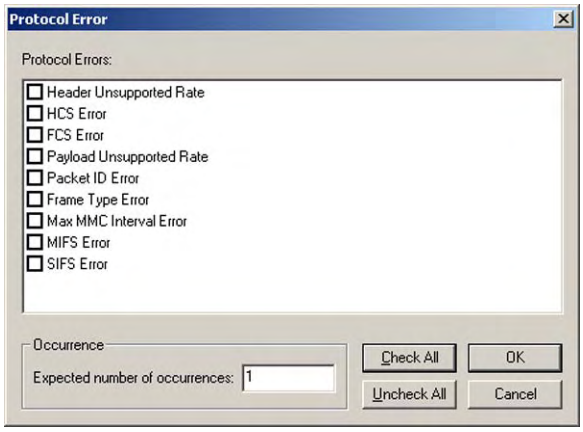
WUSB Data Pattern Double-click **WUSB Data Pattern** to display the WUSB Data Pattern specification dialog.



1. Enter values in the Common Fields area for **Source ID**, **Destination ID**, **Sequence Control** and **Stream Index**.
2. Enter values for specific data patterns.

Protocol Errors

Double-click **Protocol Errors** to display the Protocol Errors selection dialog.



Check the desired Protocol Error(s) for capture and click **OK**.

Triggering Setup

The **Trigger-on** tab, allows the user to specify when the analyzer will complete a data capture. Three trigger modes are available: The default **Don't care (Snapshot), Manual Trigger** and **Pattern.**

When a data capture is started with **Don't care (Snapshot)** selected, the analyzer will trigger on the first data pattern detected. Starting a data capture with **Pattern** selected the analyzer will trigger when user specified pattern(s) are detected in the captured data stream. The following are three ways to trigger the analyzer with **Pattern** selected.

- Trigger on any added pattern (Any Trigger Mode)
- Trigger on timer
- External Trigger
- Trigger on a sequence of patterns (Sequential Trigger Mode)

Snapshot Mode

To trigger immediately on any pattern, check the **Don't care (Snapshot)** button.

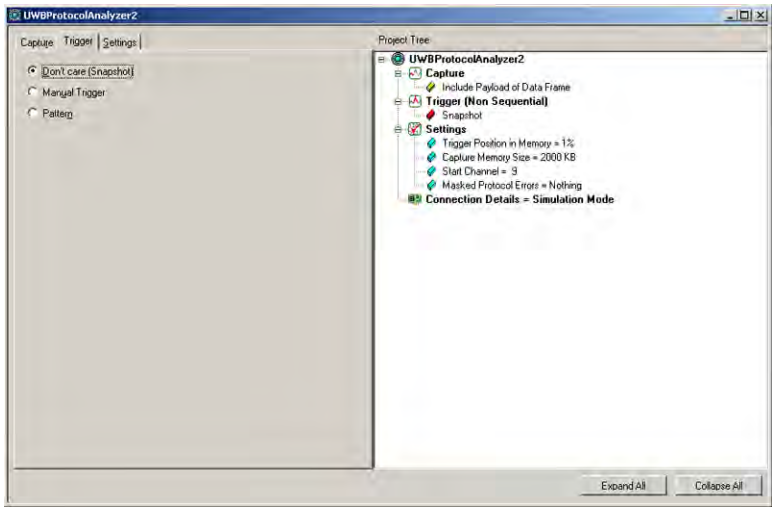


Figure 14. Default Trigger Selected

Manual Trigger Mode

In the **Manual Trigger** mode the analyzer captures traffic continually until you click the **Stop Hardware** button on the analyzer toolbar which triggers the analyzer. To set up to perform a manual trigger, check the **Manual Trigger** option button. Note that in this mode the Trigger Pointer does not appear in the captured data Packet View

Pattern Mode

In **Pattern** mode the Analyzer will trigger whenever any one of the patterns selected for triggering occurs. The procedure for selecting trigger parameters is identical to that for selecting capture parameters. All items selected for triggering will appear in the Project Tree.

To define patterns for triggering check the **Pattern** button in the Trigger On dialog.

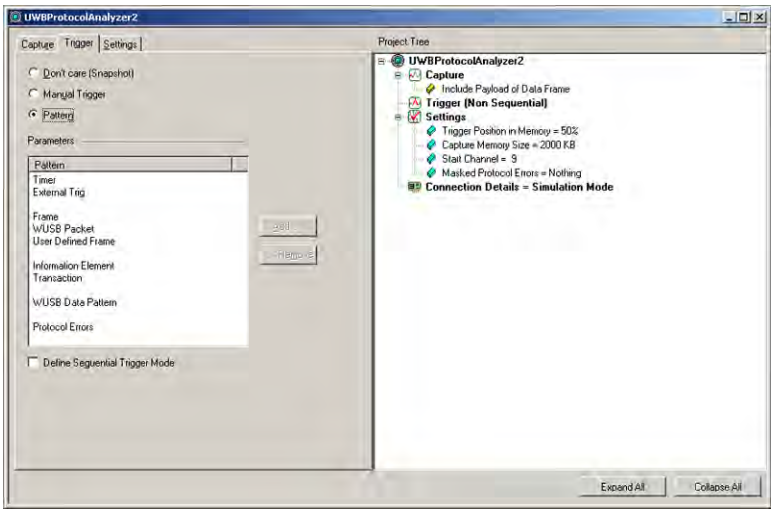


Figure 15. Select Patterns for Trigger

The **Parameters** window displays the following trigger pattern choice categories:

- Timer
- External Trigger
- Frame
- WUSB Packet
- User Defined Frame
- Information Element
- Transaction
- WUSB Data Pattern
- Protocol Error

Choose a parameter Either highlight the category and click the **Add>>** button or double-click the category to open a corresponding definition dialog.

To remove an item from trigger, highlight it in the Project tree and click the **<<Remove** button.

Triggering on a Timer

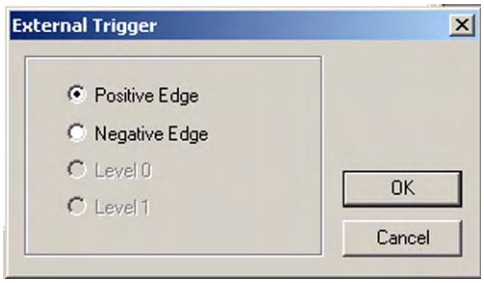
A timer may be set independently of any other trigger selection to cause an unconditional trigger after a set time.

To set the timer value, double-click **Timer** in the Patterns window of the Capture Project dialog to open the Timer dialog.

Check the Time unit desired, enter the Timer Value and click **OK.**

External Trigger

You may trigger on an external trigger. To set up the trigger click the **External Trigger** category.



Click a desired triggering condition option button and click **OK**.

Sequential Trigger Mode

In the Sequential Trigger mode, triggering occurs whenever a specific sequence of patterns are detected. The sequence is established by the order in which the triggering patterns are defined.

To define a triggering sequence, check the **Define Sequential Trigger Mode** check box.

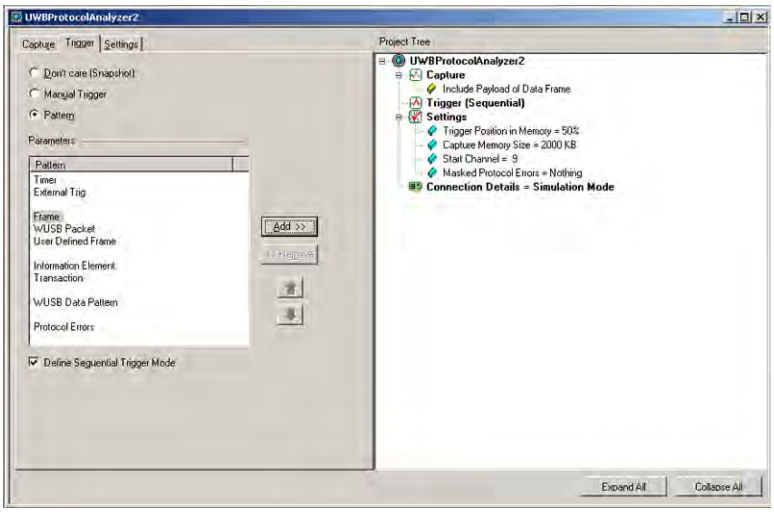


Figure 16. Select Sequential Trigger Mode

Timer

The sequential triggering mode offers the option of triggering on a timer or inserting a timer in the triggering sequence to delay detection of the next pattern in the sequence. To insert a timer in the trigger list Double-click **Timer** to open the timer definition dialog.

Enter the desired **Time Value**, choose the **Time Unit** and click **OK**.

Defining Patterns

The definition of patterns for the sequential trigger mode is identical to the Pattern mode with the following exception: In the sequential triggering mode the definition dialogs for these triggering patterns enable the setting, to count the number of occurrences. This allows the user to specify the number of times that the pattern must occur before triggering or proceeding in the trigger sequence.

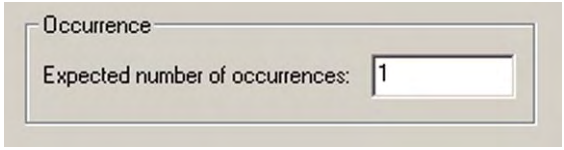
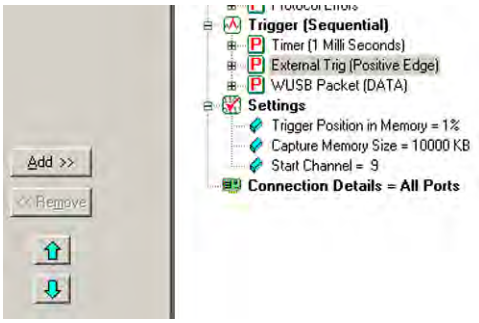


Figure 17. Number of Occurrences

Triggering order

As triggering patterns are defined and added they are displayed in the Project Tree sequentially in the order that they were entered under the Trigger On category. When the project is run, the analyzer will detect the occurrence of each pattern in order and trigger on the last one.

The sequence of triggering patterns can be re ordered if desired. To change the sequence order, highlight a trigger pattern and use the enabled green Up or Down arrow to move it to a new position.



Project Settings

To set project options click the **Settings** tab.

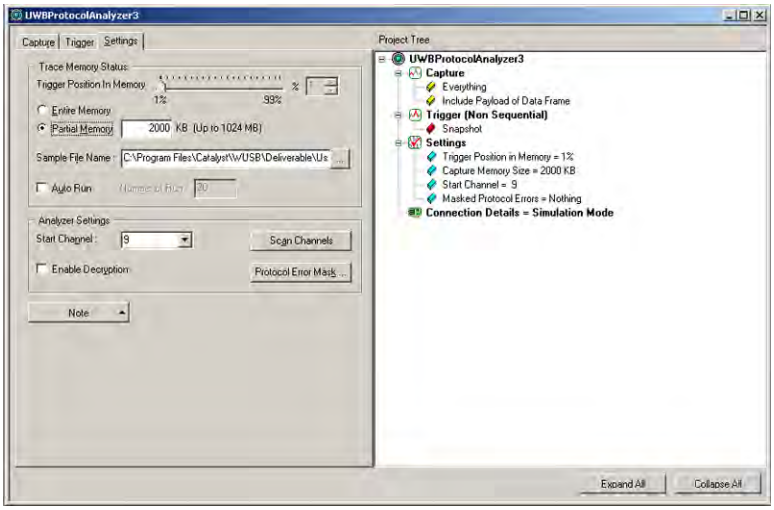


Figure 18. Setting Project Options

Trace Memory Status

Memory Size

To reduce the capture memory size, check Partial Memory and enter the desired buffer size or, check entire memory to allow capture for the entire memory (1 GB) if you want to capture the maximum amount of trace data.

Note: In cases where the size of a data packet exceeds the set buffer memory allocation, the project will run, but no capture will result. In such cases you must increase the buffer memory size to a value greater than the packet size.

Trigger Position

Pre-Trigger is set to define the percentage of data to be captured before and after the triggering event. It is set by default to 1% in the Snapshot mode and to 50% in the Manual trigger and Pattern mode. You may change this percentage by dragging the slider to the desired value.

The capture of the specified percentage of the data prior to the triggering event cannot be guaranteed and may in some cases be 0. This can occur in cases where the triggering event occurs before the required number of pre-trigger event data can be stored. In these cases the data display will show fewer than the specified data points prior to the triggering event. For more detail see "Pre-Trigger" on page 30.

Sample File Name

Click the ellipses next to the Sample File Name text box and choose a file name and location for the results of your current project.

Auto Run

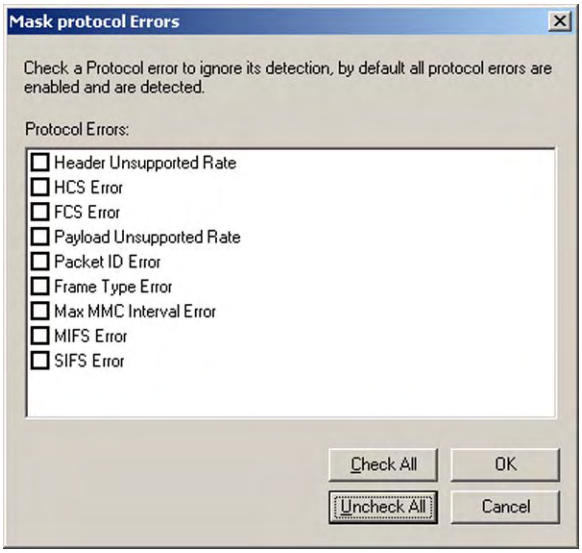
To repeat the current capture and trigger setup automatically, check the **Auto Run** checkbox and enter the number of times in the **Number to Run** text box. The capture and trigger will repeat automatically for the specified number of times and the results saved in consecutively numbered **User Defined Sample File Name.was** files.

Analyzer Settings

Scan Channels Click the **Scan Channels** button to scan for active channels.

Start Channel Set the **Start Channel** number to the active channel to be analyzed.

Protocol Error Mask Click the **Protocol Error Mask** button to open the Protocol Error Mask dialog.



Check the Protocol Errors that you wish to not display in the sample view.

Add a Project Note

To enter and save information about the current project click the **Note** button and enter the data about the project.

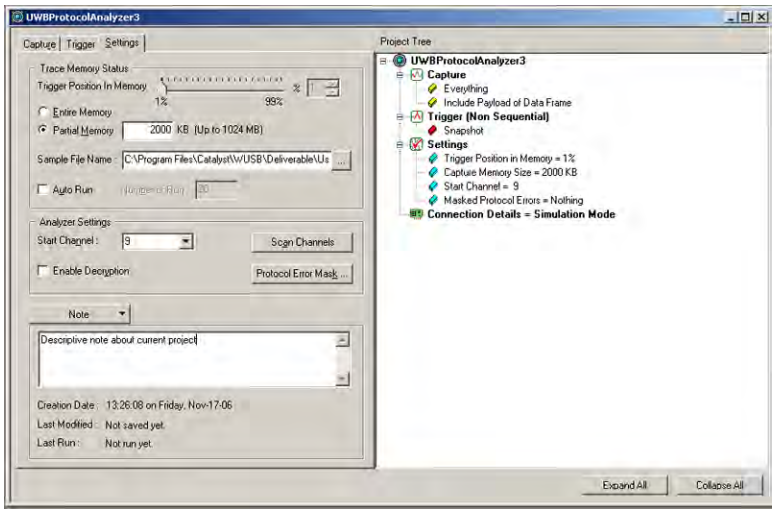


Figure 19. Project Note

To run the project, click the run  button.

Pre-Trigger

The amount of data to be captured before and after the trigger may be set as a percentage of pre-trigger, between 1% and 99%. This may be done by positioning the pre-trigger slider to the desired percentage. This feature allows the evaluation of bus activity leading up to and after the triggering event. The operation of the pre-trigger in the data memory is conceptually illustrated in Figure 20.

Pre-trigger Data is the capture of the specified percentage of the data prior to the triggering event cannot be guaranteed and may in some cases be 0. This can occur in cases where the triggering event occurs before the required number pre-trigger event data can be stored. In these cases the data display will show fewer than the specified data points prior to the triggering event.

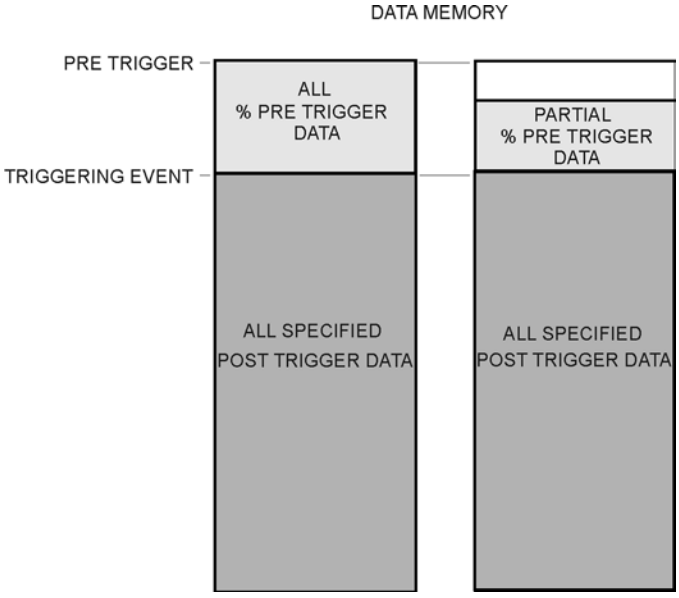


Figure 20. Pre-Trigger Example, 20% Pre-Trigger

Frame Generator Projects

Defining and running a Frame Generator Project will enable you to transmit user defined frames over the air. To run a Frame Generator Project you must first create Frame Generator files, which define the frames that you want to transmit.

For instructions how to create a Frame Generator file see “Appendix A” on page 69.

Note: To create a new Frame Generator project, click the **New** button and select **Frame Generator**

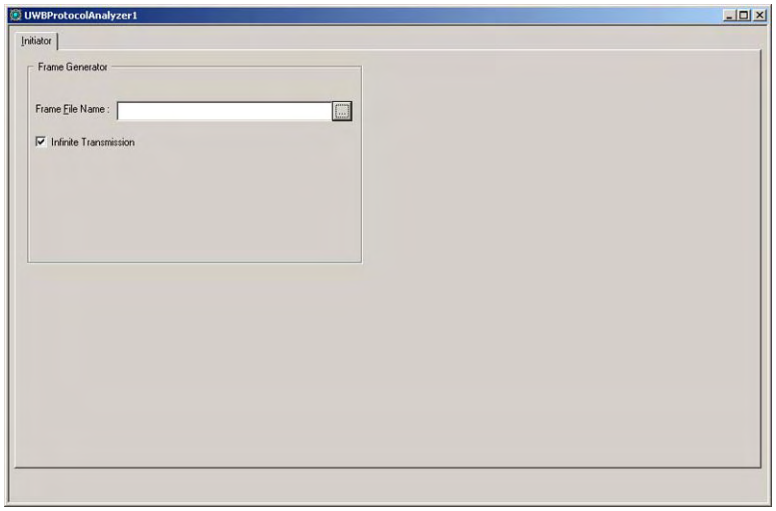


Figure 21. Initiator Dialog

Frame Generator Setup

1. Check the **Run Frame Generator** check box and then click the ellipses button next to the **Frame File Name** list box and choose a Frame Generator *.wpg file.
2. Choose **Transmission mode** by checking the corresponding option button.
    - Check the **Infinite Transmission** check box to transmit the pattern continually.

Data Display Manipulation

View Packets Display

The data viewer display may be configured to meet your individual test and viewing preference needs. Toolbars are available for quick access to data viewer display features.

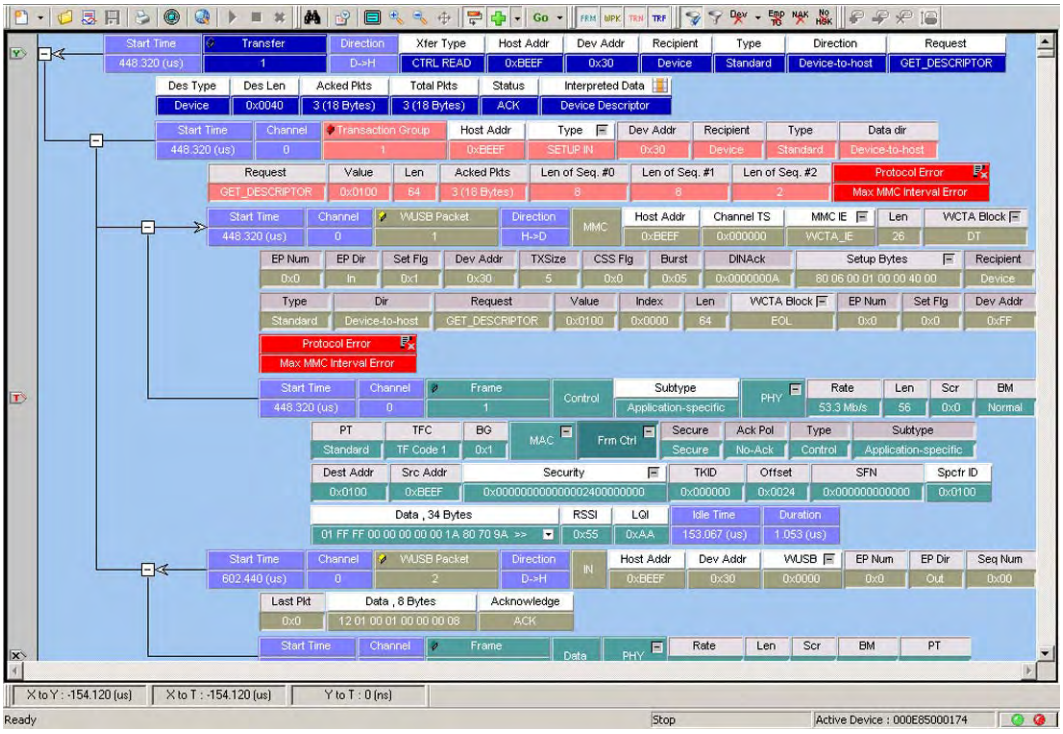
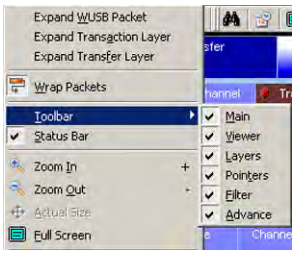


Figure 22. View Packets Display

Enabling Toolbars

To customize your Sample Viewer Display workspace you can enable/ disable and reposition the available toolbars. To display or hide toolbars click **View, Toolbar** and check or uncheck the desired toolbar.



Once enabled, the toolbars can be docked to the viewer display window or allowed to float on the desktop.

Spec View

To get a comprehensive specification of frame content, position a Frame to be the first item in the sample viewer and click **View** on the main toolbar and choose **Show Spec View**. You may also get a Frame specification by right-clicking on any frame in the sample viewer.

Note: If you scroll the sample viewer display with an open Spec View, the contents of the Spec View will change to those for whichever Frame is the first item in the viewer display.

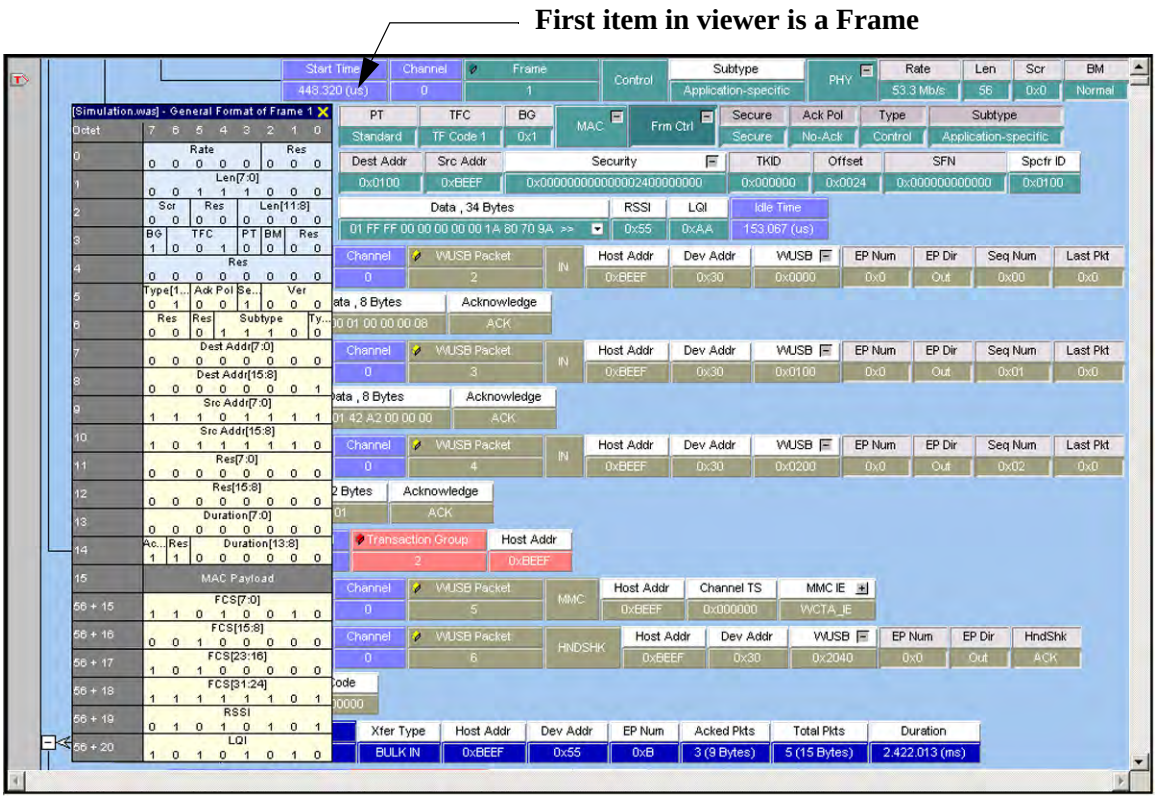


Figure 23. Spec View of Frame

Spec View Options

To change the Spec View options, right click in the Spec View window and choose the data radix (Hexadecimal or Binary), choose to show data only or copy Field Contents or all Contents to save in a different format.

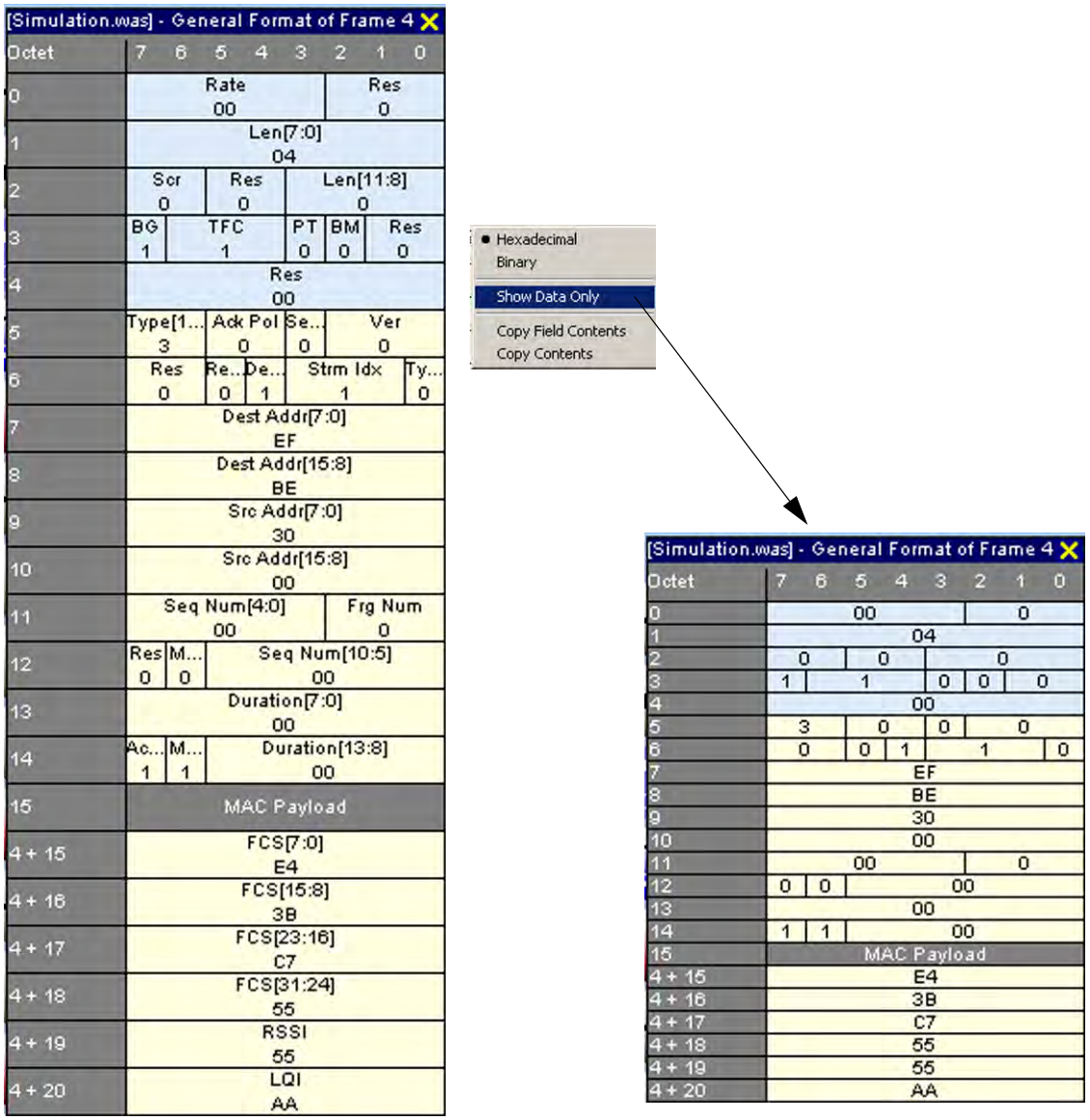


Figure 24. Spec View Format

Data View

Whenever the payload data exceeds what can conveniently be displayed in a Frame data field only the initial data values are displayed and an Expand/Collapse Data Payload toggle is enabled. Click this toggle to display all of the Payload Data.

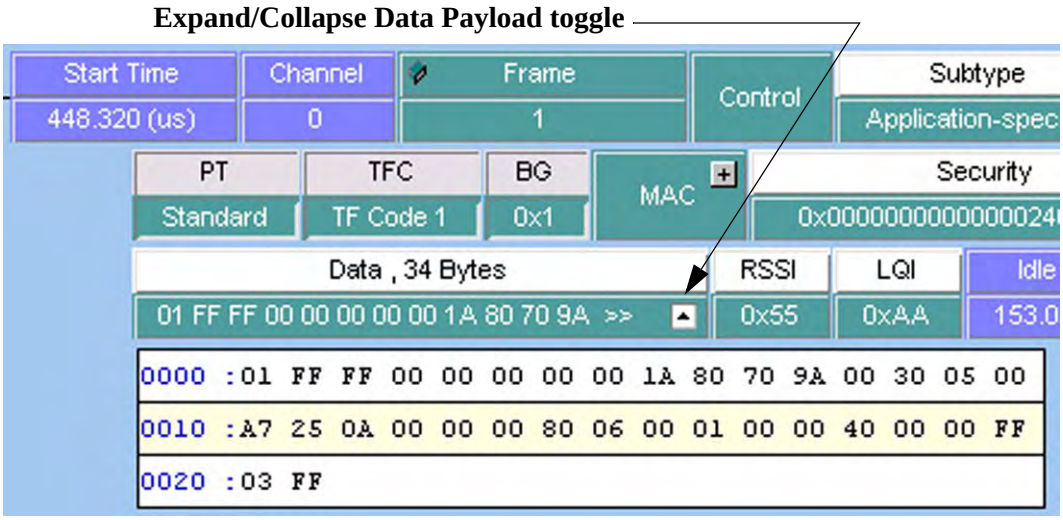


Figure 25. Complete Payload Data Display

Search for Data Pattern

To search for specific data patterns, right-click the Frame Data Field and choose **Open as Data View**. Enter a Pattern to search for and click **Find**. Repeat to find the next instance of the data pattern.

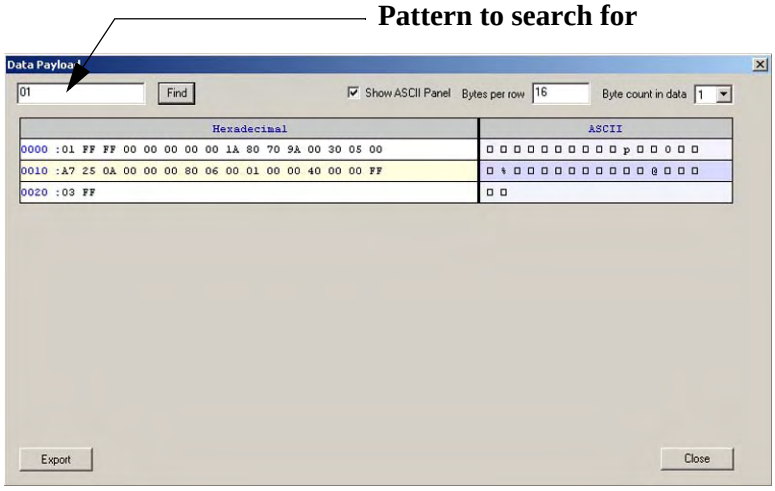
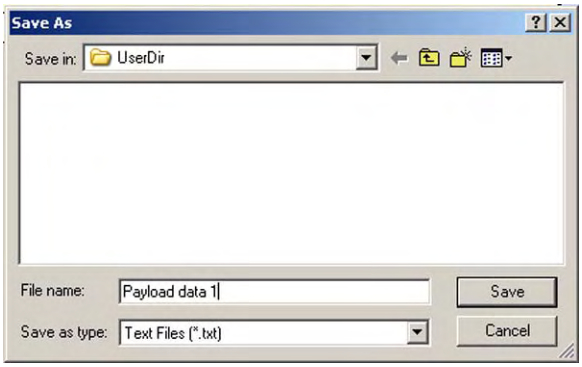


Figure 26. Search for Data Pattern

You may configure the data display to Show/Hide the ASCII Pane (Default is Show), specify the number of bytes per row (Default is 16) or Byte Count of Data (Default is 1).

To save the data in a special file, click the **Export** button to open a **Save As** dialog.



Choose a folder where to save the file, a file name and Save As type (Either Text or Binary) and click **OK**.

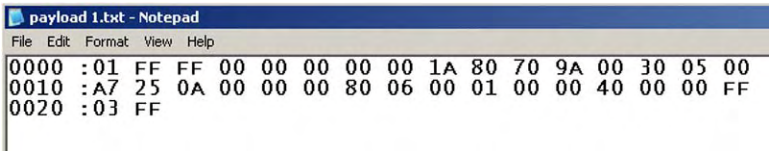


Figure 27. Data Exported as Text

Viewer Toolbar

Search button opens the search dialog.

Statistical Report button displays the statistical report setup dialog.

Click the **Full Screen** button to increase the data display area to full on the screen.

Click the **Zoom In** button to magnify the data display area of interest on the screen. In column and frame text view it increases the column width only.

Click the **Zoom Out** button to scale the data display area to display more data lines on the screen. In column and frame text view it decreases the column width only.

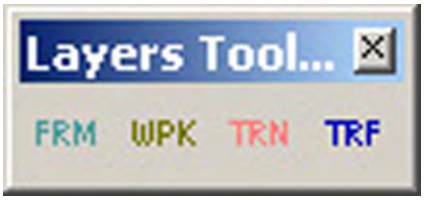
Click the **Normal Zoom** button to reset the zoom to default normal on the screen and in column and frame text view.

Click the **Wrap Packets** button to wrap the packet data in the display to eliminate the need for horizontal scrolling.

Expand/Collapse all Layers button expands or collapses layers to simplify the results display. Click the down arrow to expand or collapse specific layers.

GOTO button locates cursors in the results display. Click the down arrow to select cursor to go to.

Layers Toolbar



Click the **Show/Hide Transfer** button on the Layers Toolbar to toggle between show and hide of the Transfer layer.

Click the **Show/Hide Transaction** button on the Layers Toolbar to toggle between show and hide of the Transaction layer.

.

Click the **Show/Hide WUSB Packet** button on the Layers Toolbar to toggle between show and hide of WUSB Packets.

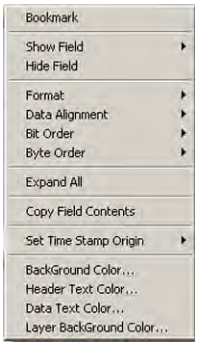
Click the **Show/Hide Frame** button on the Layers Toolbar to toggle between show and hide of the Frame Layer.

Collapsing Layers

You may simplify the viewer display by collapsing layers below a chosen layer. For example right clicking in a Transfer layer header and choosing **Collapse All** will hide all lower level layers displaying only the Transfer Layers. To redisplay the expanded view right click in the Transfer layer and choose **Expand All**. Performing this on a lower layer will configure the display to show only that layer and the one(s) above.

Interpretation Aids

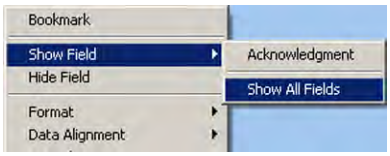
There are several user selectable options available to assist in interpreting the results displayed in the Sample View. To select any of the available options, right click in a data field in the Sample Viewer and choose the desired option.



Show/Hide Field

You may simplify the Viewer display by hiding some of the fields that are of no current interest. You may hide fields such as **Duration**, **Idle Time**, **External Signals**, **Packet number** etc. by right clicking on the corresponding field title and choosing **Hide Field**.

To restore a field to the display, right click on in any field and choose the hidden field to be restored.



Note: Only the fields previously hidden will appear in the restore list.

Byte Order

For reviewing enhancement you may change the byte order in fields marked by an arrow. Right click in the field Select **Byte Order** and choose the ordering **Big Endian** (Default) or **Little Endian**.

Bit Order

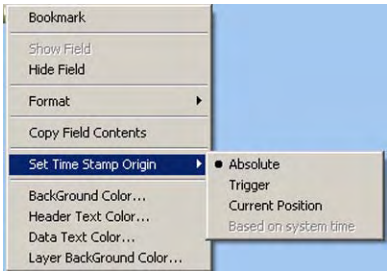
Right click on a data field, choose **Bit Order** and then to toggle the bit order between **MSB -> LSB** (Default) and **LSB -> MSB**.

Format

Right click on any field, choose **Format** and then select the desired format from **Name**, **Decimal**, **Hexadecimal** or **Binary**.

Note: Not all format options are available for each field.

Set Time Stamp Origin Right click on any field and choose **Time Stamp Origin** and select the desired time stamp origin.



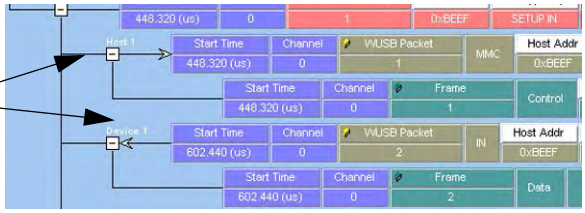
Set Direction Alias

Direction Alias allows you to assign a meaningful name to each traffic direction to assist in interpreting the Sample View.

1. To assign direction names in an open Sample View, click **Configuration** on the Menu Bar and choose **Set Direction Alias**.

2. Assign a meaningful name to each traffic direction and click **OK**.

Directions named



3. The assigned direction alias will apply to all sample files that are opened after it has been set.

User Defined Decoding (UDD)

User Defined Decoding allows you to assign custom decoding for the data stream. The AirCom software includes some pre-defined scripts. Custom decoding is created by using scripts that are described in “Appendix B” on page 83.

To assign a previously defined script click **View** on the main toolbar and choose **UDD Assignment** to display the UDD Assignment dialog.

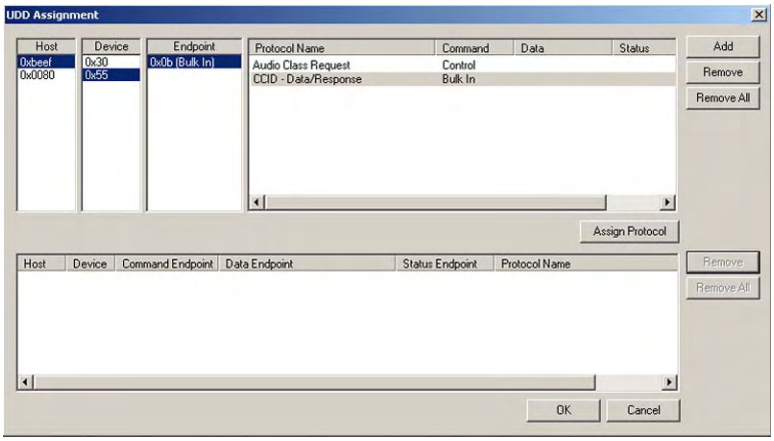
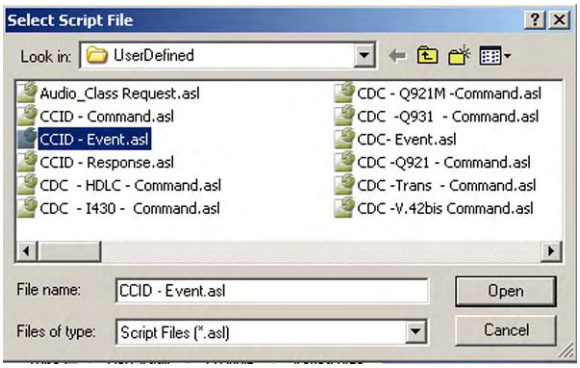


Figure 28. UDD Assignment Dialog

To make the pre-defined scripts available for assignment click the **ADD** button and locate the scripts in **\Application Directory\System\Script** folder. Choose the required script and click **Open**.



Repeat for additional files as required.

To assign a script to an endpoint click that endpoint and highlight the script to be assigned to that endpoint and click the **Assign Protocol** button.

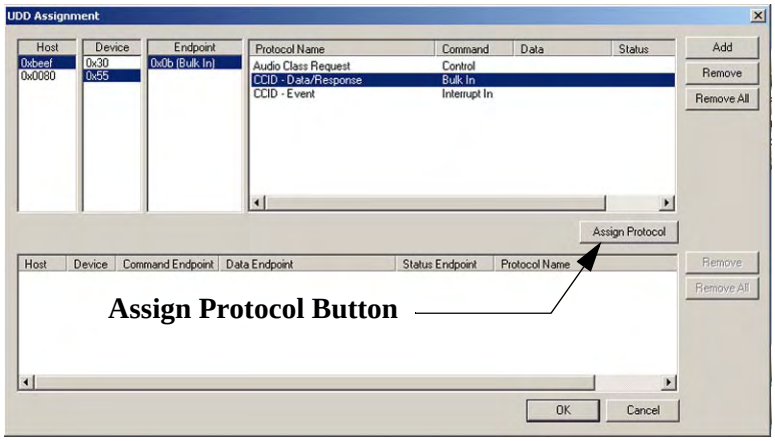
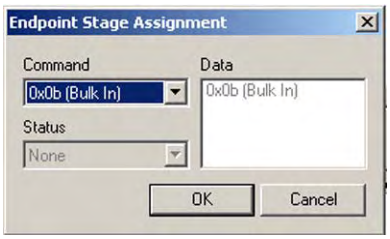


Figure 29. Assign Script

Choose an endpoint stage assignment from the **Command** dropdown list and click **OK,**



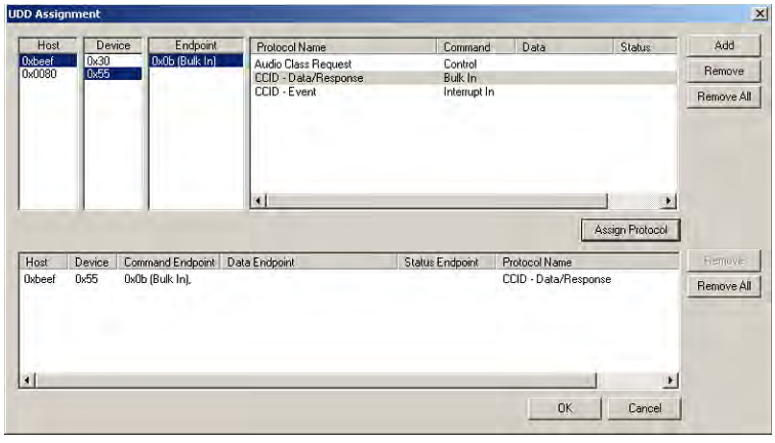


Figure 30. Script Assigned

Click **OK** to complete assignment.

A **Show Decoding** icon will appear in the Sample View for the endpoints with the script assignment

.

Show Decoding Icon

Click the **Show Decoding** Icon to display the decoding table for that endpoint.

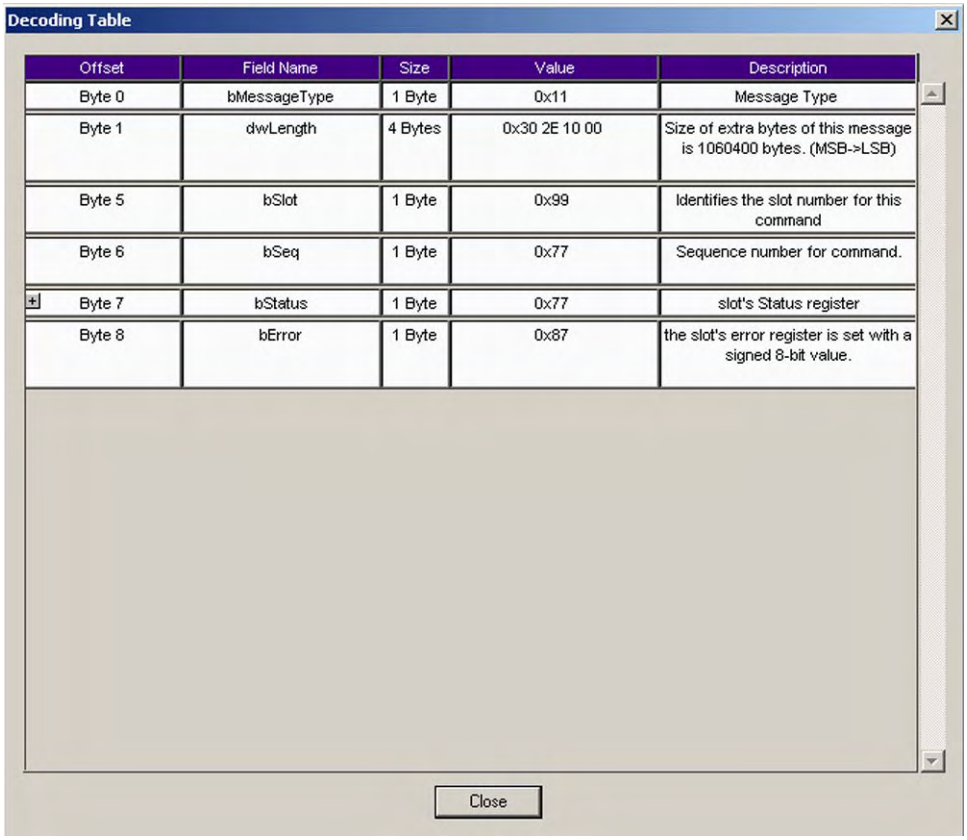


Figure 31. Decoding Table

Faded Packets

Faded Packets are used to display certain packets that are unrelated to a WUSB Transfer and also to show packets that are related to two or more different WUSB Transfers. Faded Packets are only used when the WUSB Transfer Layer is shown in View Packets.

The following are reasons for showing packets as faded:

1. **WUSB Transaction Group (TG) Packets:** Because a TG packet can relate to more than one transfer packet, the first TG is shown as non-faded and the subsequent ones are shown as faded.
2. **WUSB MMC Packets:** MMC Packet fading is the same as its related TG packet.
3. **WUSB In, Out and Handshake Packets:** If these packets are shown beneath their related Transfer, then they are shown as non-faded; otherwise, they are shown as faded.
4. **WUSB DN Packets:** If these packets are shown beneath a Transfer, then they are shown as faded.
5. **Frames:** Frame fading is the same as its related WUSB Packet (MMC, DN, or In/Out/Handshake).

In the following snapshot the Handshake Packet is faded under Transfer 1 because it is not related to this Transfer (Transfer and Handshake Packet differ in Device Address), but it is not faded under Transfer 2, because it is related to this Transfer.

Additionally, Transaction Group 1 is related to two different Transfers, so in the first occurrence, it is shown as non-faded, but in subsequent places it is shown as faded.

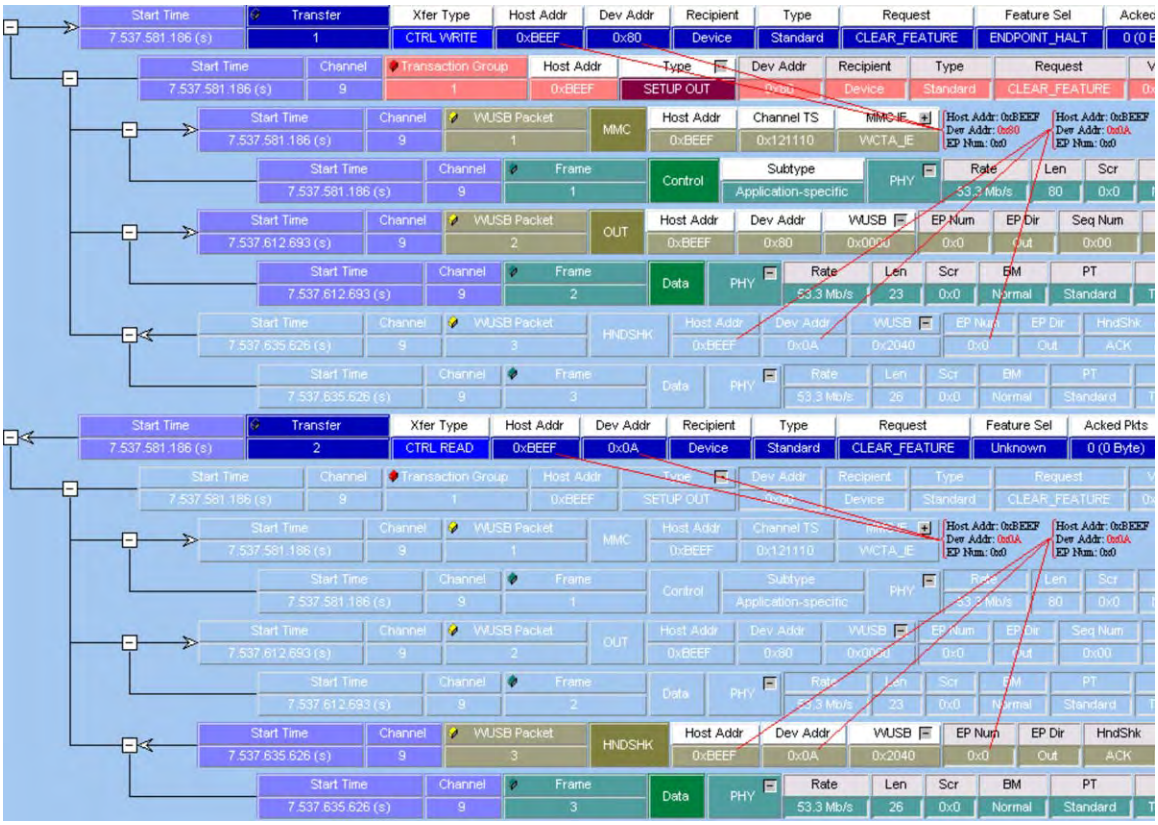


Figure 32. Illustration of Faded Packets

Statistical Report

Whenever a captured sample is displayed in the sample viewer, the **Statistical Report** selection in the **Report** menu and a **Statistical Report Button** on the viewer toolbar are enabled. You may create a Statistical Report for the entire capture or a select portion of it as desired.

To display a Statistical Report, click the **Statistical Report** button on the viewer toolbar, or select **Statistical Report** from the **Report** menu.

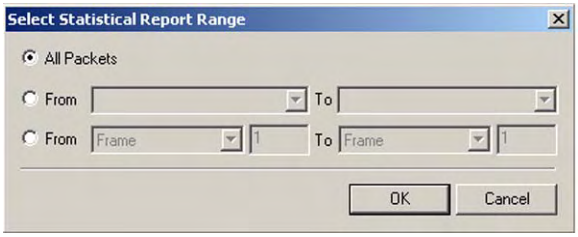
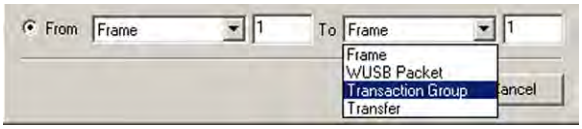


Figure 33. Statistical Report Range Dialog

The default statistical report is generated using all samples. You may, however, set a specific Statistic report range between defined cursor positions or events.

Report Between Cursors Click the option button next to the **From** cursor selection drop down list. Then click the **From** down arrow and choose the 1st. cursor, click the **To** down arrow to choose the 2nd cursor and click **OK.** The resulting report is limited to the capture between the cursors.

Report Between Events Click the option button next to the **From** the event selection dropdown list. Then click the **From** down arrow to choose the 1st event and enter the number of its occurrence. Next click the **To** down arrow to choose the 2nd event, and enter the number of its occurrence.



Click **OK.** The resulting report will be limited to the capture between the defined events.

Statistical Report Content

A complete statistical report consists of the following reports a that are accessed by clicking on the corresponding report tab in the dialog:

- Frame
- WUSB Packet
- Transaction Group
- Transfer
- IE
- HW Protocol Error
- Performance
- Other

Note: Results are displayed only for items that have been captured in the sample.

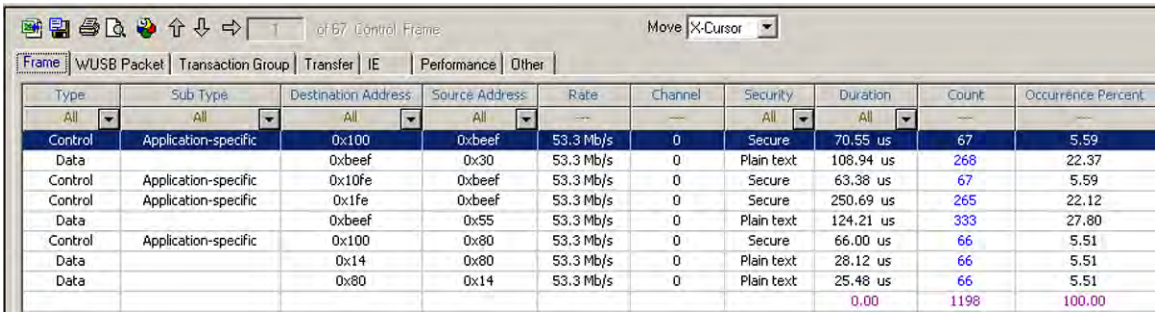
Report Options

Note: Some report categories offer options to display only items of interest.These report categories incorporate drop-down list boxes offering pre-defined and custom options. For details see “Formatting the Statistical Report View” on page 57.

Frame Report

To display the Frame report view, click the **Frame** Tab.The Frame report displays the report data in columns with the following information:

- Type
- Sub Type
- Destination Address
- Source Address
- Rate
- Channel
- Security
- Duration
- Count
- Occurrence Percent

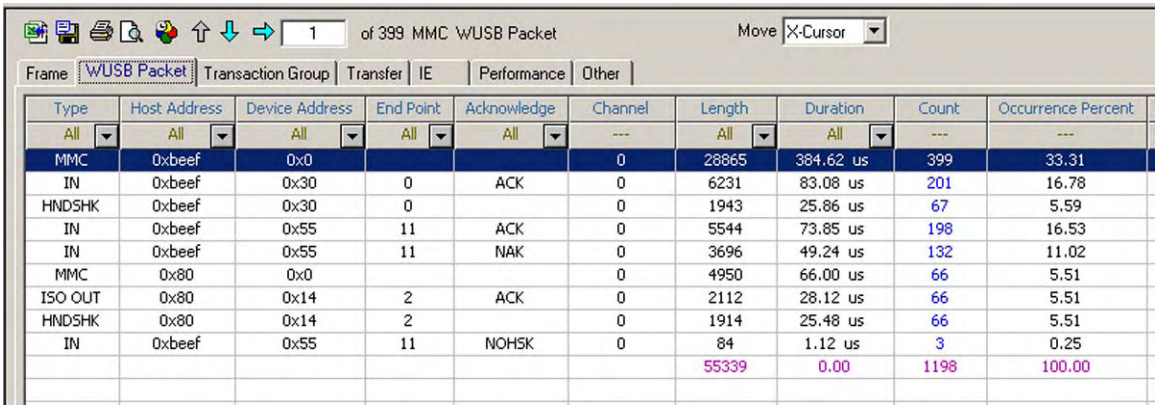


Type	Sub Type	Destination Address	Source Address	Rate	Channel	Security	Duration	Count	Occurrence Percent
All	All	All	All	---	---	All	All	---	---
Control	Application-specific	0x100	0xbeef	53.3 Mb/s	0	Secure	70.55 us	67	5.59
Data		0xbeef	0x30	53.3 Mb/s	0	Plain text	108.94 us	268	22.37
Control	Application-specific	0x10fe	0xbeef	53.3 Mb/s	0	Secure	63.38 us	67	5.59
Control	Application-specific	0x1fe	0xbeef	53.3 Mb/s	0	Secure	250.69 us	265	22.12
Data		0xbeef	0x55	53.3 Mb/s	0	Plain text	124.21 us	333	27.80
Control	Application-specific	0x100	0x80	53.3 Mb/s	0	Secure	66.00 us	66	5.51
Data		0x14	0x80	53.3 Mb/s	0	Plain text	28.12 us	66	5.51
Data		0x80	0x14	53.3 Mb/s	0	Plain text	25.48 us	66	5.51
							0.00	1198	100.00

WUSB Packet Report

To display the WUSB Packet report view, click the **WUSB Packet** tab. The WUSB Packet report displays the report data in columns with the following information:

- Type
- Host Address
- Device Address
- End Point
- Acknowledge
- Channel
- Length
- Duration
- Count
- Occurrence Percent

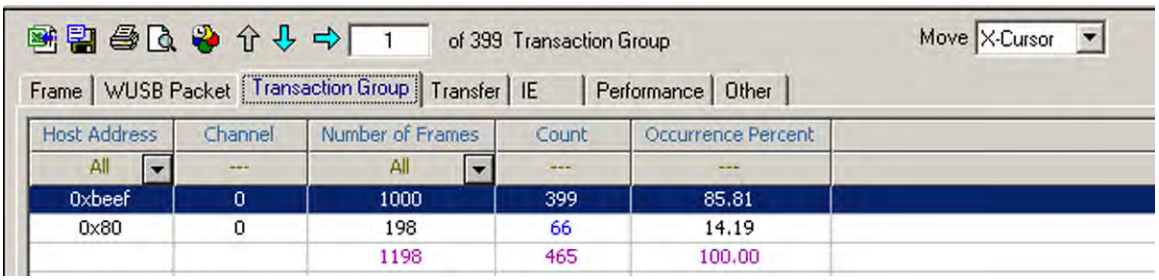


Type	Host Address	Device Address	End Point	Acknowledge	Channel	Length	Duration	Count	Occurrence Percent
All	All	All	All	All	---	All	All	---	---
MMC	0xbeef	0x0			0	28865	384.62 us	399	33.31
IN	0xbeef	0x30	0	ACK	0	6231	83.08 us	201	16.78
HNDSHK	0xbeef	0x30	0		0	1943	25.86 us	67	5.59
IN	0xbeef	0x55	11	ACK	0	5544	73.85 us	198	16.53
IN	0xbeef	0x55	11	NAK	0	3696	49.24 us	132	11.02
MMC	0x80	0x0			0	4950	66.00 us	66	5.51
ISO OUT	0x80	0x14	2	ACK	0	2112	28.12 us	66	5.51
HNDSHK	0x80	0x14	2		0	1914	25.48 us	66	5.51
IN	0xbeef	0x55	11	NOHSK	0	84	1.12 us	3	0.25
						55339	0.00	1198	100.00

Transaction Group Report

To display the Transaction Group Report, click the **Transaction Group** tab. The Transaction Group report displays the report data in columns with the following information:

- Host Address
- Channel
- Number of Frames
- Count
- Occurrence Percent

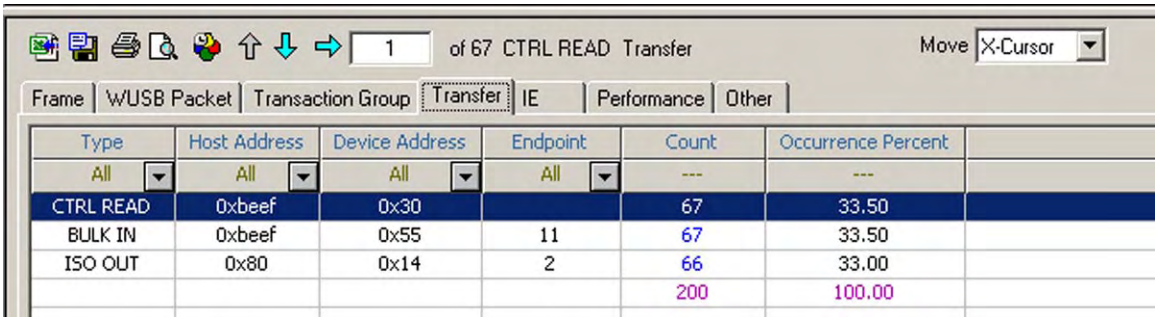


Host Address	Channel	Number of Frames	Count	Occurrence Percent
All	---	All	---	---
0xbeef	0	1000	399	85.81
0x80	0	198	66	14.19
		1198	465	100.00

Transfer Report

To display the Transfer Report, click the **Transfer** tab.The Transfer report displays the report data in columns with the following information:

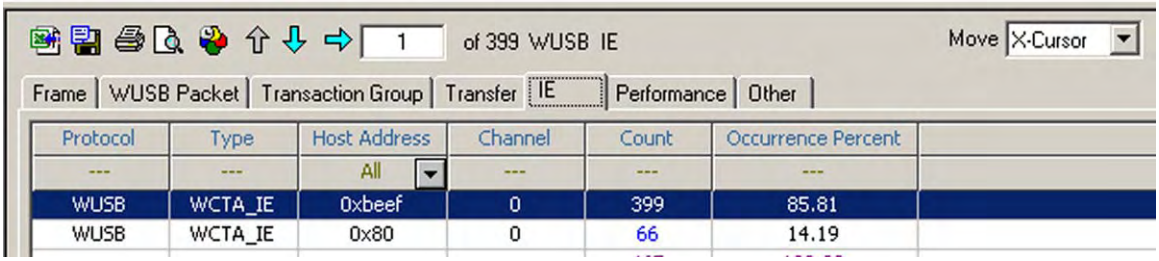
- Type
- Host address
- Device Address
- Count
- Occurrence Percent



IE Report

To display the IE Report, click the **IE** tab. The STP Transport report displays the report data in columns with the following information:

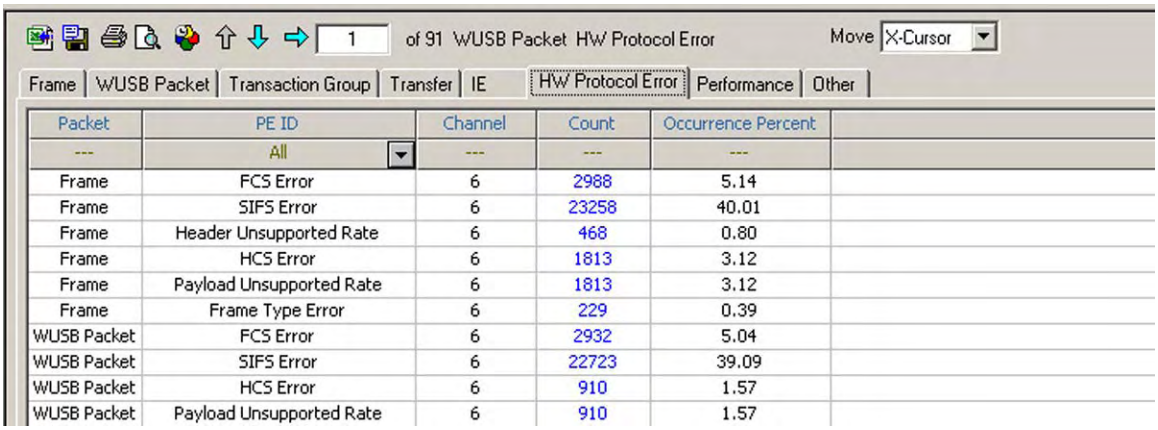
- Protocol
- Type
- Host Address
- Channel
- Count
- Occurrence Percent



HW Protocol Error Report

To display the HW Protocol Error Report, click the **HW Protocol error** tab. The HW Protocol Error report displays the report data in columns with the following information:

- Packet
- PE ID
- Channel
- Count
- Occurrence Percent

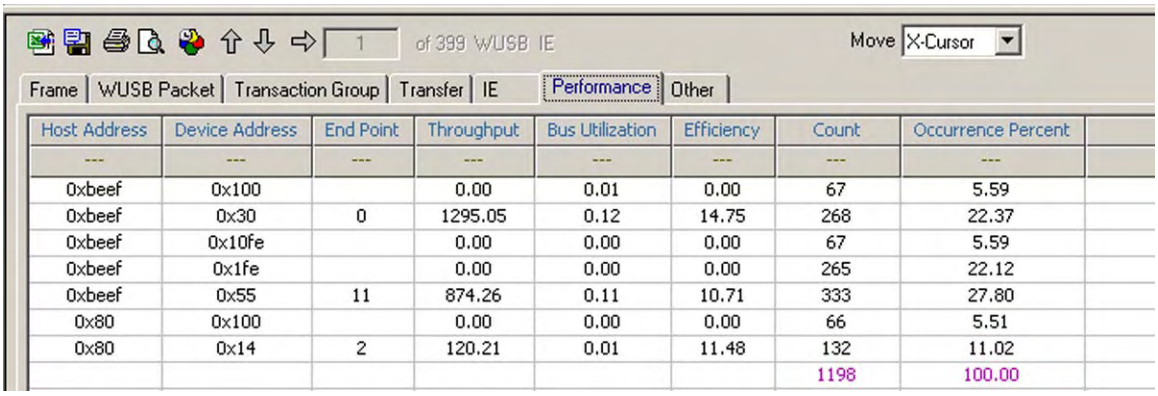


Packet	PE ID	Channel	Count	Occurrence Percent
---	All	---	---	---
Frame	FCS Error	6	2988	5.14
Frame	SIFS Error	6	23258	40.01
Frame	Header Unsupported Rate	6	468	0.80
Frame	HCS Error	6	1813	3.12
Frame	Payload Unsupported Rate	6	1813	3.12
Frame	Frame Type Error	6	229	0.39
WUSB Packet	FCS Error	6	2932	5.04
WUSB Packet	SIFS Error	6	22723	39.09
WUSB Packet	HCS Error	6	910	1.57
WUSB Packet	Payload Unsupported Rate	6	910	1.57

Performance Report

To display the Performance Report, click the **Performance** tab.The Performance report displays the report data in columns with the following information:

- Host Address
- Device address
- End Point
- Throughput
- Bus Utilization
- Efficiency
- Count
- Occurrence Percent

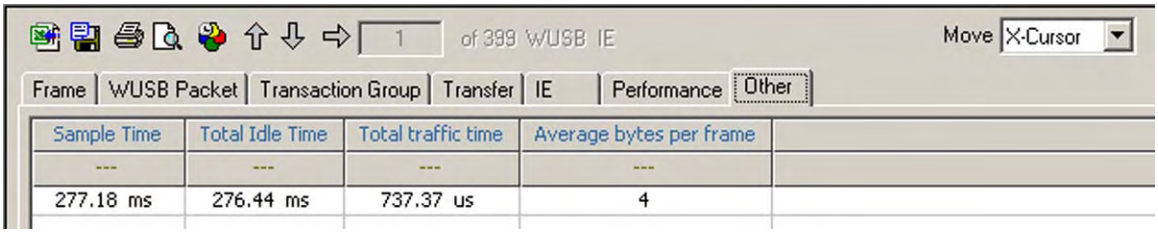


Host Address	Device Address	End Point	Throughput	Bus Utilization	Efficiency	Count	Occurrence Percent
---	---	---	---	---	---	---	---
0xbeef	0x100		0.00	0.01	0.00	67	5.59
0xbeef	0x30	0	1295.05	0.12	14.75	268	22.37
0xbeef	0x10fe		0.00	0.00	0.00	67	5.59
0xbeef	0x1fe		0.00	0.00	0.00	265	22.12
0xbeef	0x55	11	874.26	0.11	10.71	333	27.80
0x80	0x100		0.00	0.00	0.00	66	5.51
0x80	0x14	2	120.21	0.01	11.48	132	11.02
						1198	100.00

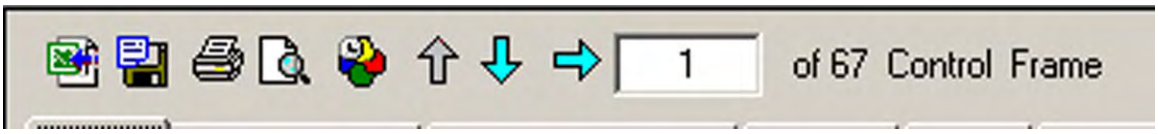
Other Report

To display the Other Report, click the **Other** tab. The Other report displays the report data in columns with the following information:

- Sample Time
- Total Idle Time
- Total Traffic Time
- Average Bytes Per Frame



Statistical Report Toolbar



The Statistical report toolbar provides the following functions accessible by buttons on the toolbar:

- Export to Excel
- Save as Text
- Print Report
- Print Preview
- Report Display Settings

Export as Microsoft® Excel file

Click the **Export to Excel** Button on the Statistical Report Toolbar to open the Export to Excel dialog.

Choose a folder to save the Excel file in and an appropriate file name and click **Save.**

Save as Text

Click the **Save as Text** Button on the Statistical Report Toolbar to open the Export to Text dialog.

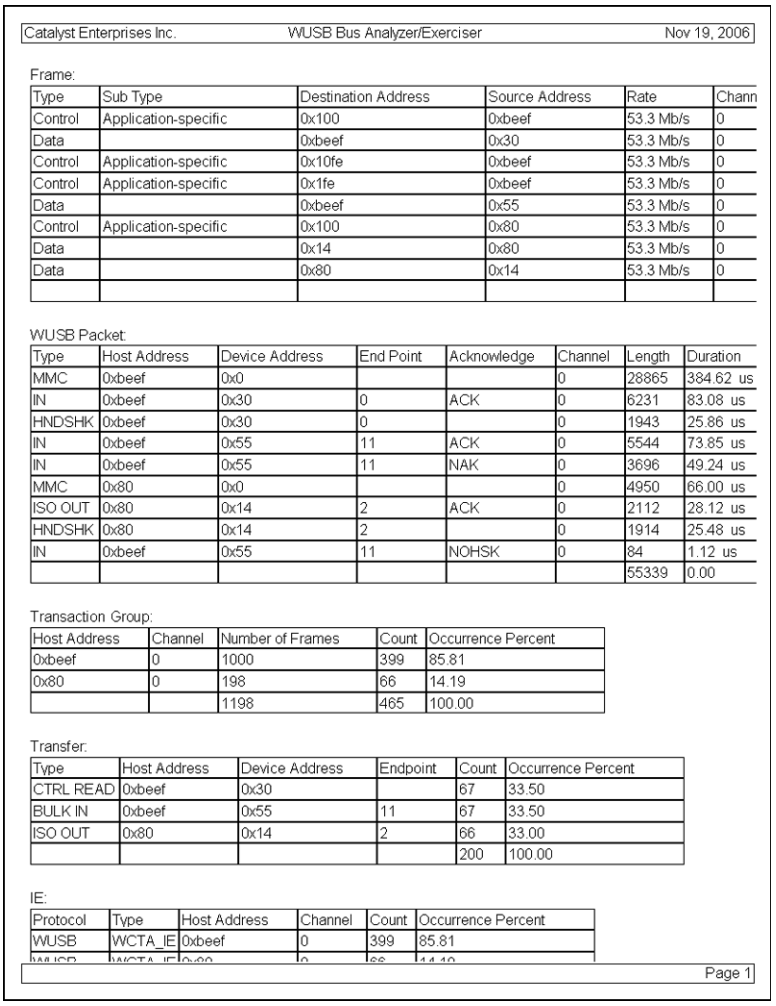
Choose a folder to save the Text file in and an appropriate file name and click Save.

Print Statistical Report

Click the **Print** Button on the Statistical Report Toolbar to open the select printer dialog. Choose an available printer and click **OK.**

Print Preview

Click the **Print Preview** Button on the Statistical Report Toolbar to display a preview of the report to be printed**.**



Catalyst Enterprises Inc. WUSB Bus Analyzer/Exerciser Nov 19, 2006

Frame:

Type	Sub Type	Destination Address	Source Address	Rate	Chann
Control	Application-specific	0x100	0xbeef	53.3 Mb/s	0
Data		0xbeef	0x30	53.3 Mb/s	0
Control	Application-specific	0x10fe	0xbeef	53.3 Mb/s	0
Control	Application-specific	0x1fe	0xbeef	53.3 Mb/s	0
Data		0xbeef	0x55	53.3 Mb/s	0
Control	Application-specific	0x100	0x80	53.3 Mb/s	0
Data		0x14	0x80	53.3 Mb/s	0
Data		0x80	0x14	53.3 Mb/s	0

WUSB Packet:

Type	Host Address	Device Address	End Point	Acknowledge	Channel	Length	Duration
MMC	0xbeef	0x0			0	28865	384.62 us
IN	0xbeef	0x30	0	ACK	0	6231	83.08 us
HNDSHK	0xbeef	0x30	0		0	1943	25.86 us
IN	0xbeef	0x55	11	ACK	0	5544	73.85 us
IN	0xbeef	0x55	11	NAK	0	3696	49.24 us
MMC	0x80	0x0			0	4950	66.00 us
ISO OUT	0x80	0x14	2	ACK	0	2112	28.12 us
HNDSHK	0x80	0x14	2		0	1914	25.48 us
IN	0xbeef	0x55	11	NOHSK	0	84	1.12 us
						55339	0.00

Transaction Group:

Host Address	Channel	Number of Frames	Count	Occurrence Percent
0xbeef	0	1000	399	85.81
0x80	0	198	66	14.19
		1198	465	100.00

Transfer:

Type	Host Address	Device Address	Endpoint	Count	Occurrence Percent
CTRL READ	0xbeef	0x30		67	33.50
BULK IN	0xbeef	0x55	11	67	33.50
ISO OUT	0x80	0x14	2	66	33.00
				200	100.00

IE:

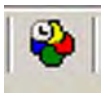
Protocol	Type	Host Address	Channel	Count	Occurrence Percent
WUSB	WCTA_IE	0xbeef	0	399	85.81

Page 1

Figure 34. Sample Print Preview of Report

Report Display Settings

You may set up the report columns for display to suit a particular analysis need. You may globally choose the columns for display thereby eliminating the need to show hide columns individually. Use the **Setting** dialog to configure the display for each page.



Click the **Setting** Button on the Statistical Report Toolbar to open the Setting dialog.

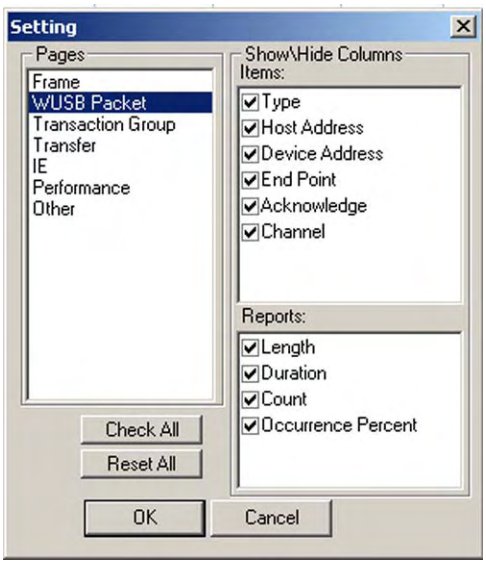
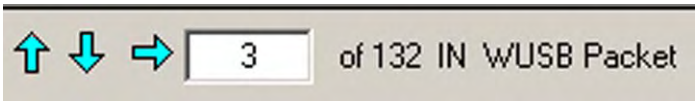


Figure 35. Statistical Report Column Setting

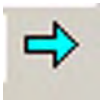
Link With Sample View

Whenever a Type is selected on any page of the statistical report, a set of navigation buttons is enabled allowing you to examine each instance of that type in the sample viewer.



Click the **Jump to Previous** Button on the Statistical Report Toolbar to go to the previous instance of the selected type in the Sample Viewer**.**

Click the **Jump to Next** Button on the Statistical Report Toolbar to go to the next instance of the selected type in the Sample Viewer**.**



Click the **Jump to Specific** Button on the Statistical Report Toolbar to go to the instance specified as N of M items on the Statistical Report Toolbar**.**

Formatting the Statistical Report View

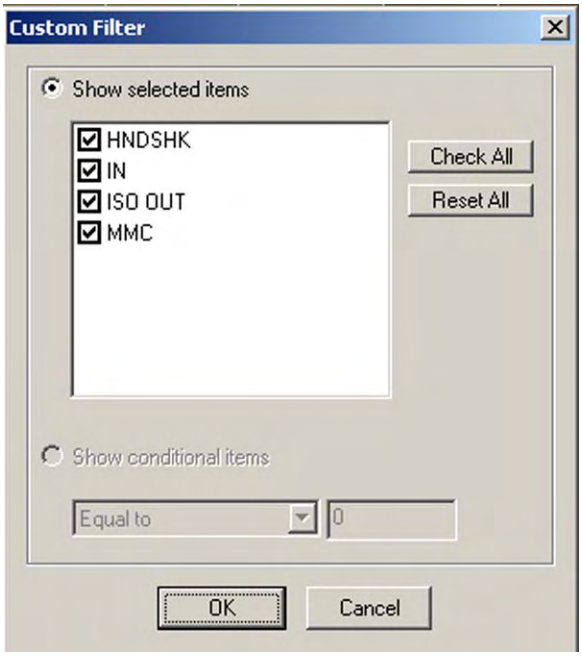
Initially the Statistical Report View contains all of the information in columns, but you may customize the display for your needs by:

- Sorting items by column
- Filtering Columns by item
- Hiding any column on the display

Filtering Column Content

To filter column content click the down arrow in the heading for that column and choose the items that you wish to be displayed. The default is All. By checking a specific item you exclude everything but that item for display.

Choosing **Custom** allows you to specify more than one item for display.



Check the items you wish to display and click **OK**.

Hiding Columns

To hide a column, right click in the column and choose Hide. To unhide a column, right click on any column and choose Unhide.

Sorting Column Content

To sort column content, click the heading for that column. Repeated clicking of the column heading will sort the column in ascending or descending order.

Type	Host Address	Device Address	End Point	Acknowledge
All	All	All	All	All
IN	0xbeef	0x55	11	ACK
IN	0xbeef	0x55	11	NAK
IN	0xbeef	0x55	11	NOHSK
HNDSHK	0xbeef	0x30	0	
IN	0xbeef	0x30	0	ACK
HNDSHK	0x80	0x14	2	
ISO OUT	0x80	0x14	2	ACK
MMC	0xbeef	0x0		
MMC	0x80	0x0		

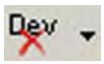
Type	Host Address	Device Address	End Point	Acknowledge
All	All	All	All	All
HNDSHK	0x80	0x14	2	
HNDSHK	0xbeef	0x30	0	
IN	0xbeef	0x30	0	ACK
IN	0xbeef	0x55	11	NOHSK
IN	0xbeef	0x55	11	NAK
IN	0xbeef	0x55	11	ACK
ISO OUT	0x80	0x14	2	ACK
MMC	0x80	0x0		
MMC	0xbeef	0x0		

Figure 36. Toggling Type Sort Order

Filtering Toolbar

Filter Enable button enables the Advanced Filter selection button.

Advanced Filter button opens the Advanced Filter specification dialog.



Hide Device button hides packets associated with specific hardware. Click the down arrow on the button to select hardware.

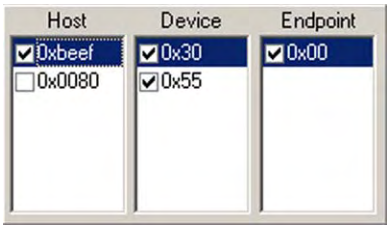


Figure 37. Specify Hardware to Hide

Hide Transaction Group Packets with no WUSB Data Packets button.

Hide Naked Packets button.

Hide no Handshake WUSB Packets button.

Advanced Filter

The Filtering patterns option allows you to modify the Sample Viewer display to show or hide Packets with a set of user defined patterns.

In order to set up filtering, you must have a viewer display open and enable the filter.

Filter Setup

Click the **Filter Enable** button to enable the filter.

To display the Filter setup dialog, click the **Filter** button on the Viewer toolbar or, click **Filter** on the main menu bar and choose **Advanced Filter**.

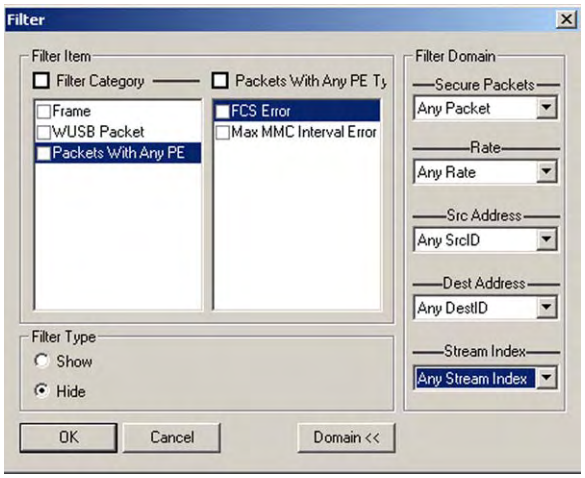


Figure 38. Filter Setup Dialog

1. Choose the packets that you wish to filter in the **Filter Item** area.
2. Define the filtering domain by choosing options for **Secure Packets**, **Rate**, **Src Address**, **Dest Address** and **Stream Index**.
3. Items selected for filtering may be designated as Show or Hide by selecting the corresponding option for **Filter Type.**

Using Pointers and Bookmarks

Pointers

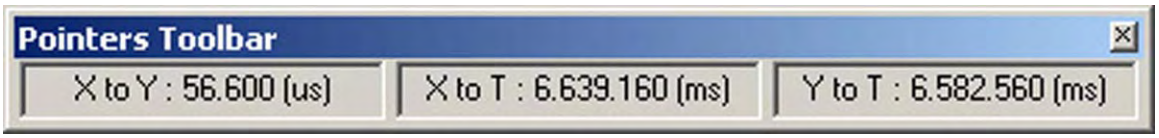
The data viewer display incorporates three cursors labeled **X, Y** and **T.** The X,Y pointers are initially overlaid and positioned at location 0. The Trigger, or **T**, pointer shows the trigger point in the captured sample and is the measurement reference.

Positioning the X Pointer To position the X-Pointer within the viewer data display, click the left mouse button in the gray bar on the left side of the sample viewer next to the line where you wish to see the pointer.

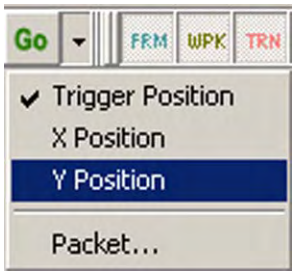
Positioning the Y Pointer To position the Y-pointer within the viewer data display, click the right mouse button in the gray bar on the left side of the sample viewer next to the line where you wish to see the pointer.

Note: You may also left click to set the X-pointer and right click to set the Y pointer in the frame and the column view by clicking in the narrow strip on the very left side of a cell.

Time differences between the pointers are displayed in the pointer position toolbar. To display the pointer position toolbar, click **View** on the main menu bar then **Toolbar** and choose **Pointers**.



Locate Pointers To quickly locate any of the pointers within the sample viewer display, click the **Go To** button and choose the pointer to locate. You may also locate the cursors by selecting Go To from the Edit menu and choosing the pointer to locate.

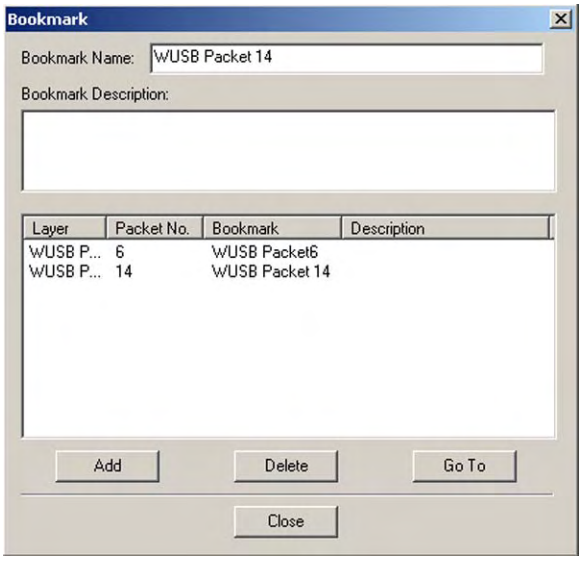


Bookmarks

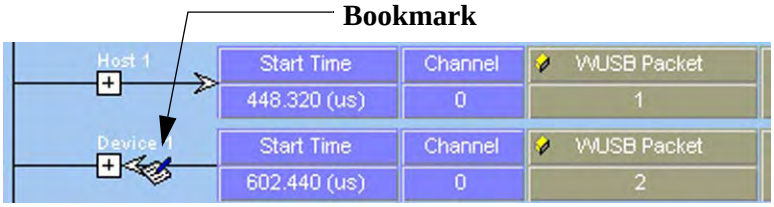
Bookmarks is a convenient way to mark a point in the data viewer display by name, such that you can rapidly return to that point. To create a bookmark:

1. Right click in the sample viewer on a packet where you wish to place the bookmark.

2. Choose **Bookmark** from the shortcut menu to open the Bookmark dialog.



3. Choose a name for the bookmark. enter a description for the bookmark and click the **Add** button. Repeat for additional bookmarks.



Finding a Bookmark

To find a bookmark, right click the mouse in the sample viewer and click bookmark.

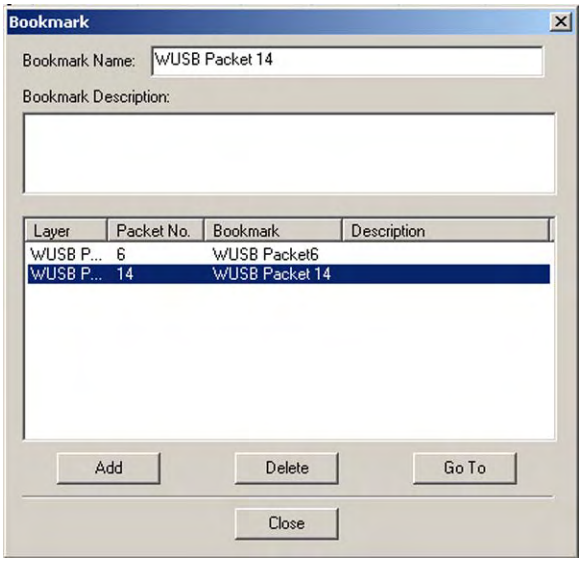


Figure 39. Go To Bookmark Dialog Box

Highlight the bookmark that you wish to go to and click the **Go** button.

Search

The search option permits you to examine any data capture file to quickly locate packets of interest.

Whenever an initial sample file is displayed, the **Search,** button is enabled on the Viewer toolbar.

To perform a search, click the **Search** button to open the search setup dialog as shown in Figure 40. You may also perform the search by selecting Search from the Edit menu.

Note: Only items captured in the sample file are enabled for search.

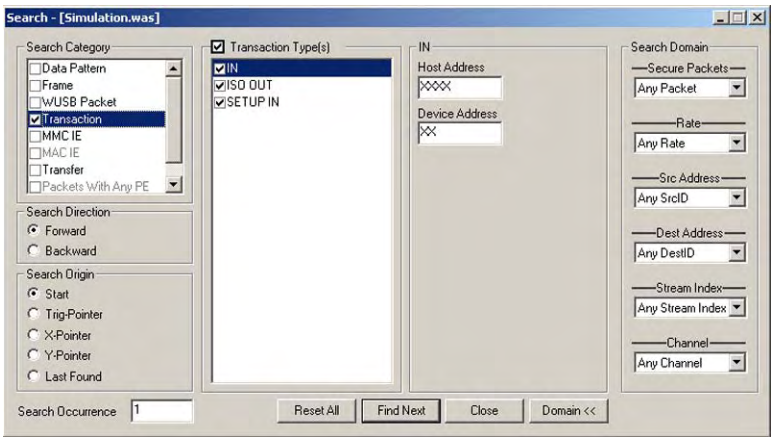


Figure 40. Search Parameter Definition Dialog Box

Search Category Choose a search category by checking a category box in the Search Category area.

Each of the search categories when selected offers additional choices to refine the search. Check the desired items for the selected category.

Search Direction The default setting is **Forward**. With this setting clicking **Find Next** will locate the specified search item from the current position forward. Check **Backward** to search backward from the current position.

Search From Choose a starting to begin or continue a search.

- Start of the sample file
- Trigger Pointer
- X Pointer
- Y Pointer
- Last Found

Click the **Find Next** button to perform the specified search.

You may continue to search the output file for the same pattern by clicking the **Find Next** button until you redefine the data capture search parameters.

Data Pattern

Search for Data Pattern allows you to search for:

- A specific Data Pattern
- Data Payload Length
- Data Pattern and Data Payload Length

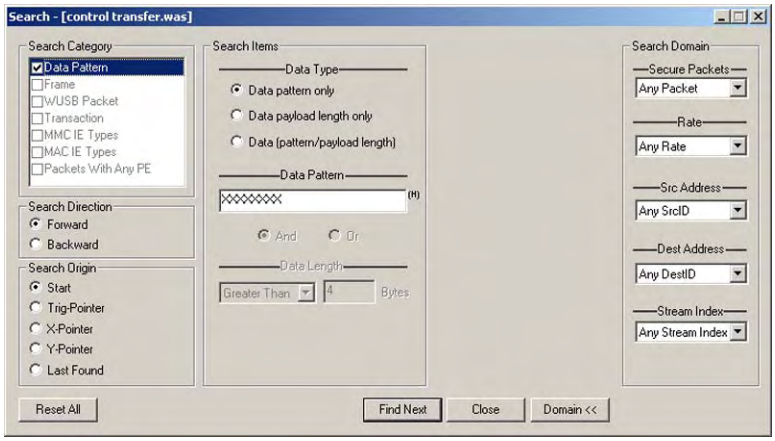


Figure 41. Search for Data Pattern

Search Domain

Define the search domain by choosing options for **Secure Packets**, **Rate**, **Src Address**, **Dest Address** and **Stream Index**.

Display Configuration

The Analyzer ships with a default display configuration of field and viewer settings. You may, however, define your own field and viewer settings for a particular testing scenario. The View Packets Display Configuration dialog allows the user to change the following display settings:

- Field settings
  - Data format
  - Fields, header, data background and text color.
  - Hide/Show field (Check/uncheck Visible)
- Viewer Settings
  - Change fonts
  - Wrap packets
  - Enable/Disable tool tip
  - Fit Text to cells
- Time Stamp Origin
- Save Display Configurations in a file.
- Load Display Configuration settings from a file.

To configure the display for your preferences click **Configuration** on the main toolbar and choose **Viewer Configuration**.

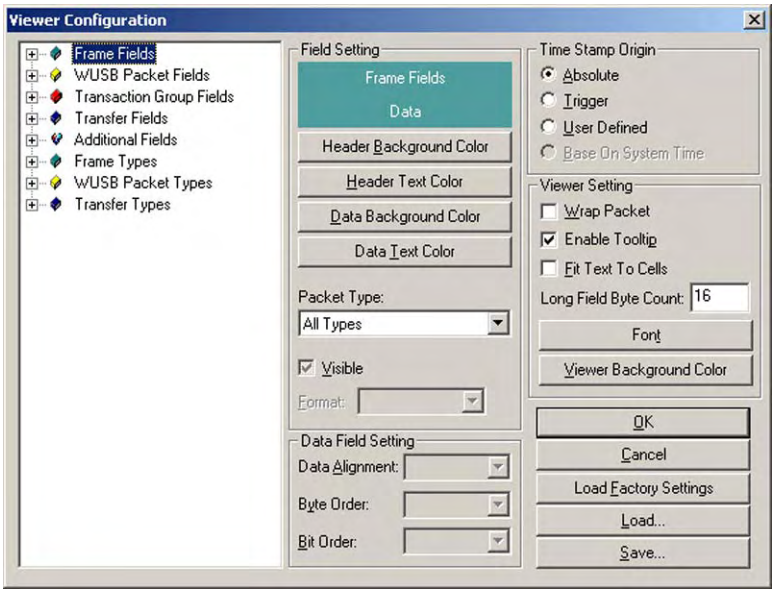


Figure 42. View Packets Viewer Configuration Dialog

Field Settings

To view a packet field, select a field from the packet field tree and check the Visible box. Uncheck it to hide the field. To change the data format of a packet field, select the field and choose a data format from the Format drop-down list.

Viewer Settings	Check the Wrap Packet box to enable the wrapping of packets in the display. Check the **Enable Tooltip** box to enable tool tips for packet fields. To change the length of long byte fields displayed, enter a number of bytes to display in the **Long Field Byte Count** text box. Choose **Time Stamp Origin** by checking **Absolute, Trigger**, **Current Position** or **System time** option button**.**
Color	To change the background or text color in a packet field header or data, select it from the packet field tree and click the desired button. Choose an appropriate color and click **OK**.
Display Fonts	To change display fonts, click the **Font** button to open the Font dialog box. Choose the desired font, font style, size and click **OK.**

When finished, click **OK** to save changes and close the Display Configuration dialog.

Appendix A

Creating a Frame Generator Pattern File

A Frame Generator pattern file (*.wpg) is a user defined text file that is used by the Analyzer hardware to generate specific frames. To create a Pattern file you may use any text editor or word processor observing the following criteria:

File Size

Each file is limited to a maximum of 128K 4-byte wide lines.

Commenting

You may add comments to each line, which must be preceded by double slashes (//) as shown in the following example.

```
01 00 00 00    01 00 00 00    01 00 00 00    01 00 00 00   // Line 1
00 00 00 00    01 00 00 00    01 00 00 00    01 00 11 00   // Line 2
00 00 00 00    01 00 00 00    01 00 00 00    01 00 00 00    // Line 3
```

File Structure

Each 32-bit line of a Pattern file uses a bit and byte structure as described in Figure 43.

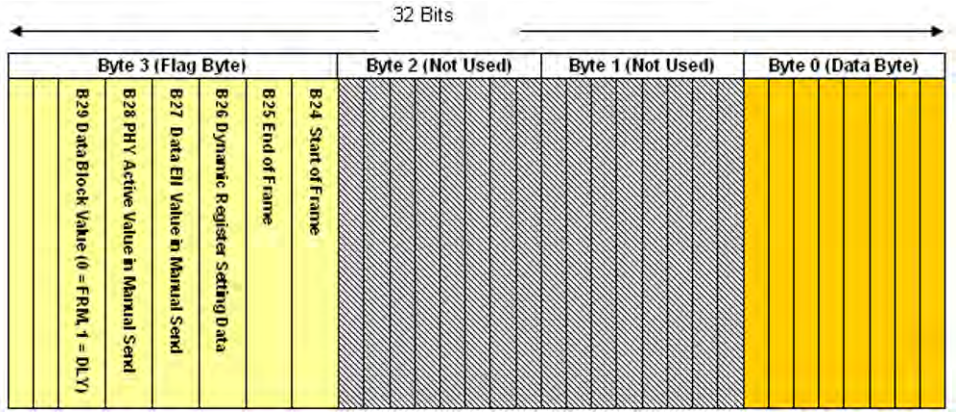


Figure 43. Bit and Byte Format for Each Line in Pattern File.

Byte Definitions

Each line in a Pattern file consists of four bytes, Bytes 3, 2, 1 and 0.

Byte 3 is the *Flag Byte* and is the left-most byte on each line. This byte must be defined for all lines in the Pattern file. Definitions for Byte 3 are as follows:

Bit31 and 30:	Reserved
Bit29:	Must be set to zero in Frames and to one in Delay values.
Bit28 and 27:	Must be set in Manual Loop-Back mode (used for internal test of Analyzer).
Bit26:	Must set to one in the fourth line of each Frame and to zero in all other lines.
Bit25:	Must set to one in the end line of Frames and to zero in all other lines.
Bit24:	Must set to one in the start line of Frames and zero in all other lines.

Bytes 2 and 1 are not used and are reserved for future use.

Byte 0 is the *Data Byte*, located as the right-most byte on each line. This byte contains either frame bytes (for frame *blocks*) or a delay value, which is used to define delays between successive frames.

Frame Format

The frame block format is defined to be consistent with definitions prescribed by the *MBOA/WiMedia MAC/PHY Interface Specification, Release 1.0.* Based on this specification, a transmit frame consists of PHY header, MAC header, MAC payload, and an FCS. The Frame structure is shown in Figure 44.

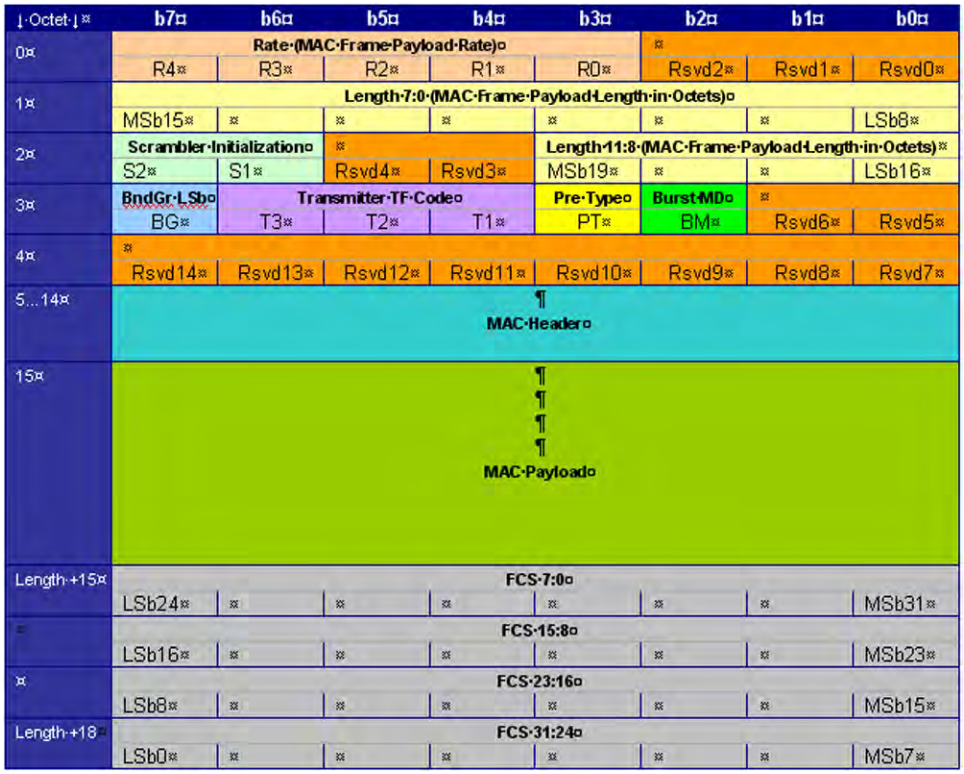


Figure 44. Frame Fields Definition.

As seen in the figure above, a frame is a stream of structured, formatted bytes, defined in a specific order. The user must insert the desired bytes/values of the frame in the data byte portion of the Pattern file (Byte 0).

Frame Example

The following is a Pattern (*.wpg) example of an application-specific control frame. Figure 45.shows the information defined for the frame.

```
01 00 00 00  // Start of PHY Header - Octets 0 through 4
00 00 00 38
00 00 00 00
04 00 00 90
00 00 00 00 // End of PHY Header

00 00 00 48 // Start of MAC Header - Octets 5 through 14
00 00 00 1C
00 00 00 00
00 00 00 01
00 00 00 EF
00 00 00 BE
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 C0 // End of MAC Header

00 00 00 00 // Start of MAC Payload - Begins at Octet 15
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 24
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 FF
00 00 00 FF
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 1A
00 00 00 80
00 00 00 70
00 00 00 1A
```

00 00 00 00
00 00 00 30
00 00 00 05
00 00 00 00
00 00 00 A7
00 00 00 25
00 00 00 0A
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 80
00 00 00 06
00 00 00 00
00 00 00 01
00 00 00 00
00 00 00 00
00 00 00 40
00 00 00 00
00 00 00 00
00 00 00 FF
00 00 00 03
00 00 00 FF
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11 //End of MAC Payload

00 00 00 43 // Start of FCS - Octet Length + 15
00 00 00 23
00 00 00 BA
02 00 00 05 // End of FCS

PHY Header: 00 38 00 90 00

Rate	53.3 Mb/s
Length	56 (0x38)
Scrambler	00 (S2=0, S1=0)
BM	0 (binary)
PT	0 (binary)
TX_TFC	1 (T1=1, T2=0, T3=0)
BG	1 (binary)

MAC Header: 48 1C 00 01 EF BE 00 00 00 C0

Frame Control	0x1C48
Destination ID	0x1000
Source ID	0xBEEF
Sequence Ctrl	0x0000
Acc Information	0xC000

Payload:
00 00 00 00 24 00 00 00
00 00 00 00 00 00 00 FF
FF 00 00 00 00 00 1A 80
70 1A 00 30 05 00 A7 25
0A 00 00 00 80 06 00 01
00 00 40 00 00 FF 03 FF
11 11 11 11 11 11 11 11

FCS: 43 23 BA 05

Figure 45. Information in Frame Example

Delay Block

In addition to a frame block, a Pattern file allows the insertion of delay blocks. A delay block format is a 4-line instruction, used by the Analyzer hardware to create delays between frames. A delay block is a 32-bit time interval, which counts with a 66MHz clock and can define an up to 65-second interval. The following formula describes delay time:

Delay Value = Delay time(S) * 66000000

Fixed Delay

There is a fixed delay between frames even if the user has not defined a delay value between frames. (It is about 2uSec for Single frames and 1.875uSec for Burst frames).
Delay Block Format

To add an additional delay between frames, the user must add a delay block between the desired frames. The format of delay block is described in Figure 46.

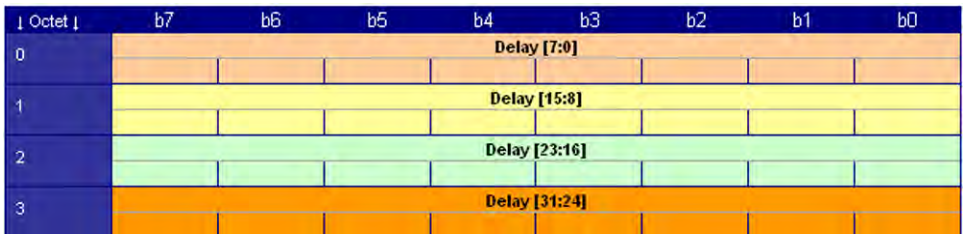


Figure 46. Delay Block Definition Format

Location of Delay Blocks

Delay block bytes must be inserted in the data byte fields (i.e., Byte 0). The following is an example that defines a delay block in a Pattern file:

For example (6us):

Delay Value = 396 (0x18C)

20 00 00 8C
20 00 00 01
20 00 00 00
20 00 00 00

Example

The following is an example file including an MMC packet and three DATA packets.

//---------- MMC 1

// PHY header
01 00 00 00
00 00 00 38
00 00 00 00
04 00 00 90
00 00 00 00

// MAC header
00 00 00 48
00 00 00 1C
00 00 00 00
00 00 00 01
00 00 00 EF
00 00 00 BE
00 00 00 00
00 00 00 00
00 00 00 00

00 00 00 C0

// Security
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 24
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00

// WUSB App Code
00 00 00 00
00 00 00 01

//MMC Code
00 00 00 01

// Next MMC
00 00 00 FF
00 00 00 FF

// Reserved
00 00 00 00
00 00 00 00

// WUSB channel Time
00 00 00 00
00 00 00 00
00 00 00 00

//////////////// WCTA IE

// IE Length
00 00 00 1a

// IE Identifier = WCTA_IE
00 00 00 80

//////////////// W_DR_CTA (12 bytes)

// EP, Setup flag, WCTA Type
00 00 00 70

```
// Start time
00 00 00 1A
00 00 00 00

// Device ID
00 00 00 30

// TXAttribute
00 00 00 05
00 00 00 00 // High bit is control status
00 00 00 A7
00 00 00 25

// bvDINAck
00 00 00 0A
00 00 00 00
00 00 00 00
00 00 00 00

// setup bytes
00 00 00 80
00 00 00 06
00 00 00 00
00 00 00 01
00 00 00 00
00 00 00 00
00 00 00 40
00 00 00 00

//////////////// EOL

// EP, Setup flag, WCTA Type
00 00 00 00

// Start time
00 00 00 FF
00 00 00 03

// Device ID
00 00 00 FF

//////////////

// MIC
00 00 00 11
00 00 00 11
00 00 00 11
```

00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11

//////////////

// FCS
00 00 00 56
00 00 00 51
00 00 00 90
02 00 00 E3

//---------- IN DATA 1

//PHY header
01 00 00 00
00 00 00 1E
00 00 00 00
04 00 00 90
00 00 00 00

// MAC header
00 00 00 C8
00 00 00 12
00 00 00 EF
00 00 00 BE
00 00 00 30
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 C0

// Security
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 02
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00

00 00 00 00
00 00 00 00

// WUSB header
00 00 00 00
00 00 00 00 // Low 4 bit is sequence number

// Data payload
00 00 00 12
00 00 00 01
00 00 00 00
00 00 00 01
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 08

// MIC
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11

// FCS
00 00 00 CE
00 00 00 FD
00 00 00 E6
02 00 00 83

//---------- IN DATA 2

//PHY header
01 00 00 00
00 00 00 1E
00 00 00 00
04 00 00 90
00 00 00 00

// MAC header
00 00 00 C8
00 00 00 12
00 00 00 EF

00 00 00 BE
00 00 00 30
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 C0

// Security
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 02
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00

// WUSB header
00 00 00 00
00 00 00 01 // Low 4 bit is sequence number

// Data payload
00 00 00 FA
00 00 00 04
00 00 00 01
00 00 00 42
00 00 00 A2
00 00 00 00
00 00 00 00
00 00 00 00

// MIC
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11

// FCS
00 00 00 B6

00 00 00 E3
00 00 00 35
02 00 00 93

//---------- IN DATA 3

//PHY header
01 00 00 00
00 00 00 18
00 00 00 00
04 00 00 90
00 00 00 00

// MAC header
00 00 00 C8
00 00 00 12
00 00 00 EF
00 00 00 BE
00 00 00 30
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 C0

// Security
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 02
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00
00 00 00 00

// WUSB header
00 00 00 00
00 00 00 02 // Low 4 bit is sequence number

// Data payload
00 00 00 00
00 00 00 01

// MIC

00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11
00 00 00 11

// FCS
00 00 00 B2
00 00 00 22
00 00 00 82
02 00 00 0E

Appendix B

Advanced Script Language (ASL)

The Advanced Script Language (ASL) is an extension of the Upper Level Protocol Decodes that allows you to define custom upper level protocol decodes in addition to those provided with the product.

The ASL, as defined, enables the user to extract and interpret arbitrary data from the UWB stream by creating custom scripts.

The ASL protocol decodes may be used to decode any class or vendor-specific requests and descriptors, protocols or any structured data transferred over the USB bus, or can be used to complement pre-defined protocols.

This appendix is the essential reference for ASL users including definitions, code snippets, and complete examples. The decode script files can be written in any text editor or using the Catalyst script editor and must be saved with an *.asl file extension.

Document conventions

This appendix uses the following convention to describe the script syntax.

Text Style	Meaning
bold	Functions, statements, or other reserved keywords
italics	Identifiers
underscored	Expressions
< >	Code enclosed in "<" and ">" is optional
normal	Integer constants
" "	Strings
parameter1 ,…, parameterN	Multiple entries
option1 | option2	Choice of options

Language Elements

Integers

ASL accepts integer values in decimal, binary, or hexadecimal formats. Floating point and negative numbers are not accepted.

Examples:

Hexadecimal: `0x21, 0x0001, 0xA5A5`

Binary: `0b00100001, 0b1, 0b101001011010010110100101`

Decimal: `33, 1, 42405`

Strings

Strings in ASL are permitted to be static character strings, or can contain variable values that are calculated at runtime.

"Constant1 (optional) %d (%x, %b) Constant2 (Optional), Value"

Constant1 and constant2 are optional. These can be any character string.

The value of the expressions is replaced by the corresponding strings in either decimal (%d), hexadecimal (%x), or binary (%b) formats.

Examples:

```
"This is a static string"
"Field length is %d, LengthOf(F1)"
```

Operators

The following lists the operators accepted by ASL. Operator precedence is that same as in C.

Operator	**Function**
( )	Associative
and	Logical And
or	Logical Or
not	Logical Not
>	Greater than
<	Less than
<>	Equal to
=	Assignment
+	Arithmetic Addition
-	Arithmetic Subtraction
*	Arithmetic Multiplication
/	Arithmetic Division

Expressions

The expressions consist of one or more Integers, Functions, or Operators. For more detail about functions see page 96.

Examples:

```
Expression 1: 0x2A and LengthOf(F1)
Expression 2:(ValueOf(F1)<2) or not (LengthOf(F2)<>10)
Expression 3:(4 + LengthOf(F1))* ValueOf(F2)
```

The priority of evaluation is as follows:

Not, (

*, and

+, or

Comments

Comments are enclosed in '/*' and '*/' and may span multiple lines.

```
Examples:
/* This is a single line comment */
/* This
    is a multi-line
   comment */
```

ASL Structure

An ASL Script file includes two types of sections:

- Protocol Extraction Section
- Protocol Decoding Section

Each ASL script may include only one of each section type. Each script file must contain a *Protocol Extraction* section, and a *Protocol Decoding* section.

Each section serves a specific function during the decoding process.

Section Type	Function
Protocol Extraction	Instructs the decoder on how to extract the high-level protocol data from UWB transactions.
Protocol Decoding	Breaks the extracted data stream into protocol fields and decodes the data per each field.

A section consists of one or more blocks. A block is a procedure that is formed with a series of statements that are enclosed within the block. Each block has a dedicated function within the section and follows one of two formats as shown:

```
Blockname
    Statement1;
    Statement2;
    ….
    StatementN;
EndBlock
```

or

```
{
    Statement1;
    Statement2;
    ….
    StatementN;
}
```

Protocol Extraction Section

The decoding section is written as follows starts with **[Decoding]** and ends with the **End** keyword.

```
[Decoding]
     Define Field Option Block
     Value Ranges Block
     Main Block
End
```

The Main block contains statements. See “ASL Statements” on page 89

Product Section

The product section identifies the product by name, such as SBAE for UWB.

```
[ProductName= SBAE]
End
```

Protocol Decoding Section

This Section consists of a Define Option Block a Valid Range Bock and a Decoding Statement. Keywords designate the start and the end of each block.

Define Option Block

DefineOptions
fieldId1 **= (Description1, Value11-Value12 ;**
Description2, Value21-Value22;
Description3, Value3);
fieldId **2 = (Description4, Value4 ;**
Description5, Value51, Value52;
…);
EndOptions

Remark

If a protocol has a field such that each value of that field has an equivalent string, ASL names this field as an optional field. User can define different options of all optional fields by the Define option statement.

FieldId is a string that specifies Id of optional field.

Parameters

Value1 is the lower range for the data of the field with the specified fieldId.

Value2 is the upper range for the data of the field with the specified fieldId.

This value is optional. If you want to specify a range for one of the options of a field, you must use Value2 for this purpose.

Description:

This string is the description for specified range (Value1 to Value2) or specified value.

Example

```
/* F3, F4, F1 and BlockStatus are fields. */
DefineOptions
     F3 = (“First Option”, 0x0000-0x1000;
           “Second Option”, 0x1001-4352);
     F4 = (“Option 1 for F4”, 0x0-14,
           “Option 2 for F4”, 0x0f);
     F1 =(“Option for F1”, 0x00-0xff);
     BlockStatus = (“Option for BlockStatus”, 0-
     0x1100);
EndOptions
```

Valid Range Block

ValidRanges
filedId 1 **= (Value1 , Value2);**
filedId 2 **= (Value1 , Value2);**
…
EndValidRanges

Remark

This statement specifies the valid range of data that can be set in a field. If the data set in the field is not within a valid range a protocol error will be generated at run time.

Parameters

Value1 is the lower range for the data of the field with the specified fieldId.

Value2 is the upper range for the data of the field with the specified fieldId.

Example

```
/*F4, F1, BlockID are fields.*/

 ValidRanges

     F4=(0x00, 0xAA);
     BlockID = (0,32);
     F1=(0b00001,0b0101010);

EndValidRanges
```

ASL Statements

Addfield

fieldId **= AddField (StartBit, Length, Name, Description, Abbreviation, BitOrder)**

Remark

This statement adds a field to a packet with given specification. This function increases CURPOS one *Length*.

CURPOS is a pointer that when a field added moves on input data, it points to the current index of the data for the next field.

fieldId:	FieldId is a string that specifies Id of fields. Each field has a unique Id. This Id is used to refer to that field.

Parameters

StartBit	This parameter specifies the start bit position of the specified field. The value of this parameter can be an Expression.
Length	This parameter specifies the length of the specified field in bits. The value of this parameter can be an Expression.
Name	This parameter specifies the Name of the field.
Description	This parameter specifies the description of the field. For the format of this parameter see “Strings” on page 84.
Abbreviation	This parameter specifies the Abbreviation of the field. If the field name is long you can use an abbreviation for the filed. In the first version of ASL the abbreviation of a field does not show in viewer. For the format of this parameter see “Strings” on page 84.
BitOrder	This parameter specifies the bit order of data of a field. The value of this parameter can be either **MSBLEFT** or **LSBLEFT**. This parameter is optional and if user does not specify a value the default value MSBLEFT.

Example

```
/* This statement adds a field at bit #2 of packet
with the length of 3 bits. The data of this field
will be read from // Lowest Bit. */

F1 = AddField(2, 3, ”Name of Field”, ”This field
is the flag field.”, ”Abbreviation of field”,
LSBLEFT);
```

BitStuff

BitStuff (FieldId , n)

Remark

If in a protocol one field transfer after bitstuffing algorithm the user can see the value of that field by using the BitStuff statement. This statement runs an unstuff algorithm on the specified field.

Parameters

FieldId	The field Id that was defined by AddField.
n	The number of bits for bitstuffing.

Example

```
/* run the bitstuff algorithm on 5 bits of continuous 1
. */
Flag = AddField(0,8, "Falg","Falg","");
Data = AddField(8,LengthOf(INPUTDATA) - (CURPOS
+16),"Data","Data","");
FCS = AddField(CURPOS,16, "FCS","FCS","");
BitStuff(Data,5);
```

Note : The BitStuff function must be placed after all AddFields.

GetData

DataId **= GetData (StartBit, Length)**

Remark

This statement copies a data segment with a given specification from INPUTDATA to *DataId*. The user can use from copied data with referring to *DataId*. This function does not increases CURPOS. If user needs to know the value of a segment of data without adding a field, he can use this statement.

Note: INPUTDATA is an ASL keyword that identifies the input data stream that will be passed to the script for decoding.

DataId	The fieldId that was defined by AddField.

Parameters

StartBit	Specifies the start bit position of the specified field. Value of this parameter can be an Expression.
Length	Specifies the length of the specified Data in bits. The value of this parameter can be an Expression.

Example

```
/*This function Puts the Data from Bit#0 to Bit#9
in a dataId named D31.  */
DataSegment = GetData (0,9);
```

If

If Expresssion Then
Block1
Else If Expresssion Then
Block2
Else If Expresssion Then
Block3
…
Else
Block4

Remark

The **if** statement evaluates expressions.(For information about expressions see “Expressions” on page 85

The **if** executes *block1* if the *expression* is true (nonzero); if **else** is present and *expression* is false (zero), it executes *block2* ;…

After executing *block1* or block*2*, control passes to the next statement.

Each block may have several inner if.

Example

```
If CURPOS > 5 and ValueOf(F1) < 8 Then
     {
     H1 = AddField(CURPOS,8,"H1","Field H1","H1");
     }
Else if(CURPOS < 9) then
     {
     H2 = AddField(CURPOS,8,"H2","Field H2","H2");
}
else
     {
     H4 = AddField(CURPOS,548,"H4","Field H4","H4");
     }
```

Repeat

Repeat Expresssion
Block

Remark

This statement repeats all commands in block until the Expression is TRUE.

Example

```
     F1 = AddField(0, 20, "Field1", "It starts form
     bit# 2", "F1");
     F2 = AddField(20, 40, "Field2", "This field is
     used for..", "F2");
     F31 = GetData(32, 10);

/* This loop will repeat till current position > 34 (in
bits)*/
Repeat CURPOS < 100
{
     F1 = AddField(CURPOS, 23, "SubField of field f1",
     "subfield of f1",
     "subfield");
}
```

Repeat Count

Repeat Count = Expression
Block

Remark

This statement repeats all commands in block as many times as the value of Expression.

Example

```
F1 = AddField(2, 3, "Field1", "It starts form bit# 2",
     "F1");
F2 = AddField(2, 3, "Field2", "This field is used
     for..", "F2");
F31 = GetData(32, 343);
F31 = GetData(0b01010101, 349843);


/* this loop will be run 2 times. */
Repeat Count = 2
{
     F1 = AddField(CURPOS, 23, "SubField of field f1",
     "subfield of f1",
     "subfield");
}
```

SubFieldOf

SubFieldOf (*FiledId* [, *Separeted*])

Block

Remark

This statement specifies the sub fields of a specific field. Note that all AddField statements that exist in the body of the SubField statement are relative to the specified filed. When user defines sub fields of a field, the packet view will show sub fields below the field in the viewer and the user can expand/collapse the sub fields. If the user would like the packet view to show sub fields in a separated table, he must write the *Separated* keyword after FieldId.

Parameters

FieldId The field Id that was defined by AddField.

Separated: Is a constant keyword that specifies the defined subfield to appear in a separate table instead of bellow the parent field.

Example

```
F1 = AddField(2, 3, "Field1", "It starts form bit# 2",
     "F1");
F2 = AddField(5, 3, "Field2", "This field is used
     for..", "F2");

SubFieldOf(F1)
{
     s1 = AddField(0, 1, "Subfield1", "This is subfield
     of F1",
     "s1");
     s2 = AddField(1, 2, "s2", "a Subfield of f1",
           "subfield  f1");
}

SubFieldOf(F2, Separated)  /* Viewerwill show these
     subfields in a separared table */
{
     s21 = AddField(0, 1, "Subfield1", "This is
     subfield of F2",
     "s1");
     s22 = AddField(1, 2, "s2", "a Subfield of f2",
           "subfield  f1");
}
```

User can define inner SubFieldOf statements up to 8 levels.

SetTableHeader

SetTableHeader(*string*);
SetTableHeader(*OptionalFieldId*);

Remark

This statement sets the table header of interpreted data. The viewer will show the *string* in the header of the table that shows the interpretation of data. If user uses the **SetTableHeader(*OptionalFieldId*)** form of this statement, then the option string of the specified ***OptionalFieldId*** will be set as table header.

Parameter

String	Specifies the string that will show in the header of the table.
OptionalFieldId	Specifies the FieldId of an optional field.

Example

```
OpCode = AddField (0, 8, “Op Code”, “Op Code”,
“Op Code”);
If (ValueOf (OpCode) = 0x01) then      /* Read
command */
{
      SetTableHeader (“Read”);
      /*  Remained decoding */
}
```

SetFieldTableHeader

SetFieldTableHeader(*FieldId, string*);
SetFieldTableHeader(*FieldId, OptionalFieldId*);

Remark

This statement sets the table header if the user has specified that sub fields of a field are shown as separate table. (See SubFieldOf statement).

If the user uses the **SetFieldTableHeader(*FieldId, string*)** form of this statement, the specified ***string*** will be set in the table header, and if user use **SetFieldTableHeader(*FieldId, OptionalFieldId*)** form of this statement, the option string of the specified ***OptionalFieldId*** will be set in the table header. For more information about optional field please see See “Define Option Block” on page 87..

Parameters

FieldId	The field Id that was defined by AddField
String	The string that user wants to show in the header of the table.
OptionalFieldId	Specifies FieldId of an optional field.

Example

```
OpCode = AddField (0, 8, “Op Code”, “Op Code”, “Op
    Code”);
Type = AddField (CURPOS, 8, “Type”, “Type”, “Type”);
SubFieldOf(Type, Separated)
{
    SetFieldTableHeader(Type, “Sub fields of type”);
    T1= AddField (0, 4, “T1”, “T1”, “T1”);
    T2= AddField (4, 8, “T2”, “T2”, “T2”);
}
```

Functions

LengthOf (Data)

Remark

This function returns the length of Data.

Parameters

Data	This parameter can be INPUTDATA or DataId of a data segment that was specified in the GetData statement or can be a field specified by AddField. If the user passes INPUTDATA as a parameter this function returns the length of all input data that is passed to the script for decoding.

StartOf (FIELDIdentifier)

Remark

This function returns the start position of the field that is specified by FieldIdentifier.

Parameters

FieldIdentifier	Identifier is the Id of a field that has been set by the AddField statement.

ValueOf (Identifier)

Remark

This function returns the value of the Identifier when the user needs to know the value of a field (or data segment that was specified by the GetData statement).

Parameters

Identifier	Identifier is the Id of a field that has been defined by the AddField statement or it can be *DataId*, that has been described in GetData Statement.

Find (StartBit, Value)

Remark

This function searches the input data from the given start bit for a specified value.It returns the first position of the first found value. If the value is not found it will return LengthOf(INPUTDATA) + 1.

Parameters

StartBit	This parameter specifies the start bit position from which to search from this location to the end of input data. The value of this parameter can be an Expression.
Value:	Value to be searched for in this call. Value can be a constant BIN or HEX number or can be a expression.

CURPOS

Remark

This function returns the current position of the cursor in bits of INPUTDATA.

At first, CURPOS is zero and increases one field's length in each Add Field call.

CURPOS has a local scope in script, that is in each SubFieldOf statement CURPOS has a local scope too. So in each SubFieldOf statement CURPOS will be set to zero and increase one sub field length and when return to out of sub field statement CURPOS value will be set to the value that it had before SubFieldof statement.

Example

```
F1 = AddField(0, 8, "F1", "F1", "F1");
F2 = AddField(CURPOS, 8, "F2", "F2", "F2");  /* CURPOS
is equal to 8 and will be 16 after this statement */
SubFieldOf(F2)
{
     F11 = AddField(0, 2, "F11", "F11", "F11") ;
     F12 = AddField(CURPOS, 2, "F12", "F12", "F12") ;
     /* CURPPOS = 2 */
     F13 = AddField(CURPOS, 4, "F13", "F13", "F13") ; /
     * CURPPOS = 4 */
}
F3 = AddField(CURPOS, 2, "F3", "F3", "F3"); /* CURPPOS = 16
     */
```

EOD

Remark

If CURPOS is at the end of data this function returns TRUE, If not it returns FALSE. That is, if all input data has been decoded, this function returns TRUE.

China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:

部件名称	有毒有害物质和元素					
	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:
温度: 5摄氏度到40摄氏度
湿度: 5% - 95%最大相对湿度 (无冷凝)
高度: 最高2000米

Part Name	Toxic or Hazardous Substances and Elements					
	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:

Temperature	5C to 40C
Humidity	5% to 95% max RH (non-condensing)
Altitude	Up to 2000 meters

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