FRONTLINE TEST SYSTEM™

SETUP AND QUICK START GUIDE

FTS4BT™

07-Dec-09 300-DOC-BT-000-040

Packing List for FTS4BT (Full Version)

* *Bluetooth*® ComProbe® USB Adapter
* USB 3-foot Extension Cable (Can be used with *Bluetooth* ComProbe)
* Cable Set (for serial HCI sniffing), containing one Routing Cable, one Monitor Head (beige), one Source Head (black), three male 9-pin to female 25-pin adapters and one female 9-pin to male 25-pin adapter
* CD Case containing FTS4BT application software CD-ROM and this Setup and Quick Start Guide

High Speed UART Option

* The EB ComProbe with cable set

Packing List for FTS4BT (All Trial Versions)

- *Bluetooth* ComProbe USB Adapter
- USB 3-foot Extension Cable (Can be used with *Bluetooth* ComProbe)

Some Trial Versions also include:

- Cable Set, containing one Routing Cable, one Monitor Head (beige), one Source Head (black), three male 9-pin to female 25-pin adapters and one female 9-pin to male 25-pin adapter
- CD Case containing FTS4BT application software CD-ROM and this Setup and Quick Start Guide

Minimum System Requirements

- PC with Windows XP (Service Pack 2 or higher), Windows Vista (32 bit) or Windows 7 (32 bit).
- Pentium 1GHz processor
- RAM Requirements: 1GB minimum, 2GB recommended
- 50 MB free Hard Disk Space (capture file size is only limited by disk size)

For Air Sniffing:

- 1 USB Port, preferably a USB 2.0 port

For Serial HCI Sniffing:

- Minimum of one COM port, two required for bi-directional monitoring when using cable set
- FTS4BT supports COM1 through COM64
- Maximum data rate supported is dependent on PC processor speed

For High Speed UART Option:

- Windows XP Service Pack 2 or higher
- One USB 2.0 High Speed enabled port. The EB ComProbe will not run on USB 1.1 Full Speed ports.

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Introduction

FTS4BT™ is a PC-based, *Bluetooth* protocol analyzer capable of sniffing *Bluetooth* data in five ways:

- Through the air
- From the Serial HCI interface between a *Bluetooth* Host CPU and a *Bluetooth* Host Controller
- From the USB HCI interface between a *Bluetooth* Host CPU and a *Bluetooth* Host Controller
- Optional High Speed UART
- By "virtual" sniffing via the product's Live Import feature, which permits any application to feed data into FTS4BT.

In this document, Serial HCI Sniffing Mode refers to sniffing over the HCI UART (also known as H4), HCI Three-Wire UART (also known as H5) and BCSP Transports.

This Setup and Quick Start Guide was designed to get you up and running quickly with FTS4BT. It provides a high-level overview of product installation, initialization, and operation. The FTS4BT interface is easy to use without training, but you will want to read the FTS4BT Tutorial (found in the FTS4BT folder on the desktop) and the online Help manual to learn how to take maximum advantage of all the features.

We have tried to make the online Help complete and easy to use. You can reach the online Help by choosing Help Topics from the Help menu, or by pressing the *F1* key from any window.

To access the PDF version of this Quick Start Guide from your Windows operating system, click *Start* |*Programs* |*FTS4BT* [version #] |*Bluetooth Quick Start Guide*.

FTS4BT Installation Instructions

Software Installation

Please refer to the installation and activation instructions in **Installing, Activating, and Managing Frontline Test System Products** in the installation folder.

Hardware Installation

As mentioned in the introduction, FTS4BT operates in five modes. Most of the configurations for three of these modes require hardware setup, and some instances require I/O settings as well. This section describes the setup procedures for each mode of operation. Skip to the sub-section for the mode you wish to use.

Air Sniffing Mode

Bluetooth ComProbe Installation on XP

Step 1.

Plug the *Bluetooth* ComProbe into a USB port. The *Found New Hardware Wizard* dialogue box appears which may ask you if you want to connect to Windows Update to search for software. Choose *No, not this time* and click *Next*. This process may vary slightly depending on your operating system.

Figure 1 Hardware Update Wizard

Step 2.

Choose *Install from a list or specific location* and click *Next*.

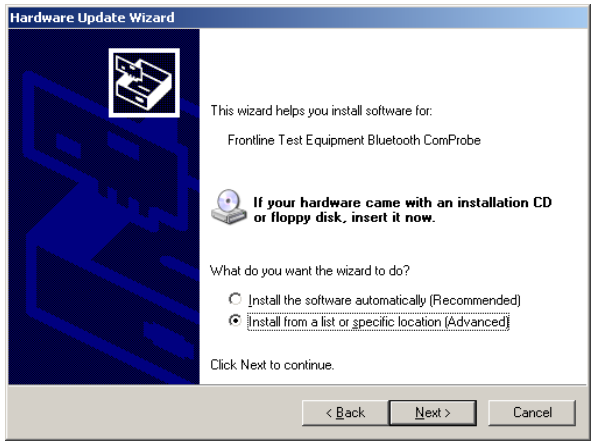


Figure 2 Hardware Update Wizard

Note that if you have already installed a *Bluetooth* ComProbe on your system you might not get the *Found New Hardware Wizard*. You may get this dialog in the future if you plug the *Bluetooth* ComProbe into a USB port that is different from one you have used previously.

Step 3.

Select the "Search for the best driver in these locations" radio button, and check only "Include this location in the search" checkbox. Browse to the directory where you installed FTS4BT. The default is C:\Program Files\Frontline Test System II\FTS4BT [version#]\Drivers*Bluetooth* ComProbe. Select the appropriate directory and click *OK*. This directory contains the *Bluetooth* ComProbe and the Windows driver information file (bluetoothComProbe.inf) needed to install the driver.

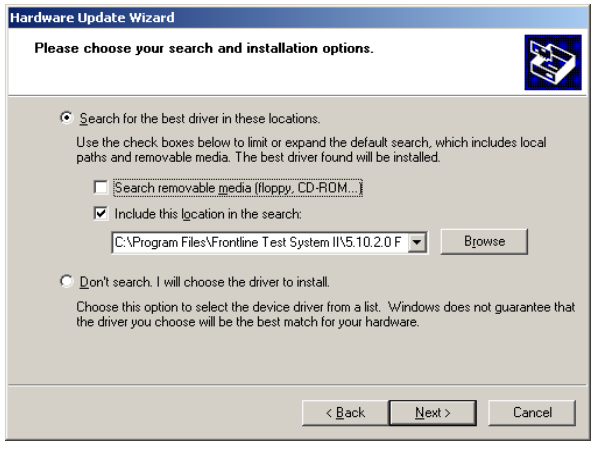


Figure 3 Select File Location Dialog

Step 4.

Click the *Next* button to finish the *Bluetooth* ComProbe installation. If you get a dialog box like the one below, don't worry—Click *Continue Anyway*.

Figure 4 Hardware Installation

Step 5.

Your computer will now install the *Bluetooth* ComProbe driver from the directory you selected; you will get a dialog box saying that the installation is finished. Click the *Finish* button to close the wizard.

The installation of the FTS4BT software and the *Bluetooth* ComProbe hardware is now complete.

You are now ready to begin capturing data. Skip to the section titled *Using FTS4BT*.

Bluetooth ComProbe Installation on Win7

The procedure for installing the ComProbe driver is different for Win7. Follow the steps below.

Step 1. Plug the *Bluetooth* ComProbe into a USB port. The *Found New Hardware Wizard* dialogue box appears, then disappears.

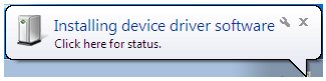


Figure 5 - Installing Driver - Win7

Then a message similar to this one appears/disappears indicating that the generic Bluetooth adapter has been installed.

Figure 6 - Driver Installed - Win7

Note: You may also see a message indicating that the driver was not installed correctly. In either case, you will go to the Step 2.

Step 2.

Go to the Control Panel and open the Device Manager.

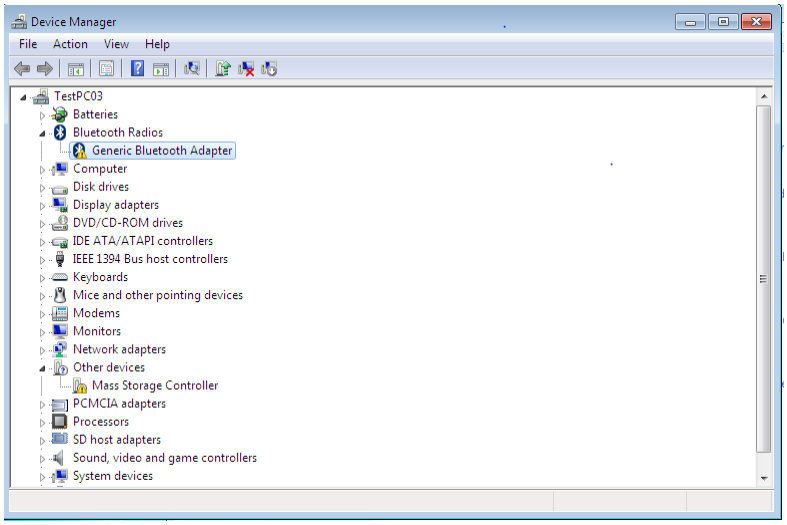


Figure 7- Device Manager - Win7

Right click on **Generic Bluetooth Adapter** and select **Update Driver Software.**

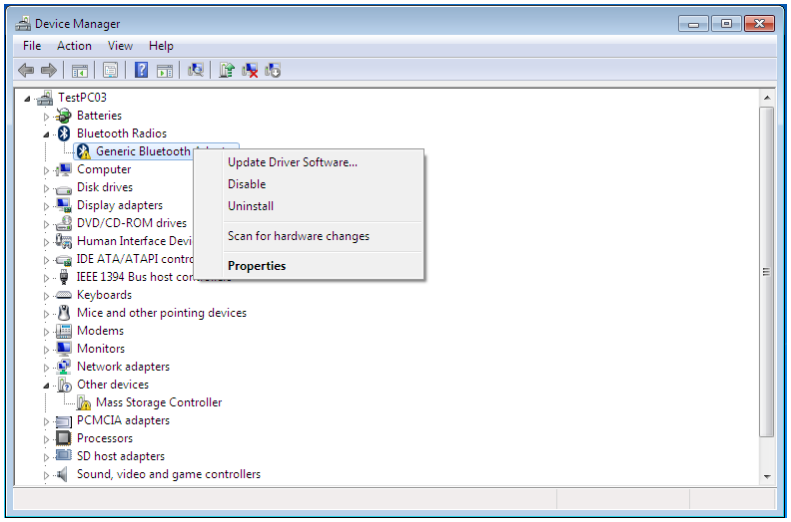


Figure 8 - Update Driver Software - Win7

Step 3.

The next step is to choose the driver location. Select **Browse my computer for driver software.**

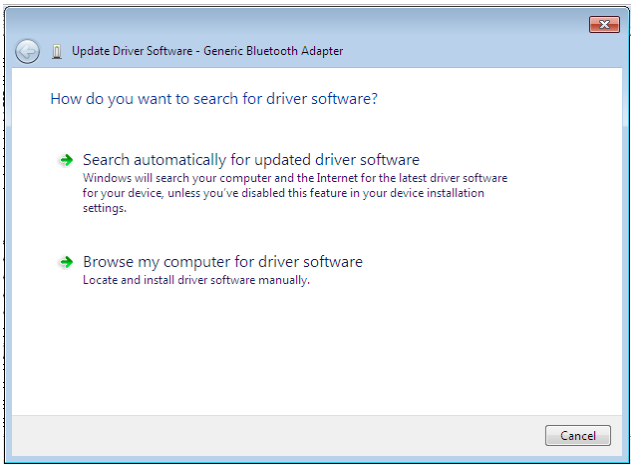


Figure 9 - Browse my Computer - Win7

Select **Let me pick from a list of device drivers on my computer**.

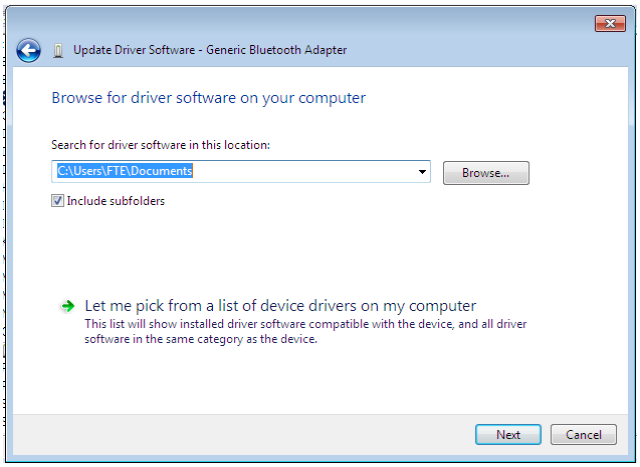


Figure 10 - List of Device Drivers - Win7

Step 4.

Select **Generic Bluetooth Adapter** under Model, then **Have Disk.**

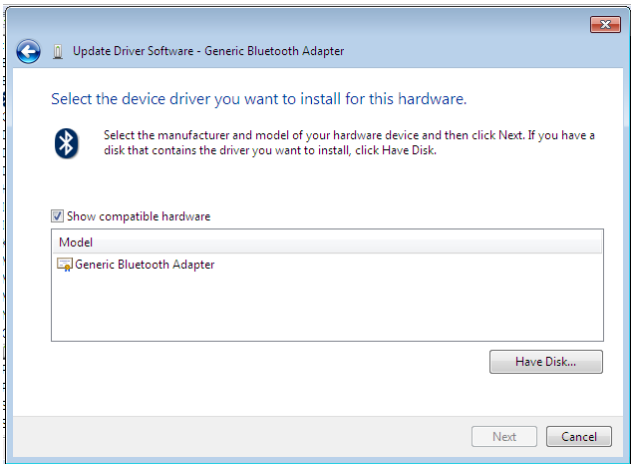


Figure 11 - Generic *Bluetooth* Adapter - Win7

Step 5.

On the Install From Disk dialog select **Browse**.

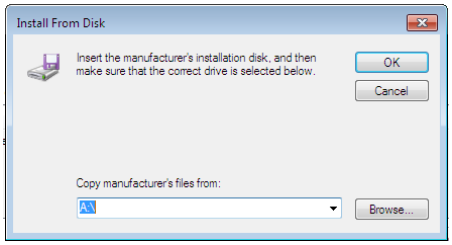


Figure 12 - Browse for Driver - Win7

Now you have to drill down to find the folder that contains the driver. The driver is located at: Windows7\Program Files\Frontline Test System II\Frontline [Application Name and #]\Drivers\Bluetooth ComProbe.

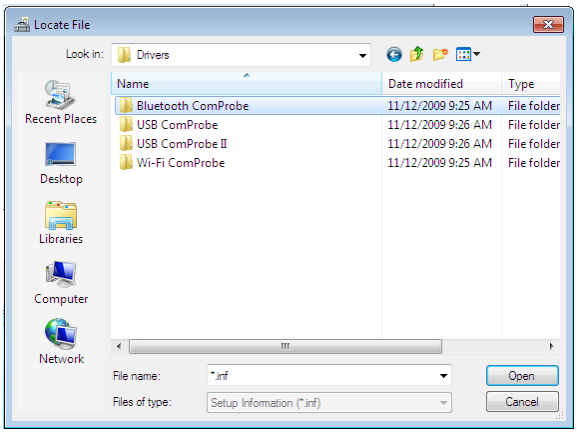


Figure 13 - Select Driver Location - Win7

Double-click on the **Bluetooth ComProbe** folder.

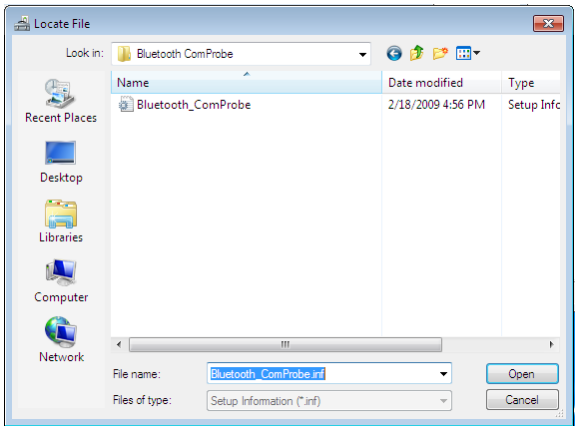


Figure 14 - Bluetooth ComProbe - Win7

Select the **Bluetooth_ComProbe** file and click **Open**.

Step 6.

On the **Install From Disk** dialog select **OK**.

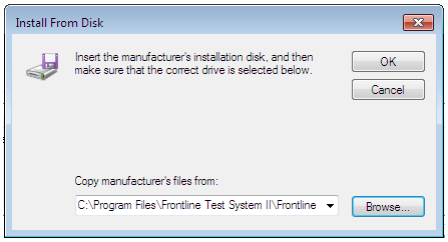


Figure 15 - Install from Disk - Win7

Step 7.

Select **Frontline Bluetooth ComProbe** under Model, then select **Next**.

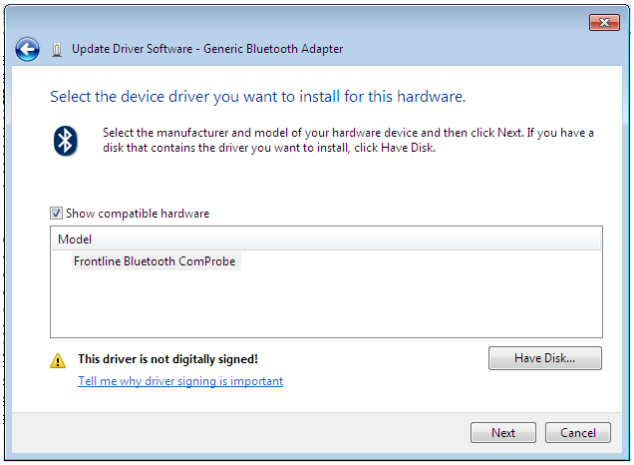


Figure 16 - Select ComProbe - Win7

Once the driver starts to load:

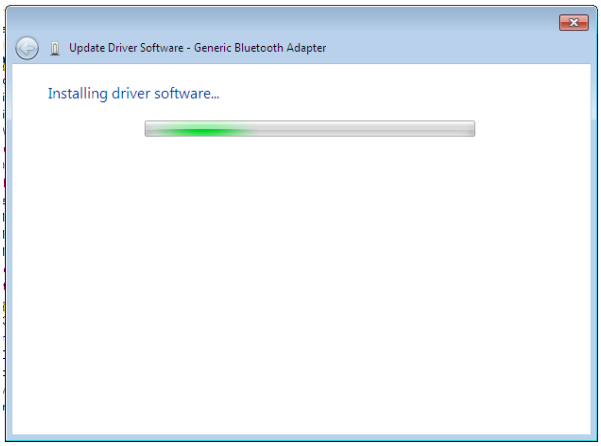


Figure 17 - Software Loading - Win7

you may get a Windows Security warning. You can ignore this warning by selecting **Install this driver software anyway**.

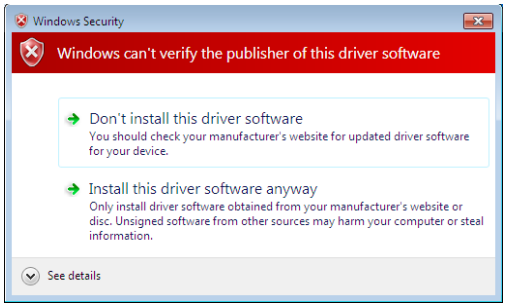


Figure 18 - Security Warning - Win7

Your computer will now install the *Bluetooth* ComProbe driver from the directory you selected; you will get a dialog box saying that the installation is finished.

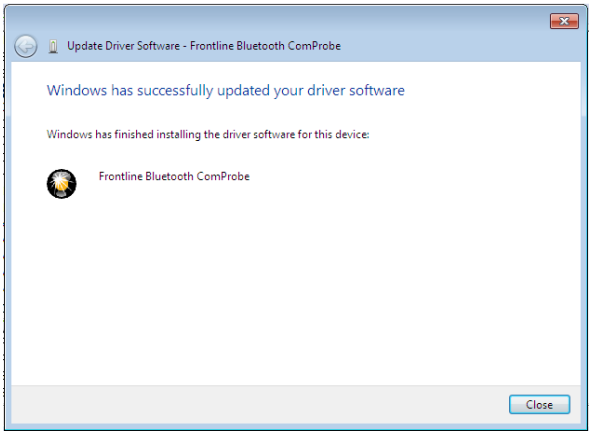


Figure 19 - Installation Complete - WIn7

Step 8. Click the *Close* button to close the wizard.

When you close this dialog you will see that the correct driver is displayed in the Device Manager.

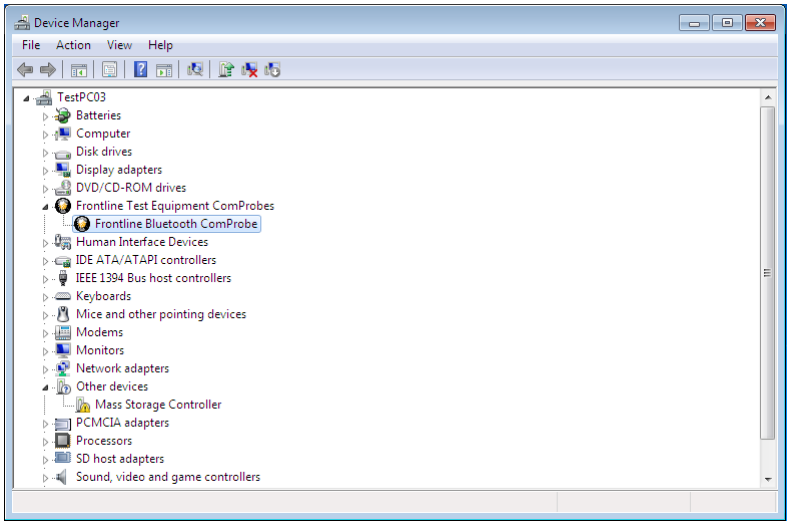


Figure 20- Device Manager - Win7

Serial HCI Sniffing Mode

Cable Installation

If you do not have the serial HCI sniffing cables that are provided with the full version of FTS4BT or if those cables are not practical for you to use (for example, if you are developing an embedded device) then see the section called *Connecting Directly to Serial Ports*.

The exact details of how to tap the circuit vary widely depending on the application or hardware being developed. There are two basic methods for feeding signals from the circuit into the serial ports of the PC running FTS4BT. One method uses the cable set provided with FTS4BT and the other sends signals directly to the serial ports. In either case, if the signals coming from the system under test are not RS-232, it might be necessary to use a converter.

If your *Bluetooth* Application is running on the PC that is running FTS4BT, an alternative is to run FTS4BT in Spy mode. Spy monitors data directly from the serial port on the PC running the *Bluetooth* application. In this situation, no cables or converters are needed and no extra wiring needs to be done.

It is strongly recommended that you set the Host to be DTE and the Host Controller to be DCE; otherwise, the Commands and Events may be reversed.

Connecting Cables to Monitor a Circuit

The instructions and diagram below explain how to connect the cables to the PC running FTS4BT and to the circuit being monitored. This information assumes that you have two serial ports available on the PC running FTS4BT. Two serial ports are required in order to see both sides of the circuit. If you have only one serial port, you will only be able to monitor one side of the circuit. See the Online Help under Cable Configuration for instructions on setting up the cables with one serial port.

- Connect the two 9-pin connectors on the Routing Cable to the two serial ports on the PC running FTS4BT.
- Connect the Monitor Head (beige) to the 25-pin connector on the Routing Cable. The cable set includes a beige Monitor Head and a black Source Head that, aside from their color, look very similar; be sure you have the correct cable Head.
- Connect the T-connector on the Monitor Head to the circuit. The Monitor Head is a straight-through connector. Use the adapters provided to convert between the 25-pin Monitor Head and any 9-pin connections on your circuit.

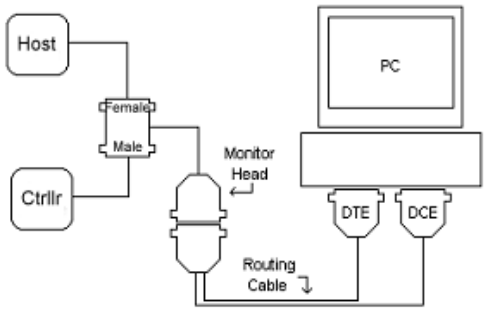


Figure 21 Wiring Diagram

- Click on *Hardware Settings* and select *Use FTS Cables*. You will also need to select which COM Ports you will be using.
- Skip to the section titled *I/O Settings*.

Connecting Directly to Serial Ports

In order for FTS4BT to capture data correctly, when not using the cable set, TxD, RxD and Signal Ground need to feed to the proper pins on the serial ports of the PC running FTS4BT. Note that FTS4BT will not be able to monitor control signals without the cable set.

- Connect the *Serial Data Out* of the Host to the Serial *Data In* of the Host Controller. Connect this also to the RxD of the COM Port that will be selected in the Upper List Box of the Hardware Settings.
- Connect the *Serial Data In* of the Host to the *Serial Data Out* of the Host Controller. Connect this also to the RxD of the COM Port that will be selected in the Lower List Box of the Hardware Settings.
- Connect the *Signal Ground* of the Host to the *Signal Ground* of the Host Controller and to both COM Ports.

- Click on Hardware Settings and select Use FTS Cables.
- Also in Hardware Settings, select the COM Ports you will be using as directed in steps 1 and 2.
- Disable *Notify if Auto Detect Fails*. This will prevent FTS4BT from looking for FTS Cables.

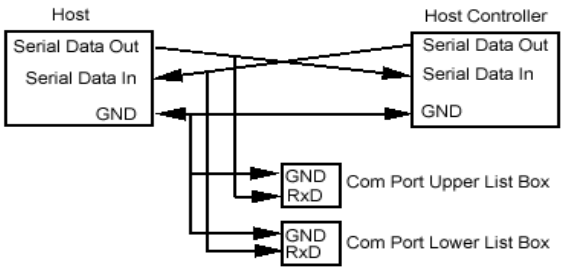


Figure 22 Cable Connection Diagram

You are now ready to begin capturing data. Skip to the section titled *Using FTS4BT*.

Connecting to a Port Using Spy

Important! In order to monitor an internal port, FTS4BT must be started before the application using the port. This ensures that both FTS4BT and the application use the FTS4BT serial driver.

- The computer running Spy should be the Host talking to the external Host Controller.
- Click on *Hardware Settings* and select *Spy*. You will also need to select which COM Port you will be using.

No special hardware setup needs to be done to monitor an internal port.

You are now ready to begin capturing data. Skip to the section titled *Using FTS4BT*.

I/O Settings

Start FTS4BT in Serial HCI mode by running Serial HCI Sniffer (H4), Serial HCI Sniffer (H5) or Serial HCI Sniffer (BCSP).

Before you can begin capturing data, you need to tell FTS4BT whether you intend to monitor or transmit data, and at what data rate. You give FTS4BT this information in the *I/O Settings* window.

- Click on the I/O Settings icon  on the Control window toolbar, or choose *I/O Settings* from the Window menu.
- In the Operating Mode box, choose *Monitor Both*. If you have only one serial port, choose either *Monitor DTE* or *Monitor DCE*, depending on which side you want to see.

- Set the baud, parity, word length and stop bits to the correct settings for both sides of the circuit. For Spy, it is not necessary to set these values, as the *Bluetooth* application will do this when it is started. In Spy Mode, these boxes automatically reflect the values being used by the application.
- Click the *Close* button.

You are now ready to begin capturing data. Skip to the section titled *Using FTS4BT*.

USB HCI Sniffing Mode

The USB HCI Sniffing Mode is capable of capturing and decoding USB packets. There are three ways to capture USB data. Two of these require the *USB* ComProbe.

- *USB HCI Sniffer (H2) - Internal Software Tap*: Captures USB data internally by monitoring the data passing between the USB driver and the device driver inside the PC. No hardware installation or additional software setup is necessary for this mode, as all files install during the FTS4BT installation.
- *USB HCI Sniffer (H2) - USB* ComProbe: Captures *Bluetooth* HCI data carried over USB using the USB ComProbe, and filters out Non-HCI packets.
- *USB HCI Sniffer (H2) + Raw USB Packets - USB* ComProbe: Captures raw USB packets using the USB ComProbe, and optionally filters out NAKs and SOFs with user configured Capture filters.

If you wish to capture USB data using the *USB HCI Sniffer (H2) - Internal Software Tap* option, then continue with the next section titled *Internal Software Tap*.

However, if you wish to capture USB data using the *USB HCI Sniffer (H2) - USB* ComProbe option or the *USB HCI Sniffer (H2) + raw USB Packets - USB* ComProbe, then skip to the section titled *Installing the USB* ComProbe.

Internal Software Tap

Internal Software Tap requires no additional hardware. It sits between the USB driver and the device driver inside the PC.

Start USB HCI sniffing by running *USB HCI Sniffer (H2) - Internal Software Tap* from the FTS4BT folder on your desktop. The *FTS4BT USB HCI Datasource* dialog appears.

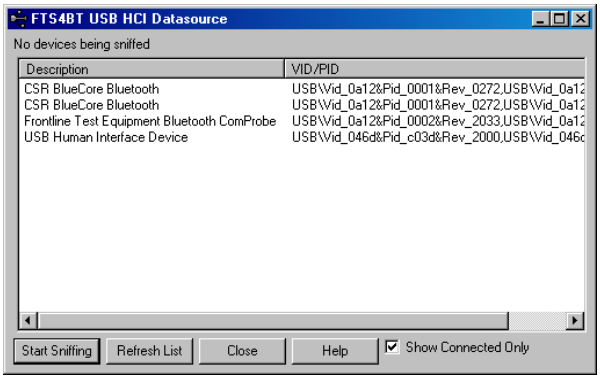


Figure 23 USB HCI Datasource

The USB HCI Datasource dialog allows the user to select which *Bluetooth* device to sniff and to initiate and terminate the sniffing process.

The dialog has a list containing the *Bluetooth* Devices connected to your system. If the *Show Connected Only* checkbox is unchecked then all USB devices that have ever been connected to your system will be listed.

- If you have connected or disconnected a device while this dialog is open, click on *Refresh List* to update the list.
- Select the device you wish to sniff then click on the *Start Sniffing* button (this must always be done in order to capture data in this mode).

You are now ready to begin capturing data. Skip to the section titled *Using FTS4BT*.

Installing the USB ComProbe

The USB ComProbeis a high speed, full speed and low speed USB 2.0 protocol analyzer that sends data to the analyzer PC using a high-speed USB 2.0 connection.

The front of the ComProbehas two USB connections; one for the Device Under Test (DUT) and one for the PC where the device is normally connected.

There are three LEDs on the front panel (1) the Power LED, (2) the Activity LED, and (3)the Trigger LED.

* The Power LED will be either red or green, and either steady or flashing.
  - Green means the USB port on the Analyzer PC is 2.0.
  - Red means the port is not a 2.0 port.
  - Flashing means the analyzer is not yet initialized or there is a driver problem
  - Steady means all is well.
* The Activity LED flashes when the ComProbe senses activity on the circuit.
* The Trigger LED is not used in this version.

The back panel has one USB connection labeled "Analysis Computer" for connecting the USB ComProbe to the computer running FTS.

The ComProbe receives power from the USB port of the analysis computer eliminating the need for an external power source.

USB COMPROBE DRIVER INSTALLATION

Step 1.

Connect the white USB cable to the back of the ComProbe in the USB port labeled “Analysis Computer”. Connect the other end to a USB port on the computer with FTS installed.

The *Welcome to the Found New Hardware Wizard* appears.

Figure 24 - Welcome to the Found New Hardware Wizard

If you have installed FTS4BT, the hardware driver should be installed, so you don't have to search for it.

Select *No, not this time*, then *Next.*

The *Found New Hardware Wizard* dialogue box will appear. Choose *Install from a list or specific location* and click *Next.*

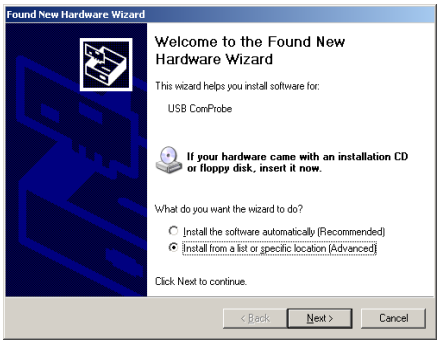


Figure 25 - Found New Hardware

Step 2.

Select the "Search for the best driver in these locations" radio button, and check only "Include this location in the search" checkbox. Browse to the directory where you installed FTS4BT. The default is C:\Program Files\Frontline Test System II\FTS4BT [version#]\Drivers\USB ComProbe. Select the appropriate directory and click *OK*.

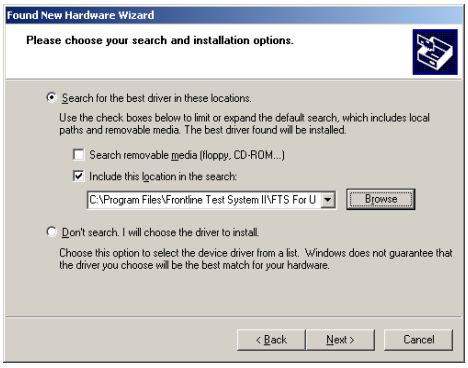


Figure 26- Search and Installation Options

Step 3.

Click the *Next* button to finish the installation. If you get a dialog box like the one below, don't worry—Click *Continue Anyway*.

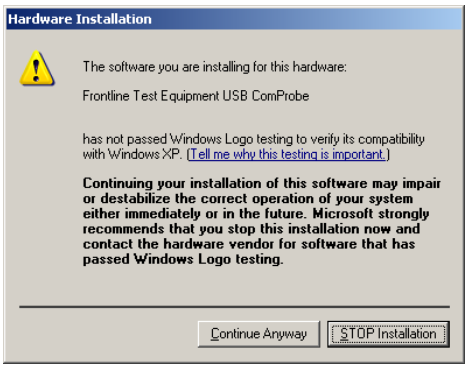


Figure 27- Windows Logo Testing

Step 4.

Your computer will now install the USB ComProbedriver from the directory you selected; you'll get a dialog box saying that the installation is finished. Click the *Finish* button to close the wizard.

The installation of the USB ComProbe driver is now complete.

Connecting the USB ComProbe to the Device Under Test (DUT)

The USB ComProbe is a high speed, full speed and low speed USB 2.0 protocol analyzer that sends data using a high-speed USB 2.0 connection. The recommended configuration requires two computers, one for communicating with the device under test and the other for displaying the results of the analysis.

> Although the USB ComProbe can download analyzed data on a full speed USB 1.1 connection, we strongly recommend that you connect it using a high speed USB 2.0 port to obtain optimal performance. If you experience any trouble with your analyzer, please ensure it is connected on a high speed USB 2.0 enabled host controller before contacting our technical support.

CONNECTING ONLY ONE DEVICE UNDER TEST

The most straightforward configuration involves analyzing only one device. Figure 28 shows the proper connection setup for a single Device Under Test.

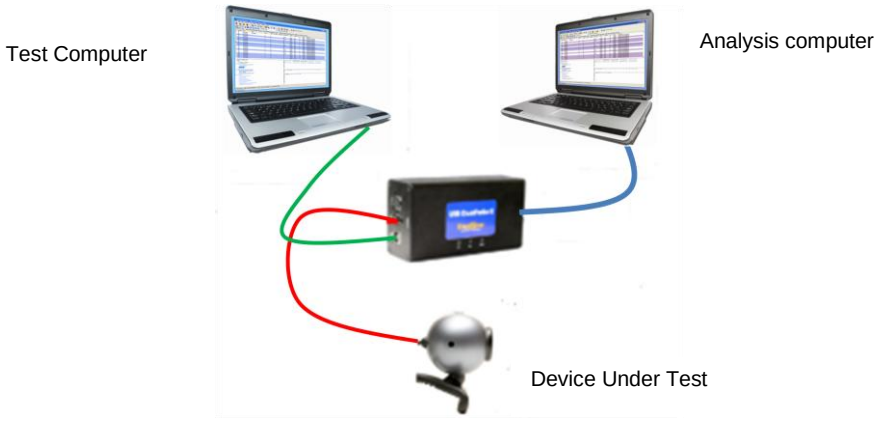


Figure 28 Connecting only one Device Under Test

To prevent connection problems, please adhere to the following instructions:

- Make sure that **NO USB DEVICE** is plugged into the same root hub as the Device Under Test (DUT). An extraneouos USB device can result in FTS capturing data from the device, not the DUT.
- The Analysis computer cable must be no longer than 5 meters.
- The total length of the Test computer and Device Under Test cables must not exceed 3 meters. A greater length could result in an abnormally high error rate on the bus being analyzed.

CONNECTING MORE THAN ONE DEVICE UNDER TEST

USB analyzers only analyze traffic coming from devices connected below the analyzer. Traffic coming from devices connected above the analyzer is not analyzed. The analyzer will only register data packets coming from the host. Figure 29 shows an incorrect connection. The USB mouse connected above the analyzer is not analyzed.

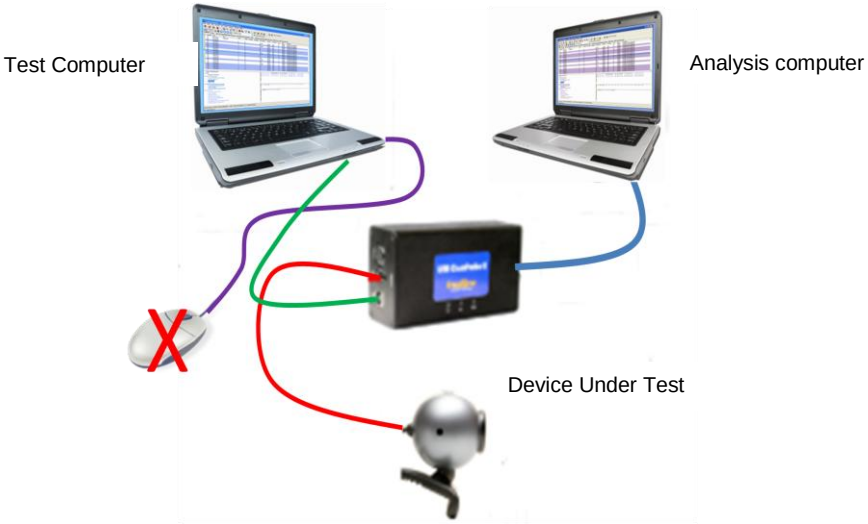


Figure 29 Wrong connection with more than one DUT

When analyzing multiple devices, the analysis requires the use of a USB hub. Using a USB hub connected to the ComProbe ensures analysis of all devices. Be aware that the analyzer records all hub and device traffic, and could result in a large amount of data. The software's functions easily filter out extra traffic eliminating any inconvenience a large data set may cause. Figure 30 illustrates proper connection of several devices under test.

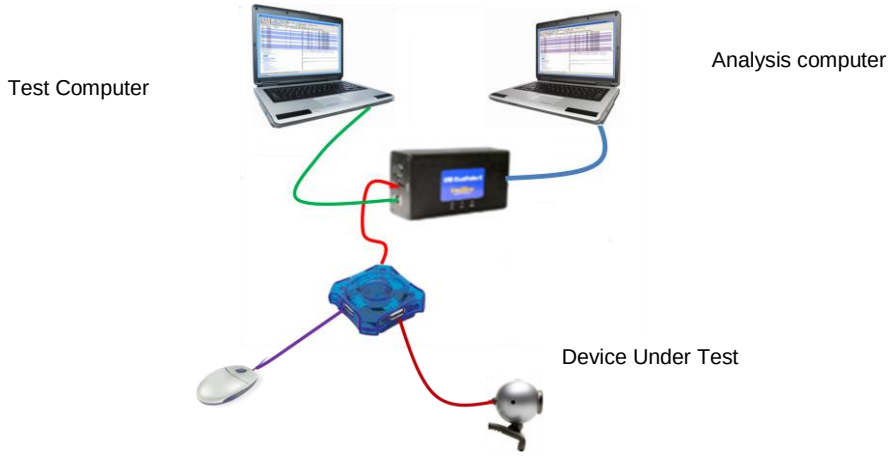


Figure 30 Correct connection with more than one DUT using a Hub

Hardware Settings

The Hardware Settings window will appear automatically the first time FTS is run. Choose *Hardware Settings* from the *Options* menu on the Control window if you need it later.

USB COMPROBE/CAPTURE FILTERS

Use the Hardware Settings window to select which USB ComProbe to monitor (if you have more than one) and to choose which capture filters to apply.

There are two capture filters, one for SOF packets and one for NAK packets. Click the *Capture Filters* button on the Hardware Settings window to change the capture filter selections. By default, both filters are selected, which means all SOF and NAK packets will be filtered out.

Troubleshooting

Most performance problems such as input buffer overflow are the result of improper connections.

To achieve optimal performance from the USB analyzer, we recommend the following configuration:

- use two high-speed computers, one for the analyzer and one for the device under test
- use USB 2.0 connections
- use cables that do not exceed the recommended maximum lengths (the cable connected to the analysis computer should not exceed 15 feet, and the total length of the cables connected to the test computer and the device under test should not exceed 9 feet).

Although it is possible to use one computer as both the analysis and the test computer, this requires that the computer in use is high-speed and has two or more host controllers available. If you attempt to analyze data using one computer with only one host controller, then the system displays an error message informing you of the problem.

If the operating system encountered an error when trying to install a device, simply disconnect the device, then reconnect it and try again.

High Speed UART (HSU) Option

Note: You must be running Windows XP and have USB 2.0 port available to operate the EB ComProbe.

After installing your FTS4BT software, simply plug the EB ComProbe into an available USB 2.0 port. Your operating system automatically installs the necessary drivers.

Hardware Settings for HSU

The Hardware Settings window appears automatically the first time you run FTS. Use the Hardware Settings window to select which EB ComProbe to monitor (if you have more than one). Choose *Hardware Settings* from the *Options* menu on the Control window if you need it later.

I/O Settings for HSU

Click the *I/O Settings* icon  on the Control window. The analyzer requires information on Bit Rate, Parity, Length, and number of Stop bits in order to operate properly. If you are capturing framed data, the analyzer needs to know what protocols are present on your circuit to decode them correctly.

There are two rows of settings, one for the CH 0 (data connection), and one for the CH 1 (data connection). To change the bit rate, parity, word length or number of stop bits, click on the down arrow next to the setting box and choose an option from the list. For bit rate, you can either choose a listed rate or enter a rate. After entering the settings for CH 0, click the *Copy CH 0* button to apply the same settings to the CH 1 row.

Connect the EB ComProbe to a Source

The EB ComProbe is designed for use with TTL voltage levels, 0 to 5 volts max (exceeding the 5.0 volts max damages the ComProbe®). The ComProbeinterprets 0 to 1.9 volts as a logical zero, and 2.0 to 5.0 as a logical one. To ensure accurate data collection and proper operation, connect the ComProbeto the TTL side of any transceivers, line drivers, or line receivers.

Use the table below to determine the connection configuration you need for monitoring signals on the source device. Disconnecting and reconnecting the wires in a different configuration negates the validity of the following table. To avoid confusion, we recommend that you maintain the color code as expressed in this table.

Note: Disconnecting the EB ComProbefrom the source while capturing data with FTS4BT may temporarily affect your computer's performance. To ensure proper operation of your system, always terminate FTS4BT live capture prior to removing the ComProbefrom the circuit under test.

Wire Label	Label/Wire Color	Signal	Meaning
0	Black	CH 0	Data Connection
1	Brown	CH 1	Data Connection
2	Red	RTS	Request to Send
3	Orange	CTS	Clear to Send
4	Yellow	DSR	Data Set Ready
5	Green	DTR	Data Terminal Ready
6	Blue	CD	Carrier Detect
7	Violet	RI	Ring Indicator
TRG	White	Not Used	N/A
CLK	Gray	Not Used	N/A
GND	Black	Ground	Ground

Table 1 Pin outs for the EB ComProbe

Virtual Sniffing Mode

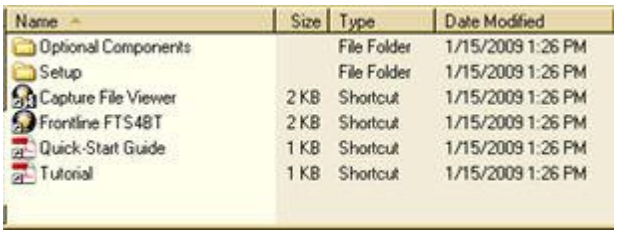
There is no hardware installation necessary for virtual sniffing. During the software installation, a sample Virtual Sniffing Application is installed. To use virtual sniffing in your environment, modify the sample application to import data from your software. For more information, please contact Technical Support. Contact information is at the end of this document.

Opening FTS4BT

On product installation, the installer creates a folder on the windows desktop labeled **Frontline FTS4BT**.

1. Double-click the Frontline FTS4BT desktop folder 

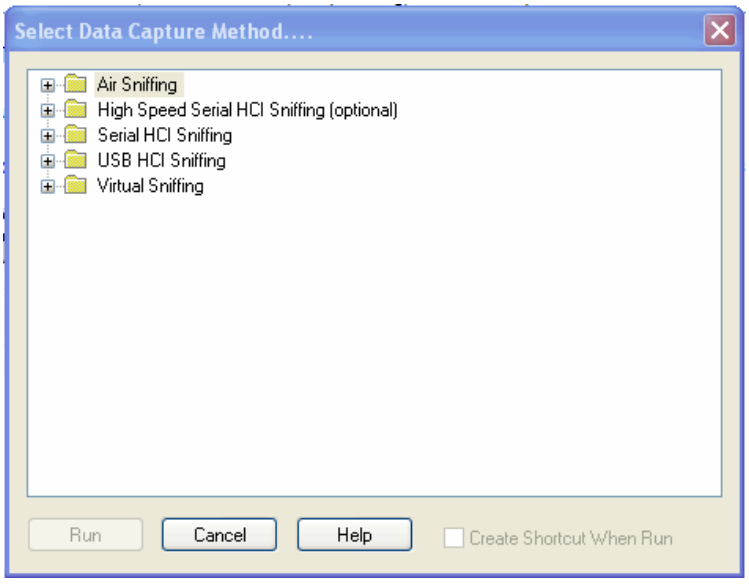
This opens a standard Windows file folder window.



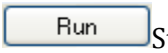
2. Double-click on Frontline FTS4BT and the system displays the *Select Data Capture Method* dialog.

Note: You can also access this dialog by selecting *Start > All Programs > Frontline FTS4BT (Version #) > Frontline FTS4BT*.

This dialog lists all the methods FTS4BT supports in a tree control.

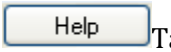


Three buttons appear at the bottom of the dialog; **Run**, **Cancel**, and **Help**. When the dialog first opens, Cancel and Help are active, and the Run button is inactive (grayed out).



Starts FTS using the selected protocol stack.

Closes the dialog and exits the user back to the desktop.



Takes the user to this help file as does pressing the F1 key.

3. Expand the folder and select the data capture method that matches your configuration.

Note: If you don't need to identify a capture method, then click the Run button to start the analyzer.

Creating a Shortcut

A checkbox labeled **Create Shortcut When Run** is located near the bottom of the dialog. This box is un-checked by default. Select this checkbox, and the system creates a shortcut for the selected method, and places it in the FTS4BT desktop folder and in the start menu when you click the Run button. This function allows you the option to create a shortcut icon that can be placed on the desktop. In the future, simply double-click the shortcut to start the analyzer in the associated protocol.

The *Control Window* appears as the small rectangular window at the top of your monitor screen. FTS4BT is organized around this window. The Control window allows you to control data capture and access the other windows used to view data.

How to Capture Data

Initiating Data Capture in All Sniffing Modes

FTS4BT will capture data to a single file or series of files. Data capture can be initiated from the Control window, the Event Display or the Frame Display. You do not need any window other than the Control window open to capture data.

- To capture to a file, click the *Start Capture* icon  .
- To stop capture to a file, click the *Stop Capture* icon  . Stopping capture means no new data will be added to the capture file until capture is resumed by clicking the Start Capture icon. The previously captured data remains in the file.
- To clear capture, click the *Clear* icon  .

  If you select Clear after selecting Stop, a dialog appears asking whether you want to save the data.

  - You can click *Save File* and enter a file name when prompted .
  - If you choose *Do Not Save*, all data will be cleared.
  - If you choose Cancel, the dialog closes with no changes.

  If you select the Clear icon **while a capture is occurring**:

  - The capture stops.
  - A dialog appears asking if you want to save the capture
  - You can select Yes and save the capture or select No and close the dialog. In either case, the existing capture file is cleared and a new capture file is started.
  - If you choose Cancel, the dialog closes with no changes.

Note: If you receive a message to run the Maintenance Utility, refer to Appendix A, for more information.

Capturing Data in Air Sniffing Mode

This Quick Start Guide only describes *Air Sniffer (Basic)*. You can find more information about the other air sniffing modes in the online Help and by calling Technical Support (see the end of this document for contact information).

There are two steps to capturing data in the FTS4BT Air Sniffing mode. The first is initiating data capture (see previous section), and the second is synchronizing the *Bluetooth* ComProbe to the *Bluetooth* piconet. Data capture is initiated via the Control window, as explained in the previous section. We recommend beginning data capture before synchronizing the ComProbe so that when data begins arriving, FTS4BT is ready to capture it.

Note: If you see a message that indicates ***No Bluetooth*** ComProbe***was found connected to a USB port.,*** *the reason is that FTS4BT Versions 7.3.5 and later require that a Bluetooth* ComProbe*be connected to the PC regardless of how data is captured. Before continuing you must connect a Bluetooth* ComProbe.

Synchronizing to the Piconet

Step 1. Connect the ComProbe

Make sure the *Bluetooth* ComProbe is connected to a USB port.

Step 2. Start Air Sniffer

Open the FTS4BT folder on your desktop and double-click *Air Sniffer (Basic)*. This will cause FTS4BT to start and the *Bluetooth* ComProbe icon appears in red with a line through it in your system tray. In addition, the Datasource dialog box appears.

Step 3. Select a ComProbe Device

If you have multiple *Bluetooth* ComProbes® installed, then you will need to click the *Hardware Settings* button on the Datasource dialog to pick which one you want to use.

Step 4. Synchronization

You must next tell FTS4BT which synchronization mode to use. Click the *I/O Settings* button on the Datasource dialog.

At the top of the I/O Settings window, choose a synchronization mode. The preferred mode is *Slave Inquiry*. In this mode, FTS4BT asks the slave device for its clock and then waits for the master to page the slave.

In *Bluetooth*®, the device that initiates the connection is always the master at connection time. You only need to know the master and slave at connection time when setting up the I/O settings. Afterwards a role switch may occur, but FTS4BT will automatically follow the role switch.

The rest of these instructions assume you have selected Slave Inquiry mode. For more information on the other synchronization modes, see the online Help.

Enter in the Slave Device box the *Bluetooth* Device Address of the slave device to which FTS4BT should synchronize. If you know the device address, you can simply enter it using the *12 hex digits* box or *UAP*, *LAP* and *NAP.* Otherwise, click the *Discover Bluetooth Devices* button and then select the correct device from the drop-down list. You may wish to specify a Master Device as well if you want to be certain of monitoring a specific piconet.

If you are sniffing an encrypted session, you must set the encryption settings correctly. For the details on these settings, consult the *Encryption* topic in the online Help.

Finally, there are some optional settings for capture filtering and for using inquiry access codes to limit the list of devices returned when *Discover Bluetooth Devices* is clicked. See the information on the *I/O Settings* window in the online Help if you wish to change these settings.

Click *OK* when finished.

Piconet Synchronization State

As data is being captured, the Status box at the top of the Datasource dialog will update to show the piconet synchronization status of the *Bluetooth* ComProbe®.

You will also note that the color of the *Bluetooth* ComProbeicon in the system tray and in the Status box will vary in color depending on the state of the *Bluetooth* ComProbe®:

- Blue indicates that the *Bluetooth* ComProbeis running and in sync with the piconet.
- Green indicates that the *Bluetooth* ComProbeis running and in sync with the slave and waiting to synchronize with the piconet.
- Yellow indicates that the *Bluetooth* ComProbewill attempt to resynchronize within 5 seconds,
- Red indicates that the *Bluetooth* ComProbe is attempting to synchronize,
- Red with a "Not" symbol means the *Bluetooth* ComProbeis stopped.

Typically, you can focus your attention on the FTS4BT data displays and not worry about the *Bluetooth* ComProbe®. However, if you are not seeing data when you think you should, then check the Datasource dialog.

Looking At Frames

Protocol Navigator

Click the *Protocol Navigator* icon  on the Control window toolbar to open the Protocol Navigator. The Protocol Navigator window presents decodes of multiple protocol layers within multiple data frames. It simplifies the process of understanding the complex relationships between multiple data frames and the protocol layers that comprise the frames. The three windowpanes on the left of the Protocol Navigator enable you to select or suppress protocols of interest.

Filtering/Hiding in Protocol Navigator

You can filter on one or more protocol layers by using the *Filtered In* pane at the top left of the Protocol Navigator display. In the pane is a list of all the protocols seen so far on the circuit. Three additional filters available are:

- All Frames With Bookmarks - filters in all frames with a *bookmark* associated with them.
- All Frames With Errors - filters in all frames with errors.
- All Special Information Nodes - filters in all *special information nodes*.

Check the boxes next to the names of the protocols you want to filter in. The filter is inclusive, which means that filtering on a protocol displays only frames that contain that protocol. Frames that do not contain the protocol will not appear. You can filter on one or more protocols.

The system provides a means to create and save your own filters. Please consult the online Help under *Filtering* for instructions.

Also on the left side of the window is **Layers Hidden From View**. All the layers seen in the protocol will be displayed with a check box next to them. This allows you to zoom in on a particular protocol by hiding every protocol but the one of interest. This is especially effective when all the layers are expanded.

- If you want to see the layer, leave the check box unchecked.
- If you want to hide a layer, select the check box next to it.

When one or more layers are hidden, a note will appear at the top of the Protocol Navigator saying, "Some layers are hidden. Right-click to see." This message warns you that some layers are hidden.

You can also use the right click menu to hide/display frames and layers. Simply right click on a frame or layer. The right click menu displays options based on what you have selected. For example, if you right click on the the USB Token Message, you will see in the right click menu that you can choose, **Exclude "USB Token Message" Layer in All Frames**. If you right click on a frame you probably will see: Show Frames, Show Layers, Show All, Include All Layers, Exclude All Layers.

Frame Display

Click the Frame Display icon  on the Control window toolbar to open the Frame Display. This display allows you to have bit level visibility on your protocol.

Panes

The Frame Display is divided into panes, where each pane shows a different view of the data. The Summary pane stretches across the top of the display. Each line in the Summary Pane represents one frame except when running in one of the USB HCI Sniffing modes where each line represents one transaction. The Decode pane contains a detailed decode of the frame/transaction selected in the Summary pane, and is located on the left side of the Frame Display window. The three smaller panes on the bottom right of the Frame Display show the data in hex, binary and ASCII. The user can choose to have these panes show the data in other radixes or character sets. Select any field in the Decode pane and the corresponding bit(s) or byte(s) will be selected in the data panes.

Frame Errors

Frame numbers in red indicate an error in the frame. Select the frame, and look at the top of the Decode pane to determine the type of error.

Scrolling versus Static View

Click the *Lock/Resume* icon  to have the Summary pane scroll to always show the latest frames captured. Click the *Lock/Resume* icon again to stop the Summary pane from scrolling.

Protocol Tabs

The frame display has a series of Protocol Tabs that allow you to filter on a specific protocol quickly and easily. For more advanced filtering option please consult the online *Help*.

Common Features

Display Synchronization

The system synchronizes the display in the Frame Display with the Event Display and Protocol Navigator. Select a frame in the Frame Display and the other windows automatically update to highlight the bytes in the selected frame. Select a byte in the Event Display or Protocol Navigator, and the Frame Display updates to show the frame containing the byte.

Duplicate Displays

The *Duplicate* icon  creates a second window of the same type, identical to the first. The advantage of additional Displays is that you can look at two different groups of data at the same time. For example, you can look at the start of an interaction in one Frame Display and the end of that same interaction in the other and compare the two.

Filtering

Filtering can be accomplished from both the Protocol Navigator and the Frame Display. Regardless of where the filter is applied, it affects the data in both. In the Protocol Navigator, the filter displays the data that meets the condition defined in the filter. In the Frame Display, the system creates a tab that displays the filter name.

The quickest and easiest method for filtering data is to hover your cursor over the desired information in the summary display or the decode pane on the Frame Display and select from the right click popup menu.

Bookmarks

Bookmarks let you mark frames of interest so they can be easily found later. Bookmarked frames appear with a magenta triangle icon next to them except in the Event Display where they appear as a dashed line around the start of frame marker. You can navigate between bookmarks using the Find feature or by pressing F2 to go to the next bookmark. To make a new bookmark, right-click on the frame and choose *Add Bookmark* from the menu.

Searching

You can search for strings or patterns in your data or in the frame decode, for errors, control signal changes, bookmarks, special events, and time. Click the Find  icon to open the Find window. Click the *Help* button for more information on the different types of searches.

Statistics

Serial HCI and USB HCI Sniffing Modes

Click the Statistics icon  on the Control window toolbar to open the Statistics window.

The Statistics window provides a statistical overview of all the data on the circuit. In Serial HCI Sniffing mode, FTS4BT is always monitoring the circuit and gathering statistics, even when it is not capturing the data. In the Air Sniffing Mode FTS4BT only gathers statistics when it is synchronized with the piconet.

There are three tabs on the Statistics window: Session, Resettable and Capture File. The Session tab shows statistics from the time FTS4BT was started. The Resettable tab can be reset to show statistics from the time the Reset icon was last pressed. The Capture File tab shows statistics on the data in the capture file. If data capture has not been started or if the file has wrapped, most of the statistics on the Capture File tab will be "n/a".

Some tables on the Statistics window can display data in graphic form. Click the Graph icon  on any header that has one for a chart of that table.

Air Sniffing Mode

When operating in one of the Air Sniffer modes, Packet Error Rate Stats provides a dynamic graphical representation of the Packet Error Rate for each channel. Click on the  button to display the Packet Error Rate Stats window.

The Packet Error Rate window displays a graph for each channel numbered 0 through 78 and a pie chart summarizing the total of all channels.

Each individual graph/table displays the following parameters:

- Total number of packets (determined by reading the scale to the left of the graph)
- The number of packets with no errors, color-coded green
- The number of packets that have header errors, color-code red
- The number of payload errors, color coded dark red
- The number of retransmits, color-code yellow

Additional Displays

There are additional displays that may be of value to those doing serial HCI sniffing.

The Event Display  can be used to see the data transferred between a Host and a Host Controller before the data is decoded. Communications errors on the serial data circuit, such as overrun, framing, and parity can only be seen on the Event Display. The Event Display shows where each frame begins and ends. This can be helpful when diagnosing transport synchronization problems.

When a transport such as HCI UART (H4) uses hardware flow control, the Breakout Box  and Signal Display  windows can be used to help diagnose problems with missed messages and data overruns.

Coexistence View Introduction

The Coexistence View displays both the Bluetooth® and the Wi-Fi channels frequencies in one view. You access the Coexistence View by selecting the  icon from the ControlWindow, Frame Display, and Protocol Navigator toolbars or from the View menus.

Main User Interface

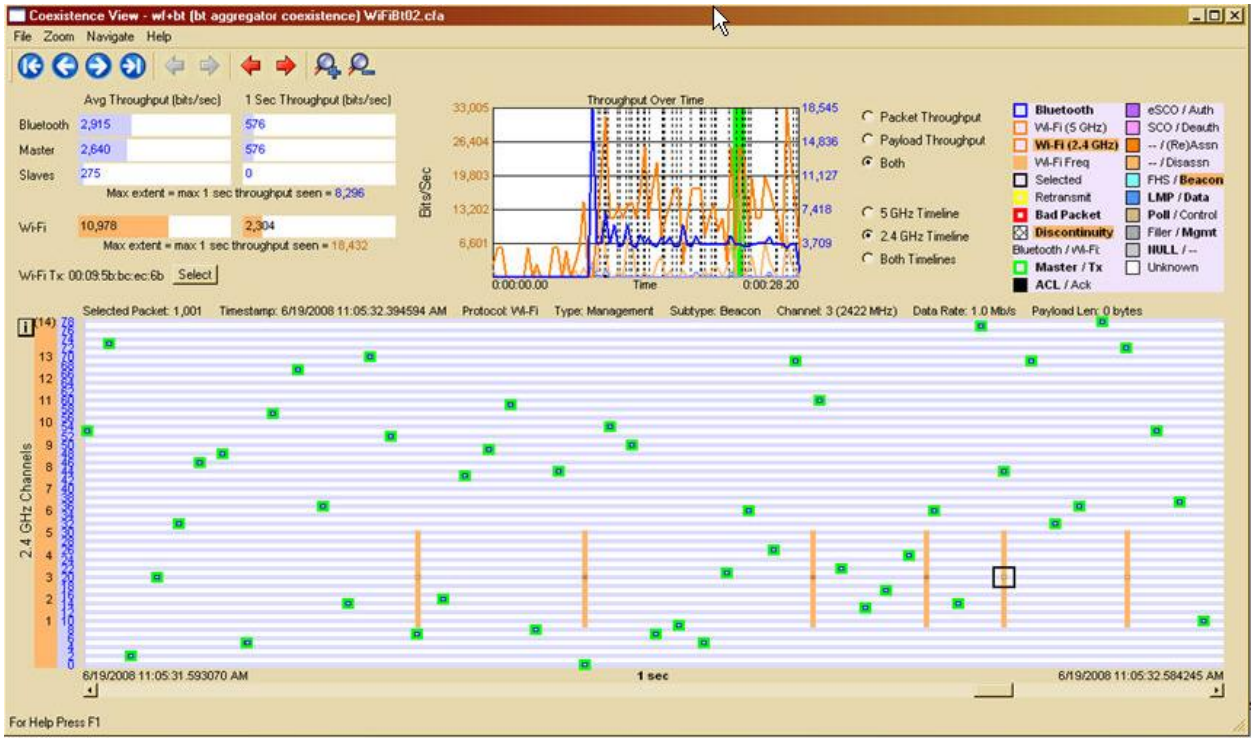
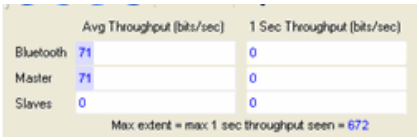


Figure 31 - Coexistence View



This chart displays the:

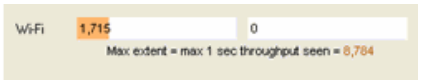
Bluetooth: Average Throughput/ 1 Second Throughput
This chart displays:

- Average Throughput in bits/seconds for all Bluetooth packets, Bluetooth Master packets, and Bluetooth Slave packets.
- One (1) Second Throughput in bits/seconds for all Bluetooth packets, Bluetooth Master packets, and Bluetooth Slave packets.

- Average Throughput = total packet/payload size divided by the duration of the entire session
- 1 second Throughput = packet/payload size during the most recent one second of the session

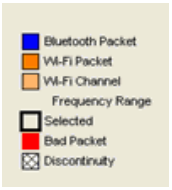
Wi-Fi: Average Throughput/ 1 Second Throughput
This chart displays the

- Average Throughput in bits/second and One (1) Second Throughput in bits/seconds for Wi-Fi.
  - Average Throughput = total packet/payload size divided by the duration of the entire session
  - 1 second Throughput = packet/payload size during the most recent one second of the session



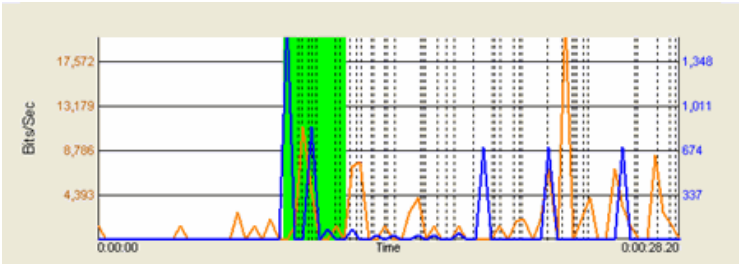
This chart displays the

- Average Throughput in bits/second and One (1) Second Throughput in bits/seconds for Wi-Fi.
  - Average Throughput = total packets divided by time
  - 1 second Throughput = most recent one second during the session



This legend identifies the color coding found in the timeline. When you select a packet in the timeline, its attributes are highlighted in the legend. A bold entry in the legend indicates that such a packet has been seen during the current session.

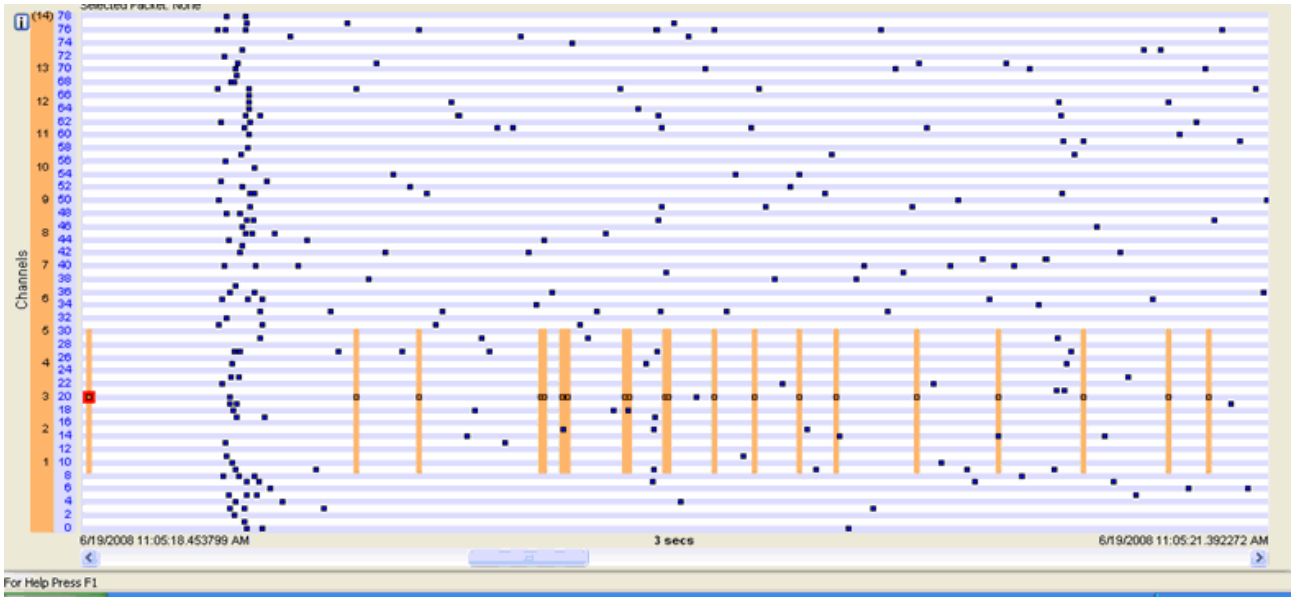
A Bluetooth packet has a blue outline, and a Wi-Fi packet has an orange outline.



The Throughput Graph displays throughput over time.

- Wi-Fi packet throughput is displayed as an orange line with corresponding orange numeric values on the left.
- Bluetooth packet throughput is displayed as a blue line with corresponding blue numeric values on the right.
- When you click anywhere in the graph, the timeline moves to the corresponding position in time.
- To keep the timeline and the throughput graph manageable, big jumps in packet timestamps are not represented linearly. Instead, they are shown as discontinuities. A discontinuity is said to exist when the timestamp goes forward more than 2 seconds or backwards any amount. A discontinuity is indicated by a cross-hatched slot in the timeline and a corresponding vertical dashed line in the throughput graph.
- You can show Packet Throughput, Payload Throughput, or both depending on which radio button to the right of the graph you select. The Avg Throughput and 1 Sec Throughput indicators are also affected.
- Payload Throughput is always less than Packet Throughput because a packet is never all payload.
- The green area in the throughput graph is called the viewport. Its position and width correspond to the beginning timestamp and duration of the timeline.

The main part of the chart displays a variety of information.



- The timeline shows Bluetooth and Wi-Fi packets within a specific period of time.
- The horizontal lines in the timeline are rows that correspond to Bluetooth and Wi-Fi frequencies.
- The vertical blue lines are Bluetooth slot markers for reference.
- The timeline displays Bluetooth and 2.4 GHz Wi-Fi packets together in the 2.4 GHz range when you select the 2.4 GHz Timeline radio button.
- The timeline displays 5 GHz Wi-Fi packets in the 5 GHz range when you select the 5 GHz Timeline radio button.
- The timeline displays Bluetooth/Wi-Fi packets in the 2.4 GHz range and Wi-Fi packets in the 5 GHz range when you select the Both Timelines radio button.
- The timeline duration is displayed underneath the timeline.
- Placing the mouse pointer on a packet in the timeline displays information about that packet in an information box.
- You can select multiple packets by dragging within the timeline or by holding the SHIFT key down while arrowing.
- On the 2.4 GHz Timeline, there are 79 Bluetooth and 14 Wi-Fi channels. Channel numbers are shown on the left side of the timeline. Bluetooth channel numbers have a blue background, and Wi-Fi channel numbers have an orange background.
- On the 5 GHz Timeline, there are 31 Wi-Fi channels. Channel numbers are shown on the left side of the timeline with an orange background. The channel spacing varies from 20 to 40 MHz.
- Each Bluetooth channel is 1 MHz wide with no channel overlap.
- Each Wi-Fi channel in the 2.4 GHz range is 22 MHz wide and overlaps. There is a 5 MHz shift between each of the first 13 channels. There is a 12 MHz shift between channels 13 and 14.The row labels for channels 1-13 are placed at the center frequency of each channel. Channel 14 is in parentheses because that channel's center frequency is above the top of the graph.Due to space limitations, each Wi-Fi channel in the 5 GHz range is drawn with a fixed height instead of being sized and spaced relative to its width and distance from other channels.
- When both timelines are visible, selecting packets by dragging with the mouse applies to packets in both timelines, regardless of which timeline the mouse is in.
- Using the mouse scroll wheel scrolls horizontally in the chart. You can also use the arrow keys and the scroll bar at the bottom of the timeline to move within the timeline.

- Using the mouse scroll wheel + CTRL zooms. You can also zoom by using a right click (which displays specific magnification values), using the + and - Zoom tools, or by selecting a value from the Zoom menu.
- Selecting the Information icons displays information about the Bluetooth and Wi-Fi channels.
- A green border appears around Wi-Fi Tx and Bluetooth Master.

Coexistence button bar

The button bar contains the following:

 Lock

 Unlock

 First Packet

 Previous Packet

 Next Packet

 Last Packet

 Previous Error Packet

 Next Error Packet

 Zoom To All Packets

 Zoom In Tool

 Zoom Out Tool

 Reset

The Lock button only appears in live mode and is automatically depressed when the user scrolls.

Coexistence View Wif-Fi Tx Address

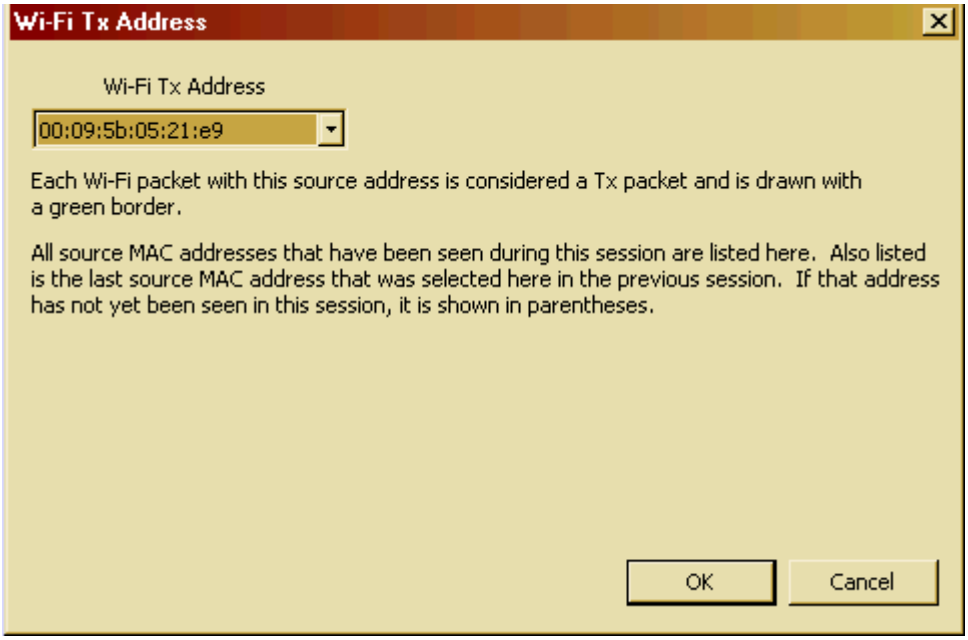
The Wi-Fi Tx Address displays a selected source address that you choose.

The specific address is highlighted with a green border.

To select a specific address:

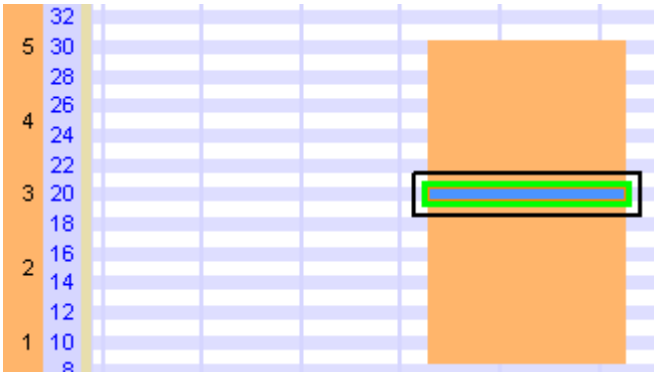
1. Click the **Select** button.

The Wi-Fi Tx Address dialog appears.



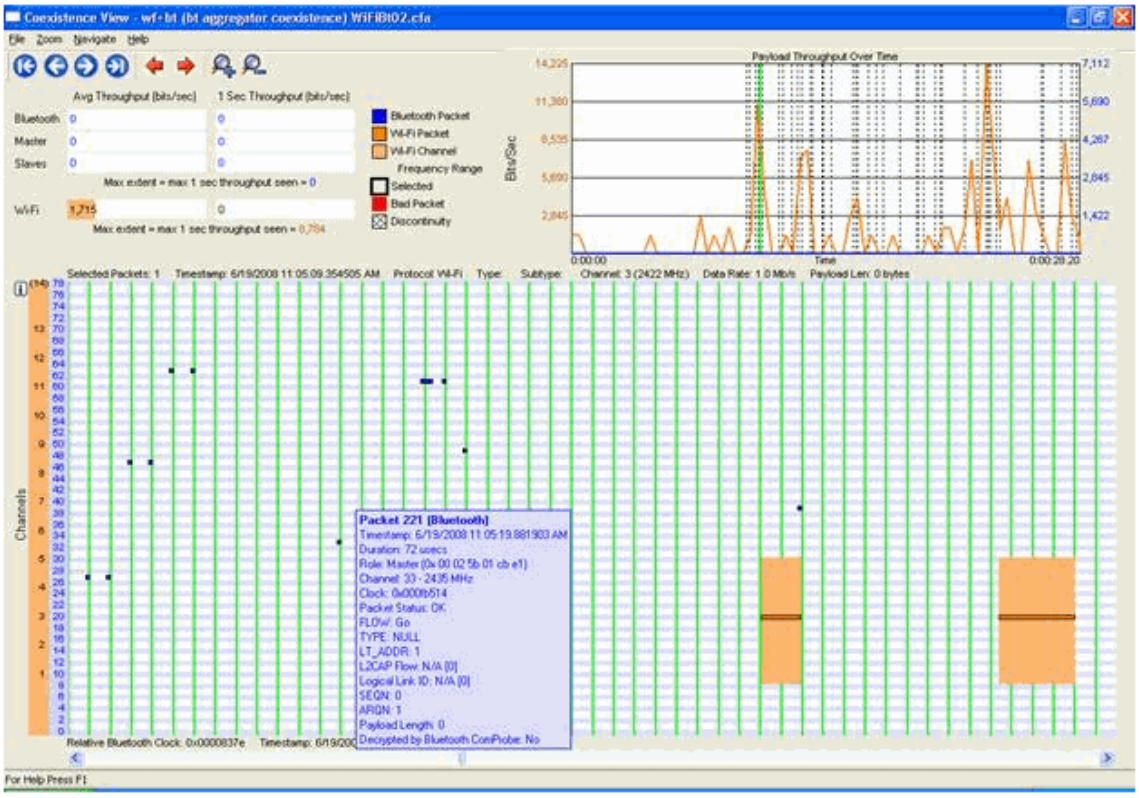
2. Select an address from the **drop-down list**.
3. Select **OK**.

The selected address appears with a green border around it.



Bluetooth Channel Frequencies

There are 79 Bluetooth channels in the 2.4 GHz timeline. The Bluetooth channel numbers appear with a blue background along the left side of the timeline.



Each *Bluetooth* channel is 1 MHz wide with no channel overlap, unlike Wi-Fi channels which do overlap.

Selecting the icon displays channel information.

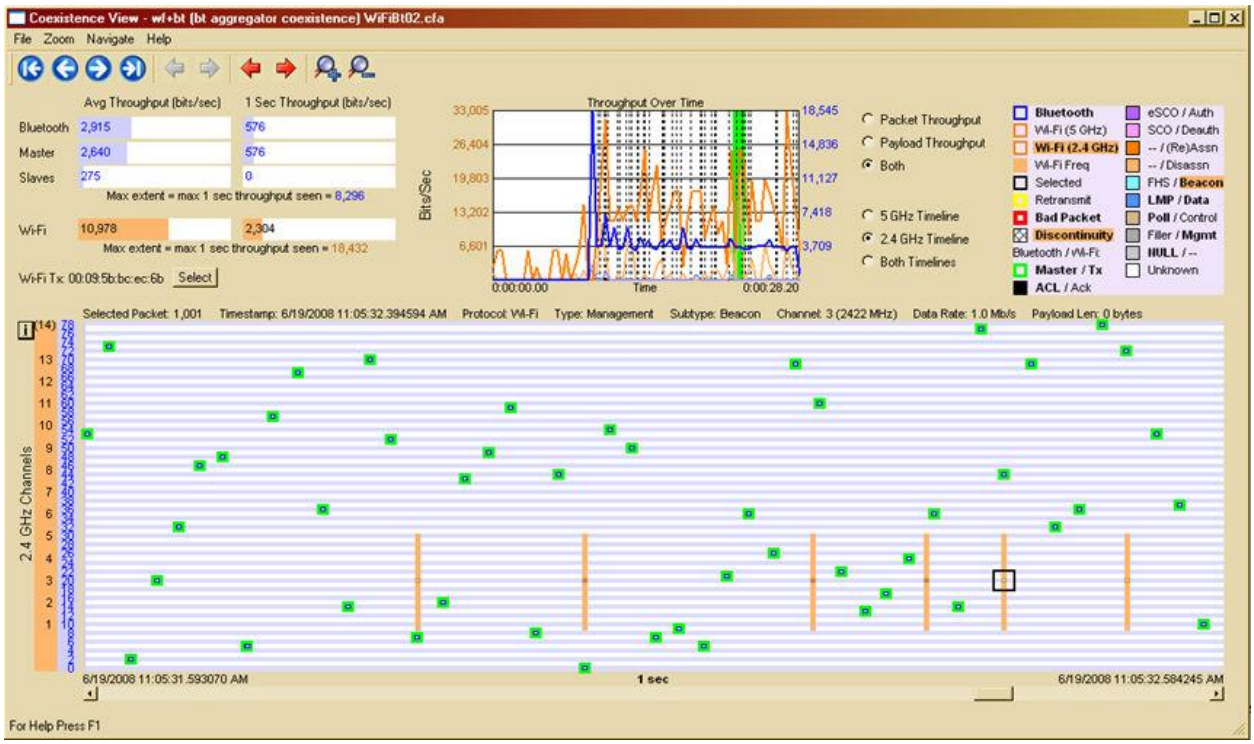
0=2402	12=2414	24=2426	36=2438	48=2450	60=2462	72=2474
1=2403	13=2415	25=2427	37=2439	49=2451	61=2463	73=2475
2=2404	14=2416	26=2428	38=2440	50=2452	62=2464	74=2476
3=2405	15=2417	27=2429	39=2441	51=2453	63=2465	75=2477
4=2406	16=2418	28=2430	40=2442	52=2454	64=2466	76=2478
5=2407	17=2419	29=2431	41=2443	53=2455	65=2467	77=2479
6=2408	18=2420	30=2432	42=2444	54=2456	66=2468	78=2480
7=2409	19=2421	31=2433	43=2445	55=2457	67=2469	
8=24010	20=2422	32=2434	44=2446	56=2458	68=2470	
9=24011	21=2423	33=2435	45=2447	57=2459	69=2471	
10=24012	22=2424	34=2436	46=2448	58=2460	70=2472	
11=24013	23=2425	35=2437	47=2449	59=2461	71=2473	

Wi-Fi Channel Frequencies – 2.4 GHz Channels

There are 14 Wi-Fi channels in the 2.4 GHz timeline. There are 11 channels available in the USA, 13 in Europe, and 14 in Japan.

The 14 Wi-Fi channels appear with an orange background along the left side of the timeline.

Selecting the icon displays channel information

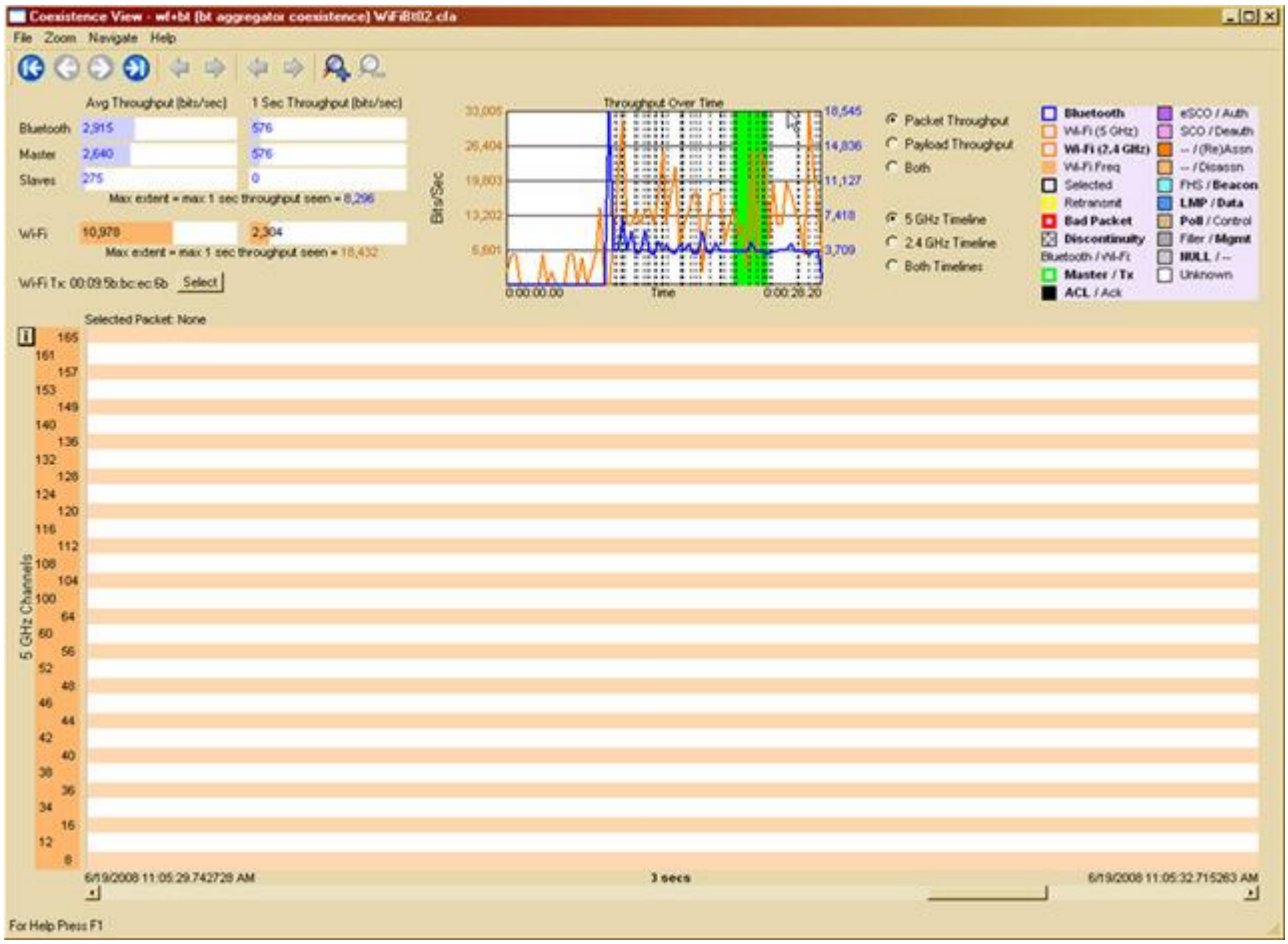


Each Wi-Fi channel is 22 MHz wide and overlap. There is a 5 MHz shift between each of the first 13 channels. There is a 12 MHz shift between channels 13 and 14.

1 = 2401-2423 MHz (centered at 2412 MHz) (USA, Europe, Japan)	8 = 2436-2458 MHz (centered at 2447 MHz) (USA, Europe, Japan)
2 = 2406-2428 MHz (centered at 2417 MHz) (USA, Europe, Japan)	9 = 2441-2463 MHz (centered at 2452 MHz) (USA, Europe, Japan)
3 = 2411-2433 MHz (centered at 2422 MHz) (USA, Europe, Japan)	10 = 2446-2468 MHz (centered at 2457 MHz) (USA, Europe, Japan)
4 = 2416-2438 MHz (centered at 2427 MHz) (USA, Europe, Japan)	11 = 2451-2473 MHz (centered at 2462 MHz) (USA, Europe, Japan)
5 = 2421-2443 MHz (centered at 2432 MHz) (USA, Europe, Japan)	12 = 2456-2478 MHz (centered at 2467 MHz) (Europe, Japan)
6 = 2426-2448 MHz (centered at 2437 MHz) (USA, Europe, Japan)	13 = 2461-2483 MHz (centered at 2472 MHz) (Europe, Japan)
7 = 2431-2453 MHz (centered at 2442 MHz) (USA, Europe, Japan)	14 = 2473-2495 MHz (centered at 2484 MHz) (Japan)
The row labels for Wi-FI channels 1-13 are placed at the center frequency of each channel	The row label for Wi-FI channel 14 is in parentheses because the channel's center frequency is above the top of the graph.

Wi-Fi Channel Frequencies - 5 GHz Channels

There are 165 Wi-Fi channels in the 5 GHz timeline. You access the 5 GHz Timeline by selecting the 5 GHz radio button.

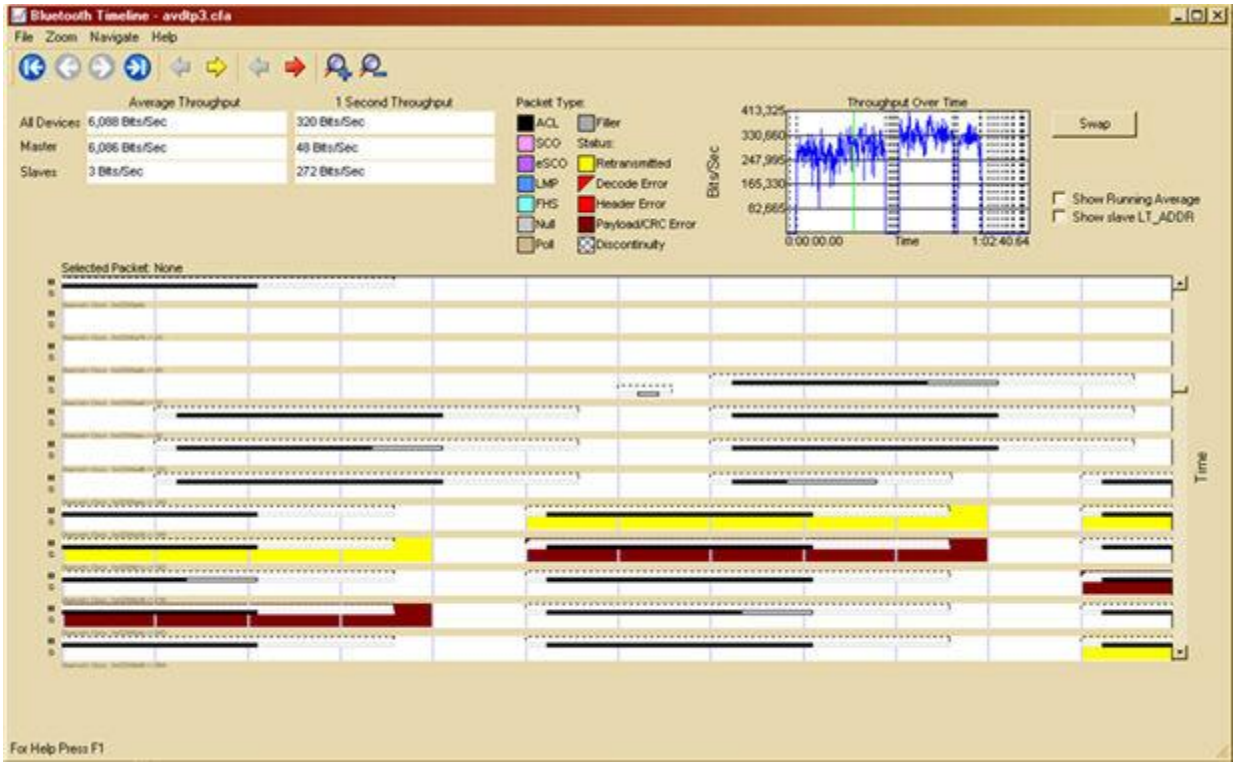


Only channels with a base value of 5 GHz and spacings of either 20 or 40 MHz are shown here. Due to space limitations, each channel is drawn with a fixed height instead of being sized and spaced relative to its width and distance from other channels (unlike the 2.4 GHz channels - both Wi-Fi and Bluetooth® - which are sized and spaced relative to each other with the exception of Wi-Fi channel 14).

Bluetooth Timeline

In addition to the Coexistence View, which displays both *Bluetooth*® and Wi-Fi data together, you can also see more information about *Bluetooth* in a separate dialog. The *Bluetooth* Timeline displays packet information with an emphasis on temporal information and payload throughput. The timelines also provide selected information from the Frame Display and the Protocol Navigator.

The timelines provide a rich set of diverse information about *Bluetooth* packets, both individually and as a range. Information is conveyed using text, color, graphic size, line type, and position.



Bluetooth Packet Timeline

You access the *Bluetooth* Packet Timeline by selecting **Bluetooth Timeline** from the View menu or by pressing the *Bluetooth* Timeline icon on the Control Window toolbar, Frame Display, or Protocol Navigator.

Visual Elements

The *Bluetooth* Timeline consists of the following visual elements:

- **The timeline shows *Bluetooth* packets within a specific period of time.**
  - The timeline shows Bluetooth packets within a specific period of time.
  - The time segments flow left to right and down, following a complete row across. Then you move down to the next row, go across, then down to the next row, just like reading a book, upper left corner to lower right corner.
  - Within each row are two divisions: M (master) and S (Slave). Packets are placed on M or S depending on which type of data it is.
  - Placing the mouse pointer on a packet displays information about that packet in an information box.
  - Selecting a packet by clicking on it shows information about that packet above the timeline.
  - You can use the arrow keys to move to the next or previous packet.You can select multiple packets by dragging within the timeline or by holding the SHIFT key down while arrowing.
  - Using the mouse scroll wheel scrolls the timeline vertically. You can also zoom by using a right click (which displays specific magnification values), using the + and - Zoom tools, or by selecting a value from the Zoom menu.
  - Packet height indicates speed (1, 2, or 3 Mbits/sec). Packet length indicates duration (for reference, the duration of a slot is 625-µs). Packet height and length together indicate size (speed times duration).

- **Rows of *Bluetooth* Slots**

  Each slot begins at the left edge of the vertical blue bar. There are two *Bluetooth* clocks per slot. Each slot represents 0.000625 seconds, or 625 µs.

- **'M' and 'S' labels**

  Within each row, master and slave packets are indicated on the left side of the row. By default, all possible slave devices (there can be up to 7) are put on the 'S' sub-row, but checking the "Show slave LT_ADDR" checkbox shows all existing slave device sub-rows with numbered labels (some or all of S1, S2, …, S7).

- ***Bluetooth* Clock**

  The *Bluetooth* clock of the first slot in each row is shown underneath each row.

- **Packet Info Line**

  The packet info line appears just above the timeline and displays information for the currently selected packet(s). If only one packet is selected, this information consists of the packet number, packet type, *Bluetooth* clock (*Bluetooth* only), and Timestamp. If multiple packets are selected, this information consists of the packet range, the *Bluetooth* clock delta (*Bluetooth* only), and the Timestamp delta. Selected packets are bounded by a magenta rectangle. See the Packet Navigation and Selection section.

- **Floating Information Window (aka Tooltip)**

The information window displays when the mouse cursor hovers on a packet (not slot). It persists as long as the mouse cursor stays on the packet or tooltip. For *Bluetooth*, the tooltip shows the packet number (in bold), the Baseband layer decode from the decode pane of the Frame Display (with the percentage of the Payload Length max added), and the decode of the highest layer (if it's not the Baseband layer) as displayed in the Protocol Navigator.

- **Discontinuities**

  Discontinuities are indicated by cross-hatched slots. See the Discontinuities section.

- **Zoom Tools**

  Zoom tools zoom in or out while maintaining the position on the screen of the area under the zoom tool. This makes it possible to zoom in or out for a specific packet or area of the timeline. See the "Zooming" section.

- **Packet Status**

  Packet status is indicated by color codes. A yellow slot indicates a re-transmitted packet, a dark red slot indicates a CRC error, and a small red triangle in the upper-left corner of the packet (not the slot) indicates a decode error.

- **Right-Click Menu**

  The right-click menu provides zooming and tool selection. See the "Zooming" section.

- **Graphical Packet Depiction**
  Each packet within the visible range is graphically depicted. See the "Packet Depiction" section.

- **Swap Button**
  The Swap button switches the position of the Timeline and the Throughput graph.

- **Show Running Average**
  Selecting this check box shows a running average in the Throughput Over Time graph as an orange line

- **Show slave LT_ADDR**

  Selecting this checkbox displays the Slave LT_ADDR in the timeline row labels.

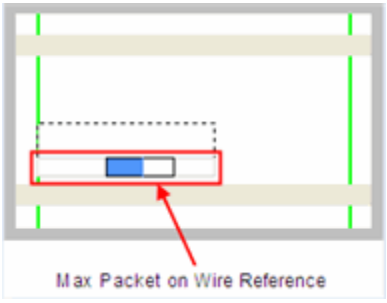
Packet Depiction

The timeline shows *Bluetooth* packets within a specific period of time.

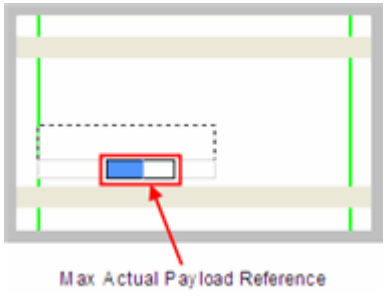
- The timeline shows Bluetooth packets within a specific period of time.
- The time segments flow left to right and down, following a complete row across. Then you move down to the next row, go across, then down to the next row, just like reading a book, upper left corner to lower right corner.
- Within each row are two divisions: M (master) and S (Slave). Packets are placed on M or S depending on which type of data it is.
- Placing the mouse pointer on a packet displays information about that packet in an information box.
- Selecting a packet by clicking on it shows information about that packet above the timeline.
- You can use the arrow keys to move to the next or previous packet.You can select multiple packets by dragging within the timeline or by holding the SHIFT key down while arrowing.
- Using the mouse scroll wheel scrolls the timeline vertically. You can also zoom by using a right click (which displays specific magnification values), using the + and - Zoom tools, or by selecting a value from the Zoom menu.
- Packet height indicates speed (1, 2, or 3 Mbits/sec). Packet length indicates duration (for reference, the duration of a slot is 625-µs). Packet height and length together indicate size (speed times duration).

A packet is drawn using the following components:

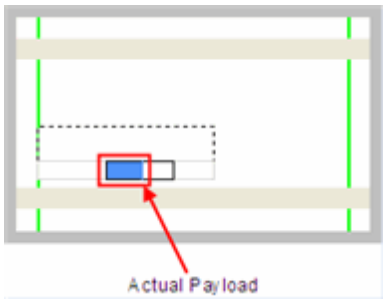
- A "**max packet on wire reference**" rectangle (light solid lines). This indicates the packet on the wire with a max payload.



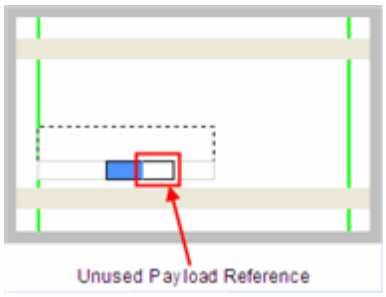
- A “max actual payload reference” rectangle (dark solid lines). This indicates a max payload as would be extracted by the receiving device (if the payload on the wire contains forward error correction (FEC), it is longer than the actual payload). The position of the beginning of the rectangle indicates where the payload begins in time.



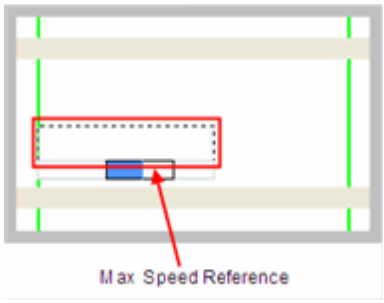
- • An “**actual payload**” colored sub-rectangle (packet category-specific; blue here). This indicates the actual received payload with FEC (if any) removed. It is the beginning portion of the “max actual payload reference” rectangle. If the actual payload is of max size, the entire “max actual payload reference” rectangle is colored.



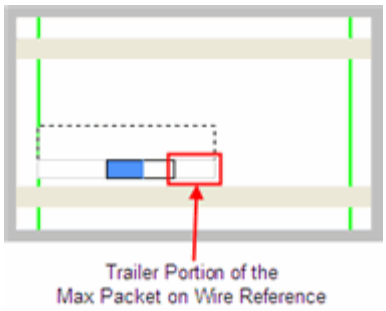
- • An “**unused payload reference**” sub-rectangle (always white). This indicates the unused portion of a maximum payload. It is the remaining portion of the “max actual payload reference” rectangle. The packet on the wire does not leave room for this. It is indicated for reference only.



- • A "**max speed reference**" rectangle (dashed lines). This is used to extend the height to that of a 3 Mbits/sec packet, and appears only for packets whose speed is less than that. The packet shown here has a speed of 1 Mbit/sec because the height of the other rectangles is 1/3 of the total height.



The part of the "max packet on wire reference" rectangle (light solid lines) that trails the "max actual payload reference" rectangle (dark solid lines) is partly packet on the wire (if the payload on the wire contained FEC) and partly trailer (CRC, etc). There is always a trailer, so there is always a little space (subject to round off error and pixel granularity) between the ends of the two rectangles.



This table shows how packets are colored:

Packet Category	Packet Types	Color
ACL	DM1, DM3, DM5 DH1, 2-DH1, 3-DH1 DH3, 2-DH3, 3-DH3 DH5, 2-DH5, 3-DH5 AUX1	Black
SCO	HV1, HV2, HV3, DV	Pink
eSCO	EV3, 2-EV3, 3-EV3, EV4 EV5, 2-EV5, 3-EV5	Purple
LMP*	DM1, DV	Dark blue
FHS	FHS	Light blue
NULL	NULL	Light gray
POLL	POLL	Light brown
Filler	Filler provided by FTS	Dark gray

*LMP is a protocol layer that uses either DM1 or DV packets. If a packet has an LMP layer, the LMP color is used instead of the packet type color.

This table summarizes the various ways in which packet information is presented:

Information	Text	Color	Graphic size	Position
Packet type	x			
Packet category		x		
Protocol	x	x		
Time of occurrence	x			x
Source device	x			x
Duration			x	
Size in bytes	x		x	
Size as a percentage of max size for that packet type	x		x	
Speed			x	
Status	x	x		

Packet Navigation and Selection

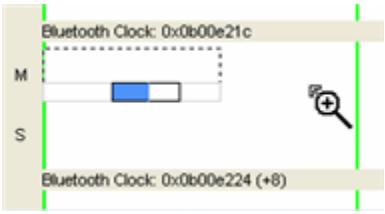
- Buttons, menu items, and keystrokes can be used to go to the next or previous packet, next or previous error packet, next or previous retransmitted packet (*Bluetooth* only), and the first or last packet.
- A single packet is selected either by clicking on it, navigating to it, or selecting it in the Frame Display.
- Selecting Previous Packet with a packet that is currently not visible, places it in the top row (i.e. the display scrolls up just enough to make it visible).
- Selecting Next Packet with a packet that is currently not visible, places it in the bottom row (i.e. the display scrolls down just enough to make it visible).
- Selecting Previous/Next for a packet that's currently visible selects it without scrolling.
- Multiple packets are selected either by dragging the mouse or by holding down the shift key while navigating or clicking.
- When a single packet is selected in the timeline, it is also becomes selected in the Frame Display. When multiple packets are selected in the timeline, only one of them is selected in the Frame Display.
- The left arrow key goes to the previous packet. The right arrow key goes to the next packet. The Ctrl-left arrow key goes to the previous error packet. The Ctrl-right arrow key goes to the next error packet.

Zooming

Zoom features can be accessed from the Zoom menu, clicking a zoom tool on the toolbar, or by right clicking on the Timeline window.

A couple of things to remember about Zooming.

- Zoom tools accessed using the right click menu allow you to maintain the current position on the screen and precisely zoom in to a specific packet.
- Selecting a Zoom icon (+ or -) on the toolbar does not change the pointer to a Zoom Tool. Each distinct click only zooms in our out.
- Zoom tools accessed from the Zoom Menu have a pointer in the upper-left corner which is useful for specifying the zoom location and bringing up a tool tip of a specific packet.



Throughput Displays

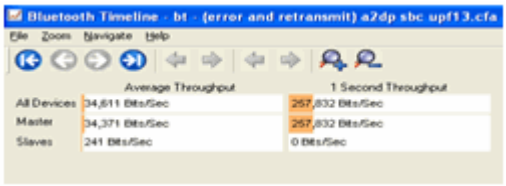
Throughput is payload over time. There are 3 categories of throughput:

- Average
- 1-second
- Graph

In computing throughput, payload is not counted from Bluetooth packets that have a CRC error (dark red slot) or that are a retransmission (yellow slot).

Average Throughput Indicators

The following figure depicts the Throughput display with the Average Throughput indicators in the left column.



Average throughput is the total payload over the entire session divided by the total time. Total time is calculated by taking the difference in timestamps between the first and last packet. In *Bluetooth*, timestamp difference is used instead of *Bluetooth* clock count because timestamp difference is immune to role switches. However, this can result in inaccuracies when the duration is small enough that a coarse timestamp granularity is significant.

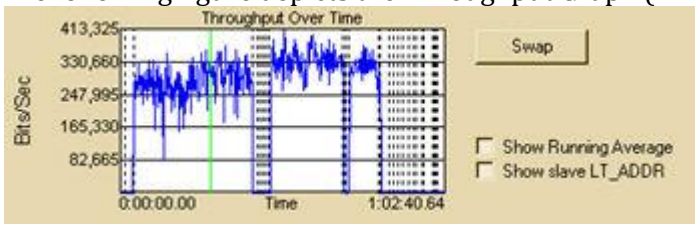
- Average throughput is shown as 0 when there is only one packet, because in that case the timestamp difference is 0 and an average cannot be computed.
- Average throughput is shown for all devices, master devices, and slave devices.
- A horizontal bar indicates percentage of max, and text gives the actual throughput.

One Second Throughput Indicators

- 1-second throughput is the total payload over the most recent one second of duration (This is determined by counting *Bluetooth* clocks). It is cleared after each discontinuity. A discontinuity is when the *Bluetooth* clock goes forward more than 2 seconds or goes backwards any amount. This is caused by either a role switch or *Bluetooth* clock rollover . The *Bluetooth* clock count is used instead of timestamp difference because the *Bluetooth* clock count is precise; however, if timestamp difference were used it would not be necessary to clear the 1-second throughput after each discontinuity.
- 1-second throughput is not an average. It is simply the total payload over the most recent one second of duration. Since it's not an average, it behaves differently than average throughput. In particular, while average throughput can be very large with only a couple of packets (since it's dividing small payload by small time), 1-second throughput is very small (since it counts only what it sees and doesn't try to extrapolate).
- A 1-second throughput is shown for all devices, master devices, and slave devices.
- A horizontal bar indicates percentage of max, and text gives the actual throughput.

Throughput Graph

The following figure depicts the Throughput Graph (Throughput Over Time).



The throughput graph shows total payload for each successive time interval. The time interval is initially 0.1 second. Each time the number of throughput elements reaches 100, they are collapsed into a set of 50 by combining adjacent elements and doubling the duration of each element. Collapsing thus occurs as follows:

Collapse count	Time since beginning of session (seconds)	Element duration after collapse (seconds)
1	10	0.2
2	20	0.4
3	40	0.8
4	80	1.6
5	160	3.2
6	320	6.4

and so on...

The bottom of the graph shows a beginning time and an ending time. The beginning time is relative to the start of the session and initially 0. When packets start wrapping out it becomes the relative time offset of the first available packet. The ending time is always the total time of the session.

Discontinuities are indicated by vertical dashed lines.

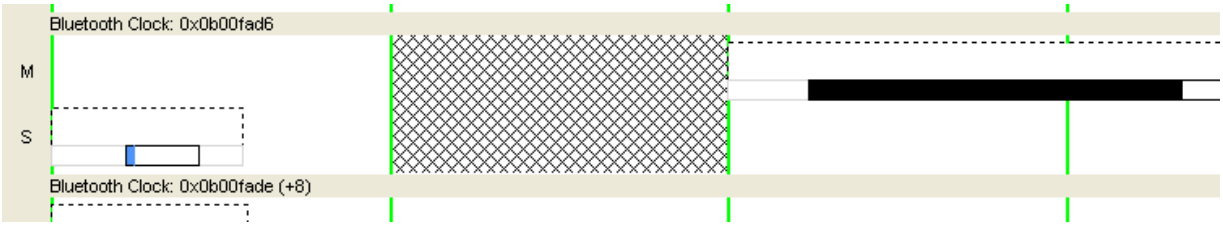
A green view port indicates the time range corresponding to the visible slots in the timeline. The view port can be moved by clicking elsewhere in the graph or by dragging. Whenever it is moved, the timeline scrolls to match. When the slot range in the timeline changes, the view port moves and resizes as necessary to match.

- The **Swap** Button
  The Swap button switches the position of the Timeline and the Throughput graph.

- **Show Running Average**
  Selecting this check box shows a running average in the Throughput Over Time graph as an orange line

Discontinuities

The following figure depicts a Discontinuity between two packets.



To keep the timeline and the throughput graph manageable, big jumps in the Bluetooth clock are not represented linearly. Instead, they are shown as discontinuities. A discontinuity is said to exist when the Bluetooth clock goes forward more than 2 seconds or backwards any amount. A discontinuity is indicated by a cross-hatched slot in the timeline and a corresponding vertical dashed line in the throughput graph. The Bluetooth clock can jump forward when capture is paused or when there is a role switch (in a role switch, a different device becomes master, and since each device keeps its own Bluetooth clock, the clock can change radically), and backwards when there is a role switch or clock rollover.

Timeline Button Bar

The button bar contains the following:


Lock - The Lock button only appears in live mode and is automatically depressed when the user scrolls.


Unlock


First Packet


Previous Packet


Next Packet


Last Packet


Previous Retransmitted Packet


Next Retransmitted Packet


Previous Error Packet


Next Error Packet

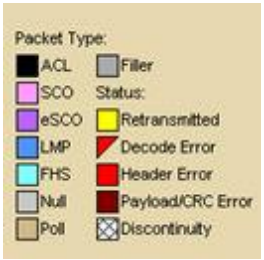

Zoom In - Click on the icon each time to zoom in from 4800 slots to 12 slots


Zoom Out - Click on the icon each time to zoom out from 12 slots to 4800 slots


Reset - The Reset button appears only in live mode. Reset causes all packet data up to that point to be deleted from the Packet Timeline display. This does not affect the data in the Frame Display or Protocol Navigator. Resetting the display may be useful when the most recent throughput values are of interest.

Legend

This legend identifies the color coding found in the timeline.



Exiting FTS4BT

To exit FTS4BT:

Go to the File menu on the Control window, and choose *Exit FTS4BT*, or close the Control window using the X icon in the top right corner of the title bar.

If you are in Air Sniffing mode, you will also need to close the Datasource by choosing *Terminate* from the *File* Menu on the Datasource or using the X icon in the top right corner.

Technical Support

Technical support is available in several ways. The online help system provides answers to many user related questions. Frontline's website has documentation on common problems, as well as software upgrades and utilities to use with our products.

Web: http://www.fte.com, click Support

Email: tech_support@fte.com

If you need to talk to a technical support representative, support is available between 9am and 5pm, U.S. Eastern time, Monday through Friday. Technical support is not available on U.S. national holidays.

Phone: +1 (434) 984-4500

Fax: +1 (434) 984-4505

Appendix A

Bluetooth ComProbe Maintenance

The *Bluetooth* ComProbe Maintenance Utility is used to configure Bluetooth ComProbes and to upgrade the Firmware. *Bluetooth* ComProbes® should be upgraded to the newest firmware release to take advantage of new features and fixes.

Upgrading Your *Bluetooth* ComProbe

1. Start the *Bluetooth* ComProbe Maintenance Utility. Open the FTS4BT desktop folder, then the Setup folder and double click the shortcut to the utility, or from your Windows operating system click *Start | Programs | FTS4BT [version#] | Setup |* ComProbe*Maintenance*. A screen similar to the following appears:

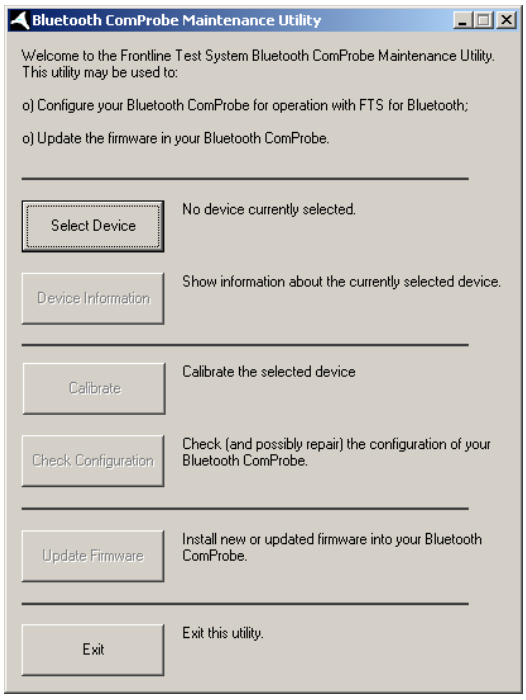


Figure 32 - *Bluetooth* ComProbe Maintenance Utility

2. Connect the ComProbe to the PC and click on the [Select Device] button. To avoid mistakes, it is recommended that only one ComProbe be connected at a time.

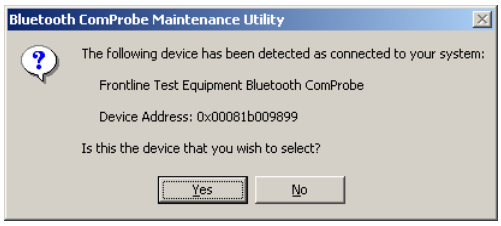


Figure 33 - *Bluetooth* ComProbe Maintenance Utility\Select Device

Select [Yes]. Older ComProbes® will display an error indicating the ComProbeis older and needs replacing. Note that when you do this, the [Device Information], [Check Configuration] and [Update Firmware] buttons should become available. [Update Firmware] will not be accessible if you are using an older ComProbe®.

3. Select the [Update Firmware] button. The utility will display a dialog titled "Select the firmware file to download".
4. There may be more than one firmware file with extension ".dfu" in the directory. The version number of the firmware will be in the name of the file. Please select the version you want (typically you should choose the highest version number) and then press the [Open] button.

If everything works correctly, the Utility should then display:

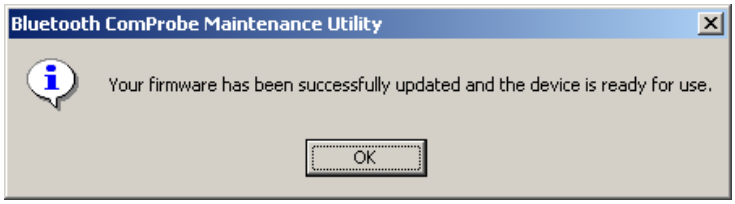


Figure 34 - *Bluetooth* ComProbe Maintenance Utility\Successful Update

Press the [OK] button.

Please note that during the firmware update process, the ComProbe is switched from normal operating mode into "device firmware upgrade" (DFU) mode. If this is the first time that a *Bluetooth* ComProbe firmware upgrade has been performed on this computer, the "Found New Hardware Wizard" may appear asking you for location of the device driver. Those may be found in the "*Bluetooth* ComProbe" sub-folder under the "Drivers" folder. For further information on using the "Found New Hardware Wizard" to install the *Bluetooth* ComProbe consult the Quick Start Guide under "*Bluetooth* ComProbe Installation".

5. As a final check of readiness, press the [Device Information] button.

- The "Device Name" should be "Frontline Test Equipment *Bluetooth* ComProbe";
- The "Device Address" should match the address printed on the label attached to the back of the device;
- "Firmware ID" should identify the latest shipping firmware.

6. Press the [OK] button.
7. Exit the Maintenance Utility by pressing the [Exit] button.