Quick Start Guide

Bluetooth Protocol Expert System

1. Bluetooth Protocol Expert System

The *Bluetooth* Protocol Expert System is used to debug protocol-related events for *Bluetooth* protocols. The expert system provides the ability to interactively select protocol events from a table of events in live capture mode or in analyzing a previously captured file. The expert system automatically analyzes *Bluetooth* packets to reveal when your implementations is violating protocol (currently A2DP and L2CAP with more coming), and identifies with reference to the relevant entries in the Bluetooth specification, violations of best practices and protocol ambiguities.

Protocol error events appearing in the **Protocol Events** pane identify the related *Bluetooth* specification reference that is likely to point to a solution to the error. The expert system references *Bluetooth* specification 5.0 and the following protocols for both Classic *Bluetooth* and *Bluetooth* low energy.

- L2CAP
- A2DP
- SDP
- SMP
- ATT

Selecting an event will dynamically link the related packet selection to the ComProbe software **Frame Display**, **Coexistence View**, **Message Sequence Chart**, **Bluetooth Timeline**, and **Packet Error Rate Statistics** (**PER Stats**).

The expert system **Toolbox** includes tools for greater precision and more control over your testing environment. The **A2DP** tool allows the Sodera, Sodera le, or BPA 600 units to become a user-controlled sink device. This tool provides a much more accurate depiction of the source device's *Bluetooth* audio score. The **LE** tool is useful for the Sodera, Sodera le, or BPA 600 creating random or sequential jammer traffic on all *Bluetooth* channels. This gives the user the ability to see how their device's communications performs on each channel in a very noisy environment.

2. Starting the *Bluetooth* Protocol Expert System

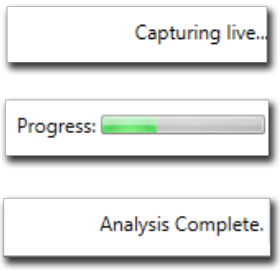
To use the *Bluetooth* Protocol Expert System the user must haveSodera, Sodera le, or BPA 600 hardware with *Bluetooth* Protocol Expert System license installed and connected to the PC. This is a requirement for both live capture and when viewing a saved capture file.

For live capture, set up the Sodera, Sodera le, or BPA 600 device datasource and begin capturing data. The Sodera, Sodera le, or BPA 600 must be capturing before the expert system can be started.

For viewing a capture file, load the saved file from the **Control** window **File** menu.

> **Note:** To use the *Bluetooth* Protocol Expert System with a capture file, Sodera, Sodera le, or BPA 600 hardware with *Bluetooth* Protocol Expert System license installed must be connected to the PC.

Bluetooth Protocol Expert System Window is opened by clicking on  on the **Control** window toolbar. If the Sodera, Sodera le, or BPA 600 hardware is not licensed for *Bluetooth* Protocol Expert System, a tooltip will appear with "Bluetooth Protocol Expert System is not licensed. Please contact sales@fte.com." Click on the  or select **Bluetooth Protocol Expert** from the **View** menu. The *Bluetooth* Protocol Expert System window will open.



When the protocol analyzer begins analysis of the captured data, the **Bluetooth Protocol Expert System** window status bar (bottom of the window) will show **Capturing live...**. The expert system does not get any frames until after the frames are analyzed. When a complete captured frame set is available, the expert system knows the file size so a **Progress** bar appears while the expert system analyzes. The expert system will search and evaluate for protocol events for warnings and errors. When the expert system has completed analyzing frames, the status bar will show **Analysis Complete** indicating that all frames have been analyzed.

If no protocol warnings or errors are detected, the window will remain empty of data.

For instructions on using the expert system Toolbox with the Frontline Sodera, see 7. Bluetooth Protocol Expert System Toolbox, on page 6.

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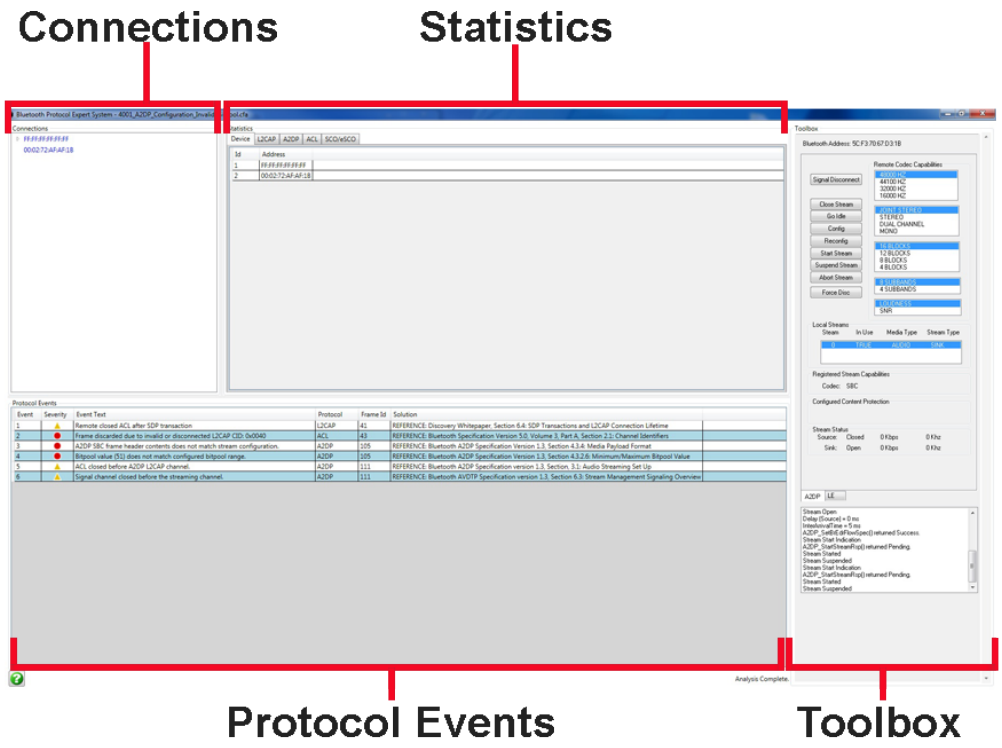
3. *Bluetooth* Protocol Expert System Window

This window is the working space for the *Bluetooth* Protocol Expert System. Upon opening *Bluetooth* Protocol Expert System by clicking on the **Control** window button, the window shown below will open with four main areas displayed described in the table below.

Detailed explanations of each window section follow.

Table 1 - *Bluetooth* Protocol Expert System Window Panes

Section	Description
Connections	Displays the *Bluetooth* master and slave device connections with associated link layer logic transport type.
Statistics	Displays the protocol statistics associated with the warning or error selected in the **Protocol Events** pane, or associated with the selected *Bluetooth* address and protocols selected in **Connections** pane. Tabbed sections contain the statistics for the protocols associated with the analyzed data. Statistics will vary depending on the protocol.
Protocol Events	Displays the *Bluetooth* protocol warnings and errors. Clicking on an event will select the associated protocol tab in the Statistics pane.
Toolbox	Used for testing audio when using the *Bluetooth* USB adapter on the HCI USB ports. See 7. Bluetooth Protocol Expert System Toolbox, on page 6



Bluetooth Protocol Expert System Window

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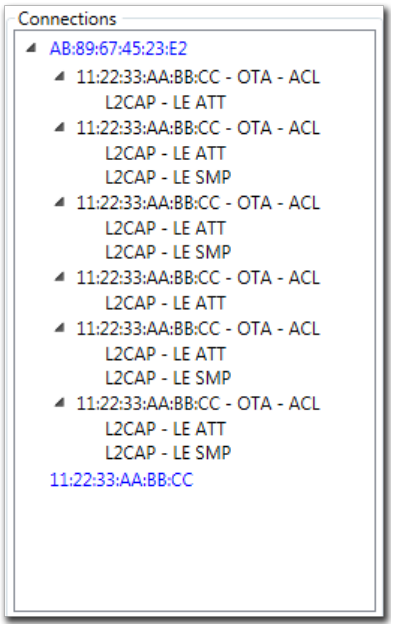
4. Expert System Connections Pane



The **Connections** pane provides a chart of all the connected devices from the current live recording session or from a loaded capture file that have a protocol error or warning appearing in the **Protocol Events** pane. Devices are identified by their BD_ADDR. A device address with an arrow symbol will expand to show the connected devices and the link layer logical transport type.

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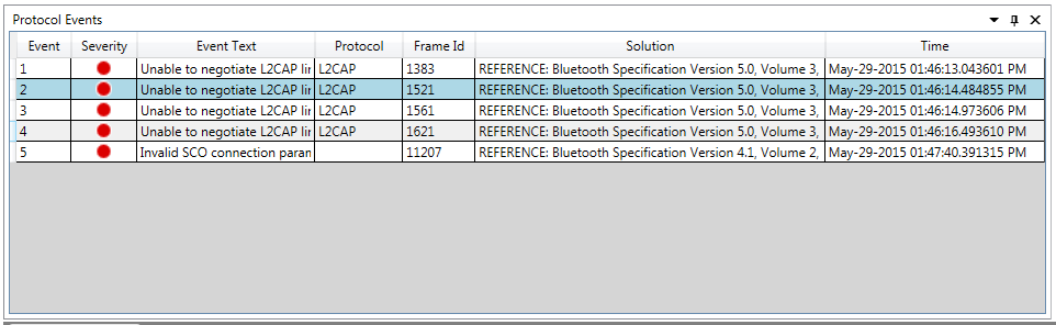
5. Expert System Protocol Events Pane



Protocol Events Pane

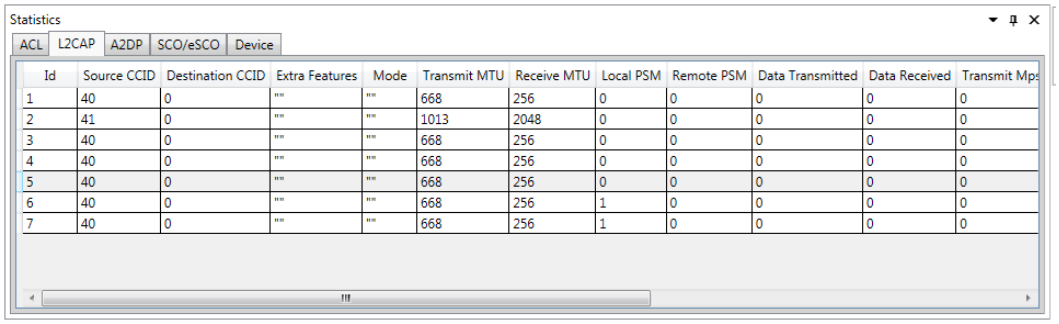
Bluetooth protocol events that generate a warning or an error in the expert system are listed in the **Protocol Events** pane. Events are listed in the order that they occur.

Table 2 - Protocol Events Pane Fields

Row Field	Description
Event	System assigned event number. Events are numbered in the order that they appear.
Severity	▲ = Warning. The event has not created a failure, but should receive some attention and further investigation.. ● = Error. The event has identified a situation that does not conform to the *Bluetooth* specification. Corrective action is required.
Event Text	Event description.
Protocol	Protocol in which the event occurred.
Frame Id	Frame where the event occurred. Clicking in the event row will select the related **Statistics** pane protocol tab and protocol **Id**. The corresponding frame is selected in the **Frame Display**, **Event Display**, **Message Sequence Chart**, **Coexistence View**, and ***Bluetooth* Timeline** or ***Bluetooth* low energy Timeline**.
Solution	A solution to the event is provided by reference to the Bluetooth specification that applies to the Event Text content.
Time	Event timestamp.

6. Expert System Statistics Pane

The Statistics pane contains detailed information about the links, protocols, and connections associated with frames or range of frames and devices of detected events. The tabs across the top list the links and protocols.



Id	Source CCID	Destination CCID	Extra Features	Mode	Transmit MTU	Receive MTU	Local PSM	Remote PSM	Data Transmitted	Data Received	Transmit Mps
1	40	0	""	""	668	256	0	0	0	0	0
2	41	0	""	""	1013	2048	0	0	0	0	0
3	40	0	""	""	668	256	0	0	0	0	0
4	40	0	""	""	668	256	0	0	0	0	0
5	40	0	""	""	668	256	0	0	0	0	0
6	40	0	""	""	668	256	1	0	0	0	0
7	40	0	""	""	668	256	1	0	0	0	0

Bluetooth Protocol Expert System **Statistics** Pane

Table 3 - Bluetooth Protocol Expert System Statistics Pane

Tab	Tab Description	Column	Column Description
ACL	An asynchronous (packet switched) connection between devices created on LMP level.	**ID**	System assigned identifier for ACL connections.
		Device A	Contains the BD_Addr of a device in the connection.
		Device B	Contains the BD_Addr of a device in the connection.
		AddrType	BR_EDR or LE
		Handle	
		Active	
		Errors	
L2CAP	L2CAP provides connection-oriented and connectionless data services to upper layer protocols with protocol multiplexing capability, segmentation and reassembly operation, and group abstractions.	**ID**	System assigned identifier for ACL connections
		Source CID	Channel Identifier for the source device.
		Destination CID	Channel Identifier for the destination device.
		Extra Features	
		Mode	
		Transmit MTU	Maximum Transmission Unit in bytes during transmission.
		Receive MTU	Maximum Transmission Unit in bytes during receive.
		Local PSM	Local device Protocol and Service Multiplexer.
		Remote PSM	Remote device Protocol and Service Multiplexer.
		Data Transmitted	
		Data Received	

Table 3 - Bluetooth Protocol Expert System Statistics Pane (Continued)

Tab	Tab Description	Column	Column Description
		Transmit Mps	
		Receive Mps	
		Transmit Window	
		Receive Window	
		Number of Retransmissions	
		Active	
		Error Count	Number of errors associated with this **L2CAP Id**.
A2DP	Advanced Audio Distribution Profile event parameters.		
SCO/eSCO	Synchronous Connection-oriented (SCO)/extended SCO.	**Id**	System assigned identification.
		Type	SCO or eSCO
		Air Mode	Part of the *voice_settings* parameter in the air mode negotiations designed to improve or optimize audio quality during transmissions. SCO: CVSD, A-law, µ-law. eSCO: CVSD, A-law, µ-law, transparent.
		Handle	
		Active	
		Error Count	
Device	This tab serves the purpose of assigning a unique expert system identification to the devices listed in the **Connections** pane.	**Id**	System assigned identification.
		Address	BD_ADDR of a device found in the **Connections** pane.

7. Bluetooth Protocol Expert System Toolbox

The Bluetooth Protocol Expert System includes Toolbox that includes the ability to emulate an A2DP sink device and the ability to generate and inject low energy packets directly into in the 2.4 GHz spectrum.

The USB adapter that is provided with your protocol expert system license is a generic Bluetooth radio. This adapter is inserted into:

- Sodera: one of the HCI USB connectors on the rear panel (See Rear Panel Connectors.), or a USB port on the host PC.
- Sodera le: a USB port on the host PC.
- BPA 600: a USB port on the host PC.

A2DP Sink

The A2DP sink functionality dramatically simplifies the troubleshooting A2DP source devices by providing engineers fine grain control of an emulated A2DP sink device. Once Toolbox A2DP is running, the user can connect to the *Bluetooth* address displayed at the top of the toolbox or by scanning for 'Frontline Test Device' friendly name.

Toolbox A2DP does not render the audio stream it receives. If the protocol stream generated by Toolbox A2DP is being captured with the OTA or HCI sniffer, audio can be extracted or analyzed via the Bluetooth Audio Expert System™ on page 1.

LE Jammer/Packet Generator

The low energy jammer or packet generation functionality provides engineers the means to test devices in a “noisy” environment by generating packets or “noise”, forcing the device under test to accommodate and adjust as it would in the real world.

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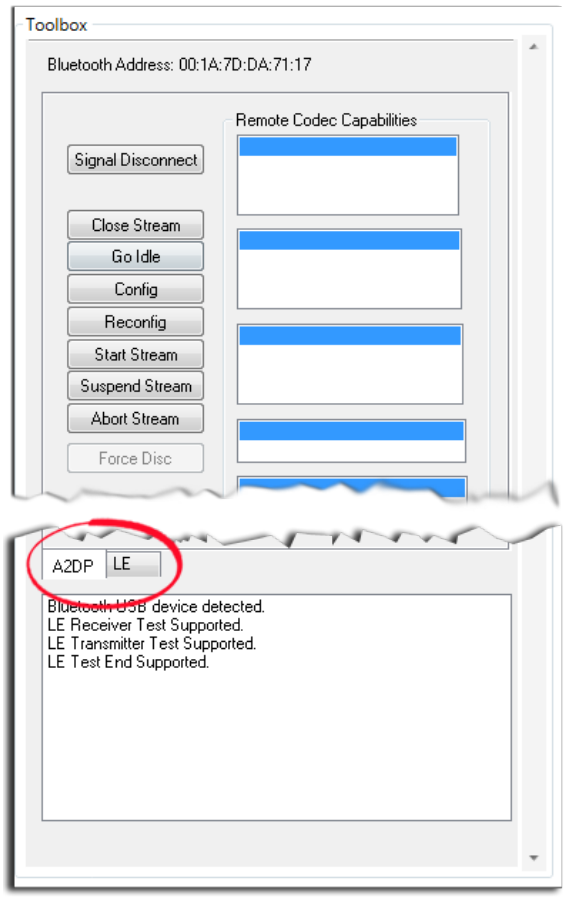
8. Toolbox Pane



The Bluetooth Protocol Expert System Test Tools pane has two tabs: **A2DP** and **LE**. Each tab has a unique set of controls. The following topics describe the controls and displays for each tab selection.

At the top of the Toolbox pane is a **Bluetooth Address**. This is the BD_ADDR of the provided Bluetooth USB Adapter. When connecting a source device this is the address to which the source is linked.

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9. Toolbox Hardware Setup

Set up the Sodera unit to use the Toolbox:

Required equipment:

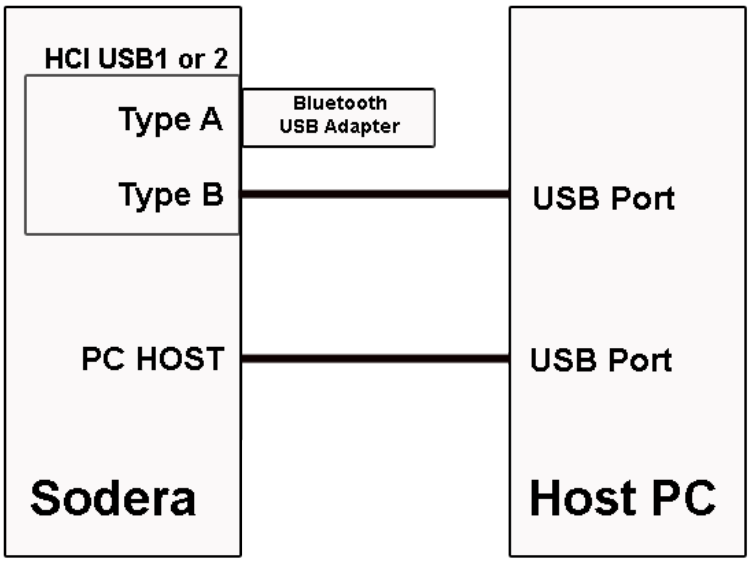
- Provided Teledyne LeCroy Bluetooth USB adapter.
- USB cable with Type A and Type B connectors.
- Host PC with 2 USB ports.

Follow these steps to prepare for using the Toolbox

1. Connect the *Bluetooth* USB adapter to the Sodera **HCI USB1** or **USB2** connector group (See Rear Panel Connectors .). Each HCI USB connector group has two ports with a USB Type A and USB Type B connector. The Bluetooth USB adapter is "keyed" to the Sodera unit.
2. Insert the provided Bluetooth adapter into the **HCI USB** group Type A connector.
3. Connect a USB cable from the same **HCI USB** group Type B connector and other end to the host PC USB connector. .

> **Note:** The adapter must be inserted prior to using the **A2DP** tool or the **LE** tool.

The Sodera hardware must also be connected to the PC Host connector via an additional USB connector, since the Bluetooth Protocol Expert System is licensed for a specific Sodera hardware unit.



Sodera Toolbox USB Adapter Test Setup.

It is not necessary to connect the *Bluetooth* USB adapter to the Sodera unit. Alternatively, the USB adapter may be connected directly to a Host PC USB port. However, an advantage to using the **HCI USB** connectors is the ability of the Sodera unit to HCI capture of the Toolbox sessions.

Set up the Sodera le unit to use the Toolbox:

Required equipment:

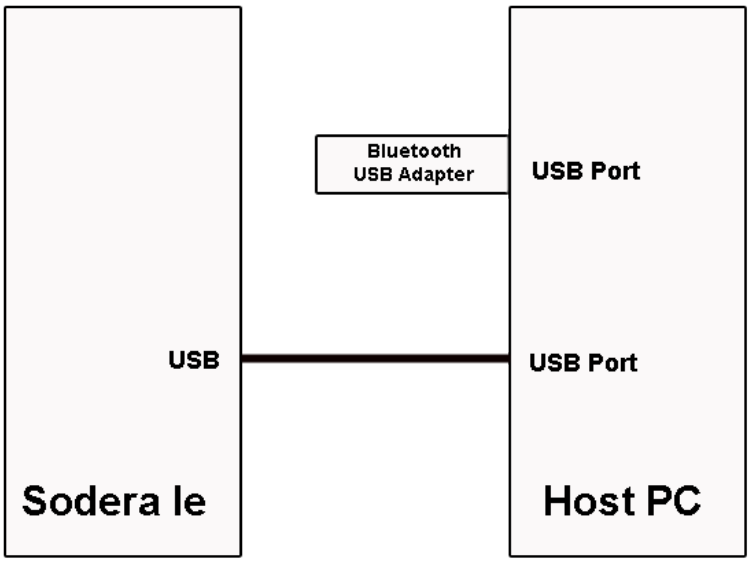
- Provided Teledyne LeCroy Bluetooth USB adapter.
- Host PC with 2 USB ports.

Follow these steps to prepare for using the Toolbox

1. Connect the *Bluetooth* USB adapter to a Host PC USB port.

> **Note:** The adapter must be inserted prior to using the **A2DP** tool or the **LE** tool.

The Sodera le hardware must also be connected to the PC Host connector via an additional USB connector, since the Bluetooth Protocol Expert System is licensed for a specific Sodera le hardware unit.



Sodera le Toolbox USB Adapter Test Setup.

Set up the BPA 600 unit to use the Toolbox:

Required equipment:

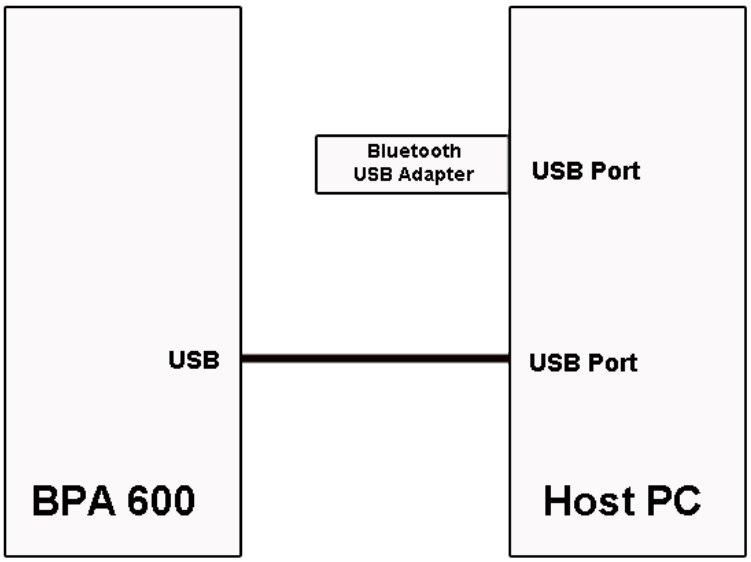
- Provided Teledyne LeCroy Bluetooth USB adapter.
- Host PC with 2 USB ports.

Follow these steps to prepare for using the Toolbox

1. Connect the *Bluetooth* USB adapter to a Host PC USB port.

> **Note:** The adapter must be inserted prior to using the **A2DP** tool or the **LE** tool.

The BPA 600 hardware must also be connected to the PC Host connector via an additional USB connector, since the Bluetooth Protocol Expert System is licensed for a specific BPA 600 hardware unit.



BPA 600 Toolbox USB Adapter Test Setup.

This quick start guide provides sufficient information to begin the data capture. Detailed hardware and software information is contained in the Frontline Sodera, Sodera le, BPA 600 User Manuals. The manual is available on FTE.com.

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