Instruction

Z-Wave Zniffer User Guide

Document No.:	INS10249
Version:	22
Description:	Description of the Z Wave Zniffer development tool used for detecting RF communication in a Z Wave network. The tool is used during SW application development for debugging etc.
Written By:	JFR;JRM;BBR;SEROMAN1;AYURTTAS;SCBROWNI;VOSAVOST;OBOIKO
Date:	2020-12-01
Reviewed By:	JKA;COLSEN;CRASMUSSEN;LTHOMSEN;JBU;JSI;ABUENDIA;SEROMAN1;SCBROWNI;JFR
Restrictions:	Public

Approved by:

Date	CET	Initials	Name	Justification
2020-12-01	04:37:57	NTJ	Niels Johansen	

REVISION RECORD

Doc. Rev	Date	By	Pages affected	Brief description of changes
1	20031126	JFR	All	Initial draft
2	20051004	TKR MVO	All All	Added 40kbps support and various GUI enhancements New 1st page/header/footer contents. New Doc No.
2	20070301	JRM JFR	Section 4	GUI description and installation updated
3	20070820	IHM	All	Getting Started section has been updated. New features (Duty Cycle Watcher, Frame Flow Diagram, Filters) have been described.
3	20070830	IHM	All	Changes according to Product Specification of Zniffer and XML Editor enhancements. RSSI section has been removed.
3	20070903	IHM	All	New features (Statistics Summary, toolbar buttons, Properties dialog) have been added
3	20070927	IHM	All	Figures/screenshots have been updated. Chapter “3. Getting Started” has been revised. Chapter “5. Capturing live RF traffic” has been enlarged.
4	20071119	IHM	All	Some missing topics in chapter 5 “Capturing live RF traffic”, chapter 7 “Working with captured packets” and chapter 8 “Statistics” have been restored. New topic “Working with encrypted frames” has been added to chapter 7 “Working with captured packets”.
5	20071119	IHM	All	Broken cross-references have been manually fixed.
6	20071228	IHM	All	Some missing abbreviations have been added. More details about the content of Developer’s Kit CD. More details for the installation procedure. New “Troubleshoot …” sections have been created. Many updates of User interface (menu, toolbar and dialogs). New section with “Keyboard shortcut” has been added. “Preferences” section has been revised. More details have been added to all file-related actions, especially to “Export to text file” and “Merge files”. New “File Properties” section has been added. More details have been added to “Highlighting frames”. “Filter” section has been enhanced. Most of the “Statistics” chapter has been re-written.
7	20110519	DDA	All	Revised document to cover all available features
8	20121207	DDA	Section 7.9	RSSI description added.
9	20130514	MVO	All	Replaced first section and updated headers/footers
9	20130530	DDA	All	Revised document to cover all available features Removed reference to SDK CD
10	20150914	SRO	All	Update all screenshots Update installation path Added Figure 13. Open Large Trace
11	20160128	SRO; VSA	3.1 4.2.5 4.2.6 7.5 7.10	Added Windows 10 as compatible OS Added: Tools menu Added: Help menu Updated: load keys from file, show key after decrypt Added: Debug output
12	20160726	VSavostianenko	3.2.2	Added: Installation of Silicon Labs ZWave programming interface
13	20180306	BBR	All	Added Silicon Labs template
14	20180531	VSavostianenko	3.1	Updated required .NET Framework version
14	20180531	VSavostianenko	All	Update all screenshots
14	20180531	VSavostianenko	3.2.1	Clarified step 7 and removed steps 8 and 9
14	20180531	VSavostianenko	All	Removed redundant screenshots
14	20180531	VSavostianenko	4.3	Updated Table
15	20190315	JFR	All	Fixed page numbers
16	20190325	SRO	3.2.2	Added missing figure

17	20190923	seroman1	4.8 All	Added section Update screenshots
18	20200615	seroman1	1	Added US_LR, PTI, WSTK abbreviation
18	20200615	seroman1	All	Update screenshots
18	20200616	seroman1	3.2	Update sections
18	20200617	seroman1	3.4,5.2,5.3,7.9	Added section related to WSTK board
19	20200625	seroman1	3.4.2	Added how to configure IP Address for the WSTK board
20	20200828	vosavost	3.3	Updated startup description and added CLI arguments
21	20201124	vosavost	3.4.2	Updated 'PTI Firmware update'section
22	20201130	Scbrowni	All	Tech Pubs review for all sections add or revised since the document was last publish at Revision 13

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1 Abbreviations

Abbreviation	Explanation
ANZ	Australia and New Zealand, 921.42 MHz frequency
COM	Serial port interface on IBM PC-compatible computers
EU	European Union, 868.42 MHz frequency
HEX	Intel HEX is a file format for conveying binary information for applications like programming microcontrollers, EEPROMs, and other kinds of chips
HK	Hong Kong, 919.82 MHz frequency
ID	Identification number
IL	Israel
IN	India, 865.22 MHz frequency
JP	Japan, 950.95 MHz frequency
KR	South Korea
MY	Malaysia, 868.2 MHz frequency
NaN	Not a number
PC	Personal computer
PTI	Packet Trace Interface
RF	Radio Frequency
RSSI	Received Signal Strength Indicator
SDK	Software Developer's Kit
SW	Software
TF	Test Frequency
US	United States, 908.42 MHz frequency
US_LR	United States, Long Range
USB	Universal Serial Bus, a serial bus standard to interface devices
WSTK	Wireless Starter Kit
XML	Extensible Markup Language
RU	Russia, 869.2 MHz frequency

2 Introduction

2.1 What is Z-Wave Zniffer

The Z-Wave Zniffer application is a development tool for capturing Z-Wave RF communication and presenting the frames in a graphical user interface on a PC. The tool shows the node ID of the Source and Destination for the communication, the type of frame [2] being sent, and the application content, i.e. the specific command, which is being sent.

The Zniffer tool listens passively to the Z-Wave network traffic and will only display the RF communications taking place within direct RF range. Be aware that Zniffer can occasionally miss RF communication even from Z-Wave nodes within direct range.

2.2 Purpose

The purpose of this document is to describe the Z-Wave Zniffer development tool used during SW application development for debugging, etc.

2.3 Audience and Prerequisites

The audience is external R&D software application programmers.

3 Getting Started

3.1 Check the Prerequisites

The .NET Framework 4.6.1 or later should be installed on the machine that you need to run Z-Wave Zniffer Windows application.

Limitation: Z-Wave Zniffer has been tested on Windows 10. The PC application is a 'desktop application'.

Important: Make sure you have the latest service pack and critical updates for the version of Windows that you are running.

3.2 Install the Zniffer

3.2.1 Install Application

1. Run ".msi" installer file. Follow the instructions.
2. Please note the copyright notification on the welcome page and click **Next** button.
3. Select the installation folder. Please note that it is recommended one does not move the Zniffer application manually after it has been installed into the above specified folder. When done, click **Next**. Then follow the installation procedure. The actual installation procedure will pass with a progress indicator. After the final confirmation appears, click **Close** to complete the installation.

3.2.2 Install Programming Driver

Skip this section if you do not have a 500 series USB Sniffer stick.

1. Exit all programs.
2. Install driver with name **"zw05xxprg.inf"** in the "<drive name>\SDK\Tools\PC Programmer\PC\ZW050x_USB_Programming_Driver" from file context menu.

To update Zniffer firmware one must install the *"Sigma Designs ZWave programming interface"* driver. If the driver is installed and the Zniffer update fails or does not start, try to repeat the previous steps after successfully removing the ZWave programming interface from device manager.

1. Open **Device Manger**.
2. Expand **Ports (COM & LTP)** in tree.
3. Check **Show hidden devices** in **Main Menu -> View** to enable view of unconnected *"Sigma Designs ZWave programming interface"*.
4. Select any *"Sigma Designs ZWave programming interface"* and run uninstall from context menu (Figure 1 below).

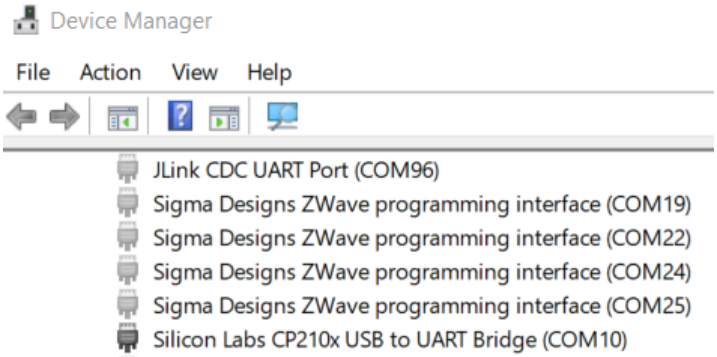

Figure 1. Device Manager. Ports list.

3.3 Start the Zniffer Application

To open Z-Wave Zniffer, click its icon shown on the desktop. If you do not see its icon there, type “Zniffer” in the windows search input.

Each time you start Z-Wave Zniffer, you are actually running the **%ProgramFiles(x86)%\Silicon Labs\Z-Wave Zniffer 4 \ZWaveZnifferUI.exe** executable file (default installation location), although you do not usually type its name or even see it.

Another way to start the Zniffer application is possible from CLI using arguments:

- ZWaveZnifferUI.exe <trace file>
- ZWaveZnifferUI.exe <trace file> -f <freq>
- ZWaveZnifferUI.exe -t <trace file> -f <freq>

Where –f <freq> is parameter to set frequency and –t <trace file> is destination to trace file. If parameters are not set will be used defaults, for the frequency, it is last used and for trace - temporary file.

After the application has started it tries to initialize a connected device by the next algorithm:

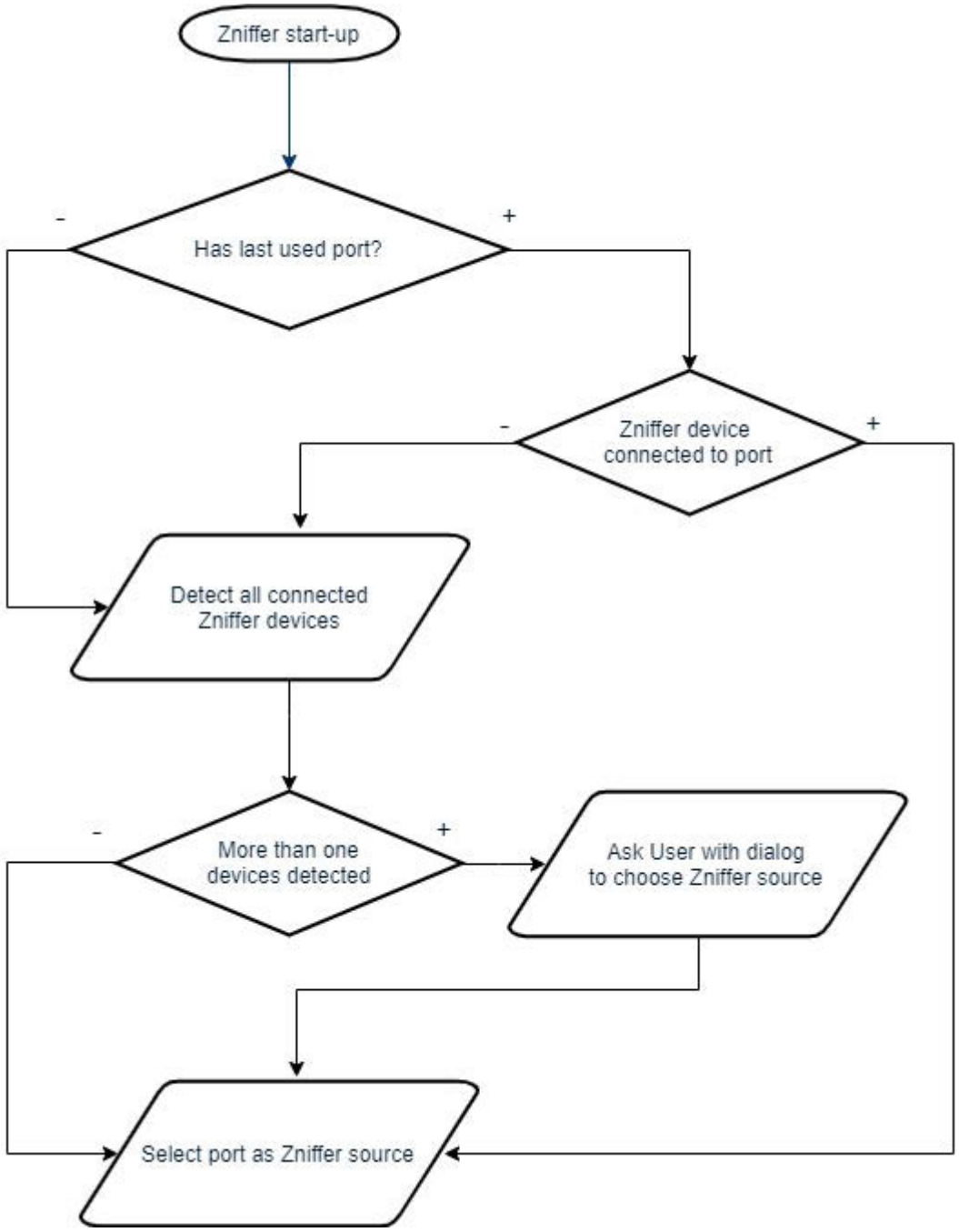

Figure 2. Z-Wave Zniffer Startup Flow

3.4 Quick-Start Guide

3.4.1 Using 500 series module with Zniffer firmware

Steps:

1. Flash the appropriate hex file to a Z-Wave module. Refer to [1] for instructions on how to do this. Connect the Z-Wave module / Z-Wave Interface module to a COM/USB port on your PC.
2. Open Z-Wave Zniffer.
3. Select the COM port in the 'Capture' – 'Port Selection' sub-menu or from the port selection dropdown list on the toolbar. You may also check the Frequency Selection item.
4. To start capturing the RF traffic, click the Start button at the toolbar or press F5 key on your keyboard.
5. To save your log file, click the Save button at the toolbar or press Ctrl+S keyboard shortcut on your keyboard, type a name for the file in the Save As box, and then click Save.

3.4.2 Using WSTK board with PTI firmware

In order to use WSTK board it must be configured to use IP Address. If you have DHCP server in your network, then the WSTK board automatically receives the IP Address, otherwise configure static IP address like:

- Configure static IP address for the ethernet adapter (example: 192.168.2.100).
- Configure static IP address of the WSTK board using Simplicity Commander (example 192.168.2.101). You can do this using Simplicity Commander in GUI mode or command line commands. Example for WSTK board with USB serial number = `440155278`
    - Get IP configuration:

```
commander.exe adapter ip -s 440155278
```

    - Set DHCP mode:

```
commander.exe adapter ip -s 440155278 --dhcp
```

    - Set static IP Address:

```
commander.exe adapter ip -s 440155278 --addr 192.168.2.102/24
```

- The adapter must be restarted to acquire a new IP address.

Steps:

1. Install 700 series module (ZGM130S) on the WSTK board. Run Simplicity Commander[4] and program it with PTI enabled application (Example of the PTI enabled application – ZnifferPTI, **Z-Wave ZnifferPTI US_LR Region 7.xx.x,** placed in Simplicity Studio v5 'Example Project and Demos')
2. Make sure you can connect to the WSTK board with its IP Address using Simplicity Commander.
3. Open Z-Wave Zniffer.

4. Select the IP address of the WSTK board in the 'Capture' – 'Port Selection' sub-menu or from the port selection dropdown list on the toolbar.
5. To start capturing the RF traffic, click the Start button at the toolbar or press F5 key on your keyboard.
6. To save your log file, click the Save button at the toolbar or press Ctrl+S keyboard shortcut on your keyboard, type a name for the file in the Save As box, and then click Save.

3.5 Auto Update 500 series module Zniffer Firmware

When you connect to the 500 series Zniffer USB stick or Z-Wave module with outdated Zniffer firmware, the start capturing trace update firmware dialog appears:

1. Click **OK** and the latest firmware programing update will be started. After successfully updating the firmware, the sniffer capture will be started.
2. If the programming update process fails, a notification dialog will open. In this case, use the PC Programmer application to update sniffer module firmware. Refer to [1] for instructions on how to do this.

3.6 Remove Z-Wave Zniffer

You can uninstall Z-Wave Zniffer from your computer if you no longer use it.

1. Open **Apps and Features** in Control Panel.
2. Click the program in the list and then click the **Uninstall** button. You can sort programs by electing different options in **Sort by**.
3. Z-Wave Zniffer and its settings will be completely removed without prompting you further.

3.7 Troubleshoot Installation Problems

Here are solutions to some common problems with installing Z-Wave Zniffer.

3.7.1 Installation Stops without .NET Framework

This is caused by lack of the .NET Framework which is the required component as is described in section 3.1 "Check the prerequisites". Please install the latest .NET Framework from Microsoft web site and run the setup again.

3.7.2 Installation Stops with an Error Message

This is caused by a previous version of Z-Wave Zniffer that is already installed on your computer and cannot be automatically removed. To see the details for this error, click the **Details** button. It displays the reason for this error:" Another version of this product is already installed. Installation of this version cannot continue. To configure or remove the existing version of this product, use Add/Remove Programs on the Control Panel."

If you have encountered this problem, uninstall the previous version using standard Windows tools and then start the installation of the new version again. For more details see section 3.6 “Remove Z-Wave Zniffer”.

4 User Interface

4.1 Layout of the Zniffer Main Window

Figure 3 shows Z-Wave Zniffer as it usually looks after some frames are captured or loaded from the previously saved file.

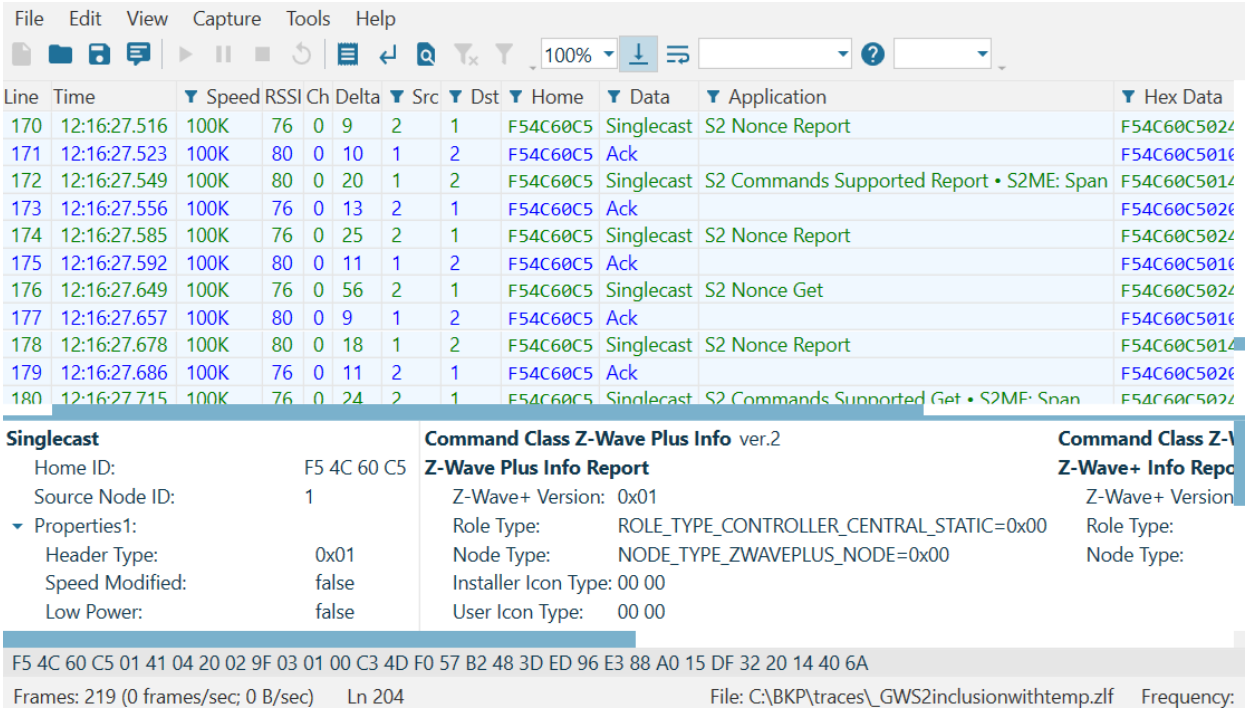

Figure 3. Z-Wave Zniffer Main Application Window

Z-Wave Zniffer main window has the same basic parts as other Windows applications:

- ***Title bar*** displays the name of the program. It may also display the name of opened/saved log file.
- ***Menu bar*** contains items that you can click to make choices in a program. See Section 4.2 “Menu Bar”.
- ***Toolbar—*** The row of buttons, which represent tasks you can do within a program. It provides quick access to common tasks frequently accessed from the menus. See Section 4.3 “The Toolbar”.
- ***Frame List pane*** displays all captured frames with summary information about every frame. By clicking on any frame/row in this pane you control what is displayed in the other parts. See Section 4.5 “Frame List Pane”.
- ***Frame Details window*** displays one frame selected in the packet list pane in more detail. See Section 0 “Frame Details window” below.
- ***Statusbar*** shows some detailed information about the current program state and the captured data. See Section 4.7 “The Status Bar”.

4.2 Menu Bar

On top of the main window is the application menu. It has the following items:

4.2.1 File Menu

This menu contains options to create new, open, save capture files, and to quit from Z-Wave Zniffer. The File menu has the following items:

Menu Item	Keyboard Shortcut	Description
New	Ctrl+N	Clear the current log and initiate a new one and create a file for it.
Open	Ctrl+O	Opens a standard File Open dialog to open the saved log and connect to it in real time.
Save	Ctrl+S	Saves the current trace to a file.
Save Fragment		Enables the user to save selected or filtered items.
Trace Comment		Add a comment to a trace.
Reload Command Classes XML File		Reload the Command Classes XML file, if required. See section 7.8 “Editing the Command Classes XML file”.
Exit		Exits the application.

4.2.2 Edit Menu

The Edit menu has these items:

Menu Item	Keyboard Shortcut	Description
Copy	Ctrl+C	Copies the values of the selected frame into the clipboard.
Select All	Ctrl+A	Selects all elements in the current window (usually all frames).
Highlight		Sub-menu with the items to operate the highlighted rows/frames.
Highlight by Source		Highlights all frames/rows with the same Source node ID as the selected one.
Highlight by Destination		Highlights all frames/rows that has the same Destination node ID as the selected one.
Highlight by Source and Destination		Highlights all frames/rows sent between the nodes shown as Source and Destination node of the selected one.
Clear Highlighting		Removes the active highlighting.
Go to line number	Ctrl+G	Shows a dialog box where the user can enter a line number. The Frame List will then change to this line.
Find	Ctrl+F	Shows a search dialog box to navigate within the visible frames in the Frame List.

4.2.3 View Menu

The View menu has these sub items:

Menu Item	Keyboard Shortcut	Description
Frame Details		Shows/hides the Frame Details window. For more details see Section “Frame Details Window” below.
Show Grid Lines		Shows/hides table grid lines.
Size All Columns to Fit		Automatically adjust the width of all columns in the Frame List for the best appearance.
Toggle Colors		Switches on and off the foreground and background colors for all trace items.
All Frame Types		Shows/hides all known frame types including Serial Api commands stored to PC Controller communication trace.
Network Load Trace		Shows/hides network load view.
Drop Filter		Clears all the active display filter conditions.
Toggle Filter		Applies/Hides the current display filter while leaving it active.
Add Watch	Ctrl+Shift+W	Add new Watch window. See Section 7.5 “Watch”.

4.2.4 Capture Menu

The Capture menu has these sub items:

Menu Item	Keyboard Shortcut	Description
Detect Zniffer Modules		Detect Zniffer modules connected to available serial ports.
Port Selection		The Port Selection sub-menu allows you to select which serial port your Zniffer hardware (Z-Wave Module programmed with sniffer embedded application) is connected to. This menu contains only the serial ports that are installed on your computer and your menu may vary. There is a check mark next to the selected serial port.
Frequency Selection		This menu will show you a list of frequencies supported by the Zniffer device currently connected to the PC. Becomes active only after start of the trace. Click on the frequency to select it.
Rescan Serial Ports		Rescan available serial ports.
Start	F5	Starts the capture using the Sniffer connected to the selected port at the selected frequency
Pause	Ctrl+Shift+P	Pauses capture. Capture can be resumed.
Stop	Ctrl+Shift+S	Stops capture. A new capture can be started only.

4.2.5 Tools Menu

The Tools Menu has these sub items:

Menu Item	Keyboard Shortcut	Description
Debug Port Selection		To connect to debug port.

4.2.6 Help Menu

Menu Item	Keyboard Shortcut	Description
About		Shows information about application

4.3 The Toolbar

The toolbar is located directly below the main menu. It contains the following controls:

Menu Item	Description
New	Creates new log and creates a file for it.
Open	Opens the previously saved Zniffer log file. See Section 6.1 “Open File”.
Save	Saves the current log into a file.
Trace Comment	Adds comment to a trace.
Start	Starts the capture.
Pause	Pauses capture.
Stop	Stops the capture.
Restart	Restarts current capture.
Reload Command Classes XML file	Reloads the Command Classes XML file, if required. See section 7.8 “Editing the Command Classes XML file.”
Add Watch	Adds new Watch window. See Section 7.5 “Watch.”
Go to line number	Navigates to the frame with the given Line No.
Find Specific line	Opens a dialog to find a frame with specific characteristics.
Drop Filter	Clears all the display filter conditions.
Toggle Filter	Applies/Hides the current display filter while leaving it active.
Zoom	Changes the font size in the frame list pane.
Auto Scroll	Clicks to start and stop automatically scrolling to last trace items in the Frame List.
Port	The dropdown list selector of the serial port for the application to run on.
Detect Zniffer Modules	Detects Zniffer modules connected to available serial ports.
Frequency	Selects working frequency.

4.4 Keyboard Shortcuts

The following table contains the keyboard shortcuts.

Press This Key	To Do This
CTRL+C	Copies the selected item to Windows Clipboard.
CTRL+A	Selects all items in a window (usually all frames in Frame List pane).
CTRL+N	Clears the current log and initiates a new one.
CTRL+O	Opens a standard File Open dialog to open the saved log.
CTRL+S	Saves the current trace to a file.
ALT+F4	Exits the application.
ESC	Cancels the current task (close active dialog).
F5	Starts the capture using the Sniffer connected to the selected port at the selected frequency.
CTRL+SHIFT+P	Pauses capture. Captures can be resumed.
CTRL+SHIFT+S	Stops capture. A new capture can be started only.
CTRL+G	Shows a dialog box where the user can enter a line number. The Frame List will then change to this line.
CTRL+F	Shows a search dialog box to navigate within the visible frames in the Frame List.
CTRL+SHIFT+W	Adds new Watch window.

4.5 Frame List Pane

The frame list pane is a table that enlists all the captured or opened frames. Right-click on pane to configure which of following columns to show in grid:

Column Name	Description
Line No.	The line number for the frame.
Date	The date when the frame has been captured.
Time	The time when the frame has been captured.
Speed	Transmission rate: 9600 bits per second or 40 kilobit per second.
RSSI	RSSI value as measured by the node.
Channel	Channel in use by the node.
Delta	Time since that last frame was captured, in milliseconds.
Source	Node ID of the source device. If frame is being routed, the following format is used: xx(yy) where, xx is the node forwarding the frame from original node yy.
Destination	Node ID of the destination device(s). If frame is being routed, the following format is used: xx(yy) where, xx is the node forwarding the frame to ultimately reach yy.
Home ID	The unique ID of the Z-Wave network where the frame originated.
Data	Frame type, that is whether it is a Singlecast, Multicast, Broadcast, or acknowledge frame and whether it is routed or not. In case of routed frames the following format is added: xx(yy)->zz, where xx is the node forwarding the frame, yy the original sender and zz the destination.
Application	Information about the application part of the frame. Attention! The values for this column are taken from the frame using the data from XML file.
Hex Data	Hex Dump of the entire frame.

To automatically fit the width of all columns for the best appearance with the current display font settings and window size, click **Auto size Columns** button at the toolbar.

4.6 Frame Details Window

In the window below the Frame List pane, you can see the Frame Details with all the details about the currently selected frame.

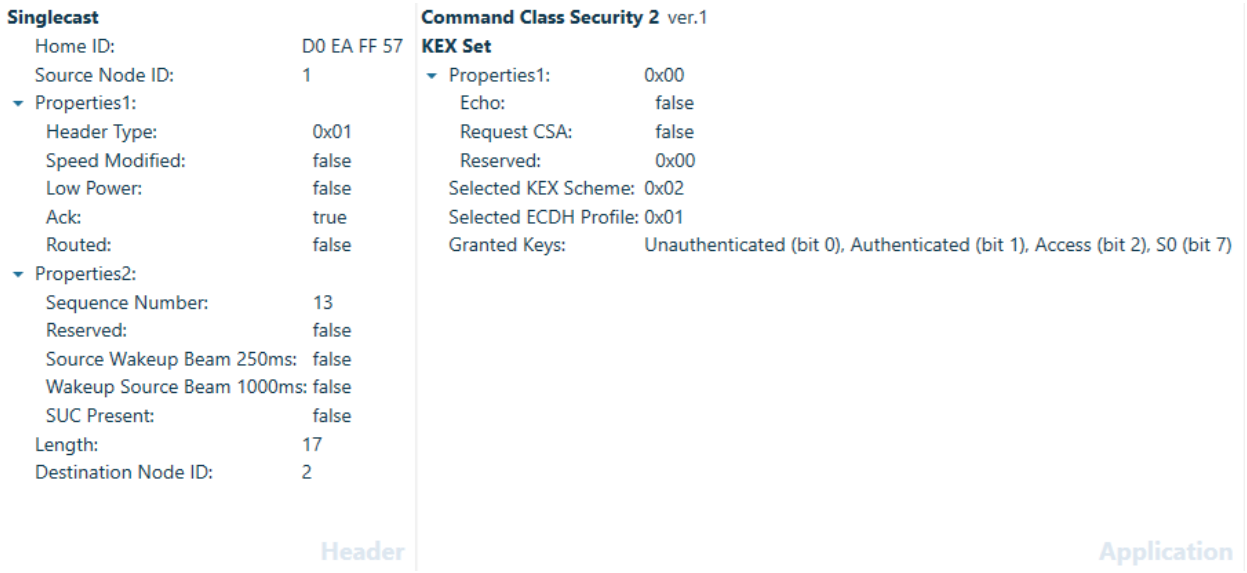

Figure 4. Frame Details Window

Zniffer parses the frames captured from RF using XML files (format R1) generated by the Z-Wave XML Editor [3]. In addition, the Z-Wave XML Editor allows the customer to define command classes under development or proprietary command class structures and, thereby, enables interpretation in the Zniffer tool.

To show/hide the Frame Details window, click the **View** menu, then click **Frame Details** or the arrow button in the window top.

4.7 The Status Bar

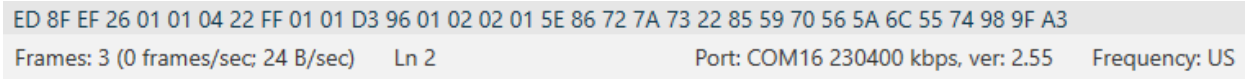

Figure 5. Status bar

In the status bar on the bottom, you can see status information:

Area	Description
Frames: N (X frames/sec; Y B/sec)	Total count of the frames that have been captured in the log and the average data speed.
Line: N	Line number of the current frame.
Selected Count: X Timespan: Y	Quantity of selected frames and the total time span of these selected frames calculated on basis of Delta values.
Is Filtered: False/True	Status of the current display filter. It displays “Filtered: True” if some display is active or “Filtered: False” if display filter is inactive or display conditions are empty. **Note!** After starting to capture the traffic, you may see an empty Frame List pane while traffic is coming. Check the **Filtered** state at the status bar to make sure you have no display filter that prevents frames from being displayed in the Frame List.
Port: X	Active Port selection.
Frequency: X	Active Frequency selection.

4.8 Network Load Trace View

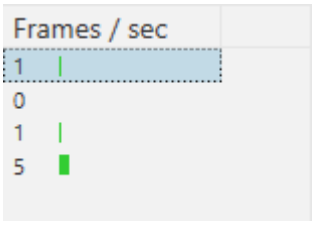

Figure 6 Network Load Trace

The network load trace view shows frames per second for a time slice of 10 seconds. Click on an item to navigate to the desired network load in trace. The network load trace automatically updates every 10 seconds showing the average frames per second rate.

5 Capturing Live RF Traffic

5.1 Introduction

Capturing live Z-Wave network RF messages is one of the major features of Z-Wave Zniffer.

The Zniffer capture engine provides the following features:

- Captures messages from all Z-Wave devices within direct RF range.
- Stops the capture on different triggers like capture duration, captured number of frames, size of log file.
- Simultaneously shows decoded frames while continuing to capture.

5.2 Prerequisites

To capture the Z-Wave network RF communication you need to set environment depending on the available hardware.

5.2.1 Using 500 series module with Zniffer Firmware

You need the following items:

- Z-Wave module. ZW050x based Z-Wave module is recommended. This module supports 9.6 kbps, 40 kbps, and 100 kbps RF communication.
- Firmware in a correct HEX file to be flashed for running the Sniffer on the Z-Wave module. Sniffer_ZW050x.hex is needed for the recommended Z-Wave module.
- Available COM or USB port with properly connected Z-Wave module.

5.2.2 Using WSTK board with PTI firmware

You need the following items:

- WSTK board configured to use IP Address. (See 3.4.2)
- ZGM130S module
- ZnifferPTI firmware in a correct HEX file to be flashed for running on the ZGM130S module. Example: **ZW_ZnifferPTI_7.* _*_ZGM130S_REGION_US_LR.hex**

5.3 Capturing Interface

To check or select the COM port (or IP address in case of PTI) where the Z-Wave Zniffer application will look for a Z-Wave module with Sniffer firmware connected, do the following:

5.3.1 Using 500 series module with Zniffer Firmware

1. Under the **Capture** menu, select **Detect Zniffer Modules** (or click the corresponding button on the toolbar)
2. After this, select the proper COM port in the port selection sub-menu or from the port selection dropdown list on the toolbar. If any port is connected to a Z-Wave device, then it also displays some system information for that device – firmware version and revision.
3. Select an appropriate frequency region in the sub-menu that appears or from the frequency selection drop down list on the toolbar.
4. Start a trace.

5.3.2 Using WSTK board with PTI firmware

1. Select the proper IP Address in the port selection sub-menu or from the port selection dropdown list on the toolbar.
2. No frequency selection available. It depends on the PTI firmware region frequency.
3. Start a trace.

5.4 Start Capturing

To start capturing the RF communication of Z-Wave network, click the **Start** button at the toolbar. Or press **F5** key on your keyboard. Or click **Capture** menu, and then click **Start** item.

Any existing trace will be cleared, and a new trace will be started.

If Start action is initiated after the Pause action, then:

- the capture will continue (resume) without clearing the capture
- the Delta for the first frame is zero

5.5 Pause Capturing

Pause action interrupts the capturing RF communication of the Z-Wave network. To pause capturing, click the **Pause** button at the toolbar, or press **Ctrl+Shift+P** shortcut on your keyboard, or click **Capture** menu and then click **Pause**.

5.6 Stop Capturing

Stop action stops the capturing RF communication of Z-Wave network without the possibility of continuing the capture. To stop capturing, click the **Stop** button at the toolbar, or press **Ctrl+Shift+S** shortcut on your keyboard, or click **Capture** menu and then click **Stop** item.

5.7 Saving the Trace to a File on-the-Fly

To start saving the trace into a file, use the **Create New Trace** option. Use **File > New** from the main menu or **Create New Trace** from the toolbar. Browse for the file name. You will be asked to **Save As** your trace before starting the capture.

5.8 Troubleshoot Capturing Frames

Here are solutions to some common problems with capturing the frames in Z-Wave Zniffer.

5.8.1 Capture Starts but Frame List is Empty

This could be caused by these typical reasons:

- The capture interface has not been selected or the wrong port and/or frequency has been selected. Check the current interface selection using the information that the Status bar displays on the right.
- Make sure you have selected the correct COM port and frequency before stating the capture. Use the Capture menu to change the interface selection.
- Display Filter is applied. The frames are coming but Frame List is empty because all the frames are filtered out. Check the current status of Display Filter by using an icon in the Header bar.

To fix this temporarily, de-activate the filter using the **Toggle Filter** button at the toolbar or drop the filter, if you don't need it anymore by using the **Drop Filter** button at the toolbar.

6 File Input/Output

6.1 Open File

1. To open any previously saved log file, click **File** menu, and then click **Open**. Or press **Ctrl+O** keyboard shortcut or click the **Open** button at the toolbar to open a standard Open Dialog.
2. In the **Look in** list, click the folder, drive, or Internet location that contains the file that you want to open.
3. To check or select the file type, use **Files of type** drop-down list. Current Z Wave Zniffer supports two file types: .ZLF and .ZWLF files that have same structure and contain frames captured by Zniffer device as well as data from other Z-Wave Serial API device .
4. In the folder list, locate and open the folder that contains the file.
5. Click the file, and then click **Open**.

Note: To open a .ZWLF file a menu item ‘All Frame Types’ in ‘View’ toolbar should be selected first.

Another option is to open a log file directly from the Windows environment.

1. Find the file that you want to open.
2. Double-click the file to start Z-Wave Zniffer and open the selected file.
   If you have a file that will not open, you probably need to install Z-Wave Zniffer.

6.2 Save a File

It is recommended that one save the captured frames in a file to avoid losing data unexpectedly due to a power failure or other problem.

To save your capture file, stop the trace, and click the **Save** button at the toolbar, or press **Ctrl+S** keyboard shortcut on your keyboard, or click **File** menu and then click **Save**.

Type a name for the file in the **Save As** box.

To specify the range of saved frames, select one of the available options using the **File > Save As** option:

- **Selected Items**, to save the selected frames only
- **Filtered Items**, to save the filtered frames only

When finished, click **Save**.

6.3 Add a Comment to the Trace

It is possible to add a text comment to the trace. To do so, do the following:

1. Select **File > Trace Comment** from the main menu or **Trace Comment** on the Toolbar to add your comment.

6.4 Open Files Saved in older Zniffer Formats

The current version of Zniffer creates log files in .ZLF format. However, it can also read .ZBF and .ZNF file formats created with previous versions of the Zniffer application. To do this, the File Converter application must be installed in addition to the Zniffer application.

7 Working with Captured Packets

7.1 Navigation within Frames

To simplify the navigation within frames in Frame List, use the **Go To Line** and **Find** dialogs.

7.1.1 Navigation with Go To Line Dialog

To quickly navigate to a frame with any given Line No, use Go To action. Click the **Edit** menu, then click **Go To Line** item. Or press **Ctrl+G** shortcut at your keyboard. Or right-click at any row in the Frame List and select **Go To** item in shortcut menu.

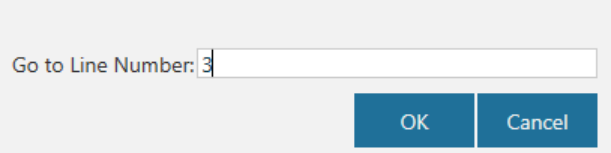

Figure 7. Go To Line dialog

To quickly navigate without opening a separate Go To Line dialog, use **Go to Line** textbox and button at the toolbar. Enter the Line No value and press **ENTER** on your keyboard or click the **Got To** button.

7.1.2 Navigation with Find Frame Dialog

To open Find dialog, click the **Edit** menu, then click **Find** item. Or press **Ctrl+F** shortcut on your keyboard.

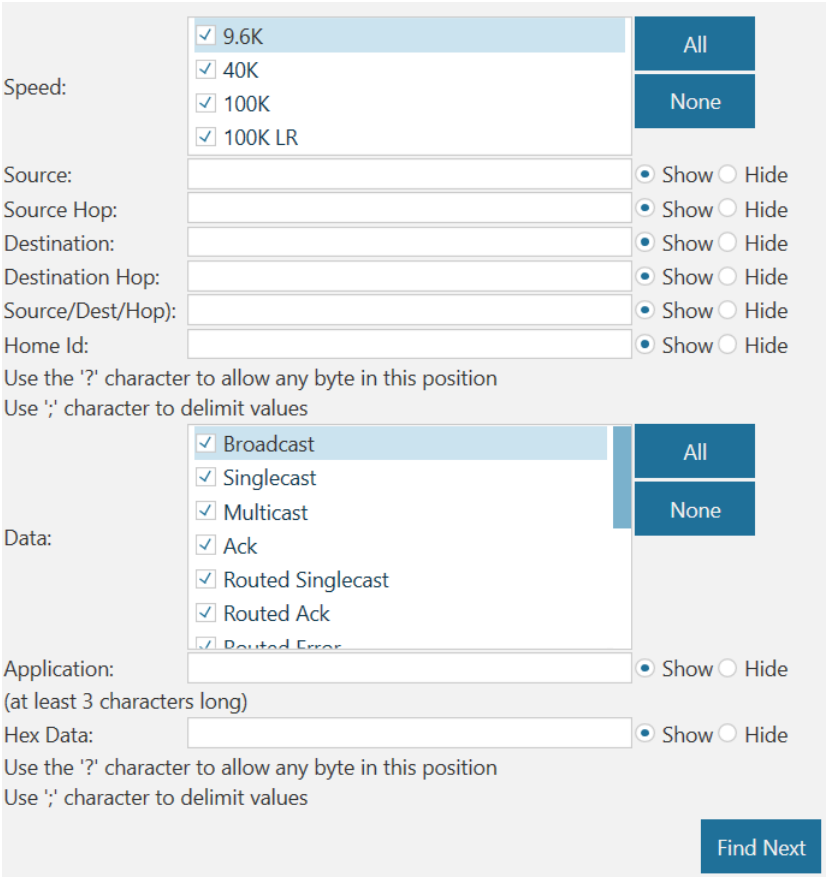

Figure 8. Find Frame Dialog

Find dialog includes controls to set the find criteria by several columns:

- Date
- Source Node ID
- Destination Node ID
- Home ID
- Time
- Data - contains the list of available human-readable values in favor of hexadecimal codes;
- Application
- Hex Data

Select the required comparison operator and enter or select the required value for every field you want to look for.

Select the search direction, that is top-down by default.

To navigate to the next occurrence of the frame that meets the entered criteria, click **Find Next** or press **ENTER** button on your keyboard. Find dialog changes the active row in Frame List and remains on the top of the Z-Wave Zniffer until it has been intentionally closed.

To exit from Find dialog, click **Cancel** button at the bottom of the dialog or click the **Close** button at the title bar.

7.2 Highlighting frames

To highlight the frames you need, right-click at the frame you would like to use as a sample and select **Highlight Frames** item in shortcut menu. It has the following sub-menu items:

- **By Source Node ID** highlights all frames that have the same Source node ID as the selected one.
- **By Destination Node ID** highlights all frames that have the same Destination node ID as the selected one.
- **Highlight by Source and Destination** highlights all frames sent between the nodes shown as Source and Destination node of the selected one.
- **Clear Highlighting** removes any active highlighting.

Right-clicking on the column header and selecting any of the highlighting options will result in corresponding highlighting of all frames.

7.3 Using Display Filter

To reduce the amount of the frames that are displayed at Frame List use filters.

Attention! Please note that display filter affects the displayed frames while the total captured frames remains untouched.

Filtering can be applied by Date, Speed, Source, Destination, Home ID, Data, Application, HEX Data.

To apply the display filter that uses some value for the filtering criterion, use the **Filter** icon at the column heading in the Frame List. Click the icon to open the drop-down list with the available values.

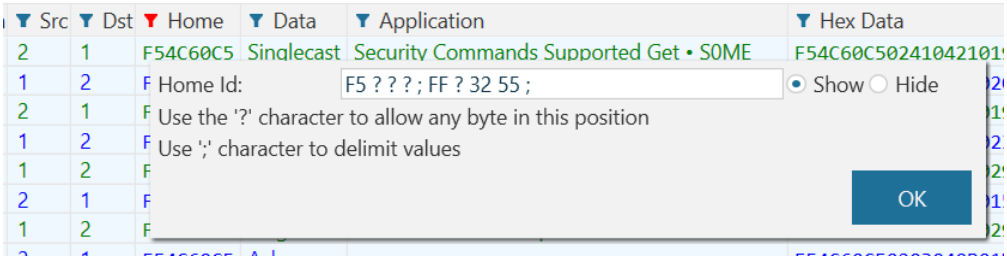

Figure 9. Quick filter drop-down list for Destination column

Enter the required value to apply the filtering by this value only. Click OK or press Enter button to apply.

Clear the input field and press OK to drop the active filter.

7.4 Control Active Filters

To clear the filtering conditions, click the **Drop Filter** button at the toolbar.

To activate/deactivate the current filter while pre-serving it, click the **Toggle Filter** button at the toolbar.

7.5 Working with Encrypted Frames

Some of the frames that Zniffer captured could be secure (encrypted) frames. The frames that Zniffer was unable to decrypt using known encryption keys contain a special **Decrypt** link in the Frame Details window as shown at the figure below. Also, it is possible load keys from storage using **Load Keys** button.

Zniffer support Security and Security 2 encapsulation.

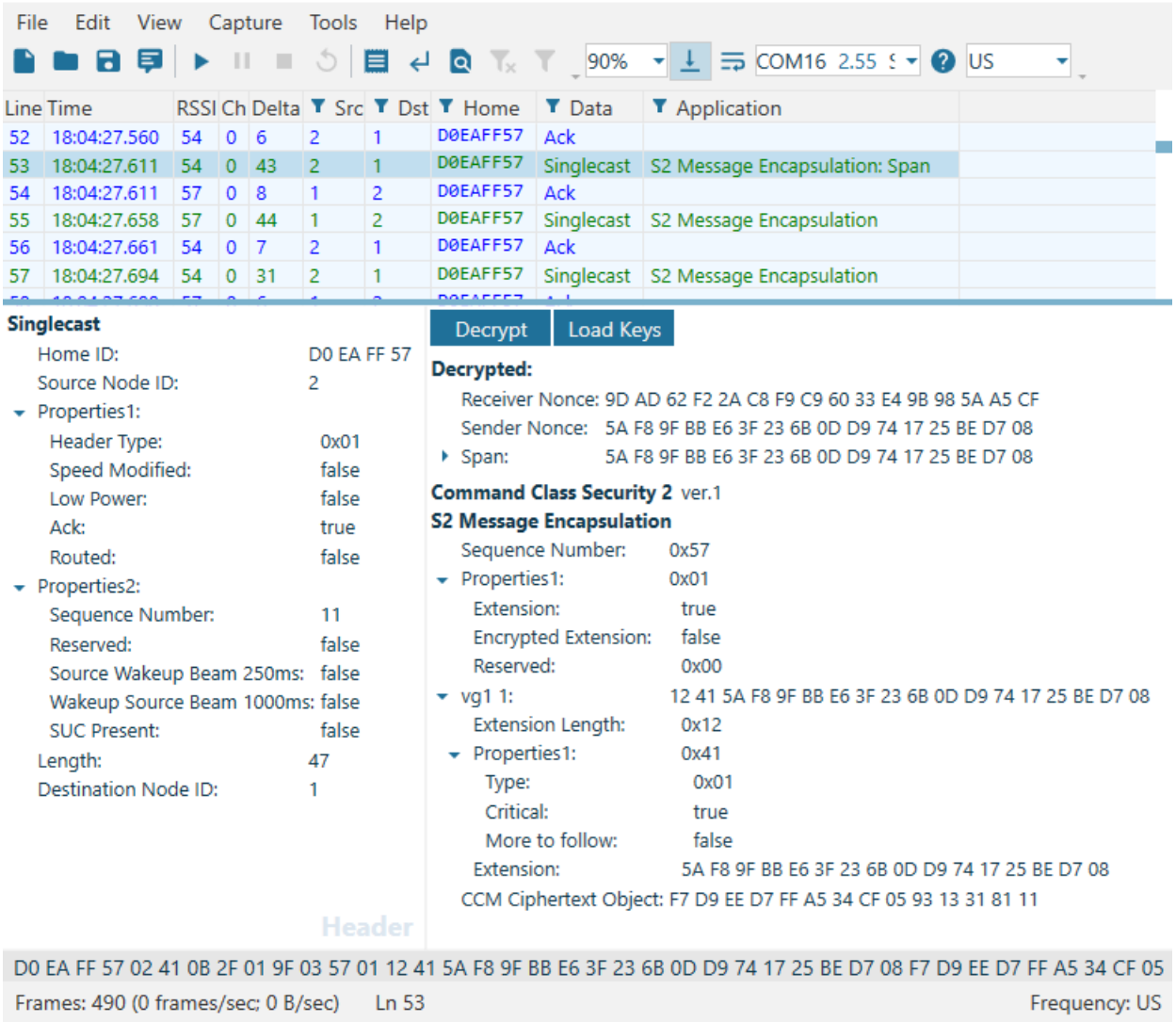

Figure 10. Decrypt Button in the Frame Details Window

To enter the required key, click the **Decrypt** link or press **Ctrl+Shift+D** shortcut at your keyboard. Encryption Key dialog appears as shown at the figure below.

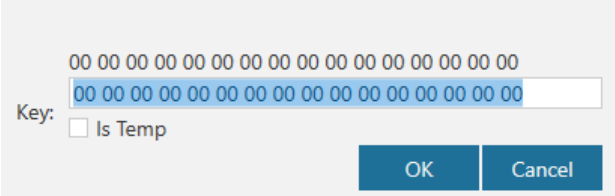

Figure 11. Encryption Key Dialog

To load keys from storage, open the file with the appropriate name according to network Home ID and update the frame selection to decrypt frame. The file must be created from PC Controller before or ZATS.

Attention! Zniffer is unable to automatically define what key should be entered – either network key for a whole Secure Z-Wave Network or temporary (inclusion) key for some node. So, the user need to follow the sequence of the events/frames and define what key should be entered.

The key values according to the Secure Command Class Specifications should be 16 hexadecimal values long. Encryption Key dialogs support two possible formats – space-separated values (e.g. “01 02 03 04…”) and continuous string (e.g. “01020304…”).

Zniffer adds trailing zeros 0x00 up to 16 hexadecimal values. So, if you need to enter “01 02 03 04 00 00 00 00 00 00 00 00 00 00 00 00” you can enter just “01 02 03 04” or “01020304”.

Attention! Note please that Encryption Key dialog accepts even number of values only.

Click **Ok** to apply the entered key and store it into the Key Storage that Zniffer will try to use for any secured frame within current capture.

If the frame could be decrypted using the key that the user provided, then Zniffer displays the decrypted information in the Frame Details window.

After successfully decryption, the Decrypt button is disabled and Zniffer shows used key in Decryption View:

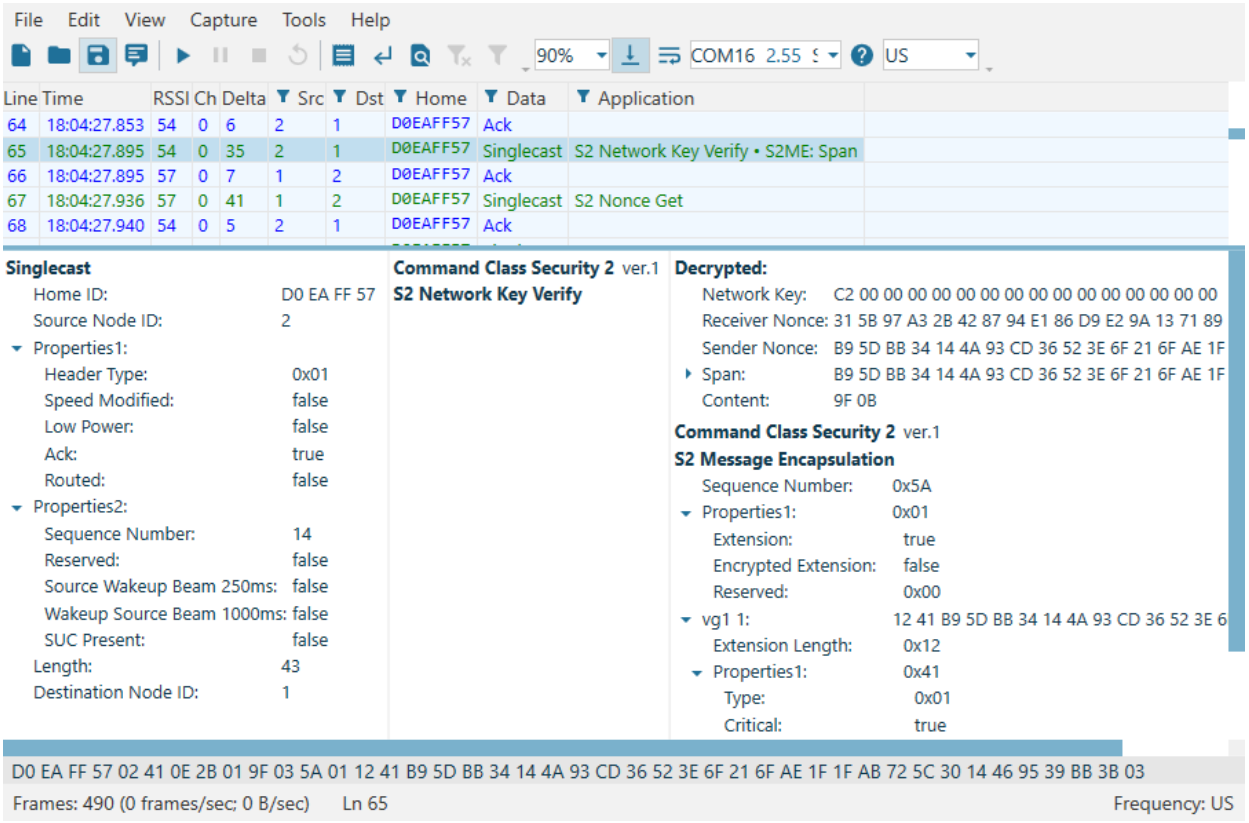

Figure 12. Decryption View

7.6 Watch

Watch allows tracking the rare frames and fast navigating to the occurrence in the trace.

To open the **Set up watch filter** dialog, click the **View** menu, then click **Watch**. Or press **Ctrl+Shift+W** keyboard shortcut.

Enter the appropriate criteria in column titles in the same way as when using filters

7.7 Best Practices in Handling the Frames

7.7.1 Select the Specific Frames

Sometimes it is difficult to manually select the specific frames while selection is required to target the range of the frames to perform the further action upon.

Here are the recommended solutions:

- **Highlight** the frames by specific Source node ID, Destination node ID, or between specific nodes, and then click **Select Highlighted**. See section 7.2 for more details.
- Apply a display filter to reduce the number of visible frames by specific criteria, and then click **Select All**. See section 7.3 for more details.

7.7.2 Operate the Large Capture

After running the Zniffer in a very active Z-Wave network, it can capture very large number of frames that are rather difficult to operate with. Another reason for reducing the number of frames is the need to send the capture file with specific frames for analysis to somewhere else.

Here are the recommended solutions:

- Open trace dialog appears for large traces:

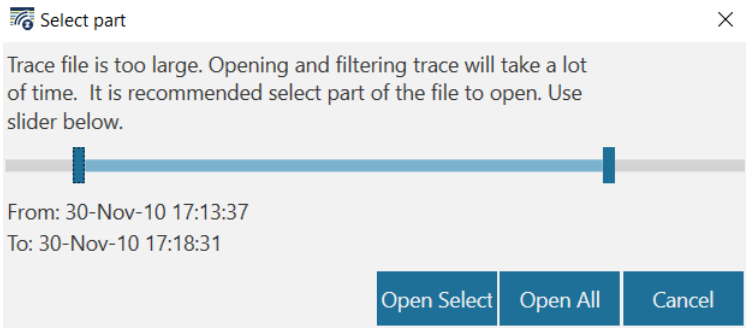

Figure 13. Open Large Trace

- Select the specific frames and then click **Save As** to save as a new file. Select **Selected only** option in **Save Items** drop-down list, and finally click **Save**. For more details, see section 6.2.

- Apply a filter using the Filter dialog or quick filter, and then click **Save As** to save as a new file. Select **Displayed** option in **Save Items** drop-down list, and finally click **Save.** For more details, see section 7.3.
- Before starting the capture, specify the criteria for automatic saving the multiple files when some condition is reached using **Capture Options** dialog.

7.8 Editing the Command Classes XML File

If the Zniffer does not parse user-defined command classes, one must edit the Command Classes XML file manually.

Command Classes XML file is located at:

```
%AppData%\Silicon Labs\Z-Wave Zniffer Secured
```

When the Command Classes XML file has been edited manually, it must be reloaded into the Zniffer application. Select **File > Reload Command Classes XML file** from the Main Menu or press the button on the Toolbar.

7.9 RSSI

7.9.1 Using 500 series module with Zniffer Firmware

The RSSI value (Received Signal Strength Indicator) is displayed in Zniffer. The RSSI value is supported by the Z-Wave 400 series chip/modules, which enable the PC Zniffer application to provide the user with a relative indication of the received signal strength. Note that the principles of RSSI will not justify the captured RSSI value on Zniffer to represent exact interpretation of the signal quality: many external parameters in the RF environment must be considered, in case "real" signal strength is desired.
The RSSI value on Zniffer is presented as 1.5dB steps per LSB, and higher RSSI value means higher signal strength.

RSSI_value (decimal value read out from the chip) is proportional to the RFinput.

RSSI_value = (RFinput(chip) + Offset) / 1.5

When applying -80dBm at the chip input result in an RSSI_value of about 49(d). The Offset used for the conversion from RSSI_values to input power is:

Offset = RSSI_value x 1.5 – RFinput

Offset = 49(d) x 1.5 – (-80dBm) = 153.5dB.

Hence, the actual signal quality may be calculated using the following expression:

RFinput(chip) = RSSI_value x 1.5 – Offset

7.9.2 Using WSTK board with PTI firmware

The RSSI value measured in dBm taken from the PTI to provide the user with a relative indication of the received signal strength.

7.10 Debug Output

To read debug frames from a device, one must connect to the debug port of the device and choose port in **Tools -> Device Port Selection** menu item.

8 References

[1] Silicon Labs, INS10679, Instruction, Z-Wave Programmer User Guide
[2] Silicon Labs, SDS10243, Software Design Specification, Z-Wave Protocol Overview
[3] Silicon Labs, INS10680, Instruction, Z-Wave XML Editor User Guide
[4] Silicon Labs, UG162: Simplicity Commander Reference Guide