Eye Opening Tool

User's Manual

Rev 0.40

Mellanox Technologies

© Copyright 2006. Mellanox Technologies, Inc. All Rights Reserved.

Eye Opening Tool User's Manual

Document Number: 2190UG

Mellanox Technologies, Inc.
2900 Stender Way
Santa Clara, CA 95054
U.S.A.
www.Mellanox.com

Tel: (408) 970-3400
Fax: (408) 970-3403

Mellanox Technologies Ltd
PO Box 586 Hermon Building
Yokneam 20692
Israel

Tel: +972-4-909-7200
Fax: +972-4-959-3245

Mellanox Technologies

NOTE:

THIS INFORMATION IS PROVIDED BY MELLANOX FOR INFORMATIONAL PURPOSES ONLY AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL MELLANOX BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS HARDWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Contents

Contents **3**
List of Figures **5**
1 Introduction **7**
2 Package Contents and Installation **8**
2.1 Package Contents 8
2.2 Hardware Requirements 8
2.2.1 Test Platform 8
2.2.2 InfiniBand Related Hardware 8
2.3 Software Requirements 8
2.4 Installing Eye Opening 9
3 Using Eye Opening GUI (eye_gui) **10**
3.1 Before Running Eye Opening GUI 10
3.2 Running Eye Opening GUI 10
3.2.1 Starting Eye Opening GUI 10
3.2.2 Configuring Eye Opening GUI 12
3.2.3 Configuration Modes Photo Captures 14
3.2.4 Configuration Example 18
3.2.5 Running the Eye Opening Test 18
3.3 GUI Log and Configuration Files 20
3.3.1 Log File Setup 20
3.3.2 Saving and Loading a Configuration File 22
3.4 Troubleshooting Eye Opening GUI 23
3.4.1 Warning Messages 23
3.4.2 Error Messages 24
4 Running from the Command Line **25**
4.1 Before Running Eye Opening 25
4.2 Usage 25
4.2.1 Usage Examples 26
4.2.2 Run Examples 26
5 Evaluating Test Results **29**

Mellanox Technologies

Mellanox Technologies

List of Figures

Figure 1: Eye Opening GUI Display Window 11
Figure 2: Full Configuration Scan Mode Display - InfiniScale III Case (4X IB Ports) 14
Figure 3: Full Configuration Scan Mode Display - InfiniScale III Case (12X IB Ports) 14
Figure 4: Full Configuration Scan Mode Display - InfiniHost III Ex Case 15
Figure 5: Full Configuration Scan Mode Display - InfiniHost III Lx Case 15
Figure 6: User Defined Mode Display 16
Figure 7: set_conf Mode Display 17
Figure 8: Configuration Example 18
Figure 9: Configuration Run Example 19
Figure 10: 'File' Pull-down Menu 20
Figure 11: Log File Settings Display 21
Figure 12: 'Configuration' Pull-down Menu 22
Figure 13: Configuration File Selection Filter - Load and Save 23
Figure 14: Warning Printed by eye_gui 23
Figure 15: Missing Port(s) for SerDeses' Configuration Scan 24
Figure 16: Missing Port Number for set_conf Mode 24
Figure 17: Missing MST Device Error Message 24

Mellanox Technologies

Mellanox Technologies

1 Introduction

Eye Opening is a tool package for:

- Evaluating and testing InfiniBand cables
- For configuring port SerDeses and physical port state (for a single port)
- For finding the optimal configuration for SerDeses of an InfiniBand Tx-Rx pair connected by a cable

The package includes three tools (binary executables) and a GUI which can be used to activate these tools. All tools support IB cable operation at 2.5Gb/s (SDR) or 5Gb/s (DDR).

The three binary executables are:

- **eye_opening_is** - for use with switch systems based on Mellanox's MT47396 InfiniScale III switch device
- **eye_opening_ex -** for use with MT25208 InfiniHost III Ex based HCA cards (Dual 4X IB ports cards)
- **eye_opening_lx -** for use with MT25204 InfiniHost III Lx based HCA cards (Single 4X IB port cards)

The above tools can be run either using the tool's GUI '**eye_gui'** (this is recommended), or from the command line.

Eye Opening enables tuning the *Amplitude* and *Pre-emphasis* levels for the output buffers of Tx SerDeses, and the *Equalization* levels for the input buffers of Rx SerDeses. Tool output is the width of the eye-opening measured in picoseconds (ps) at the Rx-port end. The optimal configuration of SerDeses is that which gives the widest eye-opening possible.

Mellanox Technologies

2 Package Contents and Installation

2.1 Package Contents

The eye_opening-<release>-<system_arch>.tgz package contains the following:

- install.sh - Installation script
- eye_gui - GUI tool to run all binaries
- eye_opening_is - Eye Opening tool for the MT47396 InfiniScale III based switch systems
- eye_opening_ex - Eye Opening tool for the MT25208 InfiniHost III Ex based HCA cards
- eye_opening_lx - Eye Opening tool for the MT25204 InfiniHost III Lx based HCA cards
- uninstall.sh - Uninstall script
- BUILD_ID - Tool revision number

2.2 Hardware Requirements

2.2.1 Test Platform

A PCI or PCI Express host machine with the Linux operating system installed. See *Eye Opening Release Notes* for the list of supported operating systems and kernels.

2.2.2 InfiniBand Related Hardware

Table 1 lists hardware requirements per InfiniBand product type, sorted based on the Mellanox Technologies device used.

Table 1 - Hardware Requirements

InfiniBand Product Type	Mellanox Technologies Device	Required Hardware
Switch System	MT47396 InfiniScale III	• A USB to I2C Adapter Card (MTUSB-1) - Connects between the USB port of the host machine and the I2C port of the switch system. *OR* • A PCI to I2C Adapter Card (Calibre) - Connects to a PCI slot on the host machine at one end and to the I2C port of the switch systems on the other.
		One 4X or 12X IB cable (depending on port width) to be connected between two ports[1]
HCA Card	MT25208 InfiniHost III Ex (Dual 4X IB Port)	One 4X IB cable to be connected between the two IB ports of the HCA[1]
HCA Card	MT25204 InfiniHost III Lx (Single 4X IB Port)	The single IB port needs to be connected in an *external* self-loop. One possible way is to use an IB Self-loop Connector.

1. The cable is not needed in case the Eye Opening tool is run in the ‘set_conf’ configuration mode. See Section 3.2.2, “Configuring Eye Opening GUI,” on page 12 for details.

2.3 Software Requirements

- MST (Mellanox Software Tools) version 4.2.0 or later must be installed

Mellanox Technologies

- Tcl version 8.4 or later must be installed

2.4 Installing Eye Opening

The Eye Opening tool can be obtained from the following sources:

1. It is part of Mellanox's IBGold Distribution (IBGD) software package - see http://www.mellanox.com
2. Mellanox's document distribution system (DDS) at http://docs.mellanox.com (which requires a customer's login name and password). It is located in the 'Code Releases / Tools' folder under the name eye_opening-<release>-<system_arch>.tgz.

After downloading the appropriate tar file (according to the system architecture: x86 or x86_64), perform the following steps to install the tool:

1. Extract files to a temporary directory using:

   > tar -zxvf eye_opening-<release>-<system_arch>.tgz

   This creates a subdirectory called 'eye_opening_install' with Eye Opening installation files.
2. cd to 'eye_opening_install'
3. Run the install script as root:

   >./install.sh

   The installation creates (by default) a /usr/eye_opening directory and copies the packed contents there.
4. (Optional) Delete the temporary installation files and directory (see step 1 above).

Mellanox Technologies

3 Using Eye Opening GUI (eye_gui)

This section describes how to configure and start the Eye Opening tool using its GUI.The GUI is an upper level user interface that runs the tool for all the devices.

3.1 Before Running Eye Opening GUI

For Eye Opening tools to operate correctly, the following conditions must be met:

1. The MST driver must be started. Run ‘mst status’ and verify that the relevant Mellanox (switch or HCA) device of the tested hardware is listed.
2. Firmware must be burnt on the device. Moreover, the firmware configuration setting in the .INI file used for firmware burning should have *forced* the IB ports either to SDR operation or to DDR operation, but *not* to auto-negotiation of speed.

   Note: If you burnt firmware using a DDR-specific .INI file provided by Mellanox, then the IB ports were set to auto-negotiate IB SDR or DDR operation. This means than firmware must be burnt with a modified .INI file. For details, see the *IB DDR Auto-Negotiation Application Note, Document no. 2162AN*.

   Note: If you burnt firmware using an SDR-specific .INI file provided by Mellanox, then the IB ports were forced to operate at SDR. No further action is needed.

3. All HCA device drivers (vapi / gen2 / etc.) must be unloaded.

3.2 Running Eye Opening GUI

3.2.1 Starting Eye Opening GUI

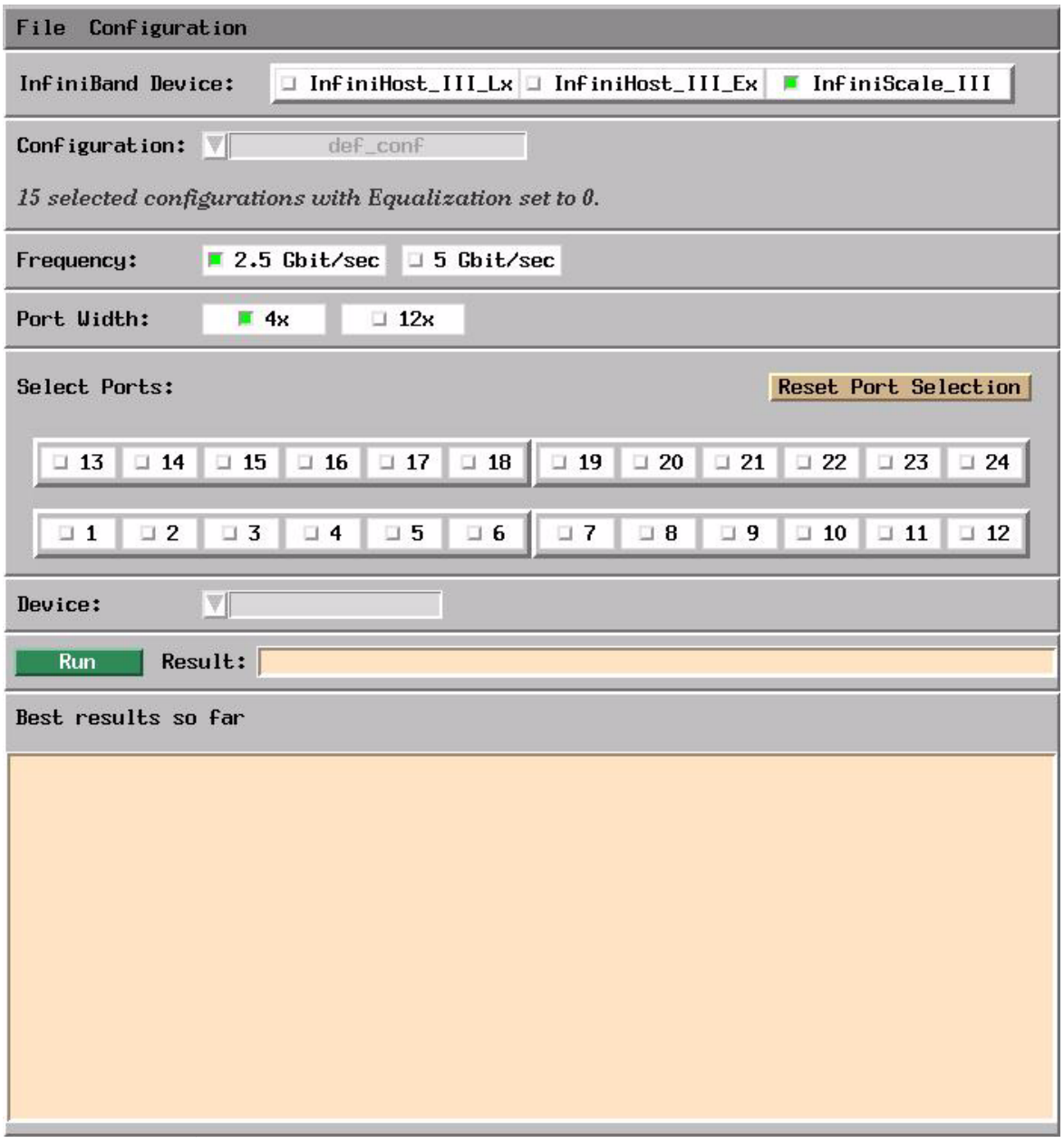
To start using the Eye Opening GUI from the tool directory (by default /usr/eye_opening), enter at the command line:

```
>./tools/eye_gui &
```

A display window should appear shortly as in Figure 1,“Eye Opening GUI Display Window”. See Section 3.2.2, “Configuring Eye Opening GUI” for details.

Mellanox Technologies

Figure 1: Eye Opening GUI Display Window



3.2.2 Configuring Eye Opening GUI

The Eye Opening GUI display window (see Figure 1 on page 11) includes the configuration fields described in the paragraphs to follow. Buttons or selection pull-down menus are available for the various fields.

InfiniBand Device: Select the appropriate Mellanox device for the hardware under configuration/testing.

Configuration: There are four configuration modes in the pull-down menu:

1. 'def_conf' - This is the default configuration mode. 15 pre-selected default configurations are tested on the cable. See Figure 1, "Eye Opening GUI Display Window," on page 11.

   In all the configurations, the receiver equalization was set to 0 (no receiver equalization). Furthermore, there is one configuration per *Amplitude* in the range 0 to 15, with the *Pre-Emphasis* parameter chosen so as to obtain optimized performance across all cable lengths range. (The settings are based on Mellanox's experience with cables from different vendors across all lengths up to 30m.)

   The 15 selected configurations of (*Amplitude, Pre-Emphasis, Equalization*) - in addition to (0,0,0)- are:

   (1,2,0); (2,2,0); (3,4,0); (4,5,0); (5,4,0); (6,5,0); (7,6,0); (8,6,0); (9,6,0); (10,5,0); (11,6,0); (12,5,0); (13,4,0); (14,5,0); (15,7,0)

   Note: As no receiver equalization is present in the above configurations, the receiver eye width should be similar to the obtained eye width from external oscilloscope.

   Typical execution time in this mode is 2 minutes.

2. 'full configuration scan' - In this mode, all possible SerDes configurations of *Amplitude, Pre-Emphasis,* and *Equalization* are tested (16x16x16 = 4096 configurations). If the cable is tested at 2.5Gb/s, it is possible to set the step resolution in this mode to either 12.5ps (fine) or 6.25ps (very fine). See Figure 2, "Full Configuration Scan Mode Display - InfiniScale III Case (4X IB Ports)," on page 14.

   The typical execution time with *fine* resolution takes about 6 hours; with *very fine* resolution it takes about 12 hours.

3. 'user defined' - This is a user defined mode. Three bars will appear by which the user can set the desired SerDes *Amplitude, Pre-emphasis,* and *Equalization*. Each such parameter can be set to a value in the range 0-15.

   See Figure 6, "User Defined Mode Display," on page 16.

   Execution time in this mode takes a few seconds.

4. 'set_conf' - This mode is used for setting a *single* port configuration and state. Three bars will appear by which the user can set the desired SerDes *Amplitude, Pre-emphasis,* and *Equalization*. Each such parameter can be set to a value in the range 0-15. Only one port can be selected in this mode.

   Below these bars, five state-buttons should be present, by which the user can set a desired physical port state (TX state as described in the *InfiniBand Architecture Specification*). The five optional states are: *Polling, Disabled, TS1, TS2* and *Idle*. See Figure 7, "set_conf Mode Display," on page 17.

   Execution time in this mode takes less than a second.

Frequency: The Eye Opening tool supports 2.5Gb/s (SDR) and 5Gb/s (DDR) IB cable operating rates.

Port Width: The tool can test 4X cables or 12X cables. 12X is optional for InfiniScale III testing only. To test 12X, a trio of ports out of the following list must be chosen: {(13,14,15), (16,17,18), (19,20,21), (22,23,24)} (see Figure 8, "Configuration Example," on page 18).

Select Ports: Select the connected ports out of the displayed list. If a 4X cable is being tested, choose two out of the 4X available ports. If a 12X cable is being tested, choose a pair of trios (see description of 'Port width' above).

Device: The pull-down menu allows to choose between existing *mst* (interface) devices. Through one of these interface devices, Eye Opening commands are passed to the device, using the mst device driver. If the Device tab shows a

Mellanox Technologies

blank field, this means that more than one mst device exists and you need to select one of them (click on the arrow to pull down the selection menu).

However, if the Device tab shows 'simulator', this means that no mst device was found. In this case, exit the GUI, reload the mst driver ('mst start'), run 'mst status' to verify than an interface device exists in your system, re-run the Eye Opening GUI (and select the proper mst device one if more than one exists).

Mellanox Technologies

3.2.3 Configuration Modes Photo Captures

Figure 2: Full Configuration Scan Mode Display - InfiniScale III Case (4X IB Ports)

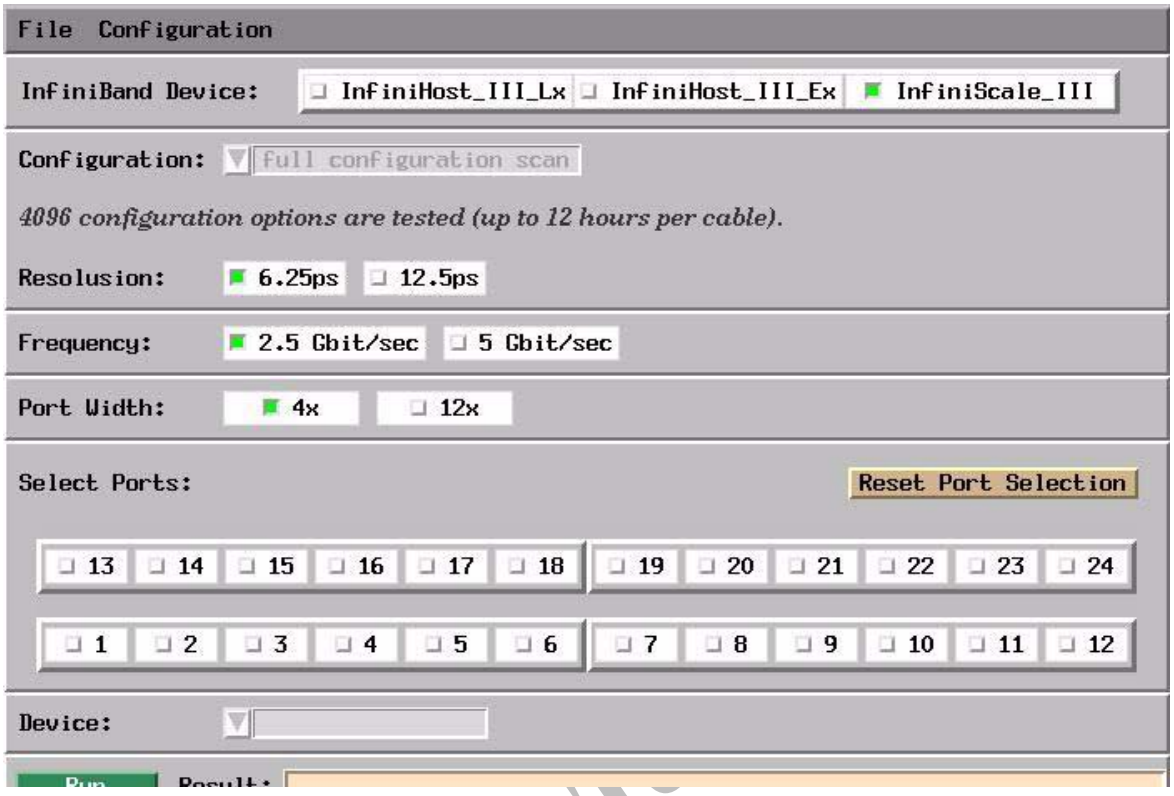


Figure 3: Full Configuration Scan Mode Display - InfiniScale III Case (12X IB Ports)

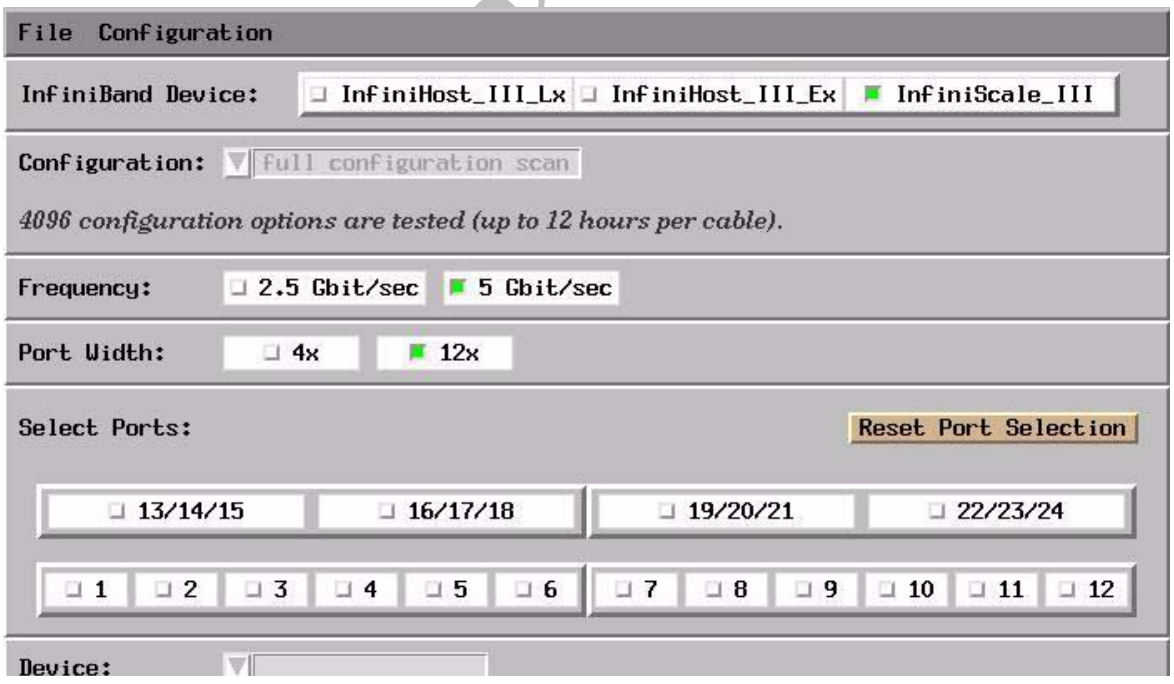


Figure 4: Full Configuration Scan Mode Display - InfiniHost III Ex Case

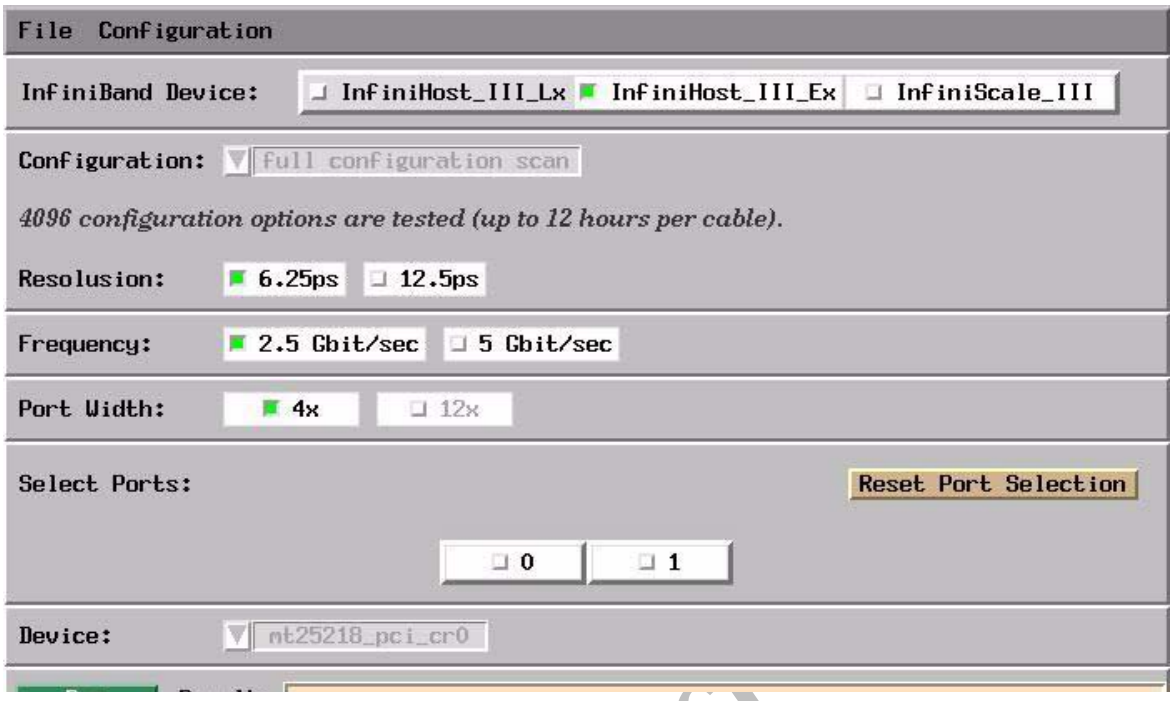


Figure 5: Full Configuration Scan Mode Display - InfiniHost III Lx Case

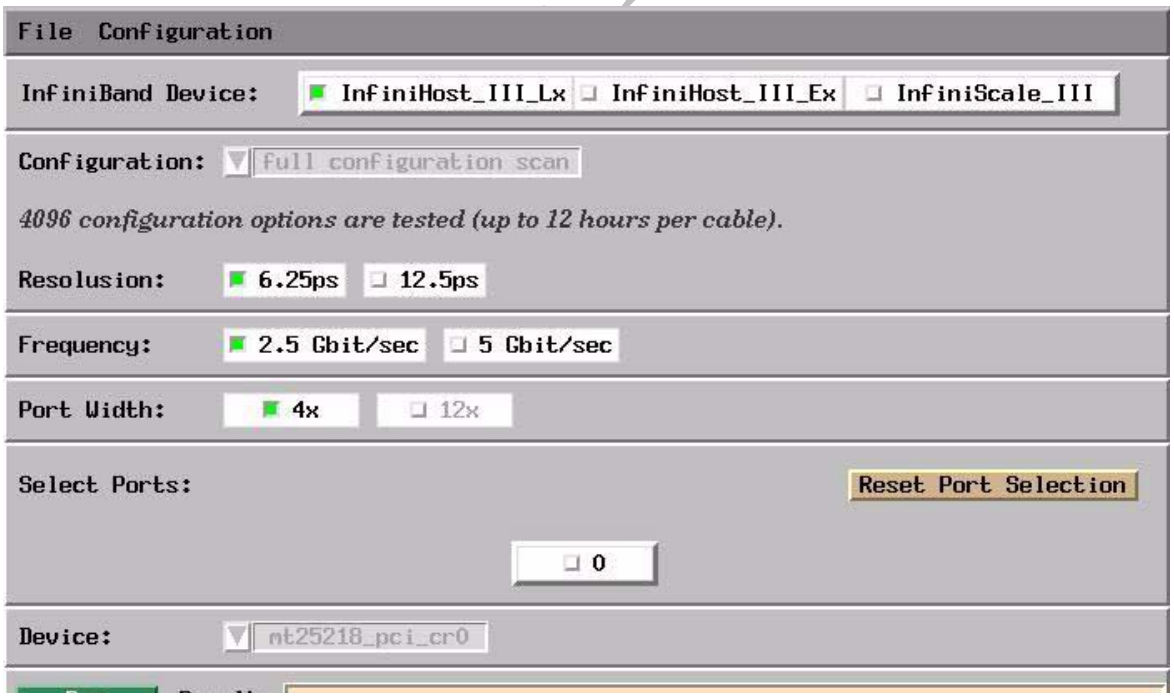
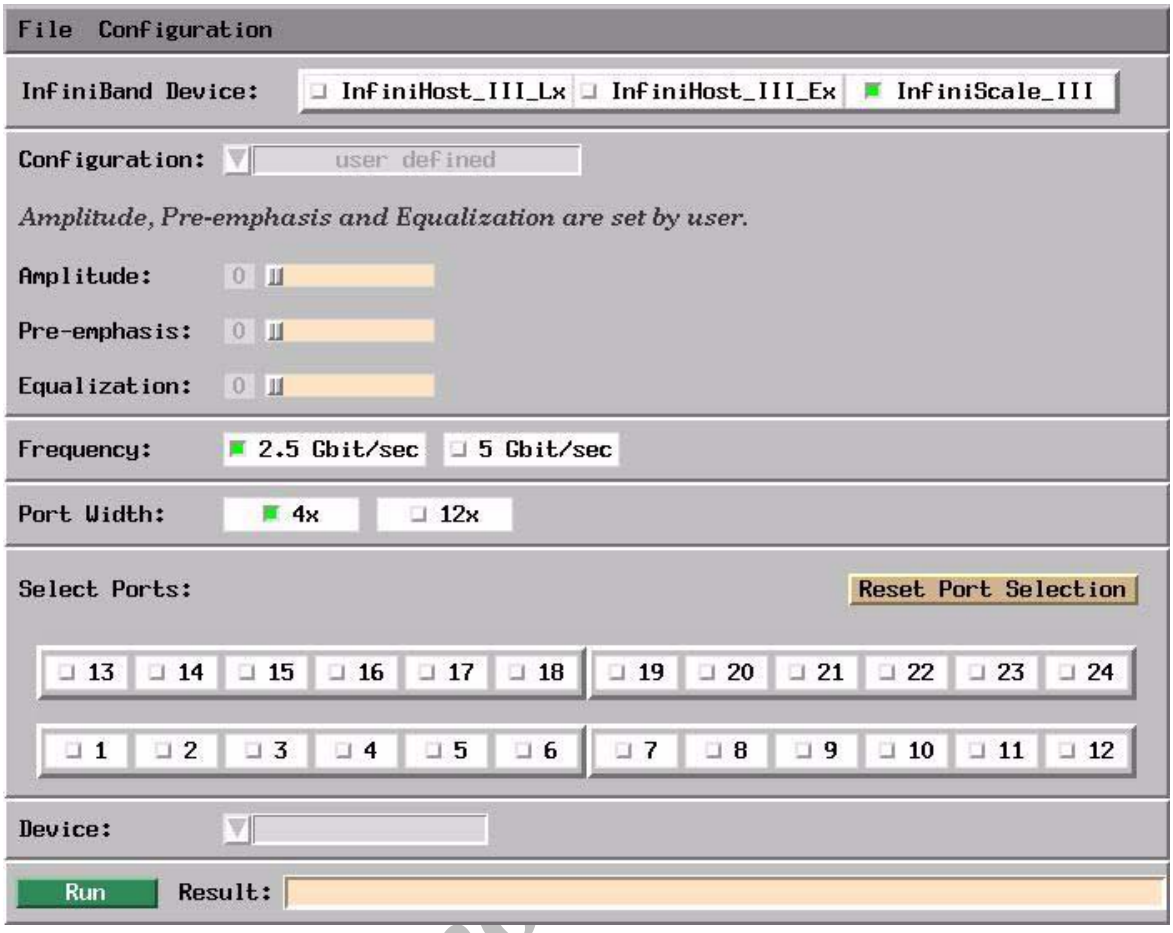
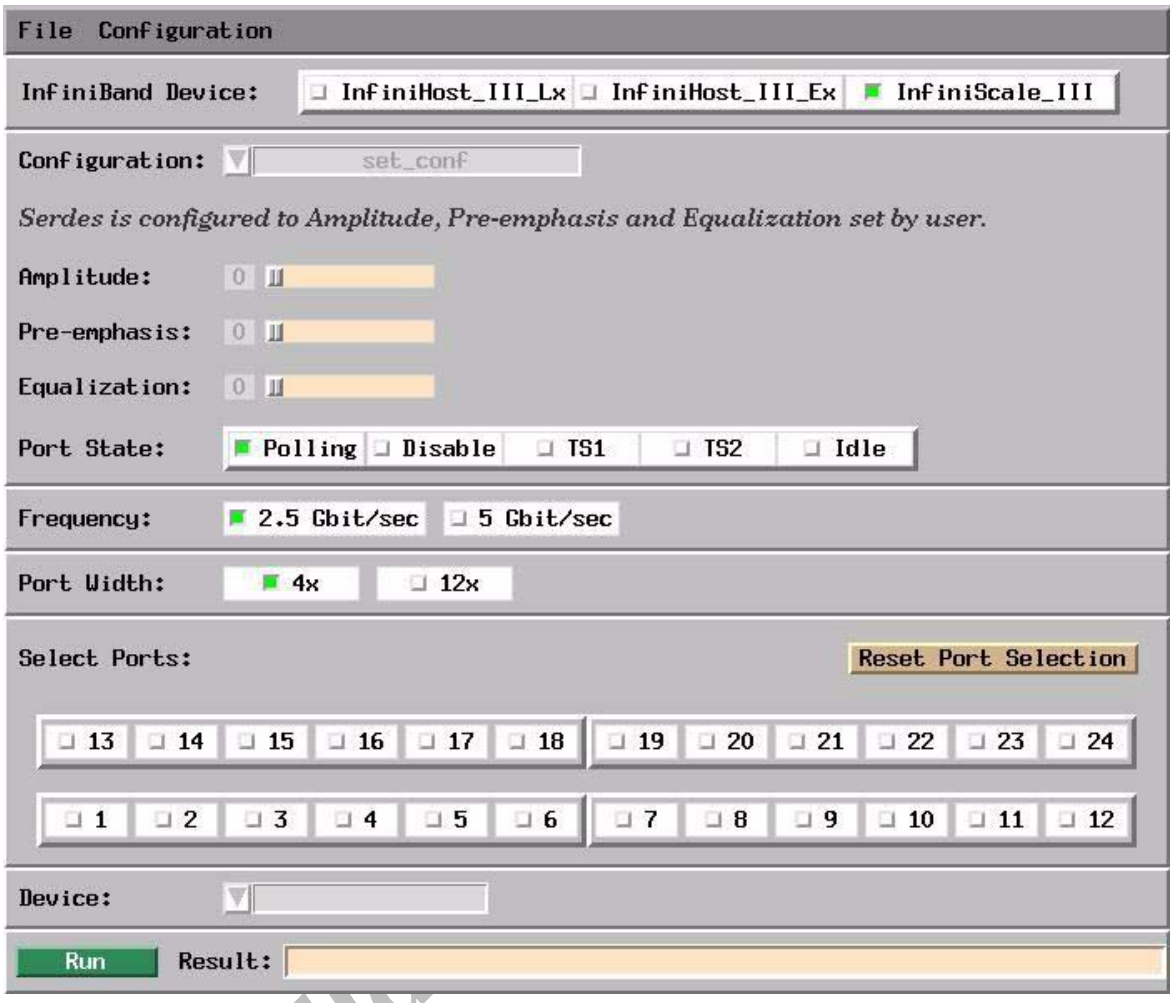


Figure 6: User Defined Mode Display



Mellanox

Figure 7: set_conf Mode Display

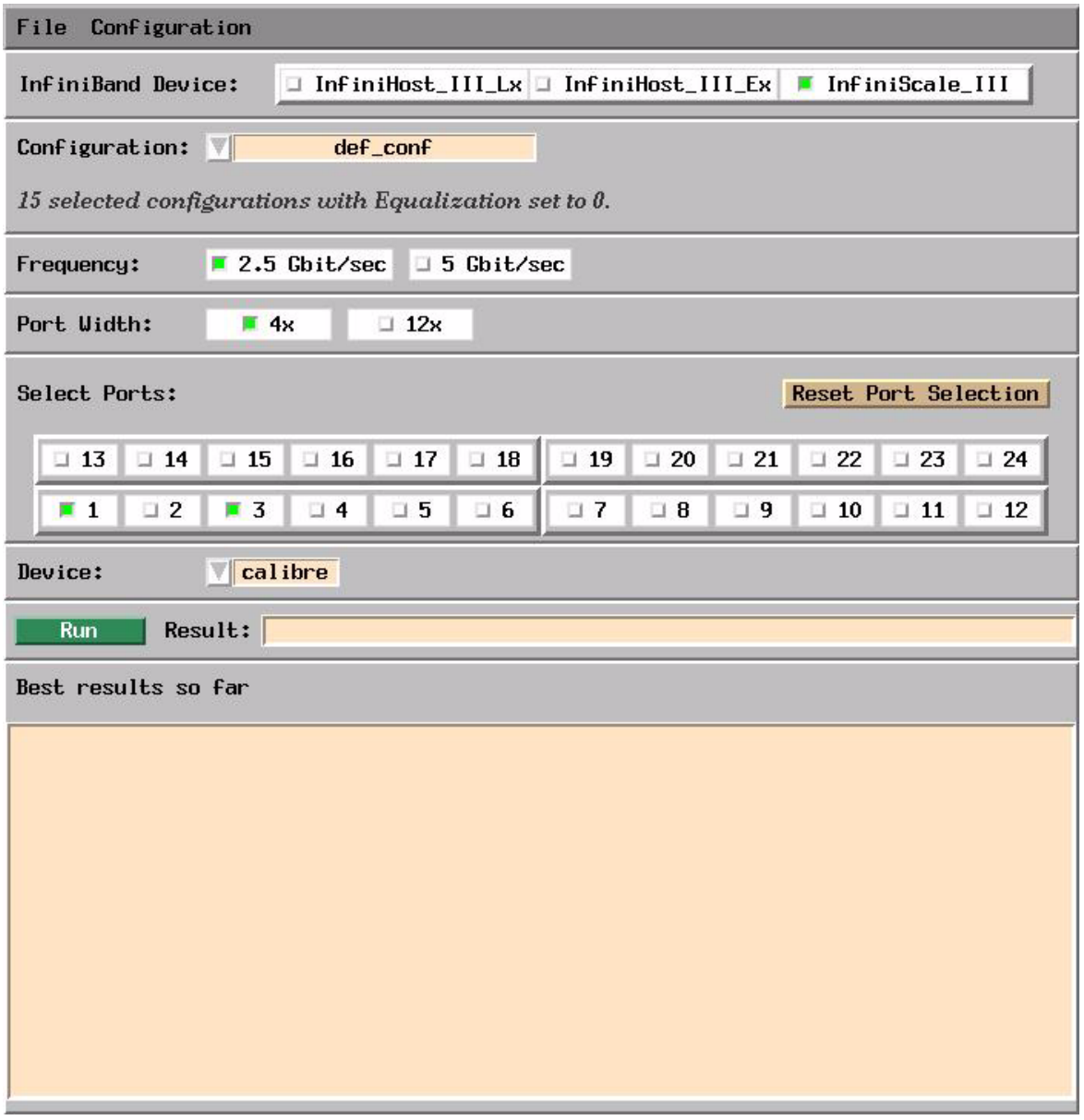


Mella

3.2.4 Configuration Example

Selecting ‘InfiniScale_III’ for device, ‘2.5Gb/s’ for frequency, ‘def_conf’ for configuration, ‘4X’ for port width, ports ‘1’ and ‘3’, and ‘calibre’ for device will yield the display presented in Figure 8,“Configuration Example”.

Figure 8: Configuration Example



3.2.5 Running the Eye Opening Test

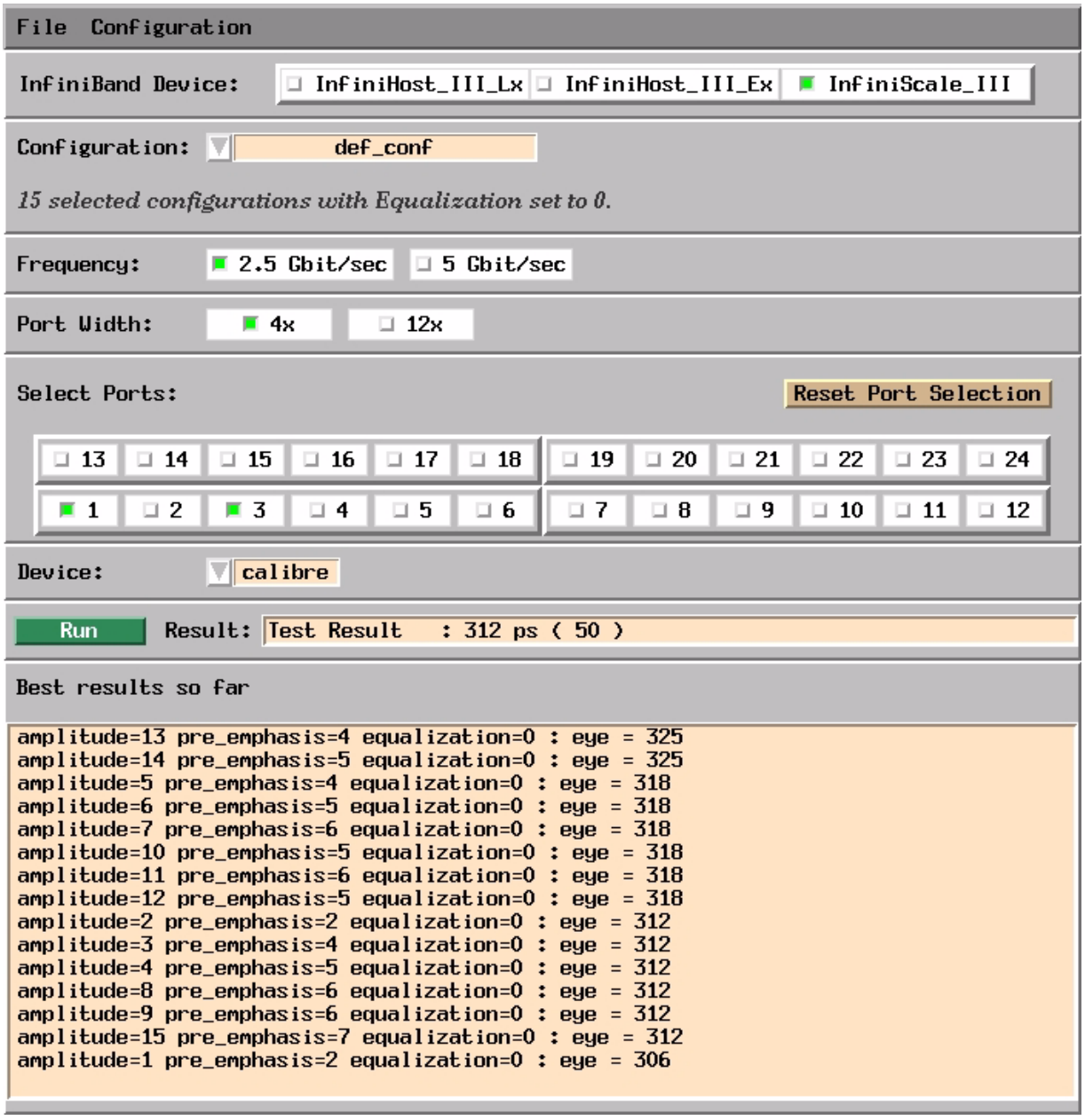
Once configuration is finished, click on the green <Run> button to start the Eye Opening test.

For the ‘user defined’ mode, the Eye Opening test result will be displayed in the ‘Result’ bar window (see Figure 9 on page 19 for the results of running the example described in Section 3.2.4, “Configuration Example,” on page 18).

For the ‘def_conf’ and ‘full configuration scan’ modes, the test results will be displayed in the ‘Best results so far’ window, where the best 15 results will be displayed sorted from the best of them down to the least good.

Note: For the 'def_conf' and 'full configuration scan' modes it is recommended to define a log file for holding all the execution results prior to the actual test run. It may be useful for post-execution data analysis. See "GUI Log and Configuration Files" on page 20 for log file setup.

Figure 9: Configuration Run Example

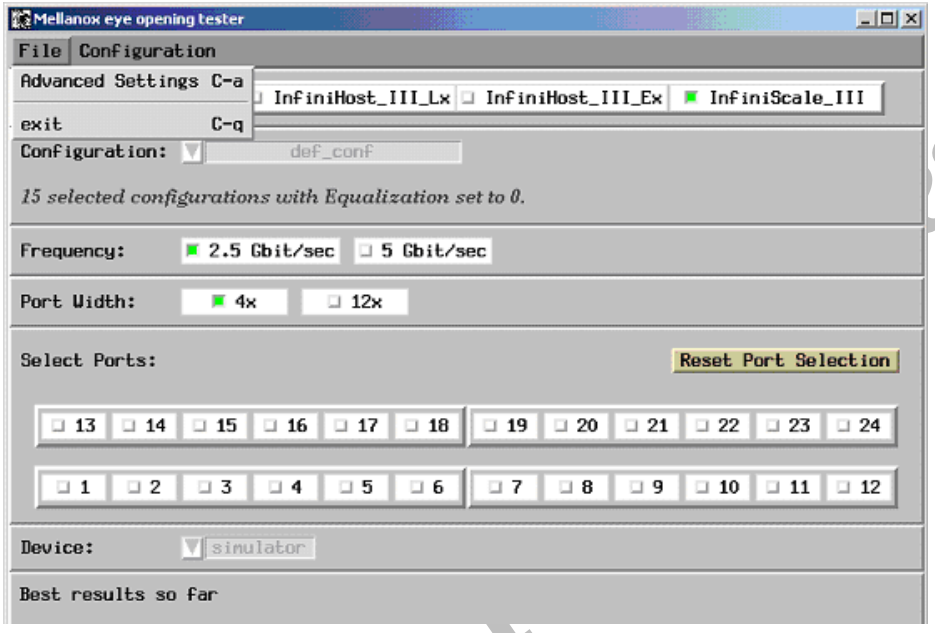


3.3 GUI Log and Configuration Files

3.3.1 Log File Setup

In order to record test execution results into a log file, pull down the ‘File’ menu and select ‘Advanced Settings’. See Figure 10.

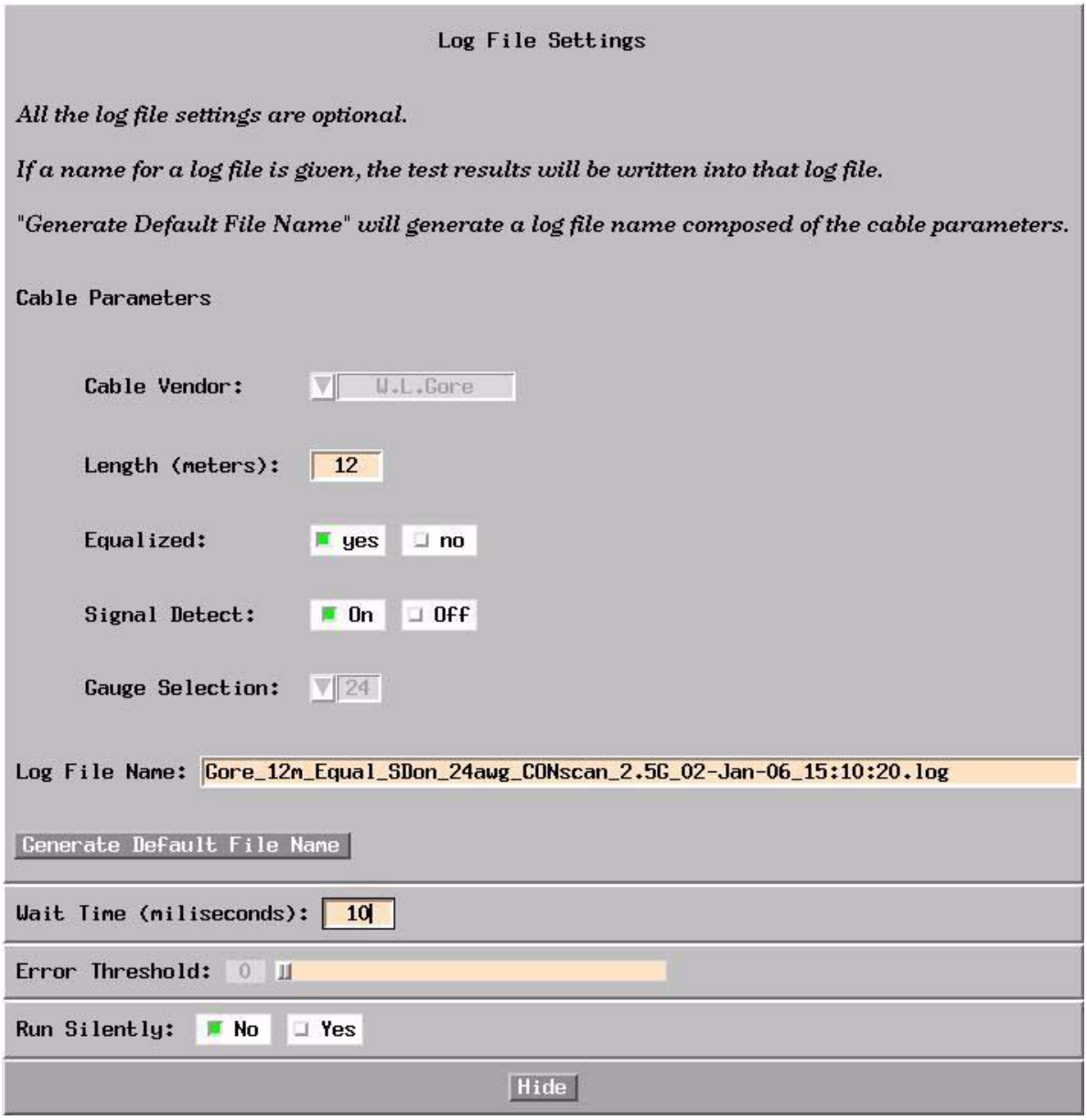
Figure 10: ‘File’ Pull-down Menu



Mellanox Technologies

An 'Advanced Settings' window will be displayed with a few *optional* items to be set (see Figure 11). These are described next.

Figure 11: Log File Settings Display



- **Cable vendor**: Options are: "W.L.Gore", "Amphenol", "Fujikura", "Tyco", "Molex", "Golden Bridge", "Leoni", "EMCore", "FoxConn", and "Other". In addition, the user may add new cable vendors by editing the (tcl) file 'is3_eye_gui.setup' residing in the same directory as the IS3 Eye Opening tool. (Note: Restart the tool after changing this file.)
- **Length**: Enter the cable length in meters
- **Equalized**: Select 'yes' if the cable is equalized, 'no' otherwise
- **Signal Detect**: This is a future feature and currently has no impact.
- **Gauge Selection**: Select the cable gauge. Options are: 22, 23, 24, 25, 26, 28, 30, and 32.

- **Wait Time**: Define the delay in milliseconds between two successive steps. Usually 2ms suffice for testing in stable conditions.
- **Error Threshold**: Define the number of symbol errors allowed in each step (0-255).
- **Run Silently**: For a switch system, this mode enables skipping the i2c-mux setting stage. Note that to run in silent mode, you must first set the i2c-mux after turning on the switch system.

When all these items are set, press ‘generate default file name’ in order to assign the file name. The file name will appear in the ‘Log file name’ bar window (see Figure 11 on page 21).

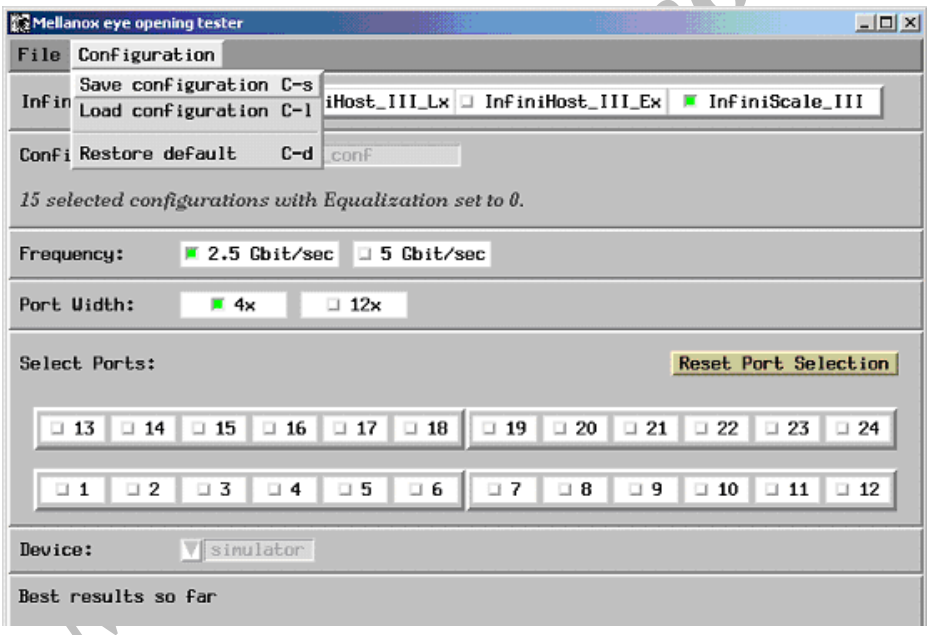
When done, press the ‘Hide’ button at the bottom of the display to close this window (see Figure 11 on page 21).

> Note: At this stage, it is possible to run the test by clicking on the green button ‘Run’ on the main display window.

3.3.2 Saving and Loading a Configuration File

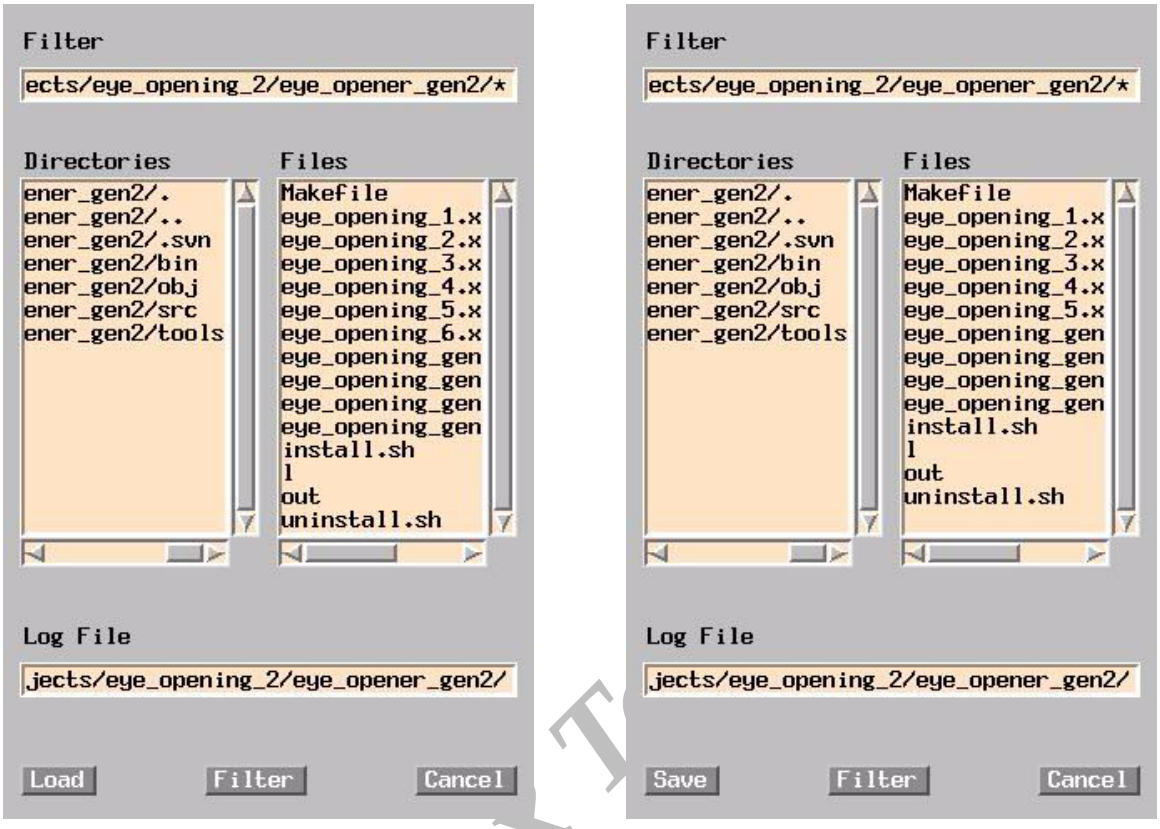
It is possible to save or load a test configuration file (a record of user selections) to/from the disk. These operations are possible using the ‘Configuration’ pull-down menu. It is also possible to restore the Default Configuration using the same menu. See Figure 12.

Figure 12: ‘Configuration’ Pull-down Menu



When 'Save configuration' or 'Load configuration' is selected, a 'File Selection' display window pops up for locating the destination/source configuration file. See Figure 13.

Figure 13: Configuration File Selection Filter - Load and Save

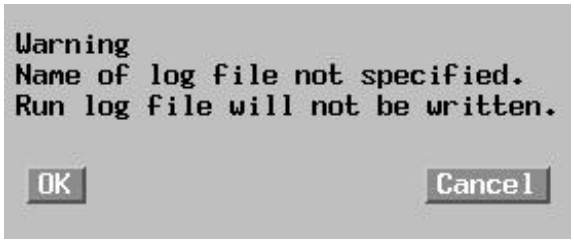


3.4 Troubleshooting Eye Opening GUI

3.4.1 Warning Messages

Figure 14 shows the warning message issued in case a log file name was not specified prior to running eye_gui. It is recommended to click 'Cancel', specify a log file name, then re-run.

Figure 14: Warning Printed by eye_gui



Mellanox T

3.4.2 Error Messages

The following error messages are printed by eye_gui:

1. Figure 15 shows the error message in case less than two ports were supplied for the configuration modes: ***def_conf, full configuration scan***, or ***user defined***.

Figure 15: Missing Port(s) for SerDeses' Configuration Scan

2. Figure 16 shows the error message in case a port number was not supplied for the ***set_conf*** configuartion mode.

Figure 16: Missing Port Number for ***set_conf*** Mode

3. Figure 17 shows the error message in case no mst (interface) device was found. This can occur due to one of the following cases:

   a. No mst device was selected when more than one exists. This is indicated by an empty field on the 'Device:' tab. To fix this, select the proper device then re-run.

   b. No mst device was found. The 'Device:' tab indicates 'simulator' in this case. To fix this, exit the GUI, run 'mst start', then 'mst status' to verify an mst device(s) is listed. If so, re-start the Eye Opening GUI.

Figure 17: Missing MST Device Error Message

Mellanox Technologies

4 Running from the Command Line

4.1 Before Running Eye Opening

Please see Section 3.1, "Before Running Eye Opening GUI," on page 10.

4.2 Usage

To run Eye Opening from the command line, change to the eye_opening directory and perform the following:

```
>./bin/eye_opening_xx   (xx - [is,lx,ex])
```

The syntax of eye_opening is as follows:

```
eye_opening_xx -ports <port1> <port2> [Optional Parameters]
```

where:

-ports <port1> <port2> - Defines the two ports with a cable connecting between them to be tested by **eye_opening**. For InfiniScale III based switch systems, the port numbers should be supplied in the range 1..24. For HCA cards, this flag is optional and the allowed port numbers are 0 and 1 for InfiniHost III Ex based HCA cards. For (single port) InfiniHost III Lx based HCA cards, do *not* specify this option.

and **Optional Parameters** are:

-dev <mst-device-name> - Changes the default device name. The device name is a string by which eye_opening_xx identifies your device. For device options, run 'mst status'

Default: /dev/mst/mtusb-1

-set_conf - Configures port SerDeses and port state with the given values in the command. No simulation is run when this flag is supplied (therefore no cable connection is required).

Note: The order of ports specified with the -ports option is important: port1 will be assigned the Tx *Amplitude* and *Pre-Emphasis* parameter settings, and port2 will be assigned the Rx *Equalization* parameter setting.[1]

-port_state <state> - Sets the physical port state. Options are: *0x2 (Polling), 0x3 (Disabled), 0x8 (TS1), 0x9 (TS2)* and *0xA (Idle)*. This options must be used with -set_conf.

-serdes_map <0-0xf> - Use this parameter with a number between 0 and 15 to select SerDeses to be tested by **eye_opening**. In the 4-bit binary equivalent, a '1' signifies that a SerDes is to be tested.

Examples: '-serdes_map 4' (binary 0100) indicates that only SerDes number 2 is to be tested; '-serdes_map 0' indicates no SerDes to be tested; and '-serdes_map 15' (binary 1111) indicates that all SerDeses are to be tested.

Default: 0xf

-i2c <i2c_addr> - Defines the virtual i2c address of your device.

1. eye_gui operates on a single port only with the set_conf configuration option. In effect, port1 and port2 there are the same.

Mellanox Technologies

	Default: 0x6c for InfiniScale III based systems; 0x48 for InfiniHost III Ex/Lx HCA cards.
-wf <wait factor in msec>	- Sets the wait/sleep period in milliseconds between successive steps of eye_opening. While small values make the run faster, big values yield more accurate results. Default: 10 ms
-threshold < threshold factor>	- Sets the number of symbol errors allowed in each step Default: 0
-amp <0-0xf>	- Sets the amplitude for all Tx SerDeses of tested ports Default: No change to current setting
-pre_emp <0-0xf>	- Sets the Pre-Emphasis for all Tx SerDeses of tested ports Default: No change to current setting
-eql <0-0xf>	- Sets the Equalization for all Rx SerDeses of tested ports Default: No change to current setting
-step_32	- Instructs eye_opening_xx to perform 32 steps of 400ps instead of 64. Used to save time in testing Default: Disabled
-12x	- Tests ports as 12X IB ports. applicable for *eye_opening_is* only. Default: Disabled
-silent	- Skips the I2C-mux setting stage of a switch system
-con	- Instructs the Eye Opening tool to skip checking for a connected cable
-h	- Displays a short help menu
--help	- Displays this (expanded) help menu
--usage	- Display the command line options (no explanations) with usage examples

4.2.1 Usage Examples

```
./eye_opening_is -ports 1 13

./eye_opening_is -ports 2 24 -wf 15 -amp 0x5 -eql 0xa -threshold 0xf

./eye_opening_is -ports 1 13 -step_32 -12x

./eye_opening_is -ports 1 13 -amp 2 -pre_emp 3 -eql 4
```

4.2.2 Run Examples

Example 1:

```
./eye_opening_is -ports 1 13 -amp 2 -pre_emp 3 -eql 4
```

Mellanox Technologies

```
****************************
***         eye_opening_is
***      Running .
         Result - IB Port 1       Serdes 0 : 281 ps
         Result - IB Port 1       Serdes 1 : 262 ps
         Result - IB Port 1       Serdes 2 : 287 ps
         Result - IB Port 1       Serdes 3 : 281 ps
         Result - IB Port 13      Serdes 0 : 275 ps
         Result - IB Port 13      Serdes 1 : 268 ps
         Result - IB Port 13      Serdes 2 : 275 ps
         Result - IB Port 13      Serdes 3 : 287 ps

                              Test Result   : 262 ps ( 42 )
```

Note: The number between parentheses on the Test Result line indicates the number of steps. The following equation is true: steps * step_resolution = Test Result (rounded down); thus 42 * 6.25ps = 262.5ps

Mellanox Technologies

Example 2:

```
 ./eye_opening_is -ports 1 13 -dev /dev/mst/calibre -step_32 -wf 2 -threshold 4
-amp 2 -pre_emp 1 -eql 1
****************************
***        eye_opening_is

***     Running .
        Result - IB Port 1       Serdes 0 : 300 ps
        Result - IB Port 1       Serdes 1 : 312 ps
        Result - IB Port 1       Serdes 2 : 300 ps
        Result - IB Port 1       Serdes 3 : 325 ps
        Result - IB Port 13      Serdes 0 : 300 ps
        Result - IB Port 13      Serdes 1 : 312 ps
        Result - IB Port 13      Serdes 2 : 300 ps
        Result - IB Port 13      Serdes 3 : 325 ps


                                Test Result   : 300 ps ( 24 )
```

Example 3: (No Eye is Found)

```
./eye_opening_is -ports 1 13 -dev /dev/mst/calibre -step_32 -wf 2 -threshold 4
-amp 14 -pre_emp 9 -eql 1

****************************
***        eye_opening_is

***     Running .
        Result - IB Port 1       Serdes 0 : 275 ps
        Result - IB Port 1       Serdes 1 : 262 ps
        Error :    symbol errors in normal mode

***        Test Result    - 0
```

Mellanox Technologies

5 Evaluating Test Results

Table 2 provides the user with criteria for cable evaluation based on Mellanox's experience running the Eye Opening tool on Mellanox products (HCA cards and IB switches).

Table 2 - Evaluating Cable Performance Based on Eye Opening Width

Eye Opening Width [ps] SerDes @ 5Gb/s	Eye Opening Width [ps] SerDes @ 2.5Gb/s	Cable Evaluation
Above 120	Above 280	Excellent performance (maximum measured is 330ps)
100 - 120	220 - 280	Robust performance
85 - 100	200 - 220	Satisfactory performance
70 - 85	180 - 200	Marginal performance
Below 70	Below 180	Inadequate performance

For the SerDes configuration (1,2,0), typical results observed are summarized in Table 4.

Table 3 - Typical Eye Opening Widths for SerDes Configuration (1,2,0)

Cable Length	Eye Opening Width Observed [ps]
2m	275 to 287
8m	262 to 287
12m	262 to 287
30m	Failure to 250

The best results observed using a Full Configuration scan are summarized in Table 4.

Table 4 - Best Eye Opening Widths Measured for Best Cables

Cable Length	Best Eye Opening Width Observed [ps]
2m	325
12m	312
25m	287
30m	262

Note: The results in Table 4 were obtained using the best cable per length category, and with the SerDeses in optimal configuration.

Mellanox Technologies

Mellanox Technologies