

# ML4070 QSFP

## GUI Manual



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## **General Safety Precautions**

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the General Safety Summary in other system manuals for warnings and cautions related to operating the system.

### **To Avoid Fire or Personal Injury**

**Use Proper Power Cord.** Only use the power cord specified for this product and certified for the country of use.

**Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal that exceeds the maximum rating of that terminal.

### **Do Not Operate Without Covers.**

Do not operate this product with covers or panels removed.

**Avoid Exposed Circuitry.** Do not touch exposed connections and components when power is present.

### **Do Not Operate With Suspected Failures.**

If you suspect there is damage to this product, have it inspected by qualified service personnel.

### **Do Not Operate in Wet/Damp Conditions.**

### **Do Not Operate in an Explosive Atmosphere.**

### **Keep Product Surfaces Clean and Dry.**

### **Symbols and Terms in this manual. These terms may appear in this manual:**

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** CAUTION:** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

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** CAUTION:** **Provide adequate cooling.** *Provide adequate cooling to the board to avoid damaging any part of it specifically for the ATE version of the board. Refer to the power section to know the power dissipation values*

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## **Contact MultiLane SAL**

**M**ultiLane SAL is an engineering services company and an OEM supplier of specialty test and communication equipment for the semiconductor and optical transport industries. Multilane delivers ultra-compact test instruments of the highest value and performance for high speed communication and signal integrity applications. The Company has a large engineering team and a fully equipped lab with state of the art equipment, having recently moved to a 6000sq foot facility in **Houmal Technology Park (HTP)**.

**MultiLane SAL** customers can leverage great flexibility and capability in product customization thanks to our team in depth expertise in high speed I/O, Signal Integrity, and access advanced development and test tools. MultiLane has the resources and know-how to meet customer's product development and design requirements. Our R&D has a proven track record in delivering leading edge products and development tool kits to the Automated Test market while applying the production processes to deliver high quality products on schedule and within budget.

**MultiLane SAL's** team is composed of experienced and disciplined engineers offering products and turnkey solutions of modules and systems for high speed IO, Signal Integrity, SOC development and optical communication from verbal requirements (Architecture, PRD, HW/FW/SW design implementation and characterization).

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<b>Address</b>	<b>MultiLane SAL Houmal Technology Park Askarieh Main Road Houmal</b>
<b>Web site</b>	<a href="http://www.multilaneinc.com">www.multilaneinc.com</a>
<b>Sales support</b>	<a href="mailto:sales@multilaneinc.com">sales@multilaneinc.com</a>
<b>Support</b>	<a href="mailto:support@multilaneinc.com">support@multilaneinc.com</a>

If any further help is needed, please contact MultiLane SAL, by sending general enquiries to [info@multilaneinc.com](mailto:info@multilaneinc.com).

# Overview:

The GUI is divided into two Main Tabs:

- Monitor Tab.
- Configuration Tab.

The ML4070 QSFP board can accept up to three QSFP modules of four channels each. The module B is a Loopback only module.

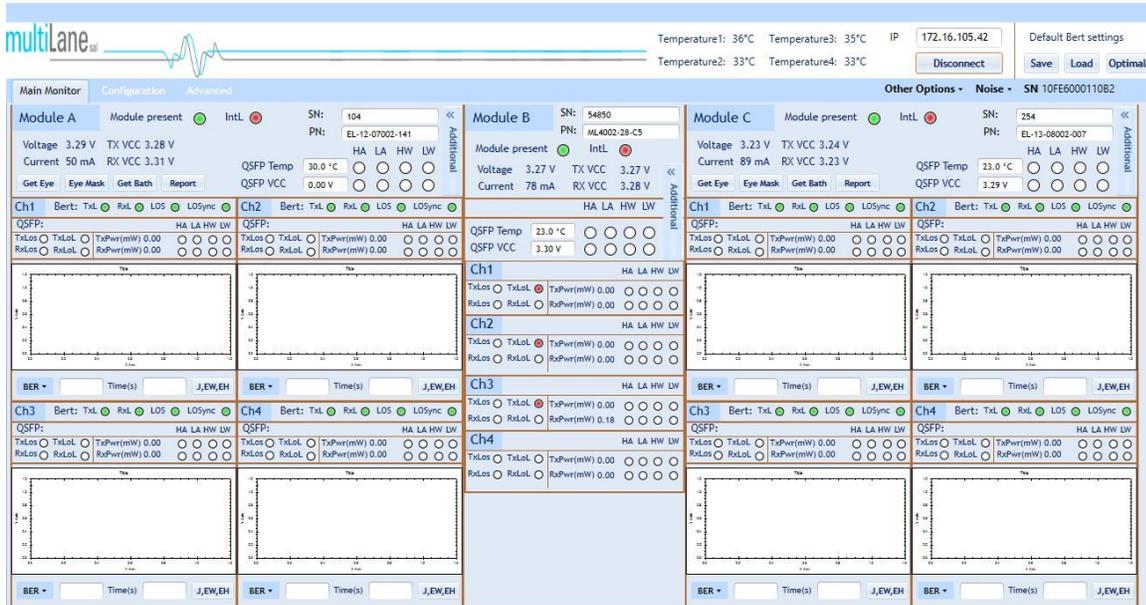


Figure 1: Monitor Tab

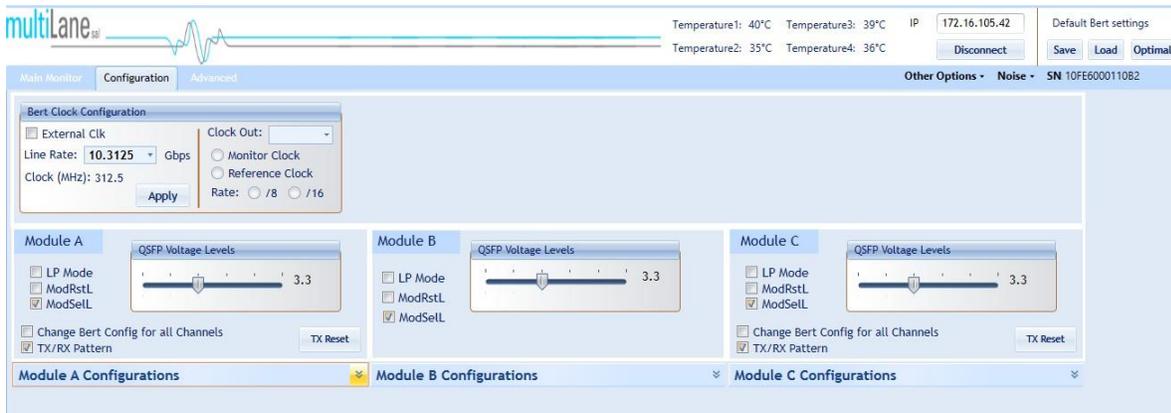
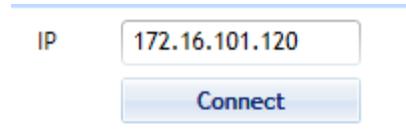


Figure 2: Configuration tab

## Connect through Ethernet:

- Connect the PC to the front panel via the RJ45 connector located on the front panel through an Ethernet cable to be able to control it. In order to connect via Ethernet the IP address of the board is required.
- Note that no drivers are required. You only have to know the current board IP address, you need to enter it in the text box next to the **IP** label shown in the below picture, then click on the **connect** button.



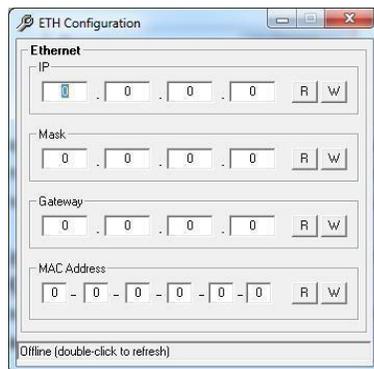
- You are now connected.

**Figure 3:** Connect button

- Once connected, the **Connect** button turns into **Disconnect** and the board Serial Number will be displayed.
- To make sure that you are connected, you can also ping your device.

## Changing the IP Address:

- To change the IP address of the board, you need to install the USB drivers.
- Install the Ethernet configuration software that allows you to read, write the **IP** address, **Mask** and **Gateway** of the instrument.



The instrument is now powered up and connected through the right IP address. Next, you need to configure the signal generated.

**Figure 4:** Ethernet Configuration

## Line Rate Configuration:

- Write the bit rate value next to the **Line Rate** label. The value entered must be in between 8.5-15 & 21-30 Gbps per lane.
- Press **Apply** to save the value.
- The GUI will calculate the Clock and display its value in the clock label then the board will generate this clock.

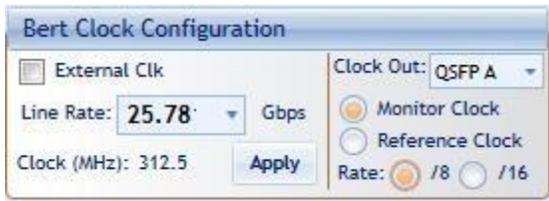


Figure 5 Clock Configuration

- Clock Out settings are available for ML4070-QSFP boards containing a clock out port.
- Checking the “Monitor Clock” radio button will forward the clock signal from the clock generator to the clock out port, divided by 8 or 16.
- While checking the “Reference Clock” radio button will forward the clock signal coming from the inphy of the selected module (QSFPA/QSFPC).

### **Board Temperature:**

Temperature1: 34°C    Temperature3: 33°C

Temperature2: 31°C    Temperature4: 31°C

Figure 6 Board temperature

- The Gui displays the temperature read from 4 sensors distributed on the board.

### **Other options:**

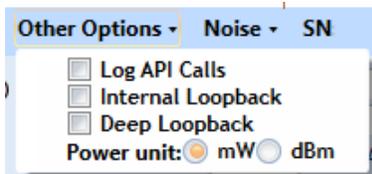


Figure 7 Other options

- When the box ‘Log API Calls’ is checked, the GUI generates Log files under the directory where the GUI is deployed, in a folder called LogAPICalls followed by today’s date. Note this function consumes disk space and is best disabled if leaving the GUI up and running for more than a day.
- Two log files will be generated by channel. All functions which do not apply at the channel level such as functions at the board level will fall under channel 0’s log files. Log files are split into two files per channel:
  - 1- LogAPICalls0.log

- 2- LogAPIFrequentCalls0.log
  - Where LogAPIFrequentCalls0 grows quickly and contains the monitoring functions that are always running in the background to do a status check determining what color to choose for the various LEDs in the GUI.
  - **Internal Loopback:** After enabling the internal loopback, the RX will be connected to the TX in the 4 channels, and the user will not be able to make TX generation anymore.
  - **Deep Loopback:** enable loopback for gearbox 2 (Module A and C).
  - **Power Unit:** Set the TX/RX power unit (mW or dBm).

### Noise:

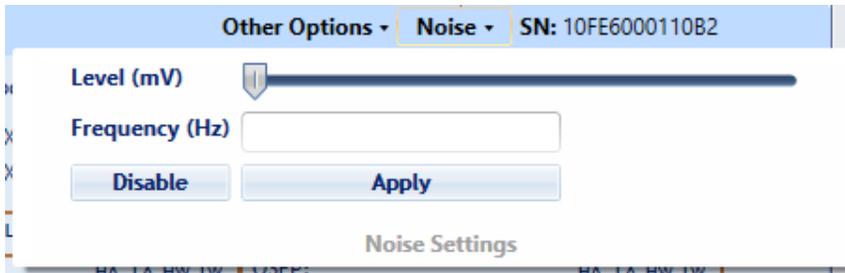


Figure 8 Noise Dropdown Menu

- **Noise Dropdown Menu:** Set the Noise Level and frequency for all channels.

### Module Monitor:



Figure 9: Module monitor

### Module pins:

- **Module present:** Turns green when the module is connected correctly to the board.
- **Interrupt signal (IntL):** Turns green when the module Latch an interrupt signal. The host identifies the source of the interrupt using the 2-wire serial interface.

**Board measurements:**

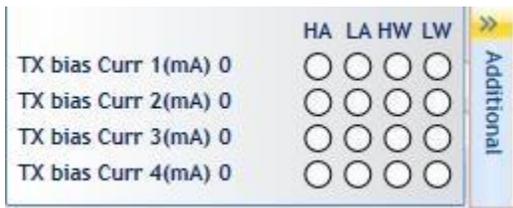
- **Voltage:** Displays the voltage on the VCC power rail.
- **Current:** Displays the current passing through VCC power rail.
- **TX VCC:** Displays the voltage on the TX port power rail.
- **RX VCC:** Displays the voltage on the RX port power rail.

**Internal measurements and flags:**

- **QSFP Temp:** Displays the QSFP internally measured temperature.
- **QSFP VCC:** Displays the QSFP internally measured voltage.
- **HA:** High Alarm
- **LA:** Low Alarm
- **HW:** High Warning
- **LW:** Low Warning

These flags reflect the stat of the module temperature and voltage of the module.

**Additional measurement:**



Displays the Tx bias current of the 4 channels with the HA/LA/HW/LW flags.

**Eye/Bathtub:**

When the Get Eye or Get Bathtub button are clicked, the Eye or Bathtub of all the locked channel of the module are plotted on the graph.

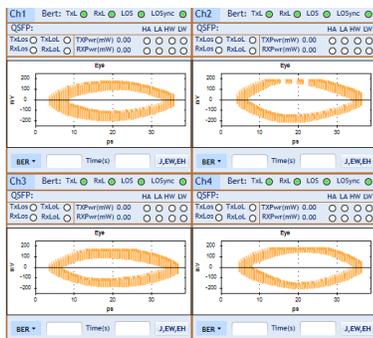


Figure 10 Eye Diagram

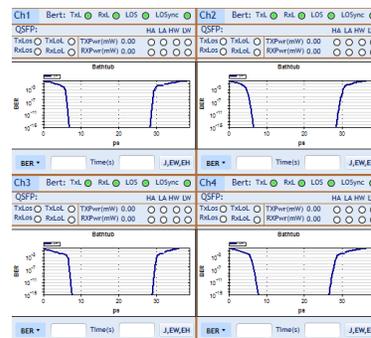


Figure 11 Bathtub

**Eye Mask:**

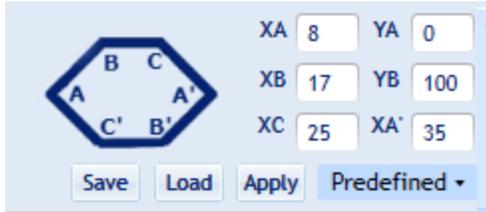


Figure 12 Eye Mask

Show/Hide the Eye Mask on the graph.

Eye Mask points can be edited, Apply button should be clicked to apply the new coordinates.

The Eye Mask can be saved for later use.

Eye Mask Points are:

A (Xa,Ya) B (Xb,Yb) C (Xc,Yb)

A' (Xa',Ya) B' (Xc,-Yb) C' (Xb,-Yb)



Figure 13 Eye Mask points coordinate

**Module report:**

The Report button generate a full report of the module’s configurations and measurements. The report contains the last taken measurement (Eye, Eye width, Eye Height, Bathtub, J2, J9, BER...)

⚠ You should take every measure before generating the report.

⚠ Any measure not taken in the gui, will be replaced by its last measured value.

⚠ The Eye and Bathtub graphs will be replaced by the Eye and Bathtub taken from the last session if they are not drawn before generating a report.

**Channel Monitor:**

In order to start BER measurements, the instrument ports should be in the loopback mode, which means TX port should be connected to the RX.



Figure 14 Bert Lock

To monitor the BER function, we have dedicated a LED to make sure it is locked.

- If the RxL LED is green that means the RX is locked to the incoming data.

- If the RxL LED is red that means the RX is not locked to the incoming data. There is a possibility that the cables are not connected correctly, thus try the invert function at the TX and RX sides; if the problem persists check the connections of your cables. The patterns of the Detector are automatically modified when you change the generator pattern value.

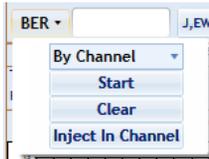


Figure 15 BER measurements

We can get the BER by channel, by module or for all the 16 channels.

We can also calculate **J2/J9** and **Eye Width** and **Height**.

Note that to calculate J2/J9 you must run the Bathtub first.

QSFP:		HA	LA	HW	LW				
TxLos	<input type="radio"/>	TxLoL	<input type="radio"/>	TX Pwr	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
RxLos	<input type="radio"/>	RxLoL	<input type="radio"/>	RX Pwr	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 16 QSFP Monitor

- **TxLoL**: TX Loss of Lock.
- **RxLoL**: RX Loss of Lock.
- **LOS** is equivalent to **TxLos** and is set when the TX Signal is lost.
- **LOSync** is equivalent to **RxLos** and is set when the RX signal is lost.
- TX and RX Power measurements.
- High/Low Alarm/Warning for the Tx and Rx Power.

# Module Configuration:

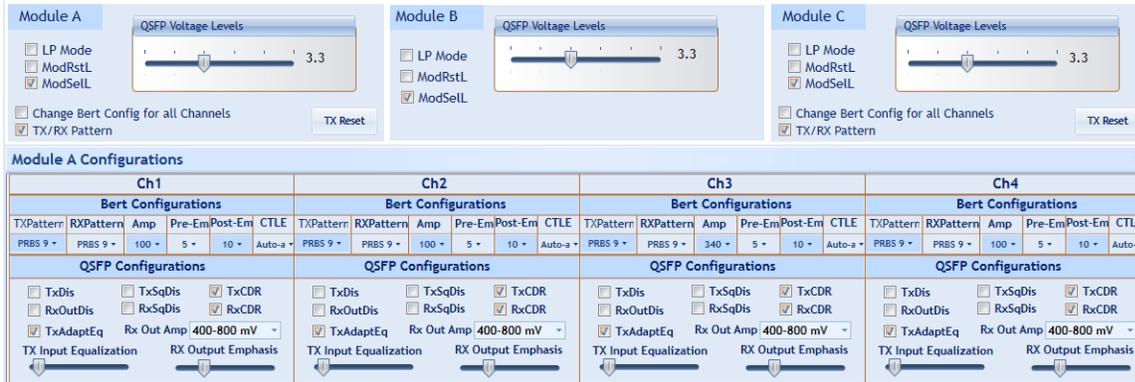


Figure 17 Module configuration

- **QSPF Voltage Levels:** Change the Voltage level of the QSPF module. Values are between 3.1V and 3.6V.
- **LP Mode:** In low power mode module will stop all power dissipation and LED changes color to orange, in high power mode the power dissipation will be set to value inside register 98 and LED will be green.
- **ModRstL:** The ResetL pin must be pulled to Vcc in the QSPF+ module. A low level on the ResetL pin for longer than the minimum pulse length ( $t_{Reset\_init}$ ) initiates a complete module reset, returning all user module settings to their default state. Module Reset Assert Time ( $t_{init}$ ) starts on the rising edge after the low level on the ResetL pin is released. During the execution of a reset ( $t_{init}$ ) the host shall disregard all status bits until the module indicates a completion of the reset interrupt.
- **ModSelL:** The ModSelL is an input pin. When held low by the host, the module responds to 2-wire serial communication commands and LED will be solid Green. The ModSelL allows the use of multiple modules on a single 2-wire interface bus. When the ModSelL is “High”, the module shall not respond to or acknowledge any 2-wire interface communication from the host and the LED will be toggling.
- **TX Reset:** Reset the GearBox2.

## **Channel Bert Configuration:**

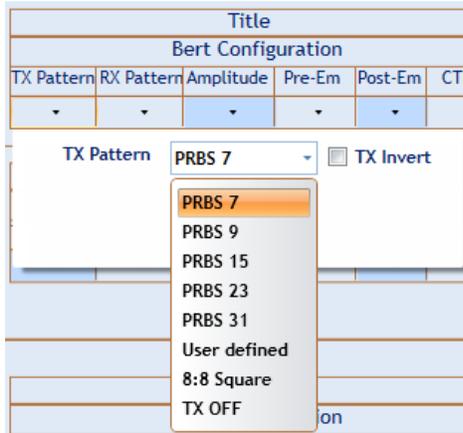


Figure 18: PRBS

1- In the **TX Pattern** group box, select the pattern required; the available patterns are 7, 9, 15, 23, 31, user defined (sequence of bits in **Hexadecimal**) and 8:8 square. To make the TX off, choose the **TX OFF**

2- In the **RX Pattern** group box, select the pattern required; the available patterns are 7, 9, 15, 23, 31, auto verification and 8:8 square

- Channel will be locked if the data received at RX matches the selected pattern -If the user selects **Automatic Verification**, the software will try to detect the received signal pattern and if it is inverted; upon success it will show the result and the LED will indicate that the channel is locked.

TX Pattern tab is used for Configuring Generated signal, RX Pattern tab is used for pattern verification.

3- This instrument includes 3 sliders to shape the form of the eye diagram, amplitude, Pre-emphasis and Post-emphasis. All slider values and other configurations are saved in the EPROM:

-Amplitude: TX output amplitude is between 0mV and 100mV if not calibrated.

-Pre Emphasis: TX output Pre-emphasis amplitude value could be changed from 0 to 20%.

-Post Emphasis: TX output Signal Post-emphasis amplitude value could be changed from 0 to 35%.

Amplitude	Pre-Em	Post-Em
50 ▾	0 ▾	0 ▾

Figure 19: Amplitude, Pre-Em, Post-Em

4- CTLE Tab allows the user to select the DFE level; DFE varies from 0 to 10 dB to compensate for cable loss from the DUT to the BERT and to de-embed the system losses.

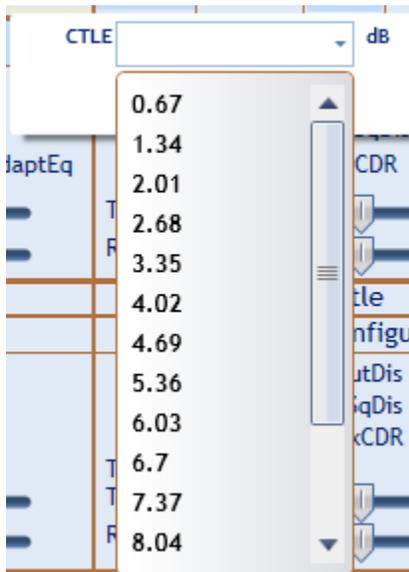


Figure 20: CTLE

### **Channel OSFP configurations:**

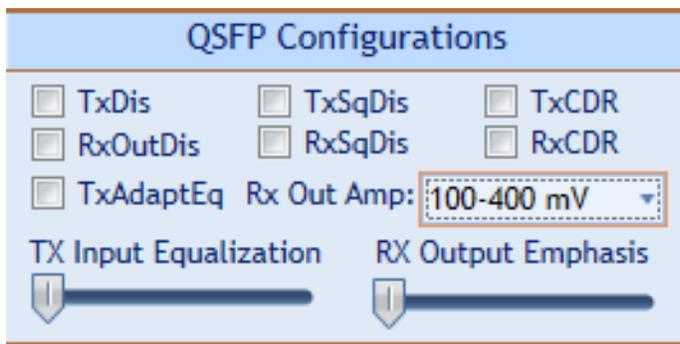


Figure 21 QSF P configuration bits

- o **TxDis:** disable the transmitter of the associated channel.
- o **RxOutDis:** Squelches the output of the associated channel.
- o **TxSqDis/RxSqDis:** Tx/Rx Squelch enable/disable for the channel.
- o **TxCDR/RxCDR:** For transceivers with CDR capability, setting the CDR to ON engage the internal retiming function. Setting the CDR to OFF enables an internal bypassing mode, which directs traffic around the internal CDR.

- o **TxAdaptEq:** Enable input adaptive equalization.
- o **RXOutAmp:** Set the modules RX output amplitude levels with no equalization enabled.
- o **Tx Input Equalization:** Input equalization (0 to 10).
- o **RX Output Emphasis:** Output emphasis (0 to 7).

### **Default Bert settings:**



*Figure 22 Default Bert settings*

The Save button saves the Bert configurations for all the channels from all the modules to reload them later.

The Optimal button loads the optimal Bert configurations for all the channels.

## Manual Revision History

This section describes the changes that were implemented in this document. The changes are listed by revision, starting with the most current publication.

Revision 1.2: May 11<sup>th</sup>, 2018; First publication of this document, preliminary revision.

### North America

48521 Warm Springs Blvd. Suite 310  
Fremont, CA 94539  
USA  
+1 510 573 6388

### Worldwide

Houmal Technology Park  
Askarieh Main Road  
Houmal, Lebanon  
+961 5 941 668

### Asia

14F-5/ Rm.5, 14F., No 295  
Sec.2, Guangfu Rd. East Dist.,  
Hsinchu City 300, Taiwan (R.O.C)  
+886 3 5744 591