TLK10002 Dual-Channel, 10-Gbps, Multi-Rate Transceiver EVM Graphical User Interface

This user's guide describes the usage and construction of the TLK10002 evaluation module (EVM) graphical user interface. This document provides a basic overview of the different portions of the program.

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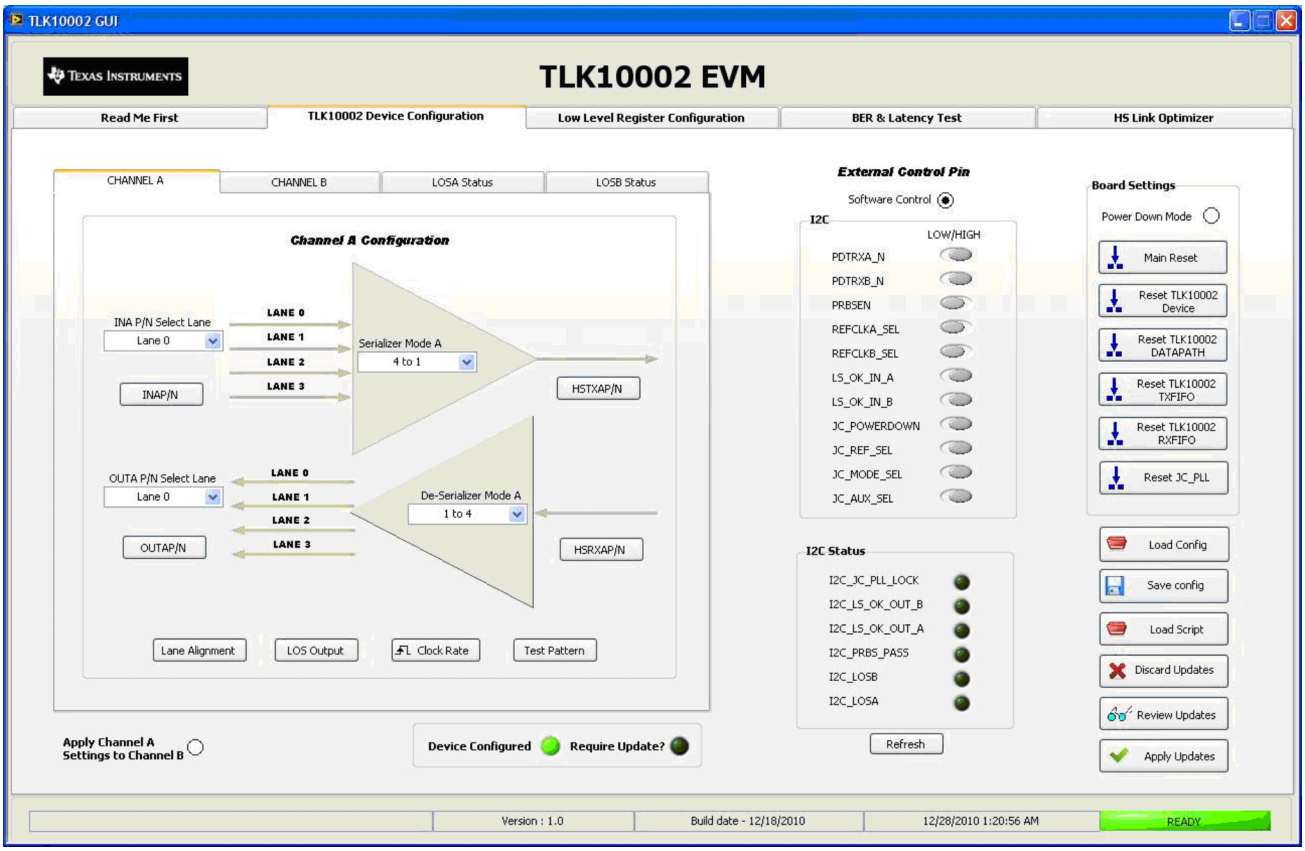


Figure 1. TLK10002 GUI Screen

WARNING

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at own expense will be required to take whatever measures may be required to correct this interference.

The Texas Instruments (TI) TLK10002 SERDES evaluation module (EVM) boards are controlled and configured using a custom-developed graphical user interface (GUI).

High-level and low-level manipulation of the registers is possible through this GUI as well as a variety of built-in test modes.

The High-Speed Transmit and Receive portions can sweep through a nested loop of parameter combinations and both visually and empirically report the results to save time in determining the optimal combination of settings.

2 High-Level Operation of the GUI

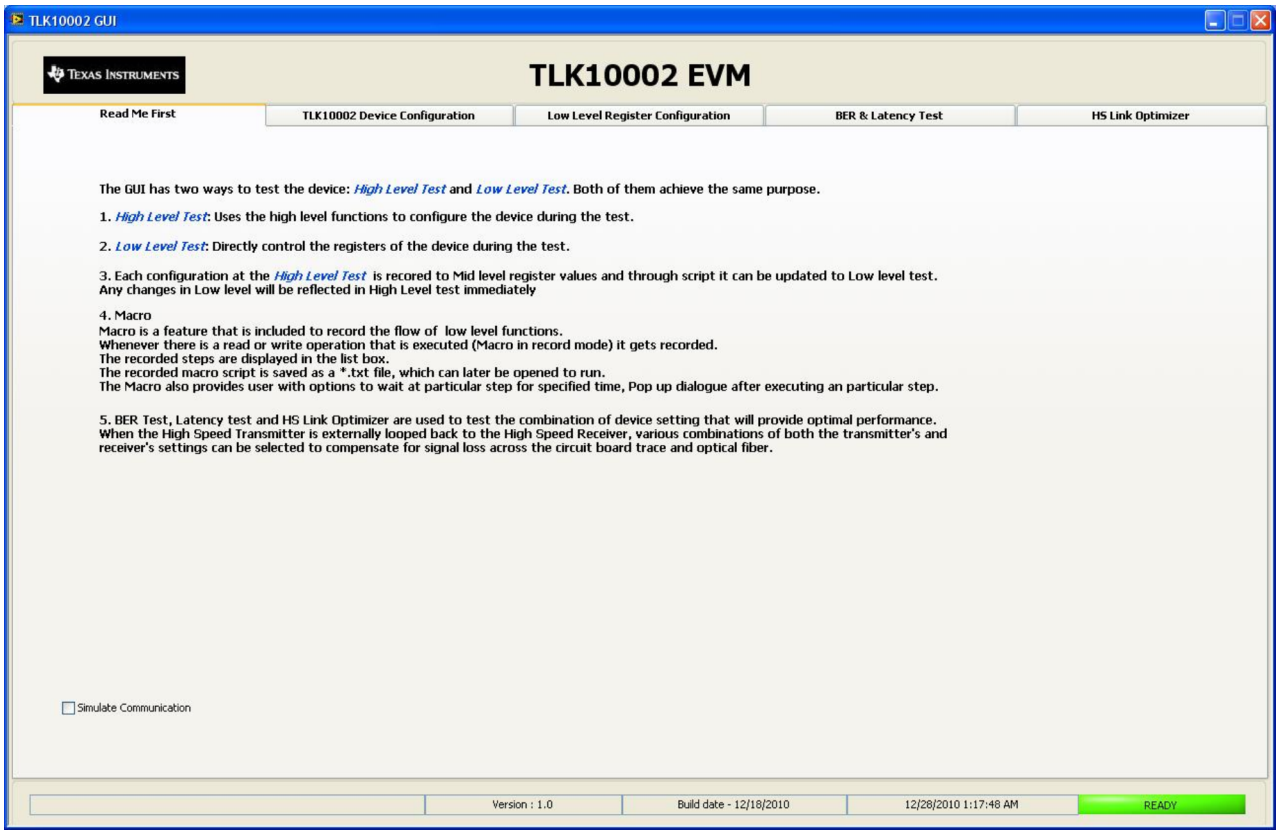


Figure 2. TLK10002EVM GUI Read Me First Window

When the GUI starts, the indicator at the bottom right corner of the window is red and displays *Working* while the GUI establishes communication with the USB port of the EVM and sets the default configurations required for proper operation of both the board and the GUI.

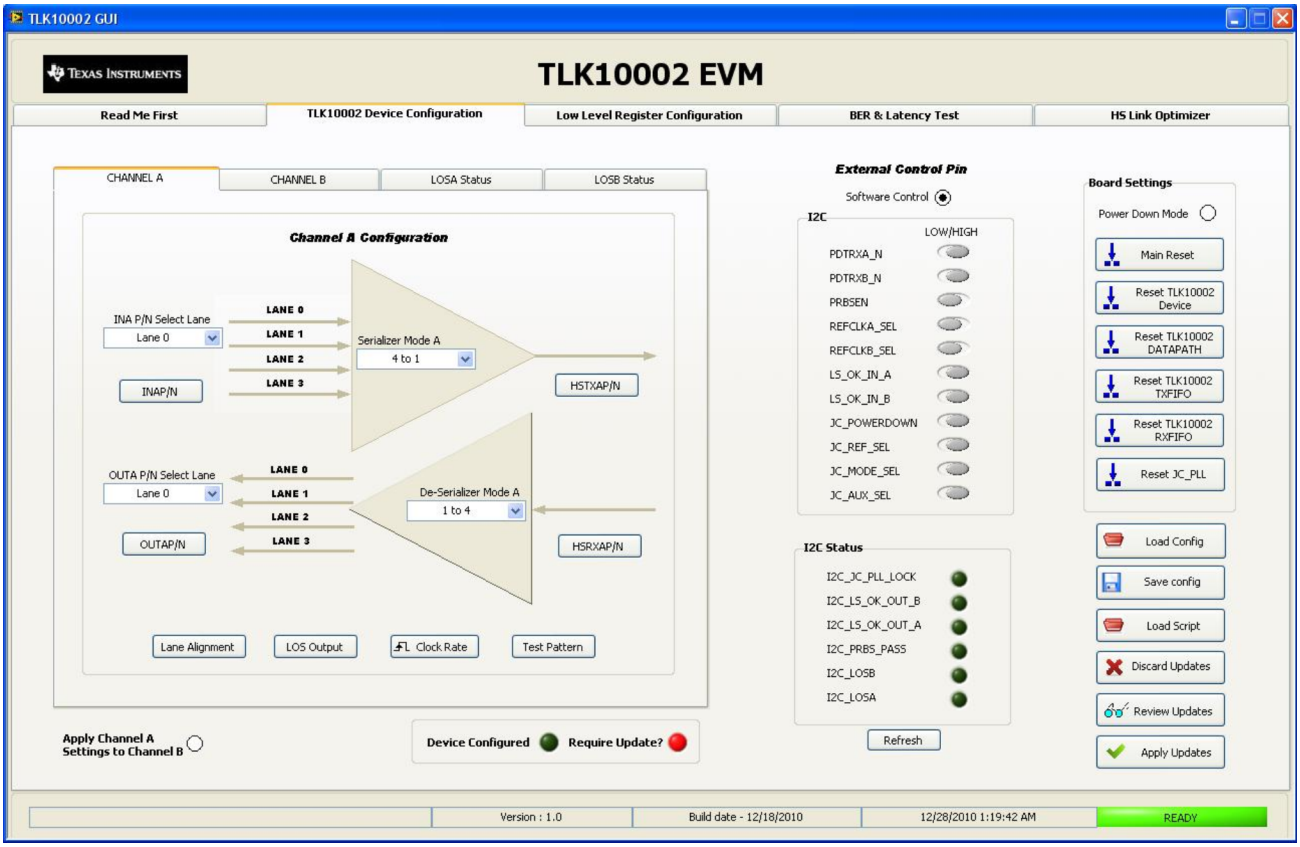


Figure 3. TLK10002EVM GUI High-Level Device Configuration Window

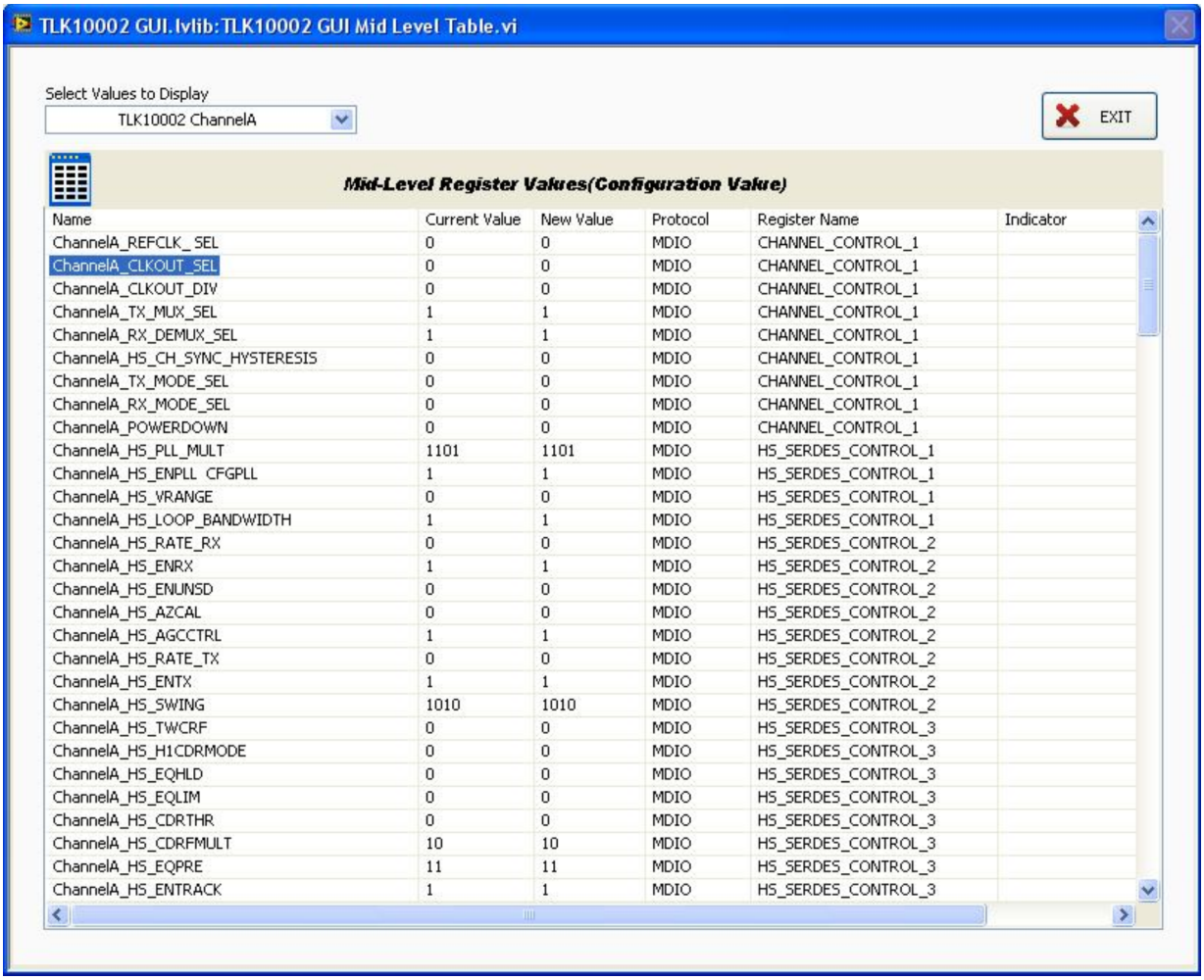
Configuration of the external control pins of the TLK10002 device through the GUI is performed by setting the toggle switch located in the central portion of the GUI, where it is grouped under the title *External Control Pin*. A TCA6424 I2C-to-GPIO device on the board is configured to control the high/low settings of the device pins from USB data sent to the board from the GUI. It is possible to disable the software control and rely on manual settings of these signals. Monitoring external status pins is also possible through this method.

In order to keep the GUI and the device settings on the board synchronized, all reset signals must be initiated from the GUI through the various buttons. If the Reset button on the board itself is pressed, the GUI does not realize that the registers were reset and continues to display the previous register values.

Configuration of the TLK10002 register settings is accomplished from the high level Device Configuration tab of the GUI. All of the settings of the TLK10002 can be modified from various portions of this tab, which are broken out and grouped into individual windows according to their functions.

When the settings of the GUI do not match the actual register settings of the EVM device, the Require Update? light glows red, indicating that some setting has changed in the GUI memory and needs to be sent to the device. When the device settings match the GUI's memory, the Device Configured light glows green, indicating that the board is configured as displayed in the GUI.

To change the various register settings in the GUI memory to a new value, find the particular parameter field in the various windows, select the new value, and click the Save button. Failing to click the Save button causes in the change to be discarded and the current value of the register to be maintained.



Name	Current Value	New Value	Protocol	Register Name	Indicator
ChannelA_REFCLK_ SEL	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_CLKOUT_SEL	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_CLKOUT_DIV	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_TX_MUX_SEL	1	1	MDIO	CHANNEL_CONTROL_1	
ChannelA_RX_DEMUX_SEL	1	1	MDIO	CHANNEL_CONTROL_1	
ChannelA_HS_CH_SYNC_HYSTERESIS	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_TX_MODE_SEL	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_RX_MODE_SEL	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_POWERDOWN	0	0	MDIO	CHANNEL_CONTROL_1	
ChannelA_HS_PLL_MULT	1101	1101	MDIO	HS_SERDES_CONTROL_1	
ChannelA_HS_ENPLL_CFGPLL	1	1	MDIO	HS_SERDES_CONTROL_1	
ChannelA_HS_VRANGE	0	0	MDIO	HS_SERDES_CONTROL_1	
ChannelA_HS_LOOP_BANDWIDTH	1	1	MDIO	HS_SERDES_CONTROL_1	
ChannelA_HS_RATE_RX	0	0	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_ENRX	1	1	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_ENUNSD	0	0	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_AZCAL	0	0	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_AGCCTRL	1	1	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_RATE_TX	0	0	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_ENTX	1	1	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_SWING	1010	1010	MDIO	HS_SERDES_CONTROL_2	
ChannelA_HS_TWCRF	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_H1CDRMODE	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_EQHLD	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_EQLIM	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_CDRTHR	0	0	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_CDRFMULT	10	10	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_EQPRE	11	11	MDIO	HS_SERDES_CONTROL_3	
ChannelA_HS_ENTRACK	1	1	MDIO	HS_SERDES_CONTROL_3	

Figure 4. TLK10002EVM GUI High-Level Device Configuration Review Updates Window

When register values change in memory and the *Require Update?* light glows red, the changed values can be reviewed prior to applying the changed values to the TLK10002 device. This is accomplished by clicking the Review Updates button on the bottom right portion of the GUI window. All the registers that are selectable are tracked by the GUI in a mid-level array that stores the current and new value for the register. When even one new value field changes, the *Require Update?* light glows red.

The new values can also be discarded with the click of the Discard Updates button.

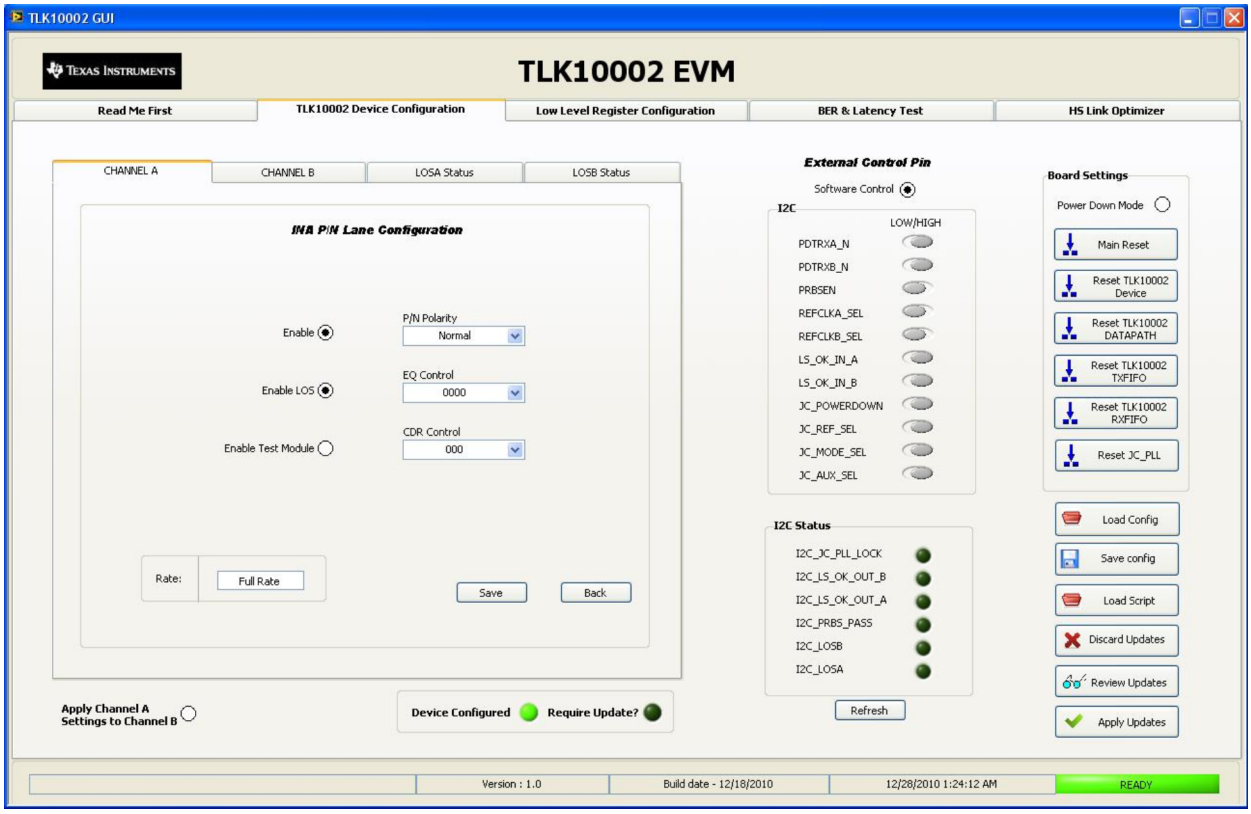


Figure 5. TLK10002EVM GUI High-Level Device INAP/N Configuration

Selecting the INA0P/N button on the left portion of the Channel A Configuration window opens the INA0P/N parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.

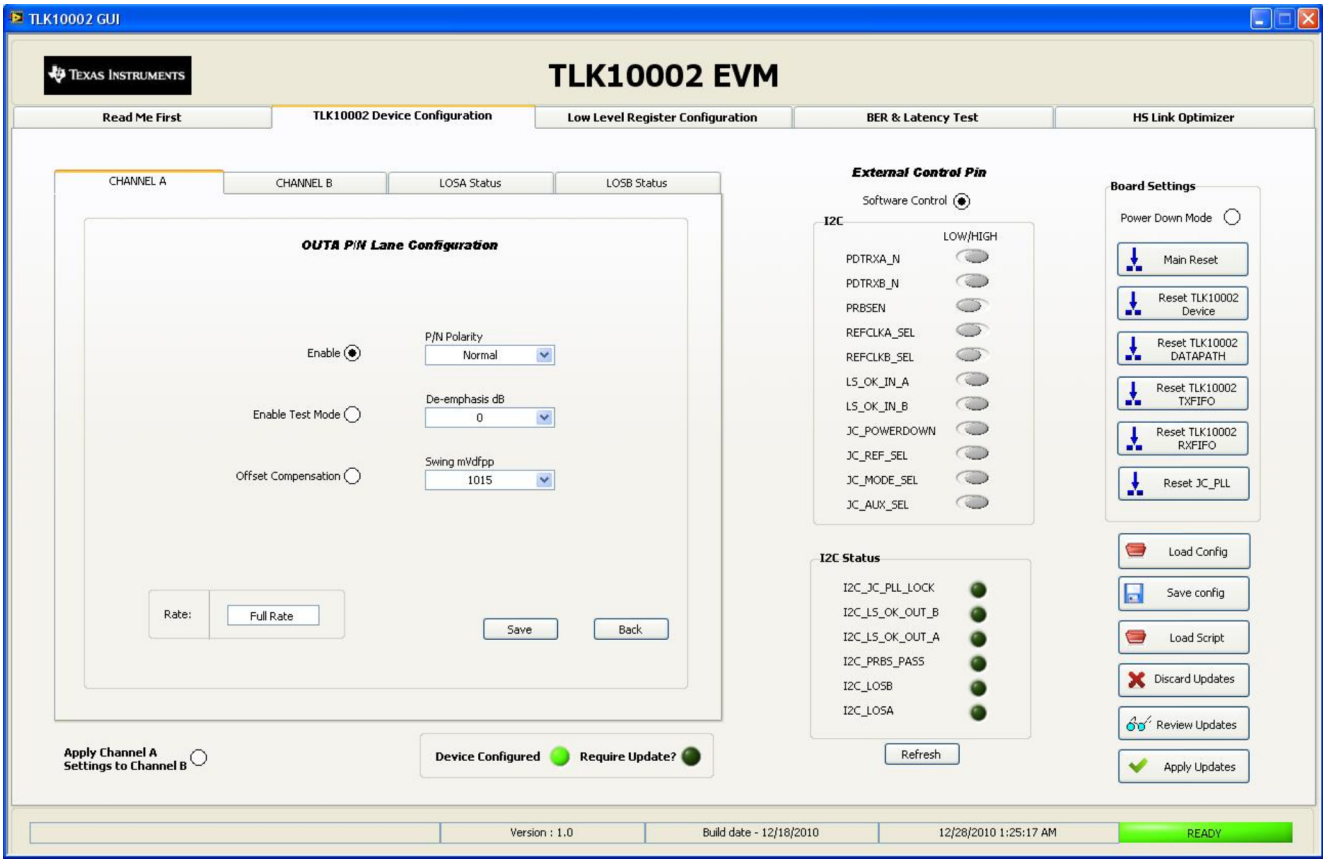


Figure 6. TLK10002EVM GUI High-Level Device OUTAP/N Configuration

Selecting the OUTA0P/N button on the left portion of the Channel A Configuration window opens the OUTA0P/N parameters. If changes need to be made to any of these parameters, simply select the new values and click the Save button. To navigate away from the window and return to the Channel A Configuration Window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.

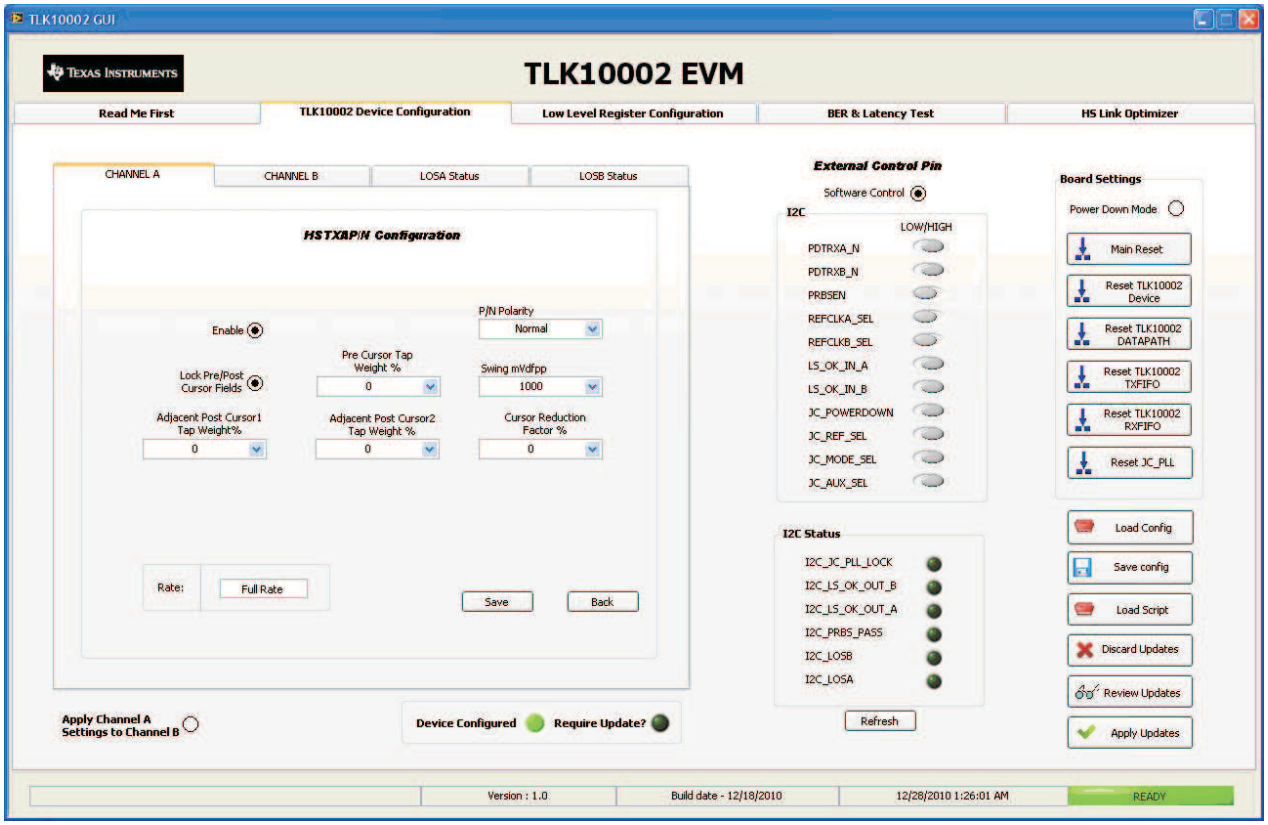


Figure 7. TLK10002EVM GUI High-Level Device HSTXAP/N Configuration

Selecting the HSTXAP/N button on the right portion of the Channel A Configuration window opens the HSTXAP/N parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.

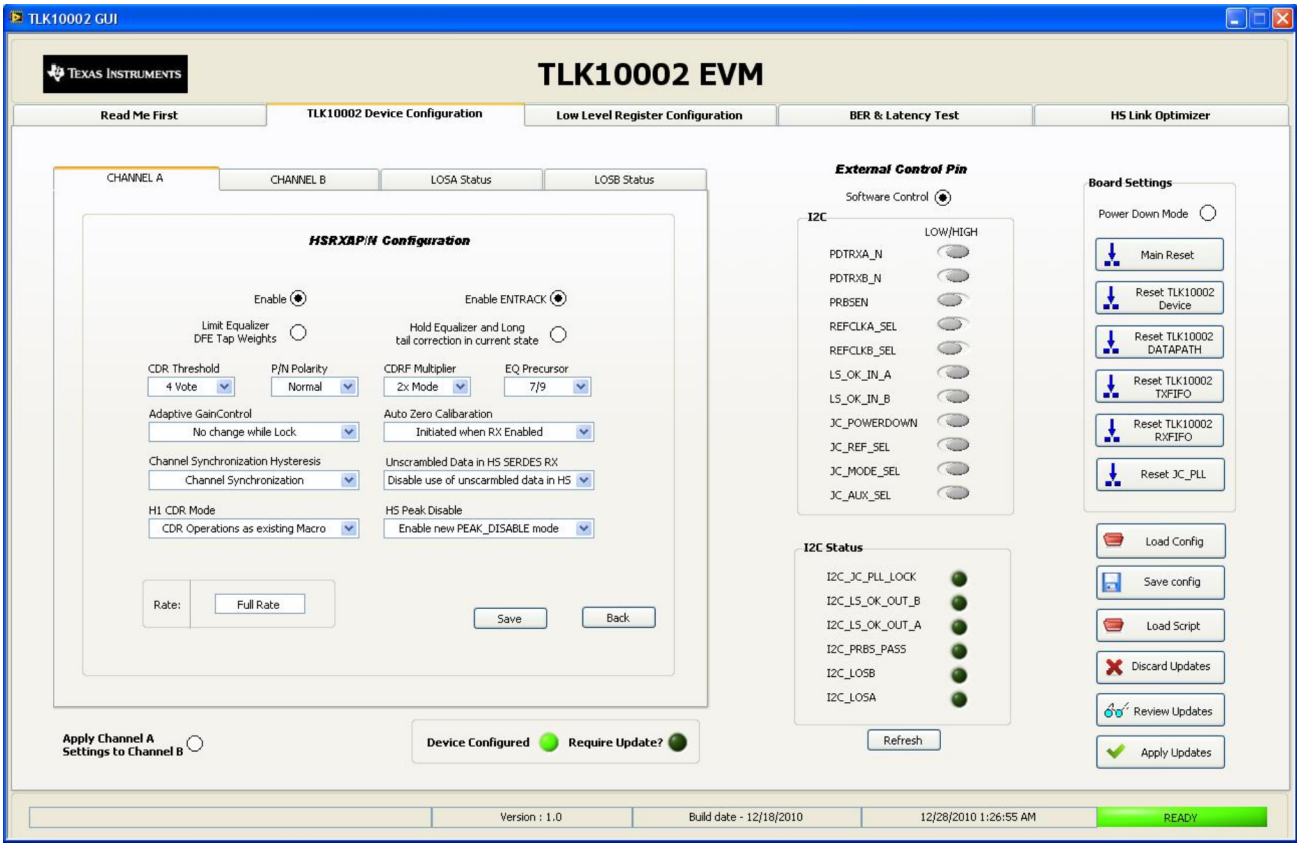


Figure 8. TLK10002EVM GUI High-Level Device HSRXAP/N Configuration

Selecting the HSRXAP/N button on the right portion of the Channel A Configuration window open the HSRXAP/N parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, and message box is displayed to inform the user that changes will be discarded if not saved.

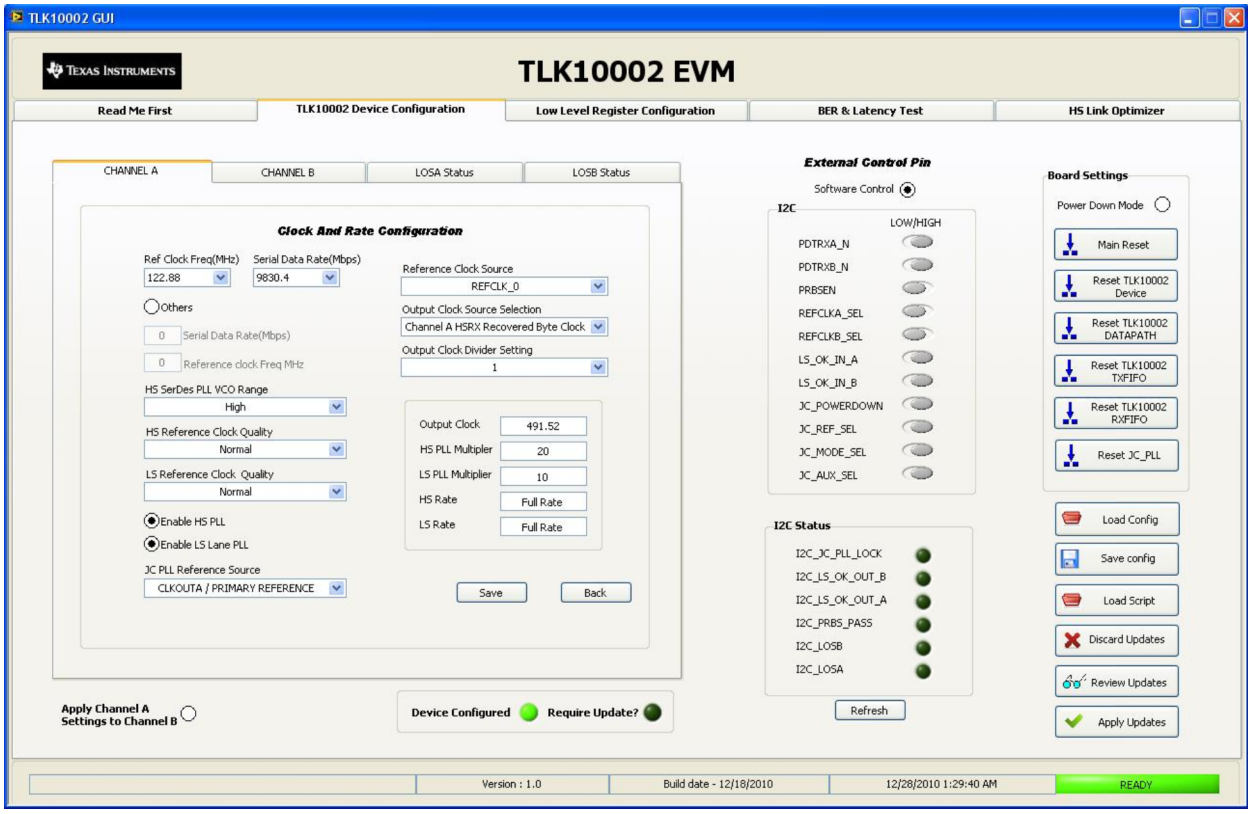


Figure 9. TLK10002EVM GUI High-Level Device Clock and Rate Configuration

Selecting the Clock Rate button on the bottom portion of the Channel A Configuration window opens the Clock and Rate parameters. The GUI is designed for easy evaluation of the supported CPRI and OBSAI standard frequencies as listed in the TLK10002 data sheet. By selecting the high-speed, serial-data rate, the reference clock frequency, the reference clock source for the lane, and the output clock source and divider values, all the various register settings are properly configured and stored into memory to await a device update. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.

If other frequencies need to be tested, manual setting of the various clock and rate parameter register settings must be performed.

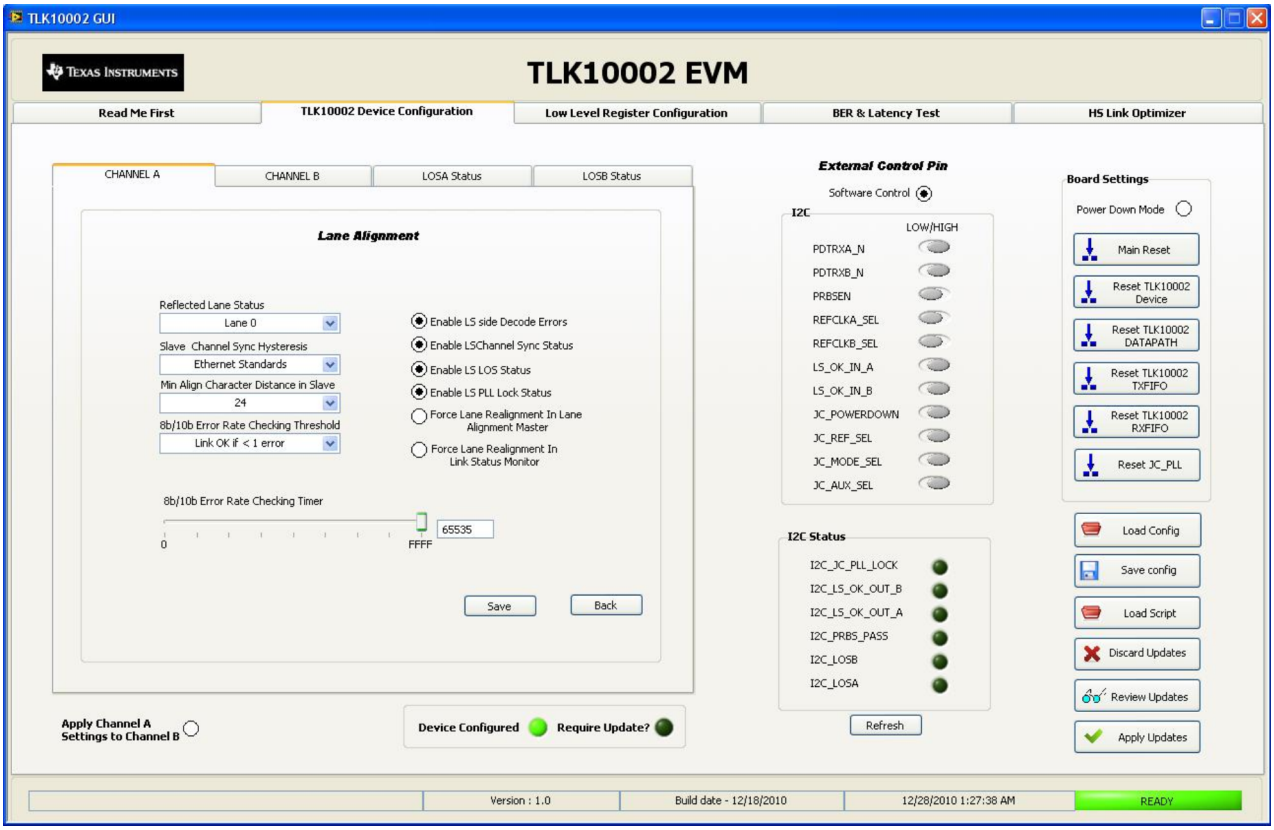


Figure 10. TLK10002EVM GUI High-Level Device Lane Alignment Configuration

Selecting the Lane Alignment button on the bottom portion of the Channel A Configuration window opens the Lane Alignment parameters. If changes need to be made to any of these parameters, select the new values and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.

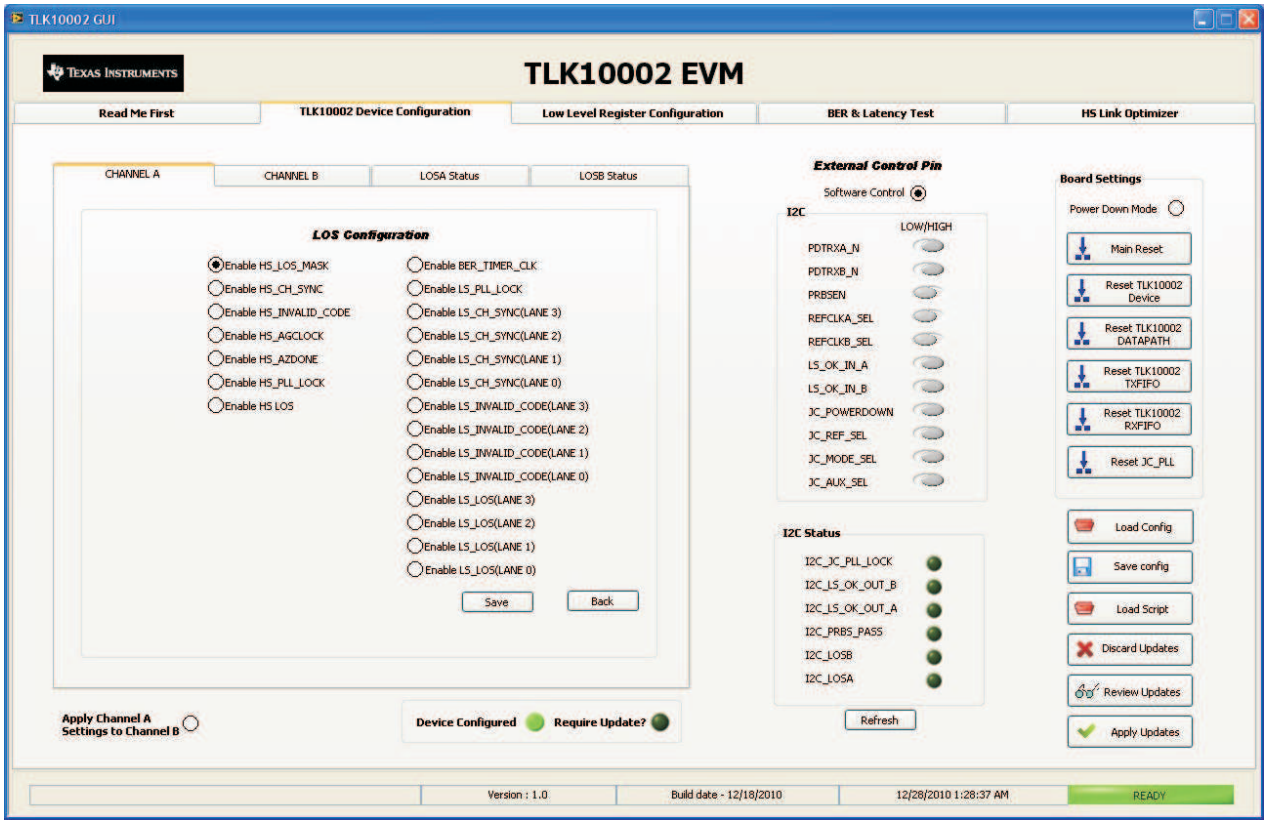


Figure 11. TLK10002EVM GUI High-Level Device LOS of Signal Output Configuration

Selecting the LOS Output button on the bottom portion of the Channel A Configuration window opens the LOS Output parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.

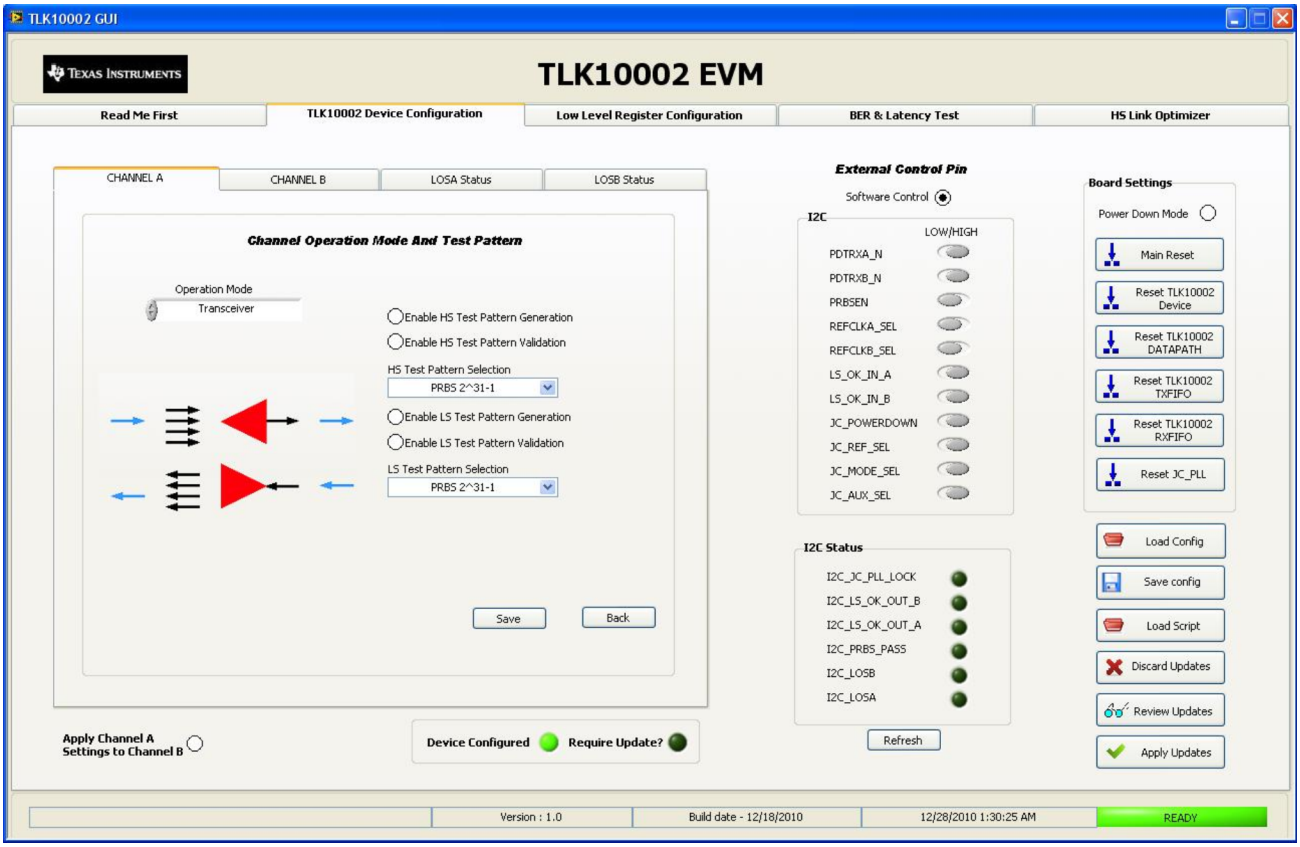


Figure 12. TLK10002EVM GUI High-Level Device Channel Operation and Test Pattern Configuration

Selecting the Test Pattern button on the bottom portion of the Channel A Configuration window opens the test pattern parameters. If changes need to be made to any of these parameters, select the new values, and click the Save button. To navigate away from the window and return to the Channel A Configuration window, click the Back button. If changes have been made and not saved, the message box is displayed to inform the user that changes will be discarded if not saved.

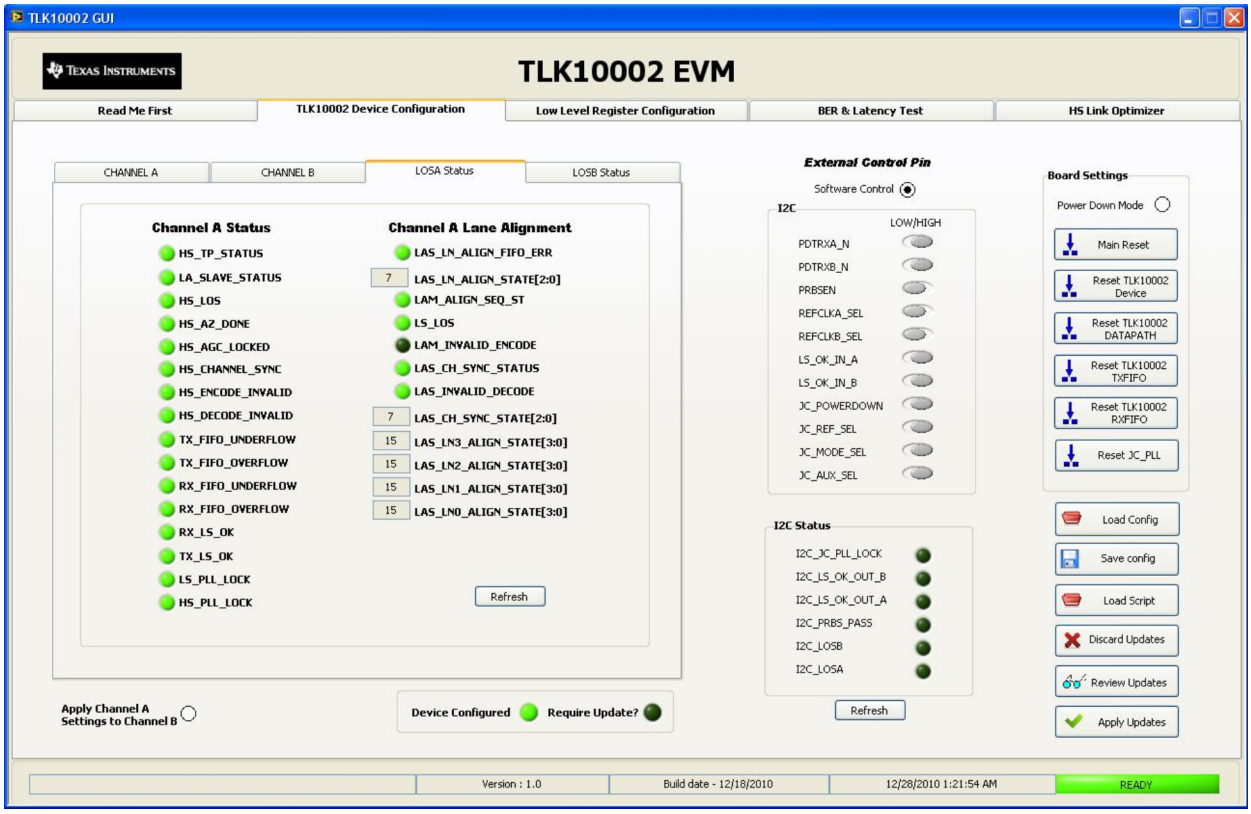


Figure 13. TLK10002EVM GUI High-Level Device LOSA Status Window

Selecting the LOSA Status tab on the top portion of the Channel A Configuration window opens the LOSA Status parameters. The values of the various status registers are read when this window is selected and can be refreshed by clicking the Refresh button at the bottom of the window.

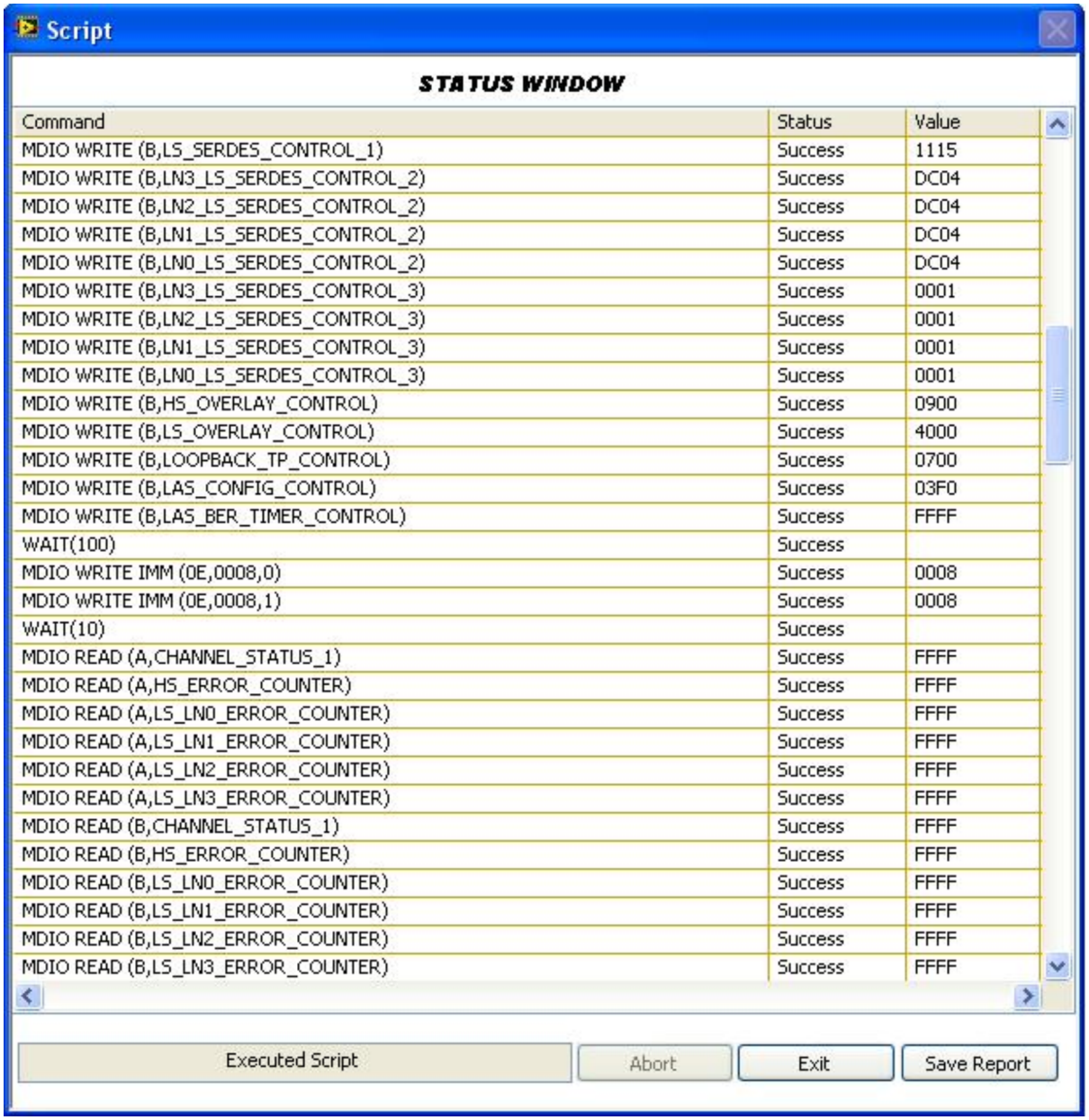


Figure 14. TLK10002EVM GUI High-Level Device Executed Commands Status Window

When all the settings have been selected and the user is ready to apply the updated values to the TLK10002 device, clicking the Apply Updates button on the bottom right portion of the GUI window causes the GUI to write all of the TLK10002 registers per a text file based script. This script can be changed and loaded by clicking the Load Script button and navigating to the desired file. To set that file as the default file, right-clicking the Load Script button after selecting the desired file and selecting the Set Default option causes the replacement of the default script file with the selected file. While the script is executing, a status window is displayed showing each transaction and the register value that is being written or read from the device. This status can be saved off to a text file if desired.

3 Low-Level Operation of the GUI

The TLK10002 device registers and settings can be controlled manually through a low-level register Read/Write portion of the GUI.

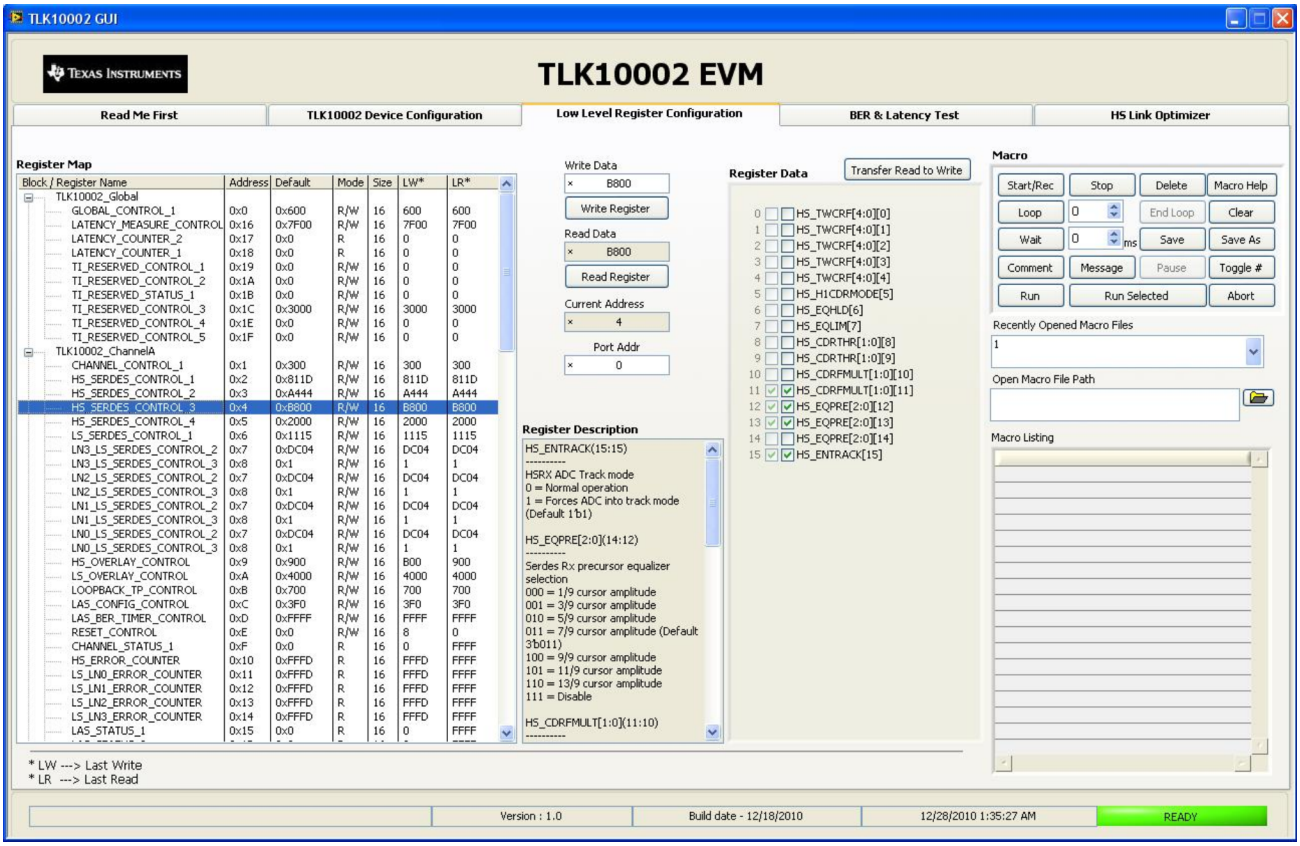


Figure 15. TLK10002EVM GUI Low-Level Register Configuration Window

Selecting the Low Level Register Configuration tab of the GUI brings up a complete register list for all the devices on the EVM. Selecting one of these registers loads the Register Description and Register Data fields with the proper values and display the current value. The bits can be set by clicking in the check boxes next to the bit's name or typing the full hexadecimal value for the register directly into the Write Data field. Clicking the Write Register button writes the register of the device. Reading the register is done by clicking the Read Data button. After a read or write operation, the LW (Last Written) or LR (Last Read) fields in the register list are updated for future reference.

The GUI's Mid Level Array synchronizes the high-level control indicator values so navigation between the high-level and the low-level portions of the GUI is possible.

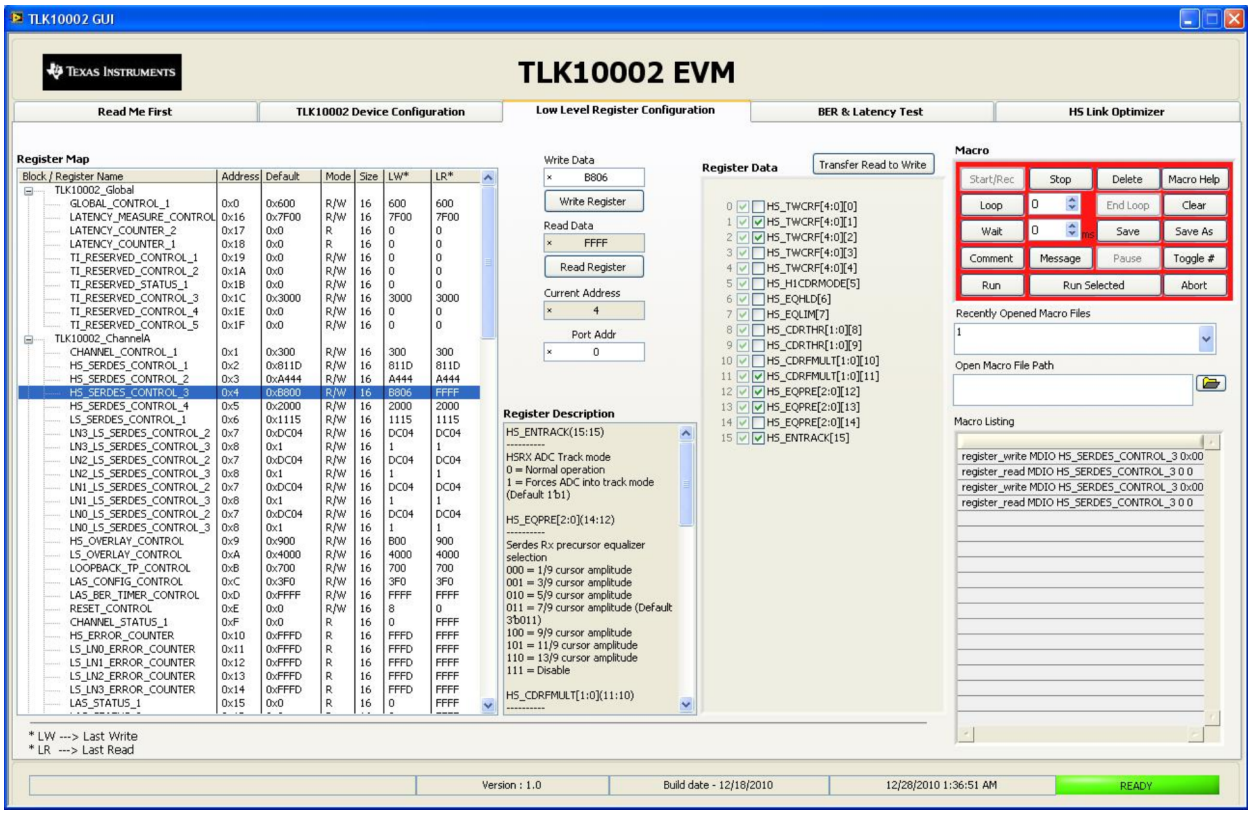


Figure 16. TLK10002EVM GUI Low-Level Configuration Through Macros

Low-level operations can be recorded, saved, and loaded for future use and convenience. To record a macro of register read and write transactions, first click the Start Record button, perform your sequence of register read/writes, and when finished, click the Stop button. Loops can be added by first selecting the number of loops desired and then clicking the Loop button. The end of the loop is set by clicking the End Loop button. Wait statements can be included by first selecting the length of the wait time in milliseconds and then clicking wait.

To save a macro, click the *Save* or *Save as* button, and select a filename and path to store the file.

To run a current or recalled macro, load the macro and click the Run button.

4 BER and Latency Tests

Once the TLK10002 device registers and settings are applied to the device, switching over to the BER and Latency tab of the GUI can provide some basic lane testing and BER optimization tests.

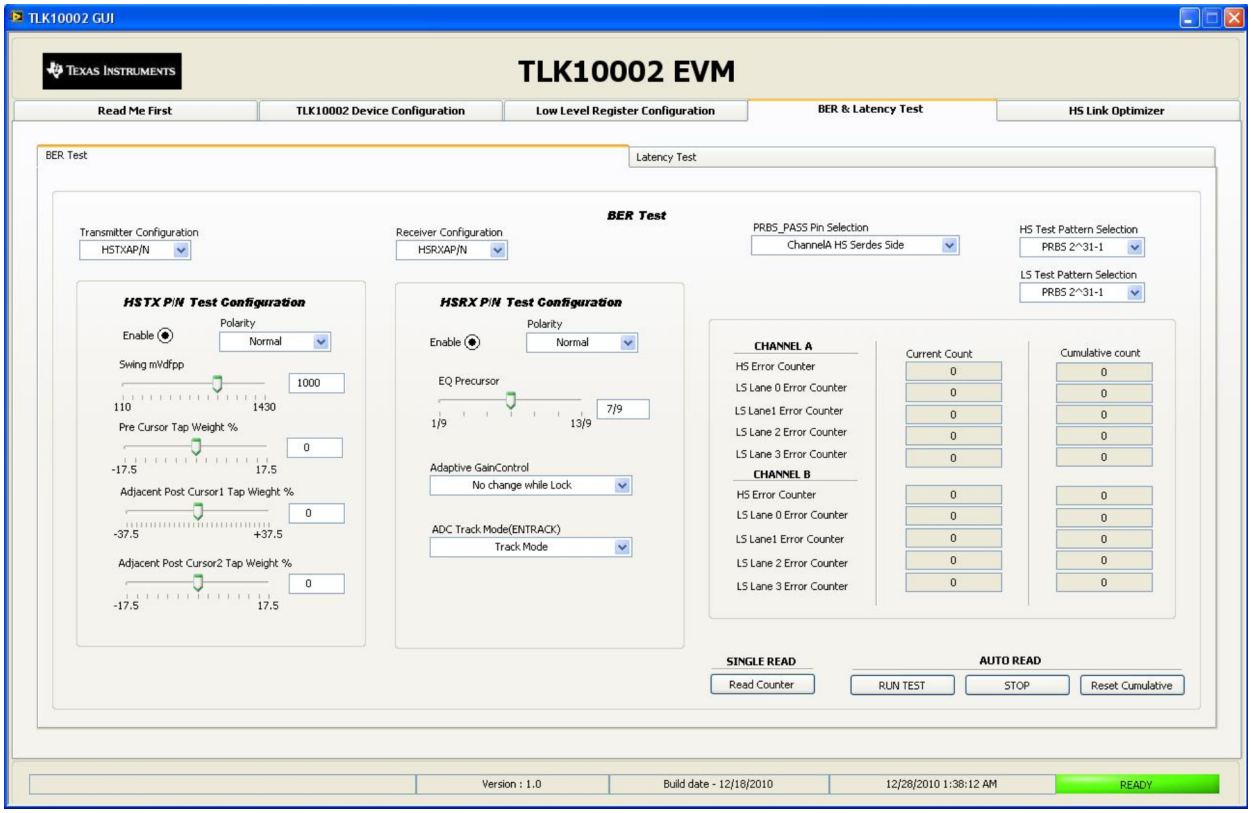


Figure 17. TLK10002EVM GUI BER Tab

The TLK10002 device test patterns can be selected and changed from this window, and the individual parameters for the various TX/RX and IN/OUT lanes can be selected and changed in real time allowing the effect of those changes to be displayed in the error count.

The TX and IN channel parameters can be switched between and modified on the left portion of the screen, the RX and OUT channel parameters can be switched between and modified in the middle portion of the screen, and the Error Count for the lanes can be seen on the right portion of the screen.

Clicking the Read Counter button reads the error counters once.

Clicking the Run Test button causes the error counters to be continually read in a loop and a cumulative total to be displayed. The cumulative totals can be cleared by clicking the Reset Cumulative button. Clicking the Stop button stops the test.

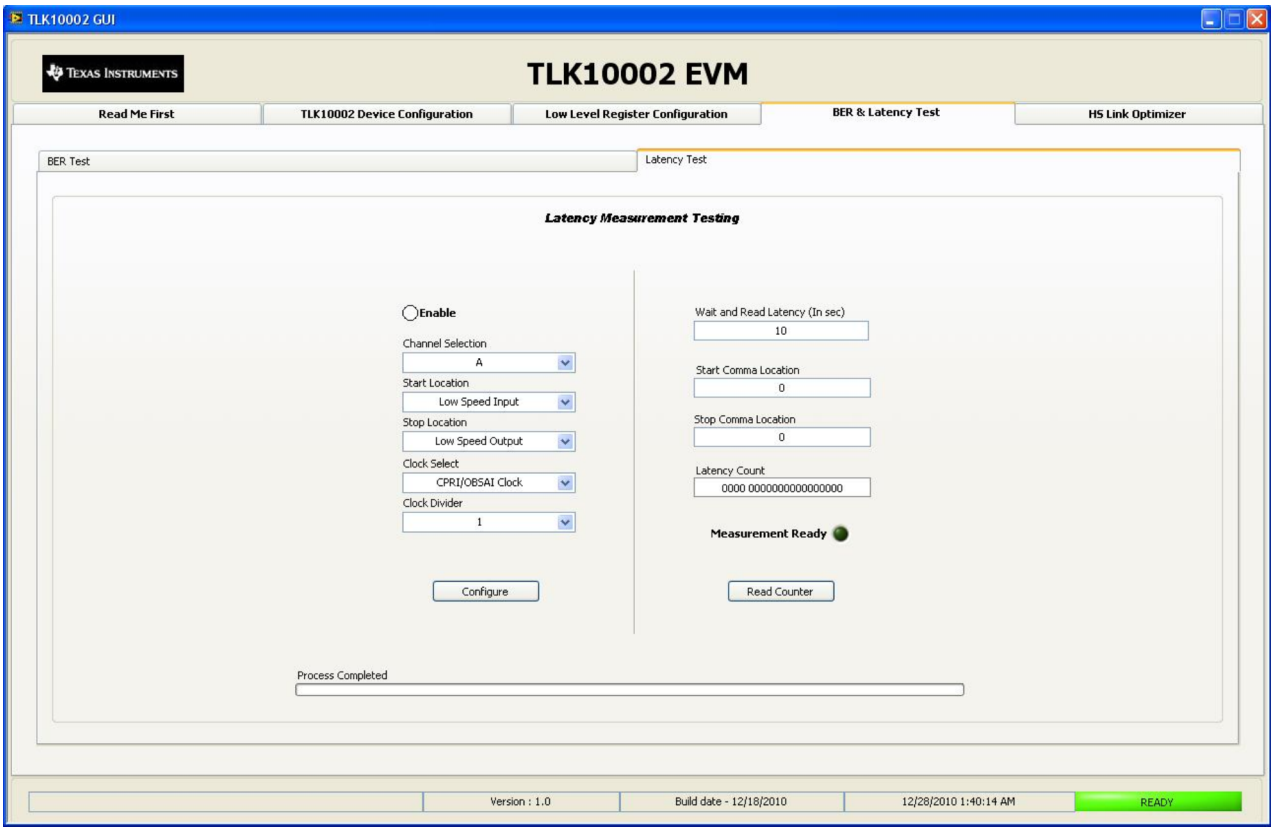


Figure 18. TLK10002EVM GUI Latency Tab

The internal latency counter of the TLK10002 can be set up and tested using the Latency tab of the GUI. Select the desired settings for the test on the left side of the screen, and click the Configure button. Then click the Read Counter button. If the Measurement Ready light does not glow green, the Measurement Ready bit of the register is a 0 indicating the measurement is either not ready or was not successful.

5 High-Speed Link Optimizer Tests

Once the TLK10002 device registers and settings are applied to the device, switching over to the High Speed Link Optimizer tab of the GUI can provide some thorough lane testing and BER optimization tests.

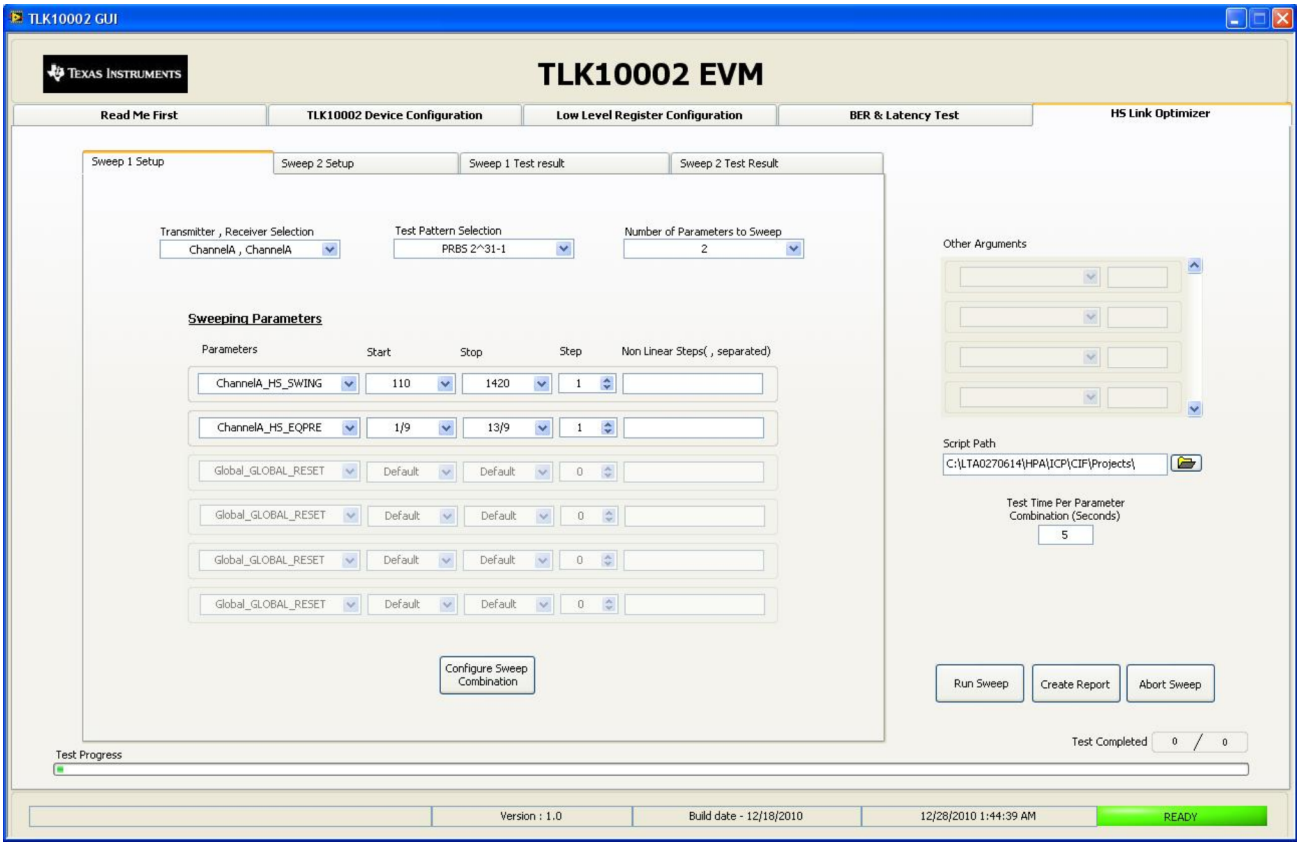


Figure 19. TLK10002EVM GUI High-Speed Link Optimizer Tab

Sweeps can be run on the various TLK10002 register settings if the TX and RX of the high-speed channels are looped back on themselves or between channels. To run a sweep, select the TX/RX mode, the data pattern, and the number of parameters to be swept along the top portion of the window. Then select the various parameters to be swept as well as their start and stop values and step size. A step size of one steps every value, a step size of 2 sweeps every other value, etc.

Then click the Configure Sweep Combination button, and if desired, de-select additional parameters that are not to be included in the sweep. Save these combinations and then setup the other sweep, if desired.

Just like the High Level General Device Configuration portion of the GUI, the Link Optimizer is run off a text-based script for flexibility and easy revisions. To load a script other than the default script, navigate to the desired script, and then right click the script path and set it as the default file.

Enter the desired test time for the each parameter combination, and click Run Test. The GUI sets the new values for the swept parameters in its mid-level register array, apply the updates to the device based on the script, which includes reading the error counters. After the desired amount of test time, the error counters are re-read and the results are processed before the sequence is repeated for the remaining combinations.

In the Test Results windows, a grid appears with individual squares representing the parameter combinations. Clicking on the squares displays the parameter values and the associated error count for that combination at the bottom of the window. If no errors occur, the square is green. If errors occur but the counter is not maximized, the square is yellow. If the error counter was maximized, the square is red indicating that is not a good combination.

The results can also be saved to a CSV file at the end of the testing.

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