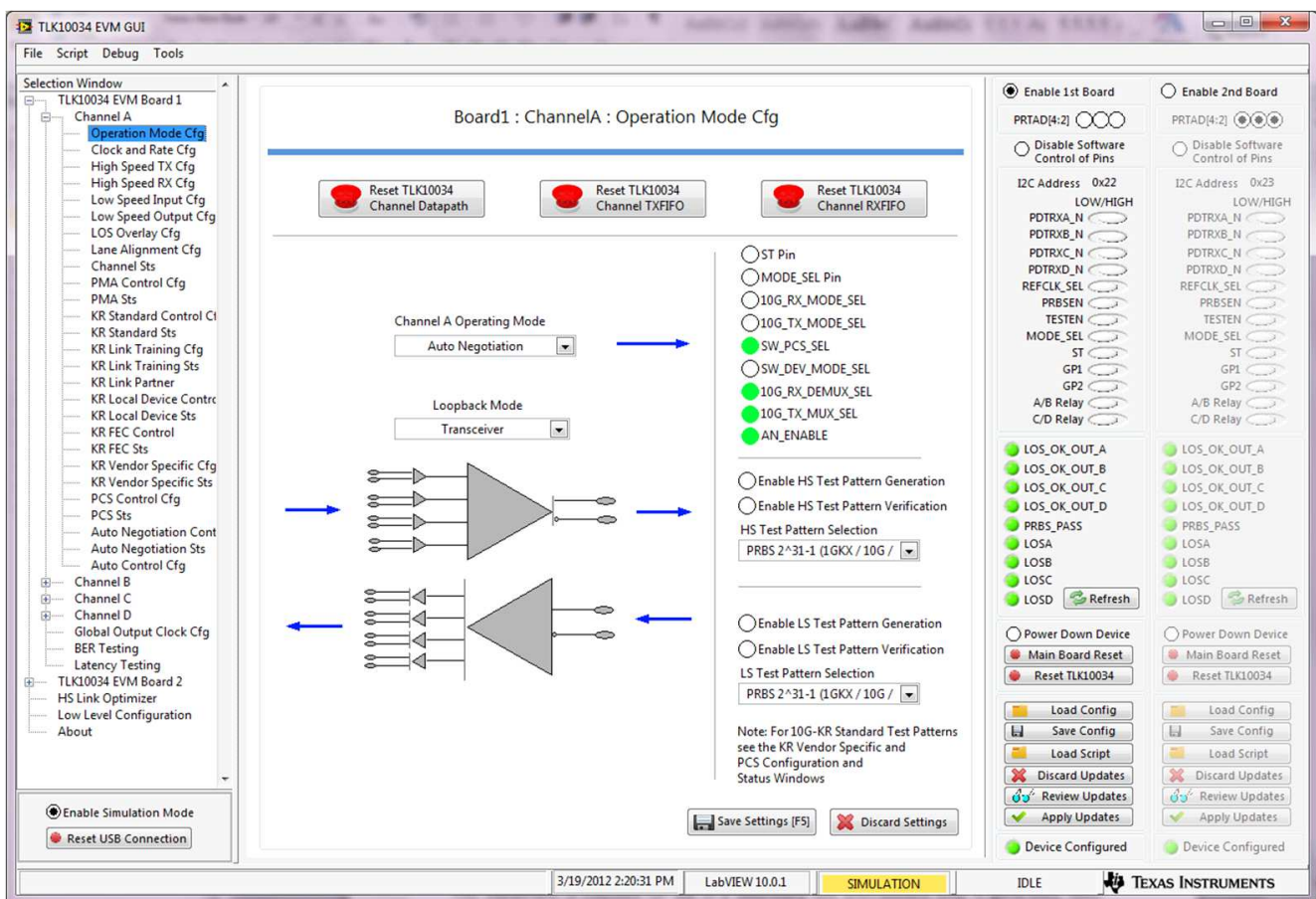


TLK10034 Quad-Channel XAUI/10GBASE-KR Transceiver Evaluation Module (EVM) Graphical Users Interface User's Guide

This User's Guide describes the usage and construction of the TLK10034 evaluation module (EVM) GUI. This document provides a basic overview of the different portions of the program.



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WARNING

This equipment is intended for use in a laboratory test environment only. It generates, uses, and radiates 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 their own expense is required to take whatever measures are required to correct this interference.

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1 Introduction

The TI TLK10034 SERDES evaluation module (EVM) boards are controlled and configured with a custom developed graphical user interface (GUI) developed using National Instrument's LabVIEW 2010 programming language.

High- and low-level manipulation of the registers is possible through this GUI as well as a variety of built-in test modes. Every channel of the TLK10034 and every low-speed input/output lane in each channel is handled independently allowing maximum configurability of the TLK10034 device. Global Write register bits exist, allowing the register read/write commands to be applied to every channel, and lane, simultaneously to shorten the configuration time. However, these bits are not implemented in the GUI, be aware that the configuration sequences in the GUI could be optimized for both time and redundancy for the particular use case when implementing the system.

Sweep the High Speed Transmit and Receive parameters through a nested loop of parameter combinations in the *HS Link Optimizer* portion of the GUI. Review the test results both visually and empirically through a saved test report with the results. Running the *Link Optimizer* saves time in determining the optimal combination of settings for the particular system or test setup.

Advanced functionality and debug capabilities are built into the GUI with the Python scripting language. The register read/write transactions can be recorded in real-time while manually using the GUI to create a reusable and easily modified script for future work. Modify these scripts to include any supported Python 2.7 features including loops, file I/O, and command-prompt user input.

2 Getting Started

Configure the EVM hardware and connect the USB dongle to the PC before starting the TLK10034 EVM GUI. The first time the GUI is started, default settings and configuration files are created and saved into the working directory of the PC causing the GUI to take longer than normal to open.

The EVM implements TI's TCA6424 I²C™-to-GPIO device, providing software control and status monitoring of the TLK10034 device's I/O pins. When the board is powered up and the GUI is run, the GUI first initializes the registers of the TCA6424 for their default values and issues a Main Board Reset, resetting the TLK10034. This ensures that the GUI and TLK10034 register values are synchronized to their default values prior to configuration. When this reset occurs, the red reset LED on the EVM blinks momentarily and then the green LED relights when the reset operation is complete.

The GUI is designed to control up to two TLK10034 EVMs, when one is configured to accept the MDIO and I²C control signals from the first board that is connected to the USB port of the PC. Currently, this feature is not fully implemented and tested in both hardware and software. See future revisions of this document for additional information. Use Board 1 settings and registers when only one board is connected to the PC.

Configure multiple channels simultaneously using Channel A's settings as a reference. Selecting the TLK10034 EVM Board window from the *Selection Window* menu (Figure 1) allows selection of the desired channels to simultaneously configure. Select the channels and click the **Save Settings[F5]** button at the bottom of the screen.

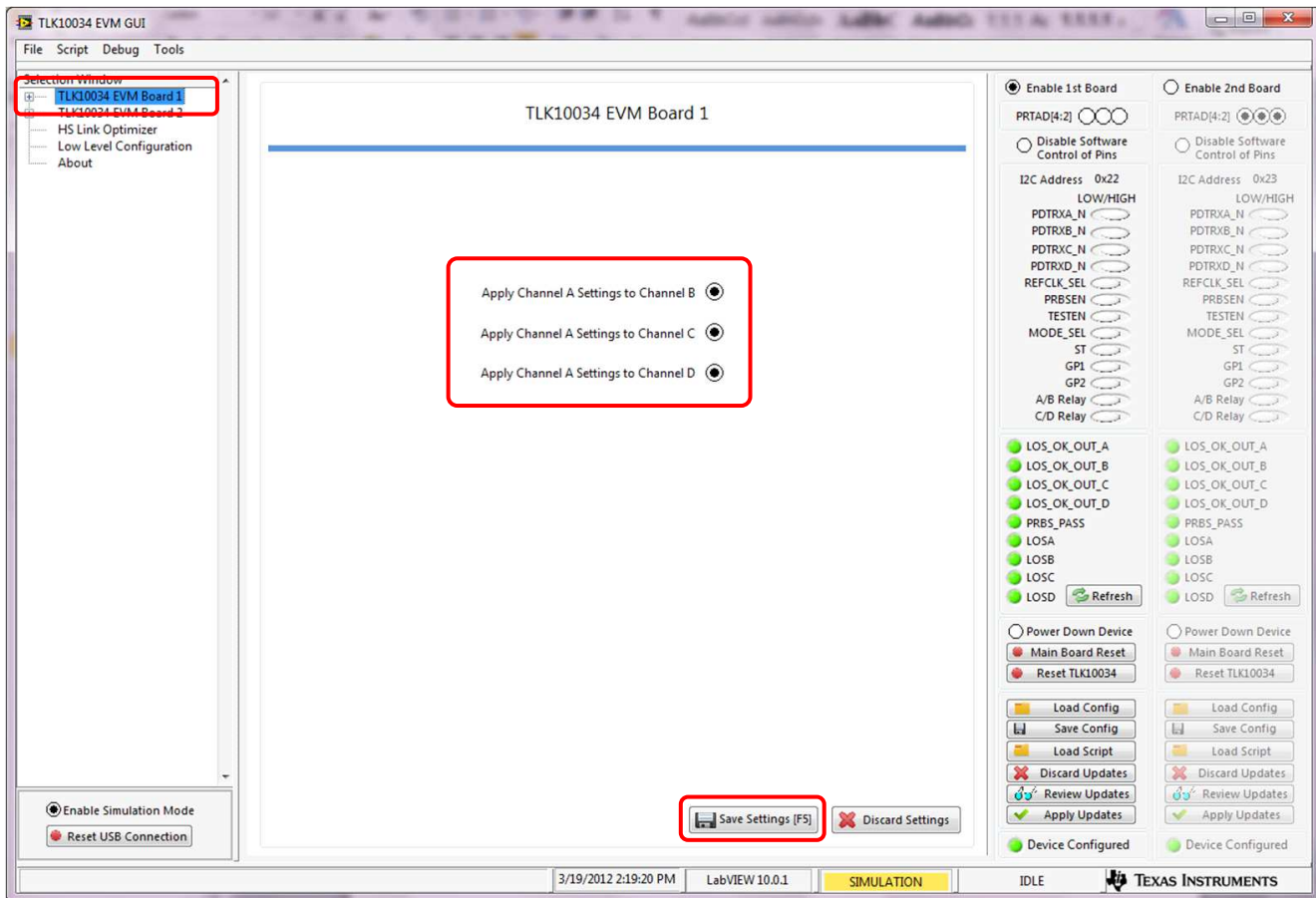


Figure 1. TLK10034 EVM GUI Board 1 Window

3 High-Level TLK10034 Device Configuration

All of the TLK10034 control and status register fields have been grouped together based upon function and are accessed on an individual basis through the use of a *high-level* control. Expanding the board hierarchy in the GUI's *Selection Window* tree (Figure 2) displays the various channel and window windows. If multiple channels are chosen for simultaneous configuration, the GUI disables the selection windows for those channels. The registers are written to the device individually, but the GUI saves time and adopts Channel A's settings into the GUI's register configuration array.

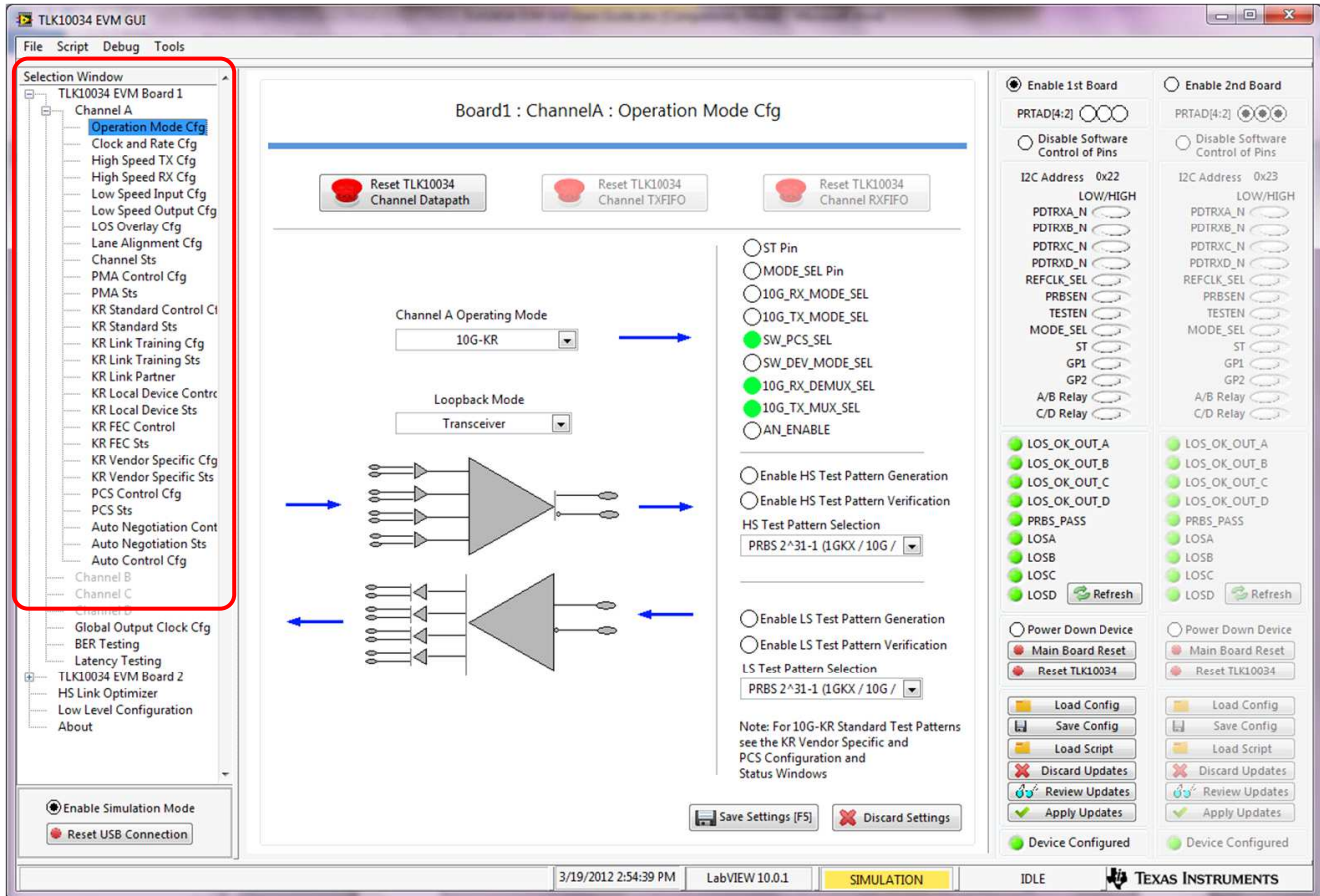


Figure 2. TLK10034 EVM GUI Hierarchical Selection Window Tree

The GUI configures the external control pins of the TLK10034 through TI's TCA6424 onboard I²C-to-GPIO device. The TCA6424 is configured to control the high/low settings of the device from USB data sent to the board from the GUI. It is also possible to disable the software control and rely on manual settings of these signals. Monitoring external status pins is also possible through this method.

Keep the GUI and the device settings on the board synchronized by initiating all reset signals from the GUI through the various buttons. If the reset button on the board itself was pressed, the GUI would not realize that the registers were reset and continue to display the previous register values. Pressing the **Main Board Reset** button (Figure 3) in the GUI is equivalent to pressing the reset pushbutton on the EVM board and has the added benefit of resetting the GUI's register settings to match the hardware default values applied to the TLK10034 device following a Main Reset.

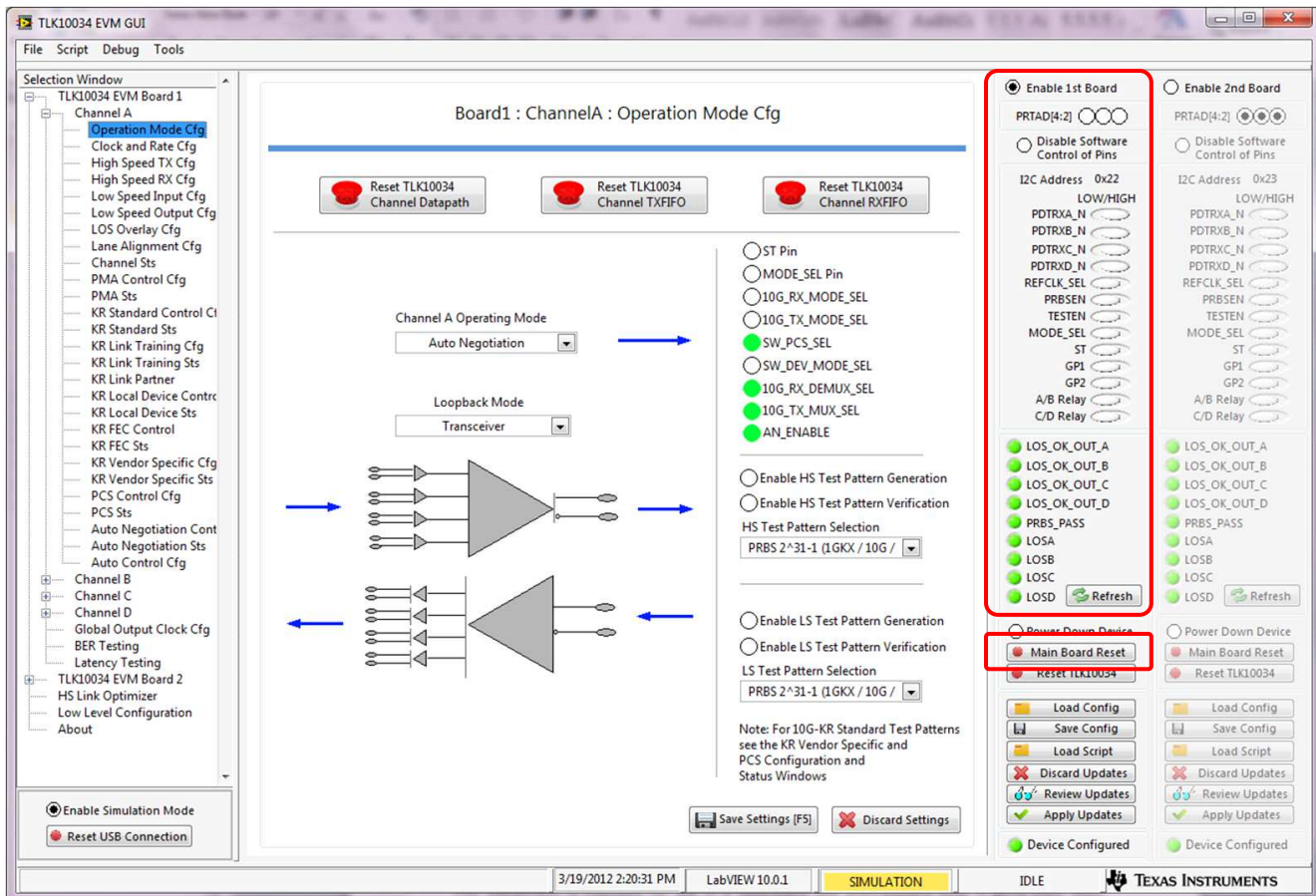


Figure 3. TLK10034 EVM GUI Software Control of TLK10034 I/O Pins and Main Reset

The TLK10034 register settings are configured from the high-level Device Configuration of the GUI. The TLK10034 settings are modified from various portions of this tab broken out and grouped into individual windows according to their function.

Configure the TLK10034 by starting at the first window in the GUI's *Selection Window* tree and work down the tree selecting and saving any settings that are changed to something other than default.

By default, the TLK10034 and GUI are configured to run in Auto Negotiation 10G-KR mode. The first window (Figure 4) has a selection box allowing configuration for all of the various *Operational Modes* of the TLK10034. This is a hybrid control and sets all of the various control register bits required for proper operation in that mode. Located to the right of this selection box is an LED indicator panel displaying the value of the various controls bits set in that particular mode.

The default PRTAD[4:2] setting for the EVM board and GUI is 3b'000. If the PRTAD[4:2] value is changed on the EVM board using the dip switch settings, the value must also be entered into the GUI on the Front Panel above the Control pin settings. If there is a hardware or software mismatch, then register read/write operations fail. The same is true for the I²C Address on the TCA6424. Clicking the 0x22 allows the selection of address 0x23.

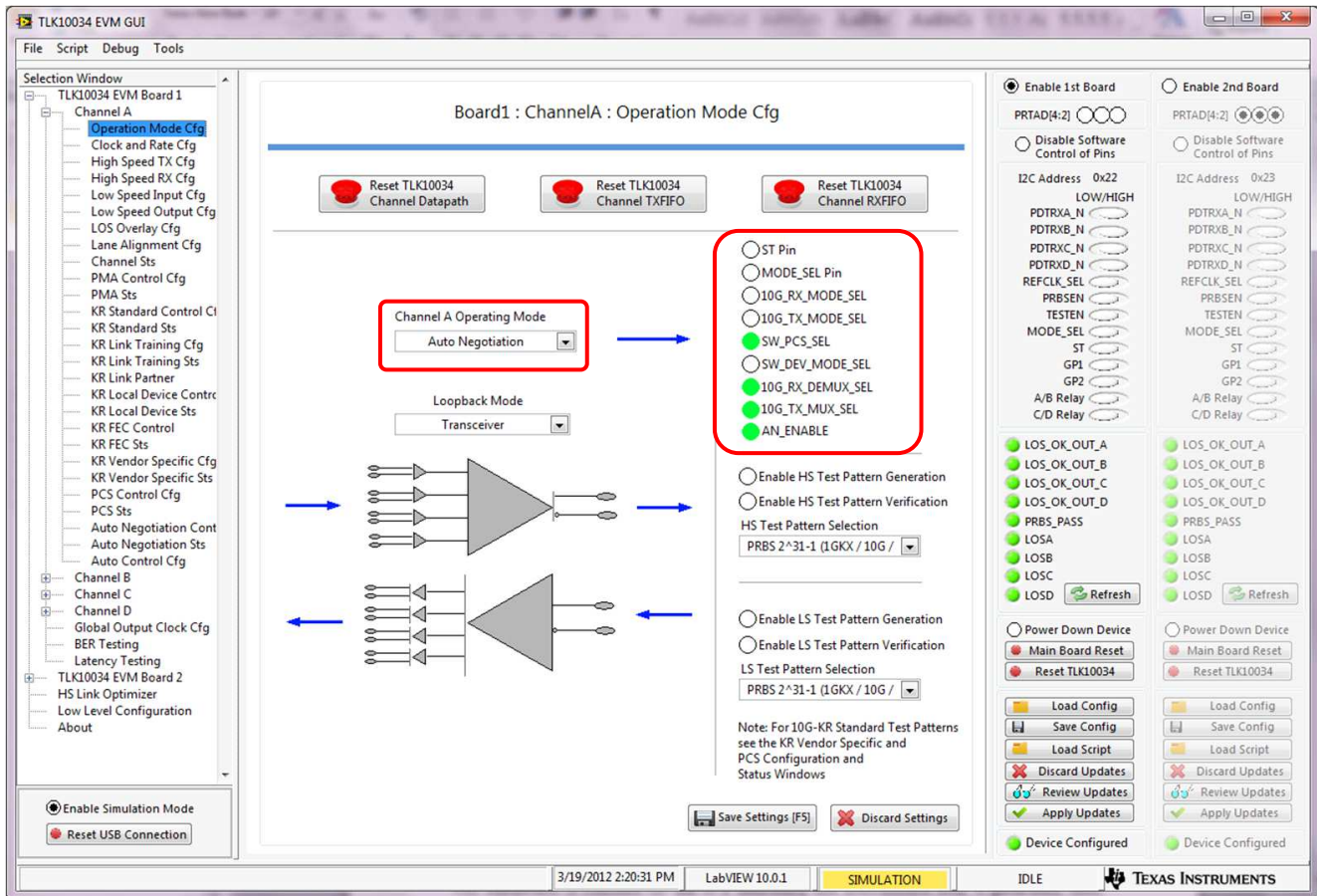


Figure 4. TLK10034 EVM GUI Operating Mode Configuration

When making changes to a particular control field in any of the high-level Control Windows, the value is stored into the GUI's register configuration array but is not immediately written to the device. When the settings have changed and the settings of the GUI don't match the actual register settings of the EVM, 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.

Change the various register settings in the GUI Memory to a new value by finding the particular parameter field in the various windows, selecting the new value, and clicking the **Save Settings** button. The change is discarded if the **Save** button is not clicked and the **Current Value** of the register is kept.

Saving all the values for the register fields in memory allows selection of the values for the device in any sequence chosen. Review the TLK10034 device settings and the newly selected register values at any time by clicking the **Review Updates** button on the Front Panel of the GUI. Clicking the **Review Updates** button brings up a window showing the Register Configuration Array (Figure 5) and shows the current and new value for every register field. If the field has a new value, the status box for that array is shaded orange allowing a review of the changes to the TLK10034. Discard the changes in memory and keep the current settings by clicking the **Discard Updates** button, resetting the new value fields with the current values.

Register Values in other windows that are not relevant in the particular operation mode are disabled and become greyed out. This allows easy determination as to which register control fields are relevant for their mode and which ones to configure.

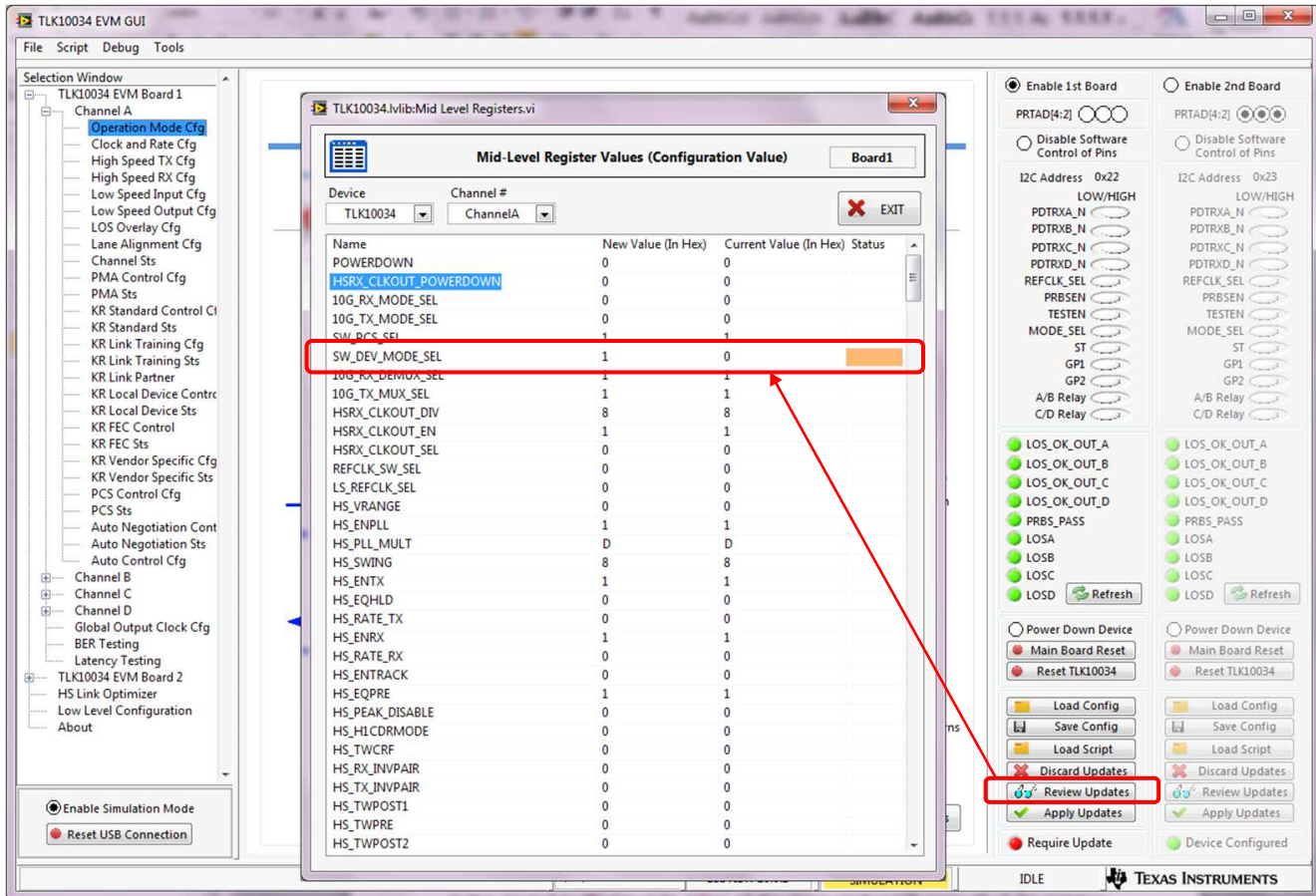


Figure 5. TLK10034 EVM GUI High-Level Review Updates

After selecting the Operating Mode settings, select the *Clock and Rate Configuration* window (Figure 6) from the **Selection Window** tree. All of the standard clock and rate controls listed in the TLK10034 data sheet (SLLSECO) are implemented using a quick reference lookup table. The *Clock* and *HS Serial Data Rate* options are operating-mode specific, requiring configuration of the operating mode before configuring the clock so the correct options are presented. Only the *Reference Clock Frequency* and *HS Serial Data Rate* selections are required. All other HS and LS PLL multipliers and rate settings are configured in the TLK10034 register.

Select which reference clock to use, and how to configure the *HS Recovered Byte Clock* for the selected channel from this window.

Selecting the **Others** button allows direct control of the HS and LS PLL multiplier and rate registers. Entering the REFCLK Frequency and HS and LS Serial Data Rates displays the Output Clock Frequency calculations for reference, even though they do not have any direct register configuration value.

Save any changes to the **Clock and Rate Configuration** window.

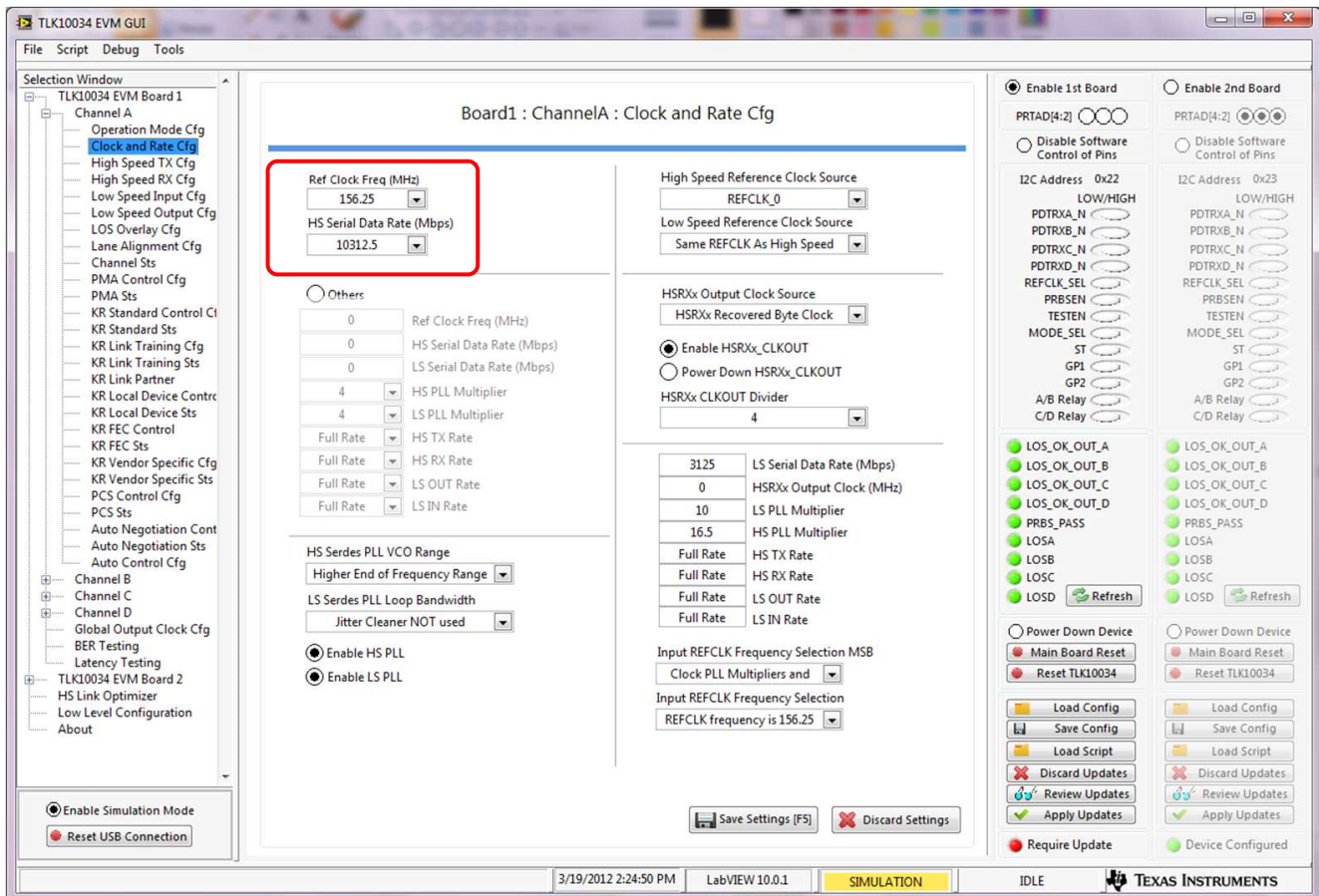


Figure 6. TLK10034 EVM GUI High-Level Device Clock and Rate Configuration

Not all configuration windows are displayed in this document. Work through the various windows making any other necessary configuration settings.

Read the *Status Registers* at anytime from the various *Status* windows (Figure 7). Clicking the **Refresh** button located in the top right corner of the *Status* window causes a read of all of the registers associated with that particular window and the results are displayed.

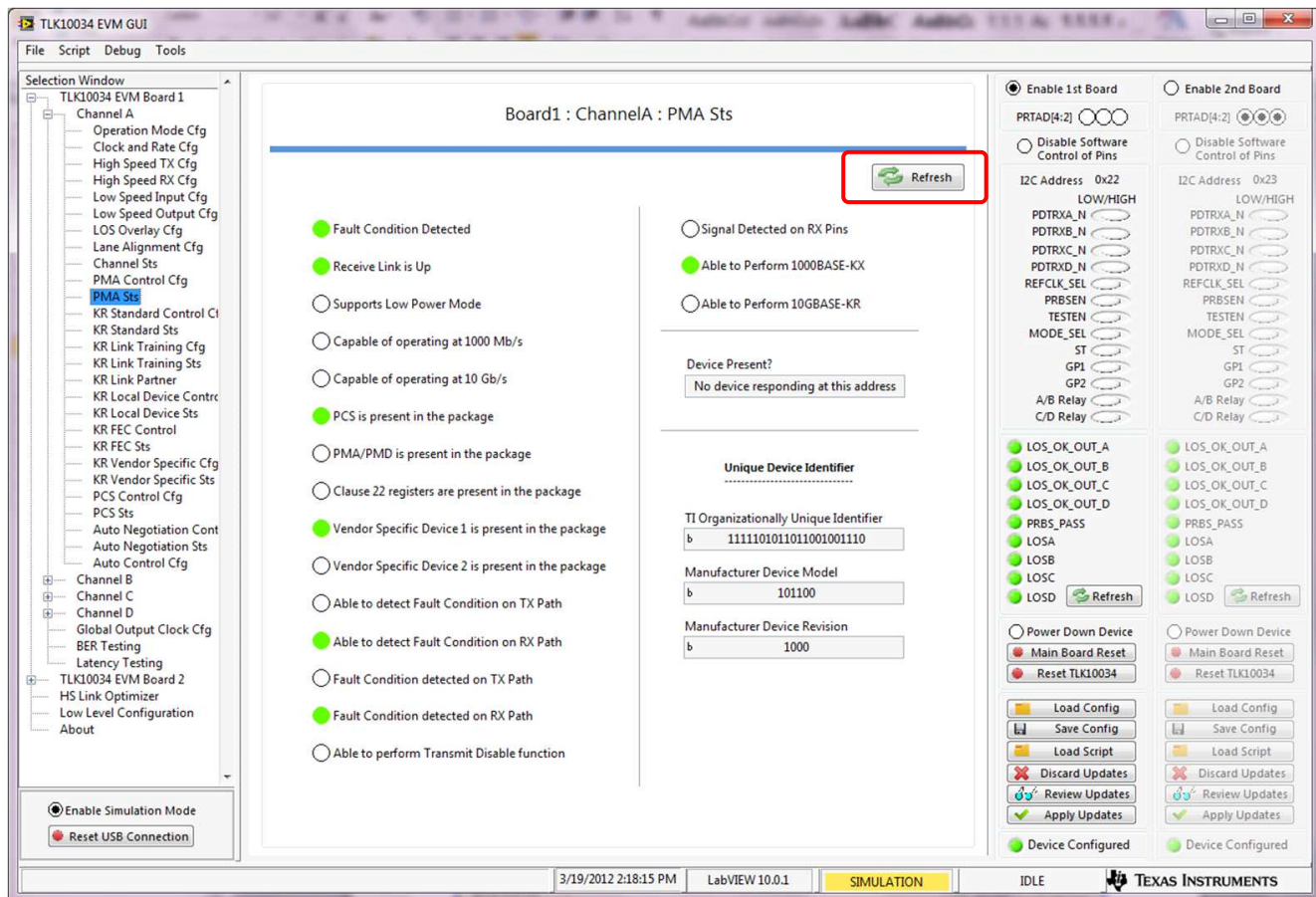


Figure 7. TLK10034 EVM GUI High-Level Device Status Windows

The red pushbutton controls located on the various windows, such as the **Reset TLK10034 Channel Datapath** button on the *Operation Mode* window, cause an immediate write of that register. Other modes such as the *10G* modes allow for a reset of the Channel TXFIFO and RXFIFO's, and the *10G-KR*, *1G-KX*, and *Auto Negotiation* modes have a pushbutton to restart the *Auto Negotiation* procedure immediately (Figure 8). Depending upon which button is pressed, the saved register values may or may not be affected and reset. The GUI only resets the saved values if the register values are reset in hardware based upon the action committed by that particular pushbutton.

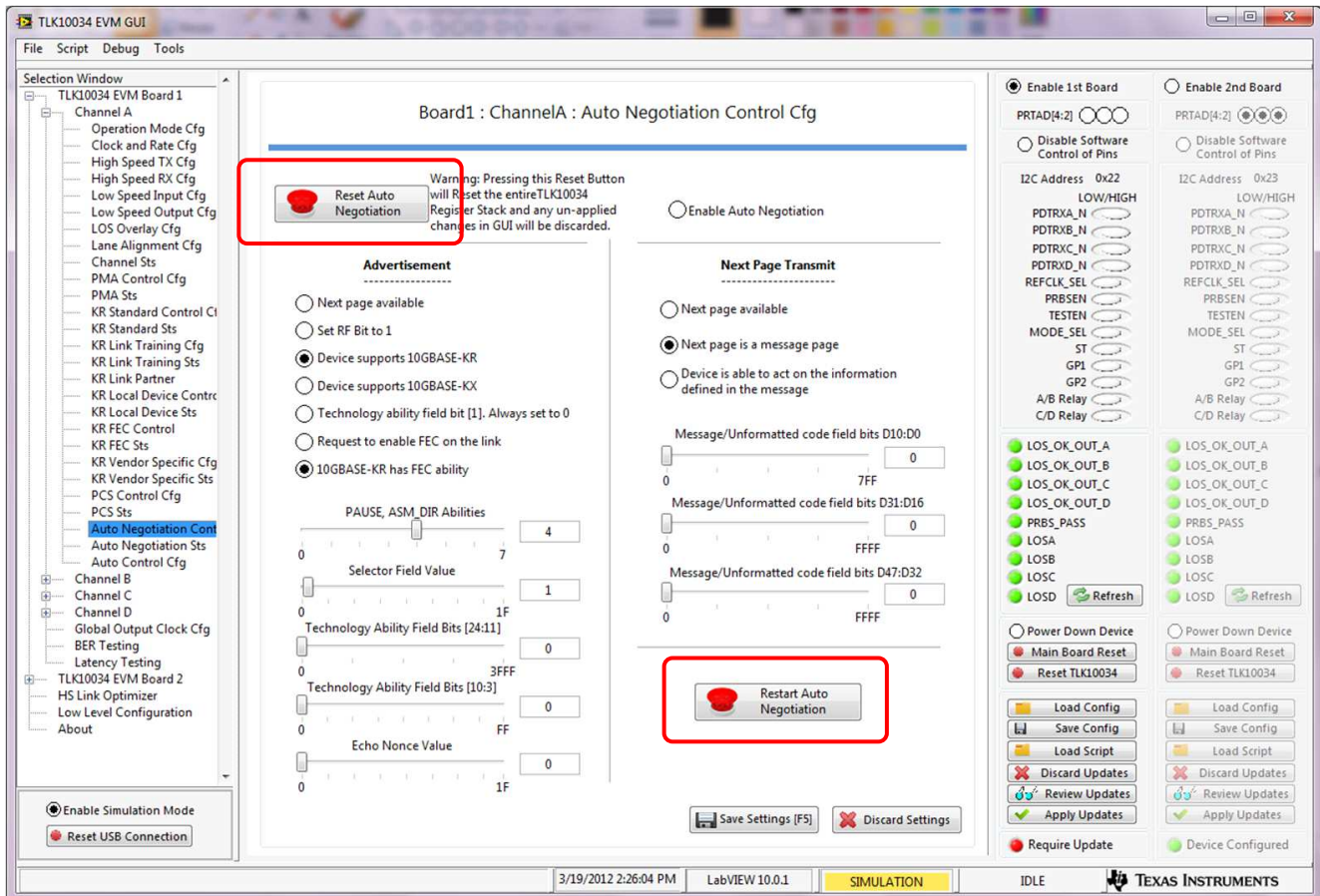


Figure 8. TLK10034 EVM GUI High-Level Device, Immediate Action Pushbuttons

After changing the various control fields and all settings are saved into the GUI's memory, apply the updated settings to the TLK10034. The TLK10034 EVM GUI configures the device based upon a text file script. Modify and load this script for any various specific or optimized use case, preventing the GUI from having a single hard-coded provisioning sequence. By implementing the use of this script, the provisioning sequence is easily modified and adjusted without requiring the creation and deployment of a full software revision. A general provisioning file is provided and loaded, by default configuring all writable registers of the TLK10034 device when executed. Also provided in the installation are several mode-specific scripts that only write to the registers valid in the particular operating mode. Selecting one of these scripts may reduce the configuration time slightly because fewer registers are being written every time the script is executed.

Any script can be set as the default script by first selecting the script in the **Load Script** button on the front panel of the GUI and then right-clicking the button and selecting the **Set as Default** option. From this point forward, this script is the default script loaded and executed by the GUI. Reset or change the default script at any time, as desired. The *Choose Script File* dialog boxes are shown in [Figure 9](#).

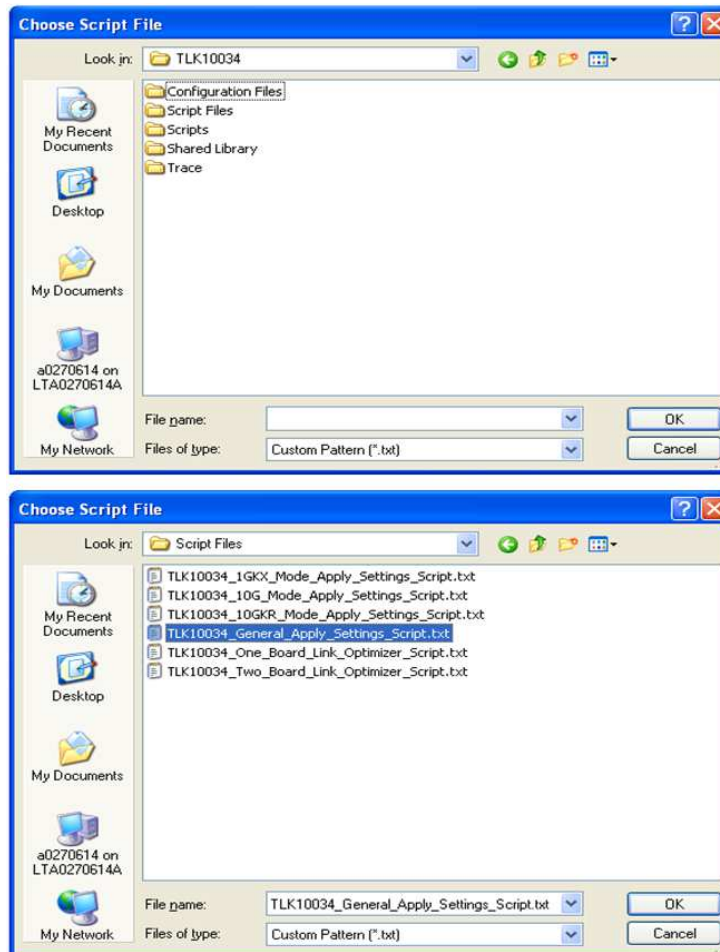


Figure 9. TLK10034 EVM GUI High-Level Device, Load Script Selection Window

Once the script is selected, no change is required if the default script is desired, click the **Apply Updates** button, executing the script. A popup window opens and displays the register read/writes in real time as they are applied to the TLK10034 device. The current executed command is displayed at the bottom of the window and the value of each register read and write is displayed in the window. Abort the script execution by pressing the **Abort** button.

A text file report of the *Apply Settings* script can be created logging all of the register read/write values that occurred during the script execution. This report is useful when determining the values needed in an FPGA or other system controller.

4 Low-Level TLK10034 Device Configuration

Read or write to any register at any time using the low-level configuration window ([Figure 10](#)). There are three device types containing register stacks that may need modification. Similar to the GUI *Selection Window* tree, the various registers are grouped in an easily-expanded hierarchal tree, allowing quick navigation to the registers of interest.

The TLK10034 is the primary device that reads and writes registers. Expanding the TLK10034 in the tree shows *Board1* and *Board2* options. Select the appropriate board number where the TLK10034 is located and expand that, showing the Global and Channel Specific registers. All registers are handled individually for maximum configuration.

Navigate to the desired register and click the register name in the tree. This loads the bit-specific register information into the *Register Data* window and shows the last read/write value of the register in both hex and bit format. The names of the bits are also displayed for easier reference. The *Register Description* box displays the description information from the TLK10034 data sheet for the chosen register, helping understand the significance of a particular register bit value without having a copy of the data sheet.

Read a register value by clicking the register and then clicking the **Read Reg** button. The new value is returned.

Write a register with a new value by clicking the register name, loading the register information into the *Register Data* window. Change the new values from 1 to 0 or vice versa by clicking the individual bit fields. A check mark indicates a 1 value and an open box indicates a 0 value. The HEX value of the register is automatically updated. Write the new value to the TLK10034 register by click the **Write Reg** button. Retyping the HEX value directly into the *Write Data* field also writes the value to the register when the **Write Reg** button is pressed and the individual bit fields are updated for the specific HEX Value.

If a chosen register has the *Write Reg* information disabled and grayed out, then that register is read only.

The GUI knows the register communication protocol of all the different registers and writes to the register in the required mode. If a TCA6424 register is read or written, the GUI executes that transaction using the I²C protocol. The TLK10034 registers are MDIO Clause 45 Protocol, and the Spartan-6 registers (if using the legacy TLK10002 EVM FPGA Daughter Board) are MDIO Clause 22 protocol.

Also, the PHY and Device Address information is used from the various input fields associated with the various board address controls. It is important to ensure that the PRTAD[4:2] address is set appropriately for the boards, and the I²C address also matches the addresses set in hardware. The EVM board ships with PRTAD[4:2] = 3'b000 and the I²C Address for the TCA6424 = 0x22.

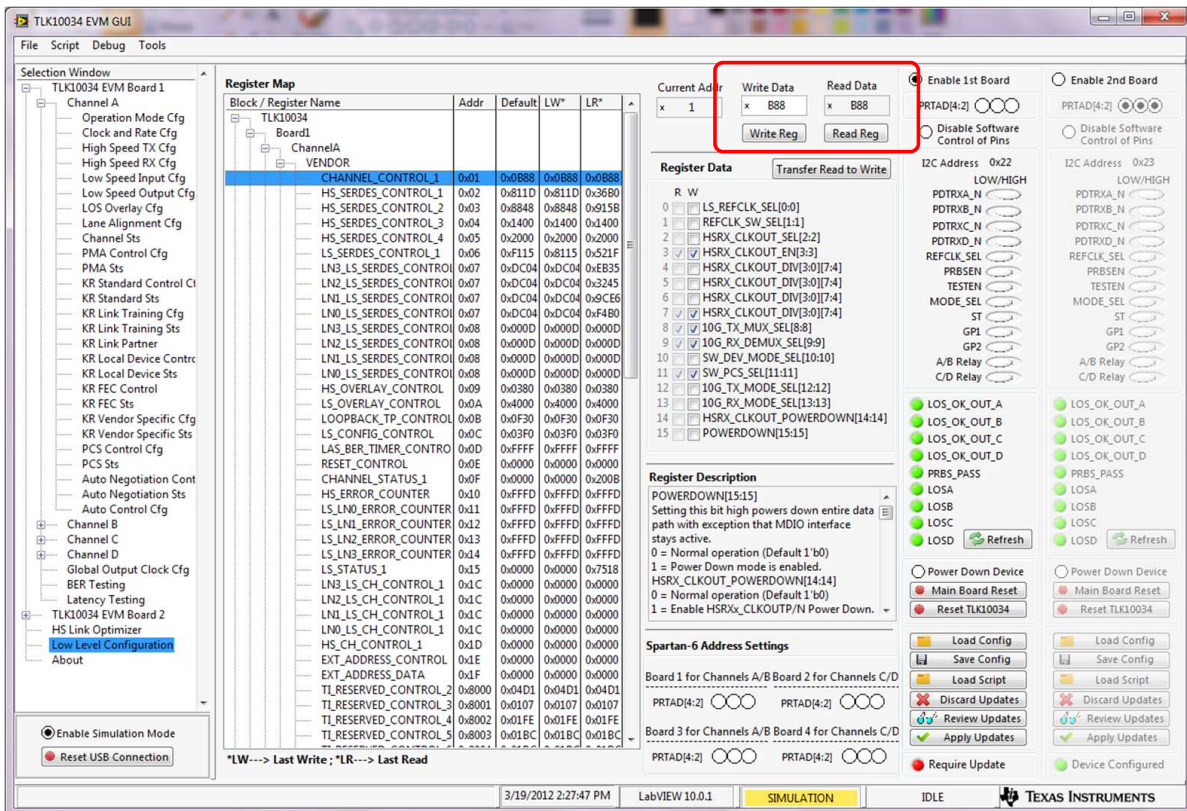


Figure 10. TLK10034 EVM GUI Low-Level Device Configuration

5 BER Testing

After configuring the desired TLK10034 settings and applying them to the device, use the *BER Testing* portion of the GUI. When selecting the *BER Testing* window from the *Selection Window* tree (Figure 11), a page is displayed for running BER tests with any of the supported internal test patterns. The generation/verification enables bits as well as the test patterns must be configured during the initial device configuration and this window only reads and displays the error counter results. Pressing the **Read Counter** button under the *SINGLE READ* title performs a single read of all the error counters. Note that the error counters are clear on read and the first read should be discarded because it contains a value set prior to the start of the test. Reading an error counter twice initially is always recommended.

Perform a cumulative BER test by pressing the **Run Test** button under the *AUTO READ* title. This reads all error counters in sequence and continues to read the error counters in a loop until the **Stop** button is pressed. Note that the error counters stop being read at the end of the loop when the button is pressed. If the test does not stop immediately when the **Stop** button is pressed, wait a short time, allowing the current loop to complete before the test is allowed to stop.

During the *AUTO READ* test, the *Current Count* error values are displayed for the current read, and any errors are added to the *Cumulative Counters*. Reset the *Cumulative Count* at any time by pressing the **Reset Cumulative** button under the *AUTO READ* title.

If bit errors are present, or if observing how different TX or RX settings affect the bit error rate is needed, the left portion of the window allows access to all TX and RX parametric settings such as TX swing, pre-emphasis, and RX equalization. The GUI applies the updated value in almost real time to the device when any adjustment is made to these controls. At the end of every error count read loop the GUI determines if any of the register control settings were changed and it writes the new values to the TLK10034 device before returning to the error-count loop. All low- and high-speed TX and RX channels and lanes can be selected for control by using the *Transmitter Configuration* and *Receiver Configuration* selection boxes.

Output the results of the BER tests to the PRBS_PASS LED on the EVM board by using the *PRBS_PASS Pin Selection* box located at the top right corner of this window.

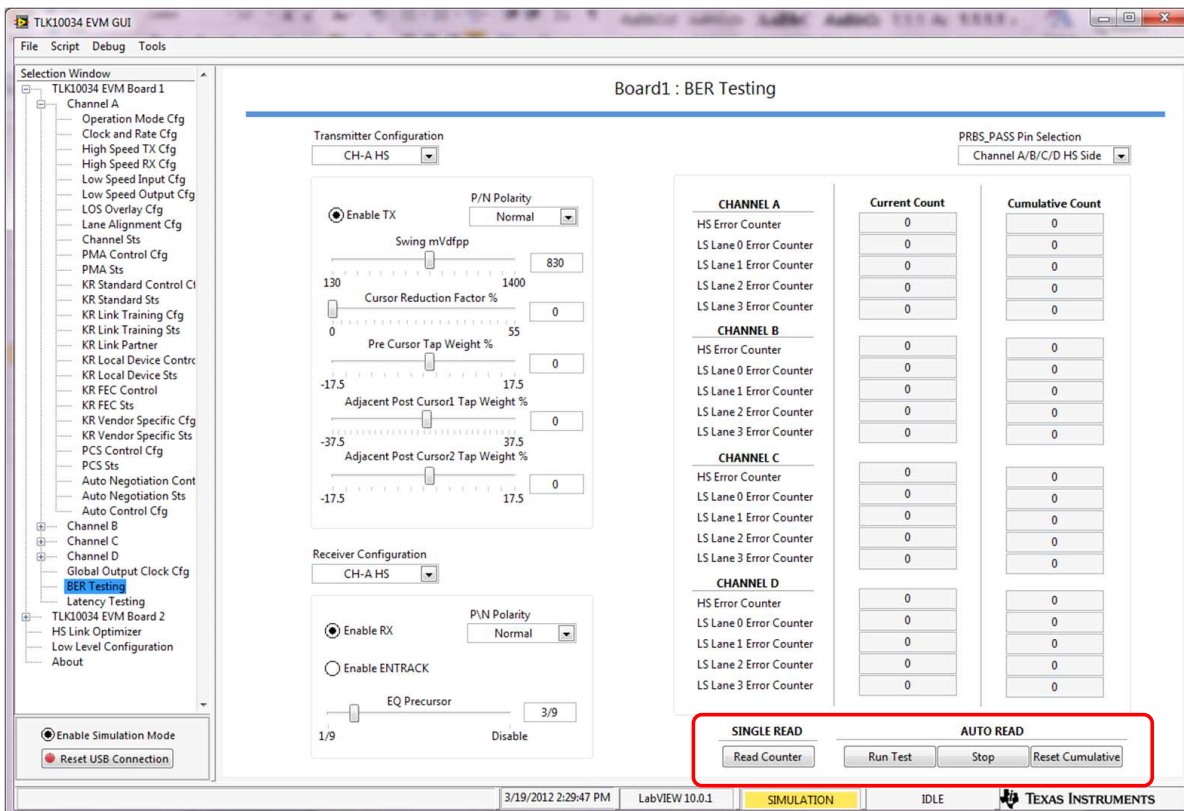


Figure 11. TLK10034 EVM GUI High-Level BER Testing

6 Latency Testing

In a similar fashion to the *BER Testing* window, a *Latency Testing* window (Figure 12) is supplied in the GUI for operation of the internal latency counters in the TLK10034 devices. Once the TLK10034 board is configured for proper latency testing and data is passing, select the *Latency Testing* window to configure the test settings and run the test. Each channel of the TLK10034 has a latency counter, but only one channel is configured and tested at a time. Once the test settings are selected, pressing the **Run Test** button writes the test configuration settings to the TLK10034 and reads the latency status register determining if the test is complete. If the test is complete, the *Latency Measurement Ready* LED glows green and the *Latency Measurement Count* is displayed. If the *Latency Measurement Ready* status bit fails to indicate the measurement is ready and the test is complete, then the test times out after the timeout is achieved. Rereading the counters is performed by pressing the **Re-Read Counter** button.

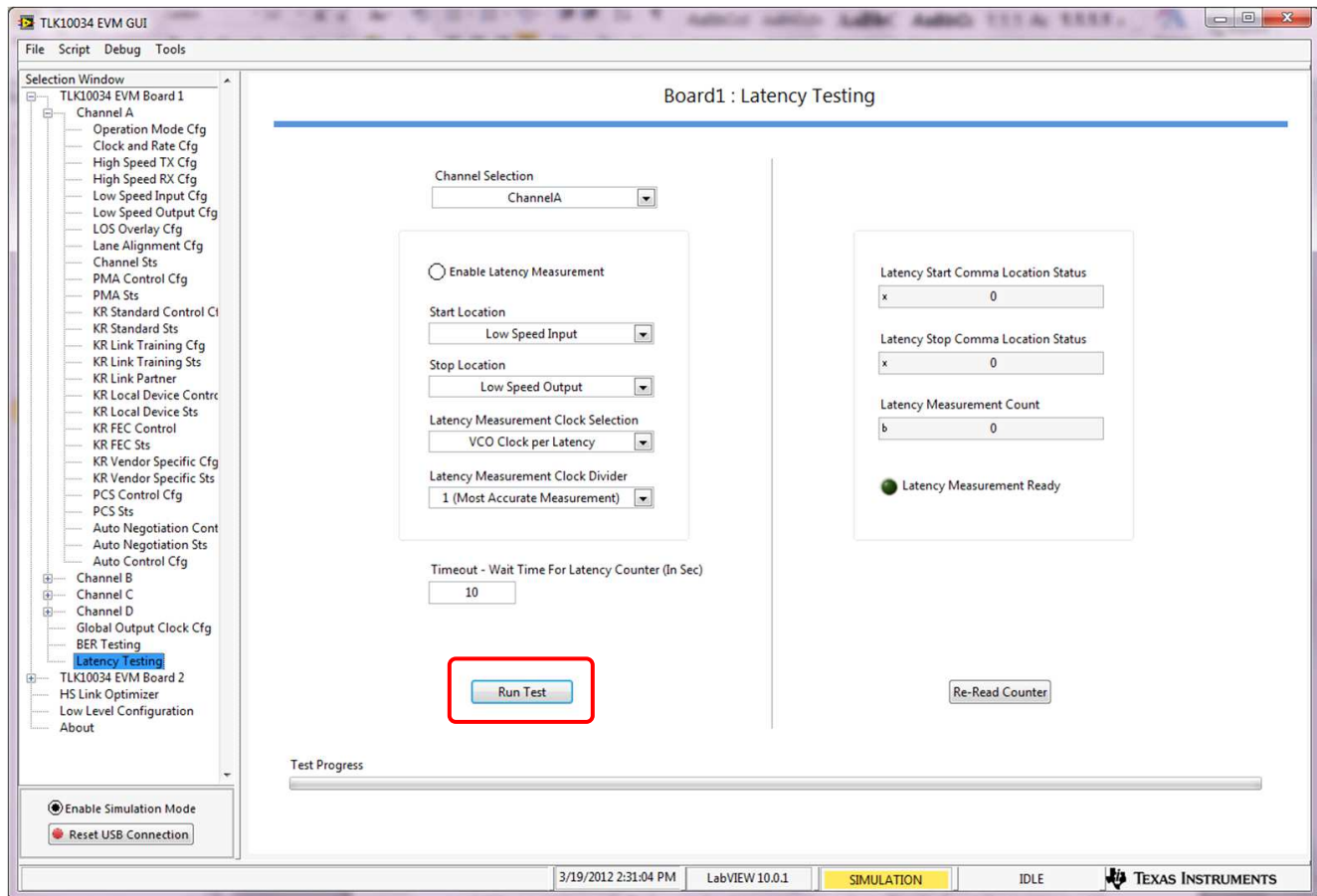


Figure 12. TLK10034 EVM GUI High-Level Device Latency Testing

7 High Speed Link Optimizer Tests

Once the TLK10034 registers and settings are applied to the device, switching over to the *HS Link Optimizer* tab (Figure 13) of the GUI provides some enhanced BER optimization tests allowing for quick evaluation of the health of the channel and what combination of parameter values yields the lowest bit error rate. This portion of the GUI is more applicable with operating modes that don't implement Link Training as part of their initialization sequence.

It is possible to optimize a link that contains two different devices on two different boards as in a real system and not a serial loop back test normally found in a lab test environment. Currently additional testing and verification of the EVM board and GUI is needed to support the two-board solution for this feature of the GUI. Look for future revisions of this document for additional information on how to configure the hardware and software for a two-board setup.

Up to four individual sweeps can be run simultaneously allowing the entire device to be optimized concurrently. Each of the four sweep setups has an enable check box in the *Set Up* tab for enabling the test of that sweep. Not selecting irrelevant sweeps uses fewer PC resources.

Select the *No. of Parameters to Sweep* from the selection box; up to 6. Notice that if less than 6 parameters are selected; the extra parameters are disabled and grayed out. The board number and channel number are required to ensure the proper board and device's parameters are swept in the two-board test setup. Once a parameter is used by a sweep, it is grayed out as an option for additional sweeps.

For each parameter swept, select the board number, channel, and parameter name. The start and stop values for those parameters are chosen with an associated step size. A step size of 1 sweeps every value; a step size of 2 sweeps every other value, and the increments are continually iterated. If a non-linear step or alternate order of the parameter values are desired, the sequence of values can be input in the form of a comma-separated list in any particular order desired. Match the syntax of the selected parameter fields to ensure the parameter is set properly. Do not include spaces in the comma-separated list. If a comma separated list is used, the *Start*, *Stop*, and *Step* fields are ignored.

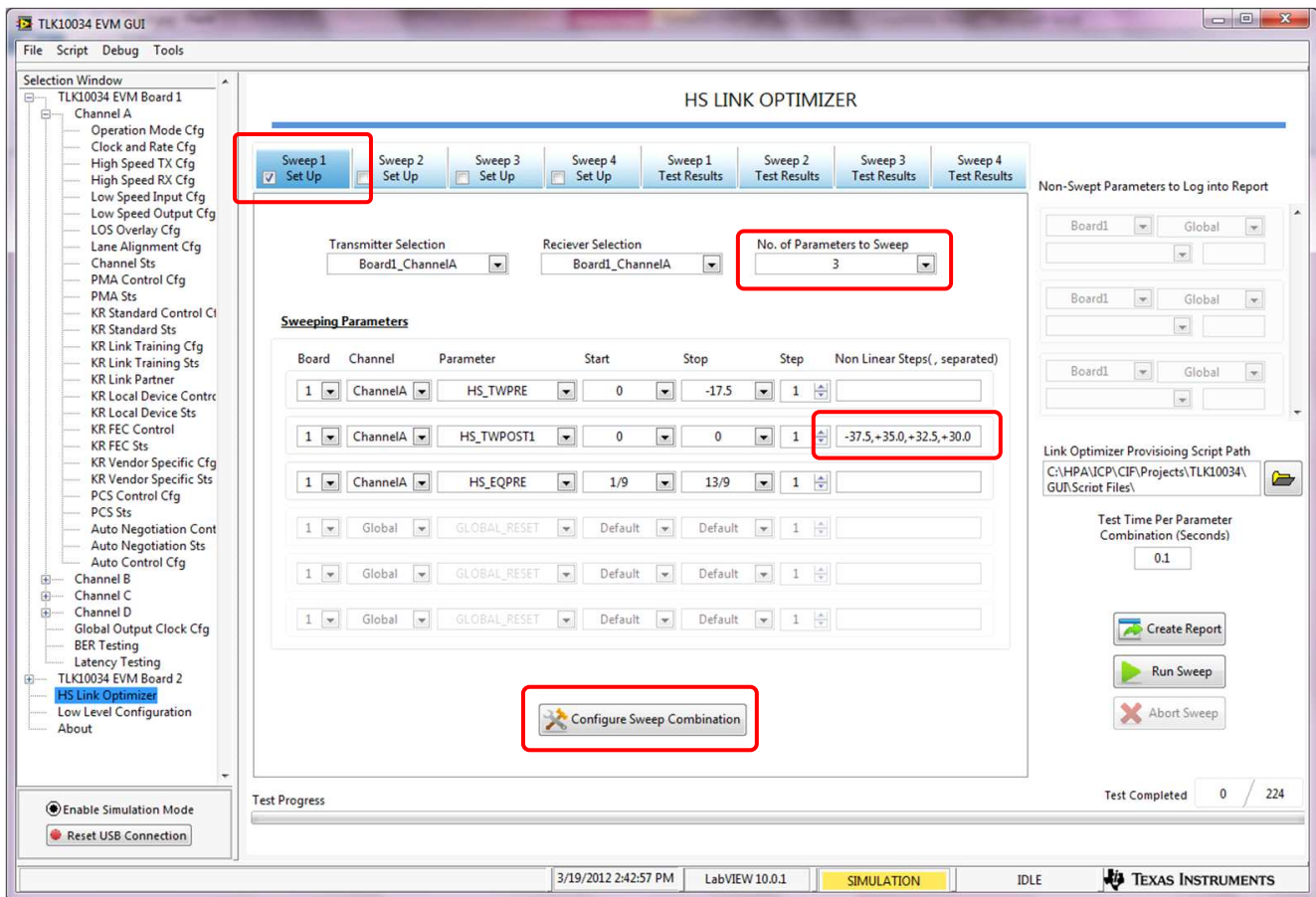


Figure 13. TLK10034 EVM GUI High Speed Link Optimizer Setup

Once all the sweeping parameters are configured, press the **Configure Sweep Combination** button creating the parameter sweep sequence. Pressing this button opens a new window (Figure 14) displaying the sweep sequence, each combination having its own checkbox. Determine if any of the particular combinations are unnecessary and exclude any individual fields from the sweep by unchecking them. Once those final selections are made, pressing the **Save** button saves the test sweep array to memory and the test is ready to begin.

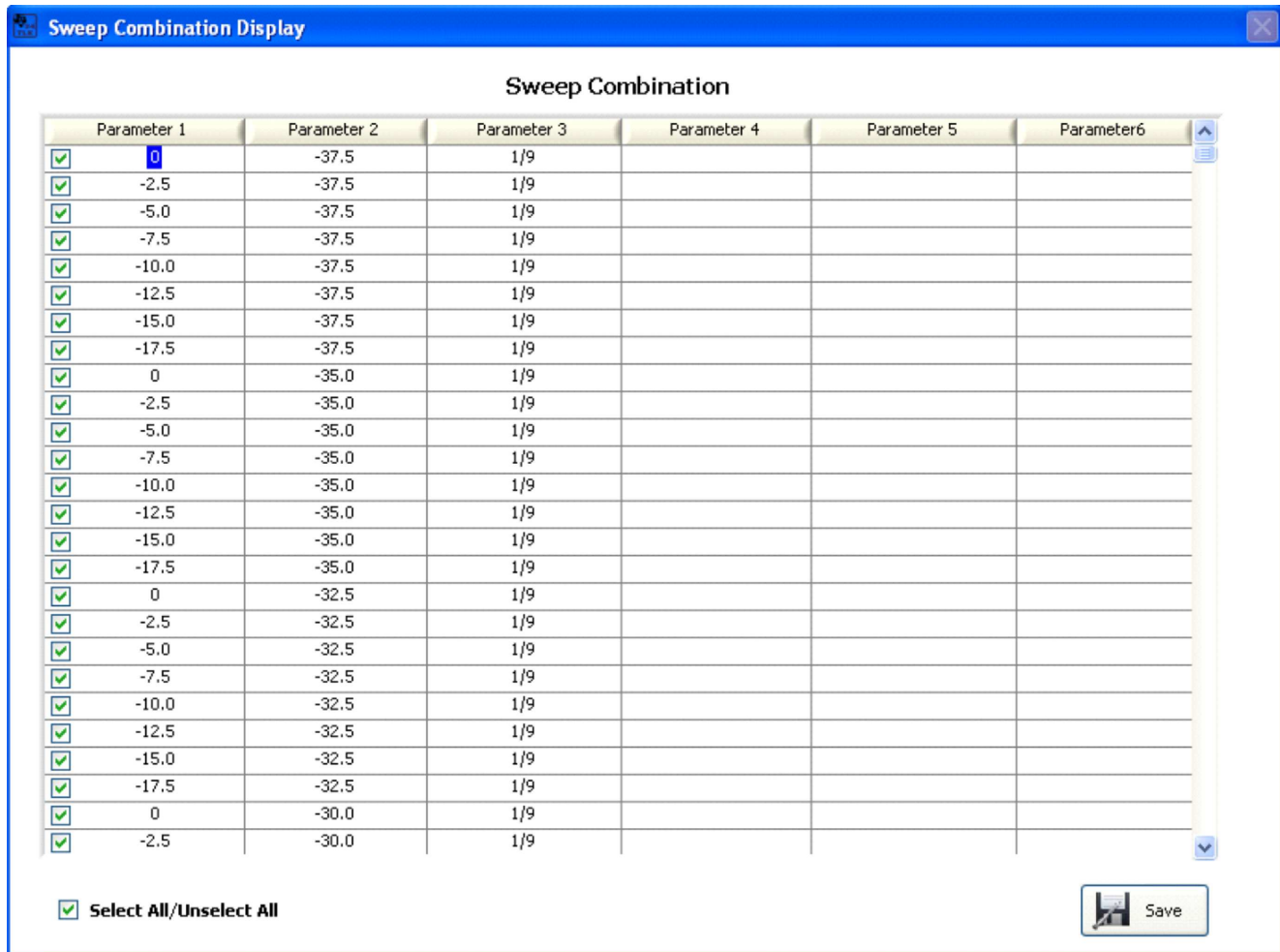


Figure 14. TLK10034 EVM GUI High Speed Link Optimizer Setup

The *Link Optimizer* is similar to the *Apply Settings* portion of the GUI and is executed with a script. There are two versions of the *Link Optimizer* script provided with the GUI; one for a single-board setup, and the other for a two-board setup. The two-board script is loaded by default and while it is possible to use in a single-board setup, the test time takes twice as long because the GUI is trying to configure an entire second board when the second board does not exist. Change the script by clicking the folder button next to the *Link Optimizer Provisioning Script Path* box and selecting the single-board script. Set this as the default script by right-clicking the folder button and selecting **Set Current File as Default Script**. It should also be noted that the scripts configure every channel of the device independently no matter what channels are implemented. If the optimized channels are known, create a version of the script that only configures the channels of concern, further reducing and optimizing test time.

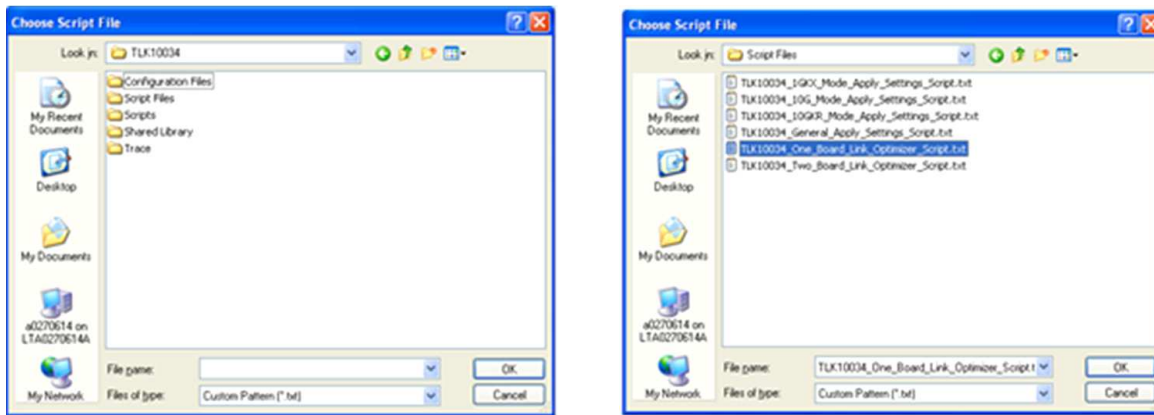


Figure 15. TLK10034 EVM GUI High Speed Link Optimizer Setup

After loading the desired script, pressing the **Run Sweep** button starts the test. When this button is pressed, the GUI takes the first set of parameter values in the configuration array and changes those values in the GUI's Register Configuration Memory. The GUI then executes the script responsible for provisioning the TLK10034 device, reading the error counters to clear them, waiting for the amount of test time entered for the BER test, and then rereading the error counters obtaining the BER count. Next the GUI stores the BER values into memory and processes the results. In the *Sweep Test Results* tab, there is an individual square pixel generated for each parameter combination in a matrix-of-matrix's configuration (Figure 16). The square is colored green if there are zero bit errors, yellow if there are bit errors but the maximum value of the error counter was not exceeded, and red if the maximum error count was achieved in the counter. Clicking on a square displays the parameter information for that test as well as the number of bit errors.

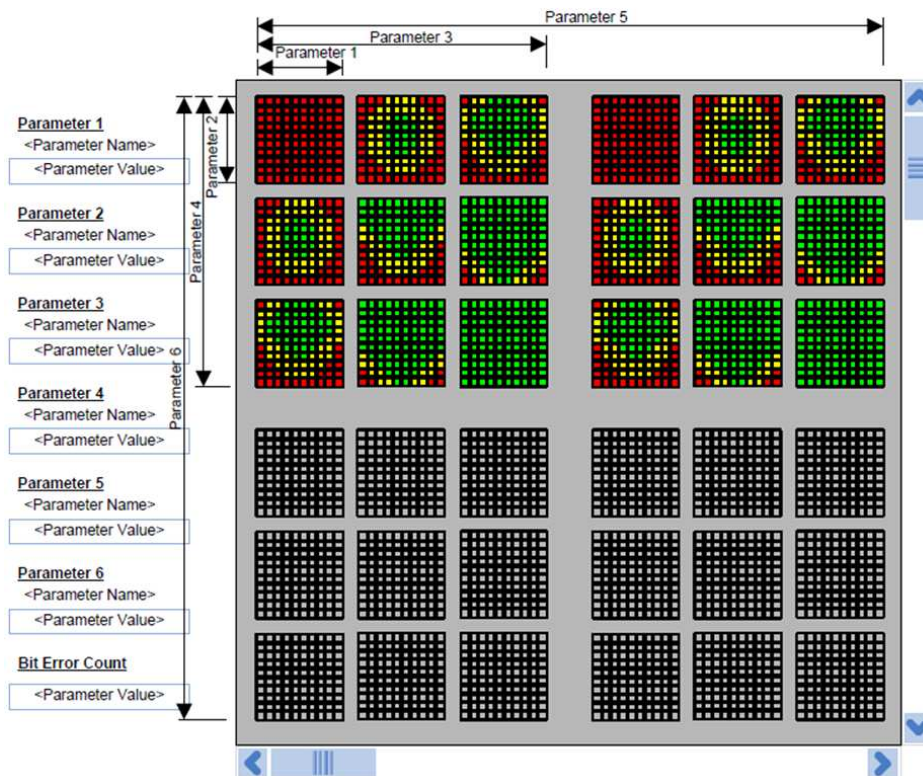


Figure 16. TLK10034 EVM GUI High Speed Link Optimizer Sweep Results Matrix

Abort the sweep at any time by pressing the **Abort Sweep** button. Test data already collected is not discarded but the remaining portion of the test configurations are kept from running.

It is possible to write the test results to a data file for further analysis or archiving at the completion of the test. Pressing the **Create Report** button writes the data to a .csv file. The report can include parameters that were not swept at part of the test by entering those values in the top right corner of the *Link Optimizer* window (Figure 17). This information is for manual entry only and is not linked to the memory array.

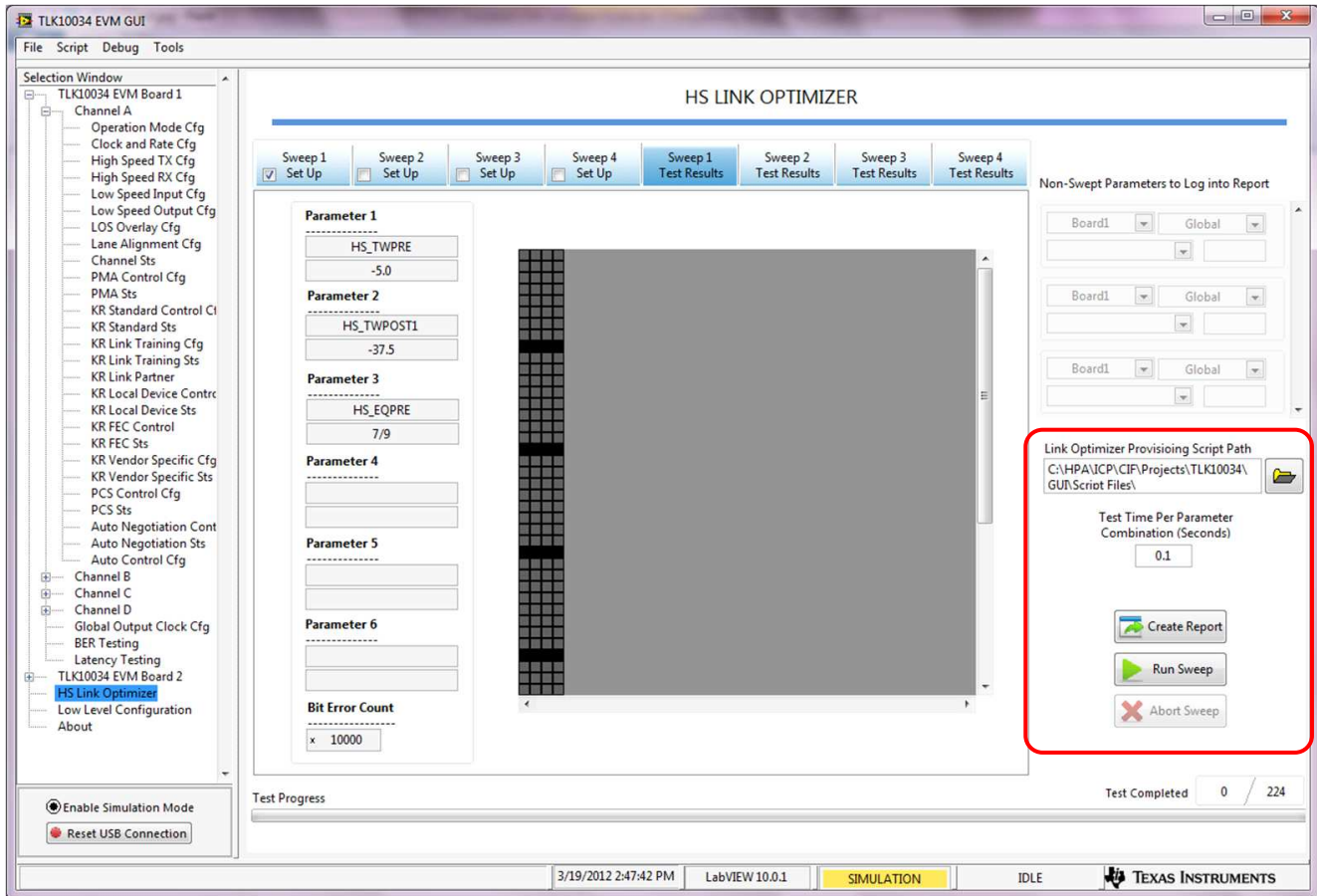


Figure 17. TLK10034 EVM GUI High Speed Link Optimizer Test Control Buttons

8 Python Scripting

Advanced operation and control features of the TLK10034 are performed by using the linked Python scripting editor. One feature logs register read/writes into a script while registers are read and written either manually through the low level, or through other areas of the GUI where registers are read or written. If advanced register control not found in the GUI is desired, manually modify the scripts, enhance them with loops, file I/O, and command-prompt entry. All aspects of the Python programming language, version 2.7, are supported. Specific aspects of the Python language are not discussed in this document.

Open a Python script editor to record a macro script by clicking the *Script* menu option and then selecting the *Launch Window* option (Figure 18).

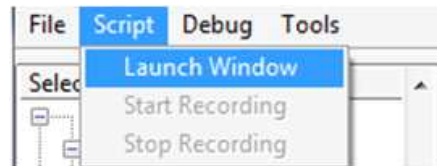


Figure 18. TLK10034 EVM GUI Launching Python Scripting Editor

A blank Python editor window opens (Figure 19).

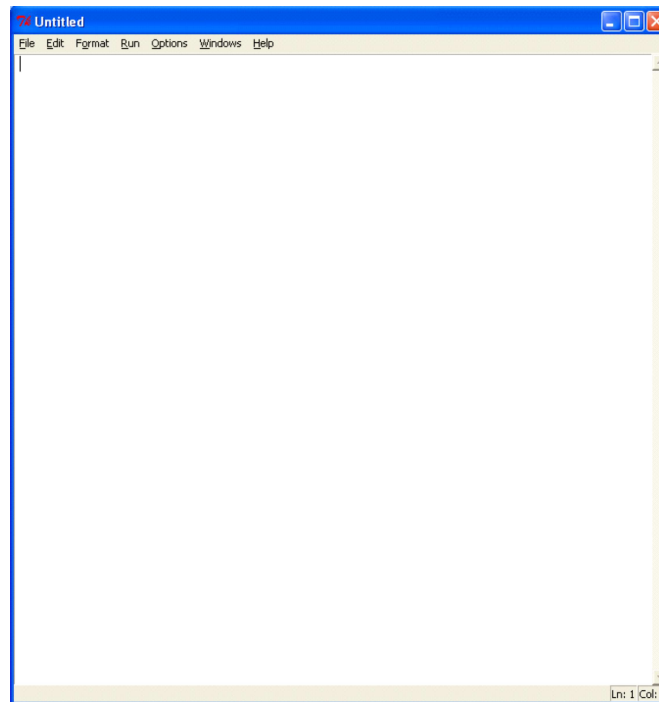


Figure 19. TLK10034 EVM GUI Blank Python Scripting Editor

On the TLK10034 GUI, click the *Script* menu option; select *Start Recording*. The header information is added to the Python Editor window and the color of the window starts to blink between white and green, indicating that it is in record mode (Figure 20). All register read and write transactions from this point forward are logged in the Python Editor window.

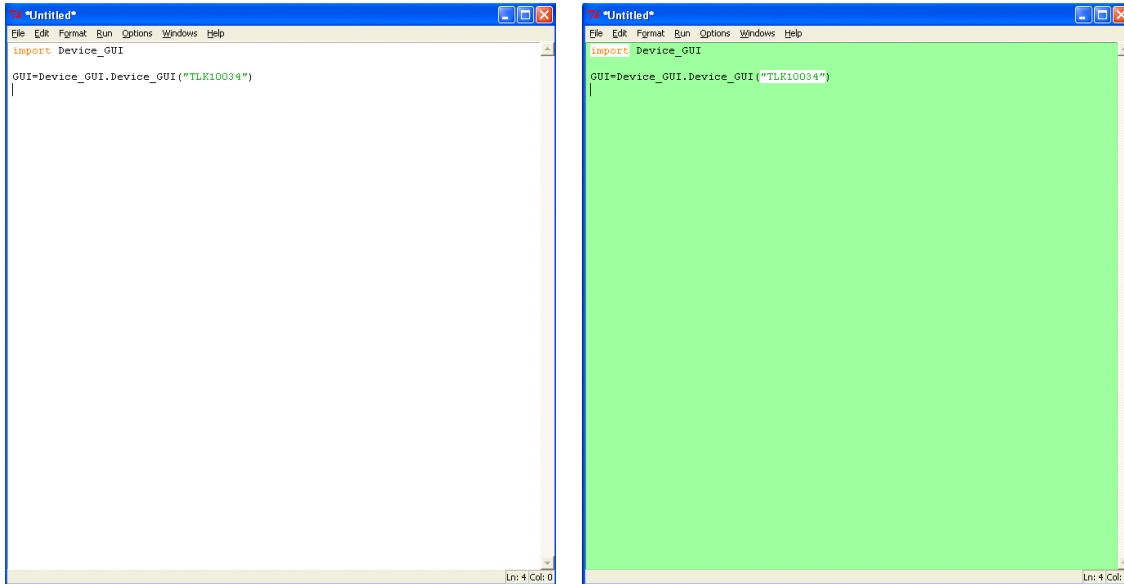


Figure 20. TLK10034 EVM GUI Python Scripting Editor in Record Mode (Toggles Color)

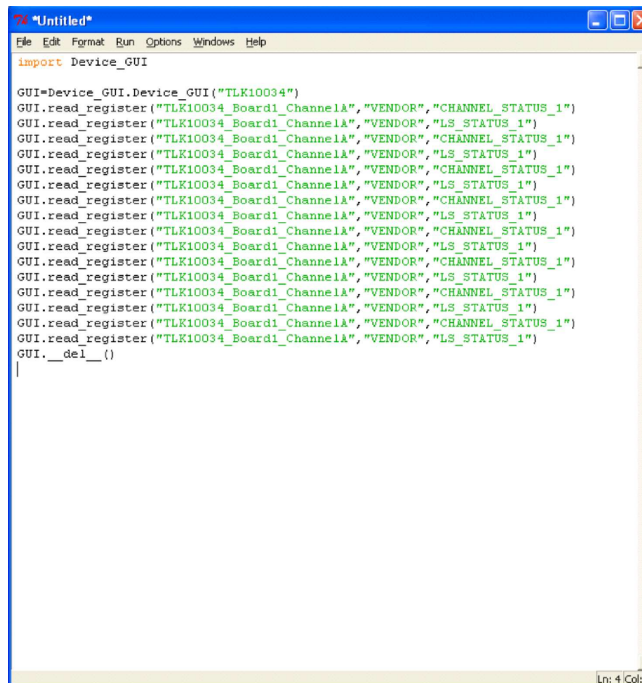


Figure 21. TLK10034 EVM GUI Recorded Script in Python Scripting Editor

Click the *Script* menu option and select *Stop Recording* to stop the recording feature and close out the script. Restart recording at any time and additional read/write transactions are added to the same script.

The script can be rerun as-is by saving the python script with the `.py` extension and selecting *Run Module* from the *Run* menu in the Python Editor. The output of the script is open in the shell window. It displays *Script completed successfully* indicating that the execution is complete. Introduce features like adding variables to assign and display read values, or writing values directly from the script, or adding looping structures by editing and saving the script and then rerunning the module.

Write small python scripts of commonly-used tasks to create a library of macros, enhancing the evaluation of the TLK10034 device and reducing test time.



```

Python Shell
File Edit Shell Debug Options Windows Help
Python 2.7.2 (default, Jun 12 2011, 15:08:59) [MSC v.1500 32 bit (Intel)] on win
32
Type "copyright", "credits" or "license()" for more information.
>>> ===== RESTART =====
>>>
Script completed successfully
>>> |
    
```

Figure 22. TLK10034 EVM GUI Python Shell

9 GUI Status

Check the status of the GUI by double-clicking the *Status* bar at any time. A *Status Log* window opens showing recent operations performed on the GUI. This window is useful for testing or debugging.

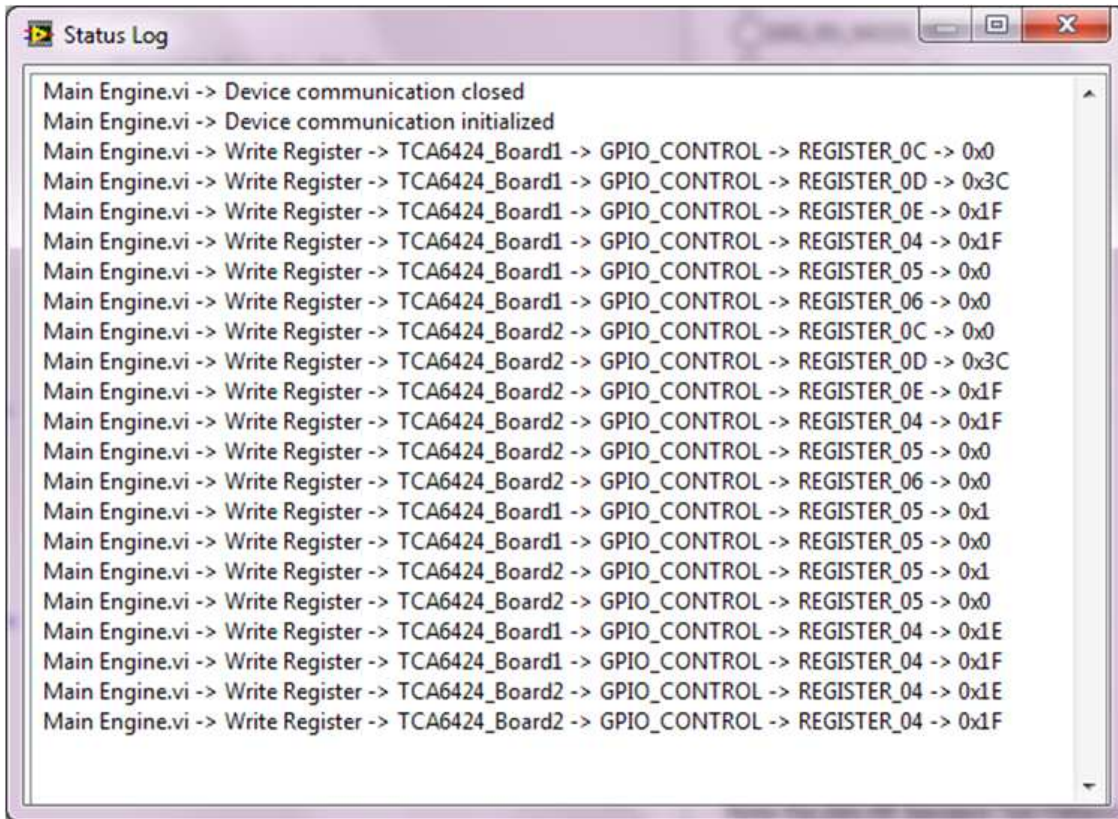
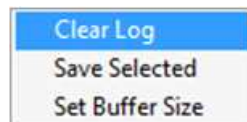


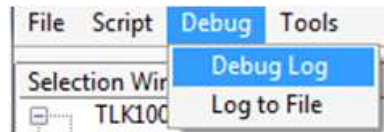
Figure 23. TLK10034 EVM GUI Status Log Window

This window has menu options for clearing the status log, saving the status log to a file, or setting the buffer limit which holds recent actions and operations done on the GUI. Use this option by right-clicking the window.



10 Debug Options

There are few debug options available for testing and debugging the GUI functionality. These options are available through menu options in the GUI.






Debug Log: On selecting this option, *Status Log* window logs all the operations needed for testing or debugging the device. It lists all the functions and actions done while performing a specific operation. Deselecting this option logs only the general operation done by the GUI.

Log to File: On selecting this option, the GUI starts logging its operations into a file (it logs all the data that are recorded in the *Status Log* window). The maximum size of a log file is 10kB. If the file size reaches the maximum, a new file is created. These files are found in the *Trace* folder under the *Application* folder.

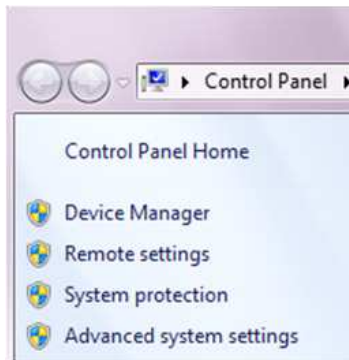
11 Troubleshooting

1. Pressing *Control + h* opens a help window with the help topics and the description of controls on the GUI. Hover the mouse over the target control and find the description in a help window.
2. If the GUI doesn't properly read or write a register:
 - (a) Check if the *Enable Simulation Mode* [below *Selection Window*] is deselected (also see [Figure 1](#)). If this control is enabled, the GUI is running on simulation values.

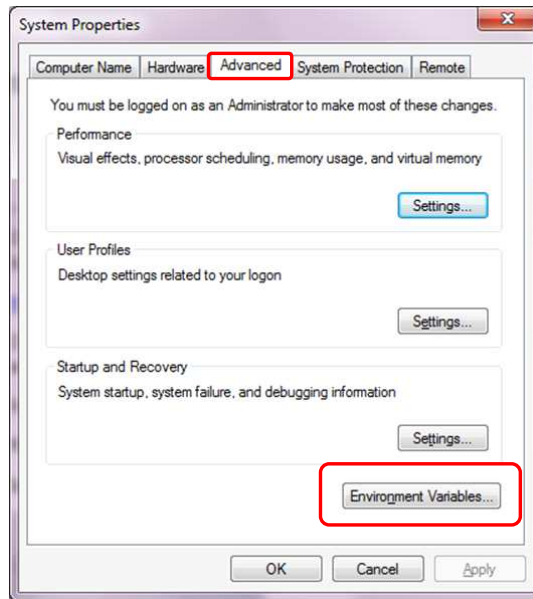


- (b) Check if the GUI status shows . If it shows , follow the above procedure. If it shows , plug in the USB device properly and press *Reset USB Connection* or restart the GUI.

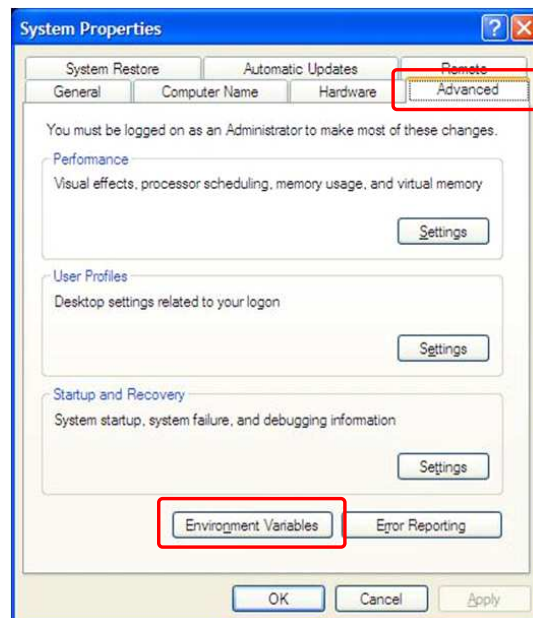
3. Error with Python Scripting. If the Python window is not launched on pressing the menu option *Launch Window*,
 - Check if Python 2.7 is installed and working on the PC. If it is not, download Python 2.7 from following location and install bit:
 - <http://www.python.org/download/releases/2.7/>
 - Check if Python is added to the environment variable. If not, add Python to the environment variable with the following:
 - Right click *My Computer* and select properties.
 - For the Windows® 7 Operating System, select *Advanced system settings* from the options available



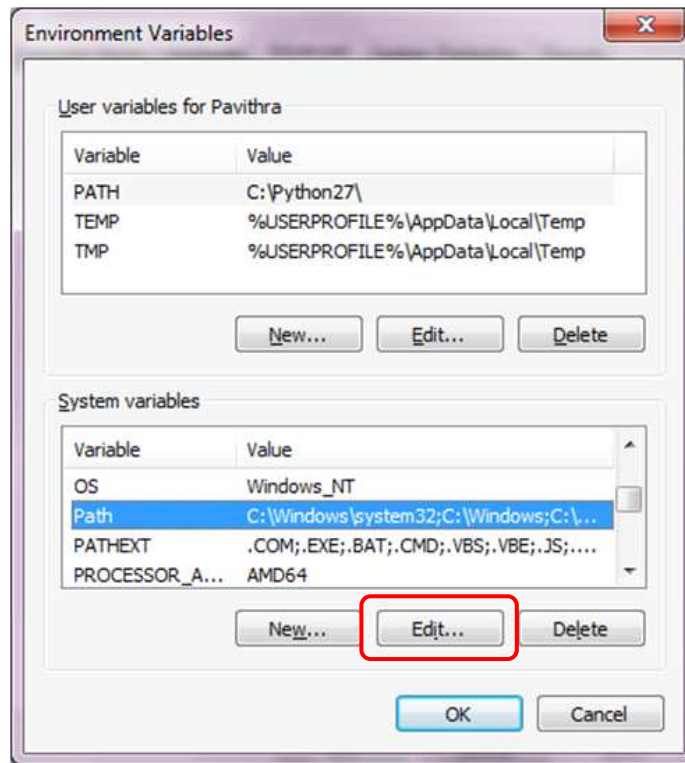
This opens a window as shown below. Press *Environment Variables*



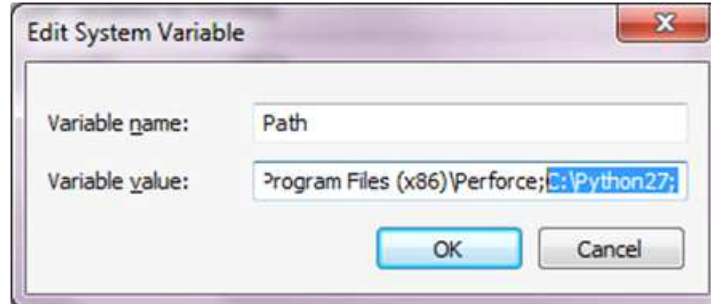
- For the Windows XP Operating System, Select *Advanced* and press *Environment Variables*



- Select *Path* from *System variables* and press the **Edit...** button.



- Add 'C:\Python27;' at the end of *Variable value* and press the **OK** button.



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Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

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For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

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General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

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【Important Notice for Users of this Product in Japan】

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3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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