

TRF3765 GUI

User Manual v2.0

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1 Overview

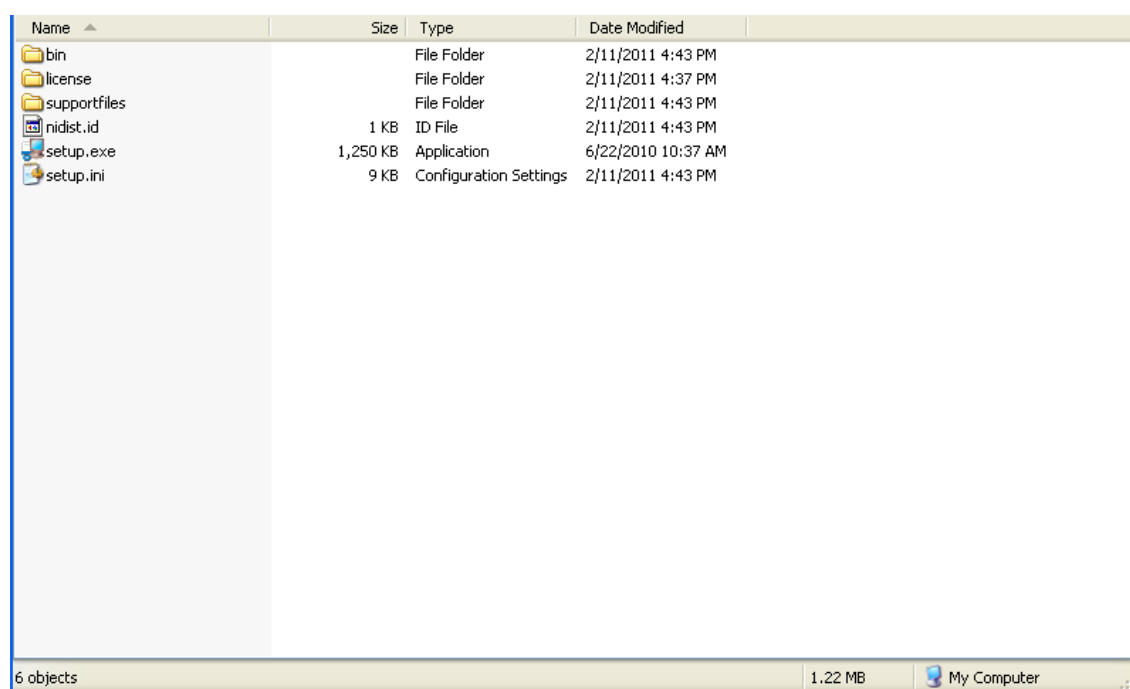
The TRF37xx GUI allows user to communicate with TRF3765 device. The GUI also handles the calculation part and sets the required values for the entered Frequency. The user can also manually play around with the values to check the settings.

2 Getting Started

The installable for the GUI will install the GUI and the required components for the GUI to function. Please follow the below procedure to install

2.1 Installation Guide

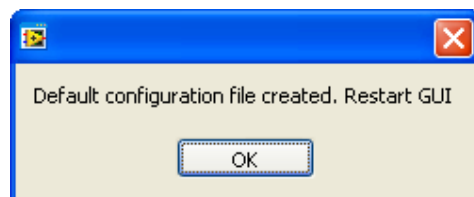
1. Please insert the CD and trace to the **Volume Folder** where the installer file is located.



2. Double click the “setup.exe” file and the installation will start immediately.
3. Please follow the steps, read through and agree to the License information and select the location of the file.
4. It will take few minutes to complete the installation. After completion, Please click “Finish” to complete it.

2.2 Start the GUI EXE

Follow the below path to start the exe
Start→ All Programs→TRF3765→TRF3765.exe



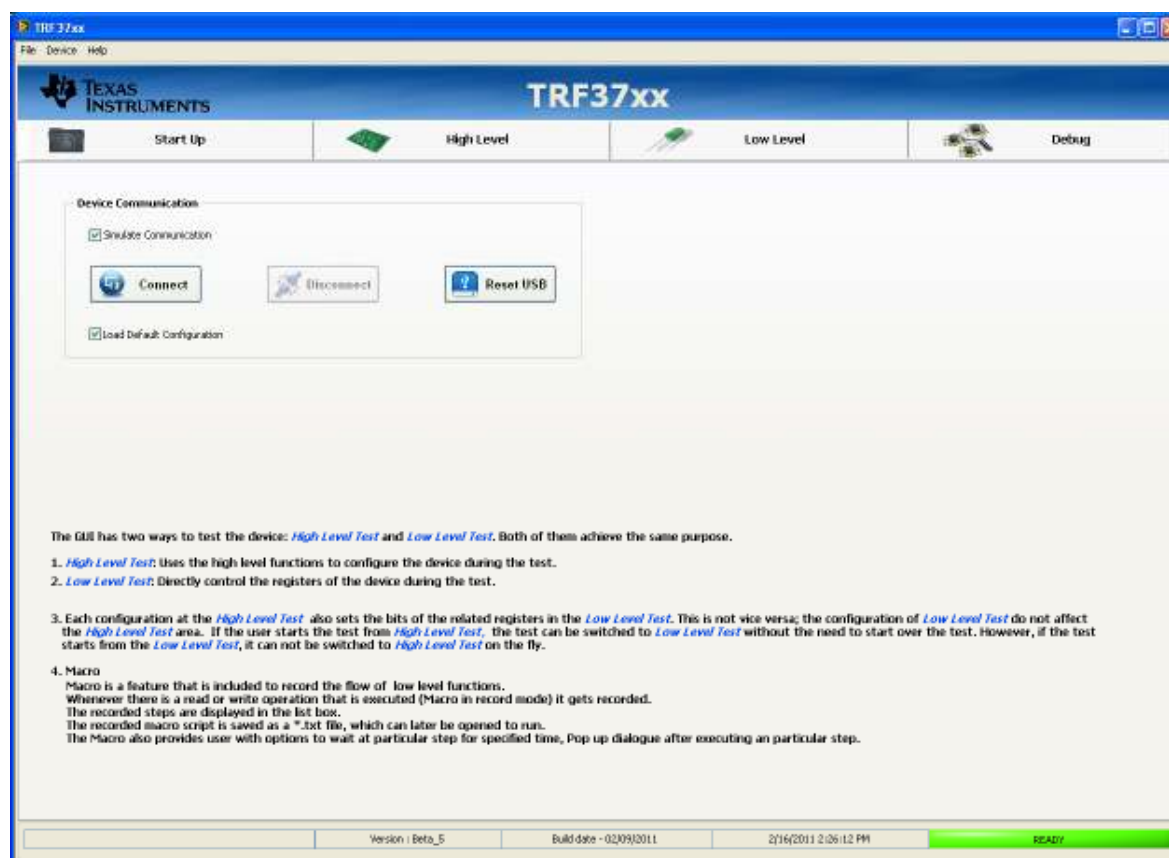
First Time the GUI starts, it will automatically create a configuration file (TRF3765.ini) for the GUI. It will pop up a window like the one shown, the user needs to click “OK” and restart the GUI from the same location.

The GUI will open.

3 GUI Options and Pages available

3.1 Start the GUI EXE

The GUI by default points to the start up page i.e. Device Communication.



Options available:

- **Simulation** – When enabled the GUI mimics the communication between the GUI and the device.
- **Connect** – Connects to the device. If the “Load Configuration File” option is chosen, then the GUI prompts the user for the default configuration file. **If this operation is cancelled the device will not be connected.**
- **Disconnect** – disconnect the connection before closing the GUI. Mandatory
- **Reset USB** – Reset the connection between the device and the GUI.
- **Load Default Configuration** – When enabled it asks the user for the default configuration file, the GUI by default points to a folder. **This needs to be turned ON/OFF before Connecting to the device**

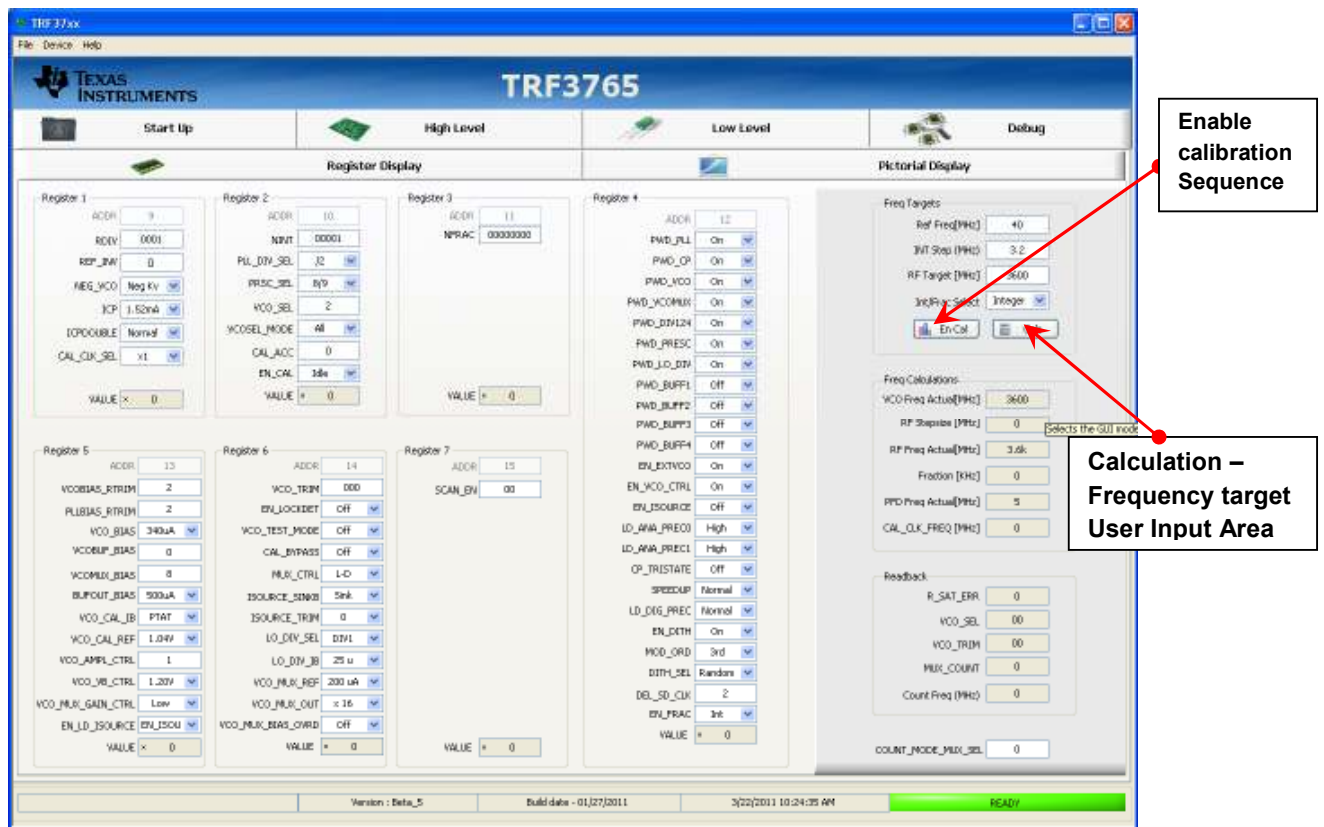
NOTE: The GUI will not allow the user to navigate to another tab when the device is not connected.

3.2. High Level – Register Display

The High Level Tab has all the register information. The user configures the registers as required and the corresponding values will be written into the Registers.



The Registers 1 through 7 are exposed with the respective fields which the user can set.



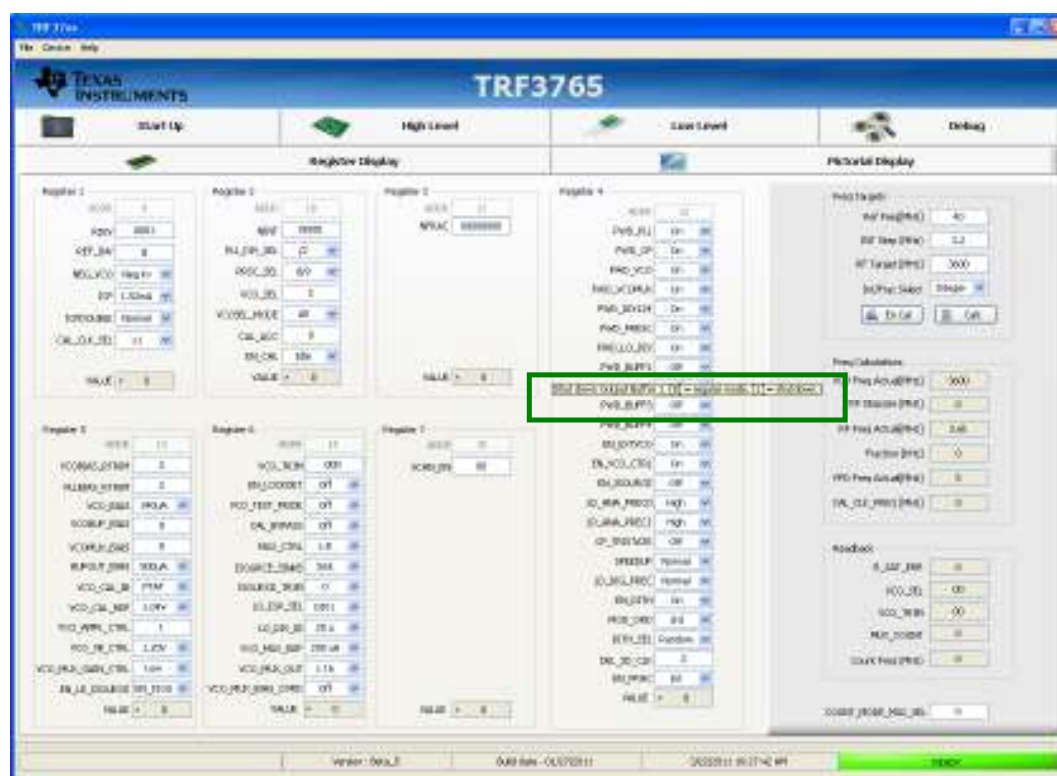
Options available:

- **Calculation Frequency targets** – User will be able to specify his requirements like
 - Reference: Frequency
 - RF Step Size
 - RF Target
 - Integer/Fractional Mode
 - Press “CALC” which will calculate and set the registers so as to program as per the user inputs.
- **Frequency calculations** – Indicates the actual set components
- **Read back** – Reads the Register 0 and displays the fields like
 - R SAT ERR
 - VCO SEL
 - VCO TRIM
 - MUX Count
 - Counter Frequency
- **Registers** – The user can set any value for the register by just changing the value available.

NOTE: Press CTRL + H to display a small description parallel to the GUI. The GUI also provides a tip when mouse moves over a control. CTRL + H

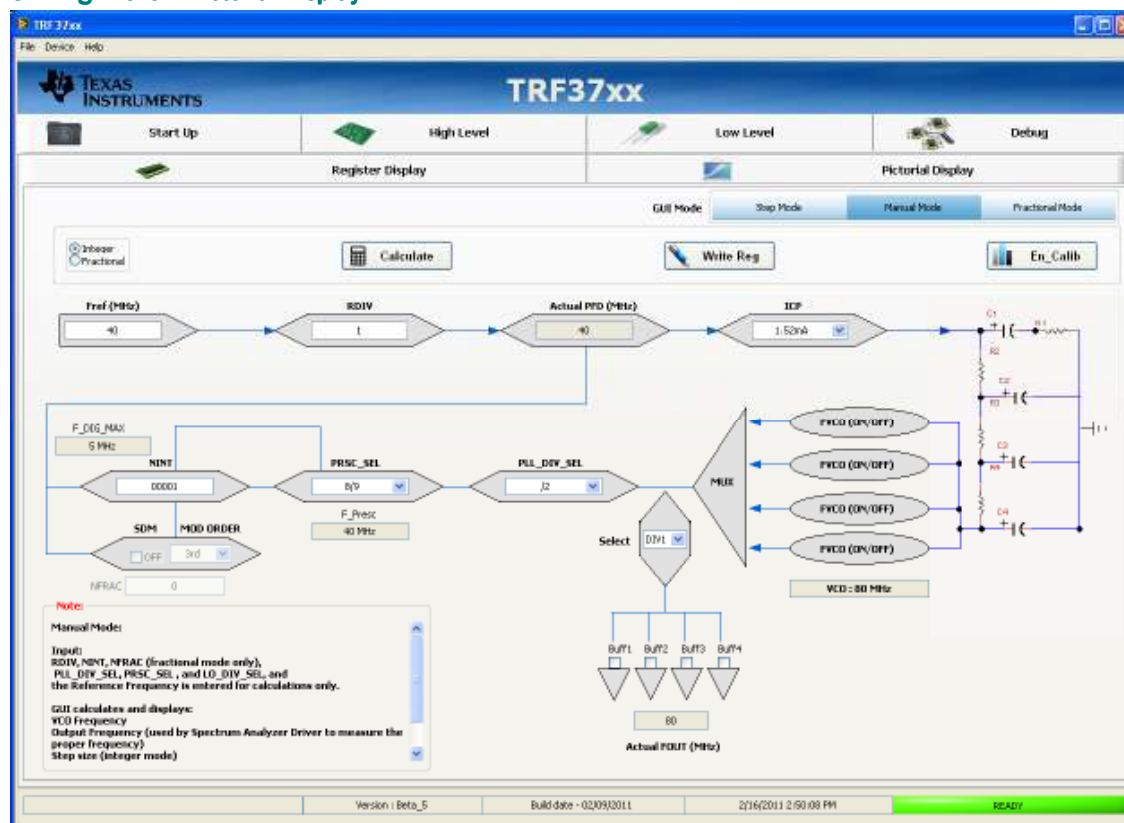


Automatic Tip Strip



NOTE: The GUI will automatically write into the registers from the High level – Register Display!

3.2 High Level –Pictorial Display



This Tab shows only the required components that would be necessary.

The GUI has three modes:

Step Mode

Manual Mode

Fractional Mode.

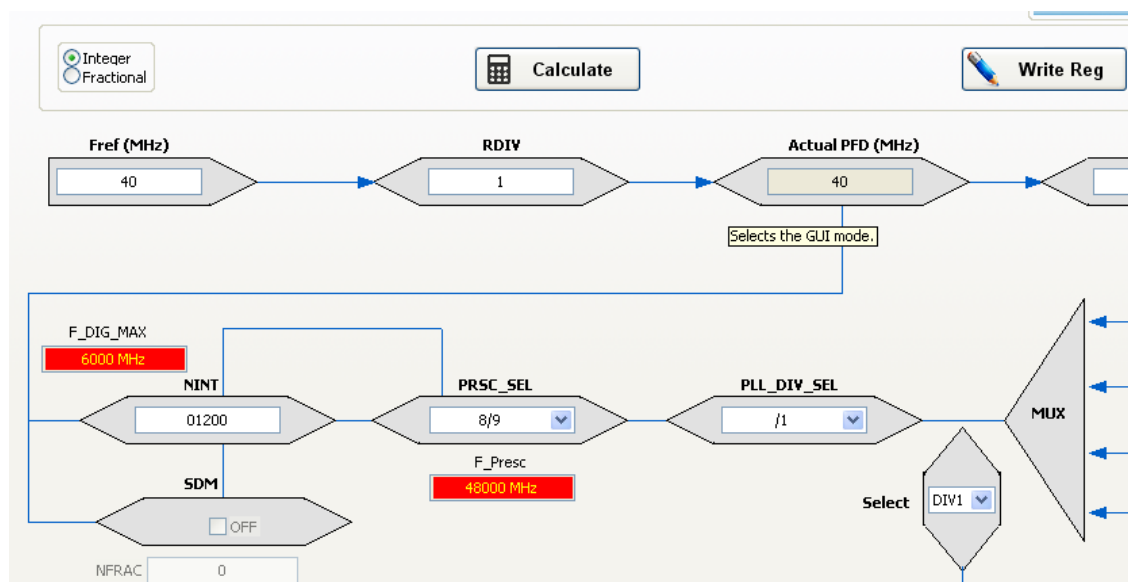
In each of the modes, the GUI will gray out/disable the controls which the user cannot set. Other controllable parameters will be exposed.

Options available:

- **Step Mode** – User will be able set the following.
 - FRef
 - INT Step Target
 - RF Target
 - User can select Integer/Fractional Mode

- **Manual Mode** – Indicates the actual set components
 - Fref
 - RDIV
 - ICP
 - NINT
 - Presc Val
 - PLL DIV SEL
 - LO DIV SEL
 - Buffers (1...4)
 - Integer/Fractional Mode

The GUI will calculate and display the output i.e. FOUT, F DIG Max and F Presc. Warning will be displayed if the F DIG MAX > 350 MHz and F Presc > 2800 MHz like below:



User can correct for it by adjusting the required fields.

- **Fractional Mode** – This mode is for the Fractional calculation part and the user can set the following:
 - FPDF Target
 - FOUT Target
 - Fref

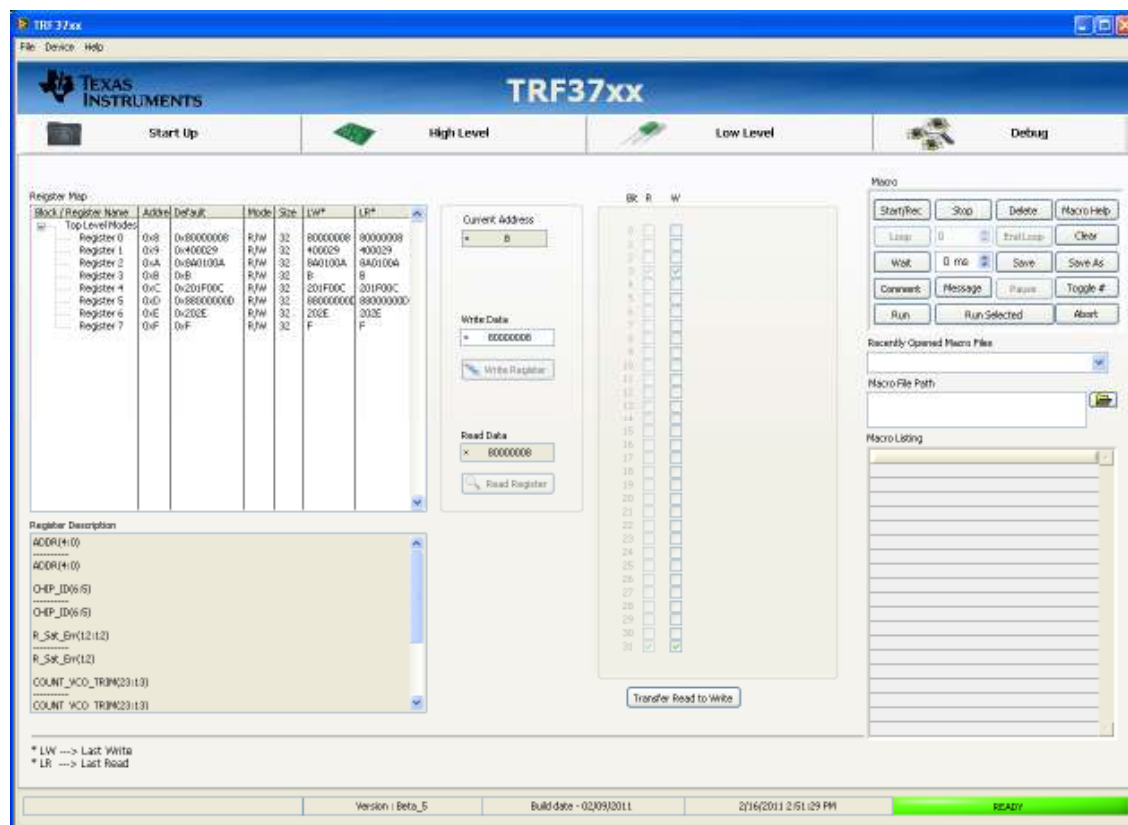
GUI will calculate NINT, RDIV, Fractional value – NFRAC, FDIG MAX, F Presc, PLL DIV SEL, LO DIV SEL, ICP, Presc Value.

User can play around with the Presc Value, PLL DIV SEL and LO DIV SEL after the calculation; GUI will not try to control them after the 1st calculation in this mode.

- **Calculation** – Calculates the Output based on which mode and displays to the user.
- **Write register** – When the user is satisfied with the calculated values, he go ahead and click “Write Register” which write the calculated values into the corresponding Registers.
- **Enable CAL** – Toggles the CAL Bit to initialize Calibration Sequence.

3.3 Low Level register Display

The GUI displays the registers in a low level pattern i.e. for each register the user can see the binary indications, toggle bits and write/read Registers.



Options available:

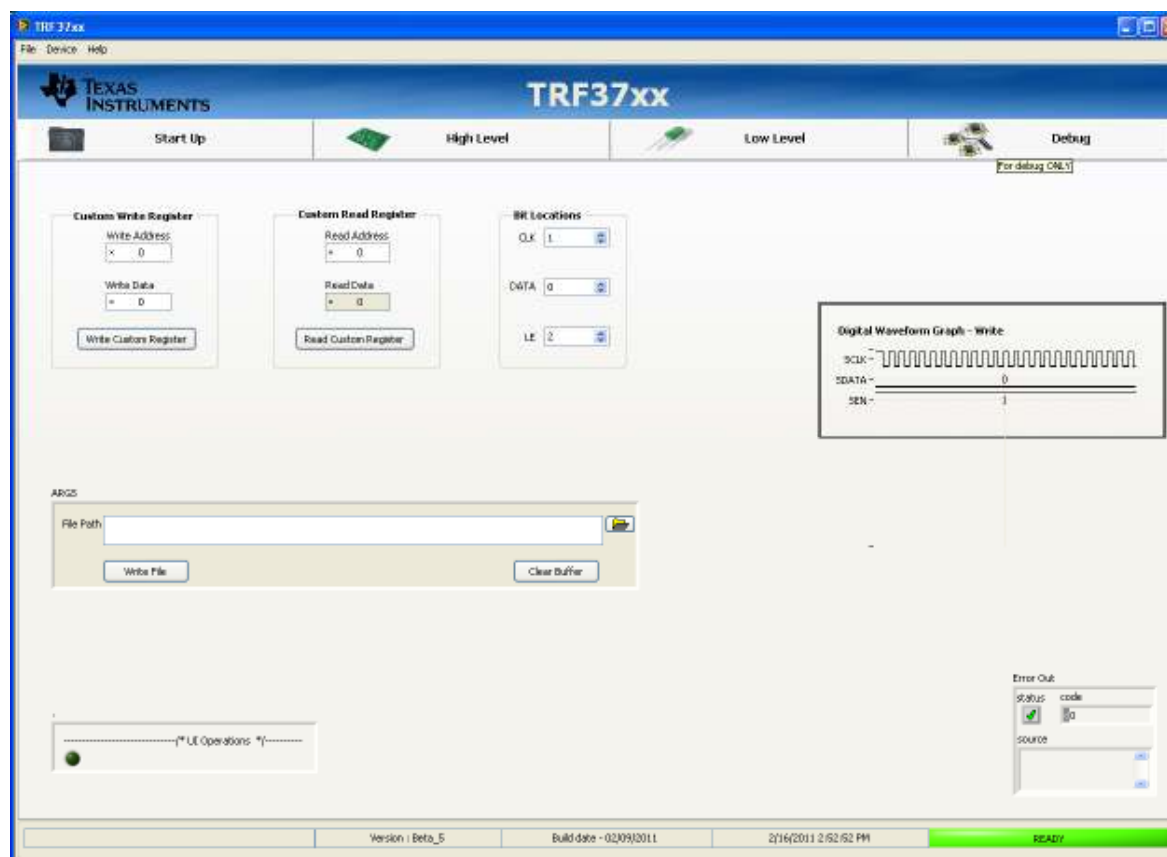
- **Register Map** – Navigates to Registers
 - Based on the register selection the register's bits will be displayed on the right pane.
- **Bits Display** – Displays the Register Value in binary format
 - Read column displays the last Read back value (corresponds with “Read Data”)
 - Write Column displays the last written value (corresponds with “Write Data”)
 - User can click on the write column to modify the values of the register.

- **Current Address** – Displays the current address of the selected register
- **Write data** – User can enter the Data in/ Modify the bits in the “Bits Display” when write register is clicked, GUI will write into the corresponding register with the value programmed. This field also corresponds with the Write Column of the Bits display.
- **Writes Register** – Button → writes the value in the “Write Data” / “Bits Display” into the register.
- **Read data** – When “Read” Button is clicked the read back data is displayed here. This field also corresponds with the Read Column of the Bits display.
- **Read Register** – Button → Read the Register value and displays in the “Read Data”.
- **MACRO:**

This is an option available to the user where, the activity in the Low Level Display page can be recorded, saved and Played back,

- **Start Rec** – Starts to record the activity
- **Stop** – Stops recording
- **Save/Save as** – Saves the Steps in “Macro Listing” as a *.txt file.
- **Run** – Runs the steps listed in the “macro Listing”
- **Run Selected** – Runs only the selected items in the “Macro Listing”
- **Macro Listing** – Displays the activity done/ Steps Run
- **Macro File Path** – to select a Macro file path that is already saved
- **Recently Opened Macro Files** – has a list of files which were opened recently.

3.4 Debug



NOT USED! Only FOR INTERNAL DEBUG

4. Calculation:

4.1 Integer Step Mode Calculation:

- Input:
 - Target Integer step (target step size), Target output frequency (RF_Target), Reference Frequency
 - NOTE: Because the dividers counter are digital, the actual Integer Step Size and actual output frequency will not always be exactly the same as the target values.
- GUI calculates and displays:
 - RDIV
 - NINT
 - PLL_DIV_SEL

- LO_DIV_SEL
- PRESC_SEL
- VCO Frequency (F_{VCO})
- Actual Output Frequency (F_{OUT})
- Actual Integer Step size (sometimes called channel spacing)
- PFD Frequency (F_{PFD})
- Maximum Digital divider frequency and displays error message when > 350 MHz
- Prescaler Frequency and displays error message when > 2800 MHz

– **Calculations for Integer Step:**

– LO_DIV_SEL (register 6 bits 24 and 25, 00=/1, 01=/2, 10=/4, 11=/8)

- If $2400 \text{ MHz} \leq F_{out} \leq 4800 \text{ MHz}$, then LO_DIV_SEL = 1
- If $1200 \text{ MHz} \leq F_{out} \leq 2400 \text{ MHz}$, then LO_DIV_SEL = 2
- If $600 \text{ MHz} \leq F_{out} \leq 1200 \text{ MHz}$, then LO_DIV_SEL = 4
- If $300 \text{ MHz} \leq F_{out} \leq 600 \text{ MHz}$, then LO_DIV_SEL = 8

– PLL_DIV_SEL (Register 2 bits 21 and 22), 00=/1, 01=/2, 10=/4

- If Target_Output_Frequency x LO_DIV_SEL \leq 2800 MHz, then PLL_DIV_SEL = 1
- Else If Target_Output_Frequency x LO_DIV_SEL \geq 2800 MHz, PLL_DIV_SEL = 2

– RDIV*

$$RDIV = \text{floor} \left(\frac{F_{REF} \times PLL_DIV_SEL}{Tgt_Int_Step \times LO_DIV_SEL} \right)$$

– PFD Frequency (F_{PFD})

$$F_{PFD} = \frac{\text{reference_frequency}}{RDIV}$$

– NINT

$$NINT = \text{floor} \left[\frac{F_{OUTTARGET} \times LO_DIV_SEL}{PLL_DIV_SEL \times F_{PFD}} \right]$$

– Pre-scaler Select

- If NINT > 56 select the 8/9 pre-scaler
- Else select 4/5 pre-scaler

– Actual Integer Step (ΔF_{OUT} when $\Delta NINT = 1$)

$$\bullet \quad INT_STEP_Actual = Channel_Spacing \times \frac{PLL_DIV_SEL \times F_{PFD}}{LO_DIV_SEL}$$

– VCO Frequency (F_{VCO})

$$\bullet \quad F_{VCO} = F_{PFD} \times PLL_DIV_SEL \times NINT$$

– Actual Output Frequency (F_{OUT})

$$\bullet \quad F_{OUT} = \frac{F_{VCO}}{LO_DIV_SEL}$$

– Digital Counter Frequency:

- (actually varies during cycle and is the maximum during a cycle)
- Display warning if > 350 MHz

$$\bullet \quad F_{DIG-MAX} = \frac{F_{VCO}}{P \times PLL_DIV_SEL}$$

– Pre-scaler Frequency (F_{PRESC})

- Display warning if > 2800 MHz

$$\bullet \quad F_{PRESC} = \frac{F_{VCO}}{PLL_DIV_SEL}$$

4.2 Fractional Mode Calculation:

– Input:

- F_{PFD} , Reference Frequency, F_{out}

– GUI calculates and displays:

- LO_DIV_SEL
- PLL_DIV_SEL
- $RDIV$
- F_{PFD_ACTUAL}
- $NINT$
- $NFRAC$

- VCO Frequency (F_{VCO})
- Actual Output Frequency ($F_{OUTACTUAL}$)
- Pre-scaler Select
- Recommended* PLL_DIV_SEL
 - *can be over-ridden by user
- Digital divider frequency and displays error message when > 350 MHz
- Pre-scaler Frequency and displays error message when > 2800 MHz

– **Calculations for Fractional Mode**

– LO_DIV_SEL (register 6 bits 24 and 25, 00=/1, 01=/2, 10=/4, 11=/8)

- If $2400 \text{ MHz} \leq F_{out} \leq 4800 \text{ MHz}$, then LO_DIV_SEL = 1
- If $1200 \text{ MHz} \leq F_{out} \leq 2400 \text{ MHz}$, then LO_DIV_SEL = 2
- If $600 \text{ MHz} \leq F_{out} \leq 1200 \text{ MHz}$, then LO_DIV_SEL = 4
- If $300 \text{ MHz} \leq F_{out} \leq 600 \text{ MHz}$, then LO_DIV_SEL = 8

– PLL_DIV_SEL (Register 2 bits 21 and 22), 00=/1, 01=/2, 10=/4

- If Target_Output_Frequency x LO_DIV_SEL \leq 2800 MHz, then PLL_DIV_SEL = 1
- Else If Target_Output_Frequency x LO_DIV_SEL \geq 2800 MHz, PLL_DIV_SEL = 2

– RDIV*

$$RDIV = \text{roundnearest} * \left(\frac{F_{REF}}{F_{PFD}} \right)$$

– $F_{PFDACTUAL}$

$$F_{PFDACTUAL} = \frac{F_{REF}}{RDIV}$$

– NINT

$$NFRAC = \text{roundnearest} * \left[\frac{F_{TARGET} \times LO_DIV_SEL}{F_{PFDACTUAL} \times PLL_DIV_SEL} - NINT \right] \times 2^{25}$$

– VCO Frequency (F_{VCO})

$$F_{VCO} = F_{PFDACTUAL} \times PLL_DIV_SEL \times \left[NINT + \frac{NFRAC}{2^{25}} \right]$$

– Actual Output Frequency ($F_{OUTACTUAL}$)

$$F_{OUTACTUAL} = \frac{F_{VCO}}{LO_DIV_SEL}$$

– Pre-scaler Select

- If NINT > 56 select the 8/9 pre-scaler
- Else select 4/5 pre-scaler

– Digital Divider Frequency

- If $F_{DIG-MAX}$ > 350 MHz, increase PLL_DIV_SEL to the next highest divide ratio and recalculate NINT, NFRAC, F_{VCO} , F_{OUT} , and F_{PRESC}
- If F_{PFD} > 350 MHz, index PLL_DIV_SEL to next highest divider value and restart calculations from NINT.
- Display warning if > 350 MHz

$$F_{DIG-MAX} = \frac{F_{VCO}}{P \times PLL_DIV_SEL}$$

– Pre-scaler Frequency (F_{PRESC})

- Display warning if > 2800 MHz

$$F_{PRESC} = \frac{F_{VCO}}{PLL_DIV_SEL}$$

4.3 Manual Mode Calculation:

– Input:

- RDIV, NINT, NFRAC (fractional mode only), PLL_DIV_SEL, PRSC_SEL, and LO_DIV_SEL, and the Reference Frequency is entered for calculations only.

– GUI calculates and displays:

- VCO Frequency
- Output Frequency (used by Spectrum Analyzer Driver to measure the proper frequency)
-
- Step size (integer mode)
- PFD Frequency
- Digital divider frequency and displays error message when > 350 MHz
- Pre scaler Frequency and displays error message when > 2800 MHz

– **Calculations for Manual Mode:**

– PFD Frequency (F_{PFD})

$$F_{PFD} = \frac{\text{reference_frequency}}{RDIV}$$

– VCO Frequency (F_{VCO})

$$F_{VCO} = F_{PFD} \times PLL_DIV_SEL \times \left[NINT + \frac{NFRAC}{2^{25}} \right]$$

• **Note: for integer mode NFRAC=0**

– Output Frequency (F_{OUT})

$$F_{OUT} = \frac{F_{VCO}}{LO_DIV_SEL}$$

– Integer Step

$$INT_STEP = Channel_Spacing = \frac{PLL_DIV_SEL \times F_{PFD}}{LO_DIV_SEL}$$

– Digital Counter Frequency

- actually varies during a digital counter cycle due to two moduli, we need to calculate the maximum during a cycle
- Display warning if > 350 MHz

$$F_{DIG-MAX} = \frac{F_{VCO}}{P \times PLL_DIV_SEL}$$

– Pre-scaler Frequency (F_{PRESC})

- Display warning if Value > 2800 MHz

$$F_{PRESC} = \frac{F_{VCO}}{PLL_DIV_SEL}$$

5. Menu Options

5.1 File Options:

- Exit
 - Choose this option to Exit the GUI.

5.2 Device Connections

- Connect
 - Connects to the device. If the “Load Configuration File” option is chosen, then the GUI prompts the user for the default configuration file. **If this operation is cancelled the device will not be connected.**
- Disconnect
 - Disconnects the active connection between the GUI and Device. **Disconnect the connection before closing the GUI. Mandatory**
- Reset USB
 - Resets the existing connection between the GUI and Device.

5.3 Help

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