

User Guide for the Analog Devices ADRF6612 Integrated Synthesizer and Dual Mixer

This guide is intended to allow the user to quickly power up and run the software for the ADRF6612 integrated synthesizer and mixer. It is intended to complement the ADRF6612 datasheet. After following the instructions in this guide, the user should be able to operate the ADRF6612 evaluation board to obtain optimal performance.

Power, RF, IF, USB Connections

Figure 1 shows the ADRF6612 evaluation board with all required connections for proper operation. All of the following connections should be made with power turned off. When all power, RF, IF and USB connections are made, the +5V supply can then be turned on. When

power is turned on initially, the 5V supply should draw approximately 500ma. When the device is initially programmed via the ADRF6612 GUI and USB interface, this current will change, as described later.

The red and black clips represent +5V and GND. In the upper left, there is an SMA cable which connects to an external PLL reference source. The dual single ended RF inputs (RF1 and RF2) are located on the right side of the board. The IF outputs are located on the top right and bottom right of the board. In Figure 1, the IF outputs are being run single ended by using the baluns on the board so there is only one SMA connected for each IF output.

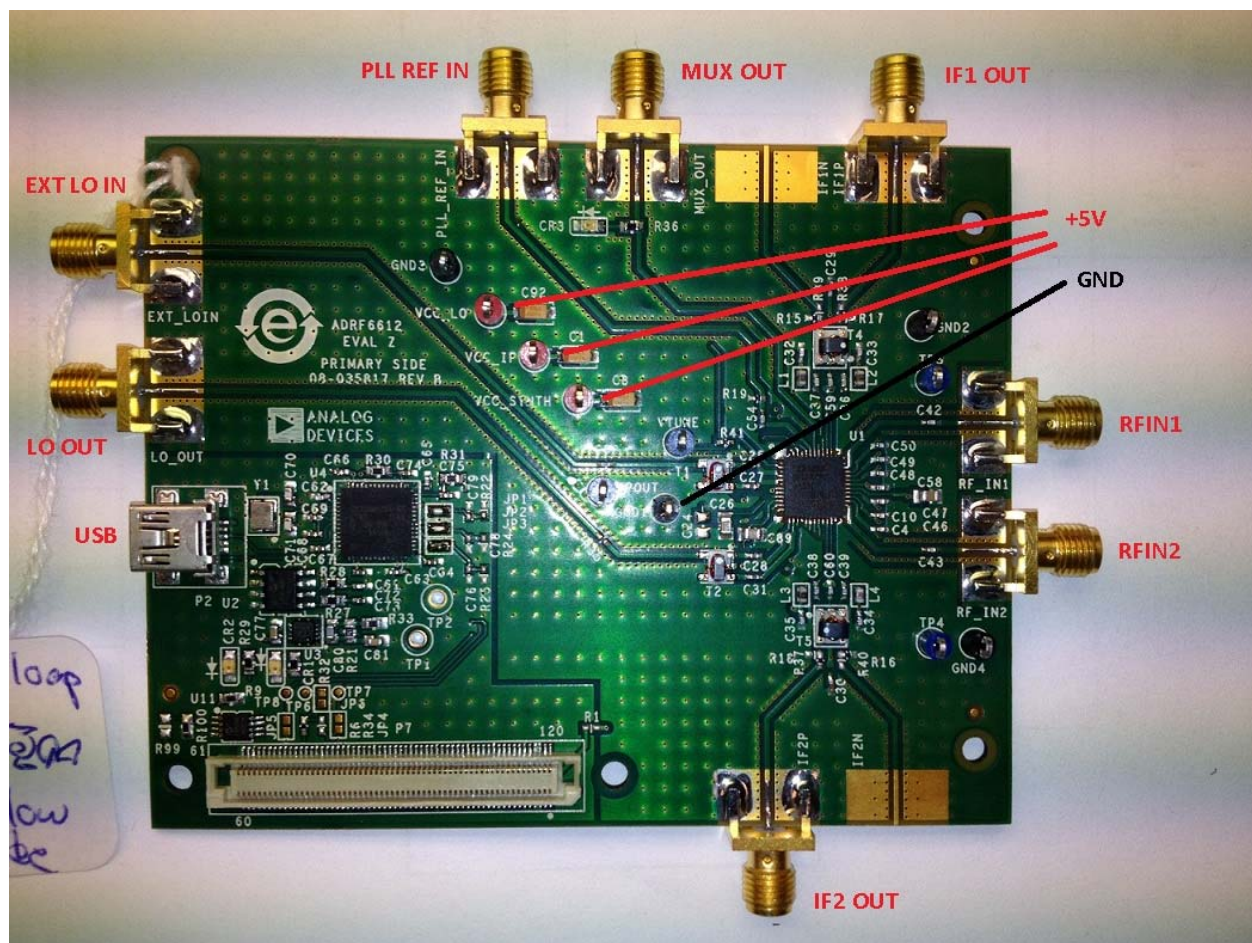


Figure 1. ADRF6612 Evaluation Board Showing Power Connections, RF, IF and USB Connections

The USB connector for software interface is located on the lower left side of the eval board. A standard USB cable, PC to mini USB is required to connect this evaluation board to a PC.

Software Directory Structure

The software comes in a .zip file. When extracted, a readme file describes how to install the driver for Windows XP, Vista, and Windows 7. This software is compatible with 32 bit and

64 bit systems. When the software is installed, the default installation directory should look like Figure 2.

The GUI itself loads its initial values from a .txt file located in the device_save_states subdirectory, as shown in Figure 3. These .txt files can be edited by the user in order to modify start up conditions.

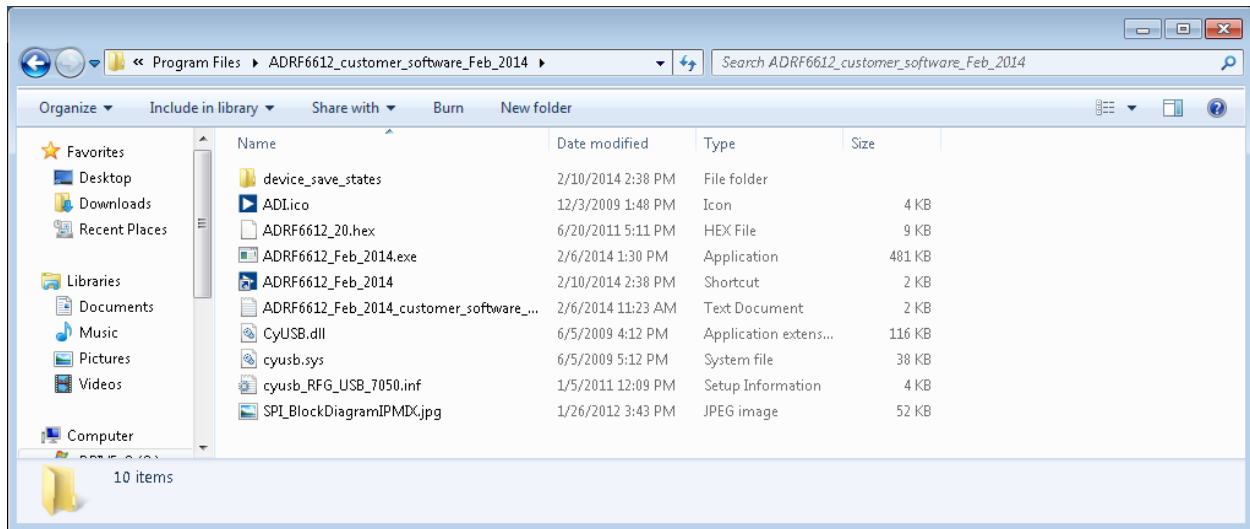


Figure 2. Default Installation Directory for ADRF6612 Software Installation

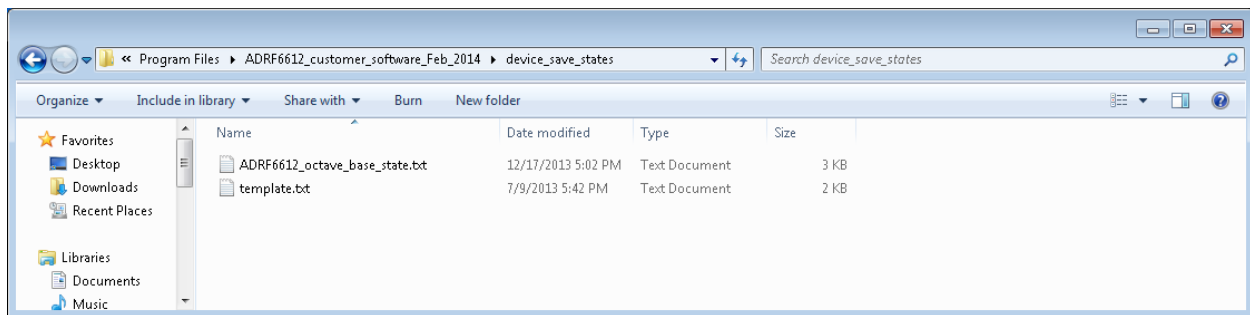


Figure 3. Device_Save_States Subdirectory

Software GUI Operation

When the software starts, it will load initial values from the .txt files described previously. As an example, when the Octave VCO software is started, the GUI should start up as shown in Figure 4. When the GUI starts, the ADRF6612 can be programmed by clicking on the INIT button in the lower right of the GUI. The default

values in the factory .txt files will program the ADRF6612 for an LO output of 1.6GHz, assuming that the user has applied an input reference clock of 160MHz.

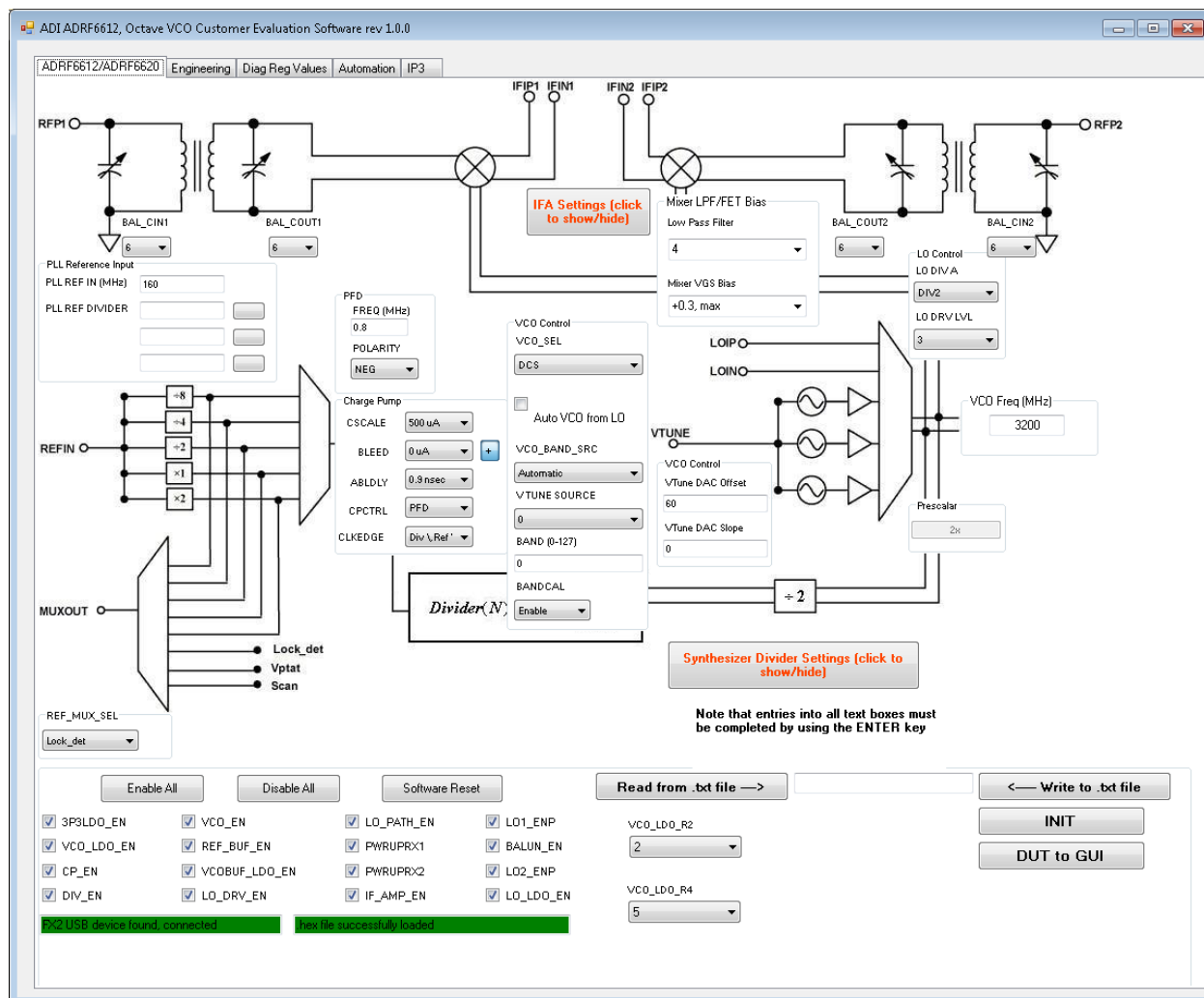


Figure 4. Software GUI for ADRF6612, note green indicators indicate proper USB connection

Critical Elements of Configuration

IMPORTANT – When entering data into any of the text fields in this GUI, the ENTER key must be pressed when the input is complete. This updates the variables in the software so that the ADRF6612 is programmed with these values during the next programming step (i.e., selecting a new value from any of the drop down boxes or clicking on the INIT button.

There are two critical areas when configuring the ADRF6612 via the GUI. They are;

1. Selecting the PLL input reference frequency and LO frequency. The most basic function of the integrated synthesizer is to convert the reference input frequency to the LO output frequency. The PLL reference input frequency and input divider settings can be set via the main GUI, with the controls in the center left. To set the PLL reference divider, type a number into one of the three boxes labeled PLL REF DIVIDER. Remember to then hit the ENTER key. The ADRF6612 will be

updated with this divider setting when the gray button is pressed which is to the right of the entered divider value. The LO frequency can be set by clicking on the Synthesizer Divider Settings

block in the center of the main GUI. Clicking on this box will bring up a dialog box as shown in Figure 5.

Figure 5. LO Frequency Dialog Box

In this dialog box, the user can also select the Integer or Fractional PLL modes. The LO output frequency is selected by entering this value in the LO OUT FREQ field, then hitting the carriage return. The INT, MOD, and FRAC values will automatically be calculated and shown in their respective fields. The ADRF6612 can then be programmed by clicking on the SET button. In addition to the LO Output Frequency, it is necessary for the user to select the LO output step size. This step size determines the MOD value and what the new LO output frequency will be when the FRAC value is incremented or decremented by 1. A step size multiplier value can be entered as well. When the INC or DEC buttons are clicked, the LO output frequency will be changed by a value equal to LO output step size * step size multiplier.

If the user wants to enter INT, FRAC, and MOD values directly, rather than by entering the LO frequency and LO out step size, they can enter

the values in the proper fields and then clicking on the INT, FRAC, or MOD buttons.

The Synthesizer dialog box can be hidden by clicking on the Synthesizer Divider Settings block in the main GUI again.

Critical factors when setting the input reference and LO output frequency include a low phase noise input reference, see datasheet for amplitude and frequency specifications. It's also important to select an output divider setting (LO_DIV_A) that allows the VCO to run in one of the bands that are selectable in the VCO_SEL drop down box.

2. Charge pump and VCO control options. These options are very complex best and are best determined at the factory. Analog Devices makes its best effort to provide optimal values for these options in the start-up .text files. If in doubt about these options, please

contact ADI for information on optimal settings.

Description and Nominal Range of Critical PLL Components

| Function | Description | Nom value | Optimal Range |
|----------------------|---|---|---------------|
| CSCALE | Charge pump drive current | 500uA | |
| BLEED | Offset current applied to charge pump. | +93.75uA | |
| ABDLY | Anti-backlash delay, used to optimize spurious performance | Ons | |
| CPCTRL | Source of charge pump control, set to PFD for all normal operation | internal | |
| CLKEDGE | Triggering edges of DIVIDER and PLL REF inputs of PFD. Edge is represent in GUI by / (rising) and \ (falling) | \\ | |
| VCO_SEL (Octave VCO) | Selects VCO band based on LO output frequency and output divider (LO_DIV_A) | Function of LO output frequency and output divider (LO_DIV_A) | |
| VCO_SEL (GSM VCO) | Selects either high band or low band VCO | Function of LO output frequency and output divider (LO_DIV_A) | |

| | | | |
|-----------------|--|--|--|
| VCO Band Source | Selects automatic or manual selection of multiple internal VCOs. Useful only for debugging. For normal operation should always be set to automatic mode. | | |
| VTUNE Source | Selects source for VTUNE input of VCO. For normal operation of VCO this is set to | | |

| | | | |
|---------|---|--|--|
| | external in which case the VTUNE source is the output of the charge pump. | | |
| Band | With VCO band source set to manual, this function allows the user to manually set the VCO band. Useful for debugging only. | | |
| Bandcal | In normal operation, with Bandcal enabled, the operational VCO performs an internal calibration when the INT, MOD, or FRAC values are written to. This calibration does not occur when this Bandcal function is disabled. | | |

Table 1. Critical Values for PLL Components

Mixer Optimization Functions

The ADRF6612 contains several programmable features which allow optimization of the mixer function. These include mixer core bias levels, bandwidth programmable input baluns, IF amplifier bias levels, and a programmable low pass filter on the IF outputs. These functions are all located at the top of the GUI. Use of these functions can help the user optimize mixer dynamic range. Misuse of these functions may be degraded.

| Function | Description | Nom value | Optimal Range |
|----------------|--|-----------|---------------|
| IFA Bias Level | Bias Current for IF amplifiers. Tradeoff for supply current vs. OIP3, may add up to 200ma of supply current. | | |
| Low Pass | Low pass filter | | |

| | | | |
|----------------|--|--|--|
| Filter | function on IF outputs | | |
| Mixer VGS Bias | Gate to source bias on mixer core for optimizing OIP3. | | |
| BAL_CIN | Tuning function for RF Input | | |
| BAL_COUT | Tuning function for RF Input | | |

Table 2. Critical values for Mixer Components

Other GUI Functions

The user can save and reload their own config files by entering a text file name (file name only, not necessary to include the .txt extension) in the field near the bottom of the GUI.

The DUT to GUI button allows the user to read back all of the register values currently programmed into the ADRF6612. When this button is clicked, all of the register values will appear in fields under engineering tab (top left of the GUI). This is a very useful function for debugging. When working with the ADI factory, it will be of great value to have these values on hand.