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Evaluating the HMC1190A Multiband Dual Channel Downconverter with Integrated PLL and VCO

FEATURES

- Edge mounted Subminiature Version A (SMA) connector provisions
- Easy connection to test equipment and other circuits
- On board LDOs create clean voltage levels for optimum functionality and reduce the necessary power supply connections to one
- Easy access to various power pins via jumpers
- Configurable external reference divider
- Configurable on-board external VCO via the VTUNE_EXT evaluation board connection port
- Auxiliary PLL-VCO outputs
- External VCO inputs

EVALUATION KIT CONTENTS

- HMC1190A evaluation board
- USB interface board
- 6-ft. cable from USB A male to USB B male
- Obtained by download from the HMC1190A evaluation board page: *HMC1190A Evaluation Kit User Guide* and evaluation board schematic and software

ADDITIONAL SYSTEM AND EQUIPMENT REQUIREMENTS

- DC power supply and dc cables
- Computer (PC) with standard USB port
- Operating system of Windows 2000®, Windows XP®, Windows Vista® or Windows 7®
- Microsoft .NET Framework 3.5 or higher (available for download from Microsoft Corporation)

GENERAL DESCRIPTION

This evaluation board user guide for the HMC1190A multiband, dual-channel downconverter with an integrated phase-locked loop (PLL) and voltage controlled oscillator (VCO), provides instructions to evaluate the functionality of the HMC1190A and is not intended to provide a complete description of the HMC1190A device. Consult the HMC1190A data sheet in conjunction with this user guide. Direct any questions not addressed in this user guide to Analog Devices, Inc., Technical Support.

HMC1190A EVALUATION BOARD

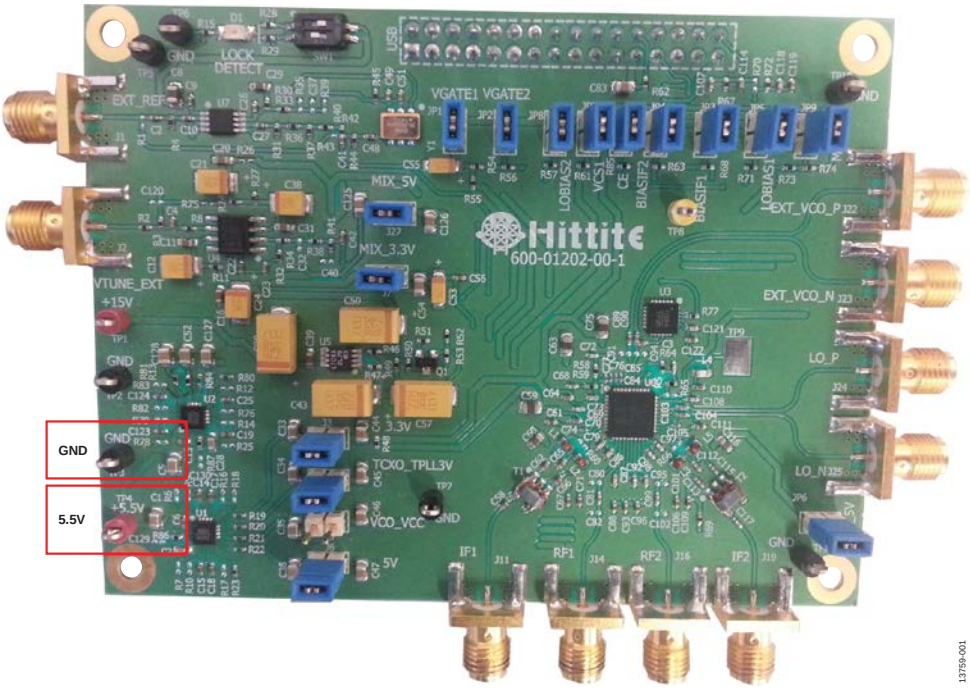

Figure 1.

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REVISION HISTORY

12/15—Revision 0: Initial Version

HARDWARE

HMC1190A DEVICE

The HMC1190A is a high linearity, compact, multiband, dual-channel downconverter with an integrated PLL and VCO. It is packaged in a 6 mm × 6 mm SMT QFN covering 0.7 GHz to 3.8 GHz. See Figure 2 for a simplified block diagram of the HMC1190A.

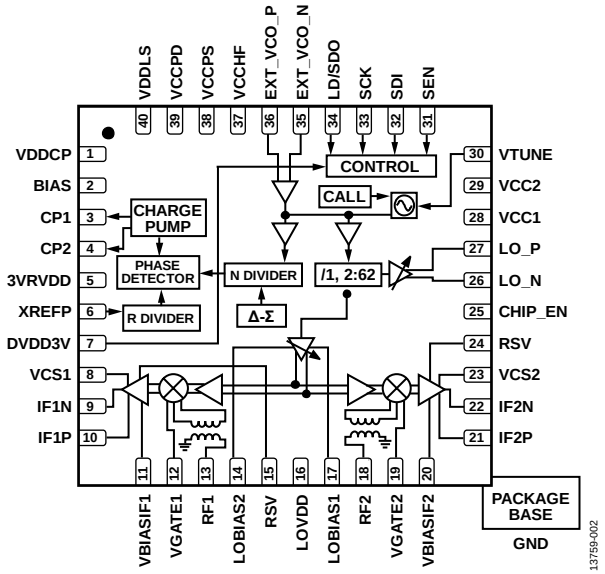

Figure 2. Simplified Block Diagram

Furthermore, it is important to review and adhere to the absolute maximum ratings (see Table 1) for the HMC1190A. Never exceed the absolute maximum ratings.

The HMC1190A evaluation kit is designed for use in a laboratory setting at ambient room temperature (25°C) and is not protected against moisture. The HMC1190A evaluation board is rated at −40°C to +85°C when the included heat sink and fan are assembled.

The USB interface board has an ESD rating of ±3000 V; however, individual components may have a lower rating (check the data sheet of the component product for its specific ESD rating). Use appropriate ESD procedures and precautionary measures when handling all electronic hardware.

Table 1. Absolute Maximum Ratings

Parameter	Rating
RF Input Power (VBIASIF1, VBIASIF2 = 5 V, LOVDD = 3.3 V)	20 dBm
VBIASIF1, VBIASIF2, LOVDD	6 V
VGATE1, VGATE2, VDDCP, VCS1, VCS2, LOVDD	−0.3 V to +5.5 V
3VRVDD, DVDD3V	−0.3 V to +3.6 V
Thermal Resistance, Channel to Ground Paddle	3.3°C/W
Channel Temperature, Maximum	150°C
Storage Temperature	−65°C to +150°C
Operating Temperature	−40°C to +85°C
ESD Sensitivity	
Human Body Model (HBM)	Class 1B
FICDM	Class IV

The pin function descriptions are listed in Table 2; additional information about the HMC1190A pins is available in the HMC1190A data sheet.

Table 2. HMC1190A Pin Function Descriptions

Pin No.	Mnemonic	Description
1	VDDCP	Power Supply for Charge Pump Analog Section.
2	BIAS	External Bypass Decoupling for Precision Bias Circuits.
3, 4	CP1, CP2	Charge Pump Outputs.
5	3VRVDD	Reference Supply, 3.3 V Nominal.
6	XREFP	Reference Input. The dc bias is generated internally. Normally, this pin is ac-coupled externally.
7	DVDD3V	DC Power Supply for Digital (CMOS) Circuitry, 3.3 V Nominal.
8, 23	VCS1, VCS2	Bias Control for IF Amplifiers. Connect to these pins to a 5 V supply through 590 Ω resistors. See the HMC1190A data sheet for the proper resistor values to adjust the IF amplifier current.
9, 10, 21, 22	IF1N, IF1P, IF2P, IF2N	Differential IF Outputs. Connect these pins to a 5 V supply through choke inductors. See the evaluation board schematic available on the HMC1190A evaluation board page.
11, 20	VBIASIF1, VBIAS2	Supply Voltage for IF Amplifier Bias Circuits. Connect these pins to a 5 V supply through filtering.
12, 19	VGATE1, VGATE2	Bias Mixer Cores. Set these pins from 4.8 V to 5 V for the operating frequency band.
13, 18	RF1, RF2	RF Input of the Mixer. These pins are internally matched to 50 Ω. RF input pins require off-chip dc blocking capacitors. See the evaluation board schematic available on the HMC1190A evaluation board page.
14, 17	LOBIAS2, LOBIAS1	Bias Control for Local Oscillator Amplifiers. Connect these pins to a 5 V supply through 270 Ω resistors. See the HMC1190A data sheet for the proper values of the resistors to adjust the LO amplifier current.
15, 24	RSV	Reserved. This pin is reserved for internal use; leave this pin floating.
16	LOVDD	3.3 V Bias Supply for Local Oscillator Drive Stages. Refer to the HMC1190A data sheet for the appropriate filtering and bias generation information.
25	CHIP_EN	Chip Enable. Connect this pin to logic high for normal operation.
26	LO_N	Negative Local Oscillator Output. LO_N is used for single-ended, differential, or dual output mode.
27	LO_P	Positive Local Oscillator Output. LO_P is used for differential or dual output mode only. Whereas it can drive a separate load from LO_N, it cannot be used when LO_N is disabled.
28	VCC1	VCO Analog Supply1, 5 V Nominal.
29	VCC2	VCO Analog Supply 2, 5 V Nominal.
30	VTUNE	VCO Varactor. VTUNE is the tuning port input.
31	SEN	PLL Serial Port Enable (CMOS) Logic Input.
32	SDI	PLL Serial Port Data (CMOS) Logic Input.
33	SCK	PLL Serial Port Clock (CMOS) Logic Input.
34	LD/SDO	Lock Detect/Serial Data or General-Purpose (CMOS) Logic Output (GPO). This is a multifunction pin.
35	EXT_VCO_N	External VCO Negative Input.
36	EXT_VCO_P	External VCO Positive Input.
37	VCCHF	Analog Supply, 3.3 V Nominal.
38	VCCPS	Analog Supply, Prescaler, 3.3 V Nominal.
39	VCCPD	Analog Supply, Phase Detector, 3.3 V Nominal.
40	VDDLS	Analog Supply, Charge Pump, 5 V Nominal.

HARDWARE SETUP

To conduct testing, the HMC1190A evaluation board input/output (I/O) pins must be controlled. The evaluation board is supplied with an I/O interface connector, which can be connected to a controller unit that interfaces the HMC1190A evaluation board to a PC. The basic test setup is shown in Figure 3.

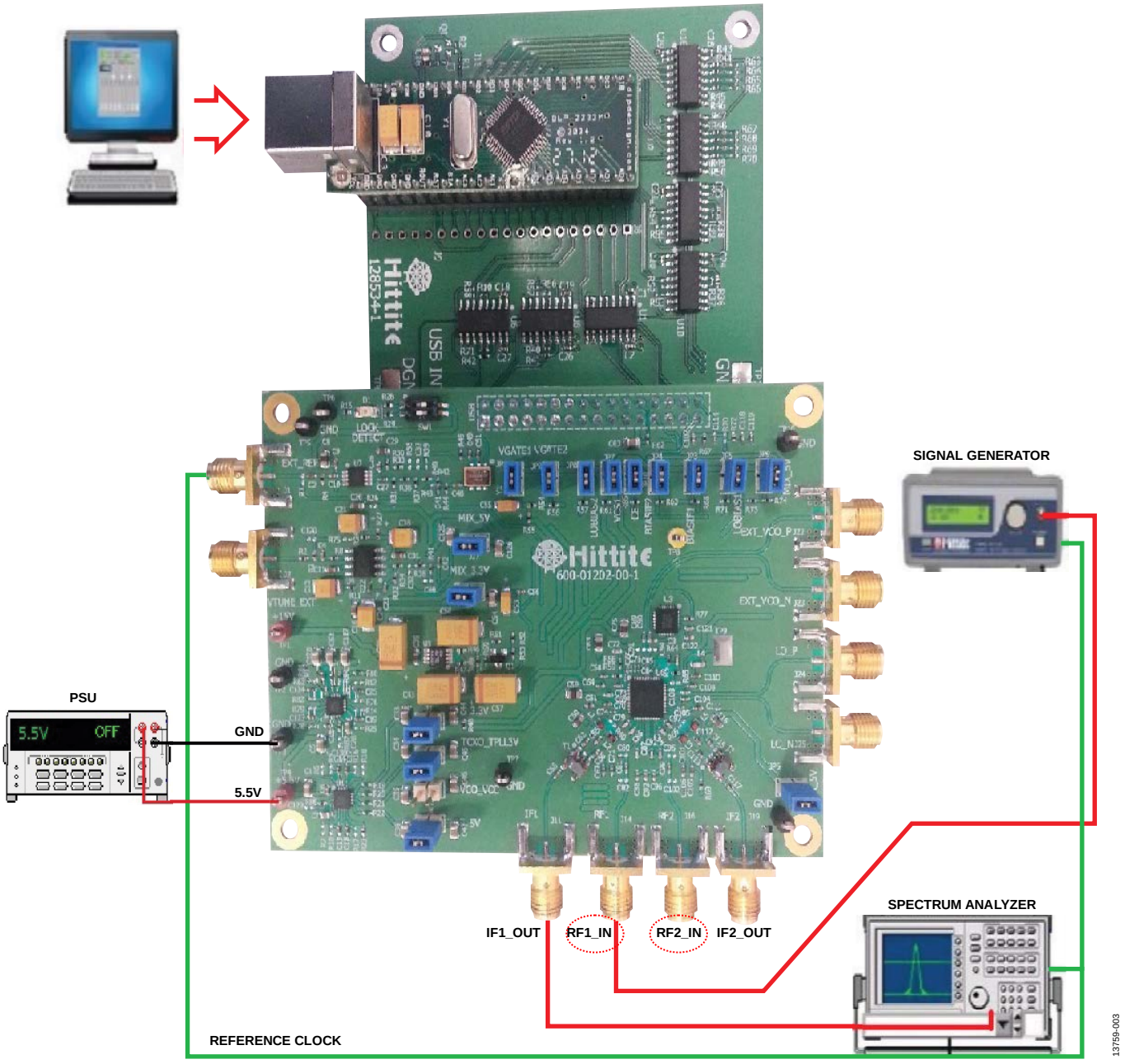

Figure 3. Test Setup for the HMC1190A Evaluation Board

HARDWARE TEST SETUP

Use the following steps to setup the HMC1190A evaluation board:

1. Terminate with 50 Ω all RF outputs or inputs on the evaluation board that are not going to be used.
   a. Do not terminate the VTUNE_EXT (J2) connector on the evaluation board.
2. Connect the HMC1190A evaluation board to the USB interface board.
3. Connect the USB cable PC interface to the USB interface board. Note that the USB interface board does not require an additional supply; the USB connection to the PC is sufficient.
4. Connect the GND pins on the evaluation board to the common ground.
5. Apply 5.5 V through the 5.5 V pin (TP4 test point).
6. Remove the VCO_VCC (J5) jumper to disable the on-board VCO.
7. If JP1 and JP2 jumpers are placed, VGATE is set to 5 V. To change the VGATE voltage, remove the JP1 and JP2 jumpers and apply 4.8 V to 5 V to the VGATE test point, as shown in Figure 4.
8. Connect an external reference input (10 dB maximum) EXT_REF (J1) RF input connector, if needed. Note that there is a 50 MHz controllable TCXO (Y1) and tiny PLL (U7) on the evaluation board that when an external reference is applied, U7 uses that signal as a reference and locks the frequency of Y1 to external inputs.
9. Adjust SW1 according to the truth table in Table 3 (also provided in the *HMC1190 Evaluation Board Schematic* that is downloadable from the HMC1190A evaluation board page).
   a. Note that when using an external frequency of 10 MHz, set SW1 to a divide-by-5 position, shown in Table 3. This setting was used to take the measurements of the HMC1190A evaluation board with both U7 and Y1 active.
   b. If the user wants to use an external reference and disable the TXCO, the following changes are required:
      i. Remove C2, R42, and C48.
      ii. Place 0 Ω resistors to R1 and R43.

Table 3. Divider Control

Divide By Position	D1	D0
Power-Down	0	0
Divide by 1	0	1
Divide by 5	1	0
Divide by 10	1	1

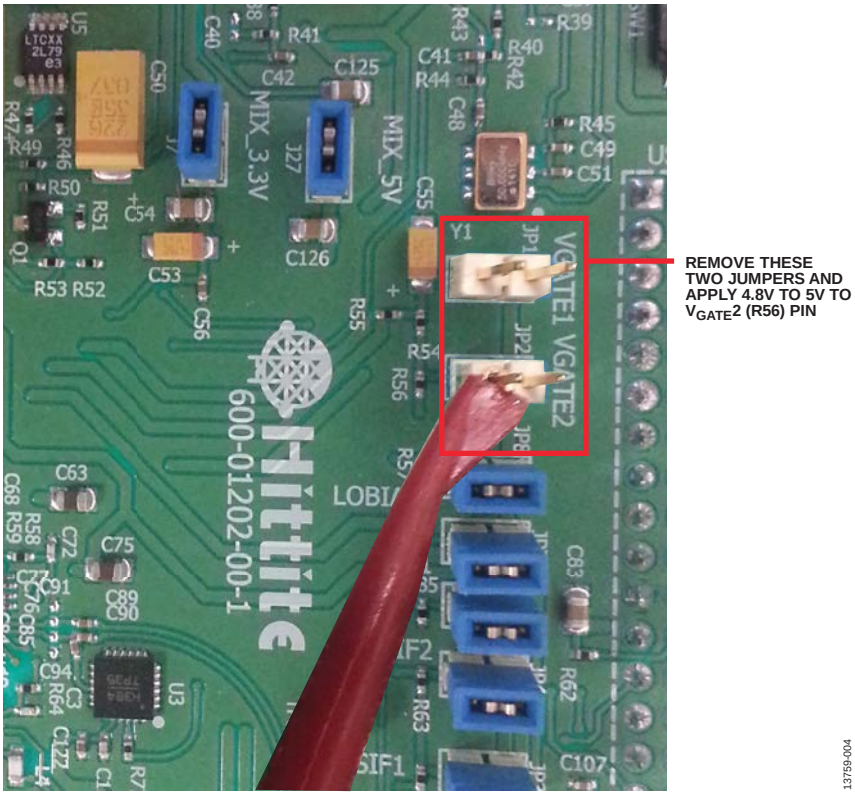

Figure 4. Test Setup

SOFTWARE

The software for the HMC1190A evaluation board that is available by download from the HMC1190A evaluation board page enables communication between a PC and the PLL. It also enables the user to observe the full functionality and performance of the HMC1190A device.

SOFTWARE INSTALLATION

To install the software, administrative privileges are required on the computer that is to receive the downloads.

To install the PLL evaluation software, follow these instructions:

1. After logging in with administrative privileges for the computer, download the PLL evaluation software, named **HMC Ultra Wideband Eval Software Installer V1040.exe**.
2. Double-click **HMC Ultra Wideband Eval Software Installer V1040.exe** from your PC.
3. Follow the installation wizard commands.
4. After installation is complete, you no longer need to be logged in as the administrator for the computer.

Uninstalling PLL Evaluation Software

1. To uninstall the software, log in with administrative privileges for the computer.
2. Double-click **HMC Ultra Wideband Eval Software Installer V1040.exe** from your PC and follow the wizard uninstall commands.
3. After the uninstall is complete, you no longer need to be logged in as the administrator for the computer.

USING THE EVALUATION SOFTWARE

1. Following installation of the PLL evaluation software, run the program on your PC from **Start** > **All Programs**.
2. Choose **HMC1190LP6GE** from the GUI dropdown menu shown in Figure 5 and click **Done**.

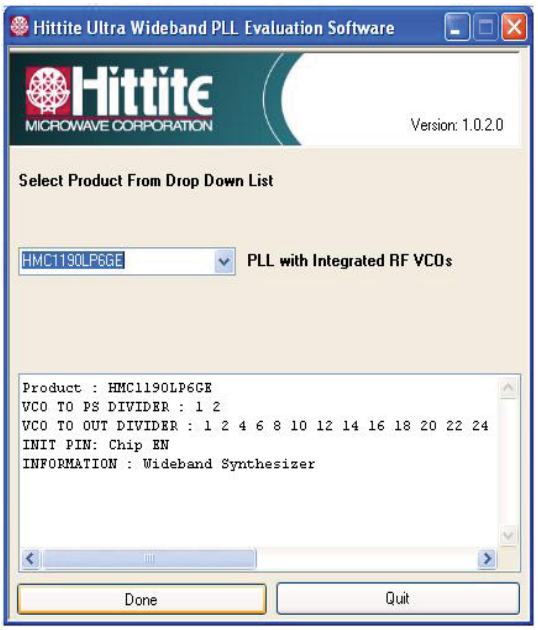

Figure 5. PLL Evaluation Software Introduction GUI

The PLL evaluation main GUI appears, as shown in Figure 6.

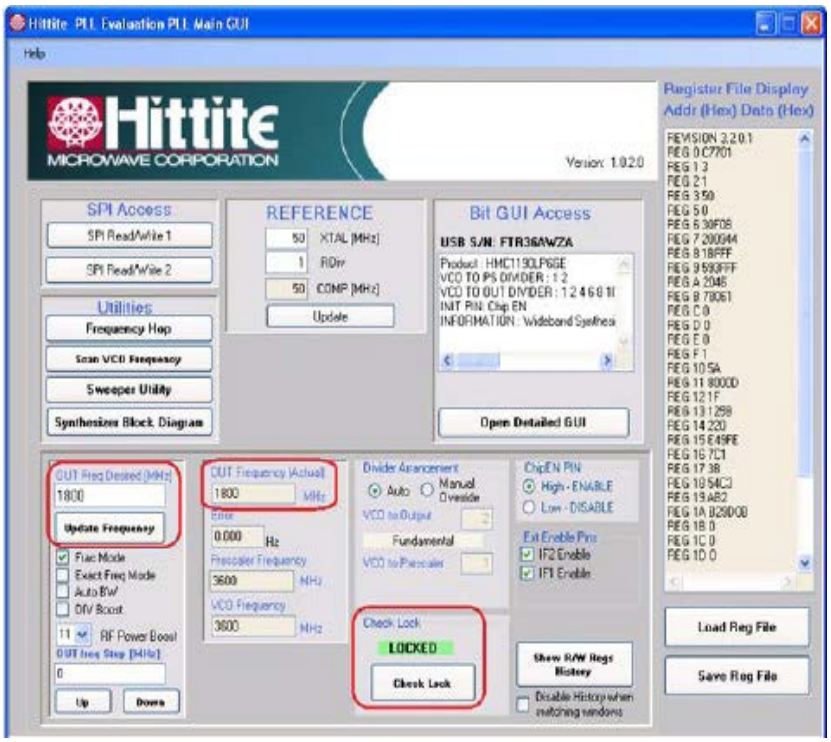

Figure 6. PLL Evaluation Software Main GUI

3. Click the **Load Reg File** button to load the necessary register file that is downloaded with the software. The location of these register files are under **Computer > C Drive > Program Files (x86) > Hittite Microwave Corp >HMC Ultra WB PLLVCO Evaluation Software >Register File Settings > HMC1190LP6GE.**
   a. For fractional mode operation only, select the **Frac_mix** file.
4. To activate **ChipEN**, select the **High – ENABLE** radio button in the **ChipEN** section of the GUI.
5. From the **Ext Enable Pins** section of the GUI, check both **IF2 Enable** and **IF1 Enable** boxes. This enables both IF outputs of the HMC1190A.
6. Enter the desired LO frequency in the **OUT Freq Desired[MHz]** field.
   a. Click **Update Frequency**. This sets the **OUT Frequency (Actual)** field to the values entered in the **OUT Freq Desired[MHz]** field.
   b. Click the **Check Lock** button to lock the PLL. This portion of the GUI indicates **LOCKED** when the PLL is at lock.

To observe IF output signals

1. Apply a signal to the RF input port(s) and monitor the IF output(s) for output signal using an analyzer.
2. Click the **Load Reg File** button that is flashing in the lower right corner of the display window.
3. Navigate to and select one of the register setting files located in **C:\Program Files\Hittite Microwave Corp\Hittite PLL Eval Software\Register Setting Files**.
4. Select the file according to the desired mode of operation, fractional or integer.
5. The **Check Lock** section of the GUI now displays the green **LOCKED** indicator.

For additional information and instructions for operating, programming, and debugging the PLL and its software, consult the following sources:

- *PLLs with Integrated VCO—RF Applications Product and Operating Guide* available on the HMC1190A product page.
- *User Manual Software and Hardware Installation for All Hittite PLLs and PLL with Integrated VCO Products* available on the HMC1190A evaluation board page.

For additional technical support, contact Analog Devices, Inc., global Technical Support.

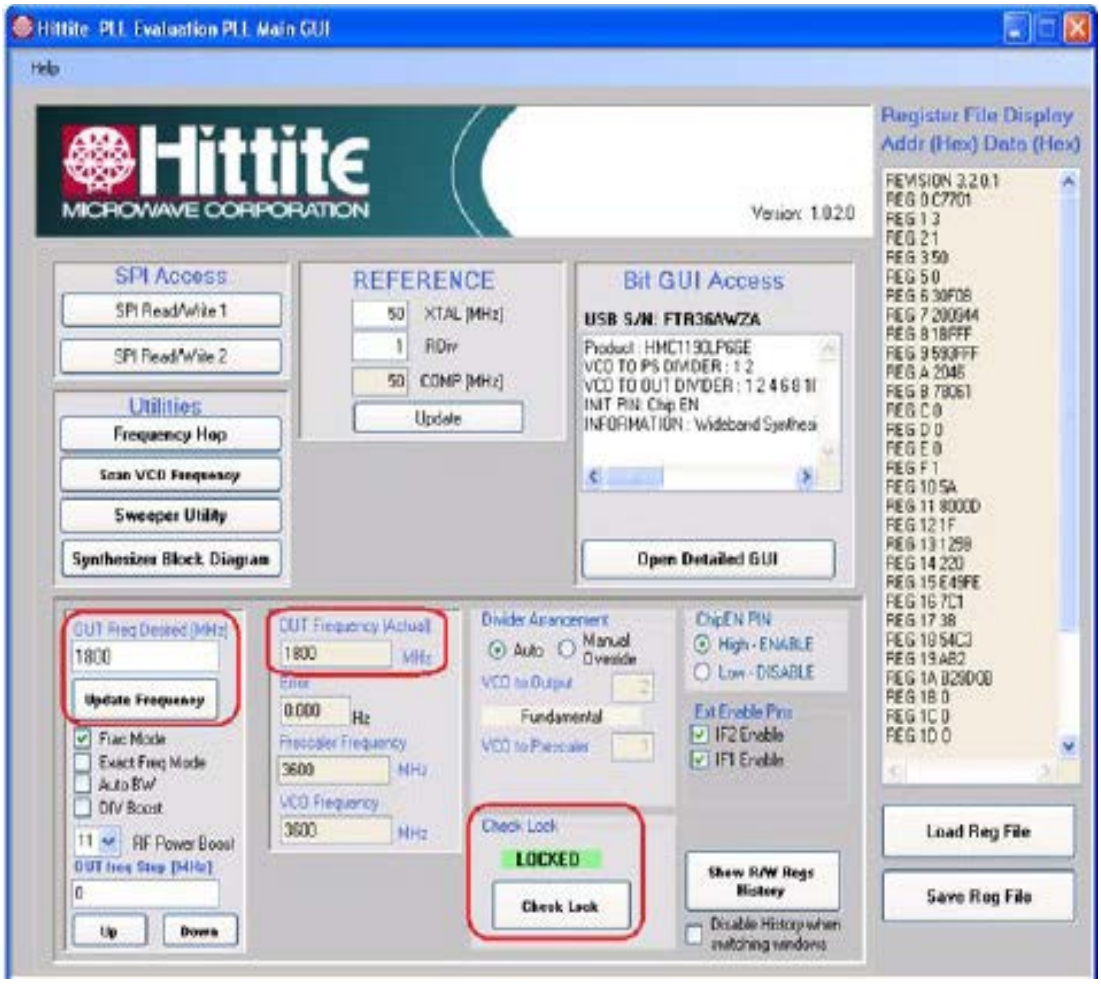

Figure 7. Setting LO Frequency

NOTES

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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