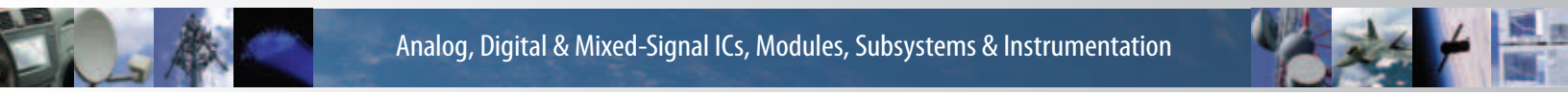
Clocks & Timing ICs Evaluation Kit



User Manual

Software & Hardware Installation

For All Hittite Clock Distribution & Generator Products

Hittite MICROWAVE CORPORATION

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1. Introduction

This document provides basic instructions for getting started with Hittite Clocks & Timing ICs Evaluation Kit. Hittite Clocks & Timing ICs Evaluation Kit consists of hardware and software that allows users to control Hittite Clocks & Timing ICs evaluation boards and observe and test full functionality and performance of Hittite Clocks & Timing ICs.

Note: For most up-to-date software download and information please visit www.hittite.com.

2. Package Contents

2.1 Hardware

Verify that all the items listed in Table 1 are included in the shipment.

Item	Quantity
PLL Evaluation Board	1
USB Interface Board	1
6' USB A Male to USB B Male Cable	1
CD ROM (Contains User Manual and software)	1

Table 1: Packing List

2.2 Software

1. Hittite Clocks & Timing ICs Eval Software
   - Enables users to communicate with and control Hittite Clocks & Timing ICs with their PCs, and observe full functionality and performance of all Hittite Clocks & Timing ICs
2. Hittite PLL Design Software
   - Is a powerful tool that can aid in the design and performance analysis of all Hittite's PLLs and Clocks & Timing ICs

3. Operating Environment

The Clocks & Timing ICs Evaluation Kit is designed for use in a laboratory setting at ambient room temperature (25°C) and is not protected against moisture. The USB Interface Board has an ESD rating of +/-3000V, however the HMC Clocks & Timing ICs may have a lower rating (check the product's datasheet for its specific ESD rating). Use appropriate ESD procedures and precautionary measures when handling all electronic hardware.

4. Setup and Installation

4.1 User Provided Equipment

In addition to the items provided in the Clocks & Timing ICs Evaluation Kit, the user must provide the following equipment to communicate with the PLL under test.

- DC Power Supply
- DC Cables
- Computer (PC) with Standard USB port
- 10 MHz Reference (Optional)
- For detailed specifications regarding operating system and software requirements please visit www.hittite.com.

4.2 Software Installation

Note: Installing/Uninstalling the Hittite Clocks & Timing ICs Evaluation Software & Hittite PLL Design Software requires administrative privileges

1. Hittite Clocks & Timing ICs Evaluation Software Installation

   To install/uninstall Hittite Clocks & Timing ICs Evaluation Software double click on "Hittite Clocks & Timing ICs Eval Software Installer.exe" that was downloaded from www.hittite.com, or provided with a CD, and follow the installation/uninstallation wizard.

2. Hittite PLL Design Software Installation

   To install/uninstall Hittite PLL Design Software, log in as administrator and right click on "Hittite PLL Design Software Installer.exe" that was downloaded from www.hittite.com, or provided with a CD, and select 'Run as Administrator,' and follow the installation/uninstallation wizard.

4.3 Hardware Setup

Setup all hardware according to Figure 1.

1. Setup the evaluation board

   a. Set the DC power supply to +5.5V and connect to the evaluation board. Some evaluation boards require a second higher power supply to operate. The evaluation board power connections are all labelled with the required voltage.

   b. Connect Phase Noise Test Set or Spectrum Analyzer to the evaluation board through an RF cable.

2. Plug the header connector of the USB Interface board into the header connector of the evaluation board or use the ribbon cable (provided with some evaluation kits).

3. Connect the USB Interface Board to the USB port of the PC through the USB Cable provided with the kit.

4. The HMC1033/HMC1035 evaluation board includes a precision PLL which generates a 50 MHz clock locked to an externally supplied 10 MHz reference. The PLL design is an HMC1031 phase/frequency detector, passive loop filter and a low noise 50 MHz VCXO. The PLL is normally, or

default upon shipping, set to lock on to a 10 MHz reference feed into “REF IN”. A 5 MHz input reference can be used if D1, D0 is reconfigured to “1,1”, or 50 MHz if D1, D0 is reconfigured to “0,1”. The “REF IN” would normally have a +/-50 ppm tolerance which falls within the VCXO pull range. Although not recommended, the HMC1033/HMC1035 Eval Board can be operated without supplying an external reference, and the PLL will pull the VCXO to about 49.992 MHz, or 180 ppm low. Alternatively, an external reference can be feed into the HMC1033/HMC1035 evaluation board which requires removing C44,C35, R32 and J6, the TPLL/TCXO Jumper, and placing a 0 Ohm resistor in the R20 and R36 locations. See Evaluation PCB Schematic for more details. The HMC1032/HMC1034 eval boards have a 50 MHz crystal oscillator and do not require an external source.

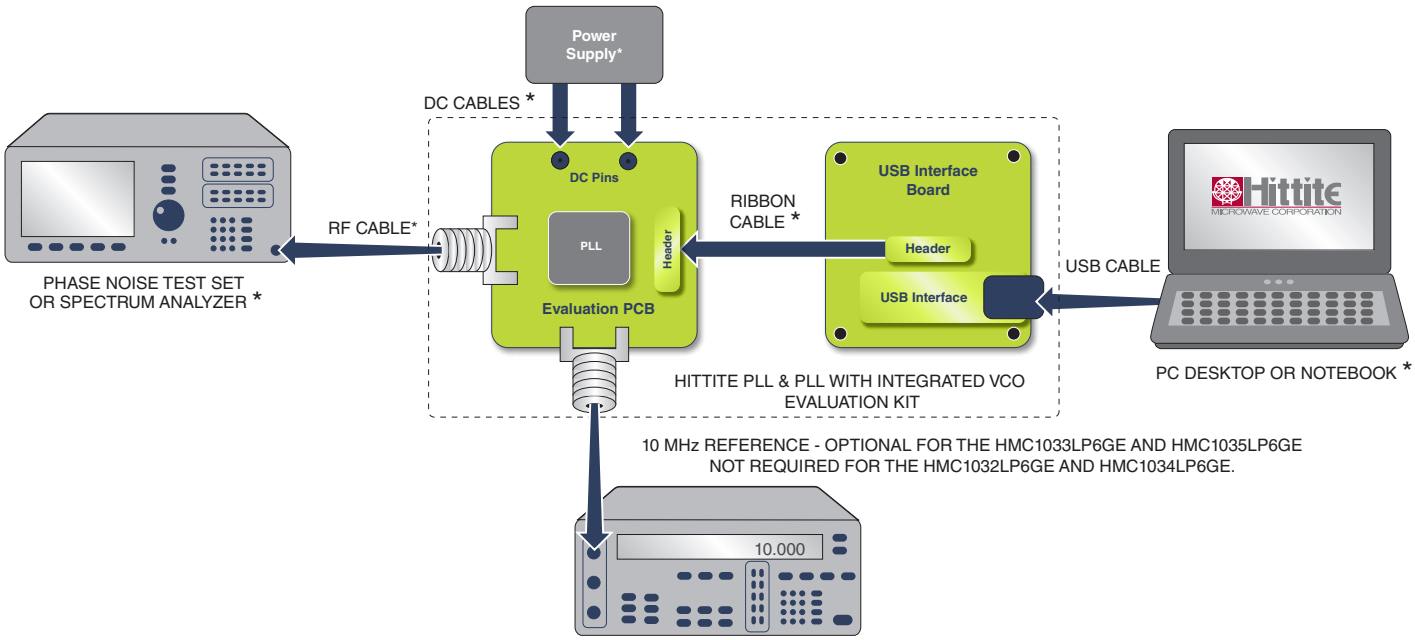

Figure 1. Hardware Setup

**Device must be provided by user. Please note that some evaluation boards connect directly to the USB board without a ribbon cable.*

4.4 Launch Hittite Clocks & Timing ICs Evaluation Software

1. Launch the “Hittite Clocks & Timing ICs Eval Software” file from Start, All Program Files menu on your PC, or from your Desktop. Hittite Clocks & Timing ICs Evaluation Software Selection Window shown in Figure 2 will appear. From the drop down list, select the part under test.

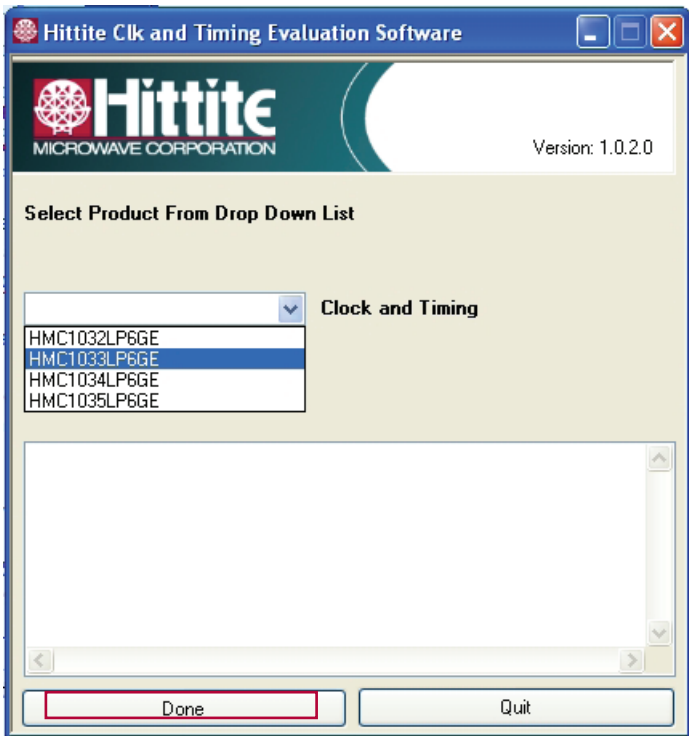

Figure 2. Hittite PLL Product Selection Window

2. Press "Done", the Hittite PLL Evaluation Software GUI shown in Figure 3 will appear.

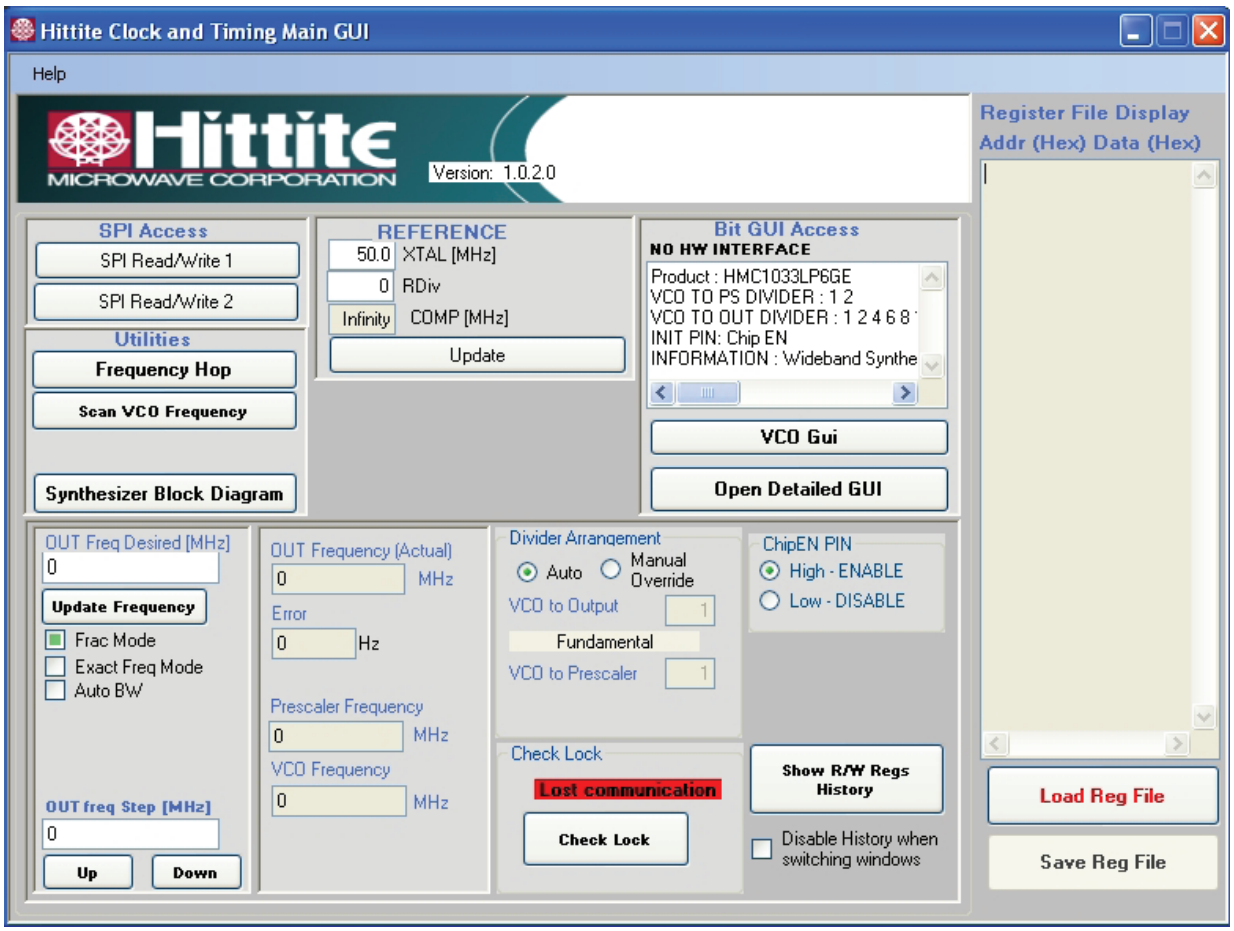

Figure 3. Clocks & Timing ICs Main Control GUI

3. Load the register file.

    a. Press the "Load Reg File" button flashing in the lower right corner of the display. Navigate to register setting files corresponding to the device under test.

    b. Select the file according to the desired mode of operation; Fractional or Integer, LVDS or LVPECL, Power Priority or Performance Priority.

    c. The Check Lock section should now display the green 'LOCKED' display indicator.

4. Consult the Product Operation Guide available on www.hittite.com or provided on the CD-ROM for detailed instructions on PLL programming and debugging.

5. PLL Programming

5.1 Frequency Selection

To program the PLL to a desired frequency, enter the frequency in the “OUT Freq Desired” box and press the “Update Frequency” button (Reference divider and VCO divider registers are only updated when the “Update Frequency” button is pressed).

The “OUT Freq (Actual)” box displays the frequency that the PLL is actually generating. The “Error” box displays the frequency error between the desired and actual frequencies.

5.2 External or Internal Fixed Dividers

Often, there will be dividers and/or doublers used between the VCO and the PLL’s prescaler, and/or between the VCO and the measurement equipment. For the GUI to calculate the correct N for the PLL, it needs to know the ratio between the “OUT Freq Desired” and the prescaler input. For standard Hittite parts, in “Auto” mode, the SW determines the value based on the selected part number, and the programmed register settings. If the user is using external dividers or multipliers, however, the “Manual Override” should be selected, and the frequency relationship between the VCO and output, and VCO and Prescaler need to be specified by the user.

A block diagram of the PLL system is available by clicking on the “Synthesizer Block Diagram” button on the Clocks & Timing ICs Main Control GUI (See Figure 4). The diagram may not be exactly as shown depending on the device and configuration. Some PLLs may have a fixed divider internal to the PLL in the loop.

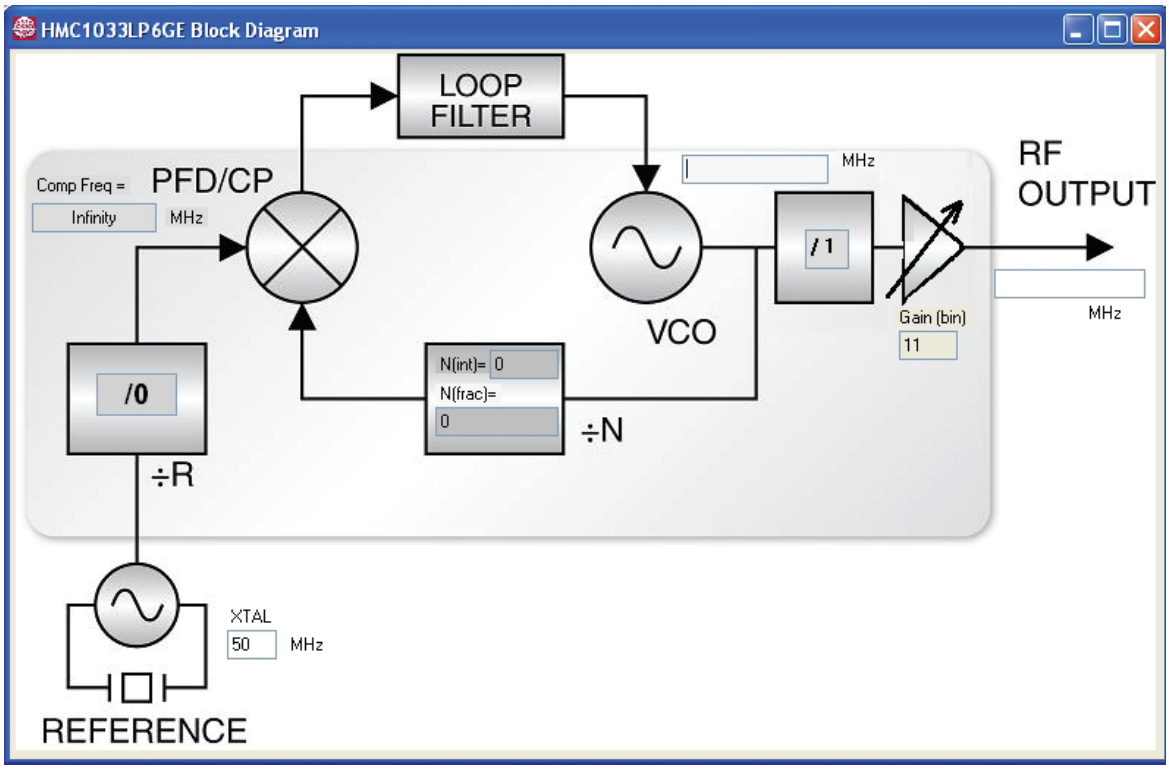

Figure 4. Synthesizer Block Diagram

For technical application questions: Phone: 978-250-3343 or timing@hittite.com

5.3 Frequency Step in Channel Size

To step up/down in frequency, enter the desired frequency step size in MHz in the “OUT Freq Step” window and press the “Up”/”Down” button.

5.4 Fractional Mode

To operate in Fractional Mode, check the “Frac Mode” box. It is recommended to run the provided register file for the desired mode (Fractional or Integer) for best spectral performance as there are other registers that need configuring when changing between these two modes.

5.5 Check Lock

The “LOCKED”/”UNLOCKED” indicator is updated every time the “Update Frequency” button is pressed. You can confirm the locked state at any time by pressing the “Check Lock” button.

5.6 Frequency Hopping

When performing settling time measurements, the PLL can also be configured to hop between two specified frequencies entered in the “Frequency Hop” window. The “Dwell Time” is not well calibrated and only offers a crude time estimation. It should not be relied upon for accurate hop timing.

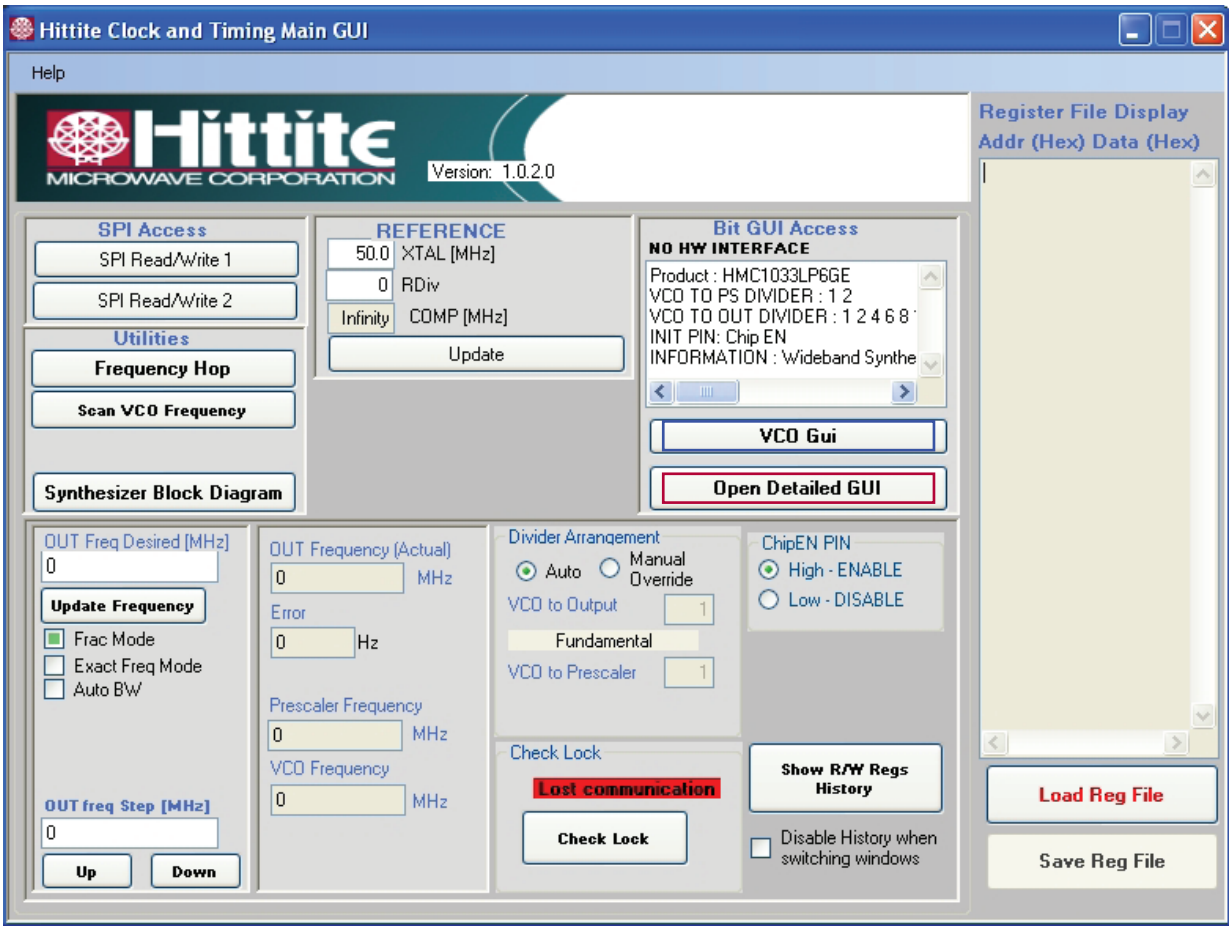

Figure 5. Clocks & Timing ICs Main Control GUI

5.7 Register Read/Write

The SPI Read/Write buttons located in the "Open Detailed GUI" and "VCO GUI" provide direct register read/write capability in Hex. These are debug tools. To observe all the detailed register states, click the "Open Detailed GUI" button and the window in Figure 5 will open or click the "VCO GUI" button and the window in Figure 6 will open. Each register in the "Open Detailed GUI" section is controlled by its own "Read" and "Write" button in its sub-panel. Changes made by clicking on any check box are only implemented upon clicking that register's "Write" button. Similarly a panel is only updated after the "Read" button is clicked. The registers in the "VCO GUI" are automatically updated when new data is entered.

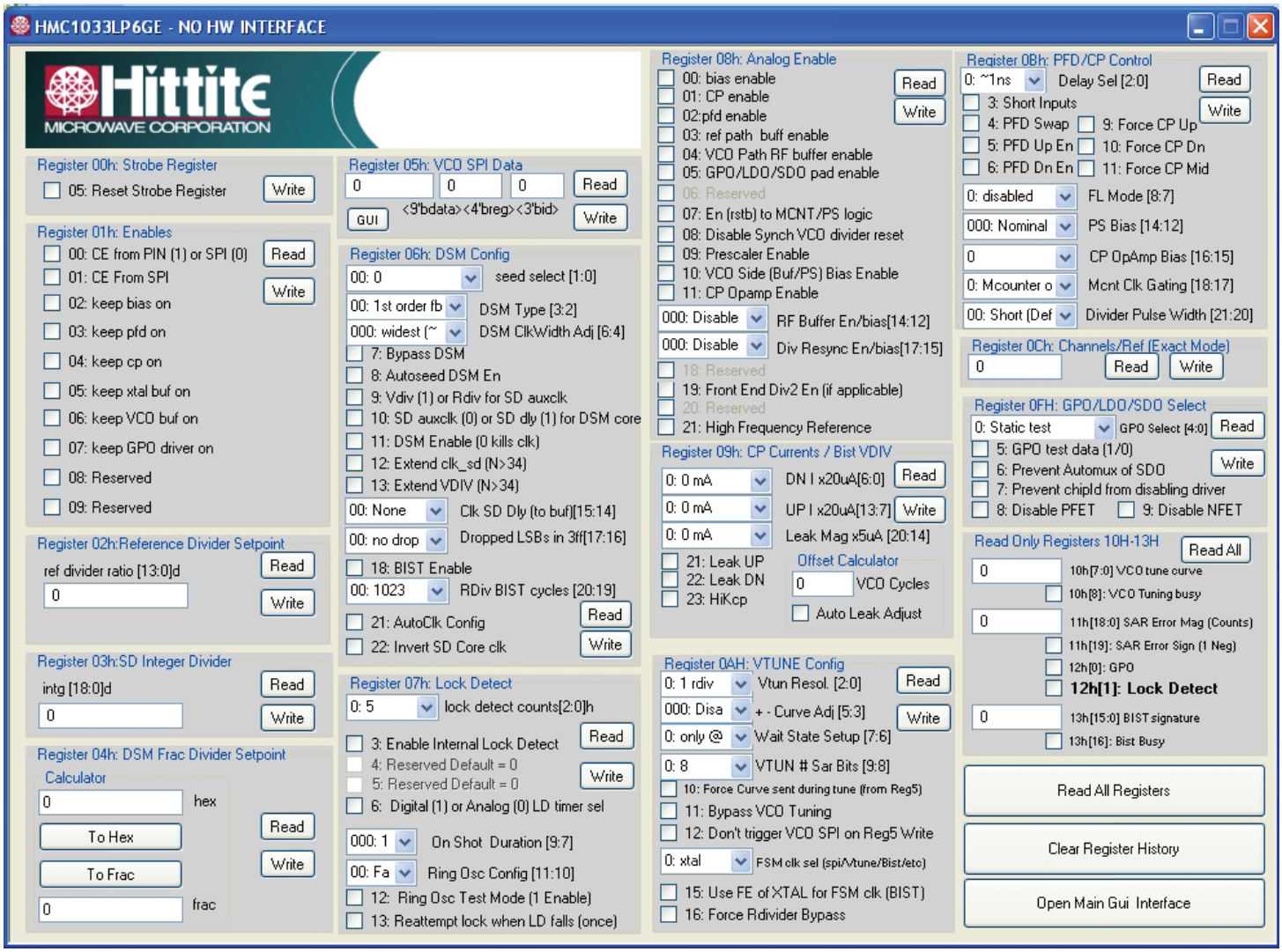

Figure 6. Typical PLL GUI (varies by PLL model)

5.8 PLL Configuration Save/Load

To save a PLL configuration to a file, use the “Save Reg File” button in the bottom right corner of the “PLL Main Control GUI”. This allows you to instantly recall the desired PLL state by using the “Load Reg File”.

Saving a “Register” file for Clocks & Timing IC devices does not capture the “Mode” state (fo/2, fo, 2fo).

Further instructions on the operation can be found in the Evaluation Board Operating Guide available on www.hittite.com or on the CD-ROM.

5.9 VCO GUI

The VCO GUI section selects the Power or Performance Priority Mode, LVPECL or LVDS output amplitude - or other output amplitudes by selecting the Output Signaling, turns on/off the OUT_P and OUT_N, sets the MUTE on/off when unlocked and sets the Internal or External Termination. See the applicable datasheet for more details on these options.

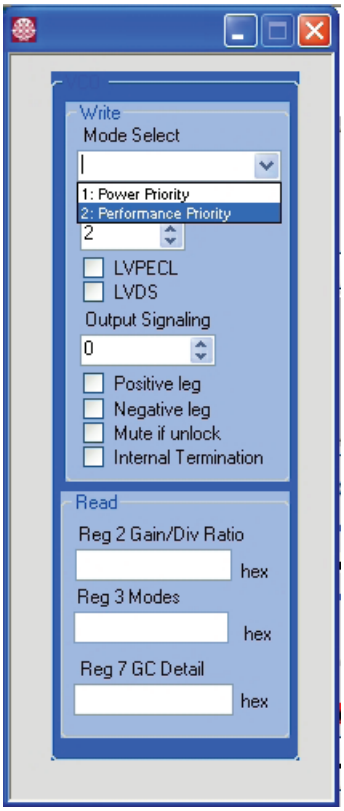

Figure 7. VCO GUI

6. Hittite PLL Design Tool

Hittite PLL Design Software is a powerful tool that can be used to model and analyze performance of Hittite's PLLs. The tool can be used to:

- Model Integer and Fractional-N PLL performance
- Design loop filter component values
- Model and analyze individual and composite noise contributions
- Model frequency and phase settling time

The PLL Design & Analysis Tool uses MathWorks' MCR (Matlab Compiler Runtime) Library which is included in the installation package. Hittite Microwave Corporation's limited rights to the deployment of MCR are governed by a license agreement between Hittite Microwave Corporation and MathWorks.

6.1 Using the Hittite PLL Design & Analysis Tool

1. The Hittite PLL Design tool requires parameters to be initialized before running a simulation. From the main software window select File, Open and select the appropriate .mat or .pll file.
2. Enter/modify design parameters to tailor the simulation to your requirements (VCO frequency, PFD frequency, Loop BW, Phase Margin, etc.). Press the 'Compute' button in the lower right corner to graphically display simulated performance data.
3. Design an optimal loop filter by clicking on the Filter Design button to open the Loop Filter Design dialog. The Loop Filter Design tool provides various loop filter topology options and configurations.
4. Edit individual noise contributors ranging from crystal oscillator, reference path, phase detector, VCO, RF divider, operational amplifier, delta-sigma modulator, etc. by clicking on Noise Contributors button.
    a. Model and simulate the effect of VCO gain variation across VCO tuning range.
    b. Model and analyze the effect of power supply noise on the loop performance from various PLL components.
5. View graphical displays of various modelled performance metrics by choosing the desired category from the Select Plot Type drop down menu.
6. Observe modelled loop parameters summary from Loop Parameters display.
7. Generate detailed HTML reports outlining simulation setup and resulting performance by selecting Generate Reports from the Tools menu.

7. Technical Support

Please contact pll@hittite.com for any questions. Hittite Microwave provides local direct support in many areas around the world. Please see the "Contact Us" page at www.hittite.com.

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