



**ANALOG
DEVICES**

Evaluation Board for ADF4360-7 Integrated PLL & VCO Frequency Synthesizer

EVAL-ADF4360-7EB1

FEATURES

- Self contained board for generating RF frequencies.
- Flexibility for reference input, output frequency, PFD frequency and loop bandwidth.
- Flexibility for changing external inductor to allow different VCO output frequency ranges.
- Accompanying software allows complete control of synthesizer functions from PC.
- Battery operated: 9V supplies.
- Typical phase noise performance of $-145 \text{ dBc} / \text{Hz} @ 3 \text{ MHz}$ offset.
- Typical spurious performance of $-70 \text{ dBc} @ 200 \text{ kHz}$ offset, (GSM 900 Setup).

GENERAL DESCRIPTION

The ADF4360-7EB1 Evaluation board is designed to allow the user to evaluate the performance of the ADF4360-7 Frequency Synthesizer consisting of integrated PLL & VCO. A photograph is shown below. It contains the ADF4360-7BCP, a PC connector, plus SMA connectors for the RF outputs. Unpopulated SMA footprints are available for the power supplies, Chip enable (CE) and external reference input. It also contains the loop filter to complete the PLL. The evaluation board can be modified as necessary for the customers PLL requirements. A cable is included with the board to connect a PC parallel port to allow software programmability.

The package also contains windows software on CD to allow quick, user friendly programming of the synthesizer. The CD also contains numerous other PLL datasheets, tech notes, articles and ADISimPLL V2.70, Analog Devices PLL simulation software. More information is available from www.analog.com/pll

EVALUATION BOARD

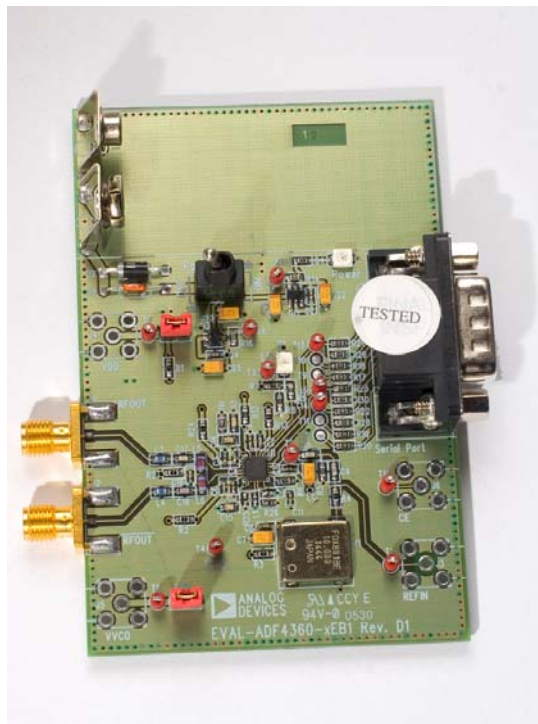


Figure 1: Evaluation Board

Rev. Pr F 08/05

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One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 www.analog.com
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EVAL-ADF4360-7EB1

HARDWARE DESCRIPTION

The evaluation board comes with a cable for connecting to the printer port of a PC. The silk screen and cable diagram for the evaluation board are shown below. The board schematic is shown on pages 4 & 5.

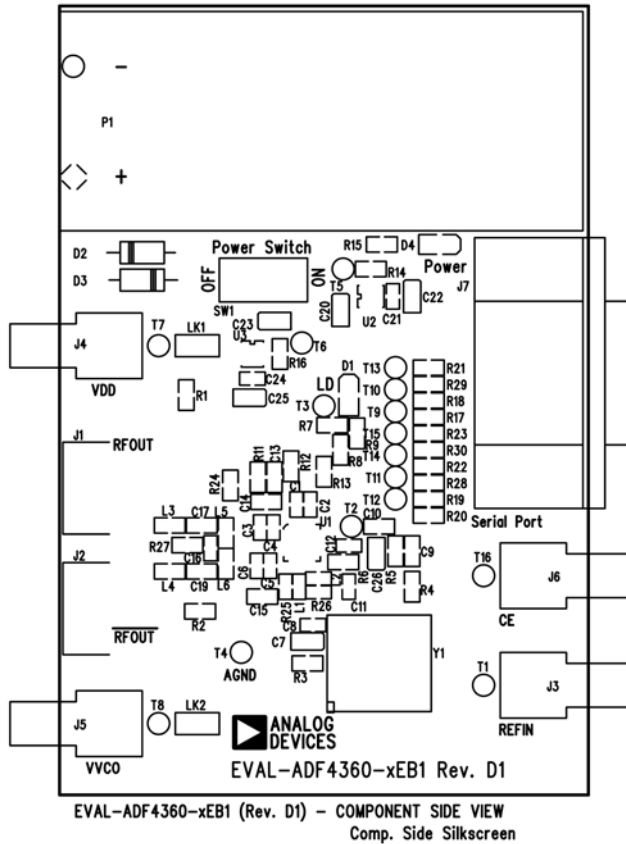


Figure 2: Evaluation Board Silkscreen – top view

The board is powered from a single 9V battery. All components necessary for LO generation are catered for on-board. A 10 MHz TCXO from Fox provides the necessary reference input. Otherwise an external reference signal can be connected via J3. The PLL comprises the ADF4360-7BCP and a passive loop filter. The VCO output from RF_{OUTA} is available through the standard SMA connector J1, and the complementary RF_{OUTB} VCO output is available from J2.

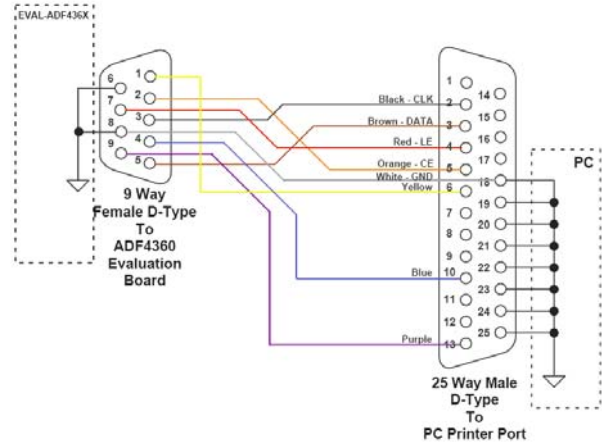


Figure 3: PC Cable Diagram

If the user wishes they may use their own power supplies using connectors J4 & J5 as shown on the silkscreen. Hardware power down using the CE pin can be controlled by inserting an SMA connector into J6 and removing R12.

The on board filter is a third order passive low pass filter. This contains three capacitors (C13, C14 & C15) plus two resistors (R10 & R11). The footprint for R10 is located on the underside of the board. The design parameters for the loop filter are for a centre frequency of 900 MHz, PFD frequency of 200 kHz and a low pass filter bandwidth of 10 kHz. To design a filter for different frequency setups, please use ADIsimPLL.

EXTERNAL INDUCTOR OPTIONS

The ADF4360-7 uses external inductors (L1 & L2) to setup the LC tank circuit of the VCO, The evaluation board has a footprint for the placing of these. A value of 3.9 nH is inserted on the board giving a VCO centre frequency of 900 MHz. For this value of inductor and for other values of inductor greater than 3.3 nH, a 470 Ohm resistor in parallel to ground for both L1 & L2 needs to be inserted (as shown).

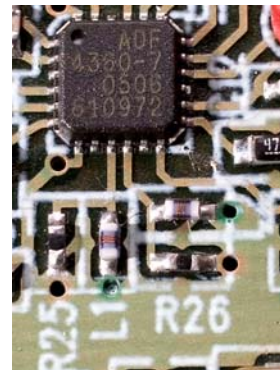


Figure 4. External inductors & resistors for ADF4360-7 tank circuit.

To find the optimum frequency range for a given inductor, please consult the graph below. Simply ensure the desired frequency is between the two lines and read off the appropriate inductance needed.

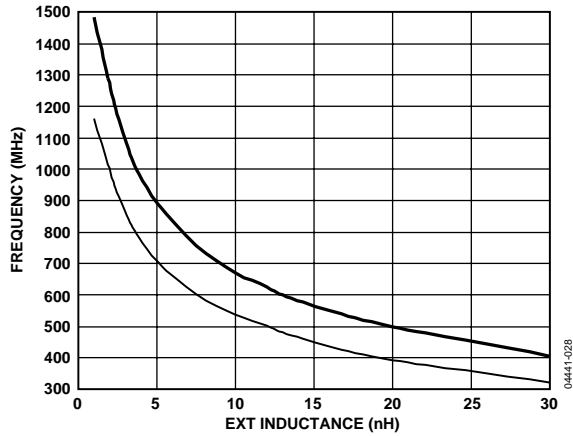


Figure x: Output Center Frequency vs. External Inductor Value

RF OUTPUT STAGES

The output stage of the board allows the user to insert a tuned load for the particular frequency. The particular network inserted in the board is optimized for 900 MHz operation. For different frequencies, the output stage needs different component values. Consult the datasheet for further information. If in doubt use a 50 Ohm resistor instead of the shunt inductor, a 100 pF bypass capacitor and a zero ohm resistor instead of the series inductor. **It is very important that the same components be placed on the RF_{OUTA} and RF_{OUTB} lines, also it is essential that BOTH outputs be terminated with 50 Ohm loads.** Otherwise the output power will not be optimum, and in some cases the part may malfunction.

EVAL-ADF4360-7EB1

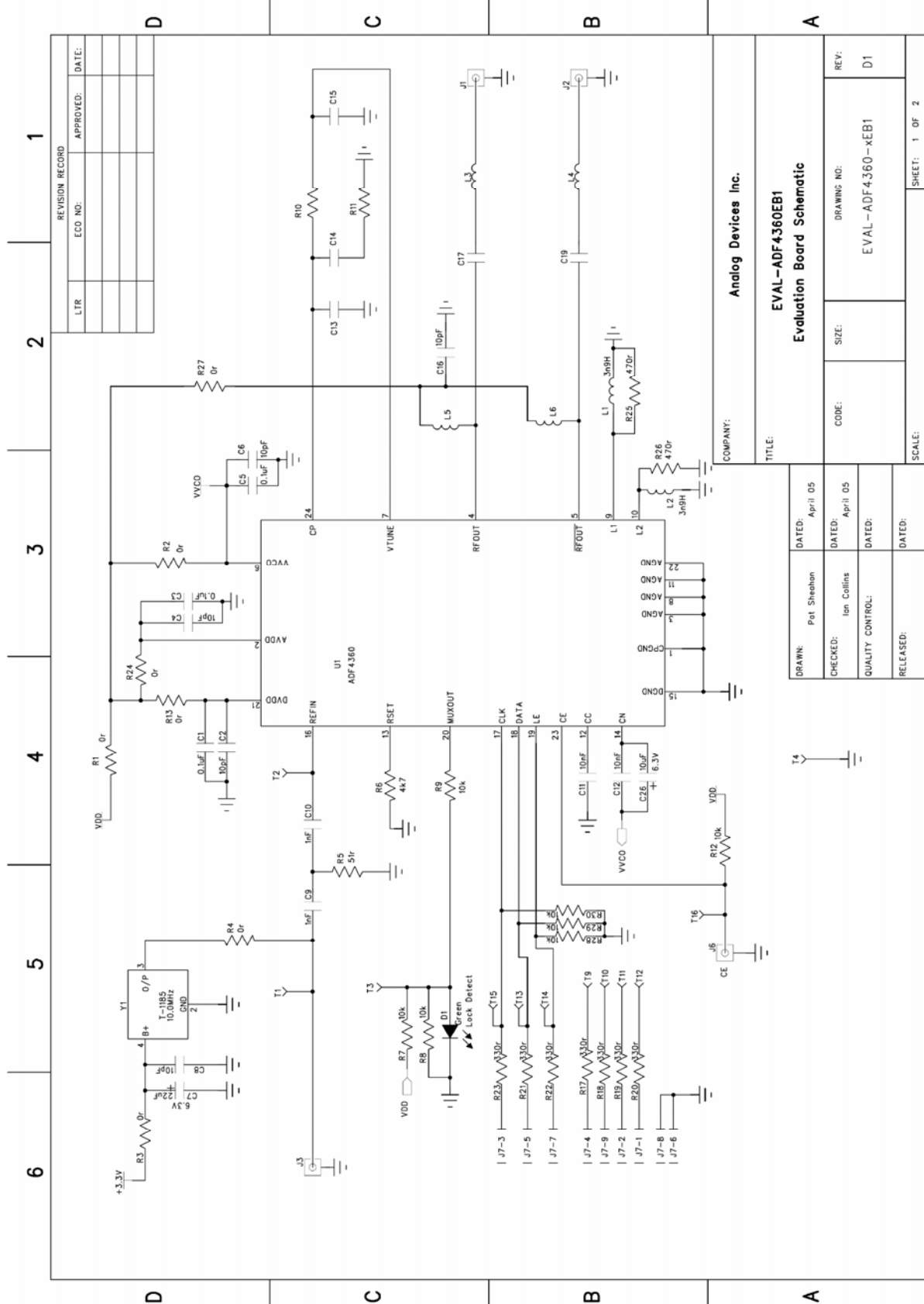
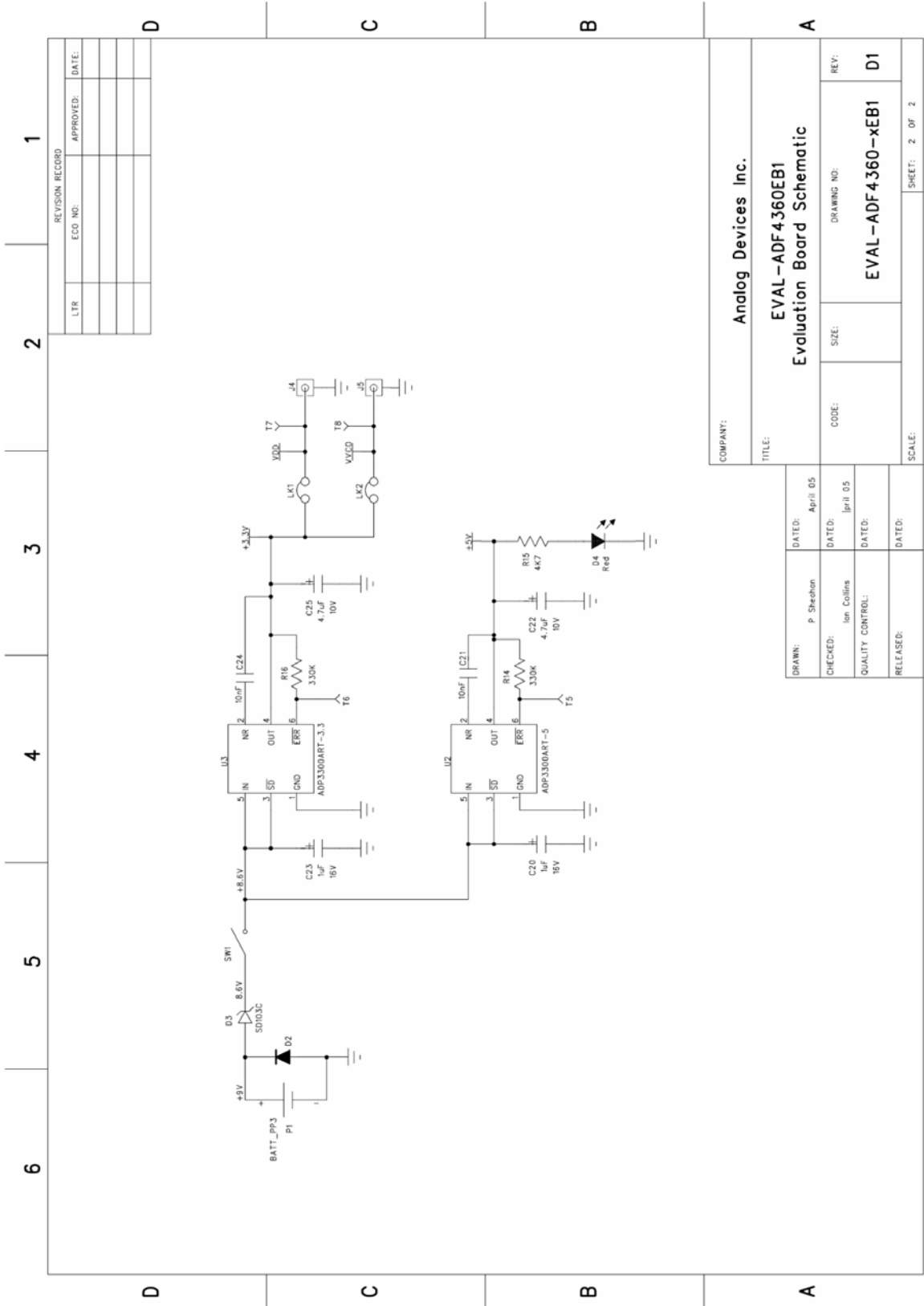


Figure 8. EVAL-ADF4360-7EB1 Circuit Diagram



| REVISION RECORD | | |
|-----------------|---------|-----------------|
| LTR | ECO NO. | APPROVED: DATE: |
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|------------------|----------|---|-------------------|
| COMPANY: | | Analog Devices Inc. | |
| TITLE: | | EVAL-ADF4360E81 Evaluation Board Schematic | |
| DRAWN: | DATE: | CODE: | REV: |
| P. Sheehan | April 05 | | D1 |
| CHECKED: | DATE: | SIZE: | DRAWING NO: |
| Ian Collins | April 05 | | EVAL-ADF4360-xEB1 |
| QUALITY CONTROL: | DATE: | SCALE: | SHEET: 2 OF 2 |
| RELEASED: | DATE: | | |

Figure 10. EVAL-ADF4360-7EB1 Circuit Diagram

SOFTWARE DESCRIPTION

The ADF4360-x software comes on a bundled installation CD. This is suitable for all the ADF4360-x devices. To install, simply double click on setup.exe and the install wizard installs the software, (Please note, administrator access on the PC is required to install the software) Follow the on-screen instructions. The software will be installed in a default directory called "C:/Program Files/Analog Devices/ADF4360". To run the software from this directory simply double click on ADF4360.exe.

Before the main software screen appears, the device window appears, which will ask the user to choose which device is being evaluated. Choose the appropriate version of the ADF4360 and click OK. The main interface window should now appear, (figure x).

PROGRAMMABLE SOFTWARE SETTINGS

Click on RF VCO Output Frequency, and the Output Frequency window will appear. Enter the desired PFD frequency (in kHz) and click OK. Click on Reference frequency and insert the desired frequency in MHz.

To modify charge pump setting 1 or 2, simply click over the text and the eight programmable settings for each will appear and can be modified. In a similar fashion the pre-scaler settings can be changed.

It may be necessary to adjust the core power level and the output power setting to give optimum operation. These settings are clearly marked in the window below.

Click on RF PD Polarity button to set the PD polarity bit positive, this ensures all registers are loaded.

The part should now be setup, and other features can now be modified by the user. To examine the contents written to each register, the registers button can be selected. This also shows the hexadecimal number written to each register. As stated on the parts datasheet, the correct sequence of register writes is to the R counter, The Control latch and finally the N counter. Please note that a small delay needs to be maintained between programming the Control latch and the N counter

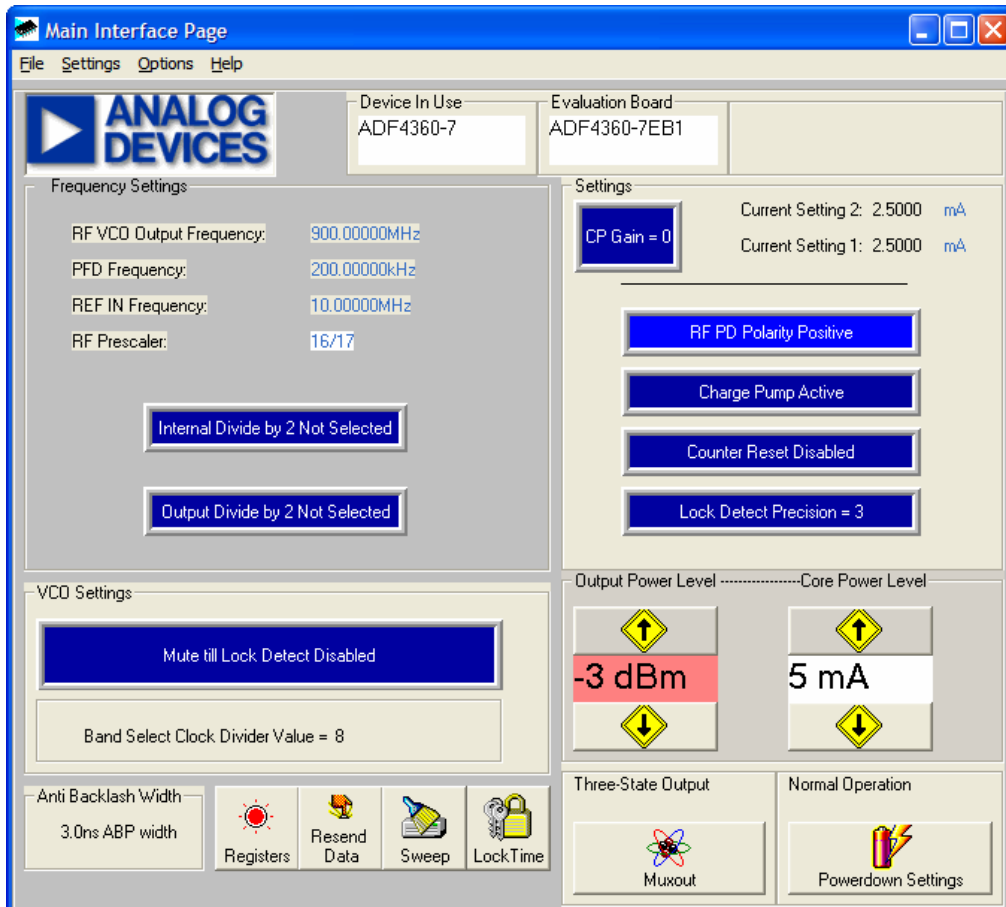


Figure 11. Software Front Panel Display

TABLE 1: BILL OF MATERIALS FOR EVAL-ADF4360-7EB1:

Analog Bill Of Materials for adf4360-7eb1 d1.pcb on 27/10/05

| Name | Part Descriptid | Value | Tolera | PCB Decal | SMD | Layer Nam | PART DESC | STOCK CODE |
|--------------------|-----------------|---------|--------|------------------|-----|-----------|---|---------------------------------|
| C1, C3, C5 | CAP | 0.1uF | | 0402 | Yes | Top | Multilayer Ceramic Capacitor | FEC 301-9482 |
| C2, C4, C6, C8 | CAP | 10pF | | 0402 | Yes | Top | Multilayer Ceramic Capacitor | FEC 301-9160 |
| C7 | CAP+ | 22uF | | CAP1TAJ_A | Yes | Top | 6.3V Tantalum Capacitor | FEC 197-038 |
| C9, C10 | CAP | 1nF | | 0603 | Yes | Top | Multilayer Ceramic Capacitor | FEC 317-202 |
| C11, C12, C21, C24 | CAP | 10nF | | 0402 | Yes | Top | Multilayer Ceramic Capacitor | FEC 301-9421 |
| C13 | CAP | 560pF | | 0603 | Yes | Top | Multilayer Ceramic Capacitor - Loop Filter | FEC 301-9640 |
| C14 | CAP | 8.2nF | | 0603 | Yes | Top | Multilayer Ceramic Capacitor - Loop Filter | FEC 301-9718 |
| C15 | CAP | 220pF | | 0603 | Yes | Top | Multilayer Ceramic Capacitor - Loop Filter | FEC 301-9627 |
| C16, C17, C19 | CAP | 10pF | | 0402 | Yes | Top | Multilayer Ceramic Capacitor | FEC 301-9160 |
| C20, C23 | CAP+ | 1uF | | CAP1TAJ_A | Yes | Top | 6.3V Tantalum Capacitor | FEC 498-701 |
| C22, C25 | CAP+ | 4.7uF | | CAP1TAJ_A | Yes | Top | 6.3V Tantalum Capacitor | FEC 498-598 |
| C23 | CAP+ | 1uF | | CAP1TAJ_A | Yes | Top | 6.3V Tantalum Capacitor | FEC 498-701 |
| C26 | CAP+ | 10uF | | CAP1TAJ_A | Yes | Top | 6.3V Tantalum Capacitor | FEC 197-014 |
| D1 | LED | | | LED_CHIP | Yes | Top | Green Low Power LED | FEC 515-620 |
| D2 | DIODE | | | DO35 | No | Top | IN4001 | FEC 365-117 |
| D3 | SD103C | 6.2v | | DO35 | No | Top | SD103C Schottky Diode | SD103C |
| D4 | LED | | | LED_CHIP | Yes | Top | Red Low Power LED | FEC 515-607 |
| J1 - J2 | SMA | | | SMA_CARD_EDGE_RF | Yes | Top | 50Ω Edge Mount SMA Connector | Johnson Components 142-0701-851 |
| J3 - J6 | SMA | | | SMA_90DEG | No | Top | Gold 90° 50Ω SMA Socket | Not Inserted |
| J7 | CON-DB9HM | | | DB9-HM | No | Top | 90° 9 pin D-Type Male Connector | FEC 150-750 |
| L1, L2 | IND | 3.9 nH | 1% | 0402 | Yes | Top | Inductor | Coilcraft 0402CS-3N9XJLU |
| L3, L4 | IND | 5.1nH | | 0603 | Yes | Top | Inductor | Coilcraft 0603CS-5N1X-BC |
| L5, L6 | IND | 50nH | | 0603 | Yes | Top | Inductor | Coilcraft 0805HQ-51NX-BC |
| LK1, LK2 | JUMPER | | | SIP-2P | No | Top | 2 pin header & Shunt | FEC 512-035 & FEC 150-410 |
| P1 | BATT_PP3 | | | BATT_PP3 | No | Top | Pair PCB snap-on battery connector | FEC 723-988 |
| R1 - R4 | RES | 0r | 1% | 0603 | Yes | Top | SMD Resistor | FEC 772-227 |
| R5 | RES | 51r | 1% | 0603 | Yes | Top | SMD Resistor | FEC 357-1245 |
| R6 | RES | 4k7 | 1% | 0603 | Yes | Top | SMD Resistor | FEC 911-318 |
| R7 | RES | 10k | 1% | 0603 | Yes | Top | SMD Resistor | FEC 911-355 |
| R8 | RES | 10k | 1% | 0603 | Yes | Top | SMD Resistor | FEC 911-355 |
| R9 | RES | 100r | 1% | 0603 | Yes | Top | SMD Resistor | FEC 612-364 |
| R10 | RES | 8.2k | 1% | 0603 | Yes | Bottom | SMD Resistor - Loop Filter | FEC 911-963 |
| R11 | RES | 4.3k | 1% | 0603 | Yes | Top | SMD Resistor - Loop Filter | FEC 321-8132 |
| R12 | RES | 10k | 1% | 0603 | Yes | Top | SMD Resistor | FEC 911-355 |
| R13 | RES | 0r | 1% | 0603 | Yes | Top | SMD Resistor | FEC 772-227 |
| R14, R16 | RES | 330k | 1% | 0603 | Yes | Top | SMD Resistor | FEC 911-537 |
| R15 | RES | 4k7 | 1% | 0603 | Yes | Top | SMD Resistor | FEC 911-318 |
| R17 - R23 | RES | 330r | 1% | 0603 | Yes | Top | SMD Resistor | FEC 911-173 |
| R24, R25, R26, R27 | RES | 0r | 1% | 0603 | Yes | Top | SMD Resistor | FEC 772-227 |
| R28, R29, R30 | RES | 10k | 1% | 0603 | Yes | Top | SMD Resistor | FEC 911-355 |
| SW1 | SW_POWER | | | SW_SIP-3P | No | Top | SPDT Switch - (Washable) | FEC 150-559 |
| T1 - T16 | TESTPOINT | | | TESTPOINT | No | Top | TESTPOINT | FEC 873-1144 |
| U1 | ADF4360-7 | | | LFCSP-24 | Yes | Top | Synthesizer | ADF4360-7BCP |
| U2 | ADP3300-5 | | | SOT23-6 | Yes | Top | 5V Regulator | ADP3300ART-5 |
| U3 | ADP3300-3.3 | | | SOT23-6 | Yes | Top | 3.0V Regulator | ADP3300ART-3 |
| Y1 | OSC_TCXO | 10.0MHZ | | OSC_TCXO | Yes | Top | 10 MHz TCXO (Fox-801) | Fox-801 |
| | | | | | | | Fully Assembled/Tested Board - Eval-ADF4360-xEB1 Rev. D1 | |
| | | | | | | | Anti-Static Bag | FEC 522-764 |
| | | | | | | | ADI Proprietary RF-Group Printer Port Cable - 1 printer cable included in each box. | |
| | | | | | | | Software CD | ADI Free Issue |
| | | | | | | | Bar Code Box Label - Eval-ADF4360-7EB1 | ADI Free Issue |
| | | | | | | | Rubber Stick-On Feet (x4) | FEC 148-922 |
| | | | | | | | 9V PP3 Battery | FEC 908-526 |
| | | | | | | | Evaluation Board Box - Small size | Europacks - K-645/1 |