

## Evaluating the **CN-0285** Wideband Tx Modulator Solution

### FEATURES

Self-contained board including

**ADF4351** wideband PLL + VCO

**ADL5375** wideband IQ modulator

Ultralow noise voltage regulators: **ADP150**, **ADP3334**

25 MHz TCXO reference

USB interface

Accompanying **ADF4351** software allows control of synthesizer functions from PC

### ONLINE RESOURCES

Documents Needed

**ADF4351** Data Sheet

**ADL5375** Data Sheet

**ADP150** Data Sheet

**ADP3334** Data Sheet

Required Software

**ADF435x** programming software

Design and Integration Files

**Schematics**, **Layout Files**, **Bill of Materials**

### EQUIPMENT NEEDED

A standard PC running Windows® XP, Windows Vista (32-bit), or Windows 7 with a USB port

**EVAL-CN0285-EB1Z** circuit evaluation board

5.5 V power supplies

An IQ signal source, such as the Rohde & Schwarz AMIQ

A spectrum analyzer, such as the Rohde & Schwarz FSQ8

### GENERAL DESCRIPTION

The **EVAL-CN0285-EB1Z** is the evaluation board described in the Circuits From the Lab™ **Circuit Note CN-0285**, *Broadband Low EVM Direct Conversion Transmitter*. A photo of the board is shown in Figure 1. It contains the **ADF4351** synthesizer, the **ADL5375** wideband transmit modulator, and ultralow noise LDOs. The board can be controlled using the **ADF4351** programming software. A USB cable is included with the board to connect to a PC USB port.

Additional information, including other PLL data sheets, technical notes, articles, and ADIsimPLL™ PLL simulation software from Analog Devices, Inc., is available at [www.analog.com/pll](http://www.analog.com/pll).

### PHOTO OF THE EVALUATION BOARD

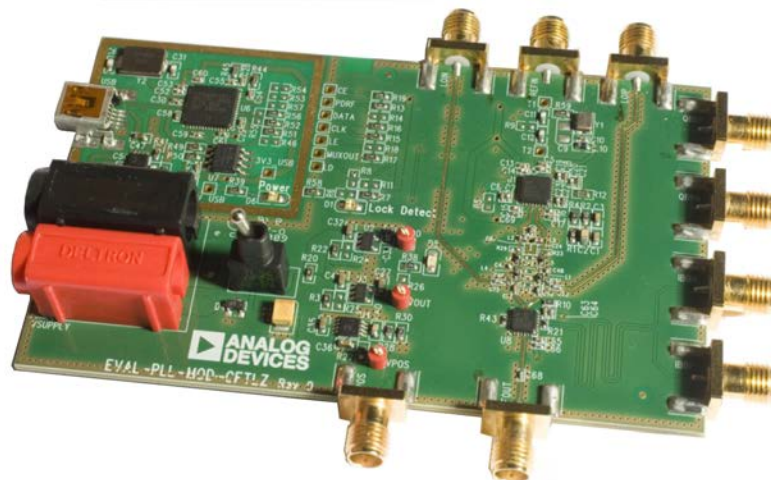


Figure 1. **EVAL-CN0285-EB1Z**

**TABLE OF CONTENTS**

Features .....	1	Power Supplies.....	3
Online Resources.....	1	IQ Inputs.....	3
Equipment Needed.....	1	RF/LO Outputs.....	3
General Description.....	1	Loop Filter and Charge Pump Current .....	3
Photo of the Evaluation Board.....	1	Reference Source .....	3
Revision History .....	2	Evaluation Board Software Quick Start Procedures.....	4
Evaluation Board Hardware.....	3		

**REVISION HISTORY**

3/13—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### POWER SUPPLIES

The user must apply 5.5 V to the VSUPPLY power connectors (4 mm banana connectors). An LED, D6, indicates when USB power is available, and another LED, D5, indicates when the main board is powered. Switch SW-EXT is used to switch in the 5.5 V supply.

### IQ INPUTS

The ADL5375 has four differential IQ inputs. These are accessible from the SMA connectors and should be connected to an appropriate analog baseband IQ source such as the Rhode & Schwarz AMIQ. Set the dc bias voltage for the IQ inputs at 0.5 V.

### RF/LO OUTPUTS

The ADL5375 RF output is ac-coupled out to the RFOUT SMA. There are also two LO output SMA connectors that can be used to view the filtered ADF4351 RF outputs on a spectrum analyzer. When connecting to an analyzer, terminate the unused LO output with a 50  $\Omega$  termination. When measuring EVM or adjacent channel leakage current (ACLR), disconnect these LO outputs by removing Capacitors C72 and C73 to prevent loading the circuit.

### LOOP FILTER AND CHARGE PUMP CURRENT

The loop filter schematic is included in the evaluation board and can be found at [www.analog.com/CN0285-DesignSupport](http://www.analog.com/CN0285-DesignSupport).

The default loop filter is set to 70 kHz. Using a charge pump setting of 2.5 mA is recommended.

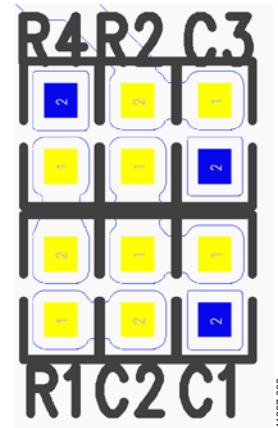


Figure 2. Loop Filter Layout

### REFERENCE SOURCE

The 25 MHz TCXO from Rakon provides the necessary reference signal. An external REFIN can be used if desired. In this case, disable the on-board TCXO by removing R59. R9 can be populated with 50  $\Omega$  to match the impedance of the evaluation board to the external reference source.

## EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

The control software for [EVAL-CN0285-EB1Z](#) uses the standard [ADF4351](#) programming software. For more details on the installation of this software, consult [UG-435, Evaluation Board for the ADF4351 Fractional-N PLL Frequency Synthesizer](#).

After installing the software, run the software by clicking the **ADI ADF435x** file on the desktop or in the **Start** menu. The software front panel opens (see Figure 3).

Confirm that **Analog Devices RFG.L Eval Board connected** is displayed in the bottom left corner of the window. Otherwise, the software has no connection to the evaluation board. In this case, check that the cable connection and USB drivers are correctly installed.

Program the RF output frequency in the **Main Controls** tab of the software front panel.

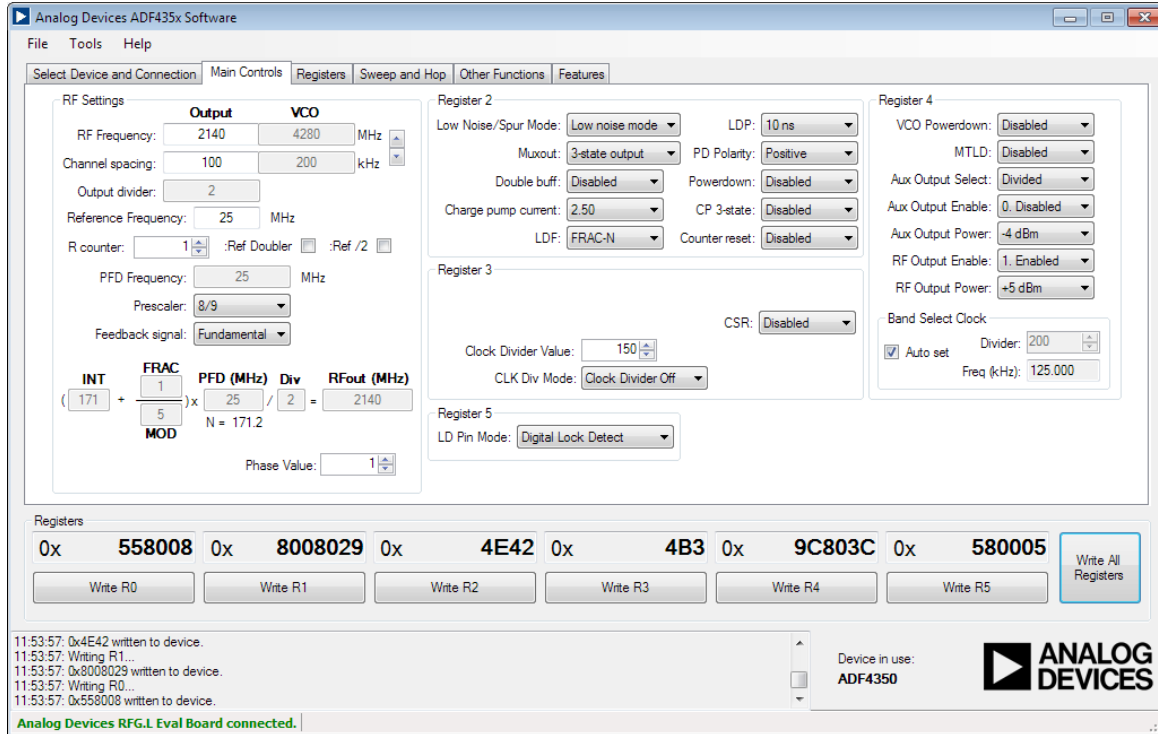


Figure 3. Software Front Panel

**NOTES**

**NOTES**

**NOTES**

## 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.

**Legal Terms and Conditions**

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. **CONFIDENTIALITY.** This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. **ADDITIONAL RESTRICTIONS.** Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. **TERMINATION.** ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. **LIMITATION OF LIABILITY.** THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). **EXPORT.** Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. **GOVERNING LAW.** This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.