

DAC3282

This is the user's guide for the DAC328x EVM. The EVM includes the TRF372017 quadrature modulator to facilitate measuring the output signals at a desired RF frequency. The TRF372017 includes an integrated RF synthesizer used for the LO. The EVM also includes the CDCE62005 clocking source which provides the clocks required for the DAC, the pattern generator, and the synthesizer reference of the RF modulator. This EVM is ideally suited for mating with the TSW3100 pattern generation card for evaluating WCDMA, LTE, or other high-performance modulation schemes.

Contents

1	EVM Block Diagram	2
2	Software Control	2
2.1	Installation Instructions	2
2.2	Software Operation	2
3	Basic Test Procedure	4
3.1	Test Block Diagram	4
3.2	Test Setup Connection	5
3.3	TSW3100 Quick-Start Operation	5
3.4	DAC328x Software Quick-Start Guide	7
3.5	DA3282 Performance Results	7
4	Optional Configurations	9
4.1	DAC Output	9
4.2	DAC Output to Filter Network and 4:1 Transformer	10
4.3	TRF3703-33 Output	10
4.4	External LO Option for the TRF372017	10
4.5	External Clock Frequency	10
4.6	DC/DC Power Supply Bypass Mode	10
5	Revision Changes	11

List of Figures

1	EVM Block Diagram	2
2	DAC3282 GUI Front Panel	4
3	Test Setup Block Diagram	5
4	TSW3100 MultiTonePattern Programming GUI.....	6
5	TSW3100 CommsSignalPattern (WCDMA) Programming GUI	6
6	Two-Tone IMD Performance: LO = 2400 MHz, DAC Clk = 614.4 MHz, 2x Interpolation, IF = 20, 21 MHz	7
7	WCDMA ACPR: LO = 2120 MHz, DAC Clk = 614.4 MHz, 2x Interpolation, 30-MHz Offset	8
8	WCDMA ACPR: LO = 1966.4 MHz, DAC Clk = 614.4 MHz, 2x Interpolation, $f_s/4$ mixing, 30-MHz Offset	8
9	WCDMA ACPR (DAC Ch. B): DAC Clk = 614.4 MHz, 2x Int, 30-MHz Offset	9
10	WCDMA ACPR (DAC Ch. B): DAC Clk = 614.4 MHz, 2x Int, $f_s/4$ Mixing, 30-MHz Offset; 183.6-MHz IF	9

1 EVM Block Diagram

Figure 1 shows the configuration of the EVM with the TSW3100 used for the pattern generation.

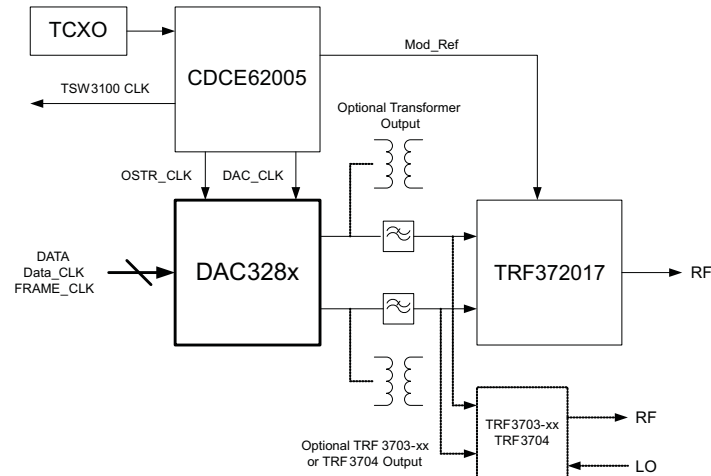


Figure 1. EVM Block Diagram

2 Software Control

2.1 Installation Instructions

1. Open folder named DAC328x_Installer_vxpx (xpx represents the latest version)
2. Run Setup.exe
3. Follow the on-screen instructions
4. Once installed, launch by clicking on the DAC328x_GUI_vxpx program in Start >Texas Instruments DACs.
5. When plugging in the USB cable for the first time, you will be prompted to install the USB drivers.
 - (a) When a pop-up screen opens, select *Continue Downloading*.
 - (b) Follow the on-screen instructions to install the USB drivers.
 - (c) If needed, you can access the drivers directly in the install directory.

2.2 Software Operation

The software allows programming control of the DAC device, the CDC device, and the TRF device. The front panel provides a tab for full programming of each device. The Top Level tab provides a more convenient and simplified interface to the most used registers of each device. The Top Level panel of the software is shown in Figure 2.

2.2.1 DAC328x

- Interpolation: Sets the DAC interpolation factor
- Inv Sinc Filter: (DAC3282 only) Sets the inverse sinc filter on
- DAC Gain: Adjusts the DAC gain for each channel
- Mixer: Selects the DAC mixer
- Temperature: Reads the temperature sensor inside the DAC device

2.2.2 CDCE62005

Frequency control is determined by register values in the CDC tab. See the CDCE62005 data sheet for detailed explanations of the register configuration to change the clock frequency. Sample configuration files are provided with a variety of common clock frequency choices that can be loaded automatically (see Load Regs). The Top Level tab gives access to the dividers for each of the outputs.

- Mod Ref In Div: The divider register to set the RF synthesizer reference frequency in the TRF372017
- DAC Clock Div: The divider register to set the DAC clock frequency
- FIFO OSTR Div: The divider register that sets the FIFO output strobe clock.
 - FIFO OSTR Div = $8 \times \text{Interpolation} \times \text{DAC clock divider}$
- TSW3100 Clk Div: The divider register that sets the clock for the TSW3100 pattern generator card
 - TSW3100 Clk Div = $8 \times \text{Interpolation} \times \text{DAC clock divider} / 4 \{BwDDR\}$
- Test Port Div The divider register that sets the clock to the SMA test port

2.2.3 TRF372017

- Ref Freq (MHz): Shows the reference frequency for the synthesizer. This is automatically generated from the CDC register.
- LO Target (MHz): Sets the LO target frequency
- RF Step (MHz): Sets the synthesizer pfd frequency which determines the synthesizer resolution

2.2.4 Register Control

- Send All: Sends the register configuration to all devices
- Read All: Reads register configuration from DAC328x device
- Save Regs: Saves the register configuration for all devices
- Load Regs: Load a register file for all devices. Sample configuration files for common frequency plans are located in the install directory.
 - Select *Load Regs* button.
 - Double click on the *data* folder.
 - Double click on the desired register file.
 - Click on *Send All* to ensure all of the values are loaded properly.

2.2.5 Miscellaneous Settings

- Reset USB: Toggle this button if the USB port is not responding. This generates a new USB handle address
- Initialize: This button toggles the *Wake up* button for the CDC device and the *Cal Enable* device for the TRF372017 device
- Exit: Stops the program
- Fin (MHz): Shows the system reference frequency from the onboard TCXO; this does not need to be adjusted.
- Out Freq (MHz): Shows the VCO output frequency from the CDC device. This frequency is changed by adjusting the appropriate register configuration in the CDC tab or by loading a different configuration file.

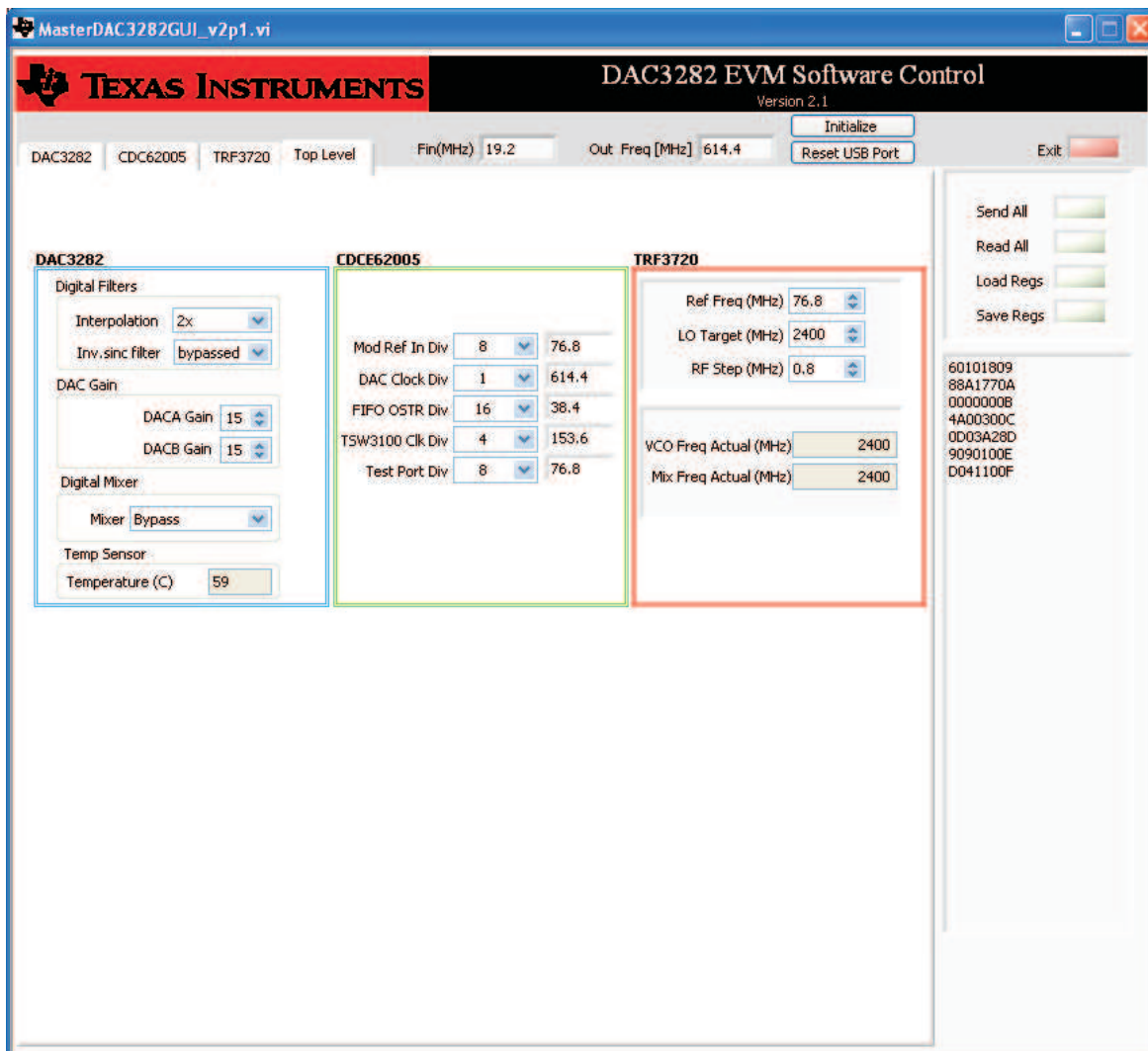


Figure 2. DAC3282 GUI Front Panel

3 Basic Test Procedure

This section outlines the basic test procedure for testing the EVM.

3.1 Test Block Diagram

The test setup for general testing of the DAC328x with the TSW3100 pattern generation card is shown in [Figure 3](#).

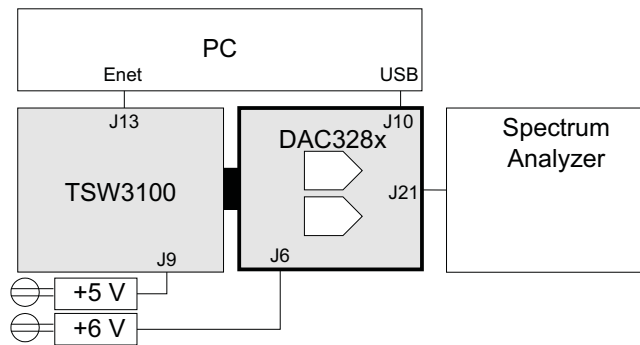


Figure 3. Test Setup Block Diagram

3.2 Test Setup Connection

1. Connect DAC328x EVM to TSW3100 EVM
2. Connect 6-V power-supply jack
3. Connect RF output to Spectrum Analyzer
4. Connect USB cable to programming computer

3.3 TSW3100 Quick-Start Operation

See the TSW3100 User's Guide for more detailed explanations of the TSW3100 setup and operation. This document assumes the TSW3100 software is installed and functioning properly. The DAC328x uses byte-wide DDR operation; hence, TSW3100 operating software version 2.2 or later is required. Also, the DAC328x can operate at higher data rates, so verify that the oscillator on the TSW3100 at Y3 is operating at 125 MHz to support the data rates above 250 MHz. The front panel of the TSW3100 is shown in [Figure 4](#) and [Figure 5](#). The following registers must be changed from the default settings.

Multitone Setup From Default Configuration

1. Change sample rate to equal DAC clock rate / Interpolation (i.e., $614.4 / 2 = 307.2$).
2. Select desired tone groups (i.e., group 1: tone center = 20, group 2: tone center = 21)
3. Select BwDDR output button
4. Check the *LOAD and Run* box
5. Press the **green** *Create and Save/Run TSW3100* button

CommsSignalPattern Setup From Default Configuration (WCDMA)

1. Change Interpolation value to (DAC clock rate / Interpolation) / 3.84 [i.e., $(614.4 / 2) / 3.84 = 80$]
2. Enter desired offset frequency (i.e., 30 MHz) for each desired carrier
3. Select the BwDDR output button
4. Check the *LOAD and Run* box
5. Press the **green** *Create* button

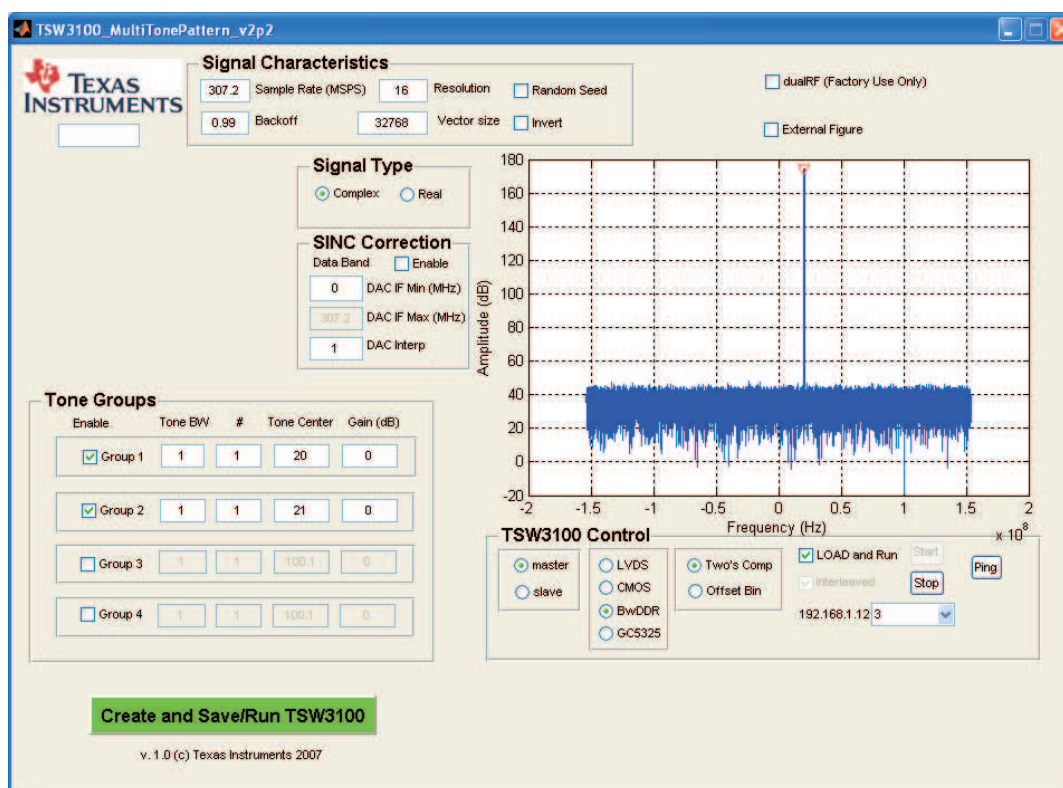


Figure 4. TSW3100 MultiTonePattern Programming GUI

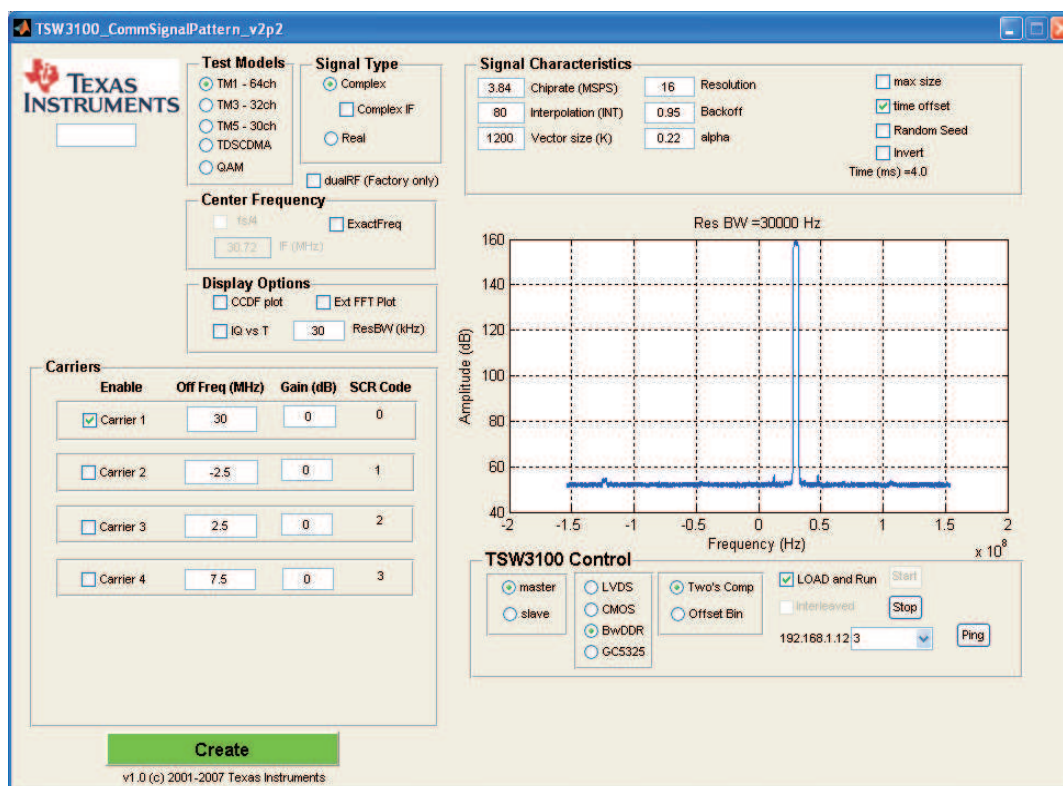


Figure 5. TSW3100 CommsSignalPattern (WCDMA) Programming GUI

3.4 DAC328x Software Quick-Start Guide

1. Select the Top Level tab. This tab shows the most pertinent registers for the DAC, CDCE62005, and TRF372017 devices. Press the *Reset USB Port* button.
2. The default configuration uses a 614.4-MHz DAC clock.
3. Set the RF output LO to the desired output frequency.
4. Toggle the *Initialize* button. This initializes the CDCE62005 clock and the TRF372017 synthesizer.
5. Verify that the CDCE62005 LED (D4) is illuminated, indicating lock.
6. Verify that the TRF372017 LED (D5) is illuminated, indicating the synthesizer is locked.
7. Monitor the output signal at the RF output connector. If default LO frequency of 2400 MHz is used and the TSW3100 is set up with two tones at 20 MHz and 21 MHz, then the tones seen in [Figure 6](#) are at 2420 MHz and 2421 MHz.

3.5 DA3282 Performance Results

[Figure 6](#), [Figure 7](#), and [Figure 8](#) show the typical two-tone and ACPR performance of the DAC3282 EVM from the setup in [Section 3.4](#). This performance incorporates the DAC device and the TRF372017 modulator device.

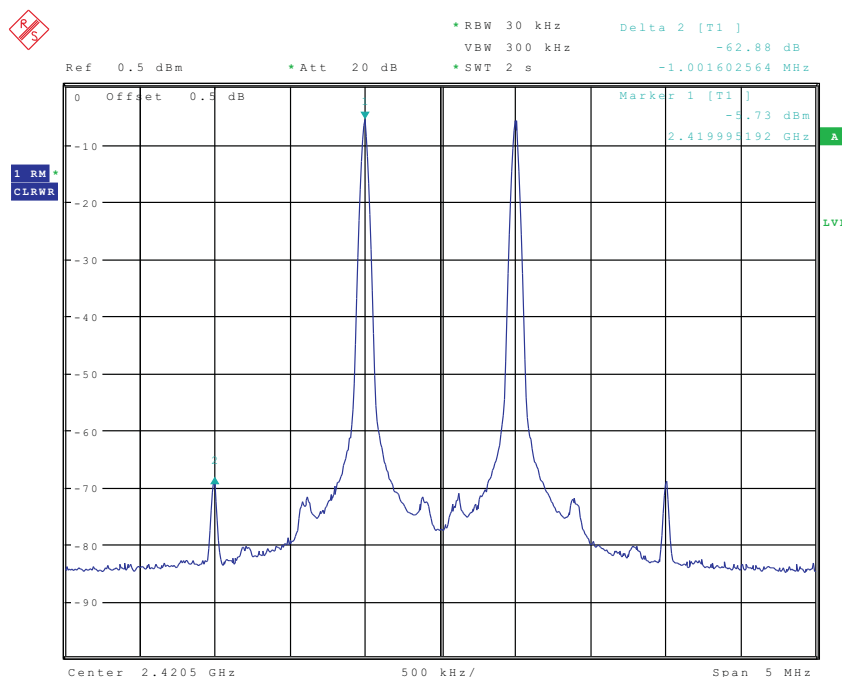


Figure 6. Two-Tone IMD Performance: LO = 2400 MHz, DAC Clk = 614.4 MHz, 2x Interpolation, IF = 20, 21 MHz

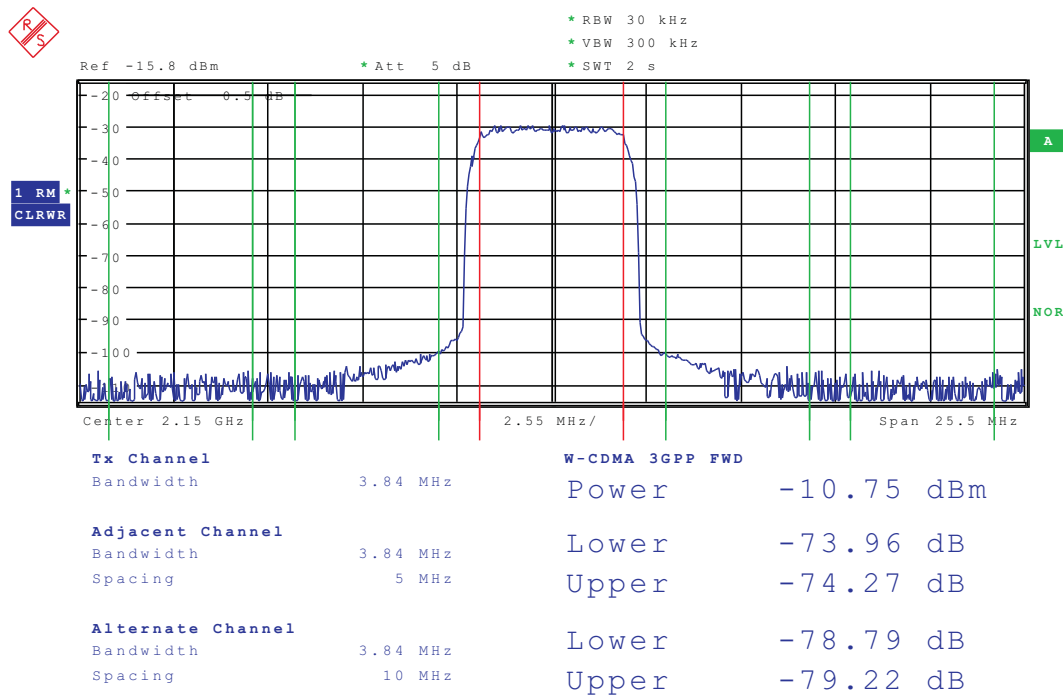


Figure 7. WCDMA ACPR: LO = 2120 MHz, DAC Clk = 614.4 MHz, 2x Interpolation, 30-MHz Offset

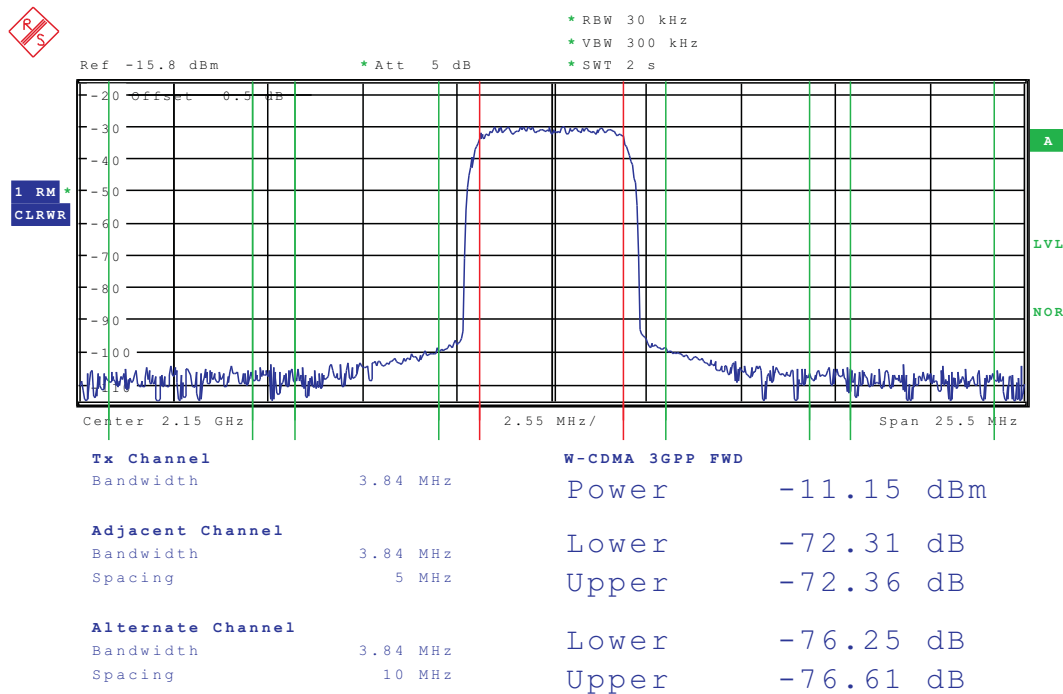


Figure 8. WCDMA ACPR: LO = 1966.4 MHz, DAC Clk = 614.4 MHz, 2x Interpolation, $f_s/4$ mixing, 30-MHz Offset

Note that there are some part-to-part performance variations that can yield significantly improved two-tone IP3 or ACPR performance. The performance plots in this document show conservative typical responses.

4 Optional Configurations

4.1 DAC Output

To view the performance of the DAC by itself, move jumpers R153, R137, R156, R155 to location R136, R135, R134, R109. The DAC can be monitored at connectors J3 and J1 from the output of the transformers. The DAC-output-only performance is shown in Figure 9 and Figure 10.

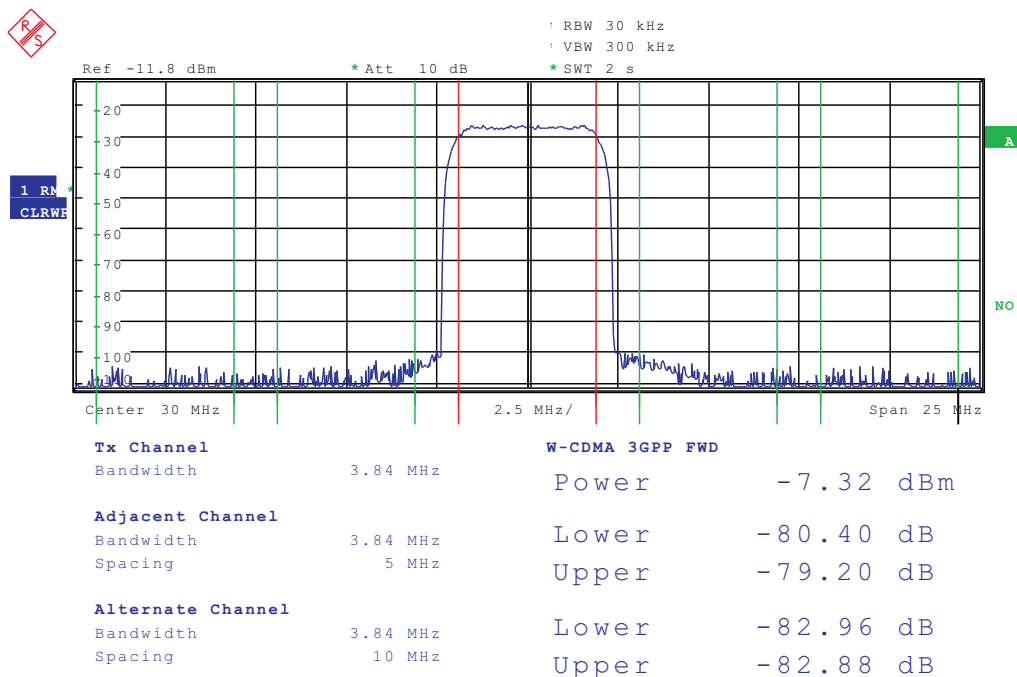


Figure 9. WCDMA ACPR (DAC Ch. B): DAC Clk = 614.4 MHz, 2x Int, 30-MHz Offset

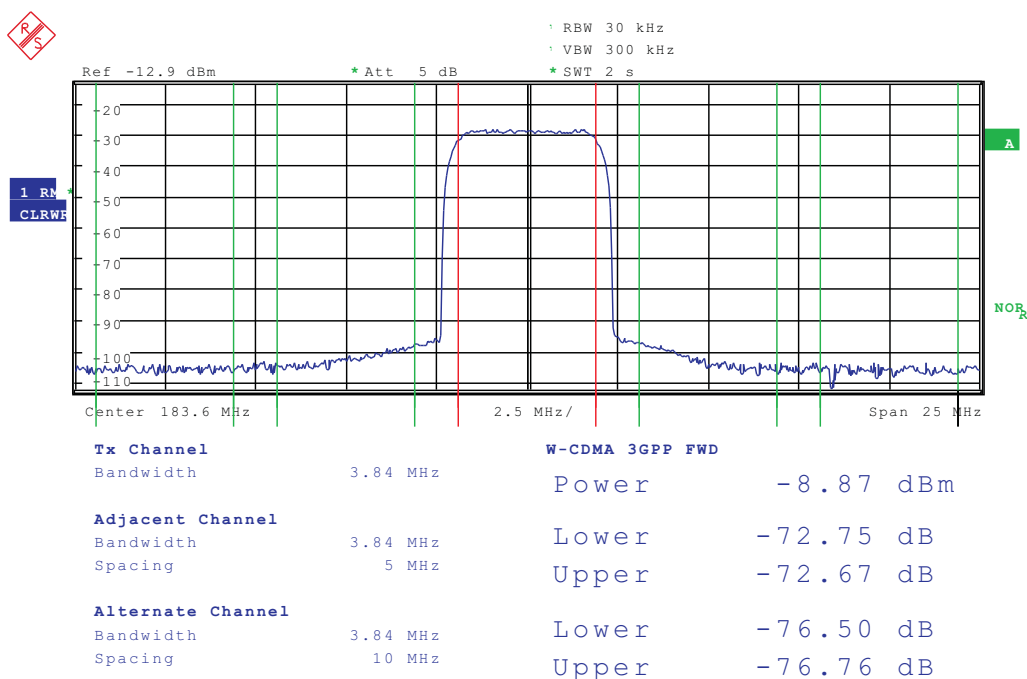


Figure 10. WCDMA ACPR (DAC Ch. B): DAC Clk = 614.4 MHz, 2x Int, $f_s/4$ Mixing, 30-MHz Offset; 183.6-MHz IF

4.2 DAC Output to Filter Network and 4:1 Transformer

The DAC output can first go through a filter network before going to the 4:1 transformer. The network can accommodate up to a 5th order filter network. As an example, the instructions below will provide an option for a 5th order Butterworth low-pass filter with 75MHz cut-off frequency. To employ this option, please use the following settings:

1. Remove 1uF at C31, C32, C33, and C34
2. Install 0-Ω at R140, R148, R150, R151, R152, R154, R158, and R159
3. Install 270nH at L12, L17, R125, R128, L14, L19, R111, and R115
4. Install 22pF at C166 and C160
5. Install 12pF at C171, R124, R105, and C161
6. Install 0-Ω at L13, L16, L15, and L18
7. Remove 100-Ω at R7, R13, R21, and R26

Please refer to the TSW4200-DAC EVM schematic in the design package for the filter example mentioned above. Other filter component values can also be used to provide a desired frequency response.

4.3 TRF3703-33 Output

The back side of the EVM contains the TRF3703-33 quadrature modulator as an alternative to the TRF372017 device. To employ this option, please use the following settings:

1. Remove 1uF at C31, C32, C33, and C34
2. Install 0-Ω at R142, R145, R146, and R149
3. Remove 100-Ω at R126 and R114
4. Install 100-Ω at R124 and R105
5. Install L13, L16, L15, and L18
6. Move jumper at JP17 to the TRF3703 side to power up the device.

For this option, an external LO signal must be applied at J27, and the output is monitored at J24.

4.4 External LO Option for the TRF372017

The TRF372017 can be configured for external LO. Toggle the *En_EXTVCO* register on the TRF372017 tab and inject the desired LO frequency at J26.

4.5 External Clock Frequency

An external clock can be provided instead of using the internal VCO of the CDCE62005. To configure the CDC for this operation, modify the following on the CDC tab of the software.

1. Inject desired clock signal at J25 (i.e., 614.4 MHz)
2. Remove jumper at JP19
3. Move jumper at JP22 to connect pins 2 and 3
4. Change *Input Level* to *LVPECL*
5. Change *Input Source* to *Manual_PRI-IN*
6. Change *Pri Ref PreDivider* to *Divide by 1*
7. Change *Sec Ref PreDivider* to *3-state*
8. Select *Pri Term* to *Disabled*
9. Change Output 0 through 4 from *VCO* to *Primary*
10. Toggle Wake up button

4.6 DC/DC Power Supply Bypass Mode

The primary DC/DC switching power supply (U14) can be completely bypassed to further minimize the switching noise of the power supply. The main 6V is stepped down initially by two TPS7A4501 LDOs (U17 and U18). To bypass the DC/DC power supply, please modify the following:

1. Remove 0-Ω at R88, R96, and R165

2. Install 0-Ω at R131, R130, R164, and R163

5 Revision Changes

Changes from Revision D. to Revision E.

- Added DAC Output to Filter Network and Transformer
- Changed routing of 5V power to TRF372017 (U3), TRF3703 (U10), and filter network bias.
- Added DC/DC Switching Power Supply (U14) bypass option.
- Changed CDCE62005 (U4) LVPECL output termination network at DACCLK and FIFO_OSTR clocks.
- Changed CDCE62005 (U4) LVPECL input termination network at J25 for external clock mode.

Evaluation Board/Kit Important Notice

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 5.5 V to 7 V and the output voltage range of 0 V to 3.3 V .

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 55°C. The EVM is designed to operate properly with certain components above 55°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2010, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps

AMEYA360

Components Supply Platform

Authorized Distribution Brand :



Website :

Welcome to visit www.ameya360.com

Contact Us :

➤ Address :

401 Building No.5, JiuGe Business Center, Lane 2301, Yishan Rd
Minhang District, Shanghai , China

➤ Sales :

Direct +86 (21) 6401-6692
Email amall@ameya360.com
QQ 800077892
Skype ameyasales1 ameyasales2

➤ Customer Service :

Email service@ameya360.com

➤ Partnership :

Tel +86 (21) 64016692-8333
Email mkt@ameya360.com