User's Guide

Programming AFE7769D to Interface with RNS802 for 2T2R

ABSTRACT

This user's guide provides a walkthrough of hardware and software setup with supplemental images as a visual representation, followed by bringup steps.

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Trademarks

1 Introduction

This guide is intended to be used in conjunction with the document ID PC-004159-DC version 3 from RANsemi.

This user's guide introduces a small cell application using Texas Instruments' AFE7769D evaluation module (EVM) in collaboration with RANsemi, a semiconductor company that provides industry-standard systems on chips (SoCs) for small cell wireless infrastructure. This reference solution serves to help customers ramp system integration of the analog front-end (AFE), and allows for seamless interfacing with the RANsemi RNS802 SoC.

The AFE7769D is a 4T4R2F RF transceiver with integrated Digital Pre-Distortion (DPD) that serves to linearize power amplifiers (PAs) for improved wireless coverage to the end customer. The small cell 5-watt radio unit (RU) uses the EVM version of the device that connects with the RANsemi component of the solution for seamless interfacing. The RNS802 is a SoC that is designed for 5GNR/LTE small cell disaggregated and integrated RAN architectures, per RANsemi's website.

Note

In the following sections, the code includes text like Picocom and PC802, as RANsemi was previously a part of Picocom before RANsemi became an independent company in November 2023. The names of the files were updated, but the hardware and software remain unchanged.

2 Basic EVM Test Procedures

2.1 Safety

- Safety glasses must be worn.
- This test must be performed by qualified personnel trained in electronics theory and understand the risks and hazards of the assembly to be tested.
- ESD precautions must be followed while handling electronic assemblies while performing this test.
- Take precautions to avoid touching areas of the assembly that may get hot or present a shock hazard during testing.
- No ESD wrist strap shall be worn for Hi Voltage testing (≥50 Vrms or ≥75 VDC) use Ionizer.

2.2 Quality

Test data or reports are made available upon request by Texas Instruments.

2.3 Apparel

- Safety glasses
- Electrostatic smock
- Electrostatic gloves or finger cots
- Ground ESD wrist strap

2.4 Hardware and Software Requirements

2.4.1 Test Equipment Required

- DC power supply at 5.5V, 5A
- DC multimeter
- USB mini-B cable
- USB 3.0 cable
- PC with USB port
- Intel USB Blaster or USB Blaster II
- Signal generator
- 1:8 relay
- Spectrum analyzer
- BNC cables, splitter
- USB hub
- TSW14J58 Rev A5

2.4.2 Software Required

AFE77xxD Latte v1.4 or later

3 AFE7769DEVM Setup

3.1 AFE7769D Hardware Changes

Make the following changes to the AFE7769DEVM to separate the SYNCOUT pins as shown in Figure 3-1.

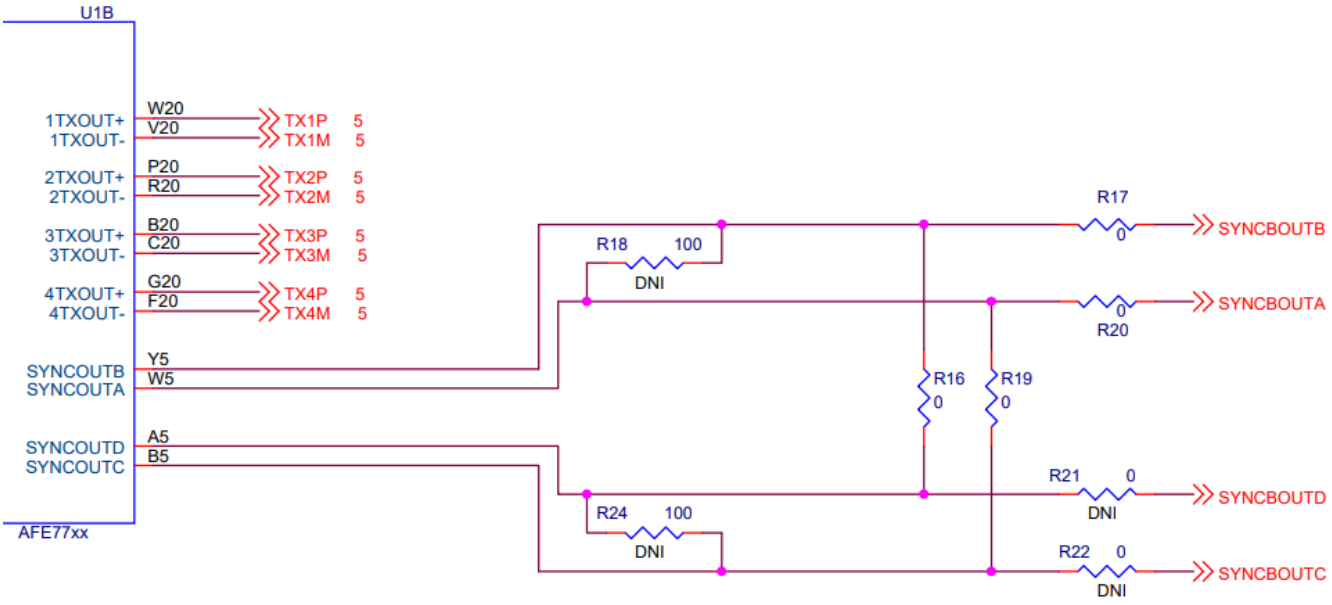

Figure 3-1. Separating the SYNCOUT Pins

In conjunction to the schematic, see Table 3-1 for the list of switches to make.

Table 3-1. List of Pin Changes, AFE7769DEVM

AFE Reference Designator	Change From	Change To
R16	0Ω	DNI
R19	0Ω	DNI
R3	0Ω	DNI
R5	0Ω	DNI
R1	DNI	0Ω
R2	DNI	0Ω
R21	DNI	0Ω
R22	DNI	0Ω

3.2 AFE7769D Connections

1. Connect the 5.5V power supply to power jack connector (J22) of the AFE7769DEVM.
   a. Check and make sure the D14 (POWER) LED lights up.
2. Connect the USB Type Mini-B Cable from PC to the USB port (J20) of the AFE7769DEVM.
   a. Check and make sure the D13 (USB_PWR) LED lights up.
3. Connect the AFE7769DEVM to the RNS802 through the FMC connector.
4. Connect the 122.88MHz reference clock (SYNC_CLOCK) from the RNS802 (J1106) to the LMK_CLKIN (J19) of the AFE7769DEVM, as shown in Figure 3-2.

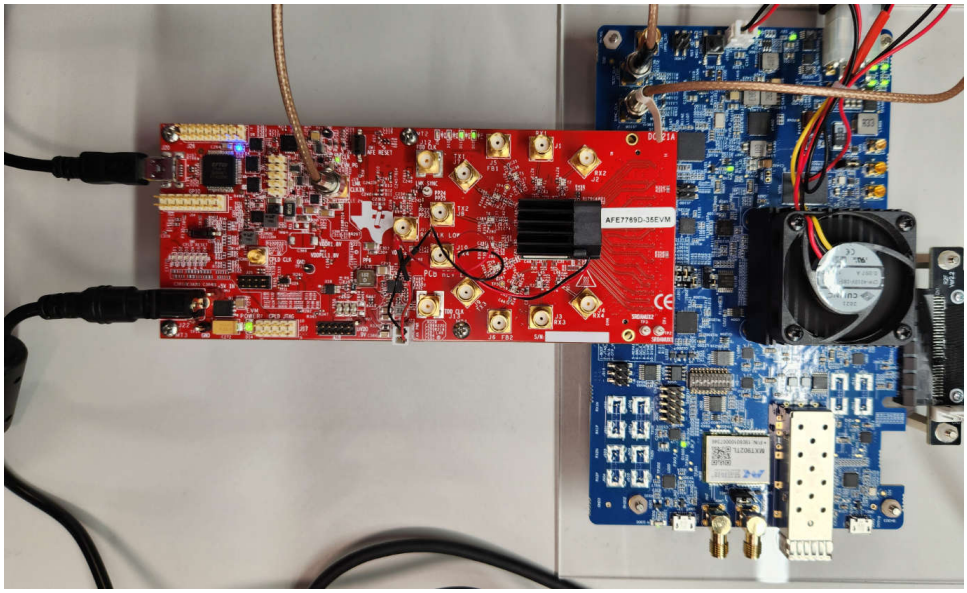

Figure 3-2. Hardware Setup and Connections AFE7769DEVM-RNS802

3.3 AFE7769D Software Setup

1. Install the AFE77xxD Latte GUI from zipped folder called “V1p4.zip” in the TI drive.
2. After installing the AFE77xxD GUI, copy the PC802_LMKDIV.py script and paste it under the following directory “…\Documents\Texas Instruments\AFE77xxDLatte\projects\AFE77xxD\AFE7769D”.
3. Copy the “AFE77xxD_Picocom_pc802_K1L.xlsx” file and paste it under “\Documents\Texas Instruments\AFE77xxDLatte\lib\configs”.

3.4 AFE7769D Programming Method 1: Automated

1. Open the AFE77xxD Latte GUI version 1.4. Make sure the interface looks like Figure 3-3, then click Continue. The message "Couldn’t Detect FPGA Reset FTDI. Please reset FPGA manually" is expected and can be ignored.

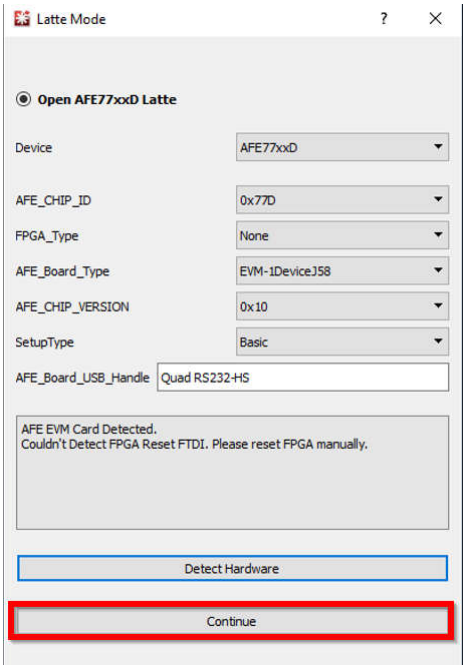

Figure 3-3. Launching AFE77xxD Latte Software

2. Wait until the GUI loads. Figure 3-4 shows the landing page.

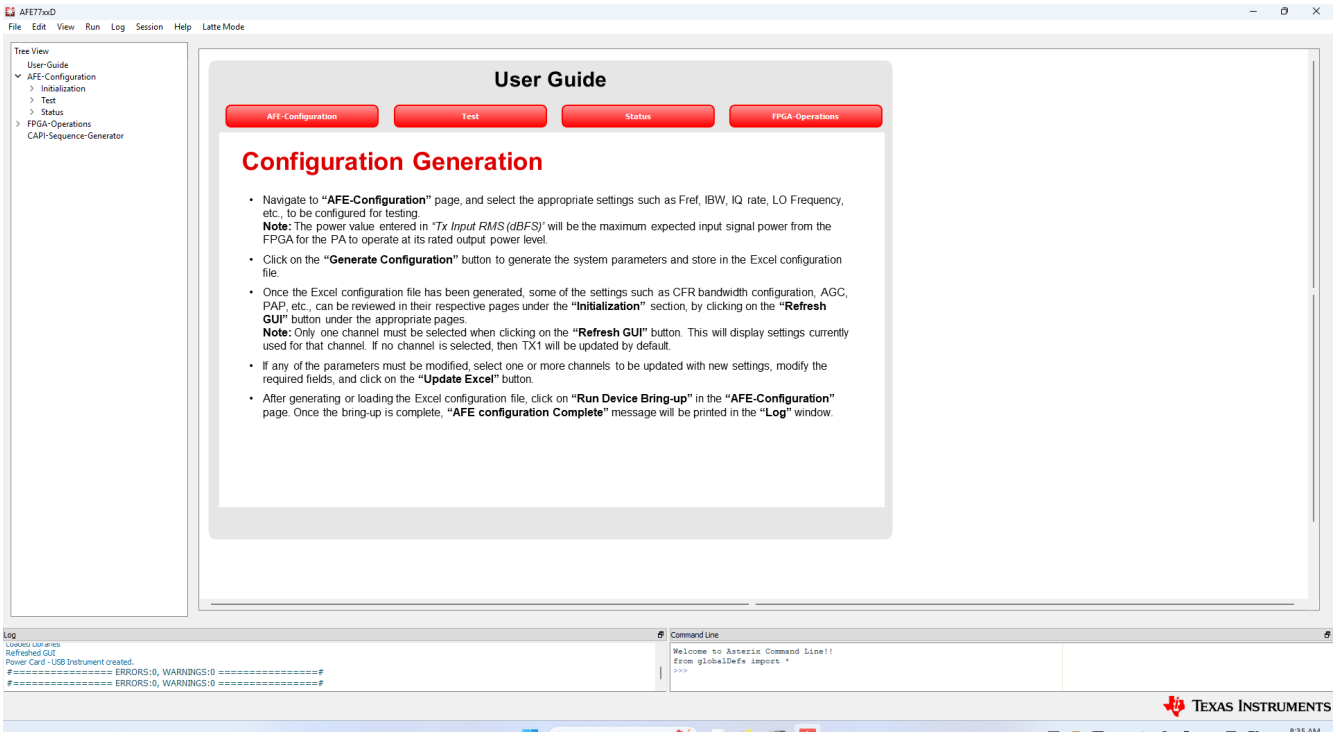

Figure 3-4. AFE77xxD Latte Landing Page

3. At the top, click on Latte Mode and navigate to Script Mode, as shown in Figure 3-5.

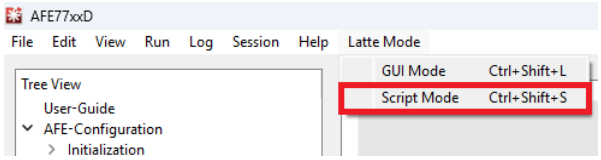

Figure 3-5. Switching to Script Mode

4. Open the PC802_2T2R_Script.py script on the tree view on the left as shown in Figure 3-6.

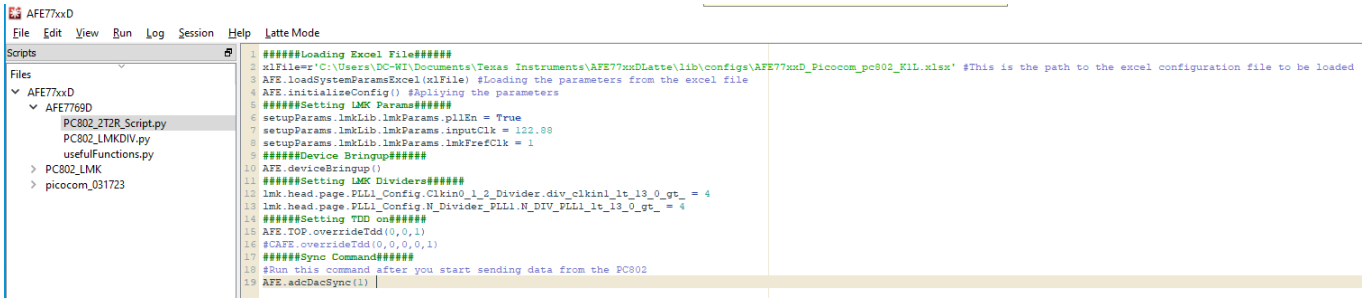

Figure 3-6. RNS802 Script

5. Run the script by pressing F5 or by clicking Run > Buffer. An output in the log window like that shown in Figure 3-7 signals that the script was run with no errors. After running this script, the LMK_LOCKED LED (D11) turns on if the 122.88MHz reference from the RNS802 is connected.

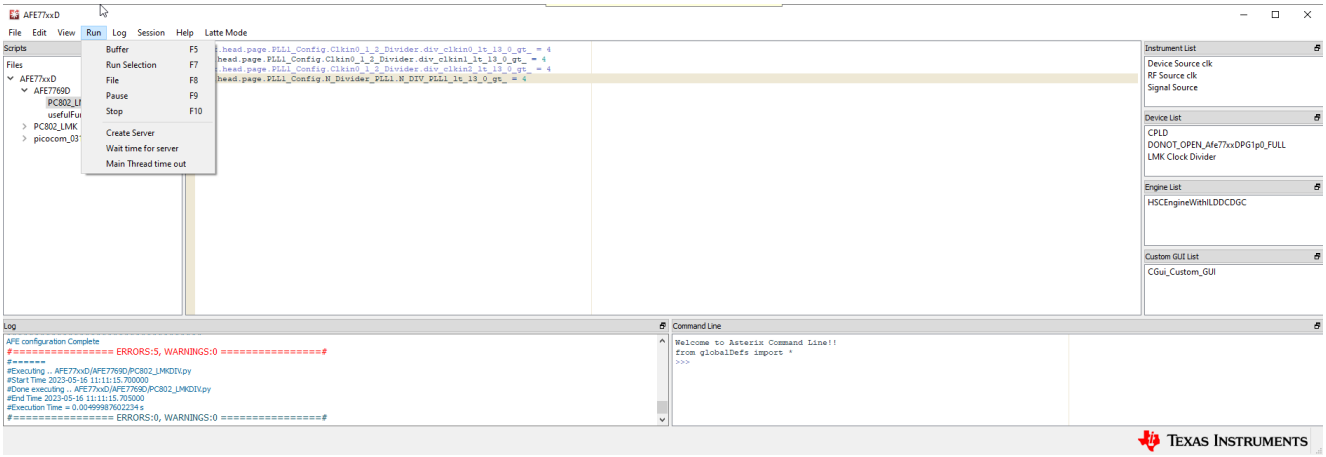

Figure 3-7. Running the RNS802 Script

3.5 AFE7769D Programming Method 2: Using GUI Mode

Note

For GUI Mode automation, the final step will require reference to Picocom's **PC802 EVB RFIC Demonstration User Guide** (Version 3), which can be procured through submitting a request on the company site.

1. Open the AFE77xxD Latte GUI version 1.4. Make sure the insterface looks like Figure 3-8, then click Continue. The message “Couldn’t Detect FPGA Reset FTDI. Please reset FPGA manually.” is expected and can be ignored.

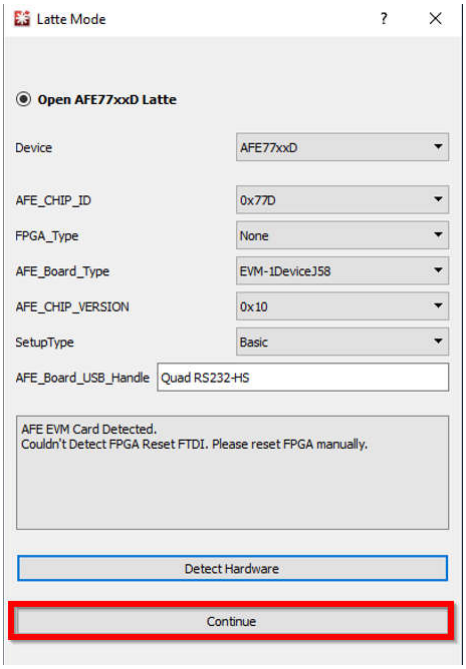

Figure 3-8. Launching AFE77xxD Latte Software

2. Wait until the GUI loads to the User Guide window, as shown in Figure 3-9. Click the *AFE-Configuration* tab under the tree view on the left for the main parameters screen.

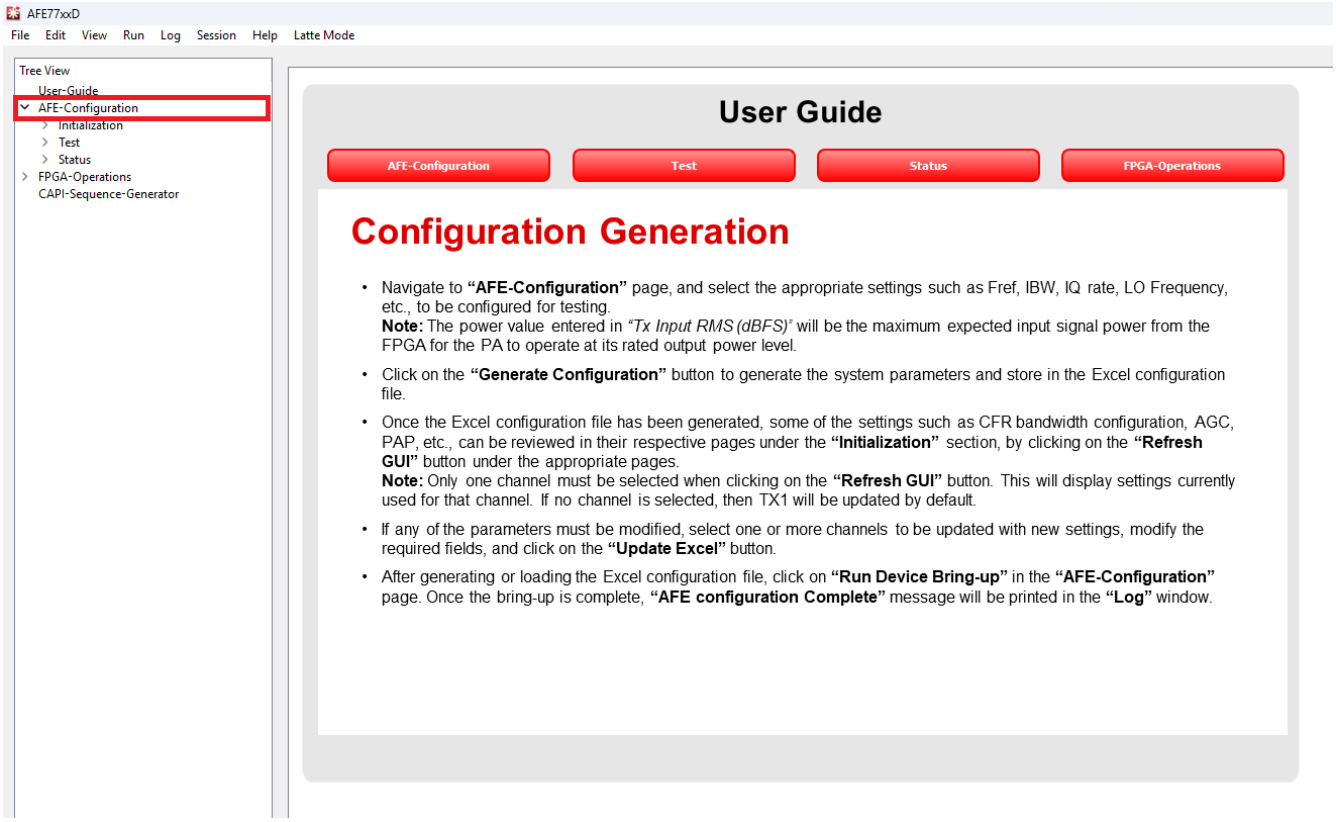

Figure 3-9. User-Guide, AFE77xxD Latte Software

3. Click *Browse* under *Load System Parameters* and select the "AFE77xxD_Picocom_pc802_K1L.xlsx" config file under "\Documents\Texas Instruments\AFE77xxDLatte\lib\configs". After selecting the file, click *LOAD*. Figure 3-10 shows the main window screen. You should also see a message in the Log window saying that the configuration was loaded.

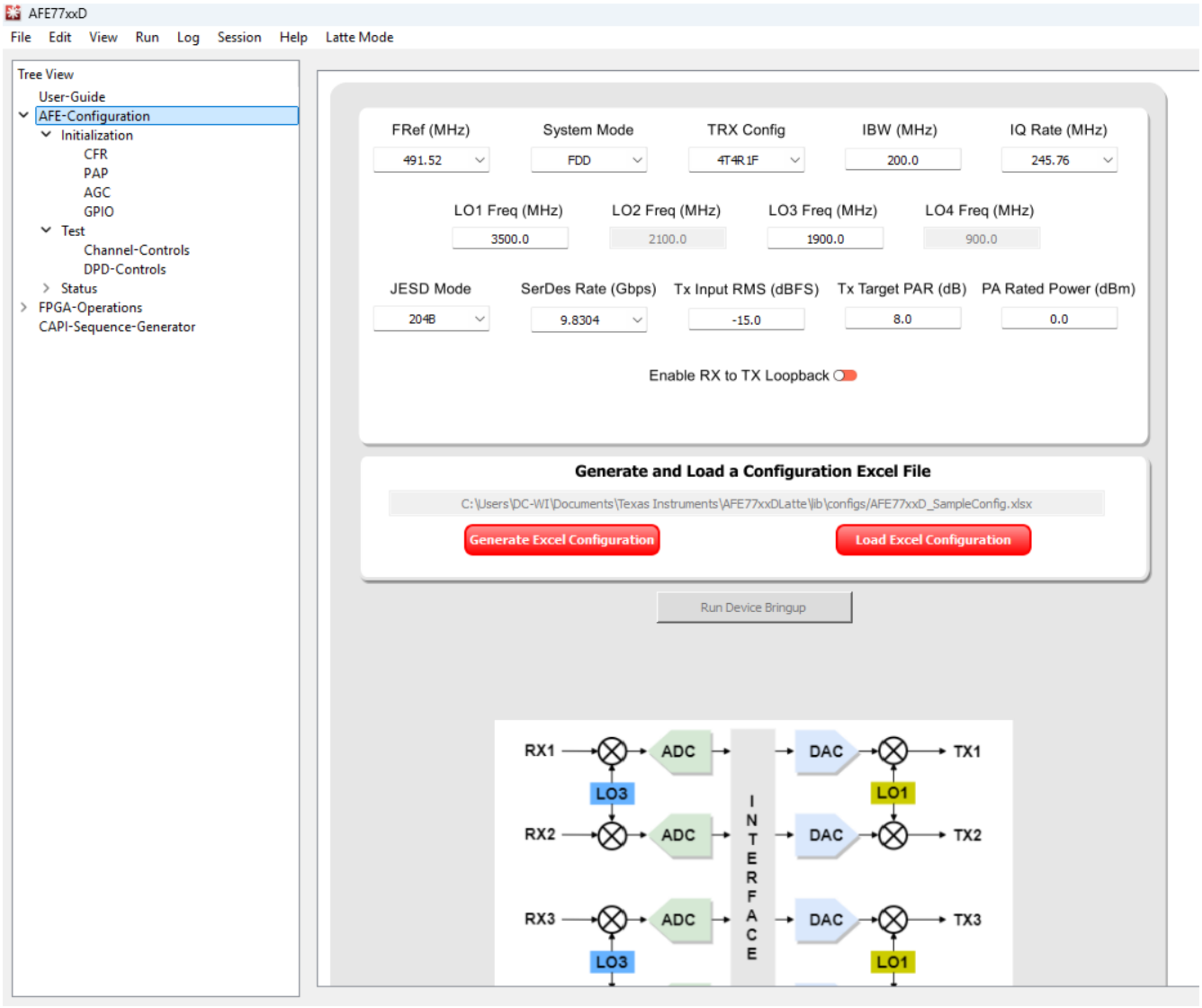

Figure 3-10. Main Window: AFE-Configuration

4. After that, under *Hardware Connection*, click the refresh GUI button to see a message on the log window saying “Refreshed GUI”. Then click *Device Bringup* to start the bringup for the device. For proper navigation, see Figure 3-11.

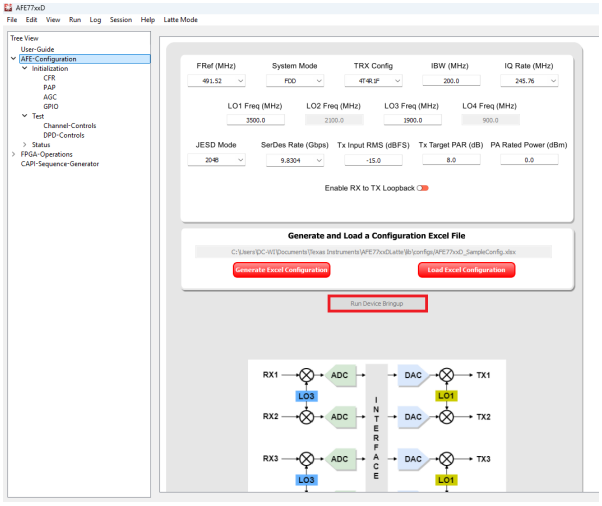

Figure 3-11. Execute Device Configuration

5. After the device bringup is done, you will see some errors on the log window (shown in Figure 3-12). Two of these errors should be “FPGA Reset device not found” and the rest should be under the “Device DAC JESD-RX 0 Link Status” line. These errors are expected because the JESD link is not up.

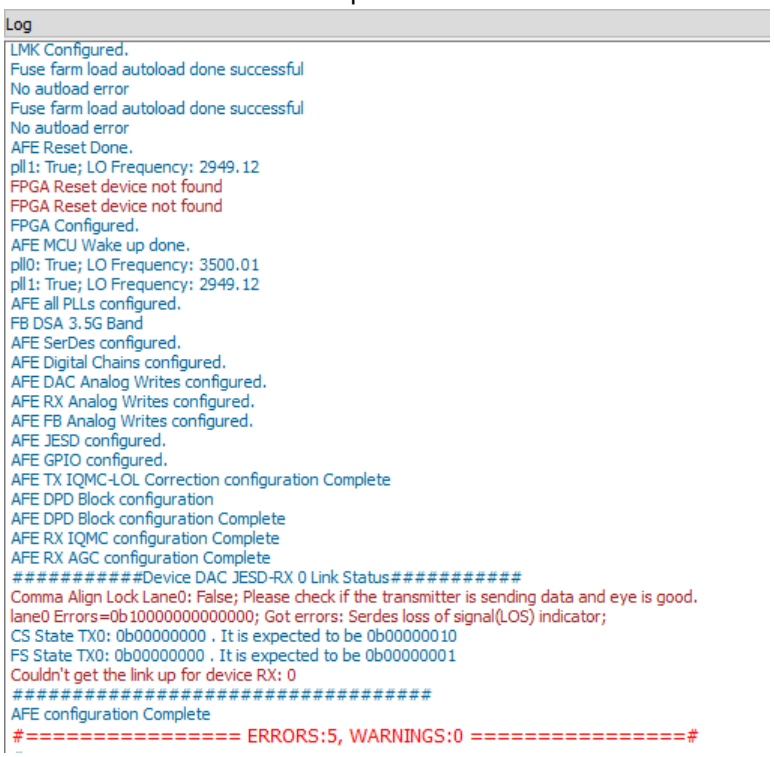

Figure 3-12. Latte Log Window Post-Device Configuration

6. At the top, click *Latte Mode* and navigate to *Script Mode* as shown in Figure 3-13.

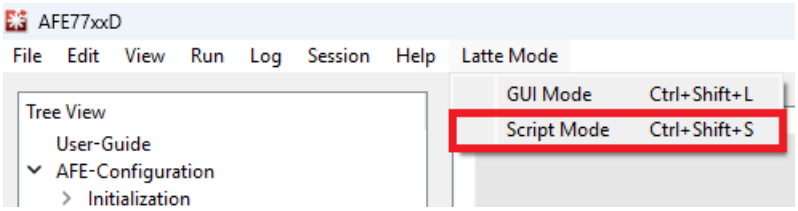

Figure 3-13. Switching to Script Mode

7. Open the PC802_LMKDIV.py script on the tree view on the left, as shown in Figure 3-14.

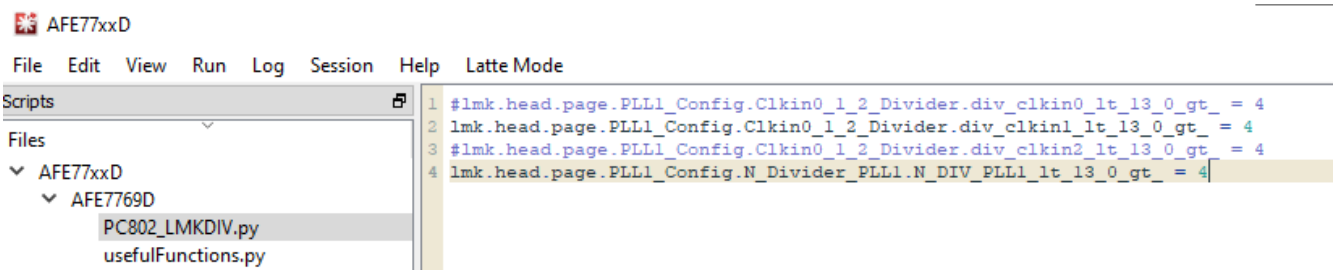

Figure 3-14. RNS802 LMK Script

8. Run the script by pressing F5 or by clicking Run > Buffer. An output in the log window like Figure 3-15 signals that the script was run with no errors. After running this script, the LMK_LOCKED LED (D11) turns on if the 122.88MHz reference from the RNS802 is connected.

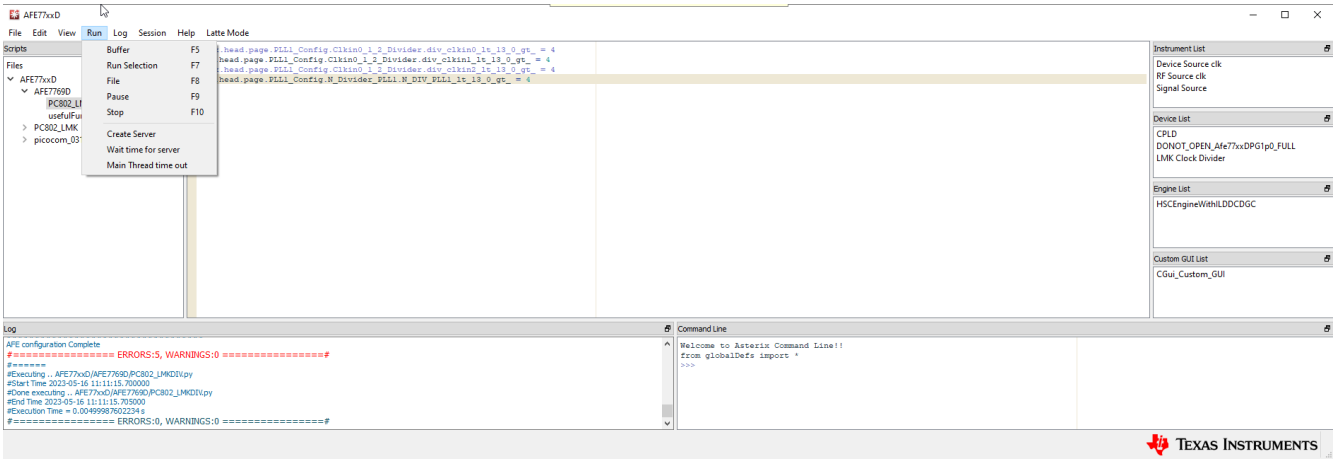

Figure 3-15. Running the LMK Script

9. Click *Latte Mode* and navigate to *GUI Mode* as shown in Figure 3-16.

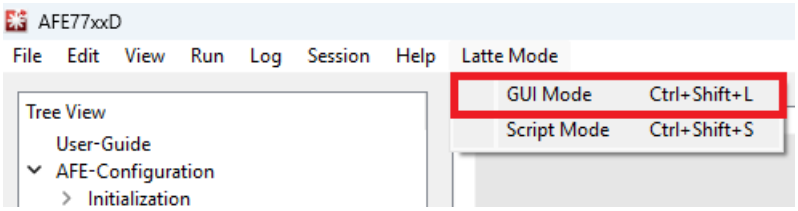

Figure 3-16. Switching to GUI Mode

10. Click *TX-Test* under the tree view, as shown in Figure 3-17.

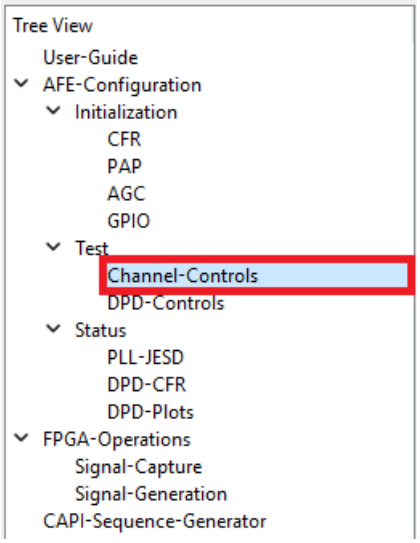

Figure 3-17. Switching to the Channel Controls Tab in Latte

11. Enable the TDD for the TX channels by setting them to green like in Figure 3-18. Then, click *Set TX TDD*. A message should appear on the log window that says “TDD set”.

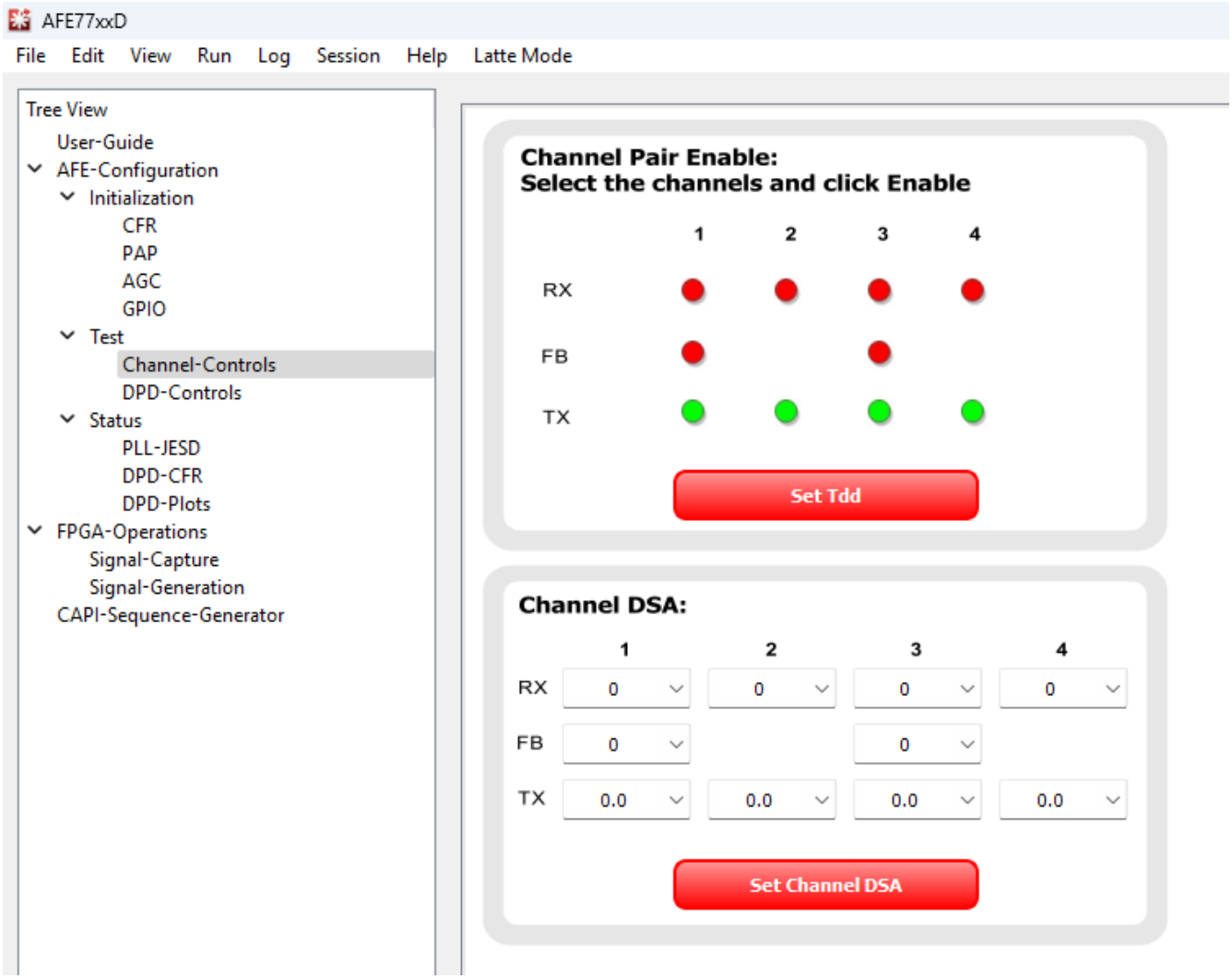

Figure 3-18. Enabling TX TDD

12. Proceed to set up the RNS802 by following the **PC802 EVB RFIC Demonstration User Guide** (Version 3) from section 2.2. When you get to section 2.2.5, after you enter the *start* command on the test mode tool to start sending data, type the “AFE.adcDacSync(1)” command in the Command line of the AFE77xxD GUI. You should now be able to see a report in the log window that the JESD link is up with no errors like in Figure 3-19. Data now flows through the AFE TX channel.

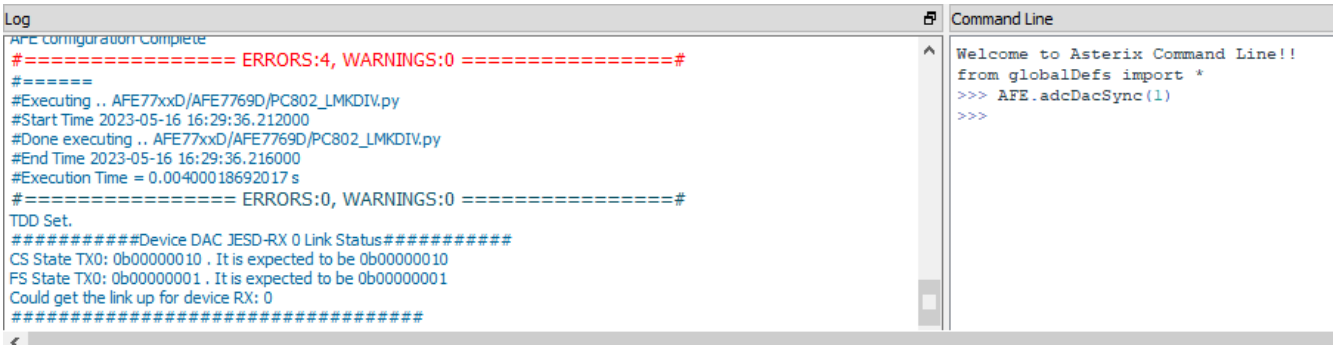

Figure 3-19. JESD Link Bringup

4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (December 2023) to Revision A (May 2025)	Page
• Added RANsemi RNS802 SoC information to the document	2
• Changed required software from: AFE77xxD Latte v0.4 to: AFE77xxD Latte v1.4 or later	3
• Changed AFE77xxD Latte GUI zip folder name from: V0p4.zip to: V1p4.zip	4
• Changed the *AFE7769D Programming Method 1: Automated* instructions	4
• Changed the *AFE7769D Programming Method 2: Using GUI Mode* instructions	6

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