Application Brief

DPD Test Report: AFE77xxD With GTRB267008FC Power Amplifier (Short)

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Introduction

This application brief presents digital predistortion (DPD) results of the AFE77xxD transceiver in conjunction with the GTRB267008FC power amplifier (PA). First, a high-level overview of the test setup and transceiver configuration for DPD is explained, followed by adjacent channel leakage ratio (ACLR) test results for three distinct use cases.

The AFE77xxD is a high-performance, multichannel transceiver, integrating that includes integration of:

- Four direct up-conversion transmitter chains
- Four direct down-conversion receiver chains
- Two wideband RF-sampling digitizing auxiliary chains (feedback paths)
- Low-power digital predistortion (DPD) engine for PA linearization

The GTRB267008FC PA is a Gallium Nitride (GaN) device with broad applications in wireless infrastructure, communications equipment, and Macro cells.

Test Conditions and Setup

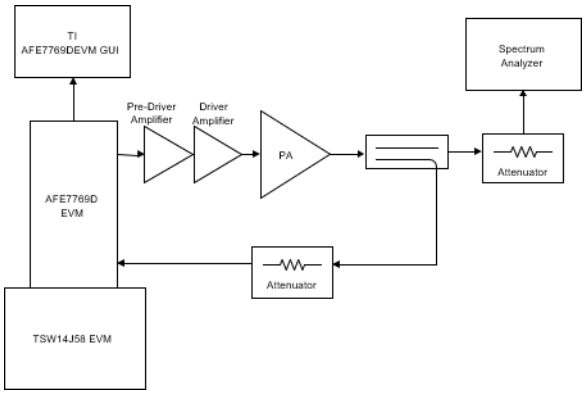

Figure 1. Block Diagram of Test Setup

Note

The measurements published in this report are from a single PA using TI's test setup shown in Figure 1. There is a potential for slight DPD linearization differences due to part-to-part variations. PA vendors release other versions of the same EVM with enhanced efficiency and linearity performance. Depending on the DPD line up, customers use different components to further fit into end application usage. Evaluate component selection to establish reproducible results highlighted in this DPD report.

Table 1. Setup Details

Parameter	Detail
Gain of pre-driver amplifier and gain block	61dB
Instantaneous bandwidths (IBW) tested	20MHz, 100MHz, 160MHz

Table 2. Power Amplifier Details According to Data Sheet

Key Attribute	Value(1)
Power amplifier	GTRB267008FC
Operating frequency range	2496MHz – 2690MHz
Rated output power	49.3dBm
PA type	GaN
Gain	14.7dB
Efficiency	53%
Supply voltage	48V_{DS}

(1) MACOM Technology Solutions Inc, *Thermally-Enhanced High Power RF GaN on SiC Amplifier, 620W, 48V, 2496 – 2690MHz*, data sheet

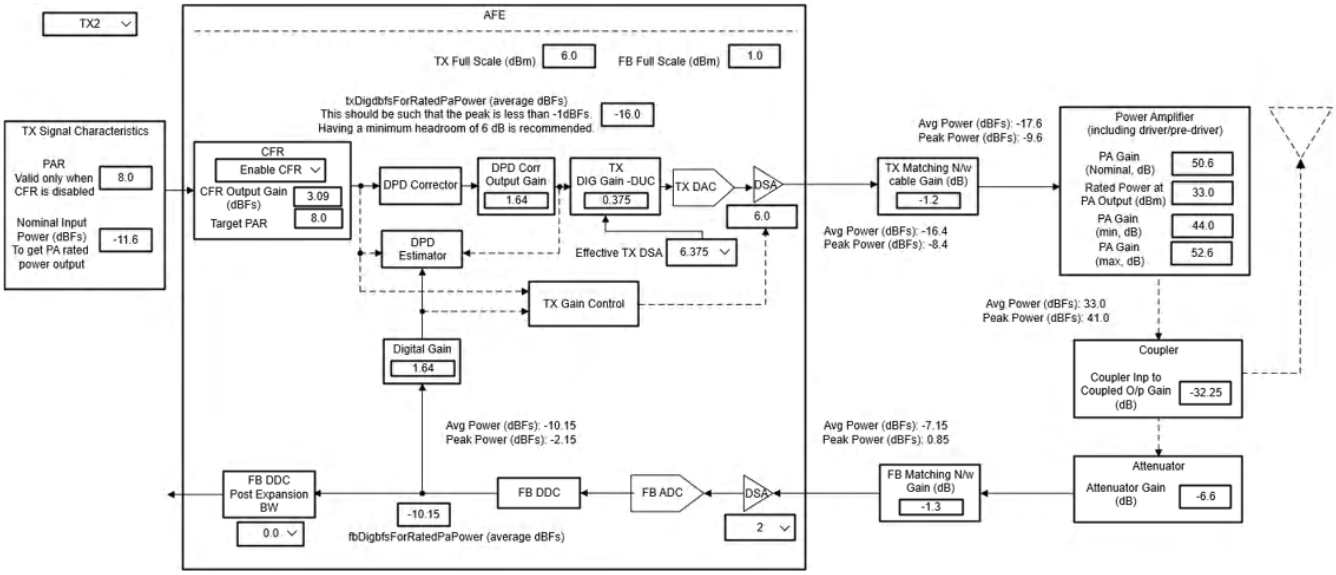

Figure 2. Example Graphical User Interface (GUI) for AFE77xxD DPD

Note

The AFE77xxD device is configured through TI's Latte software which facilitates system integration of the AFE into the system or end equipment for a customized setup of the transceiver. Customers have moderate control of AFE configuration, depending on a given use case based on multiple parameters such as PA type, frequency range, PA gain, and bandwidth. The flexible adjustment of such parameters is performed without changing the system hardware, which further simplifies the system integration process.

5G New Radio (NR) is the standard signal in wireless communications and is the signal used for the following tests in this report.

Test Case 1

Table 3. Case 1: Test Conditions

Parameter(1)	Value
TX interface rate	61.44MSPS
DPD rate	122.88MSPS

(1) 20-MHz signal with 2.595-GHz center frequency, 8-dB PAR, test signal TM3.1a FDD

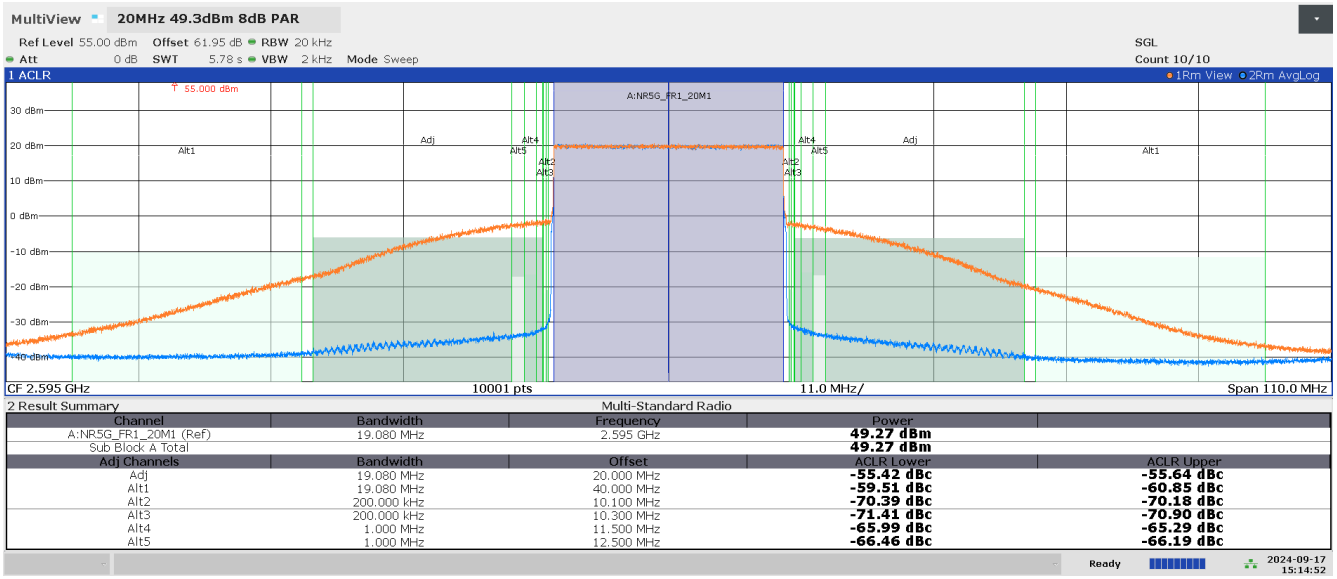

Figure 3. Case 1: ACLR Plot Before (Orange) and After (Blue) DPD Is Enabled

Table 4. Case 1: ACLR Summary

Parameter	PA Output Power	Adjacent Power Lower	Adjacent Power Upper	Alternate Power Lower	Alternate Power Upper	PA Efficiency
Without DPD	49.3dBm	–25.7dBc	–27dBc	–43.4dBc	–46.8dBc	N/A
With DPD	49.3dBm	–55.4dBc	–55.6dBc	–59.5dBc	–60.8dBc	52.8%

Test Case 2

Table 5. Case 2: Test Conditions

Parameter(1)	Value
TX interface rate	122.88MSPS
DPD rate	368.64MSPS

(1) 100-MHz signal with 2.595-GHz center frequency, 8-dB PAR, test signal TM3.1a FDD

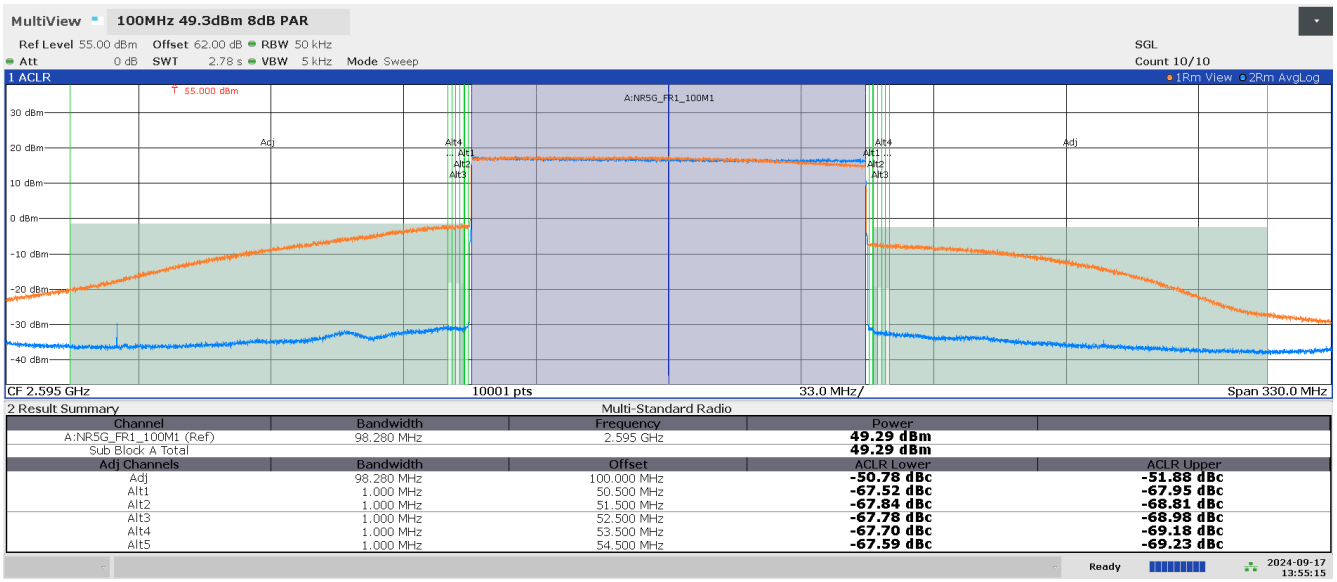

Figure 4. Case 2: ACLR Plot Before (Orange) and After (Blue) DPD Is Enabled

Table 6. Case 2: ACLR Summary

Parameter	PA Output Power	Adjacent Power Lower	Adjacent Power Upper	PA Efficiency
Without DPD	49.3dBm	–23.9dBc	–28.8dBc	N/A
With DPD	49.3dBm	–50.8dBc	–51.9dBc	53%

Test Case 3

Table 7. Case 3: Test Conditions

Parameter(1)	Value
TX interface rate	245.76MSPS
DPD rate	737.28MSPS

(1) 2×80-MHz signal with 2.595-GHz center frequency, 8-dB PAR, test signal TM3.1a FDD.

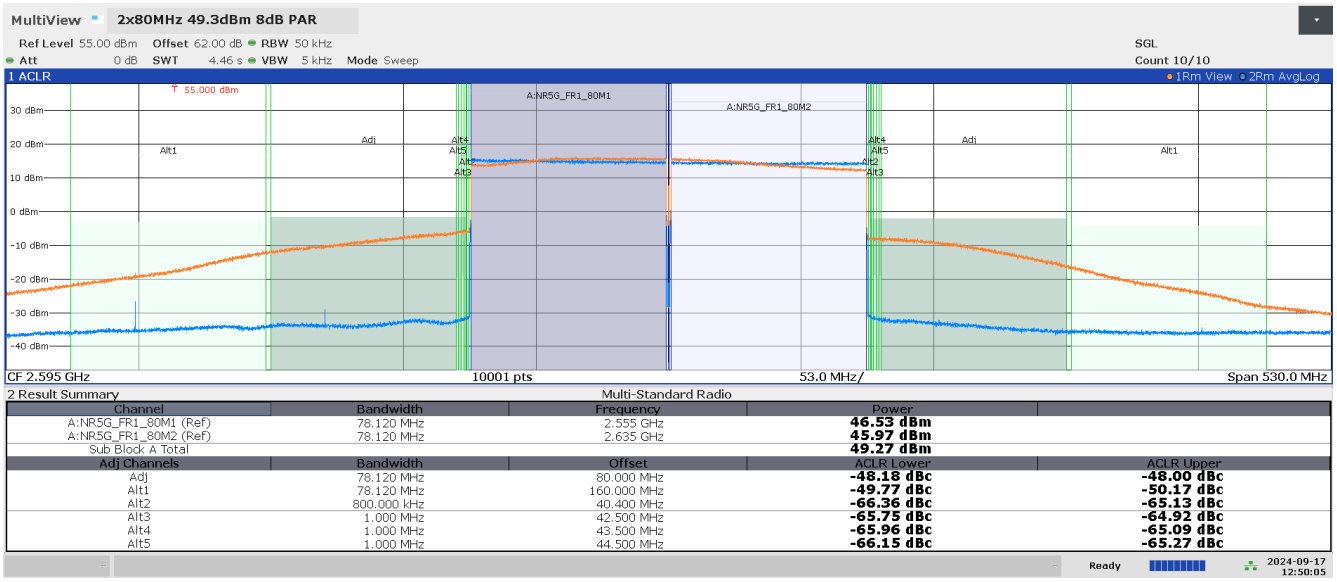

Figure 5. Case 3: ACLR Plot Before (Orange) and After (Blue) DPD Is Enabled

Table 8. Case 3: ACLR Summary

Parameter	PA Output Power	Adjacent Power Lower	Adjacent Power Upper	Alternate Power Lower	Alternate Power Upper	PA Efficiency
Without DPD	49.3dBm	–23.8dBc	–24.5dBc	–31.7dBc	–35.5dBc	N/A
With DPD	49.3dBm	–48.2dBc	–48dBc	–49.8dBc	–50.2dBc	53%

Summary

The content in Table 9 summarizes test conditions and Table 10 summarizes case results.

Table 9. Summary of Test Cases

Test	Center Frequency	Signal Bandwidth	Power	PAR	V_{DS}
Case 1	2595MHz	20MHz	49.3dBm	8dB	48V
Case 2	2595MHz	100MHz	49.3dBm	8dB	48V
Case 3	2595MHz	2×80MHz	49.3dBm	8dB	48V

Table 10. Summary of DPD Performance

Test	PA Output Power	Adjacent Power Lower	Adjacent Power Upper	Alternate Power Lower	Alternate Power Upper	PA Efficiency
Case 1	49.3dBm	–55.4dBc	–55.6dBc	–59.5dBc	–60.8dBc	52.8%
Case 2	49.3dBm	–50.8dBc	–51.9dBc	N/A	N/A	53%
Case 3	49.3dBm	–48.2dBc	–48dBc	–49.8dBc	–50.2dBc	53%

In conclusion, the AFE77xxD demonstrates linearization capability on the GTRB267008FC PA through unique DPD algorithms, and at the same time reduces power consumption when compared to TX line-up designs without DPD capability.

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