Application Brief

DPD Test Report: AFE77xxD With SKY66391-12 Power Amplifier

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Introduction

This application brief presents digital pre-distortion (DPD) results of the AFE77xxD transceiver in conjunction with the SKY66391-12 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 two distinct use cases.

The AFE77xxD is a high-performance, multichannel transceiver, integrating four direct up-conversion transmitter chains, four direct down-conversion receiver chains, two wide-band RF-sampling digitizing auxiliary chains (feedback paths), and a low-power digital pre-distortion (DPD) engine for PA linearization.

The SKY66391-12 PA is a high-efficiency power amplifier with broad applications in wireless infrastructure and communications equipment.

Test Conditions and Setup

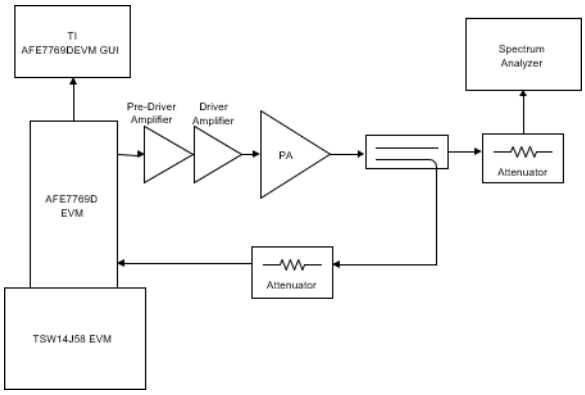

Figure 1. Block Diagram of Test Setup

Note

The measurements published in this report were taken on a single PA using TI's test setup. There can be slight DPD linearization differences due to part-to-part variations. PA vendors can release other versions of the same EVM with enhanced efficiency and linearity performance. Customers can use different components in their DPD line up to further fit into the end application usage. Component selection must be evaluated to reproduce results highlighted in this DPD report.

Table 1. Setup Details

Parameter	Detail
Gain of predriver amplifier and gain block (dB)	19.7
Instantaneous bandwidths (IBW) tested (MHz)	20, 40

Table 2. Power Amplifier Details According to Data Sheet

Key Attribute	Value
Power amplifier	SKY66391-12 (Serial no. M141545A_121)
Operating frequency range (MHz)	1800 – 1900
Rated output power (dBm)	28
Gain (dB)	36 (35.9 based on serial no.)
Efficiency (%)	34.5% (32.3% based on serial no.)
Supply voltage (V_{DS})	5

Note

The AFE77xxD device is configured through TI's Latte software, which programs and integrates the AFE into the system, or end application, for a more customized setup of the transceiver. Customers have moderate control of AFE configuration, depending on a given use case based on multiple parameters (for example, 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. Test Conditions - 20MHz Signal at 1.8425GHz Center Frequency, 8.5dB PAR; Test Signal TM3.1a FDD

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

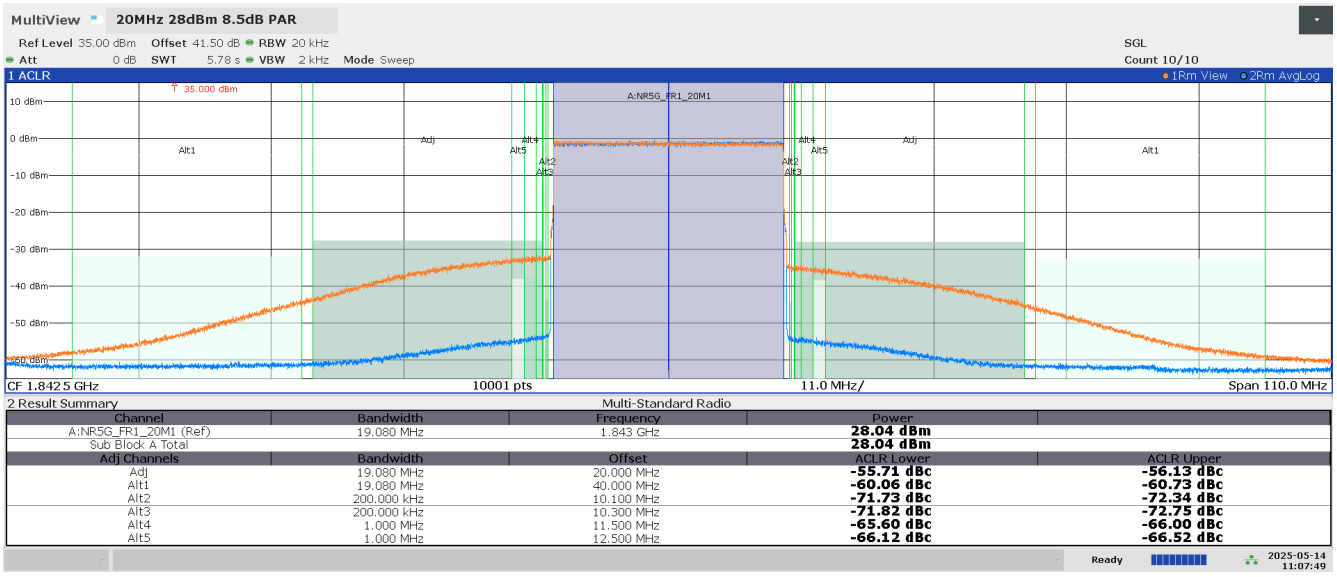

Figure 2. Case 1: ACLR Plot Before (Orange) and After (Blue) DPD is Enabled

Table 4. Case 1 ACLR Summary

Parameter	PA Output Power (dBm)	Adjacent Power Lower (dBc)	Adjacent Power Upper (dBc)	Alternate Power Lower (dBc)	Alternate Power Upper (dBc)	PA Efficiency (%)
Without DPD	28	–34.2	–37.0	–48.6	–50.3	—
With DPD	28	–55.7	–56.1	–60.0	–60.7	32.2

Test Case 2

Table 5. Test Conditions - 2x20MHz Signal at 1.8425GHz Center Frequency, 8.5dB PAR; Test Signal TM3.1a FDD

Parameter	Value
TX interface rate (MSPS)	61.44
DPD rate (MSPS)	163.84

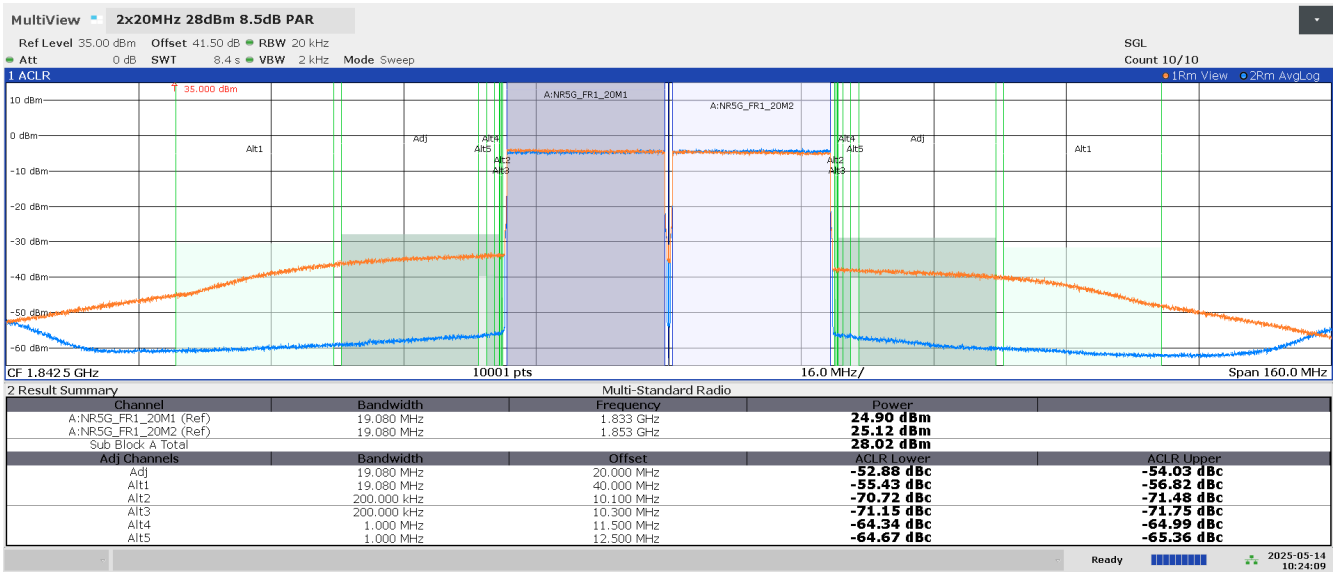

Figure 3. Case 2: ACLR Plot Before (Orange) and After (Blue) DPD is Enabled

Table 6. Case 2 ACLR Summary

Parameter	PA Output Power (dBm)	Adjacent Power Lower (dBc)	Adjacent Power Upper (dBc)	Alternate Power Lower (dBc)	Alternate Power Upper (dBc)	PA Efficiency (%)
Without DPD	28	–30.4	–34.0	–35.2	–38.1	—
With DPD	28	–52.8	–54.0	–55.4	–56.8	32.2

Summary

Table 7 and Table 8 summarize both the test conditions and case results for both test cases.

Table 7. Summary of Test Cases

Test	Center Frequency	Signal Bandwidth	Power	PAR	V_{DS}
Case 1	1.8425GHz	20MHz	28dBm	8.5dB	5V
Case 2	1.8425GHz	3x20MHz	28dBm	8.5dB	5V

Table 8. Summary of DPD Performance Results

Test	PA Output Power	Adjacent Power Lower	Adjacent Power Upper	Alternate Power Lower	Alternate Power Upper	PA Efficiency
Case 1	28dBm	–55.7dBc	–56.1dBc	–60.0dBc	–60.7dBc	32.2%
Case 2	28dBm	–52.8dBc	–54.0dBc	–55.4dBc	–56.8dBc	32.2%

In conclusion, the AFE77xxD demonstrates linearization capability on the Skyworks SKY66391-12 PA through unique DPD algorithms, and reduces power consumption when compared to TX line-up design without DPD. For the full PA test report with additional use cases, please request access here.

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