*Application Brief*

# DPD Test Report: AFE77xxD With SKY66522-11 Power Amplifier

TEXAS INSTRUMENTS

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**Introduction**

This application brief presents digital pre-distortion (DPD) results of the AFE77xxD transceiver in conjunction with the SKY66522-11 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 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 DPD engine for PA linearization.

The SKY66522-11 PA is a high-efficiency power amplifier with broad applications in wireless infrastructure and communications equipment.
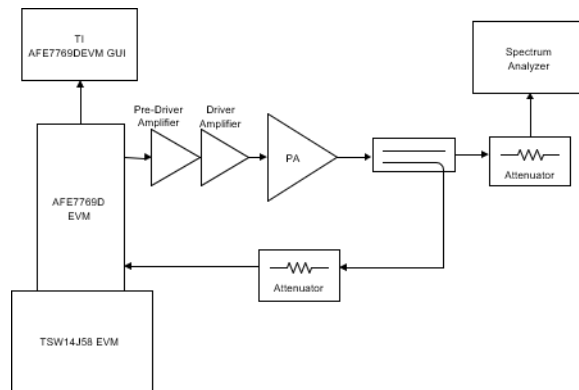
**Test Conditions and Setup**



**Figure 1. Test Setup Block Diagram**

**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 the 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) | 16 |
| Instantaneous bandwidths (IBW) tested (MHz) | 20, 100, 160 |

### Table 2. Power Amplifier Details According to Data Sheet

| Key Attribute | Value |
|---|---|
| Power amplifier | SKY66522-11 (Serial no. SN5) |
| Operating frequency range (MHz) | 2300 – 2690 |
| Rated output power (dBm) | 31 |
| Gain (dB) | 36.5 (36.4 based on serial no.) |
| Efficiency (%) | 31.2% based on serial no. |
| Supply voltage ($V_{DS}$) | 5, 12 |

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**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.

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### Test Case 1

### Table 3. Test Conditions - 20MHz Signal at 2.595GHz Center Frequency, 8dB PAR; Test Signal TM3.1a TDD

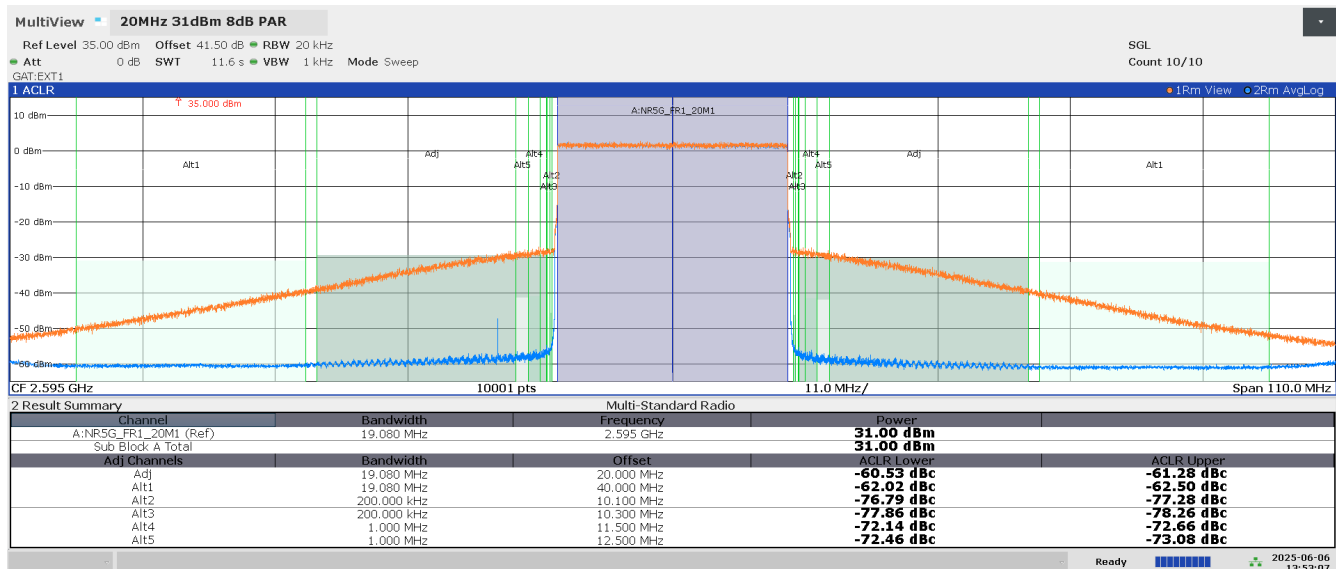| Parameter | Value |
|---|---|
| TX interface rate (MSPS) | 61.44 |
| DPD rate (MSPS) | 122.88 |



**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 | 31 | −33.7 | −34.1 | −45.5 | −46.6 | – |
| With DPD | 31 | −60.5 | −61.2 | −62.0 | −62.5 | 30.9% |

## Test Case 2

### Table 5. Test Conditions - 100MHz Signal at 2.595GHz Center Frequency, 8dB PAR; Test Signal TM3.1a TDD

| Parameter | Value |
|---|---|
| TX interface rate (MSPS) | 122.88 |
| DPD rate (MSPS) | 368.64 |
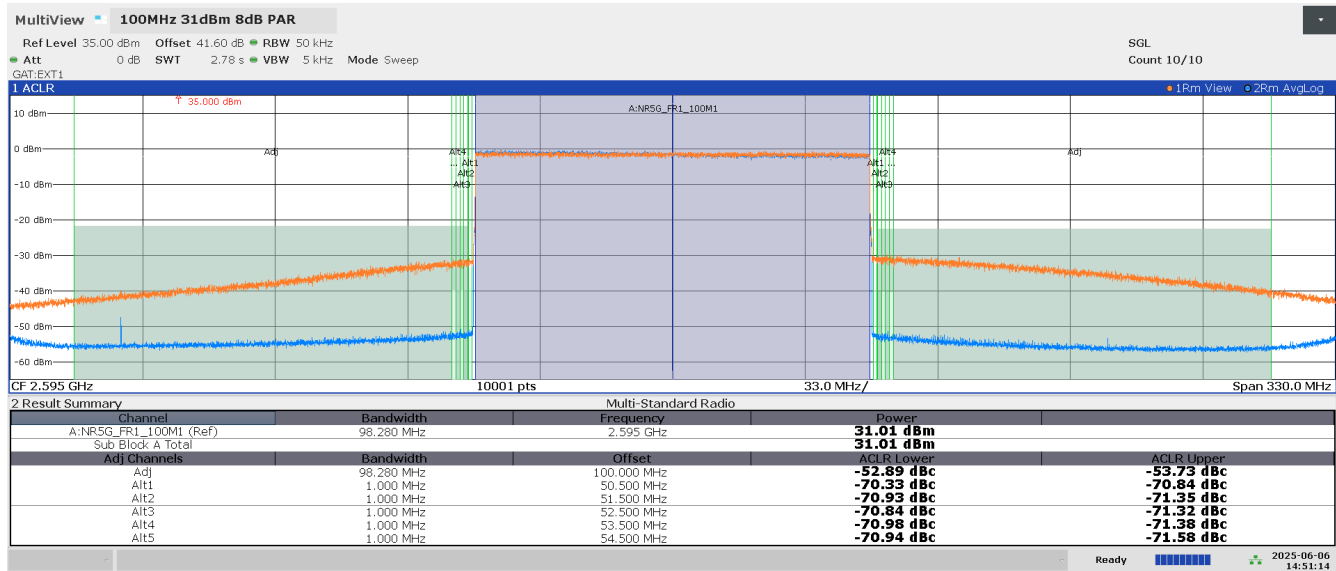


**Figure 3. Case 2: ACLR Plot Before (Orange) and After (Blue) DPD is Enabled**

### Table 6. Case 2 ACLR Summary

| Parameter | PA Output Power (dBm) | Adjacent Power Lower (dBc) | Adjacent Power Upper (dBc) | PA Efficiency |
|---|---|---|---|---|
| Without DPD | 31 | −34.8 | −32.6 | – |
| With DPD | 31 | −52.8 | −53.7 | 31% |

## Test Case 3

### Table 7. Test Conditions - 2x80MHz Signal at 2.595GHz Center Frequency, 8dB PAR; Test Signal TM3.1a TDD

| Parameter | Value |
|---|---|
| TX interface rate (MSPS) | 245.76 |
| DPD rate (MSPS) | 552.96 |
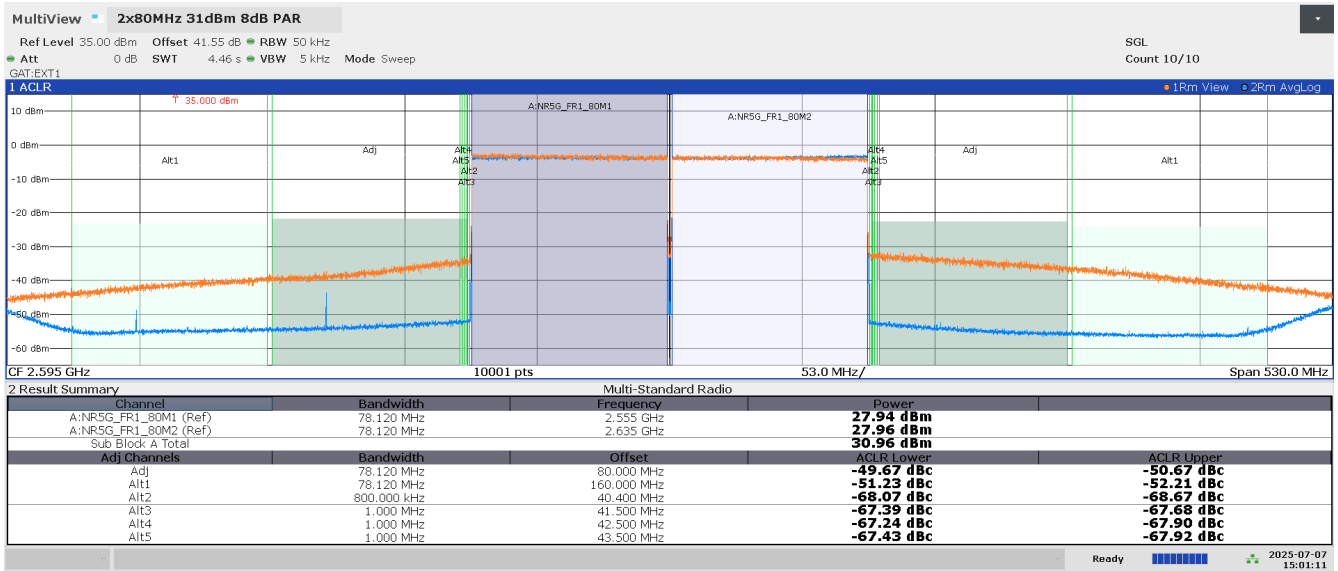
**Figure 4. Case 3: ACLR Plot Before (Orange) and After (Blue) DPD is Enabled**

**Table 8. Case 3 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 | 31 | –33.6 | –30.5 | –37.9 | –35.1 | – |
| With DPD | 31 | –49.6 | –50.6 | –51.2 | –52.2 | 31% |

## Summary

Table 9 and Table 10 summarize both the test conditions and case results for all test cases.

**Table 9. Summary of Test Cases**

| Test | Center Frequency (GHz) | Signal Bandwidth | PA Output Power (dBm) | PAR (dB) | $V_{DS}$ |
|---|---|---|---|---|---|
| Case 1 | 2.595 | 20MHz | 31 | 8 | 5V, 12V |
| Case 2 | 2.595 | 100MHz | 31 | 8 | 5V, 12V |
| Case 3 | 2.595 | 2x80MHz | 31 | 8 | 5V, 12V |

**Table 10. Summary of DPD Performance Results**

| Test | PA Output Power (dBM) | Adjacent Power Lower (dBc) | Adjacent Power Upper (dBc) | Alternate Power Lower (dBc) | Alternate Power Upper (dBc) |
|---|---|---|---|---|---|
| Case 1 | 31 | –60.5 | –61.2 | –62.0 | –62.5 |
| Case 2 | 31 | –52.8 | –53.7 | – | – |
| Case 3 | 31 | –49.6 | –50.6 | –51.2 | –52.2 |

In conclusion, the AFE77xxD demonstrates linearization capability on the Skyworks SKY66522-11 PA through unique DPD algorithms, and reduces power consumption when compared to TX line-up design without DPD.

## Trademarks

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