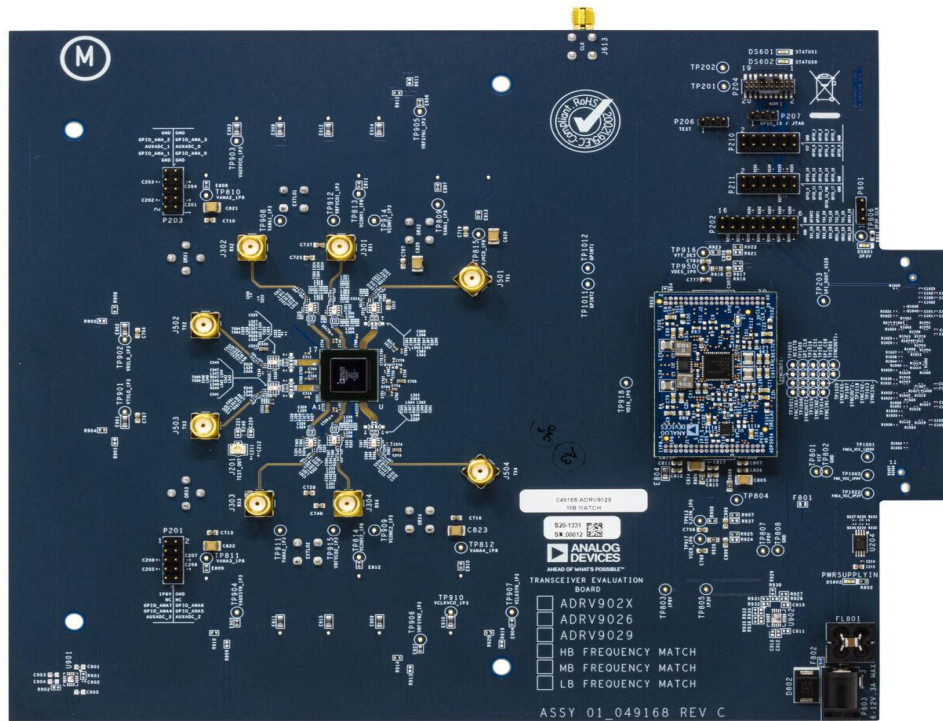




ADRV9029 DPD results with WOLFSPEED PA Part No: WS2A3540



ADRV9029 Evaluation Board with on-chip Digital Predistortion Solution

Introduction:

In this report, we present DPD results using the ADRV9029 on-chip DPD using the following setup configuration:

User Case: 51_LinkSharing

Sampling rate: 245.76Msps

JESD Lane rate: 16.22016Gbps

DFE (CFR, DPD): Enabled

LOL correction: Enabled

Wolfspeed PA test conditions

| | |
|--------------------|--|
| Transceiver | ADRV9029 |
| Power Amplifier | WS2A3540 |
| Driver Amplifier | Mini Circuits ZVA183-S+ |
| Application | M-MIMO |
| Output power | 39.0 dBm (~8 Watt) |
| PA Type | LDMOS |
| Frequency Range | 3400-3600 MHz |
| Gain | 39.85 |
| Drain Efficiency % | 50.51 |
| P3dB | 47.50 dBm |
| Bandwidth Tested | 1x100MHz NR, 4x20MHz LTE 200MHz & 1x20MHz LTE |
| ACLR | -50.00 dBc |
| Supply Voltage | 48 V |

Test setup

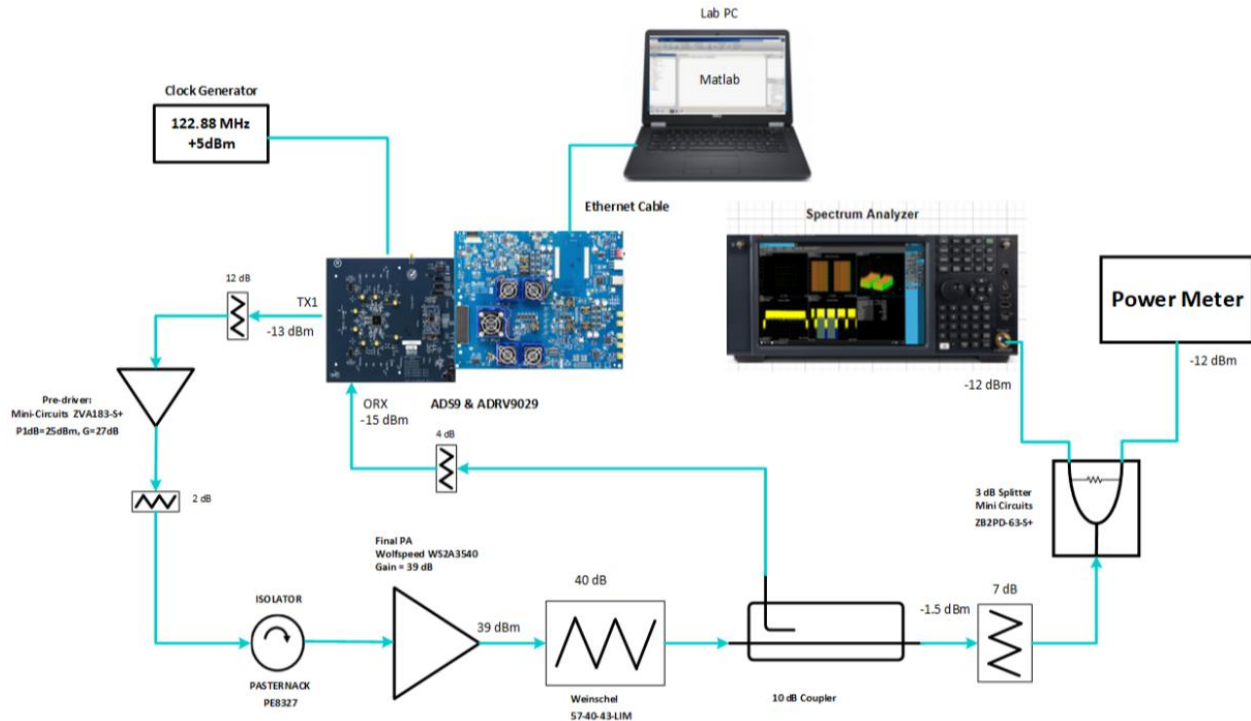


Fig. 1 ADI DPD Test Set up.

Note: The reports published are measurements done on single PA using ADI test environment. that there can be slight DPD performance difference due to part-to-part variations. PA vendors might release other versions of this same EVB with enhanced efficiency and linearity performance. Also, using a custom PA design based on this PA part number may results in different DPD performance.

The Driver amplifier used in Fig. 1 is broadband Mini Circuits ZVA183-S+. Customers may use different components in their DPD setups. However, careful component selection needs to be performed to be able to reproduce the DPD results published in this report.

In Fig. 1, the Doherty Amplifier WS2A3540 is loaded with high power attenuator presenting a max VSWR of 1.15 to not detune the PA from its optimum tuning.

We encourage our customers to evaluate the ADRV9029 DPD performance using evaluation board using the test conditions in this report. It is important to start by testing the evaluation board provided by the PA vendor with the recommended bias values and duplicate the DPD results in this report before proceeding with the custom PA design.

Summary

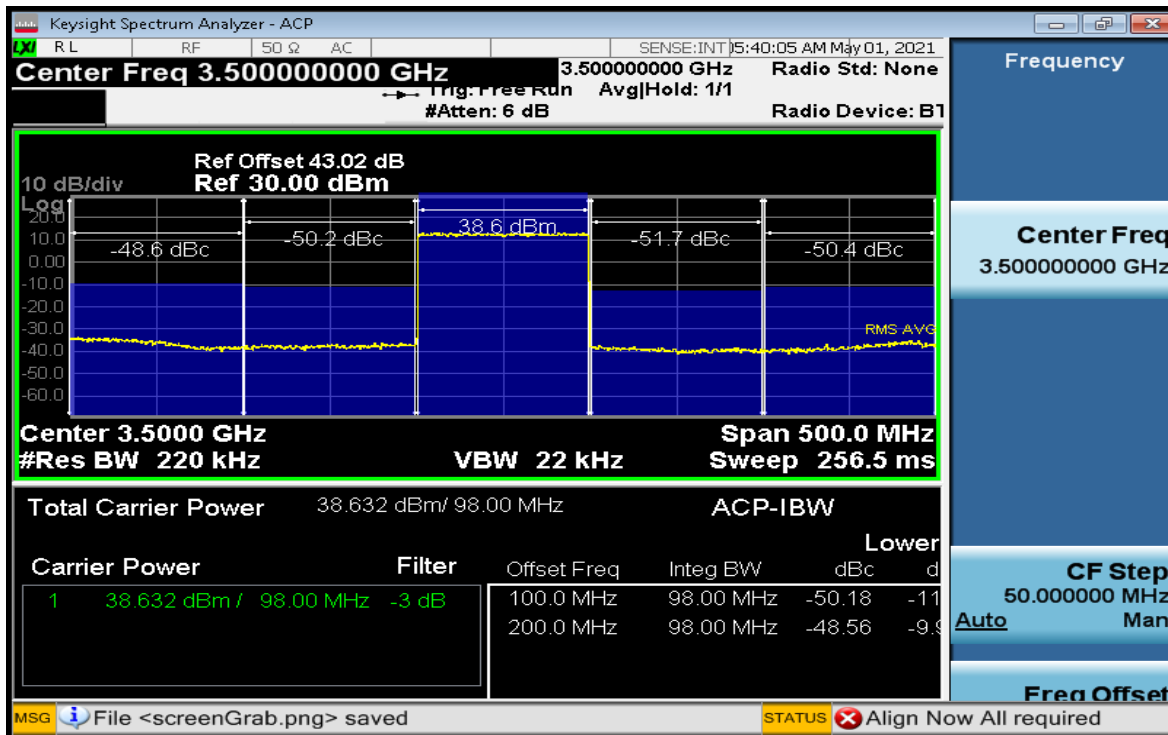
WS2A3540 test conditions are:

- Center Frequency: 3500 MHz
- Efficiency: 50.51%
- Average Output Power: 39.64 dBm (9.2 Watt)
- Test signal: 1x100MHz NR, 4x20MHz LTE 200MHz, 4x5MHz LTE 200MHz, 1x20MHz LTE & 1x5MHz LTE
- Biasing conditions: Vdd: 48.0V , 29.0mA, Vcc: 5.0V , 355.7mA, Vgs1: 2.9V , 0.0mA, Vgs2: 4.7V , 0.0mA, VDriverControl: 4.3V , 0.8mA

Test Results

Case 1: Test Signal: 1x100MHz NR (PAR = 8dB), Output Power: 39.00 dBm, Band n78:3500MHz

Post DPD results:

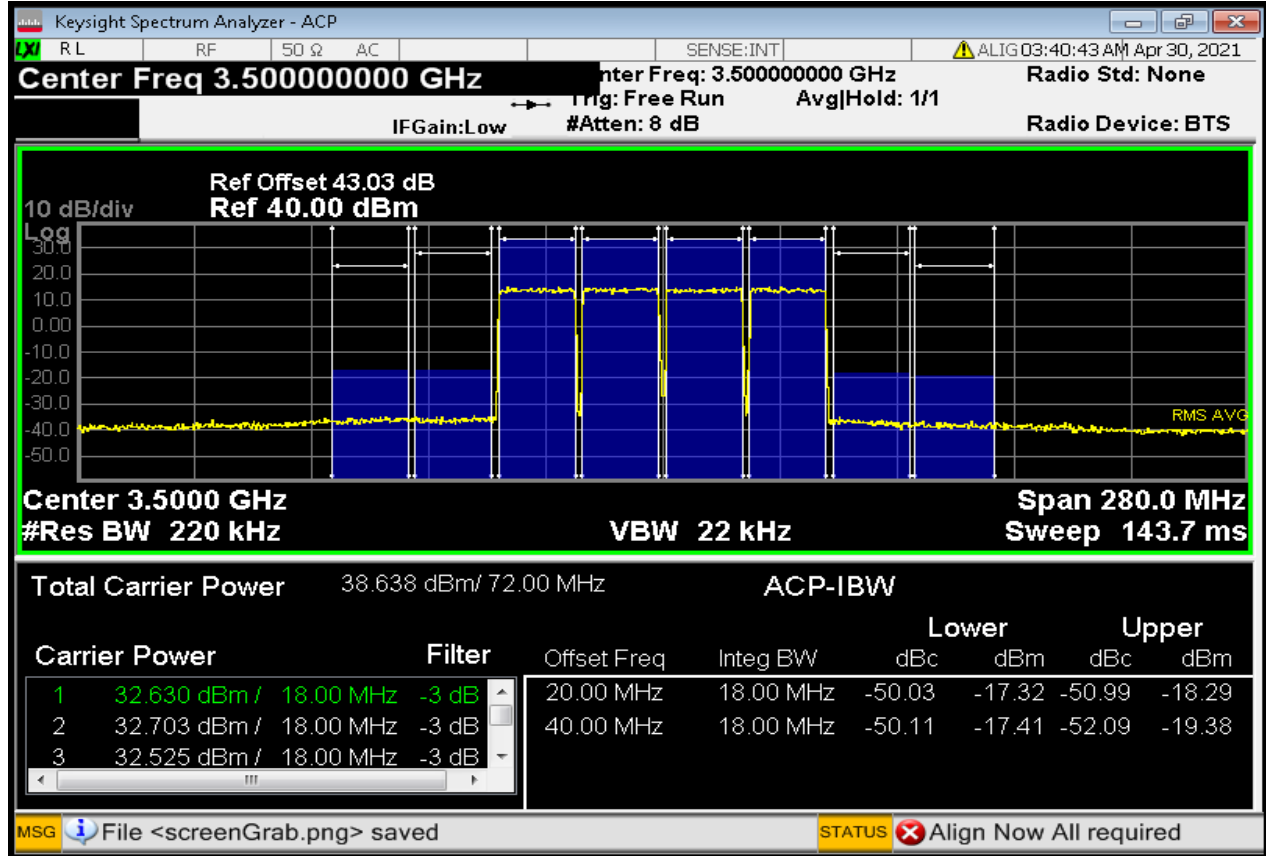


| | | | | | | Open Loop [Pre-DPD] | | | | Closed Loop [Post-DPD] | | | |
|-------|-------|-------|-------|-----|------|---------------------|--------|---------|---------|------------------------|--------|---------|---------|
| Freq: | Pout | DE | Gain | VDD | IDD | ACP_Lo | ACP_Hi | ALT1_lo | ALT1_hi | ACP_LO | ACP_HI | ALT1_lo | ALT1_hi |
| MHz | [dBm] | [%] | [dB] | [V] | [A] | [dBc] | [dBc] | [dBc] | [dBc] | [dBc] | [dBc] | [dBc] | [dBc] |
| 3500 | 38.70 | 49.88 | 38.70 | 48 | 0.30 | -30.90 | -36.70 | -41.10 | -45.70 | -50.20 | -52.70 | -48.70 | -50.50 |

ADRV9029- WOLFSPEED PA test report

Case 2: Test Signal: LTE 4x20MHz 200MHz (PAR = 8dB), Output Power: 38.70 dBm, Band 43:3500MHz

Post DPD results:

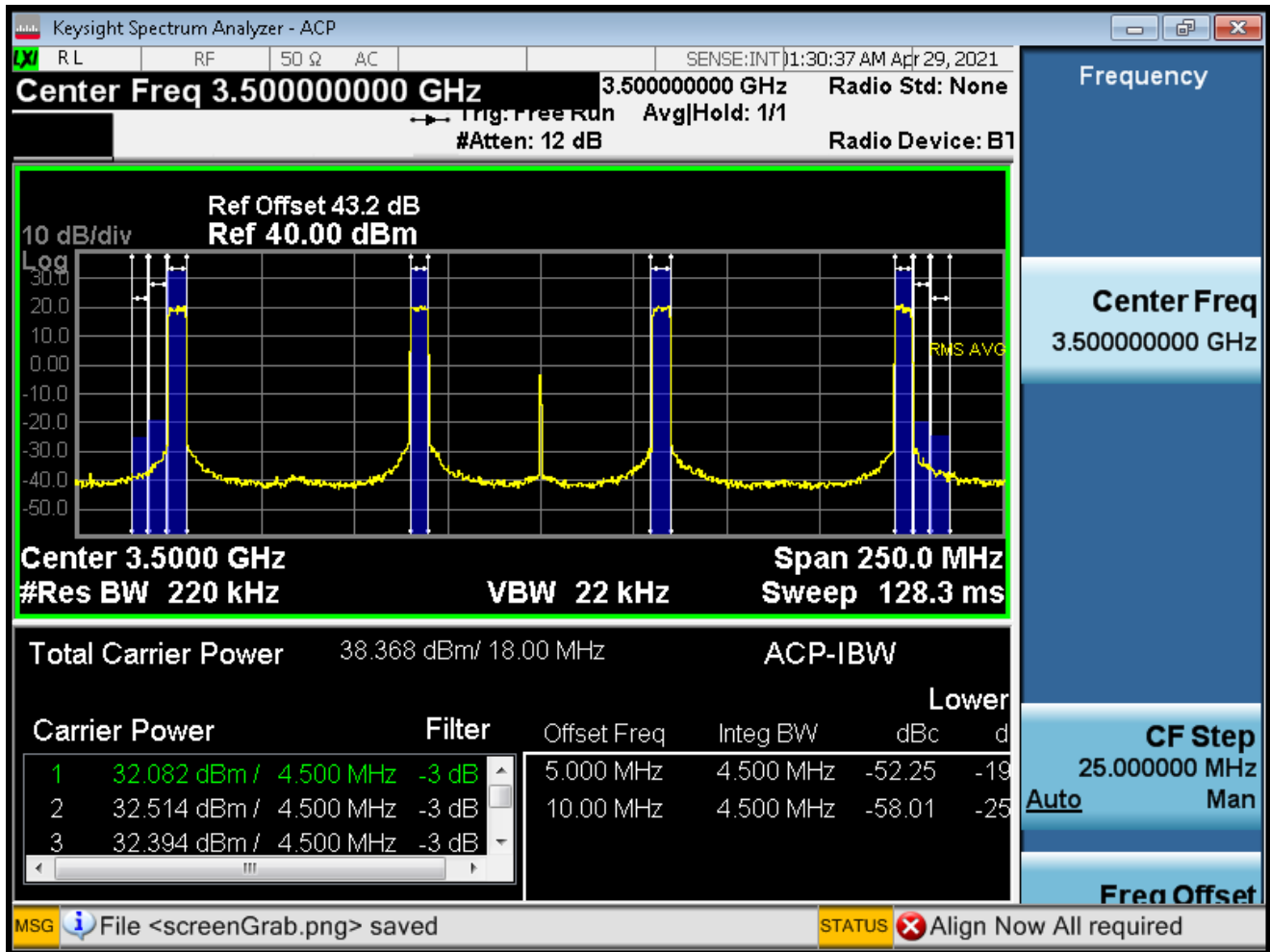


| Freq: MHz | Pout [dBm] | DE [%] | Gain [dB] | VDD [V] | IDD [A] | Open Loop [Pre-DPD] | | | | Closed Loop [Post-DPD] | | | |
|-----------|------------|--------|-----------|---------|---------|---------------------|--------------|---------------|---------------|------------------------|--------------|---------------|---------------|
| | | | | | | ACP_Lo [dBc] | ACP_Hi [dBc] | ALT1_lo [dBc] | ALT1_hi [dBc] | ACP_LO [dBc] | ACP_HI [dBc] | ALT1_lo [dBc] | ALT1_hi [dBc] |
| 3500 | 38.70 | 49.98 | 38.70 | 48 | 0.30 | -29.70 | -34;60 | -30.90 | -36.60 | -50.00 | -51.10 | -50.10 | -52.10 |

ADRV9029- WOLFSPEED PA test report



Case 3: Test Signal: LTE 4x5MHz 200MHz (PAR = 8dB), Output Power: 38.30 dBm, Band n78:3500MHz

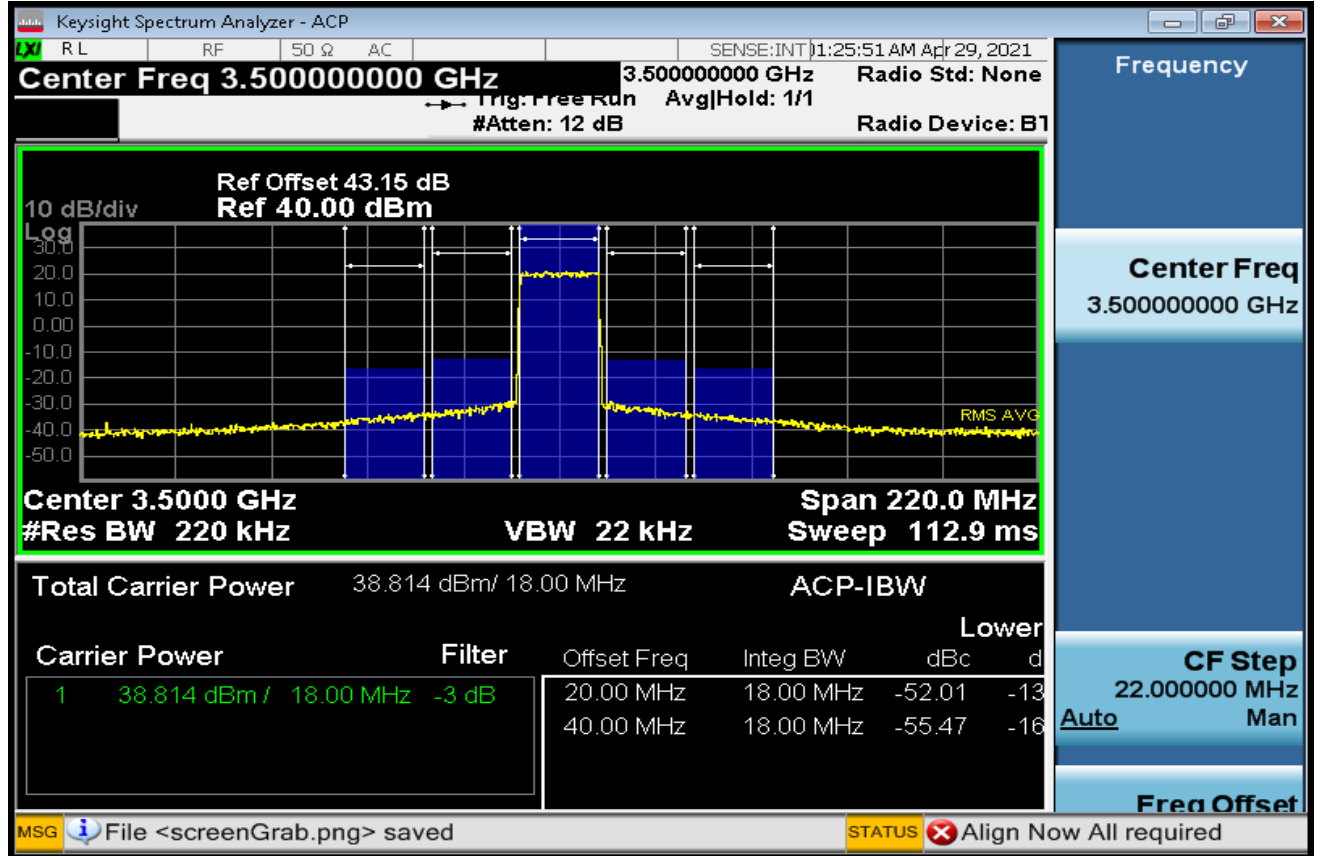


| Freq: MHz | Pout [dBm] | DE [%] | Gain [dB] | VDD [V] | IDD [A] | Open Loop [Pre-DPD] | | | | Closed Loop [Post-DPD] | | | |
|--------------|---------------|-----------|--------------|------------|------------|---------------------|-----------------|------------------|------------------|------------------------|-----------------|------------------|------------------|
| | | | | | | ACP_Lo [dBc] | ACP_Hi [dBc] | ALT1_lo [dBc] | ALT1_hi [dBc] | ACP_LO [dBc] | ACP_HI [dBc] | ALT1_lo [dBc] | ALT1_hi [dBc] |
| 3500 | 38.30 | 48.72 | 38.30 | 48 | 0.30 | -33.60 | -37.00 | -47.90 | -48.40 | -52.30 | -52.30 | -58.00 | -57.30 |

ADRV9029- WOLFSPEED PA test report

Case 4: Test Signal: LTE 1x20MHz 100MHz (PAR = 8dB), Output Power: 38.80dBm, Band 43:3500MHz

Post DPD results:

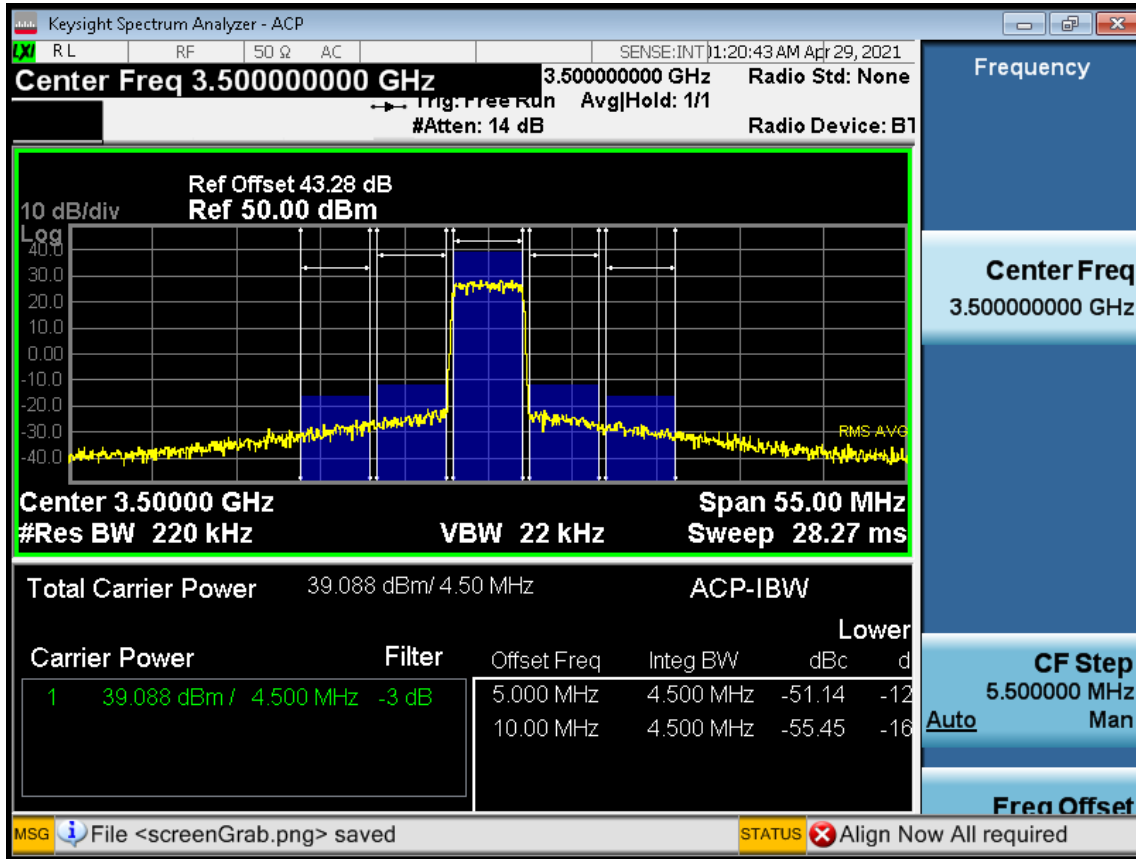


| Freq: MHz | Pout [dBm] | DE [%] | Gain [dB] | VDD [V] | IDD [A] | Open Loop [Pre-DPD] | | | | Closed Loop [Post-DPD] | | | |
|-----------|------------|--------|-----------|---------|---------|---------------------|--------------|---------------|---------------|------------------------|--------------|---------------|---------------|
| | | | | | | ACP_Lo [dBc] | ACP_Hi [dBc] | ALT1_lo [dBc] | ALT1_hi [dBc] | ACP_LO [dBc] | ACP_HI [dBc] | ALT1_lo [dBc] | ALT1_hi [dBc] |
| 3500 | 38.80 | 50.23 | 38.80 | 48 | 0.30 | -34.20 | -35.20 | -44.10 | -44.90 | -52.00 | -52.20 | -55.50 | -55.60 |

ADRV9029- WOLFSPEED PA test report



Case 5: Test Signal: LTE 1x5MHz (PAR = 8dB), Output Power: 38.70dBm, Band 43:3500MHz



| Freq: MHz | Pout [dBm] | DE [%] | Gain [dB] | VDD [V] | IDD [A] | Open Loop [Pre-DPD] | | | | Closed Loop [Post-DPD] | | | |
|-----------|------------|--------|-----------|---------|---------|---------------------|--------------|---------------|---------------|------------------------|--------------|---------------|---------------|
| | | | | | | ACP_Lo [dBc] | ACP_Hi [dBc] | ALT1_lo [dBc] | ALT1_hi [dBc] | ACP_LO [dBc] | ACP_HI [dBc] | ALT1_lo [dBc] | ALT1_hi [dBc] |
| 3500 | 38.70 | 49.85 | 38.70 | 48 | 0.30 | -34.60 | -34.50 | -44.40 | -44.70 | -51.10 | -51.40 | -55.40 | -55.70 |

Conclusion

- The ADRV9029 on-chip, with DPD and CFR engines enabled, power consumption estimate is around 6.8 W in TDD mode. The power consumption can be reduced by lowering the sampling speed and saving JESD resources. Using the Zero IF architecture with an operating bandwidth of 200MHz, the ADRV2029 consumes lower power when compared to RFDAC transceiver architecture solutions.