ELEMENT WASHINGTON DC LLC
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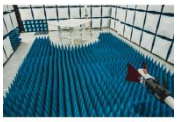

Part 96 MEASUREMENT REPORT

Applicant Name:
Atos
Avenue Jean Jaurès,
Les Clayes sous Bois
France 78340

Date of Testing:
5/2 – 7/31/2023
Test Report Issue Date:
8/12/2023
Test Site/Location:
Element Lab., Columbia, MD, USA
Test Report Serial No.:
1M2304200057-01.2A289

FCC ID:	**2A289-LFW-EXTENSE48**
APPLICANT:	**ATOS**

Application Type:	Certification
Model:	Panther 4X4 MIMO
EUT Type:	CBRS Remote Radio Head
FCC Classification:	Category B Citizens Band Radio Service Devices (CBSD)
FCC Rule Part(s):	96
Test Procedure(s):	ANSI C63.26-2015, KDB 940660 D01 v03

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez
Executive Vice President

ACCREDITED
CERT #2041.01

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MEASUREMENT REPORT
FCC Part 96

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 48 (2CC CA)	40 MHz	QPSK	3570.0 - 3680.0	40.365	46.06	37M7G7D
		16QAM	3570.0 - 3680.0	39.994	46.02	37M7W7D
		64QAM	3570.0 - 3680.0	39.719	45.99	37M7W7D
		256QAM	3570.0 - 3680.0	39.902	46.01	37M7W7D
	30 MHz	QPSK	3565.0 - 3685.0	39.264	45.94	28M0G7D
		16QAM	3565.0 - 3685.0	39.084	45.92	27M9W7D
		64QAM	3565.0 - 3685.0	39.174	45.93	28M0W7D
		256QAM	3565.0 - 3685.0	39.174	45.93	28M0W7D
LTE Band 48	20 MHz	QPSK	3560.0 - 3690.0	41.687	46.20	18M9G7D
		16QAM	3560.0 - 3690.0	41.783	46.21	18M9W7D
		64QAM	3560.0 - 3690.0	41.495	46.18	18M8W7D
		256QAM	3560.0 - 3690.0	41.687	46.20	18M9W7D
	10 MHz	QPSK	3555.0 - 3695.0	40.738	46.10	9M00G7D
		16QAM	3555.0 - 3695.0	40.926	46.12	9M00W7D
		64QAM	3555.0 - 3695.0	40.458	46.07	9M00W7D
		256QAM	3555.0 - 3695.0	40.458	46.07	9M01W7D

EUT Overview

Note: EIRP levels shown in the table above are measured over the full channel bandwidth. These values will appear on the Grant of Authorization.

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

1.2 Element Test Location

These measurement tests were conducted at the Element Laboratory located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at Element Lab located in Columbia, MD 21046, U.S.A.

- Element Washington DC LLC is a OnGo Alliance Approved Test Lab (ATL)
- Element Washington DC LLC is a WInnForum Approved Test Lab
- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- Element Washington DC LLC facility is a registered (2451B) test laboratory with the site description on file with ISED.
- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Recognition Agreement.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Atos CBRS Remote Radio Head FCC ID: 2A289-LFW-EXTENSE48**. The test data contained in this report pertains only to the emissions due to the EUT's LTE Band 48 operation in the CBRS band. Per FCC Part 96, this device is evaluated as a Cat. B CBSD (CBD)

Test Device Serial No.: 22460003, 22460006

2.2 Device Capabilities

This device contains the following capabilities:

LTE BAND 48 and 2CC CA LTE BAND 48

2.3 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

This device operates with two antenna ports (Ant 2 and Ant 4) .which produce two simultaneous signals whose antennas may be either orthogonally polarized or co-polarized.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version HW Ver.:PRB000195 / SW Ver.:0.45 installed on the EUT.

2.5 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services" (ANSI C63.26-2015) were used in the measurement of the EUT**.**

Deviation from Measurement Procedure……..None

3.2 Radiated Power and Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated power measurements, substitution method is used per the guidance of ANSI C63.26-2015. For emissions below 1GHz, a half-wave dipole is substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_{d\ [dBm]} = P_{g\ [dBm]} - \text{cable loss}_{\ [dB]} + \text{antenna gain}_{\ [dBd/dBi]};$$

where P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_{g\ [dBm]}$ – cable loss $_{[dB]}$.

For radiated spurious emissions measurements, the field strength conversion method is used per the formulas in Section 5.2.7 of ANSI C63.26-2015. Field Strength (EIRP) is calculated using the following formulas:

$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$

And

$$EIRP_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8;$$ where D is the measurement distance in meters.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01 v01r01.

Radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015.

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	ETS-001	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-001
-	ETS-002	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-002
-	MD 1M 18-40	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	MD 1M 18-40
-	RF Cable	Conducted Cable Set	4/24/2023	Annual	4/24/2024	-
EMCO	3115	Horn Antenna (1-18GHz)	8/8/2022	Biennial	8/8/2024	9704-5182
EMCO	3116	Horn Antenna (18-40GHz)	7/5/2023	Biennial	7/5/2025	9203-2178
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	1/13/2023	Annual	1/13/2024	101639
Sunol Sciences	DRH-118	Horn (Small)	2/14/2022	Biennial	2/14/2024	A102416-2
Sunol Sciences	JB5	Bi-Log Antenna (30M-5GHz)	8/30/2022	Biennial	8/30/2024	A102416-1
Keysight Technologies	N9020A	MXA Signal Analyzer	8/18/2022	Annual	8/18/2023	MY49430494
Keysight Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	8/18/2022	Annual	8/18/2023	MY54500644
Keysight Technologies	N9030A	PXA Signal Analyzer	9/6/2022	Annual	9/6/2023	MY55410501
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	8/25/2022	Annual	8/25/2023	101299

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

2. Equipment with a calibration date of “N/A” shown in this list was not used to make direct calibrated measurements.

6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 8M45W7D

LTE BW = 8.45 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (7250 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80).

7.0 TEST RESULTS

7.1 Summary

Company Name: Atos

FCC ID: 2A289-LFW-EXTENSE48

FCC Classification: Category B Citizens Band Radio Service Devices (CBSD)

Mode(s): LTE Band 48

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
Conducted	Conducted Power	2.1046(a), 2.1046(c)	N/A	PASS	Section 7.2
	Occupied Bandwidth	2.1049(h)	N/A	PASS	Section 7.3
	Peak-Average Ratio	96.41(g)	≤ 13dB	PASS	Section 7.6
	Conducted Band Edge / Spurious Emissions (CBSD)	2.1051, 96.41(e)(1)(i)	-13 dBm/MHz at frequencies within 0-10 MHz above the upper SAS-assigned channel edge and within 0-10MHz below the lower SAS-assigned channel edge -25 dBm/MHz at frequencies greater than 10 MHz above and below channel edge -emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz	PASS	Sections 7.7, 7.8
	Frequency Stability	2.1055	Fundamental emissions stay within authorized frequency block	PASS	Section 7.10
	Category B CBSD Device Additional Requirements (CBSD Protocol)	96.45	Category B CBSDs must be professionally installed. In the 3550-3650MHz band, Category B CBSDs must be authorized consistent with information received from an ESC, as described in 96.15. Category B CBSDs are limited to outdoor operations. When registering with a SAS, Category B CBSDs must tranmist all information required under 96.39 plus the following additonal information: antenna gain, beamwidth, azimuth, downtilt angle, and antenna height above ground level.	PASS	SAS Protocol Report
	Equivalent Isotropic Radiated Power (EIRP) (Catogory B CBSD)	96.41(b)	47 dBm/10MHz	PASS	Section 7.4
	Power Spectral Density (PSD) (Category B CBSD)	96.41(b)	37 dBm/MHz	PASS	Section 7.5
Radiated	Radiated Spurious Emissions	96.41(e)	-40 dBm/MHz	PASS	Section 7.9

Table 7-1 Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is EMC Software Tool 1.1 and Chamber Control 1.6.4.

7.2 Conducted Output Power / EIRP Data

Test Overview

The EUT is set up to transmit at maximum power for LTE. All power levels are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2

Test Settings

1. Span = 2 x OBW to 3 x OBW
2. RBW = 1% to 5% of the OBW
3. Number of measurement points in sweep ≥ 2 x span / RBW
4. Sweep = auto-couple (less than transmission burst duration)
5. Detector = RMS (power)
6. Trigger was set to enable power measurements only on full power bursts
7. Trace was allowed to stabilize
8. Spectrum analyzer's "Channel Power" function was used to compute the power by integrating the spectrum across the OBW of the signal

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. Conducted power measurements were evaluated using various combinations of modulation and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device.
2. Low/Mid/High channels were tested, but only representative worst cases plots from each modulations are shown in this report
3. Since the transmissions are either orthogonally polarized or co-polarized, with orthogonally polarized transmission, directional gain is 4dBi. However, with co-polarized transmission as worst scenario, the directional gain is equal to 7 dBi.

Sample Directional Antenna gain calculation for co-polarized tranmssion scenario:

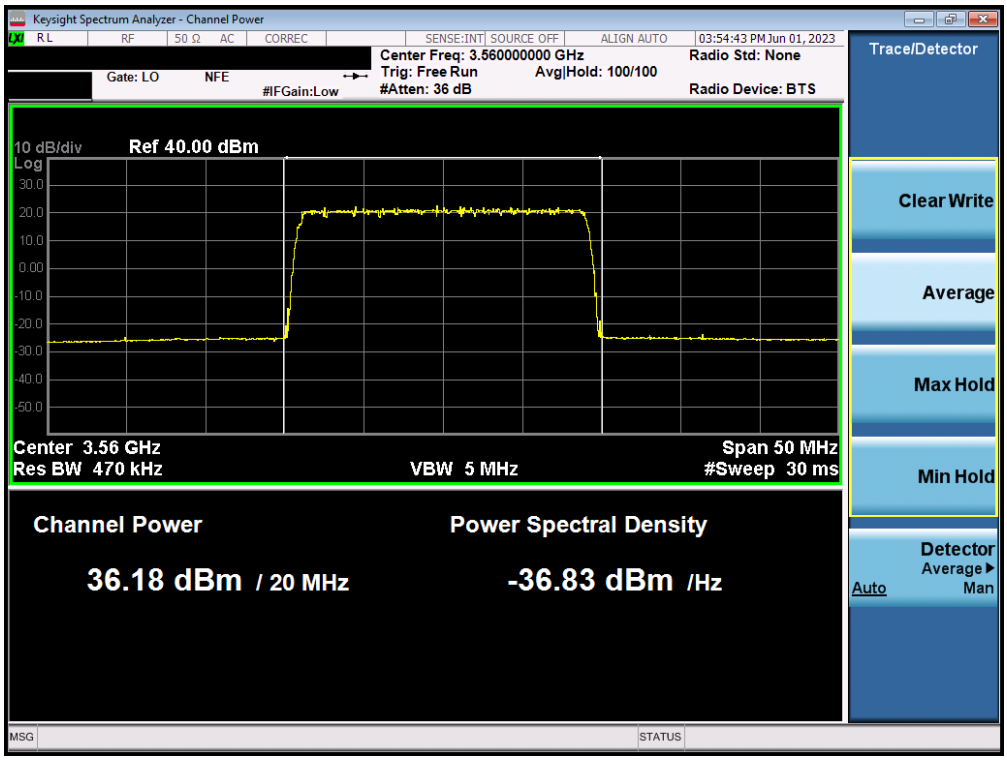
Per ANSI C63.10-2013 Section 14.4.3, the directional gain is calculated using the following formula, where G_N is the gain of the nth antenna and N_{ANT}, the total number of antennas used.

$$\text{Directional gain} = 10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}] \text{ dBi}$$
$$= 10 * \log [(10^{(4/20)} + 10^{(4/20)})^2 / 2]$$
$$= 7\text{dBi}$$

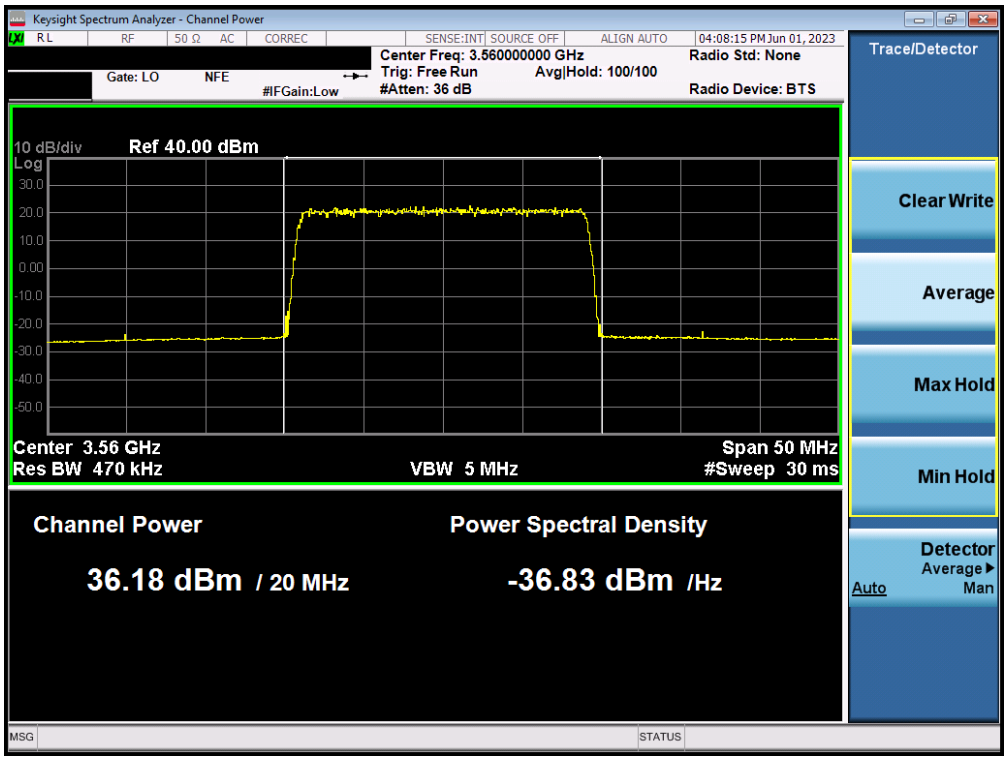
Bandwidth	Modulation	Channel	Frequency [MHz]	Conducted Power [dBm] ANT2	Conducted Power [dBm] ANT4	Conducted Power [dBm] Summed MIMO	Directional Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]
20 MHz	QPSK	55340	3560.0	36.18	36.20	39.20	7.00	46.20	41.687
		55990	3625.0	35.66	35.97	38.83	7.00	45.83	38.282
		56640	3690.0	35.66	36.03	38.86	7.00	45.86	38.548
	16-QAM	55340	3560.0	36.18	36.22	39.21	7.00	46.21	41.783
		55990	3625.0	35.69	35.98	38.85	7.00	45.85	38.459
		56640	3690.0	35.66	36.03	38.86	7.00	45.86	38.548
	64-QAM	55340	3560.0	36.16	36.19	39.18	7.00	46.18	41.495
		55990	3625.0	35.64	35.94	38.80	7.00	45.80	38.019
		56640	3690.0	35.63	36.00	38.83	7.00	45.83	38.282
	256-QAM	55340	3560.0	36.19	36.19	39.20	7.00	46.20	41.687
		55990	3625.0	35.71	35.97	38.85	7.00	45.85	38.459
		56640	3690.0	35.68	36.00	38.85	7.00	45.85	38.459
10 MHz	QPSK	55290	3555.0	36.09	36.10	39.10	7.00	46.10	40.738
		55990	3625.0	35.73	35.90	38.82	7.00	45.82	38.194
		56690	3695.0	35.59	35.94	38.78	7.00	45.78	37.844
	16-QAM	55290	3555.0	36.07	36.14	39.12	7.00	46.12	40.926
		55990	3625.0	35.70	35.99	38.86	7.00	45.86	38.548
		56690	3695.0	35.57	35.95	38.77	7.00	45.77	37.757
	64-QAM	55290	3555.0	36.04	36.09	39.07	7.00	46.07	40.458
		55990	3625.0	35.68	35.99	38.85	7.00	45.85	38.459
		56690	3695.0	35.55	35.96	38.77	7.00	45.77	37.757
	256-QAM	55290	3555.0	36.03	36.10	39.07	7.00	46.07	40.458
		55990	3625.0	35.66	35.96	38.82	7.00	45.82	38.194
		56690	3695.0	35.54	35.99	38.78	7.00	45.78	37.844

Table 7-2 Conducted Power / EIRP Measurements – LTE Band 48

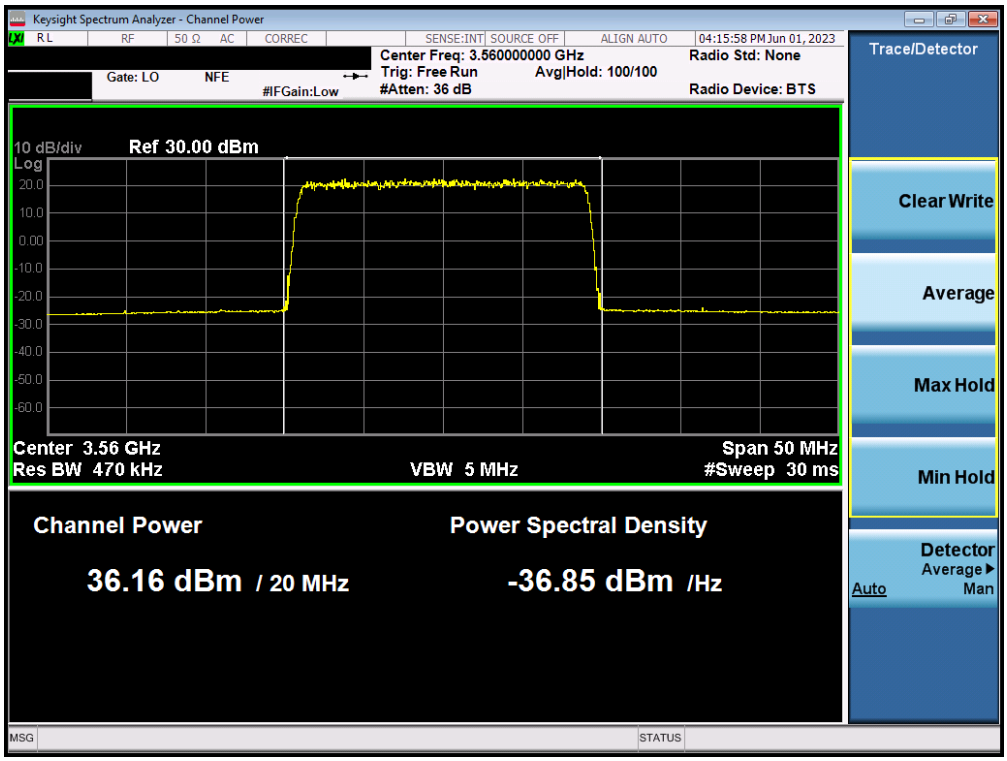
Conducted Power Measurements – Band 48 Ant 2



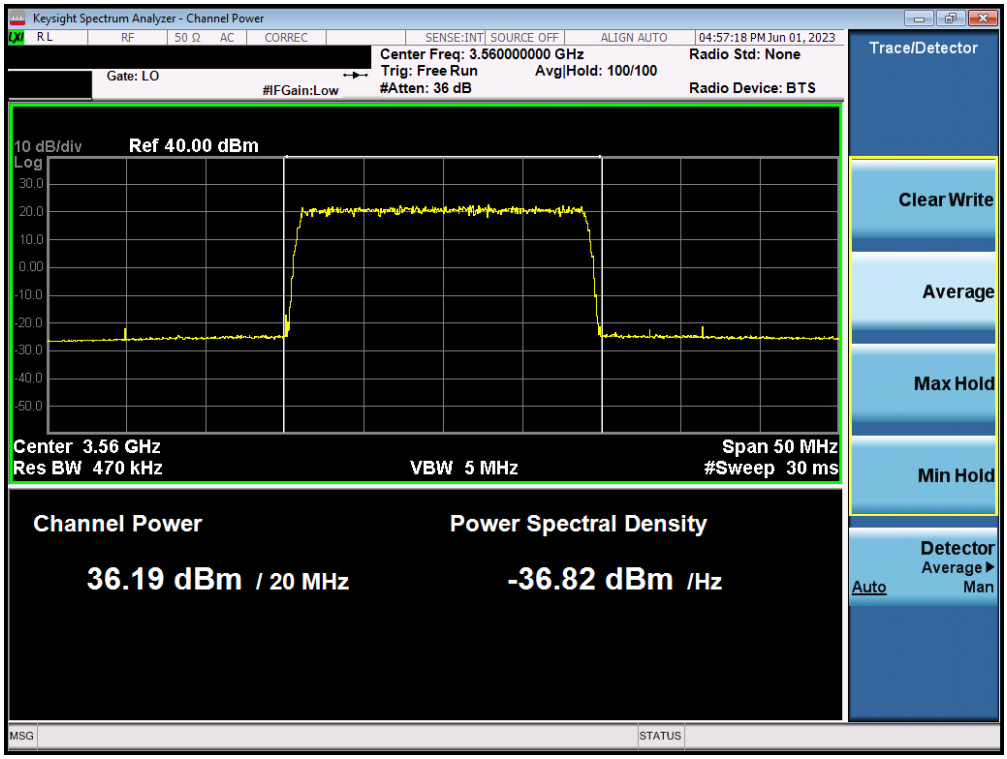
Plot 7.1 – Conducted Power Measurement – 20MHz BW, Low Channel, QPSK – Ant 2



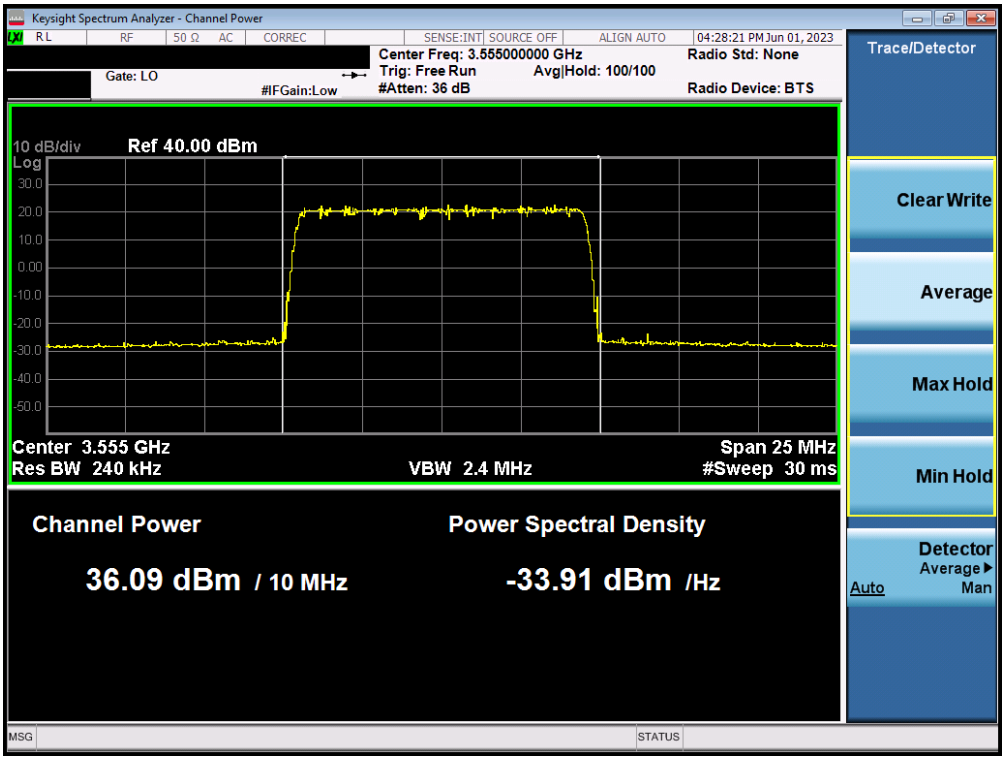
Plot 7.2 – Conducted Power Measurement – 20MHz BW, Low Channel, 16QAM – Ant 2



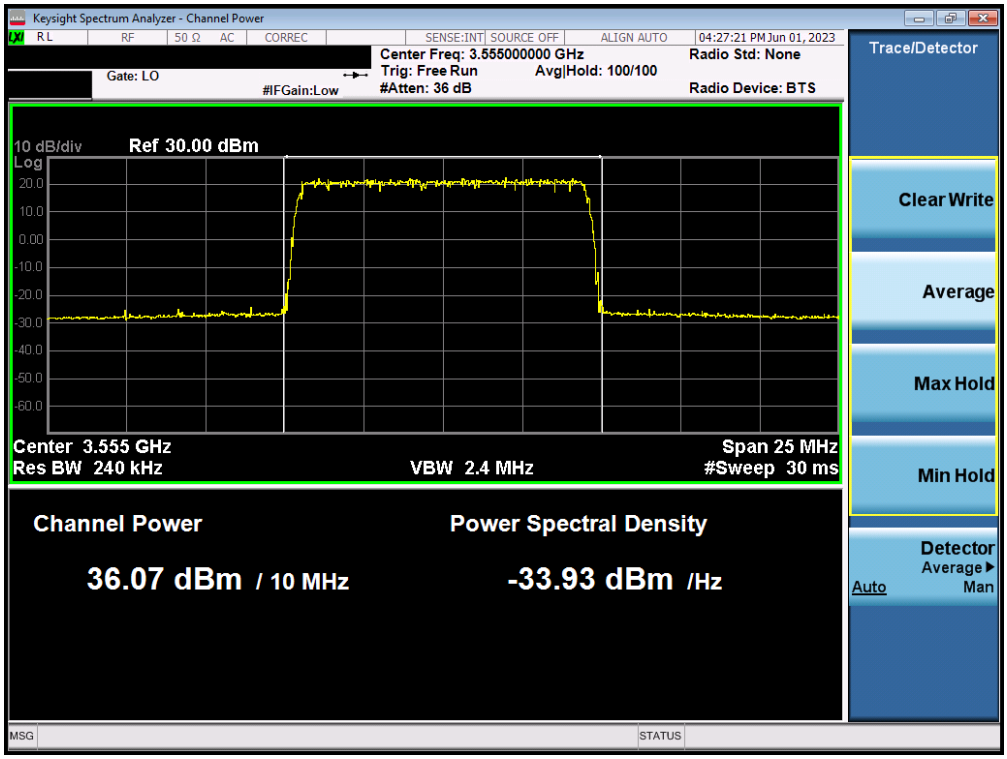
Plot 7.3 – Conducted Power Measurement – 20MHz BW, Low Channel, 64QAM – Ant 2



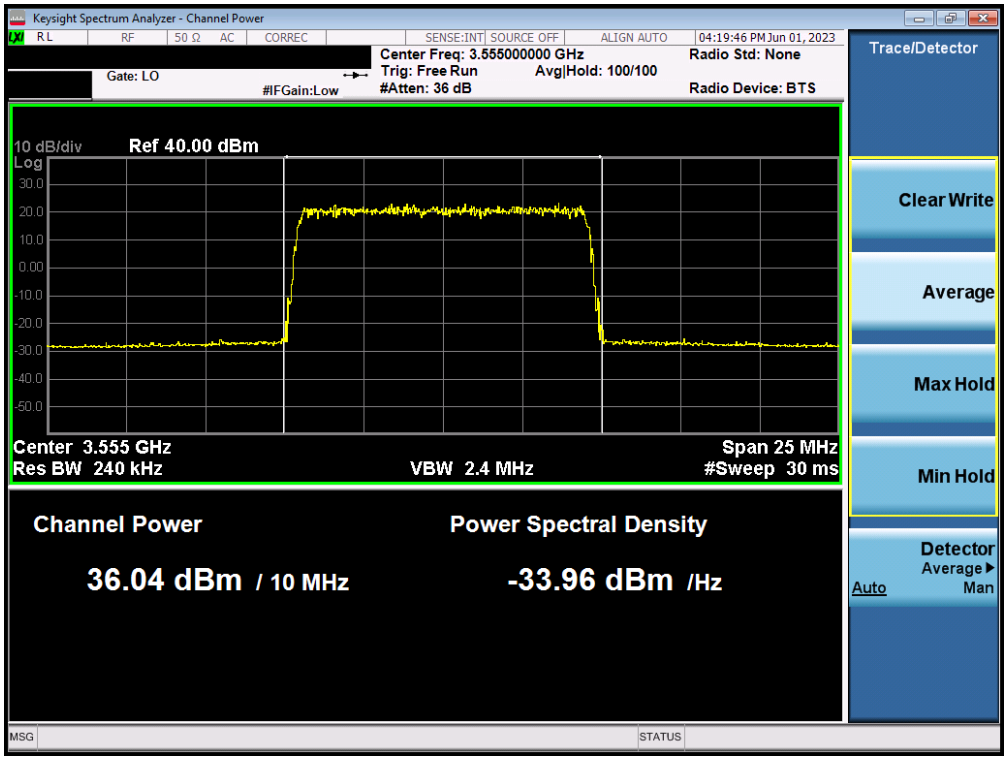
Plot 7.4 – Conducted Power Measurement – 20MHz BW, Low Channel, 256QAM – Ant 2



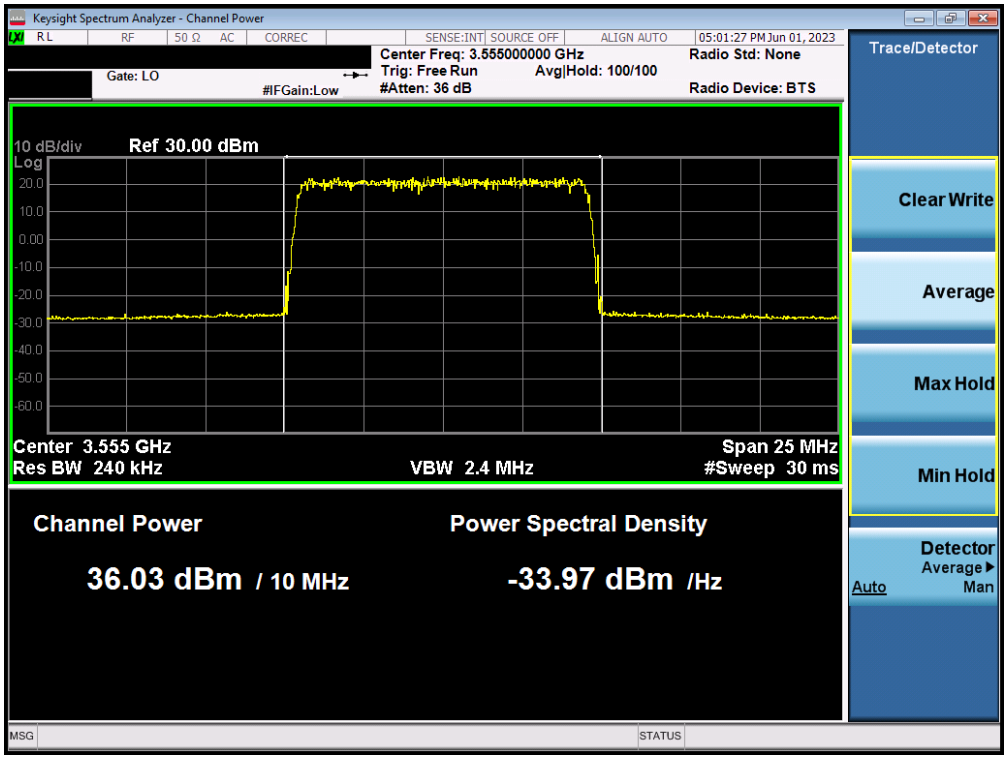
Plot 7.5 – Conducted Power Measurement – 10MHz BW, Low Channel, QPSK – Ant 2



Plot 7.6 – Conducted Power Measurement – 10MHz BW, Low Channel, 16QAM – Ant 2

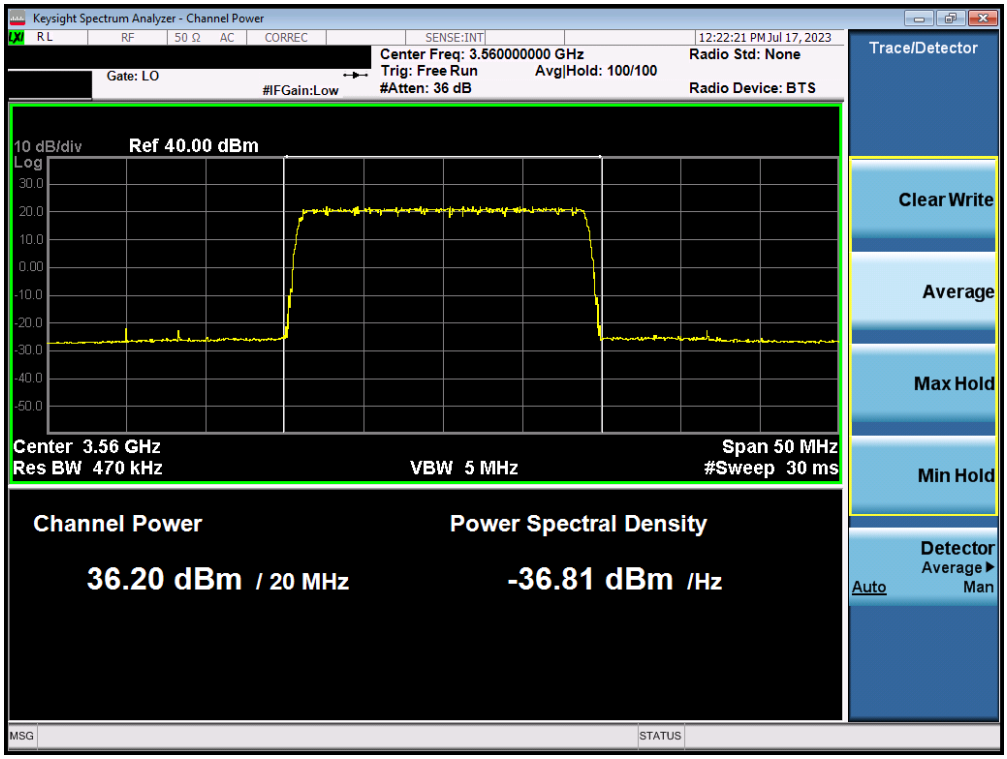


Plot 7.7 – Conducted Power Measurement – 10MHz BW, Low Channel, 64QAM – Ant 2

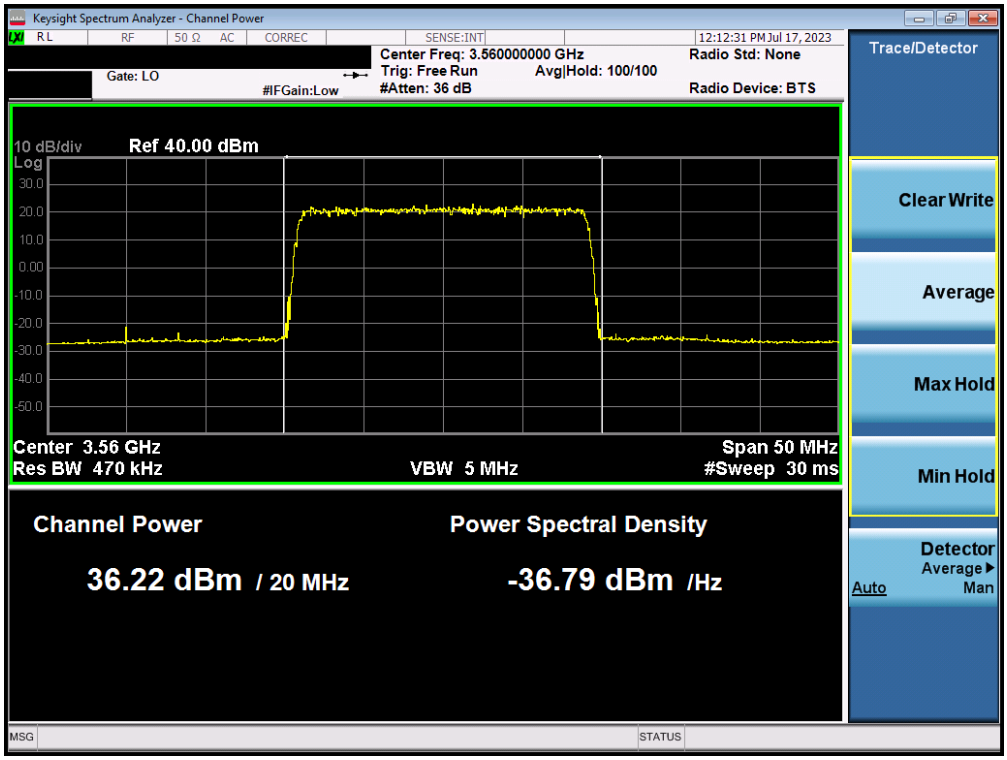


Plot 7.8 – Conducted Power Measurement – 10MHz BW, Low Channel, 256QAM – Ant 2

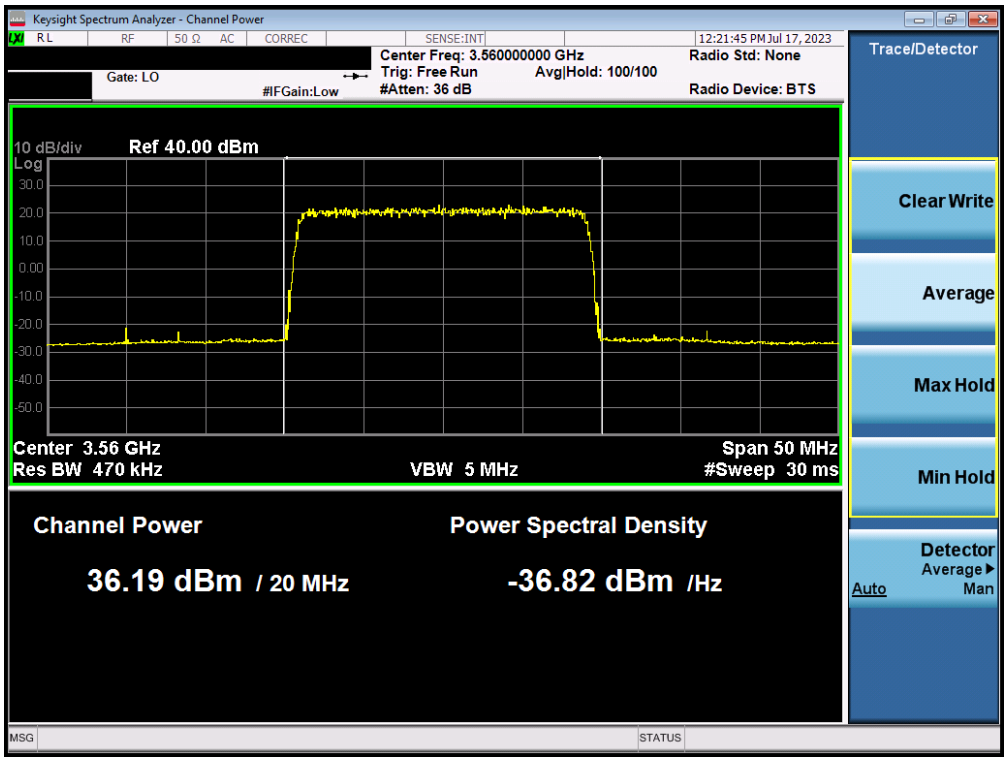
Conducted Power Measurements – Band 48 Ant 4



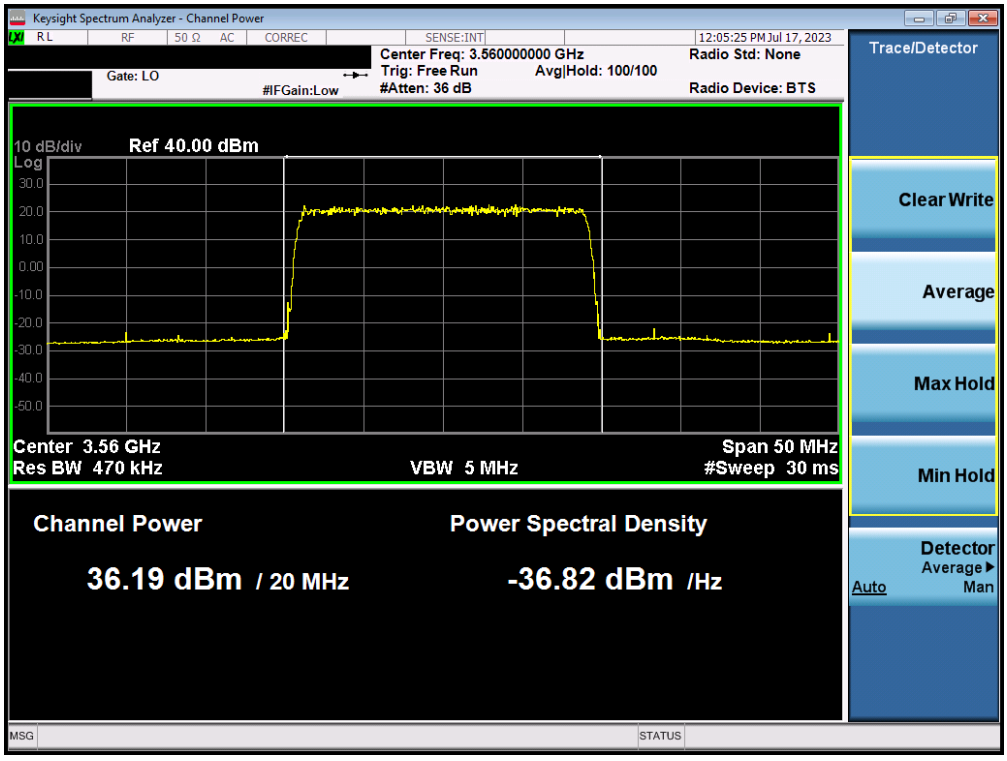
Plot 7.9 – Conducted Power Measurement – 20MHz BW, Low Channel, QPSK – Ant 4



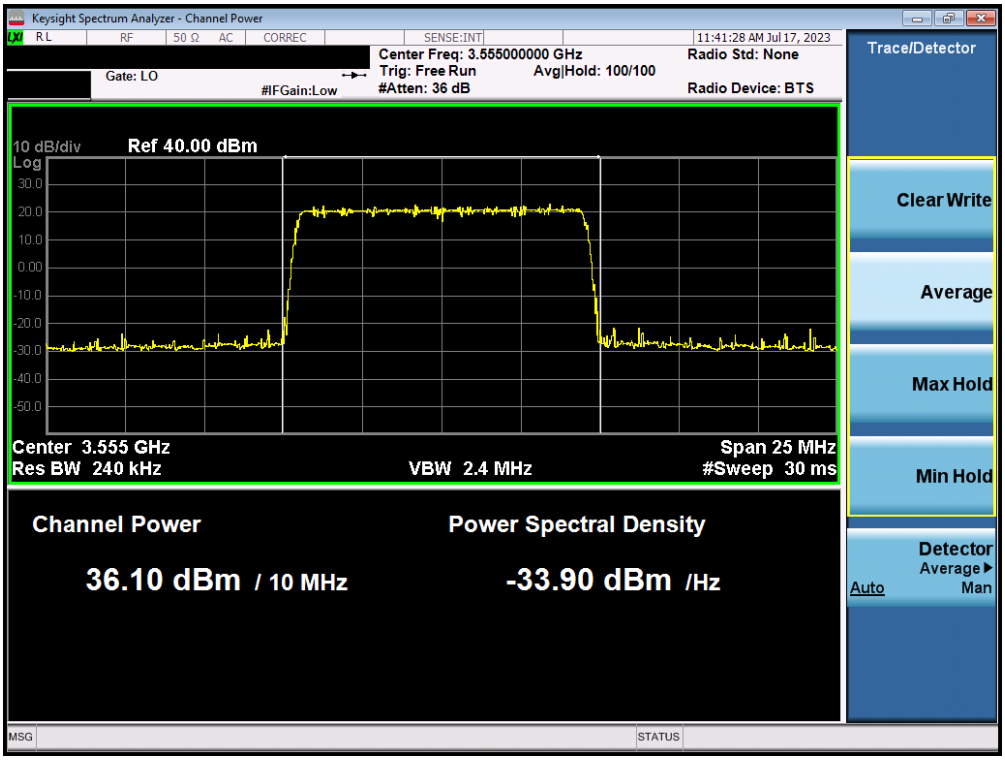
Plot 7.10 – Conducted Power Measurement – 20MHz BW, Low Channel, 16QAM – Ant 4



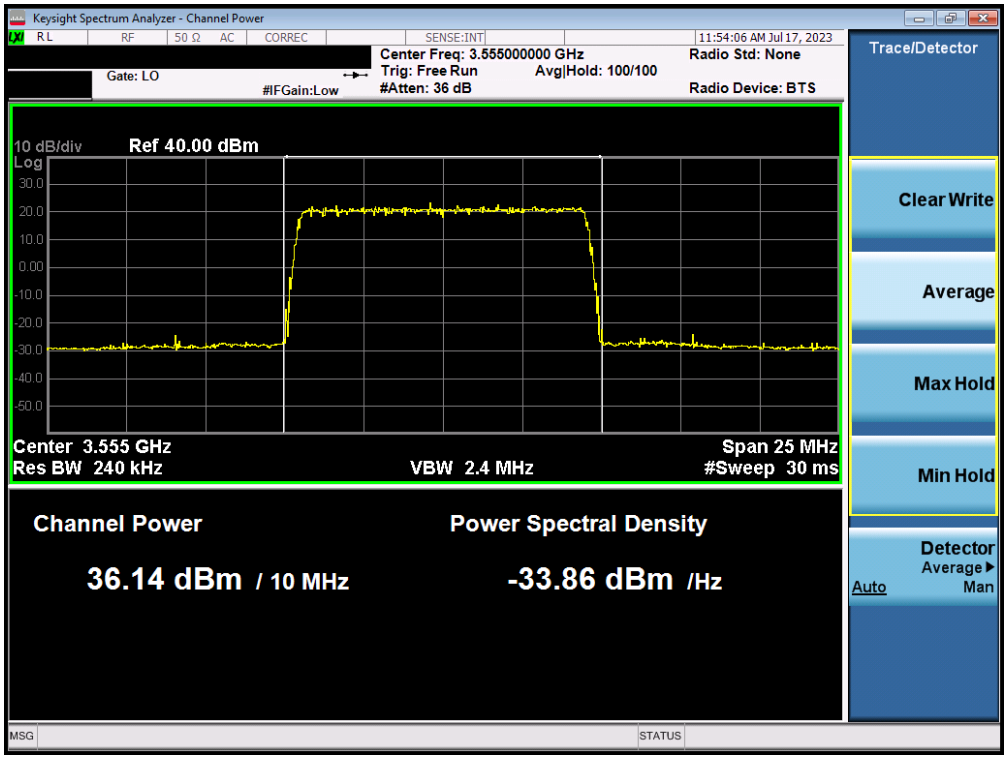
Plot 7.11 – Conducted Power Measurement – 20MHz BW, Low Channel, 64QAM – Ant 4



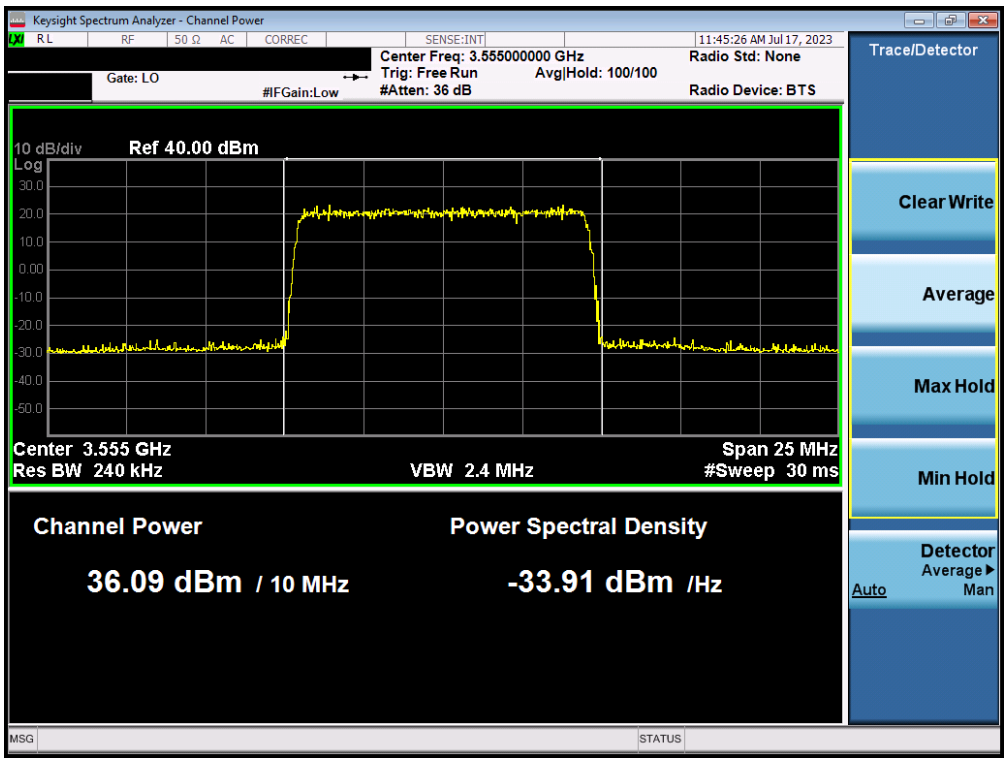
Plot 7.12 – Conducted Power Measurement – 20MHz BW, Low Channel, 256QAM – Ant 4



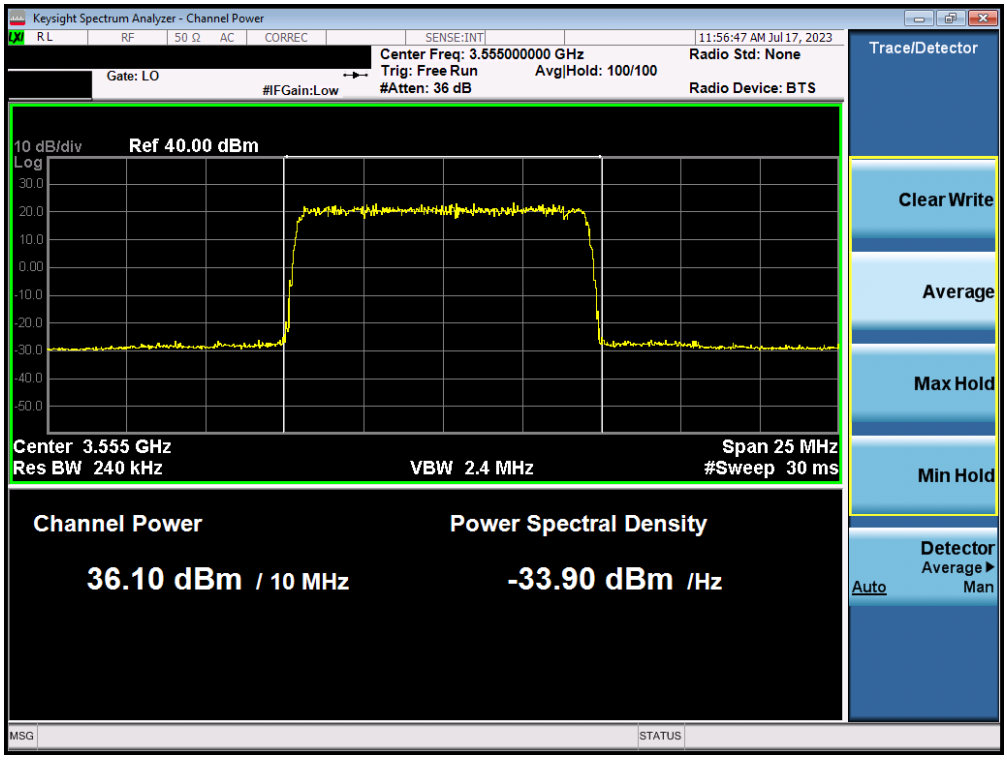
Plot 7.13 – Conducted Power Measurement – 10MHz BW, Low Channel, QPSK – Ant 4



Plot 7.14 – Conducted Power Measurement – 10MHz BW, Low Channel, 16QAM – Ant 4



Plot 7.15 – Conducted Power Measurement – 10MHz BW, Low Channel, 64QAM – Ant 4

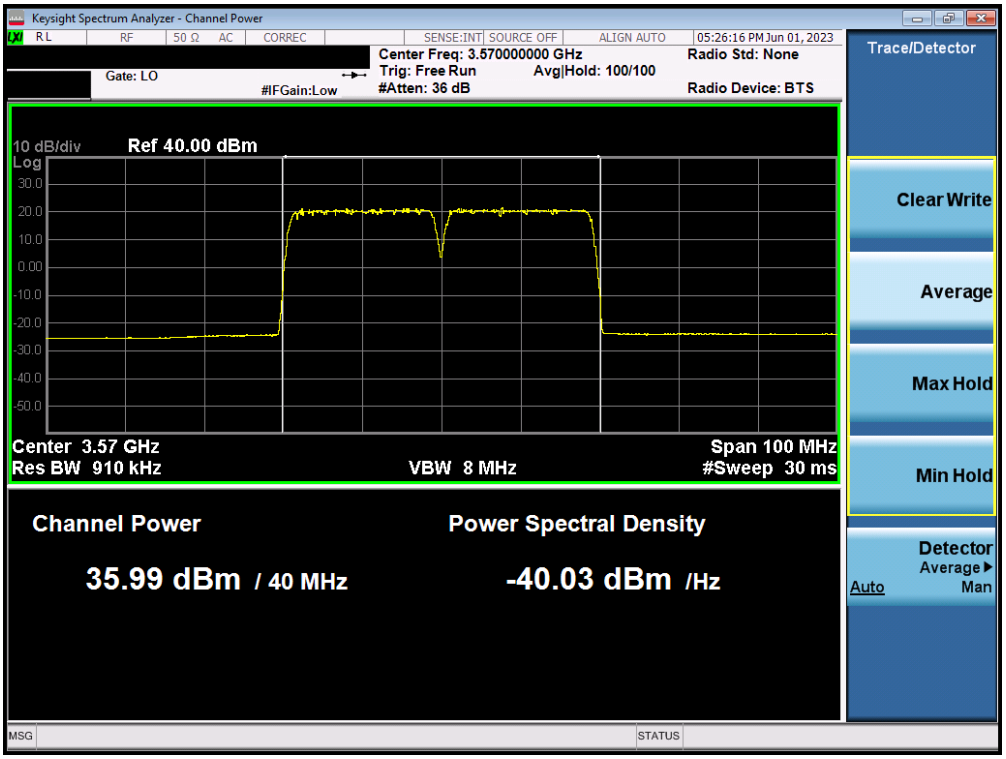


Plot 7.16 – Conducted Power Measurement – 10MHz BW, Low Channel, 256QAM – Ant 4

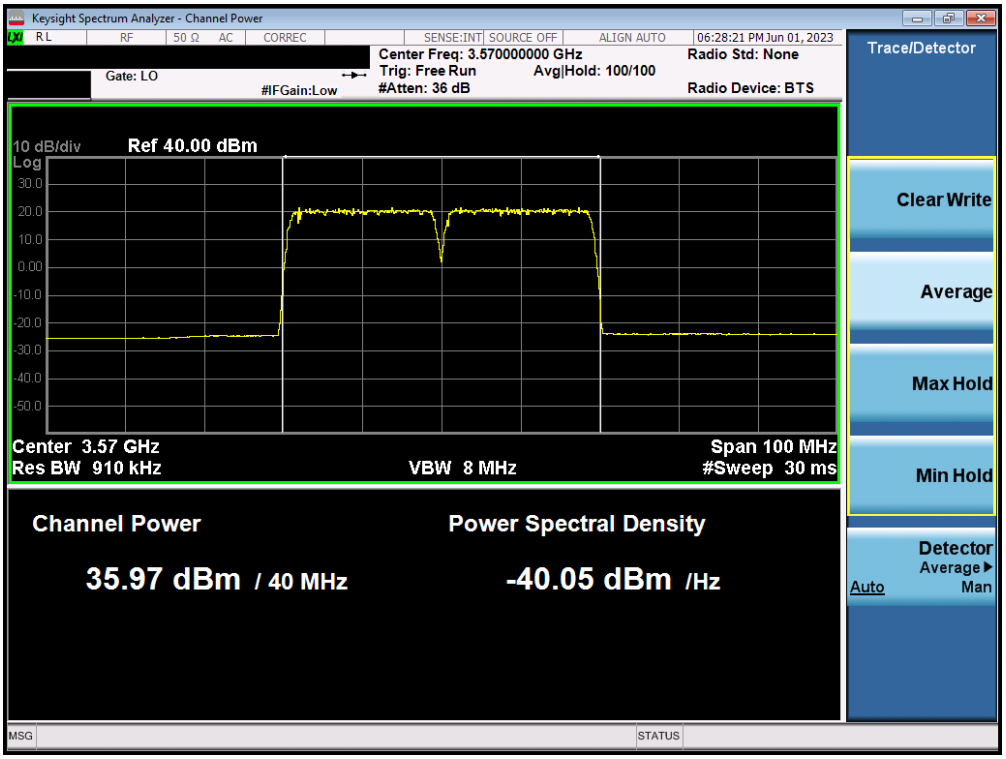
Bandwidth	Modulation	PCC		SCC		Conducted Power [dBm] ANT2	Conducted Power [dBm] ANT4	Conducted Power [dBm] Summed MIMO	Directional Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]
		Bandwidth [MHz]	Frequency [MHz]	Bandwidth [MHz]	Frequency [MHz]						
40 MHz	QPSK	20	3560.0	20	3579.8	35.99	36.12	39.06	7.00	46.06	40.365
		20	3625.0	20	3644.8	35.67	35.79	38.74	7.00	45.74	37.497
		20	3690.0	20	3670.2	35.90	35.89	38.90	7.00	45.90	38.905
	16-QAM	20	3560.0	20	3579.8	35.97	36.04	39.02	7.00	46.02	39.994
		20	3625.0	20	3644.8	35.62	35.82	38.73	7.00	45.73	37.411
		20	3690.0	20	3670.2	35.91	35.88	38.90	7.00	45.90	38.905
	64-QAM	20	3560.0	20	3579.8	35.92	36.05	38.99	7.00	45.99	39.719
		20	3625.0	20	3644.8	35.76	35.81	38.80	7.00	45.80	38.019
		20	3690.0	20	3670.2	35.92	35.80	38.87	7.00	45.87	38.637
	256-QAM	20	3560.0	20	3579.8	35.95	36.03	39.01	7.00	46.01	39.902
		20	3625.0	20	3644.8	35.73	35.78	38.77	7.00	45.77	37.757
		20	3690.0	20	3670.2	35.78	35.84	38.82	7.00	45.82	38.194
30 MHz	QPSK	20	3560.0	10	3574.4	35.74	36.11	38.94	7.00	45.94	39.264
		20	3625.0	10	3639.4	35.40	35.68	38.55	7.00	45.55	35.892
		20	3690.0	10	3675.6	35.57	35.97	38.78	7.00	45.78	37.844
	16-QAM	20	3560.0	10	3574.4	35.75	36.06	38.92	7.00	45.92	39.084
		20	3625.0	10	3639.4	35.40	35.63	38.52	7.00	45.52	35.645
		20	3690.0	10	3675.6	35.60	35.97	38.80	7.00	45.80	38.019
	64-QAM	20	3560.0	10	3574.4	35.73	36.11	38.93	7.00	45.93	39.174
		20	3625.0	10	3639.4	35.36	35.65	38.52	7.00	45.52	35.645
		20	3690.0	10	3675.6	35.65	35.96	38.81	7.00	45.81	38.107
	256-QAM	20	3560.0	10	3574.4	35.75	36.08	38.93	7.00	45.93	39.174
		20	3625.0	10	3639.4	35.40	35.66	38.54	7.00	45.54	35.810
		20	3690.0	10	3675.6	35.57	35.97	38.78	7.00	45.78	37.844
20 MHz	QPSK	10	3555.0	10	3564.9	36.09	36.20	39.16	7.00	46.16	41.305
		10	3625.0	10	3634.9	35.57	35.89	38.75	7.00	45.75	37.584
		10	3695.0	10	3685.1	35.59	36.06	38.84	7.00	45.84	38.371
	16-QAM	10	3555.0	10	3564.9	36.07	36.21	39.15	7.00	46.15	41.210
		10	3625.0	10	3634.9	35.68	35.86	38.78	7.00	45.78	37.844
		10	3695.0	10	3685.1	35.58	36.05	38.83	7.00	45.83	38.282
	64-QAM	10	3555.0	10	3564.9	36.07	36.19	39.14	7.00	46.14	41.115
		10	3625.0	10	3634.9	35.61	35.86	38.74	7.00	45.74	37.497
		10	3695.0	10	3685.1	35.57	36.05	38.83	7.00	45.83	38.282
	256-QAM	10	3555.0	10	3564.9	36.12	36.09	39.12	7.00	46.12	40.926
		10	3625.0	10	3634.9	35.62	35.87	38.76	7.00	45.76	37.670
		10	3695.0	10	3685.1	35.58	35.97	38.79	7.00	45.79	37.931

Table 7-3 Conducted Power / EIRP Measurements – CA LTE Band 48

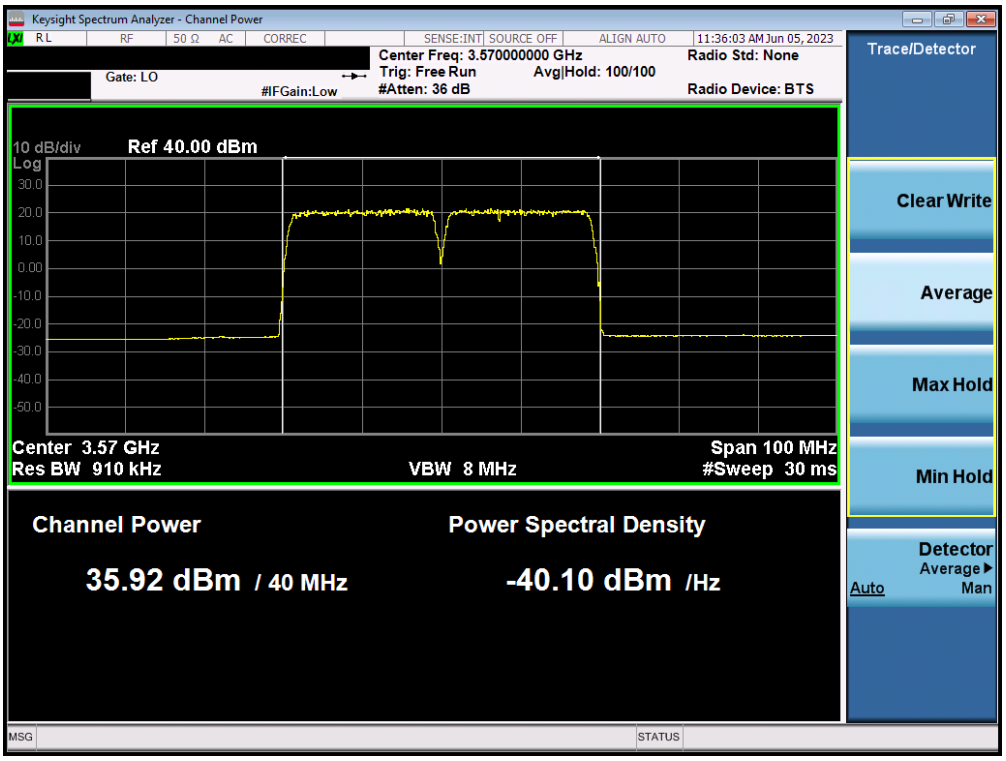
Conducted Power Measurements – CA Band 48 Ant 2



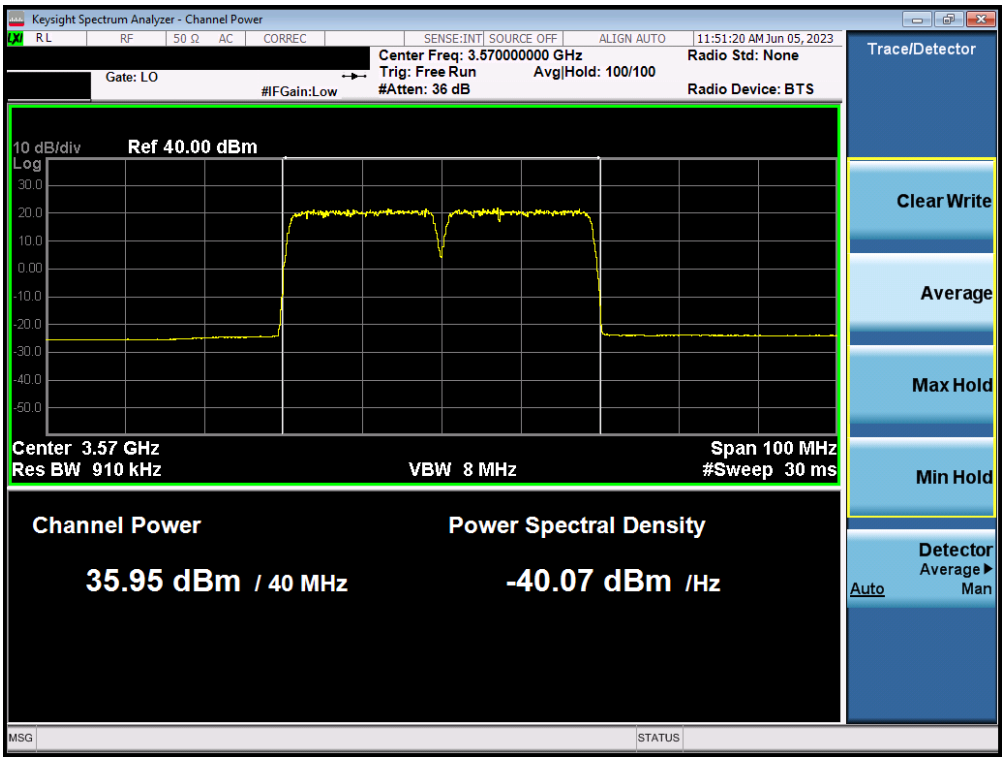
Plot 7.17 – Conducted Power Measurement – 40MHz BW, Low Channel, QPSK – Ant 2



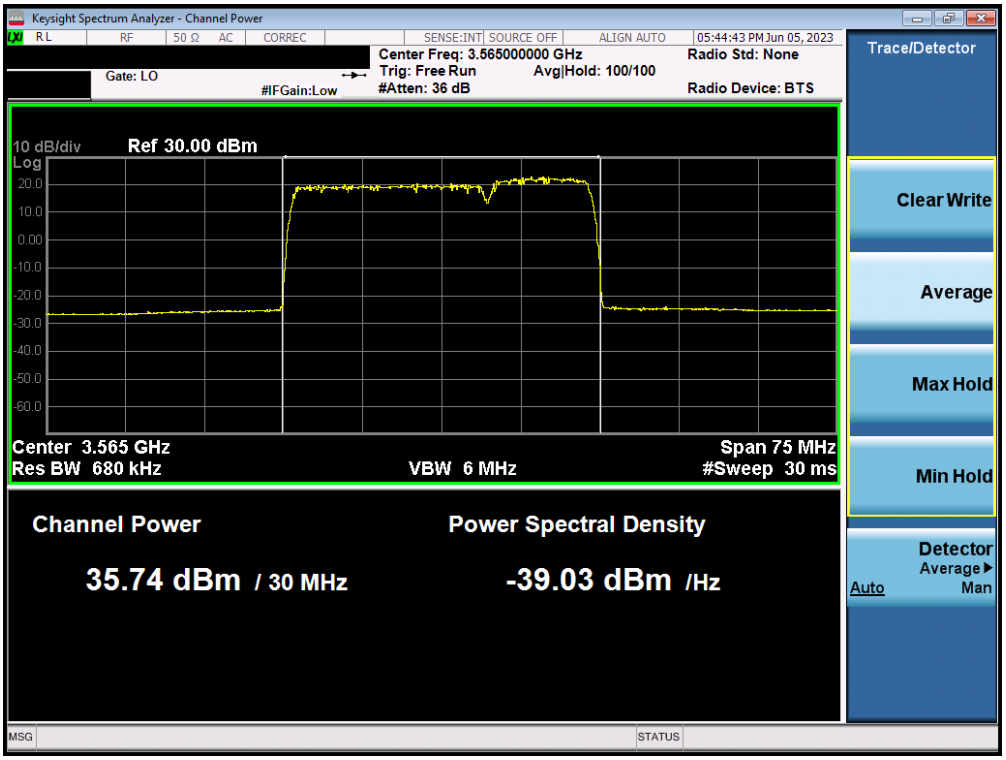
Plot 7.18 – Conducted Power Measurement – 40MHz BW, Low Channel, 16QAM – Ant 2



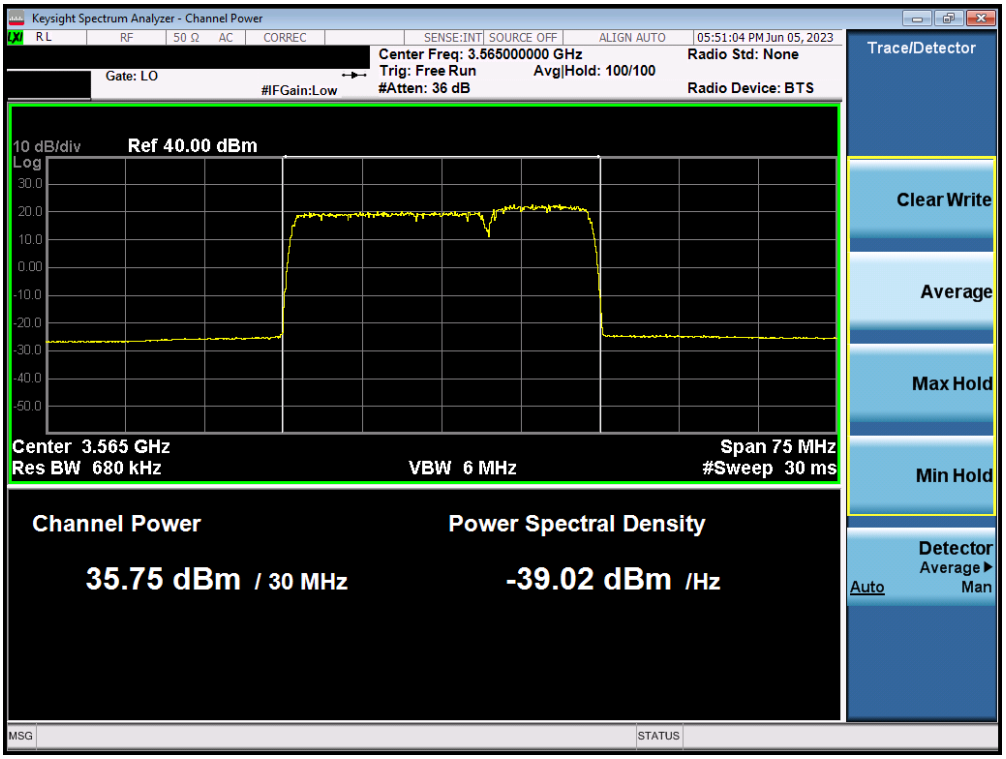
Plot 7.19 – Conducted Power Measurement – 40MHz BW, Low Channel, 64QAM – Ant 2



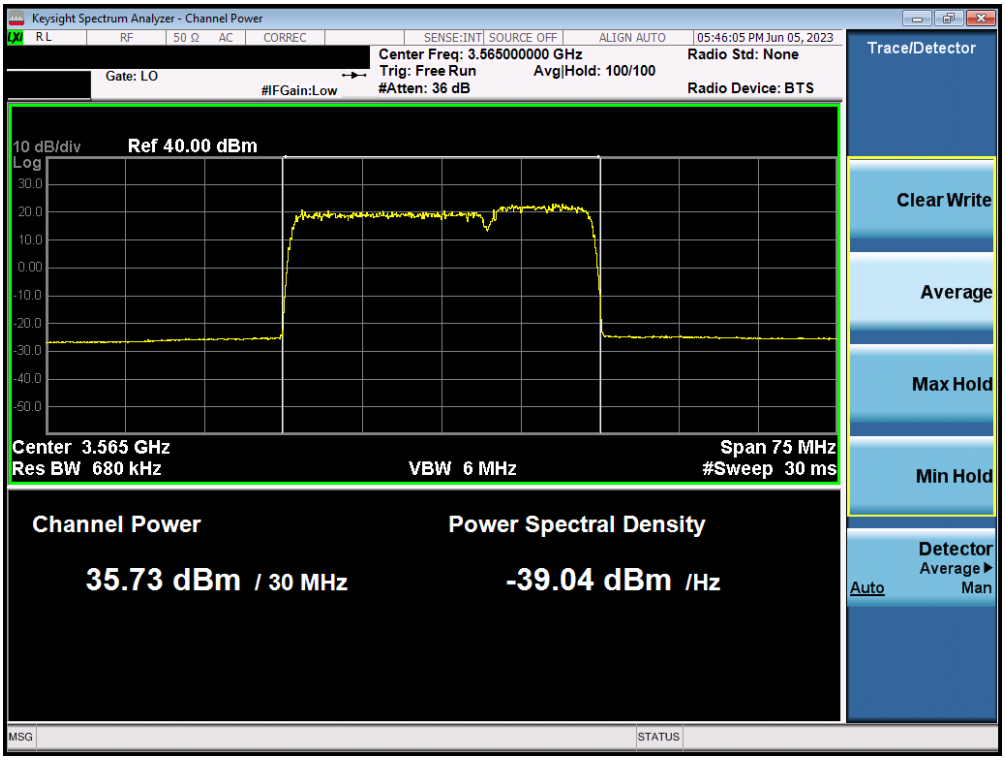
Plot 7.20 – Conducted Power Measurement – 40MHz BW, Low Channel, 256QAM – Ant 2



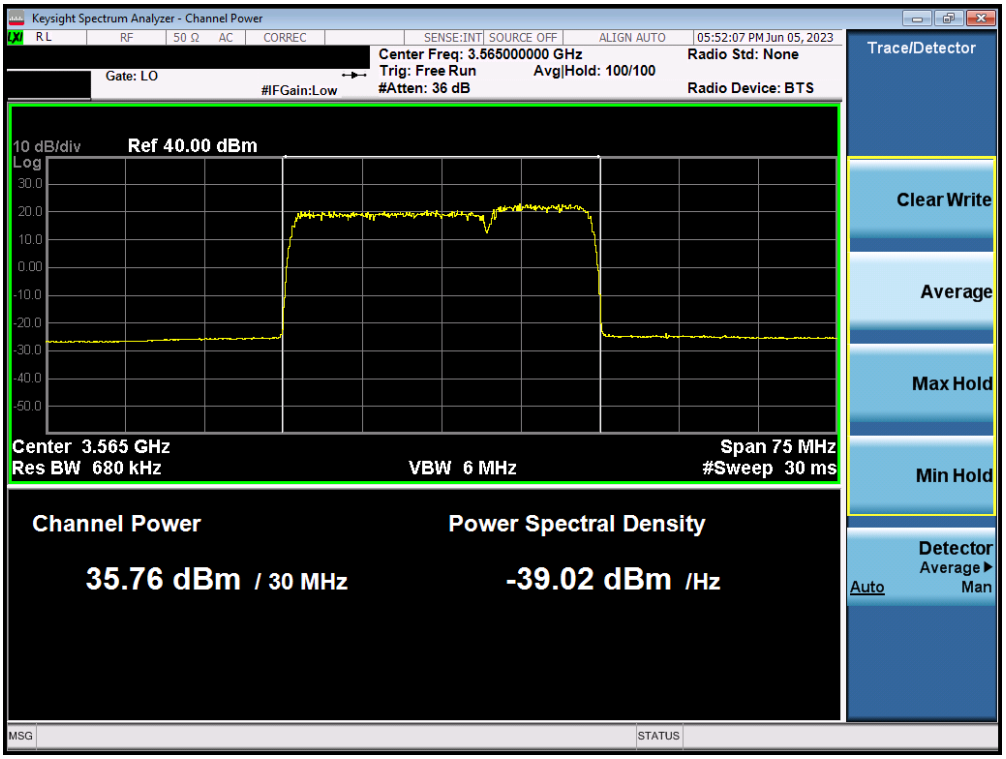
Plot 7.21 – Conducted Power Measurement – 30MHz BW, Low Channel, QPSK – Ant 2



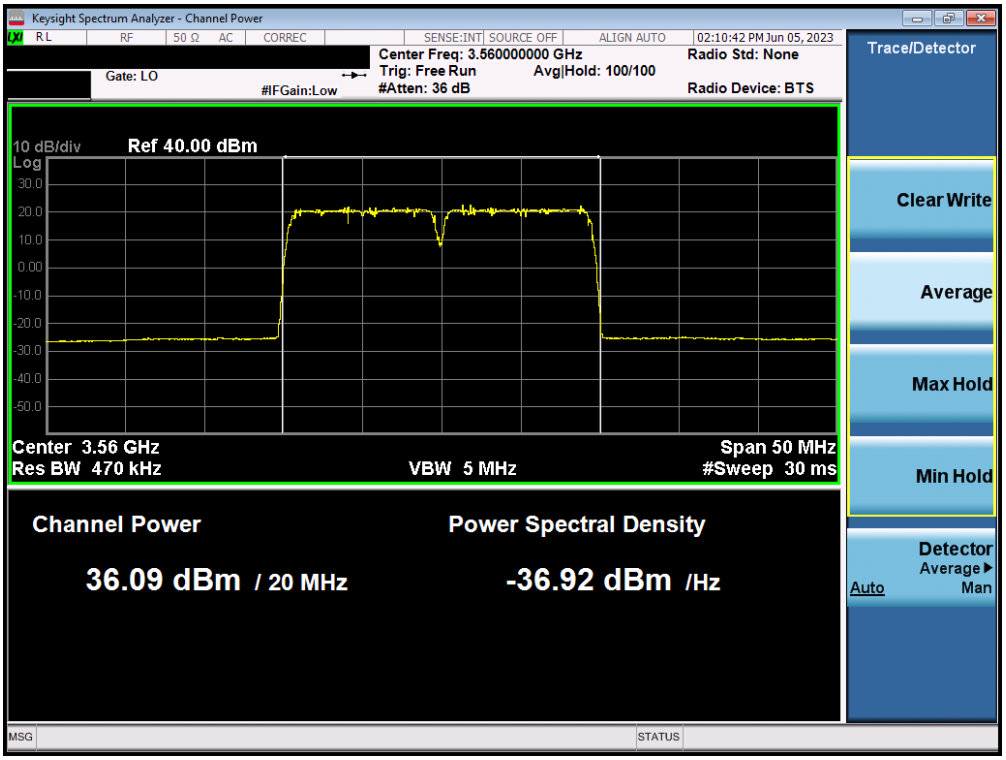
Plot 7.22 – Conducted Power Measurement – 30MHz BW, Low Channel, 16QAM – Ant 2



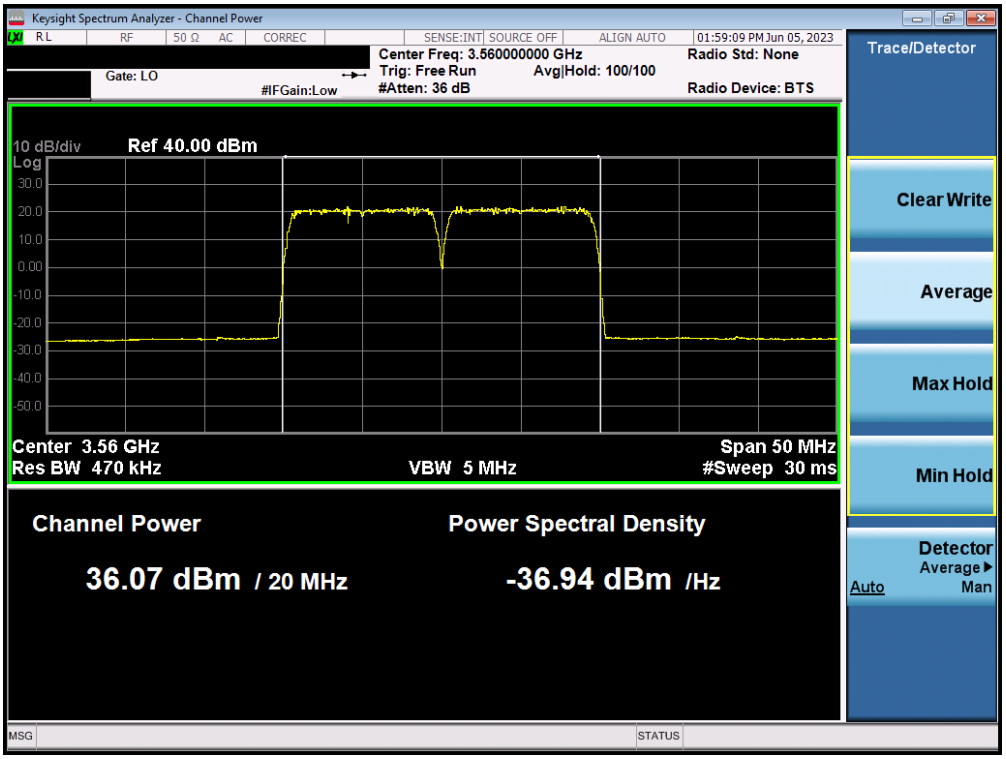
Plot 7.23 – Conducted Power Measurement – 30MHz BW, Low Channel, 64QAM – Ant 2



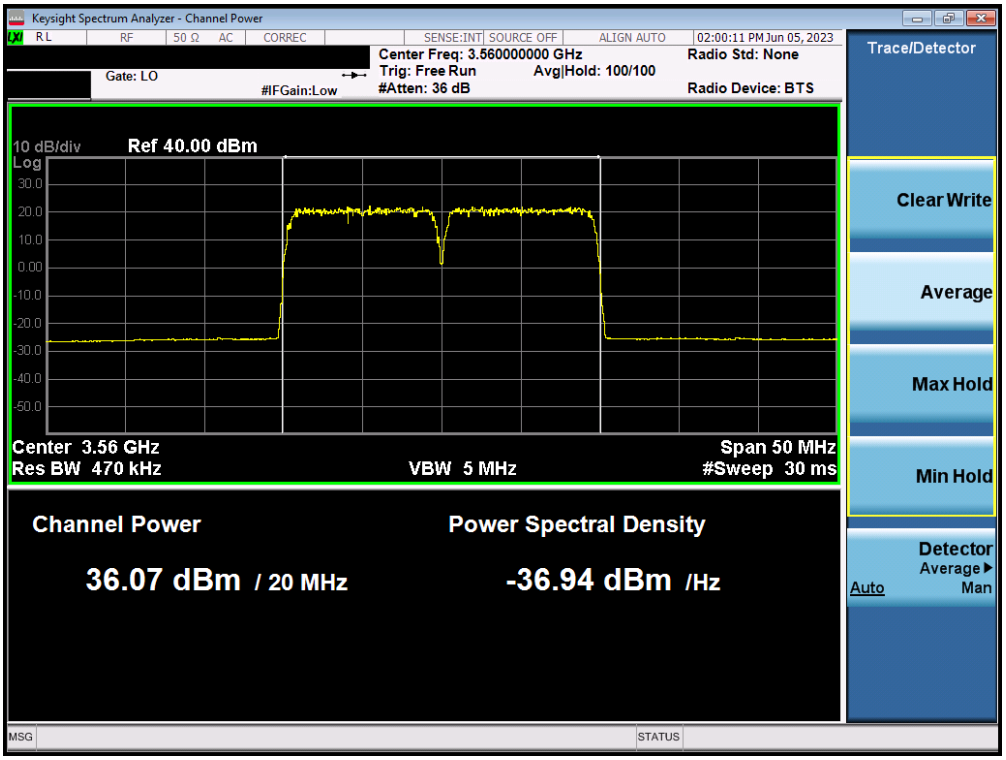
Plot 7.24 – Conducted Power Measurement – 30MHz BW, Low Channel, 256QAM – Ant 2



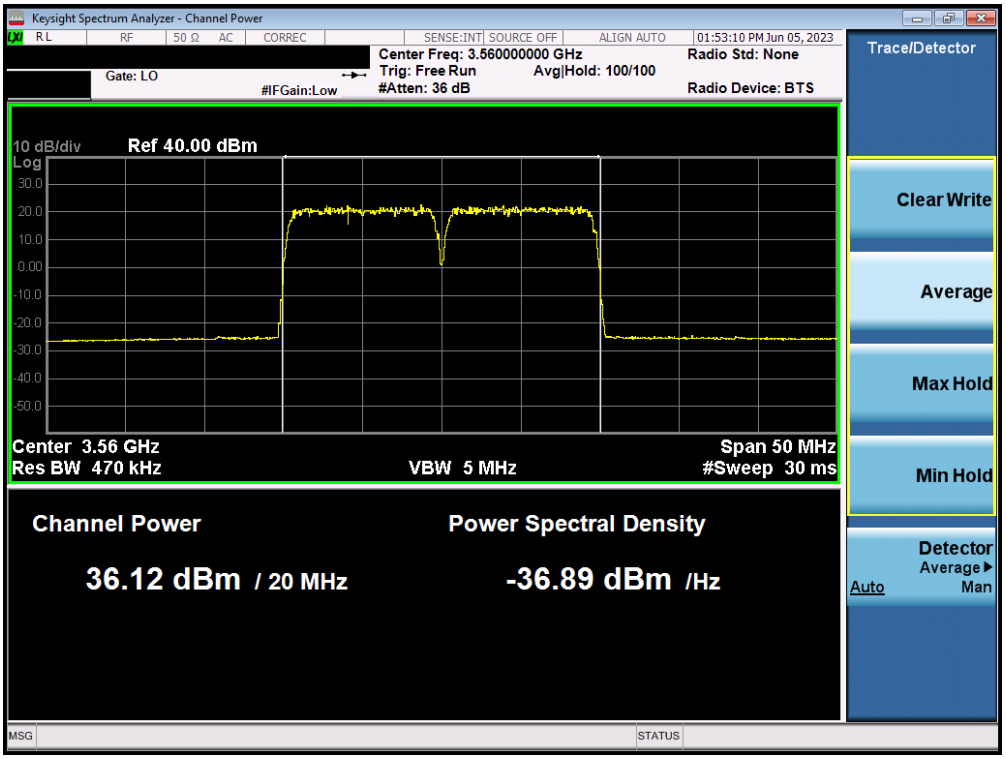
Plot 7.25 – Conducted Power Measurement – 20MHz BW, Low Channel, QPSK – Ant 2



Plot 7.26 – Conducted Power Measurement – 20MHz BW, Low Channel, 16QAM – Ant 2

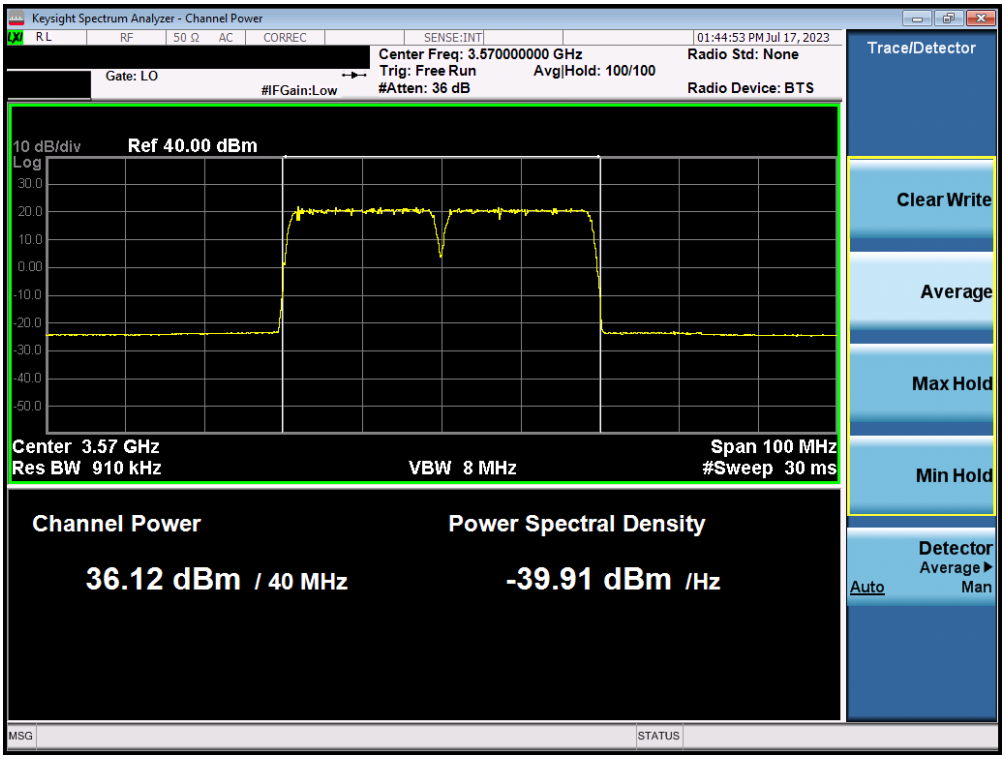


Plot 7.27 – Conducted Power Measurement – 20MHz BW, Low Channel, 64QAM – Ant 2

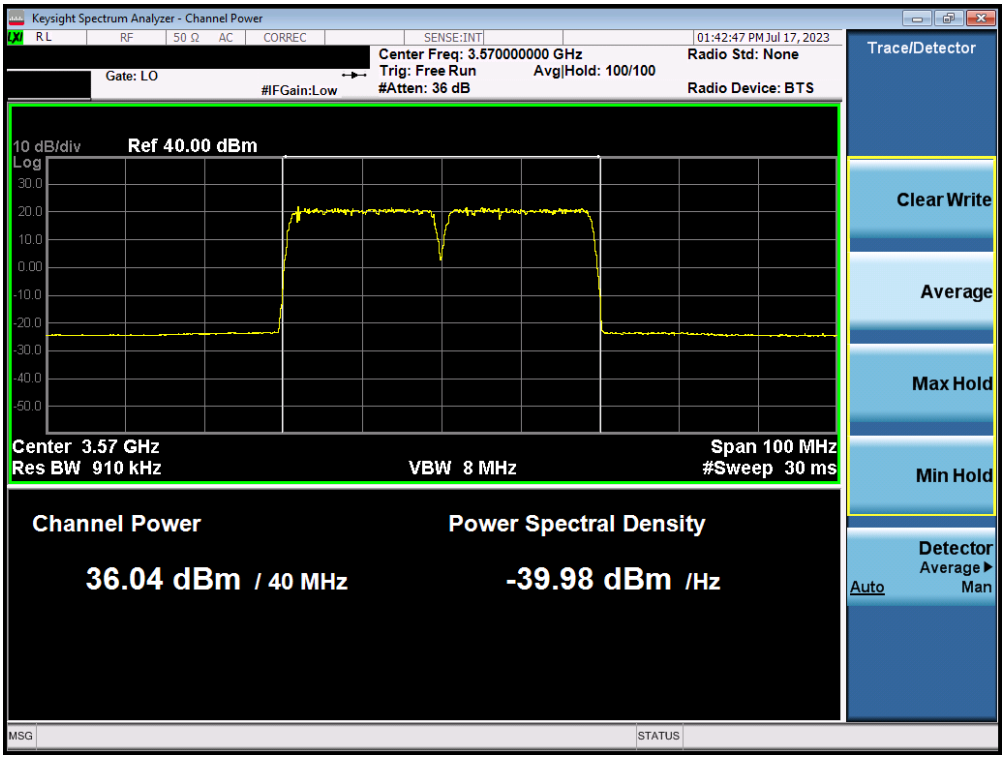


Plot 7.28 – Conducted Power Measurement – 20MHz BW, Low Channel, 256QAM – Ant 2

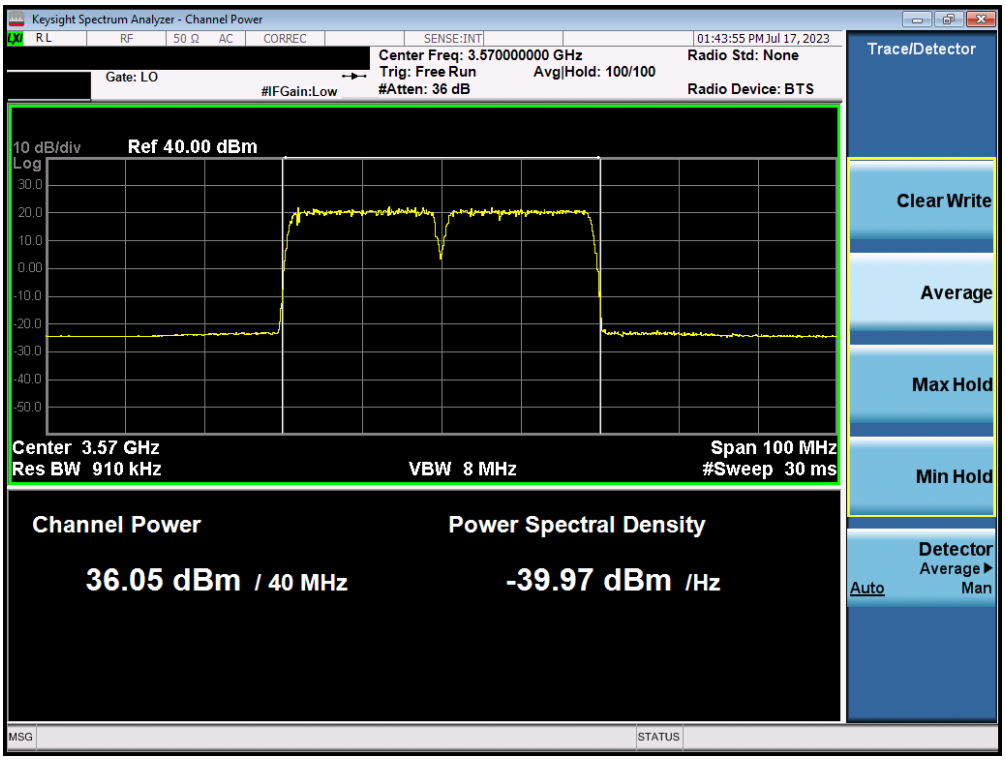
Conducted Power Measurements – CA Band 48 Ant 4



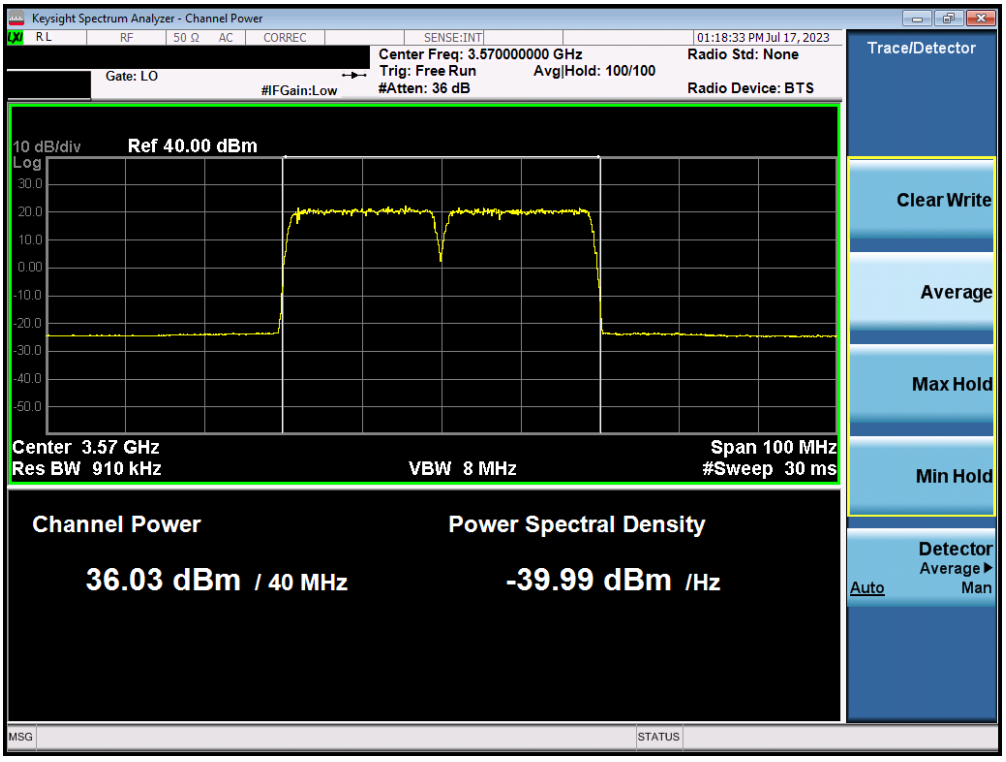
Plot 7.29 – Conducted Power Measurement – 40MHz BW, Low Channel, QPSK – Ant 4



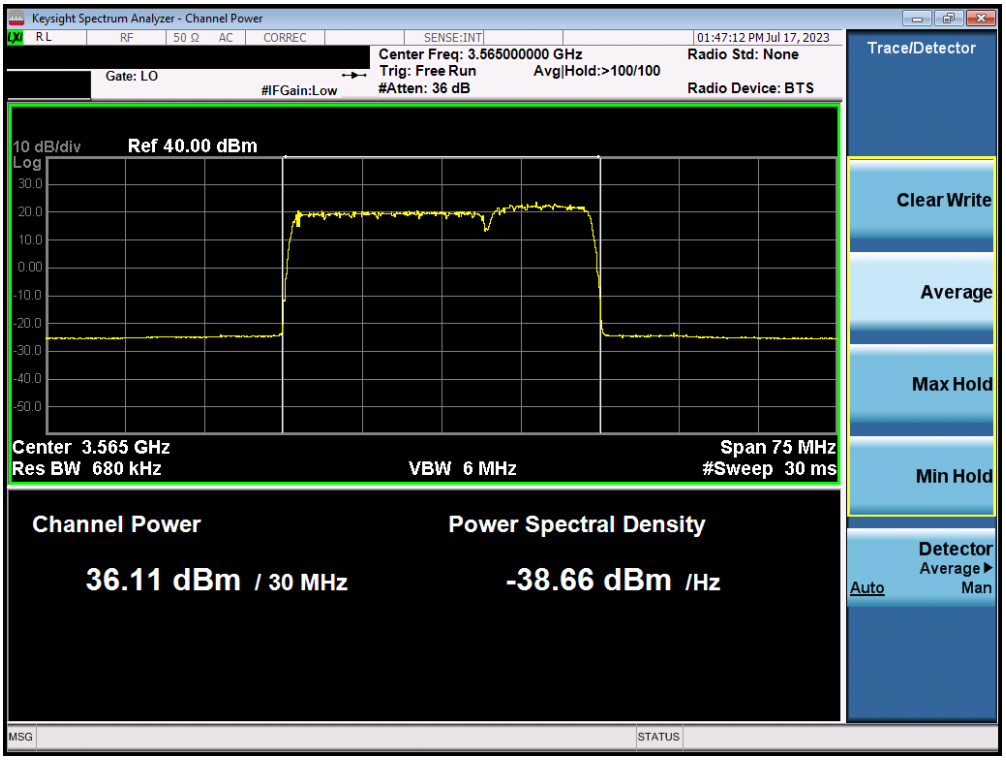
Plot 7.30 – Conducted Power Measurement – 40MHz BW, Low Channel, 16QAM – Ant 4



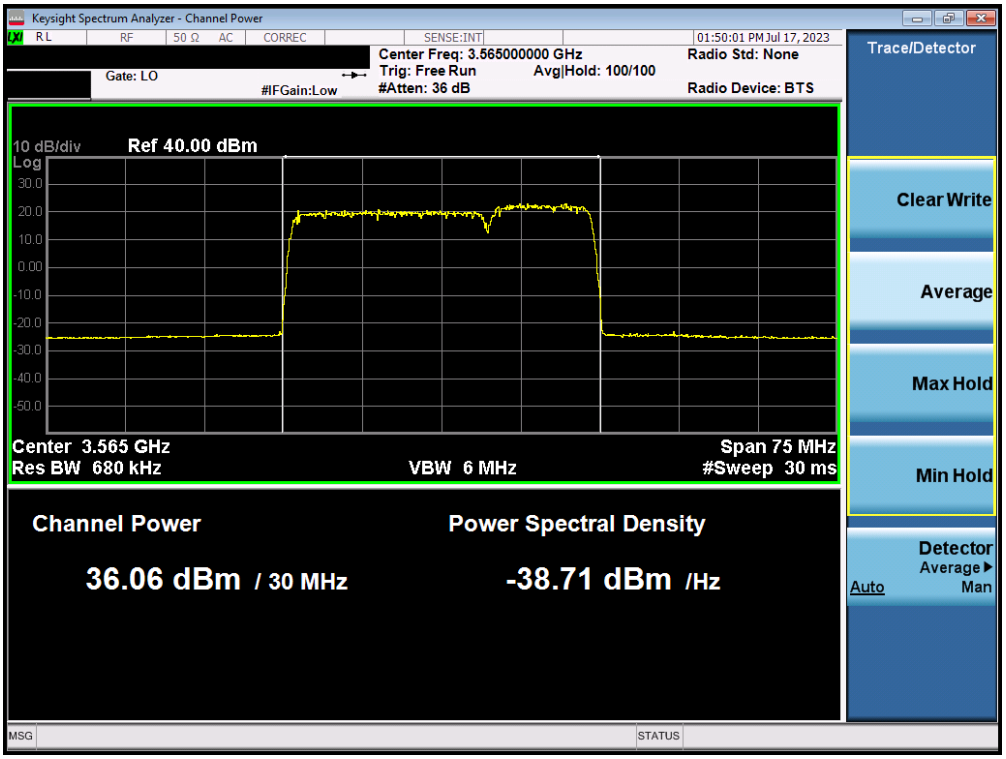
Plot 7.31 – Conducted Power Measurement – 40MHz BW, Low Channel, 64QAM – Ant 4



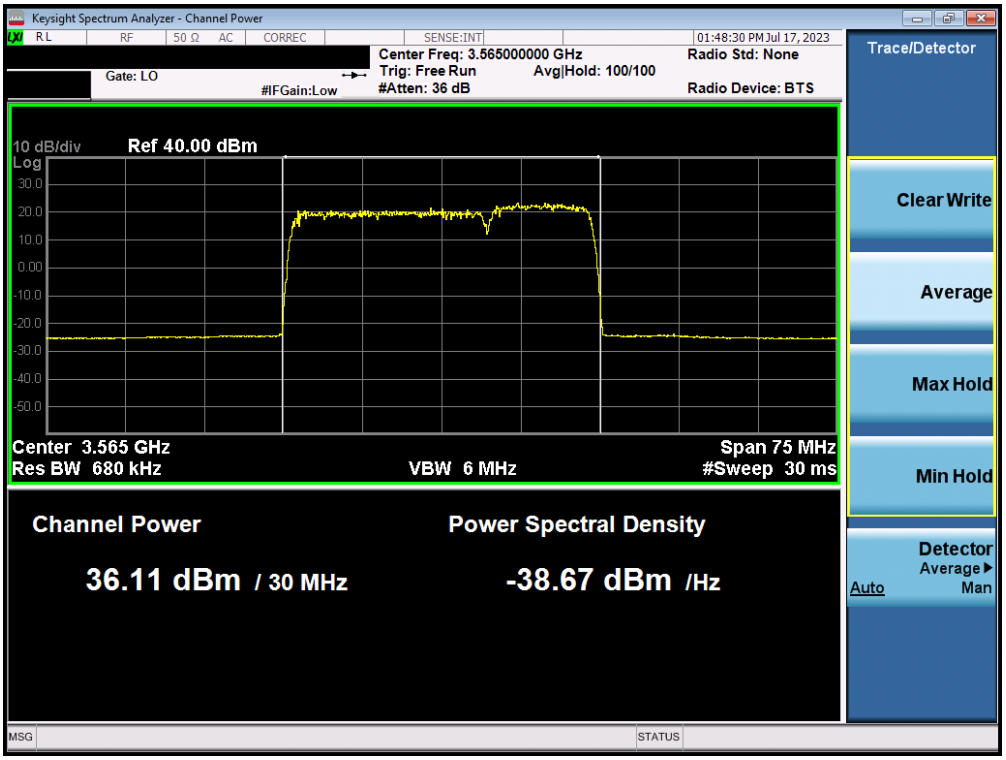
Plot 7.32 – Conducted Power Measurement – 40MHz BW, Low Channel, 256QAM – Ant 4



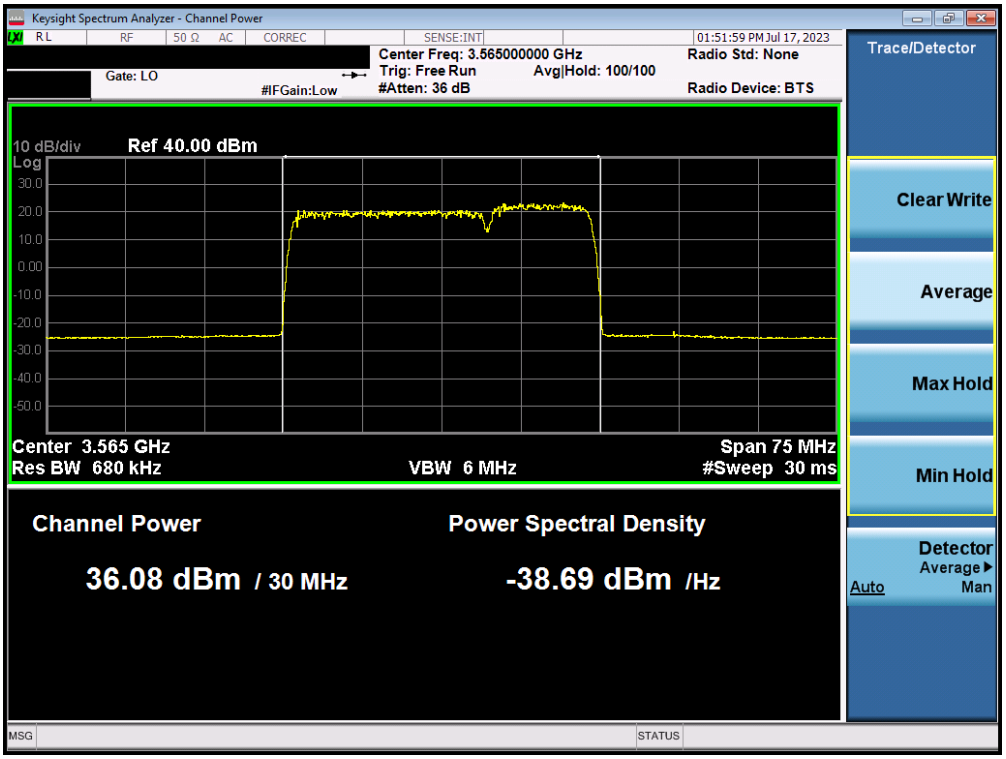
Plot 7.33 – Conducted Power Measurement – 30MHz BW, Low Channel, QPSK – Ant 4



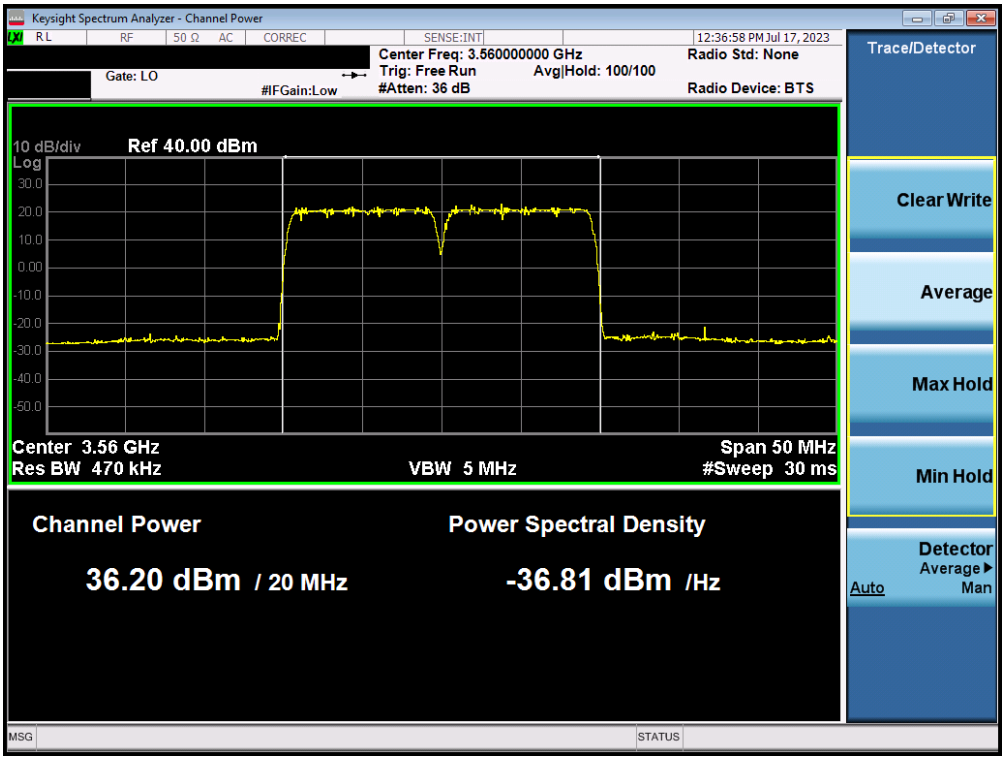
Plot 7.34 – Conducted Power Measurement – 30MHz BW, Low Channel, 16QAM – Ant 4



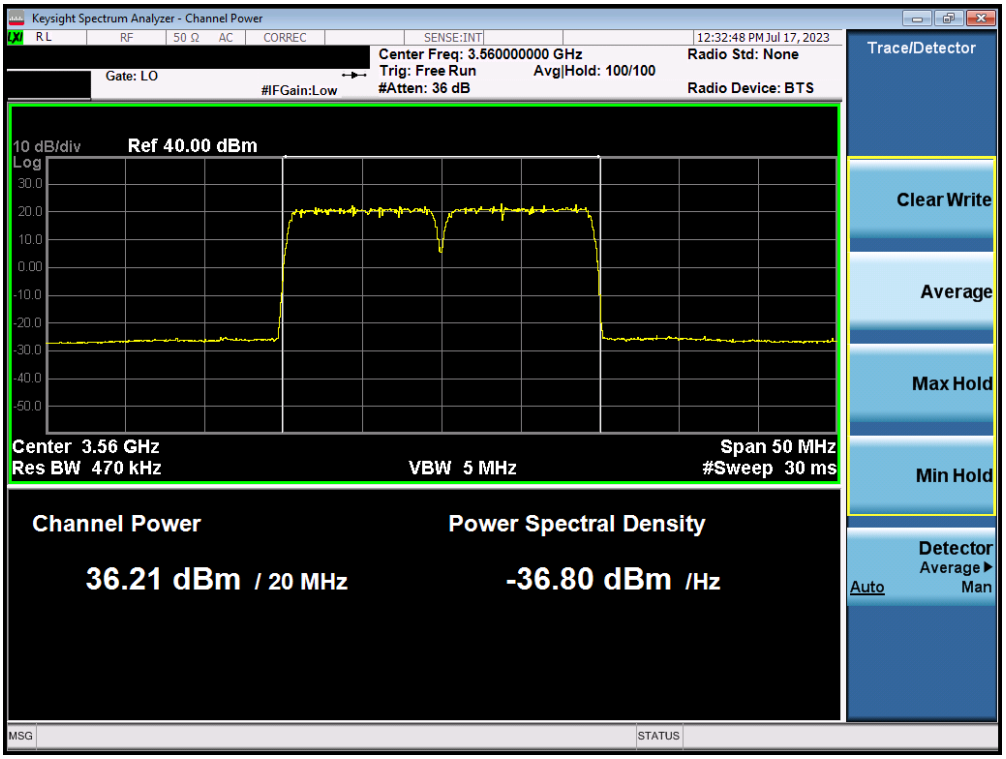
Plot 7.35 – Conducted Power Measurement – 30MHz BW, Low Channel, 64QAM – Ant 4



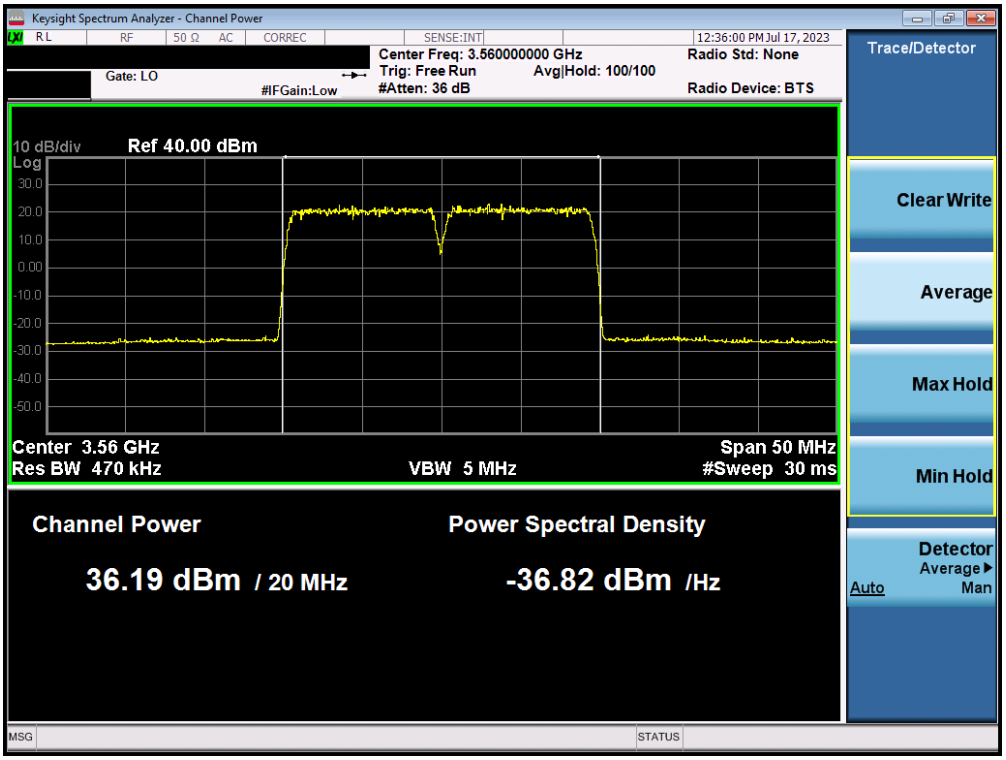
Plot 7.36 – Conducted Power Measurement – 30MHz BW, Low Channel, 256QAM – Ant 4



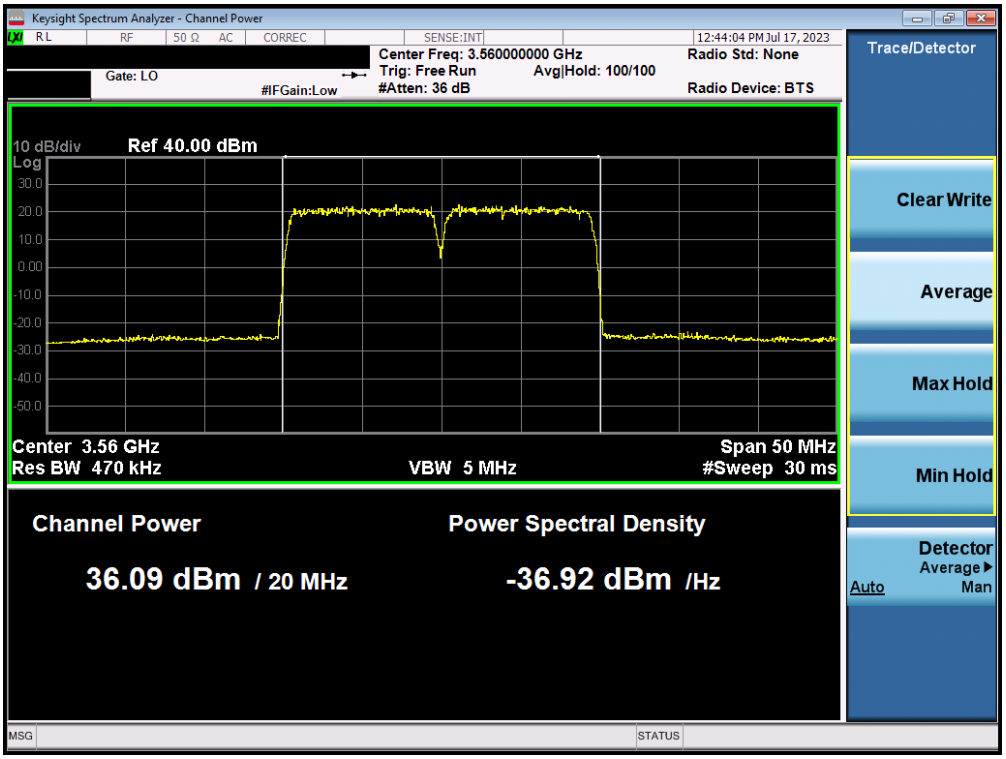
Plot 7.37 – Conducted Power Measurement – 20MHz BW, Low Channel, QPSK – Ant 4



Plot 7.38 – Conducted Power Measurement – 20MHz BW, Low Channel, 16QAM – Ant 4



Plot 7.39 – Conducted Power Measurement – 20MHz BW, Low Channel, 64QAM – Ant 4



Plot 7.40 – Conducted Power Measurement – 20MHz BW, Low Channel, 256QAM – Ant 4

7.3 Occupied Bandwidth

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

ANSI C63.26-2015 – Section 5.4.4

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-2. Test Instrument & Measurement Setup

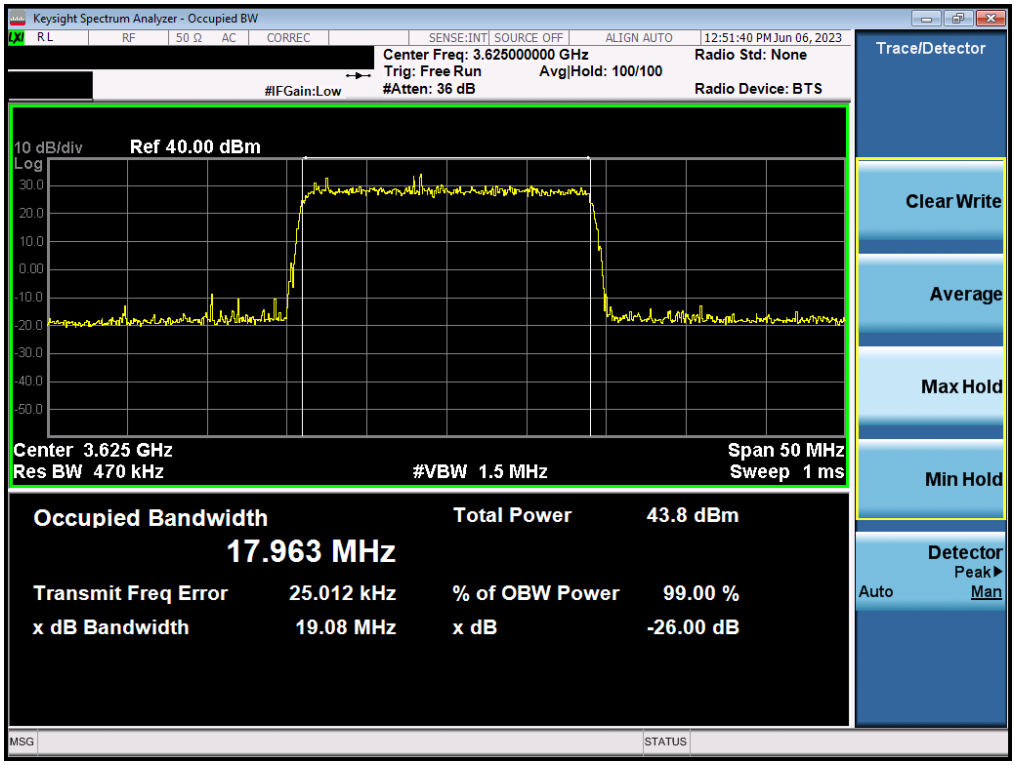
Test Notes

None

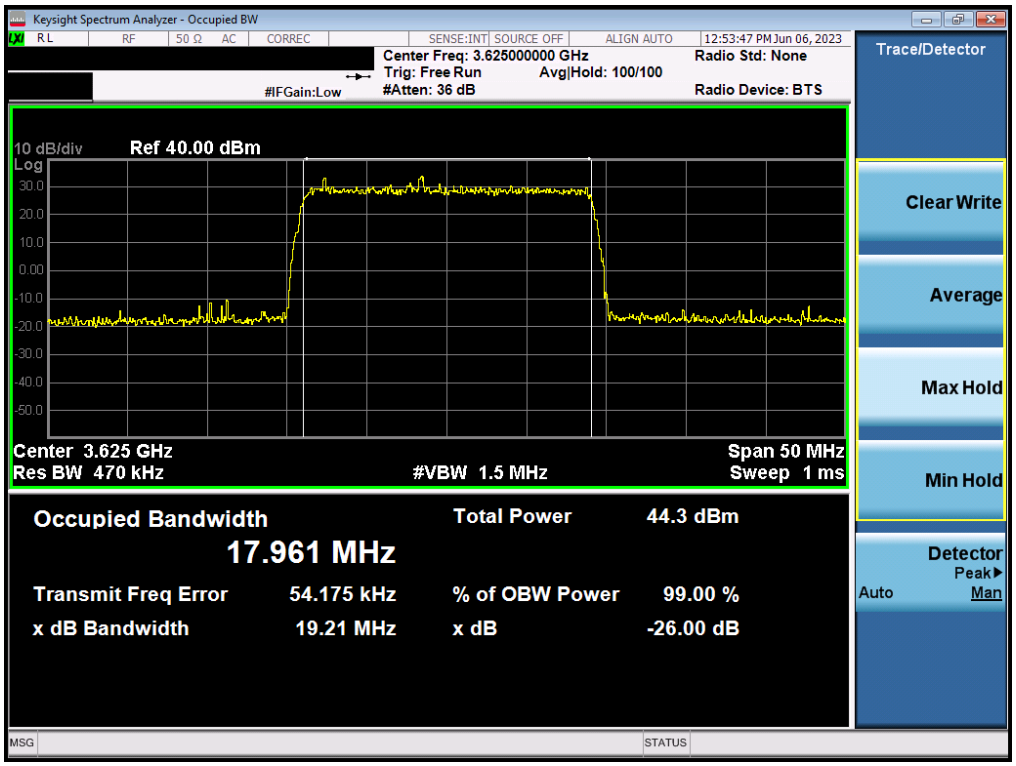
Bandwidth	Modulation	OBW [MHz]
20 MHz	QPSK	17.96
	16QAM	17.96
	64QAM	17.93
	256QAM	17.93
10 MHz	QPSK	9.00
	16QAM	9.00
	64QAM	9.00
	256QAM	9.01

Table 7-4 Occupied Bandwidth Measurements – LTE BAND 48

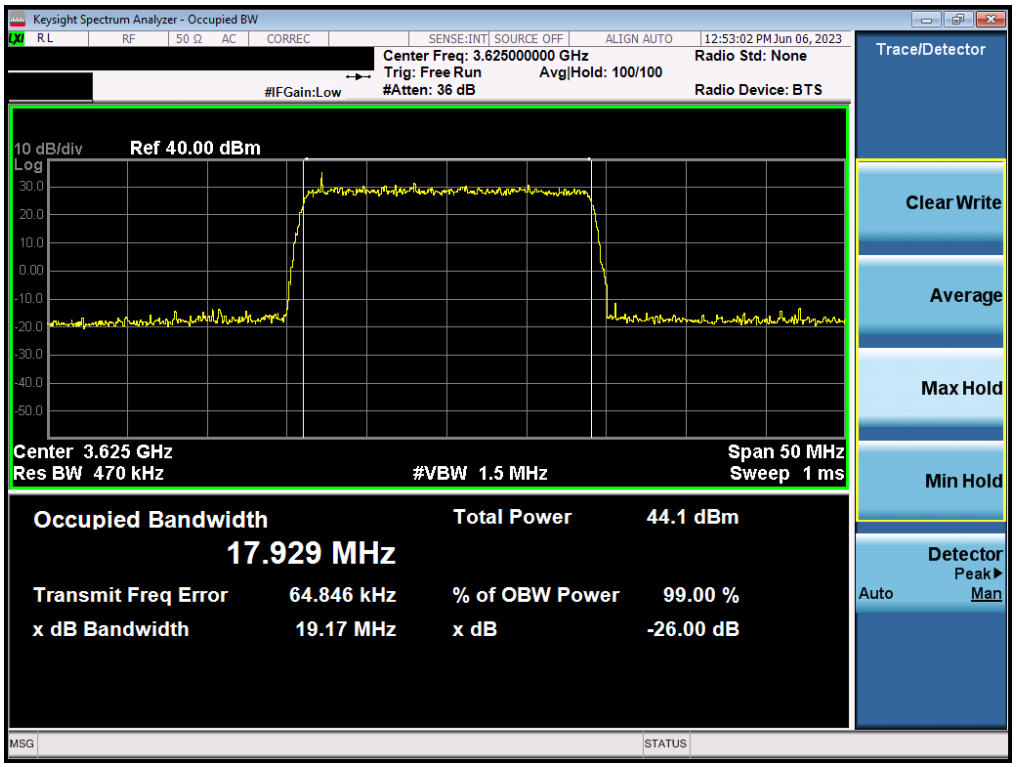
Occupied Bandwidth Measurements – Band 48



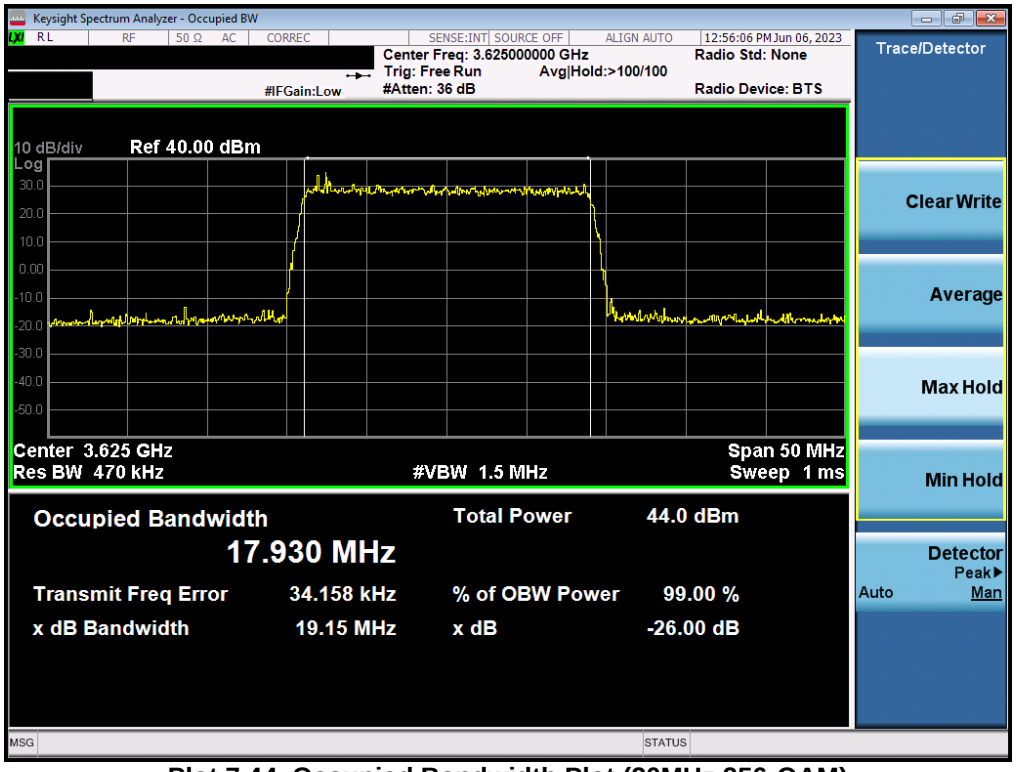
Plot 7.41. Occupied Bandwidth Plot (20MHz QPSK)



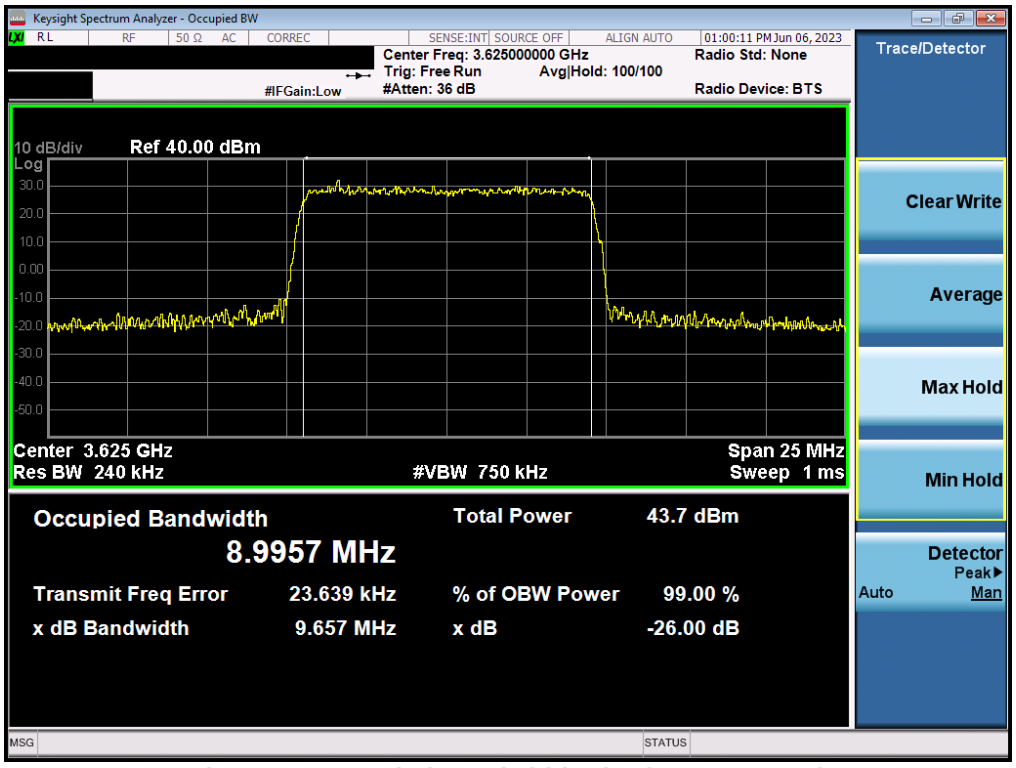
Plot 7.42. Occupied Bandwidth Plot (20MHz 16-QAM)



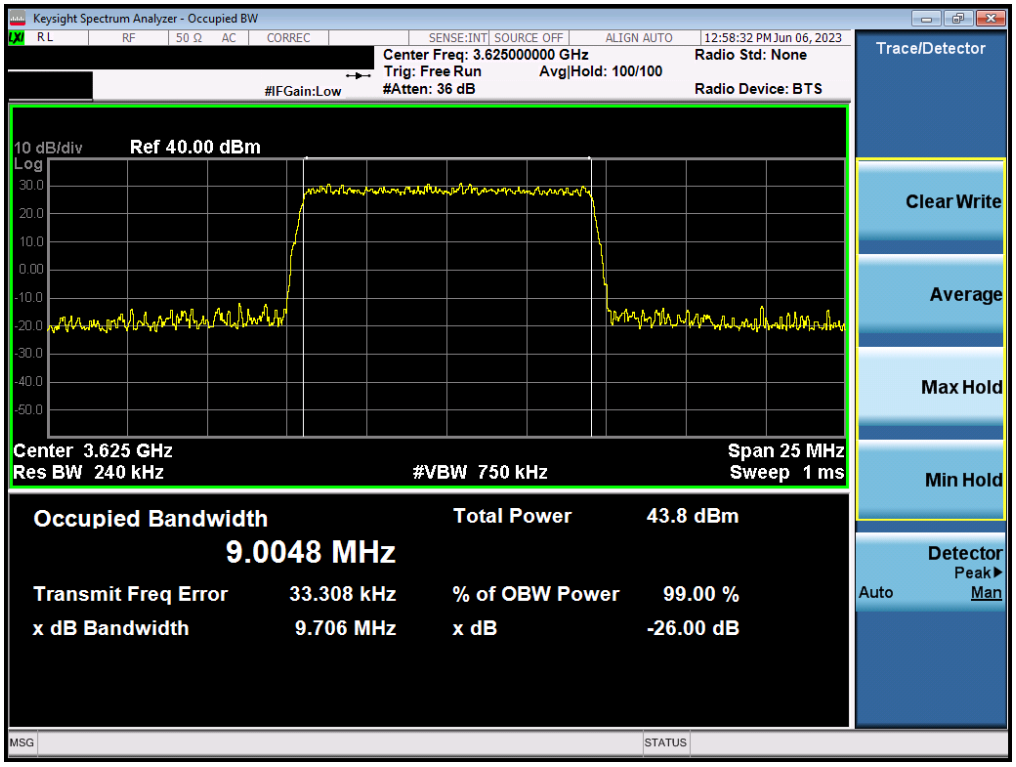
Plot 7.43. Occupied Bandwidth Plot (20MHz 64-QAM)



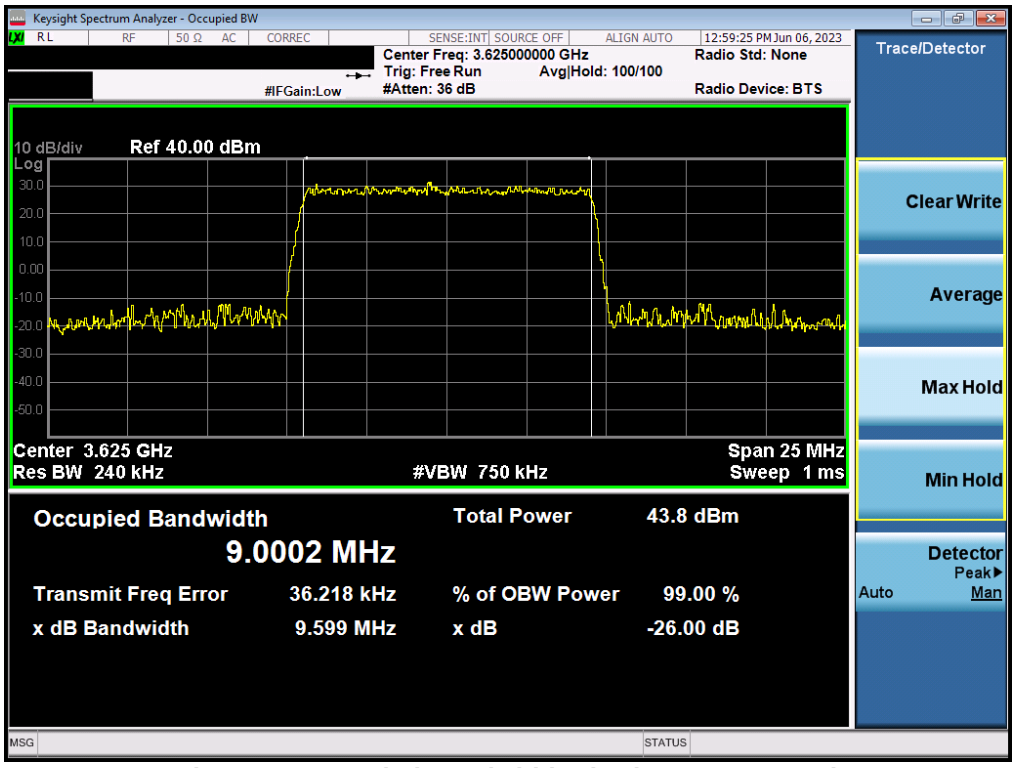
Plot 7.44. Occupied Bandwidth Plot (20MHz 256-QAM)



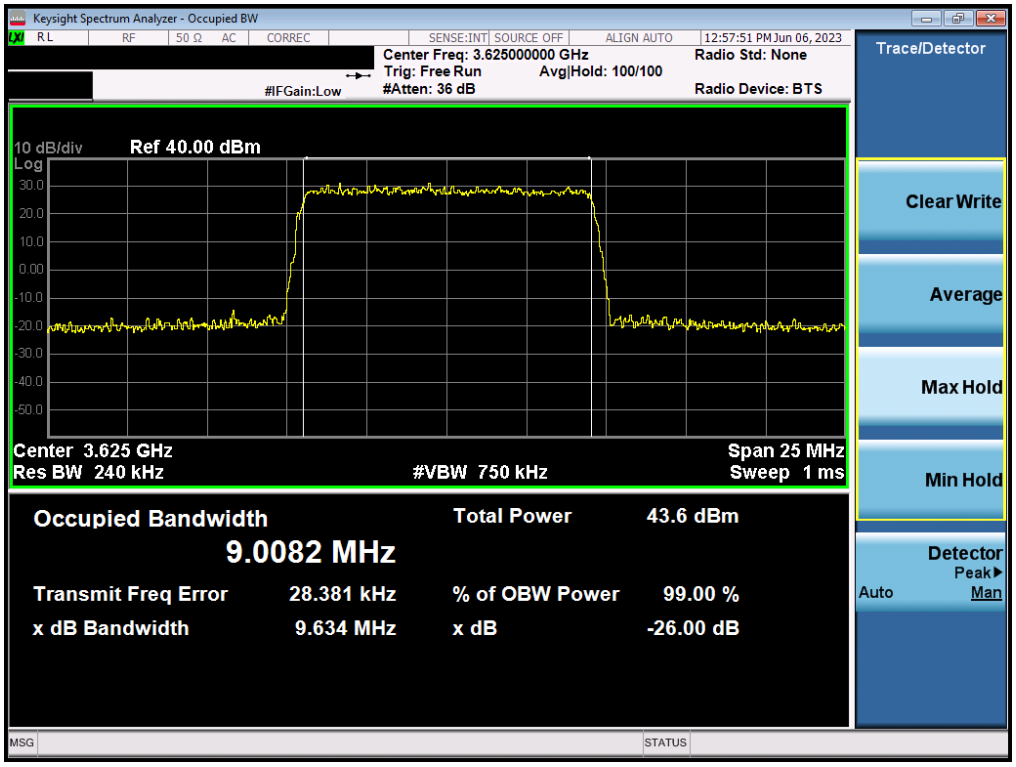
Plot 7.45. Occupied Bandwidth Plot (10MHz QPSK)



Plot 7.46. Occupied Bandwidth Plot (10MHz 16-QAM)



Plot 7.47. Occupied Bandwidth Plot (10MHz 64-QAM)

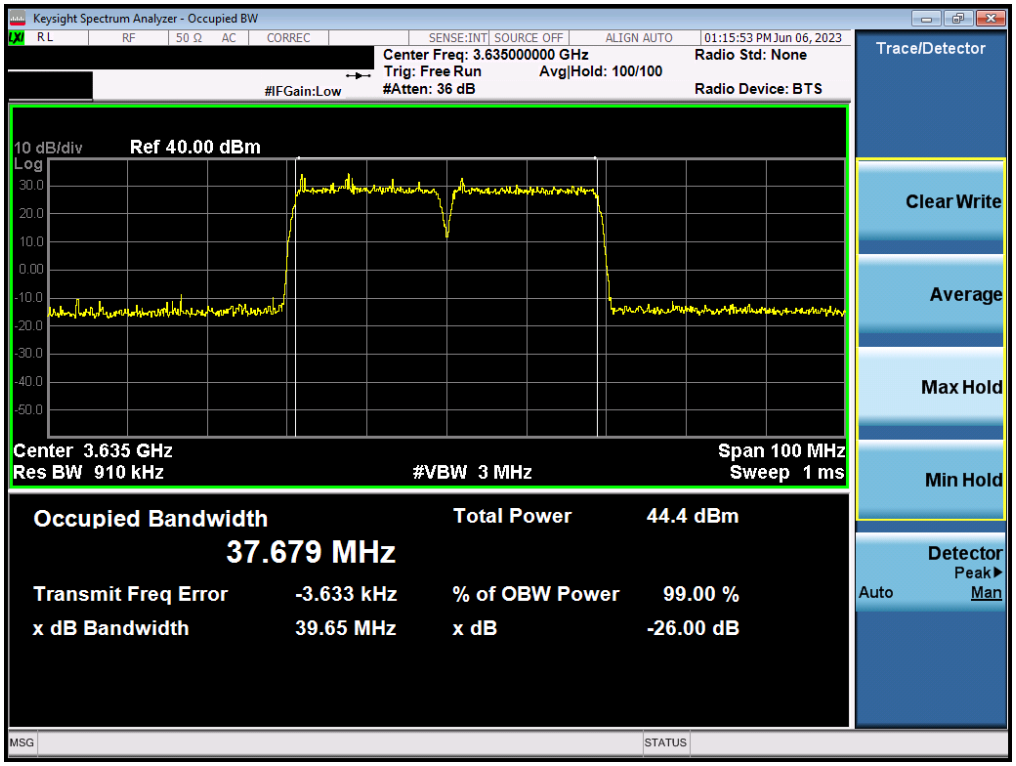


Plot 7.48. Occupied Bandwidth Plot (10MHz 256-QAM)

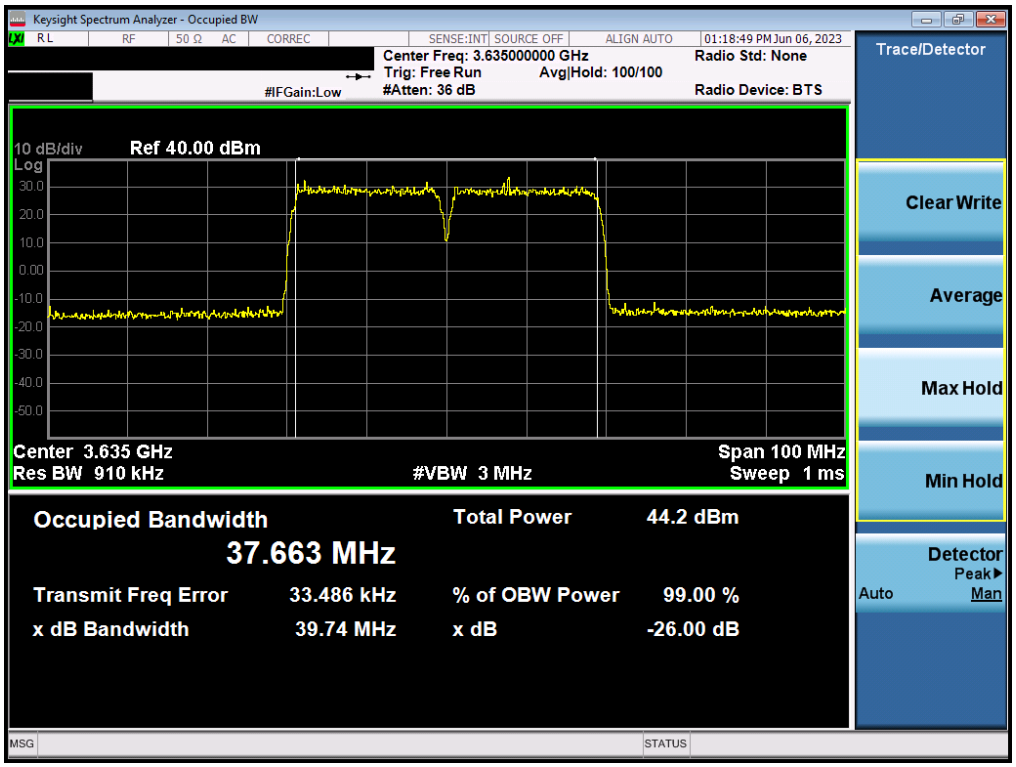
Bandwidth	Modulation	OBW [kHz]
40 MHz	QPSK	37.68
	16QAM	37.66
	64QAM	37.66
	256QAM	37.66
30 MHz	QPSK	27.98
	16QAM	27.92
	64QAM	27.99
	256QAM	28.00
20 MHz	QPSK	18.85
	16QAM	18.85
	64QAM	18.83
	256QAM	18.85

Table 7-5 Occupied Bandwidth Measurements – CA LTE BAND 48

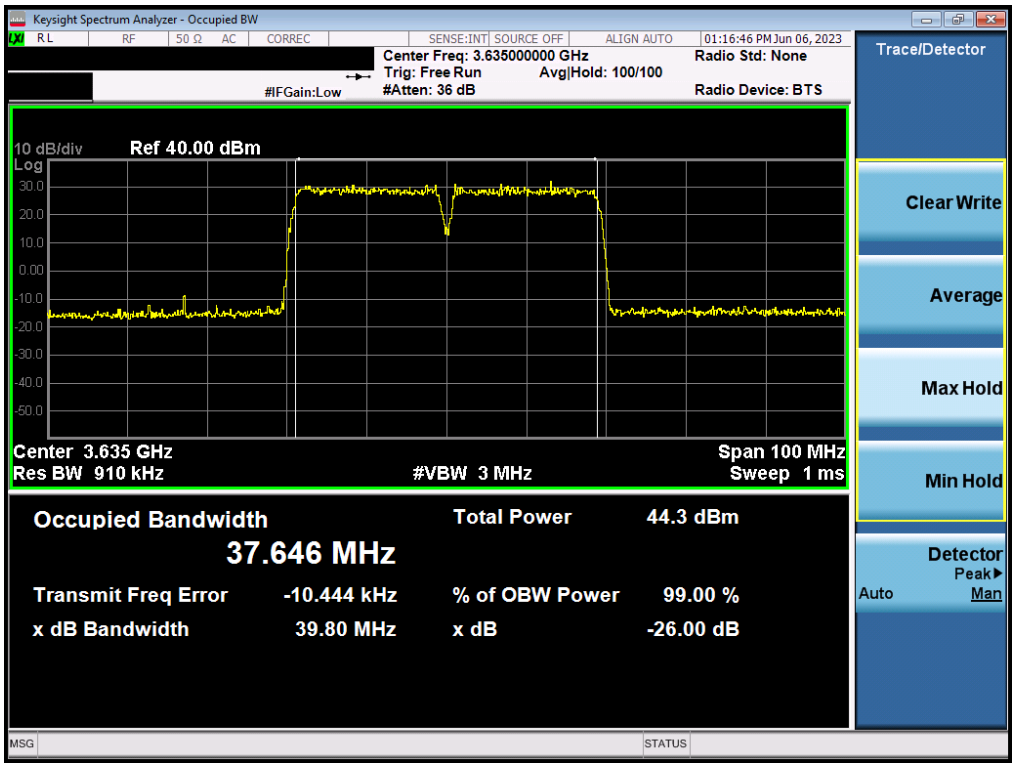
Occupied Bandwidth Measurements – CA Band 48



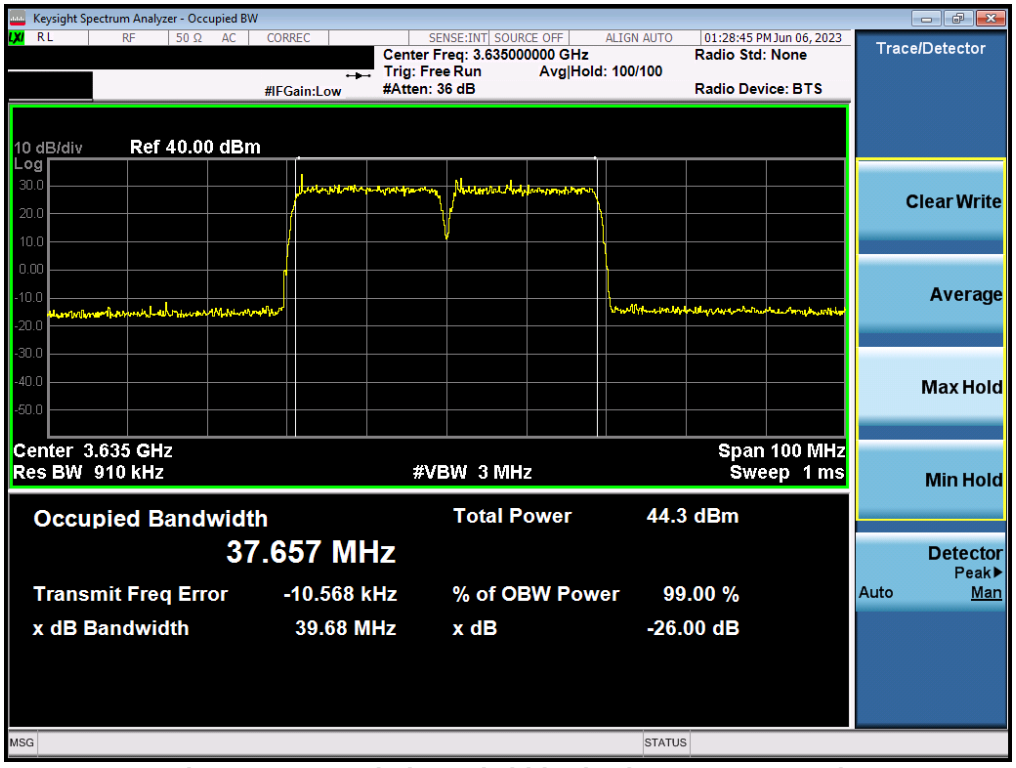
Plot 7.49. Occupied Bandwidth Plot (40MHz QPSK)



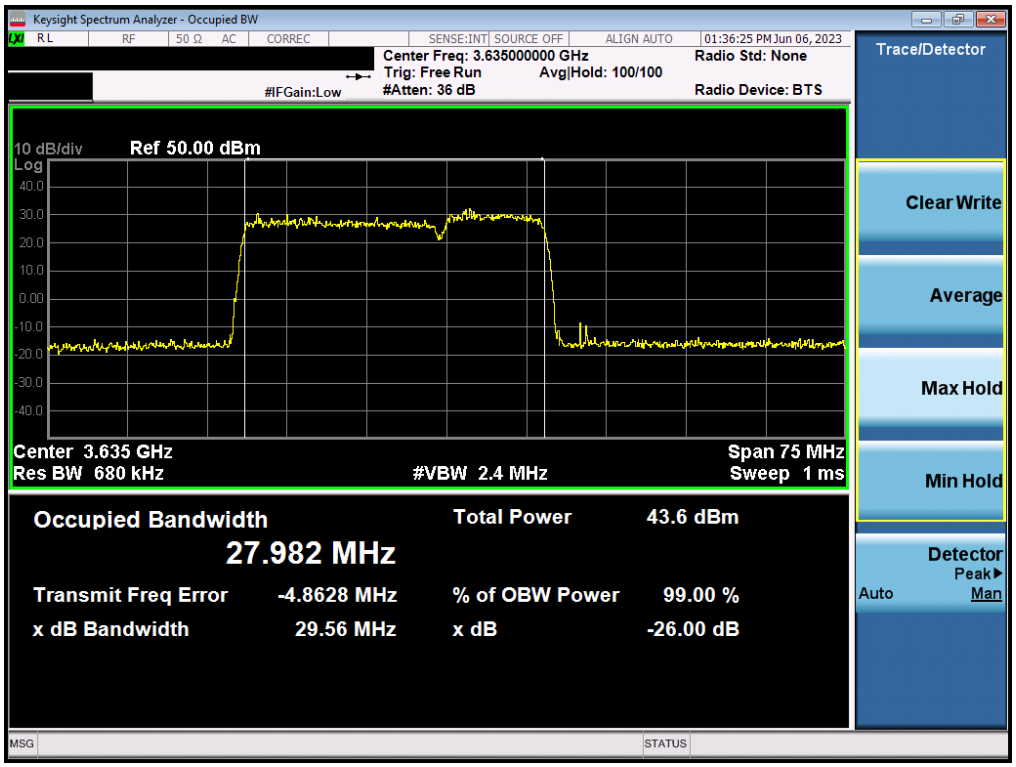
Plot 7.50. Occupied Bandwidth Plot (40MHz 16-QAM)



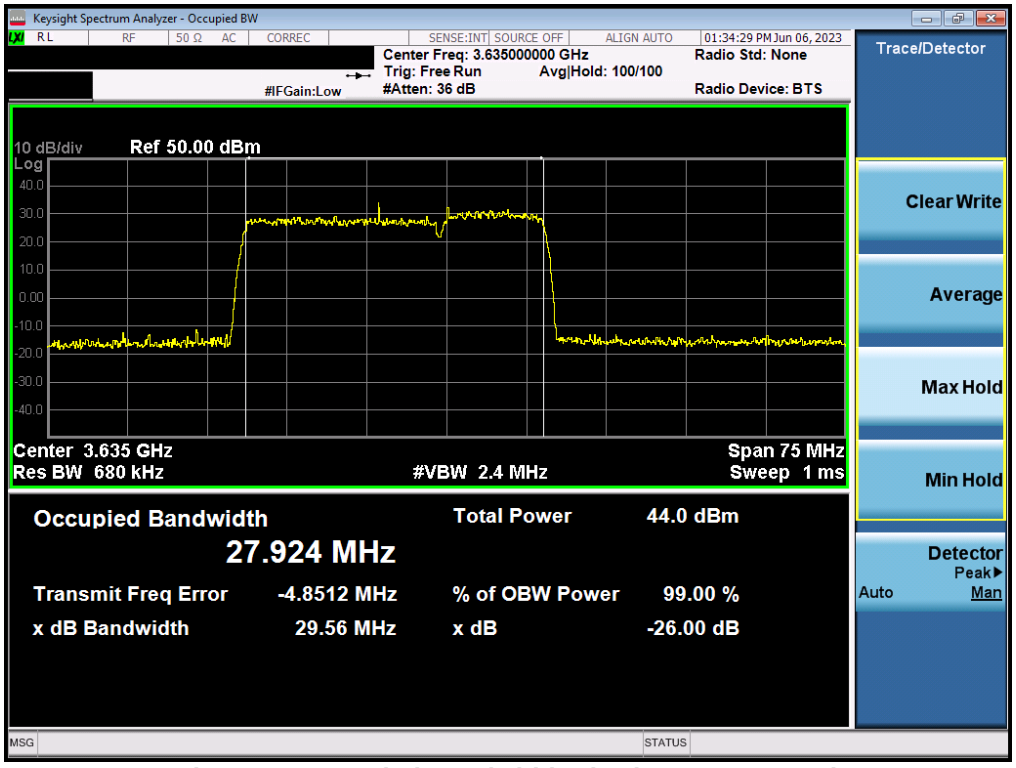
Plot 7.51. Occupied Bandwidth Plot (40MHz 64-QAM)



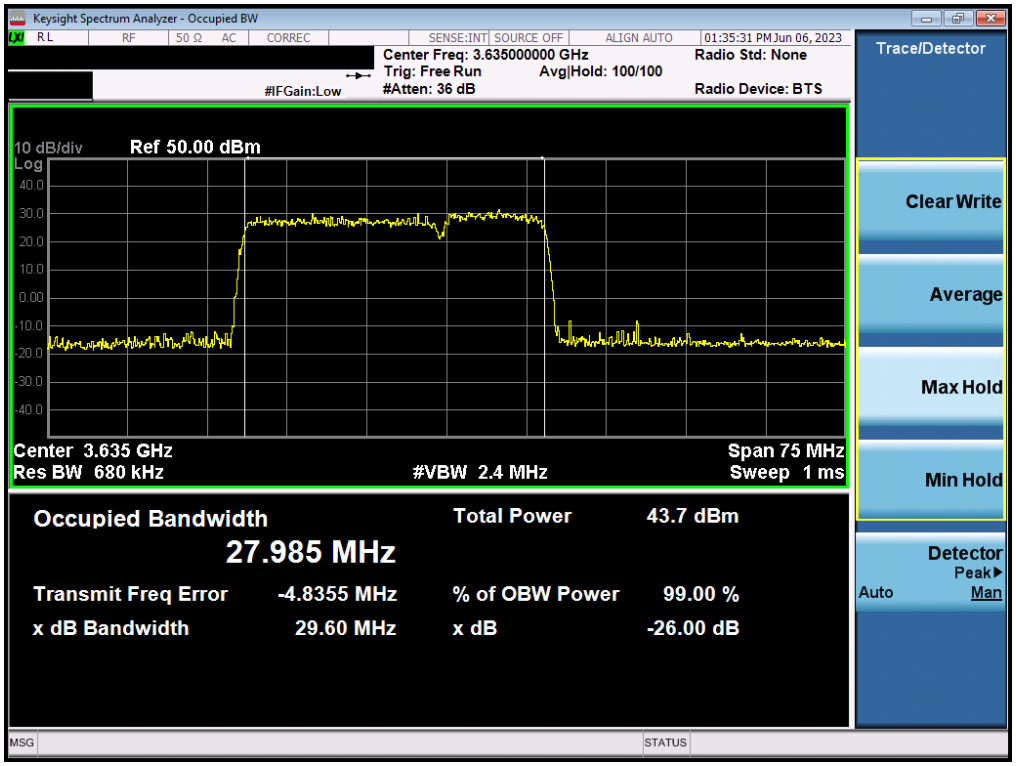
Plot 7.52. Occupied Bandwidth Plot (40MHz 256-QAM)



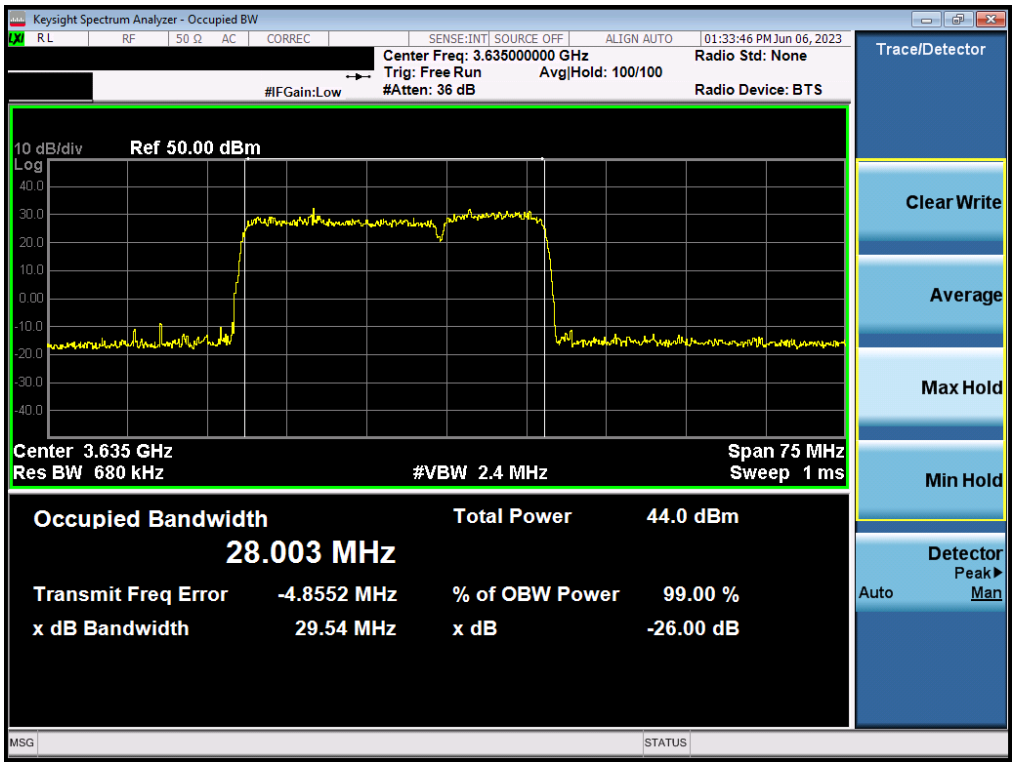
Plot 7.53. Occupied Bandwidth Plot (30MHz QPSK)



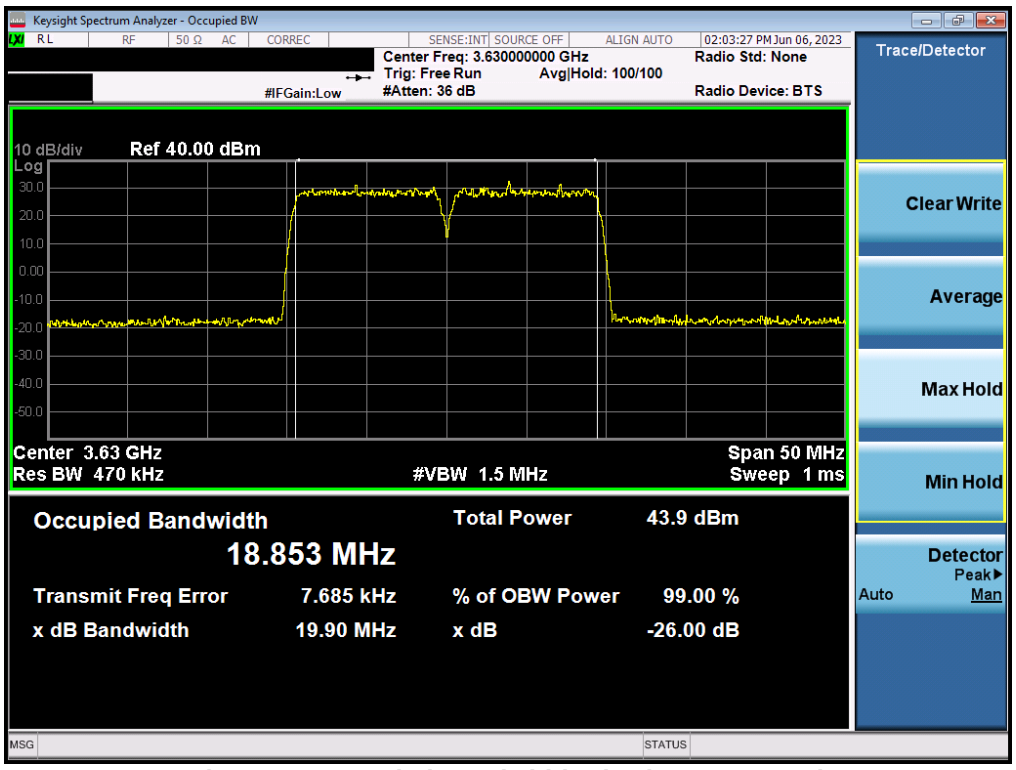
Plot 7.54. Occupied Bandwidth Plot (30MHz 16-QAM)



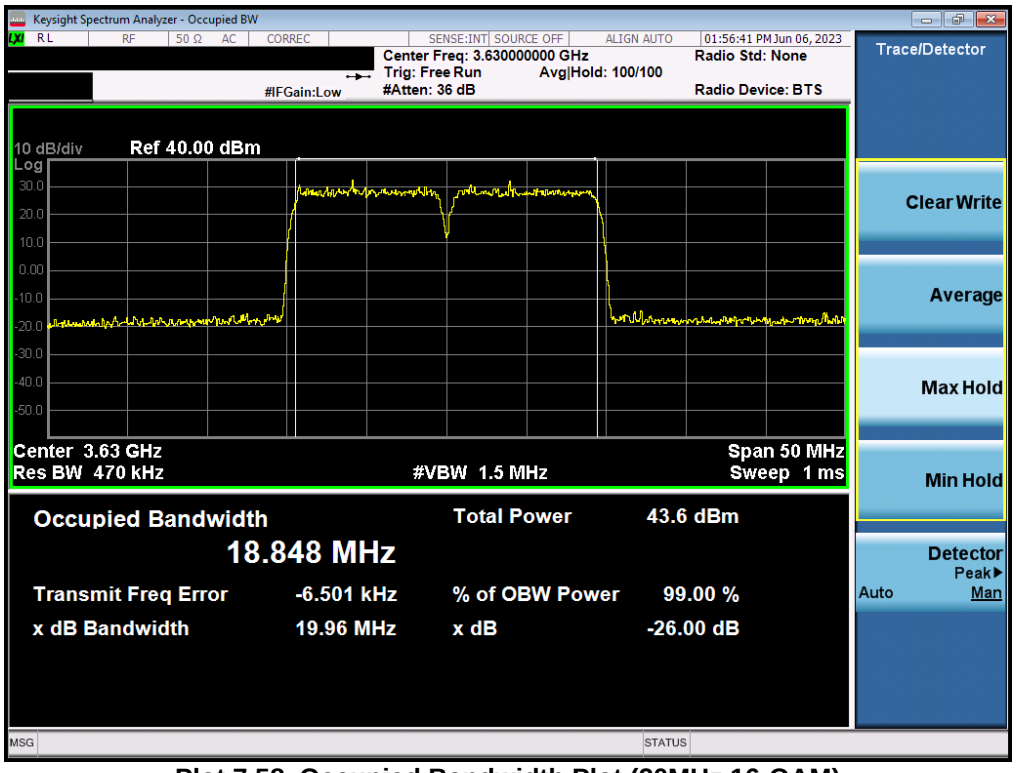
Plot 7.55. Occupied Bandwidth Plot (30MHz 64-QAM)



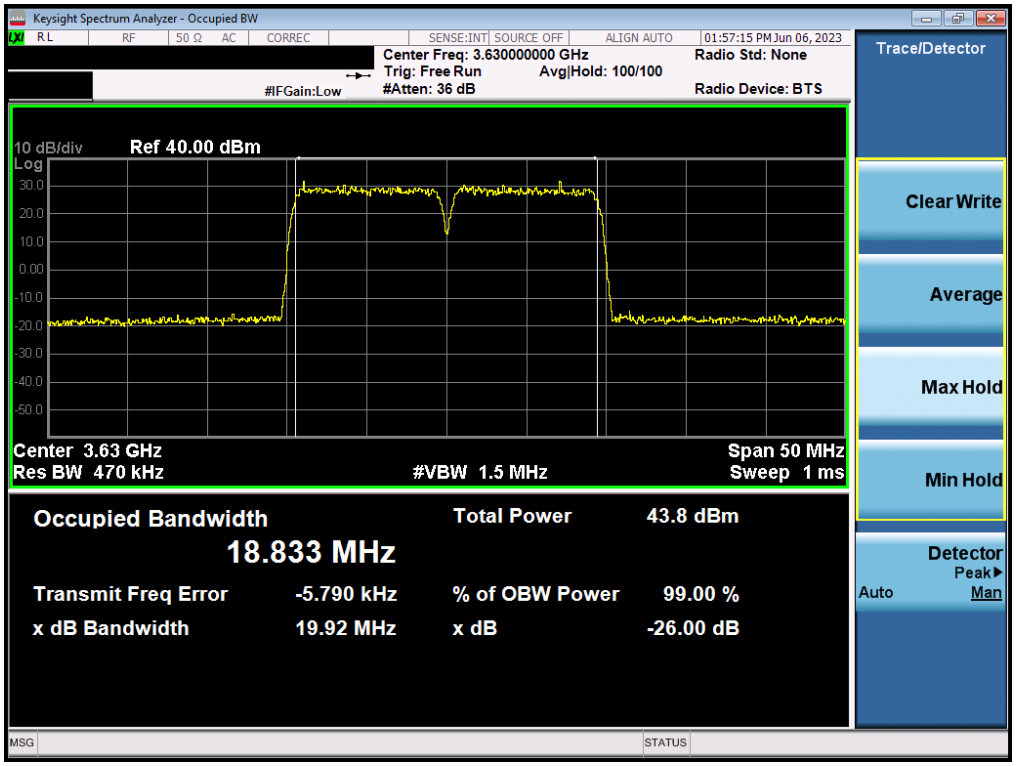
Plot 7.56. Occupied Bandwidth Plot (30MHz 256-QAM)



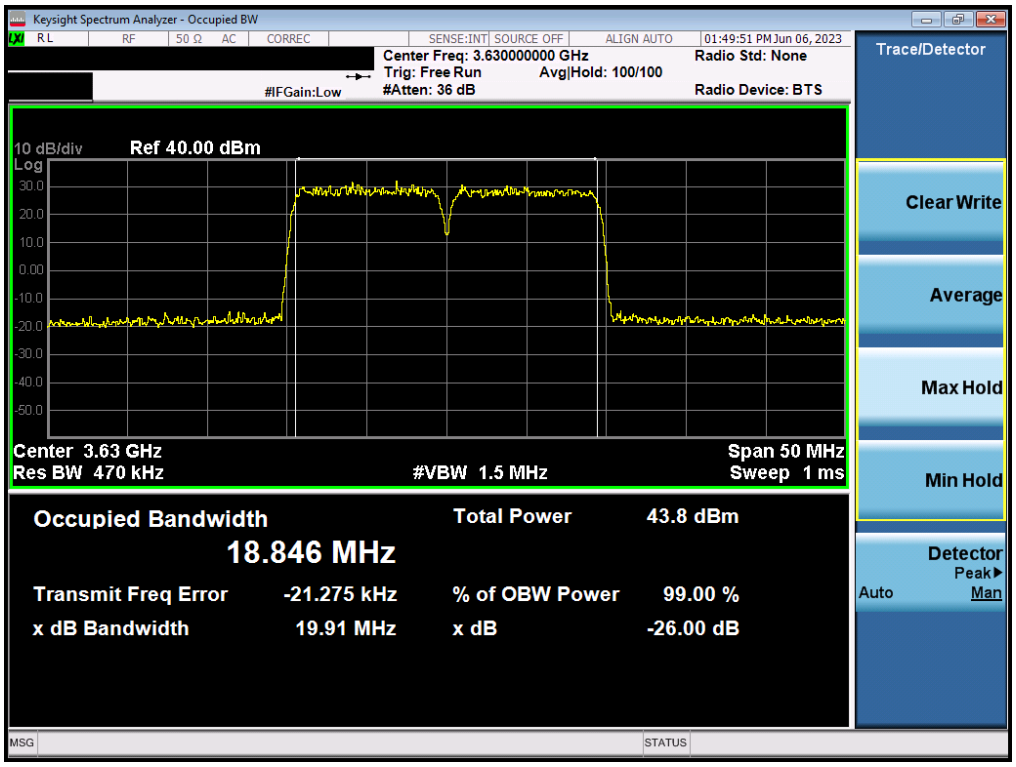
Plot 7.57. Occupied Bandwidth Plot (20MHz QPSK)



Plot 7.58. Occupied Bandwidth Plot (20MHz 16-QAM)



Plot 7.59. Occupied Bandwidth Plot (20MHz 64-QAM)



Plot 7.60. Occupied Bandwidth Plot (20MHz 256-QAM)

7.4 Conducted Power / EIRP Per 10MHz

Test Overview

The spectrum analyzer was connected to the antenna terminal while the EUT was operating at its maximum power control level, as defined in ANSI C63.26-2015, and at the appropriate frequencies. The EUT transmits with a duty cycle of approximately 67.847%. The spectrum analyzer was set to trigger and gate so as to only measure powers during periods of maximum output power.

The e.i.r.p./10MHz for a Category B CBSD must be less than 47dBm/10MHz.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2.4.4.1
ANSI C63.26-2015 – Section 5.2.4.5
ANSI C63.26-2015 – Section 6.4.3.2.3

Test Settings

1. Span = 2 x OBW to 3 x OBW
2. RBW = 10MHz
3. Number of measurement points in sweep ≥ 2 x span / RBW
4. Sweep = 1 second
5. Trace mode = Clear Write
6. Detector = RMS (power)
7. Trigger was set to enable power measurements only on full power bursts
8. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-3. Test Instrument & Measurement Setup

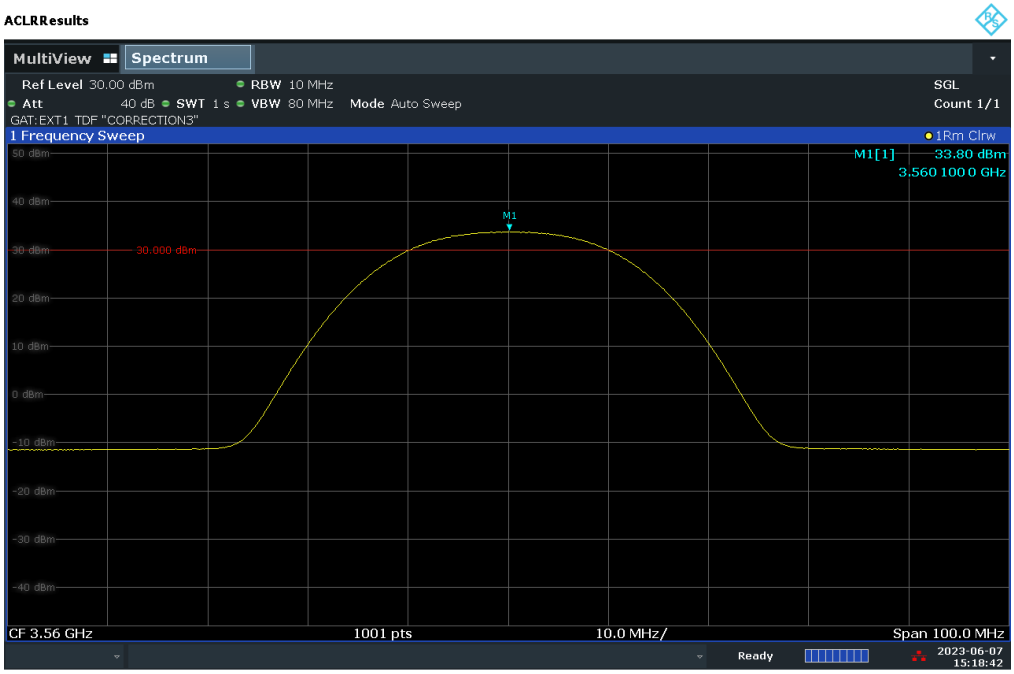
Test Notes

1. The worst case of PSD shown in this section is found with 10MHz BW for 1CC case, and 20MHz BW for 2CC case and Low/Mid/High channels are tested, but only representative worst cases plots from each modulations are shown in this report. And,only low channel for other BW are tested in this session
2. Per ANSI C63.26-2015 Section 5.2.5.3 and KDB 662911 v02r01 Section E)2), it was investigated for port equivalency. And, the Conducted Power / E.I.R.P per 10MHz at Ant 2 and Ant 4 were performed on a single output port. The measured values were then summed in linear power units then converted back to dBm.

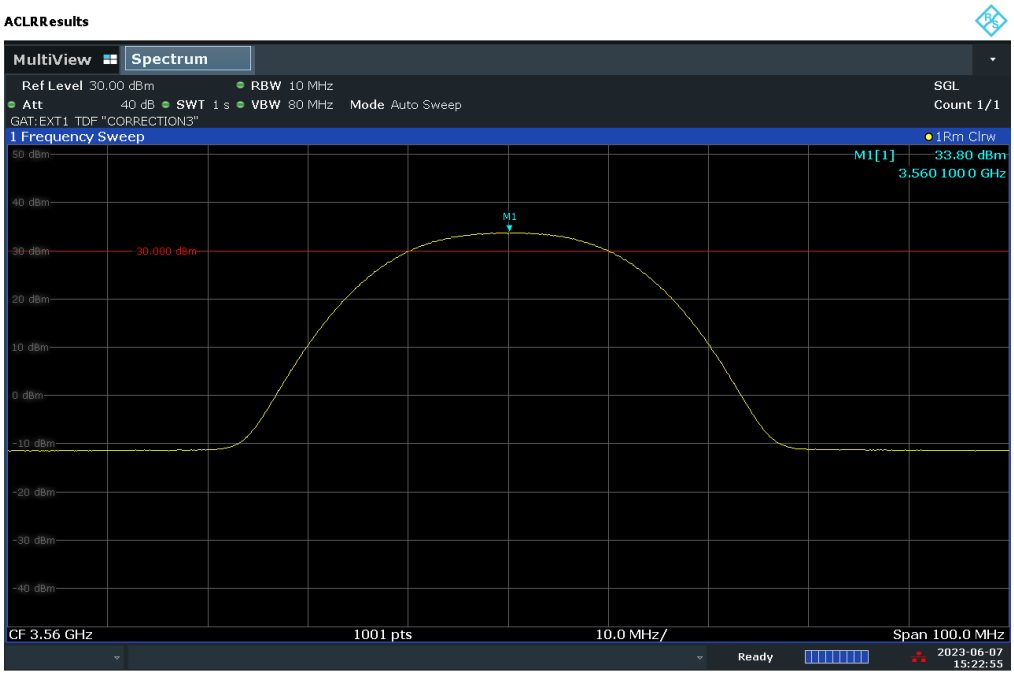
Bandwidth	Modulation	Channel	Frequency [MHz]	Conducted Power [dBm/10MHz]	MIMO Correction factor [dB]	Max MIMO Conducted Power [dBm/10MHz]	Directional Ant Gain [dBi]	MIMO Max EIRP [dBm/10MHz]	Max EIRP Limit [dBm/10MHz]	Margin [dB]
20 MHz	QPSK	55340	3560.0	33.80	3.01	36.81	7.00	43.81	47.00	-3.19
	16-QAM	55340	3560.0	33.80	3.01	36.81	7.00	43.81	47.00	-3.19
	64-QAM	55340	3560.0	33.78	3.01	36.79	7.00	43.79	47.00	-3.21
	256-QAM	55340	3560.0	33.84	3.01	36.85	7.00	43.86	47.00	-3.14
10 MHz	QPSK	55290	3555.0	35.25	3.01	38.26	7.00	45.26	47.00	-1.74
		55990	3625.0	35.05	3.01	38.06	7.00	45.06	47.00	-1.94
		56690	3695.0	34.74	3.01	37.75	7.00	44.75	47.00	-2.25
	16-QAM	55290	3555.0	35.25	3.01	38.26	7.00	45.26	47.00	-1.74
		55990	3625.0	35.02	3.01	38.03	7.00	45.03	47.00	-1.97
		56690	3695.0	34.70	3.01	37.71	7.00	44.71	47.00	-2.29
	64-QAM	55290	3555.0	35.23	3.01	38.24	7.00	45.24	47.00	-1.76
		55990	3625.0	35.01	3.01	38.02	7.00	45.02	47.00	-1.98
		56690	3695.0	34.68	3.01	37.69	7.00	44.69	47.00	-2.31
	256-QAM	55290	3555.0	35.26	3.01	38.27	7.00	45.27	47.00	-1.73
		55990	3625.0	35.00	3.01	38.01	7.00	45.01	47.00	-1.99
		56690	3695.0	34.68	3.01	37.69	7.00	44.69	47.00	-2.31

Table 7-6 E.I.R.P. / 10MHz Measurements – LTE BAND 48

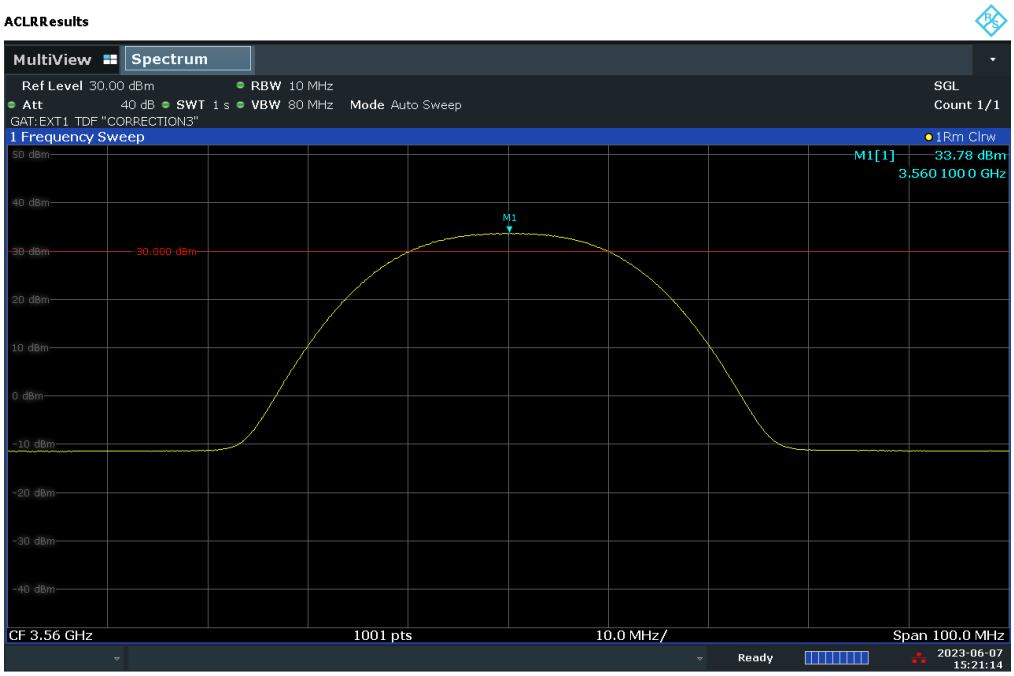
Conducted Power / 10MHz – Band 48



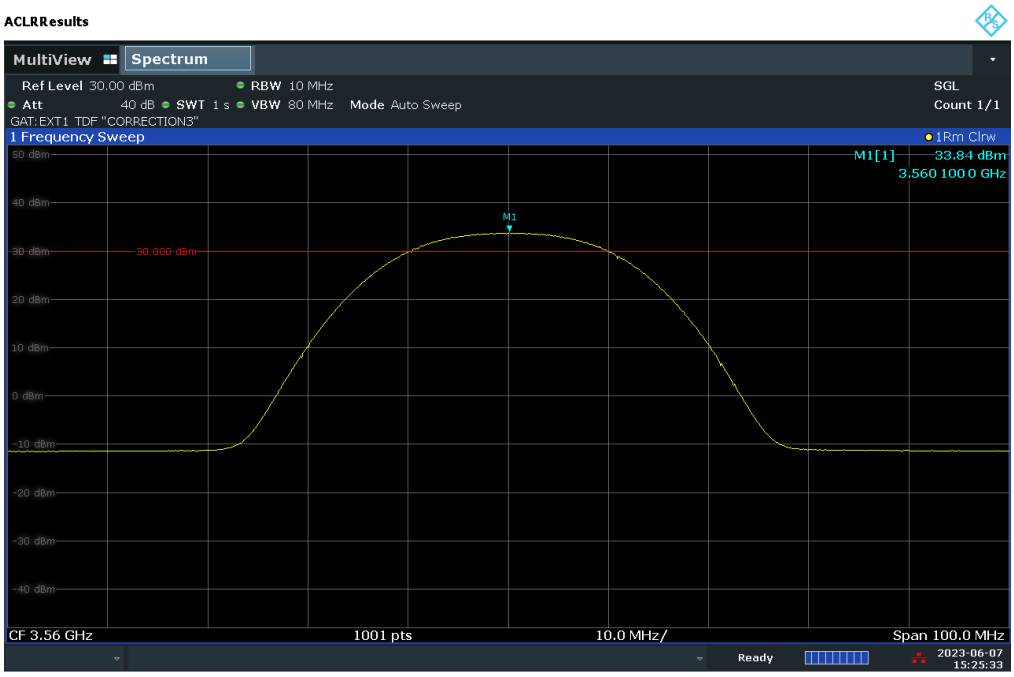
Plot 7.61. Conducted Power / 10MHz Measurement (20MHz BW, Low Channel, QPSK)



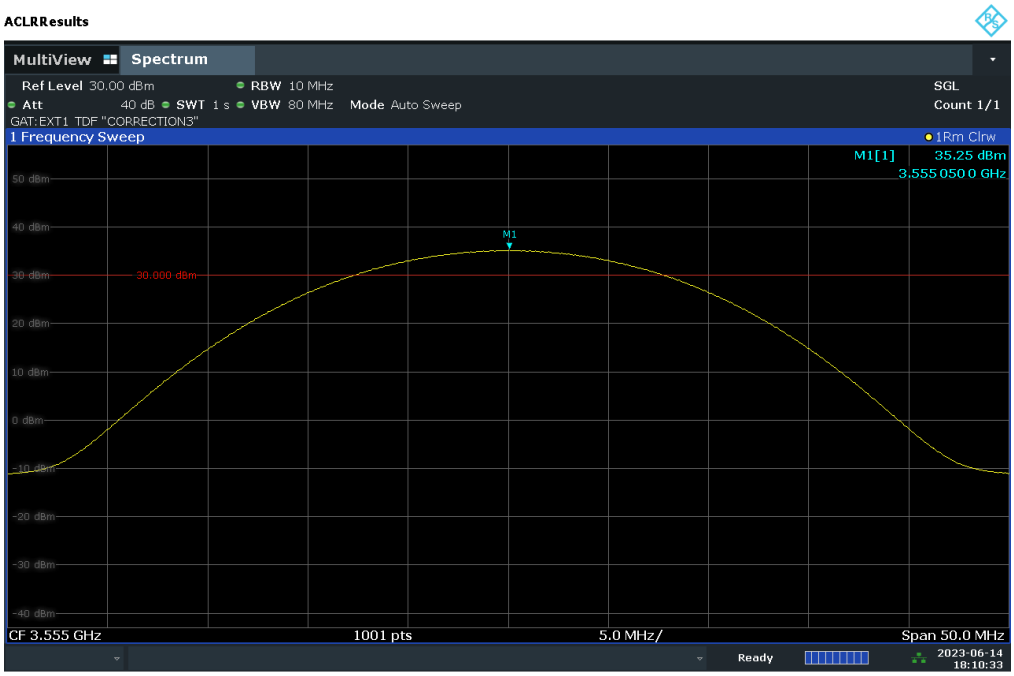
Plot 7.62. Conducted Power / 10MHz Measurement (20MHz BW, Low Channel, 16-QAM)



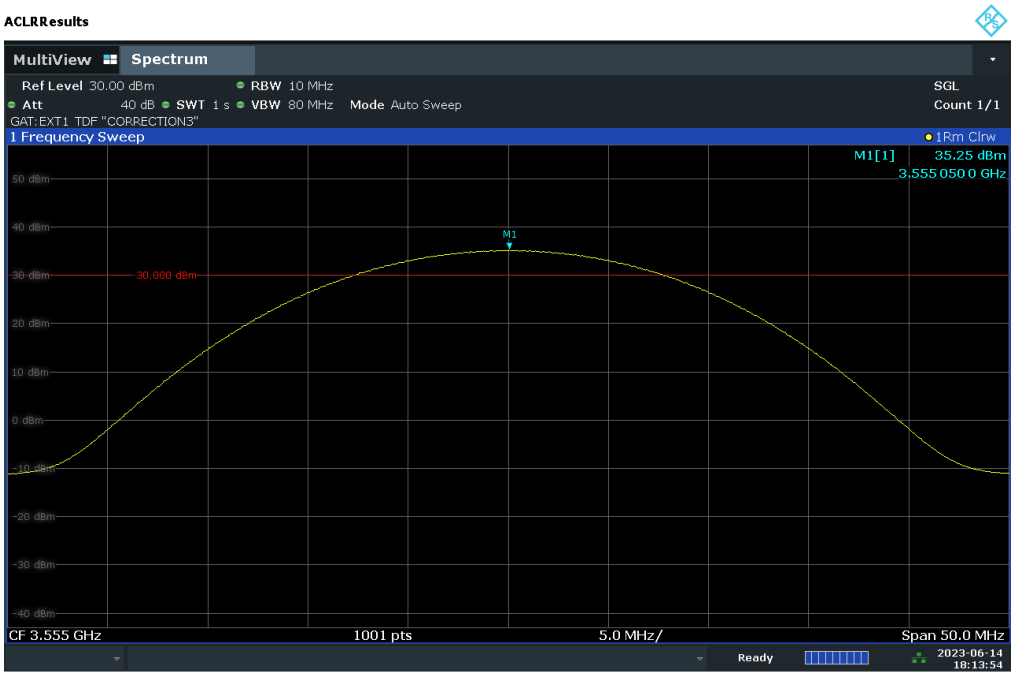
Plot 7.63. Conducted Power / 10MHz Measurement (20MHz BW, Low Channel, 64-QAM)



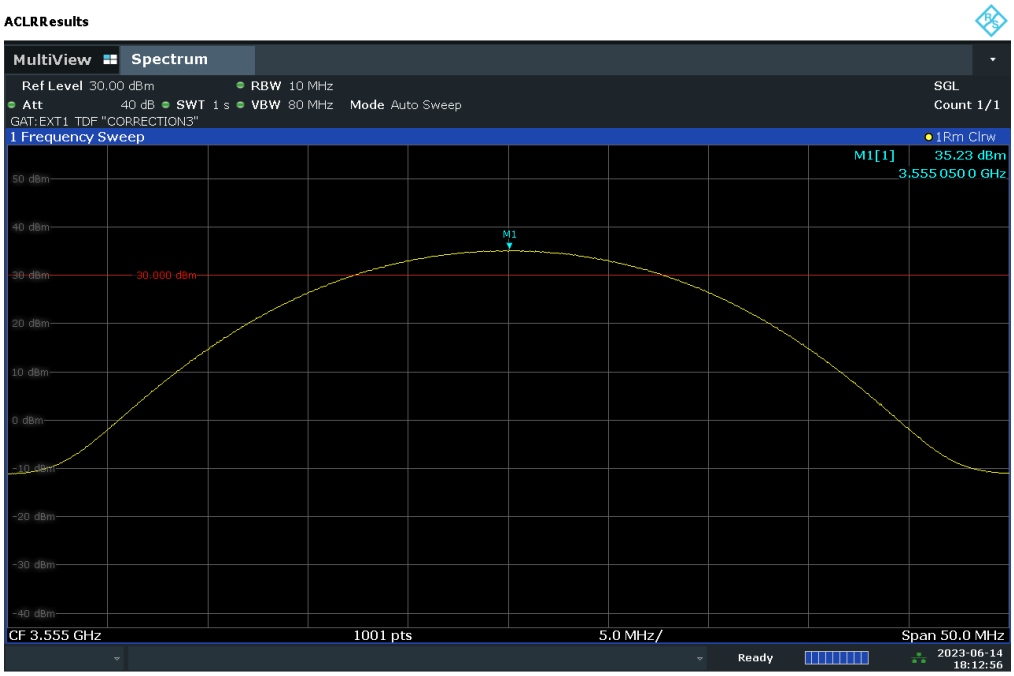
Plot 7.64. Conducted Power / 10MHz Measurement (20MHz BW, Low Channel, 256-QAM)



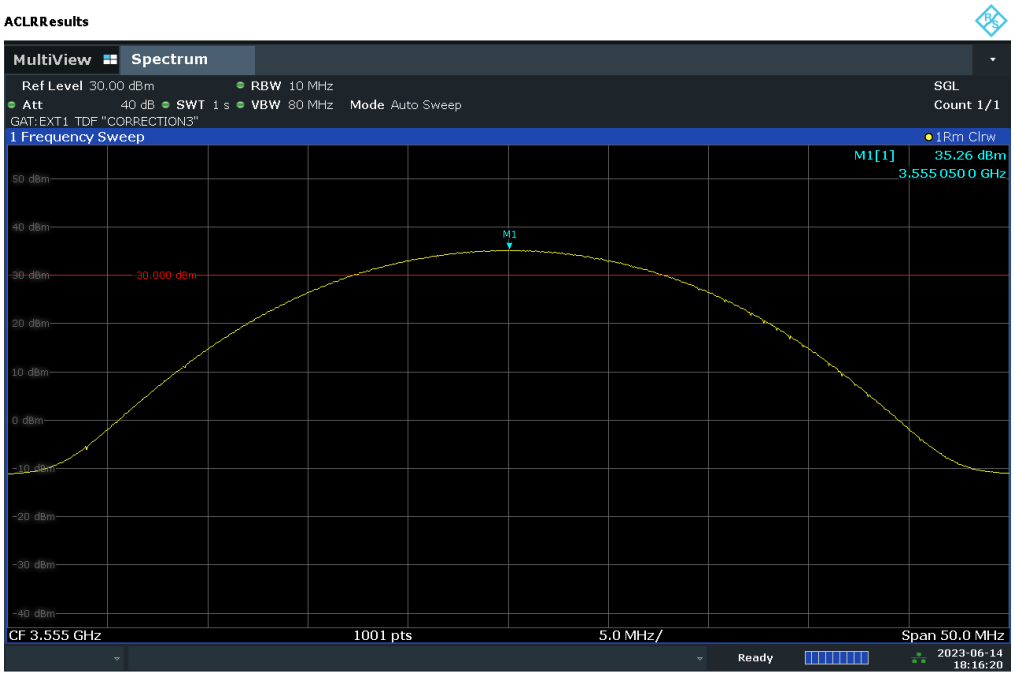
Plot 7.65. Conducted Power / 10MHz Measurement (10MHz BW, Low Channel, QPSK)



Plot 7.66. Conducted Power / 10MHz Measurement (10MHz BW, Low Channel, 16-QAM)



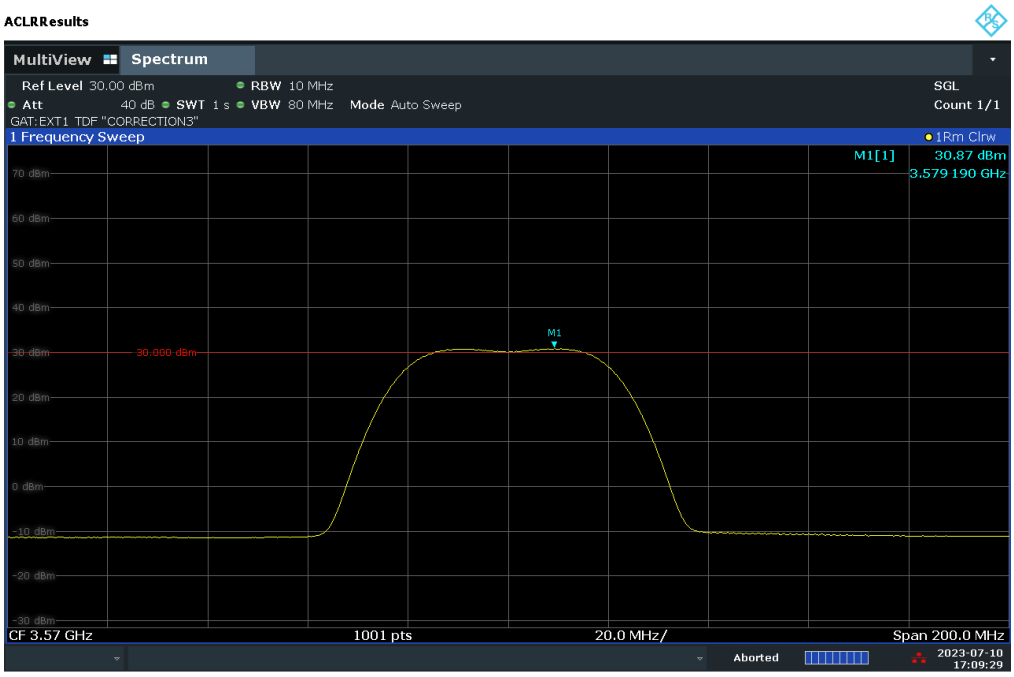
Plot 7.67. Conducted Power / 10MHz Measurement (10MHz BW, Low Channel, 64-QAM)



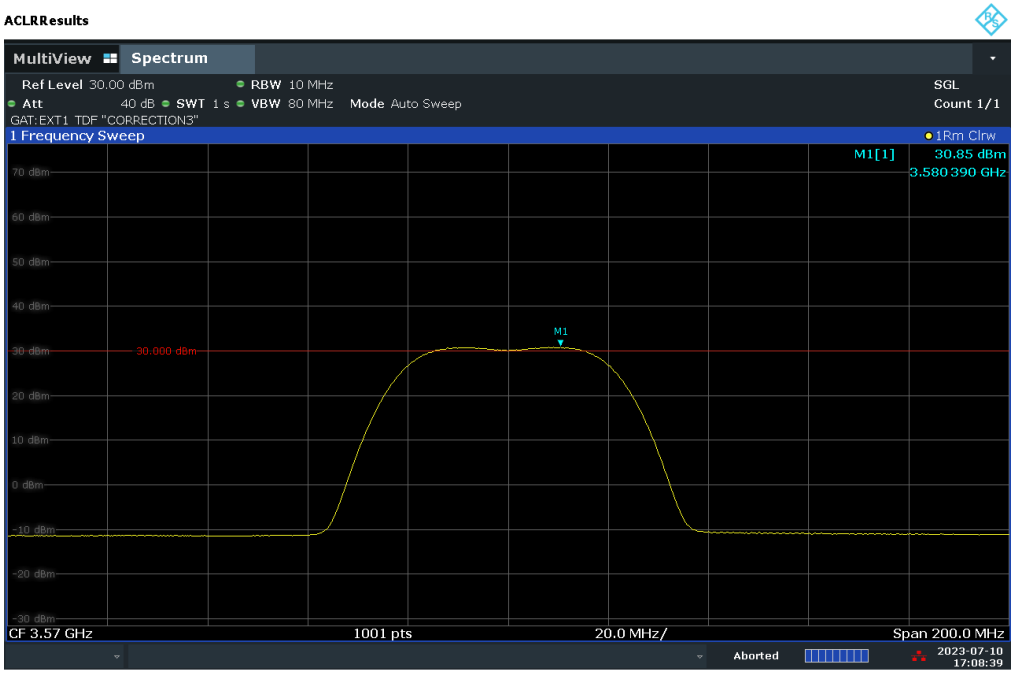
Plot 7.68. Conducted Power / 10MHz Measurement (10MHz BW, Low Channel, 256-QAM)

Bandwidth	Modulation	PCC		SCC		Conducted Power [dBm/10MHz]	MIMO Correction factor [dB]	Max MIMO Conducted Power [dBm/10MHz]	Directional Ant Gain [dBi]	MIMO Max EIRP [dBm/10MHz]	MIMO Max EIRP [Watts]	Max EIRP Limit [dBm/10MHz]	Margin [dB]
		Bandwidth [MHz]	Frequency [MHz]	Bandwidth [MHz]	Frequency [MHz]								
40 MHz	QPSK	20	3560.0	20	3579.8	30.87	3.01	33.88	7.00	40.88	12.247	47.00	-6.12
	16-QAM	20	3560.0	20	3579.8	30.85	3.01	33.86	7.00	40.86	12.181	47.00	-6.14
	64-QAM	20	3560.0	20	3579.8	30.84	3.01	33.85	7.00	40.85	12.166	47.00	-6.15
	256-QAM	20	3560.0	20	3579.8	30.62	3.01	33.63	7.00	40.63	11.562	47.00	-6.37
30 MHz	QPSK	20	3560.0	10	3574.4	32.58	3.01	35.59	7.00	42.59	18.163	47.00	-4.41
	16-QAM	20	3560.0	10	3574.4	32.60	3.01	35.61	7.00	42.61	18.250	47.00	-4.39
	64-QAM	20	3560.0	10	3574.4	32.56	3.01	35.57	7.00	42.57	18.075	47.00	-4.43
	256-QAM	20	3560.0	10	3574.4	32.67	3.01	35.68	7.00	42.68	18.555	47.00	-4.32
20 MHz	QPSK	10	3555.0	10	3564.9	33.56	3.01	36.57	7.00	43.58	22.779	47.00	-3.42
		10	3625.0	10	3634.9	33.14	3.01	36.15	7.00	43.15	20.664	47.00	-3.85
		10	3695.0	10	3685.1	33.07	3.01	36.08	7.00	43.08	20.343	47.00	-3.92
	16-QAM	10	3555.0	10	3564.9	33.56	3.01	36.57	7.00	43.57	22.766	47.00	-3.43
		10	3625.0	10	3634.9	33.12	3.01	36.13	7.00	43.13	20.575	47.00	-3.87
		10	3695.0	10	3685.1	33.07	3.01	36.08	7.00	43.08	20.340	47.00	-3.92
	64-QAM	10	3555.0	10	3564.9	33.50	3.01	36.51	7.00	43.51	22.456	47.00	-3.49
		10	3625.0	10	3634.9	33.11	3.01	36.12	7.00	43.12	20.499	47.00	-3.88
		10	3695.0	10	3685.1	33.03	3.01	36.04	7.00	43.04	20.151	47.00	-3.96
	256-QAM	10	3555.0	10	3564.9	33.50	3.01	36.51	7.00	43.51	22.447	47.00	-3.49
		10	3625.0	10	3634.9	33.15	3.01	36.16	7.00	43.16	20.680	47.00	-3.84
		10	3695.0	10	3685.1	33.07	3.01	36.08	7.00	43.08	20.304	47.00	-3.92

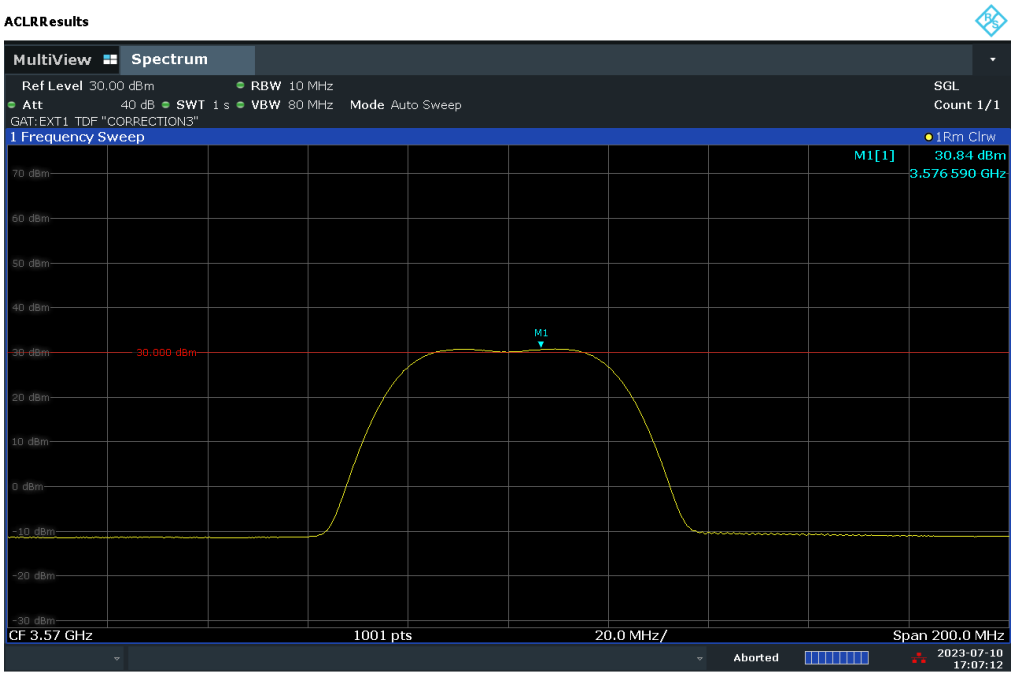
Table 7-7 E.I.R.P. / 10MHz Measurements – CA LTE BAND 48



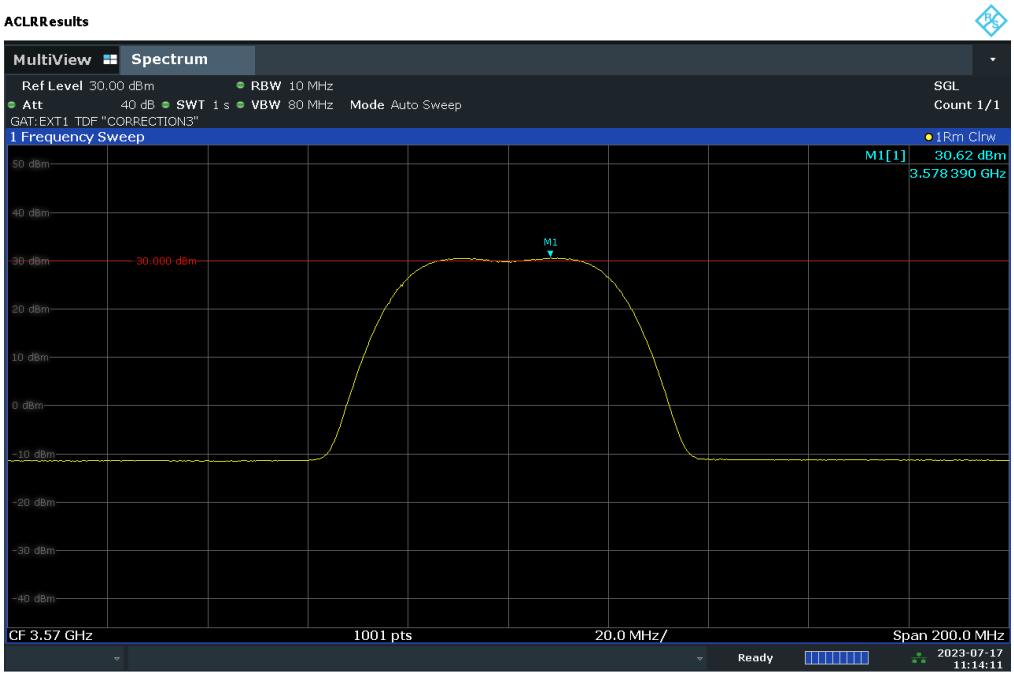
Plot 7.69. Conducted Power / 10MHz Measurement (40MHz BW, Low Channel, QPSK)



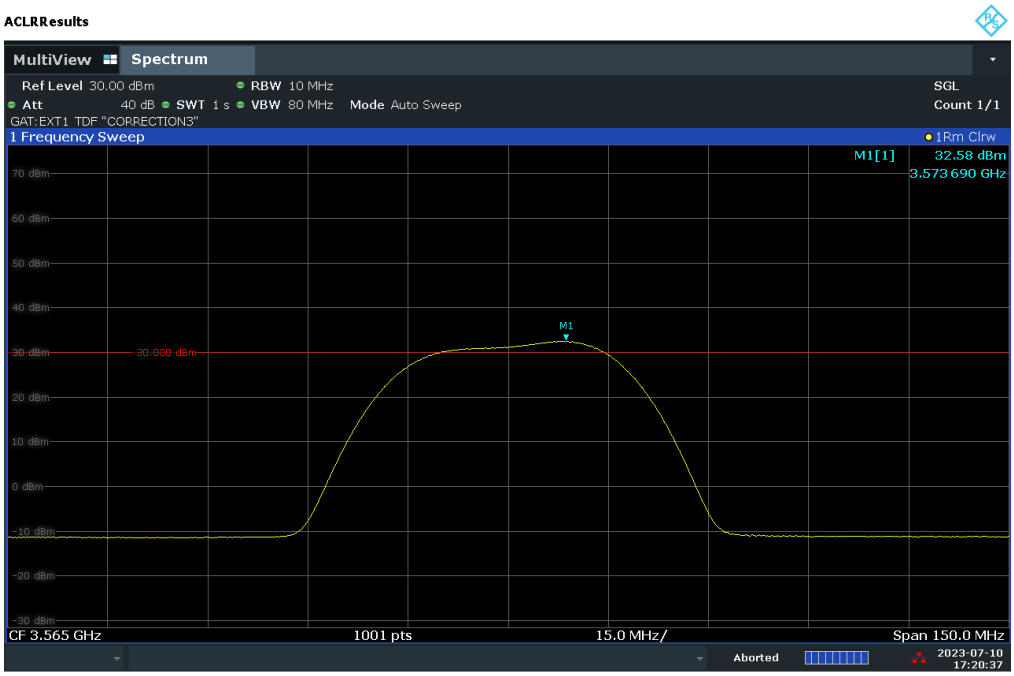
Plot 7.70. Conducted Power / 10MHz Measurement (40MHz BW, Low Channel, 16-QAM)



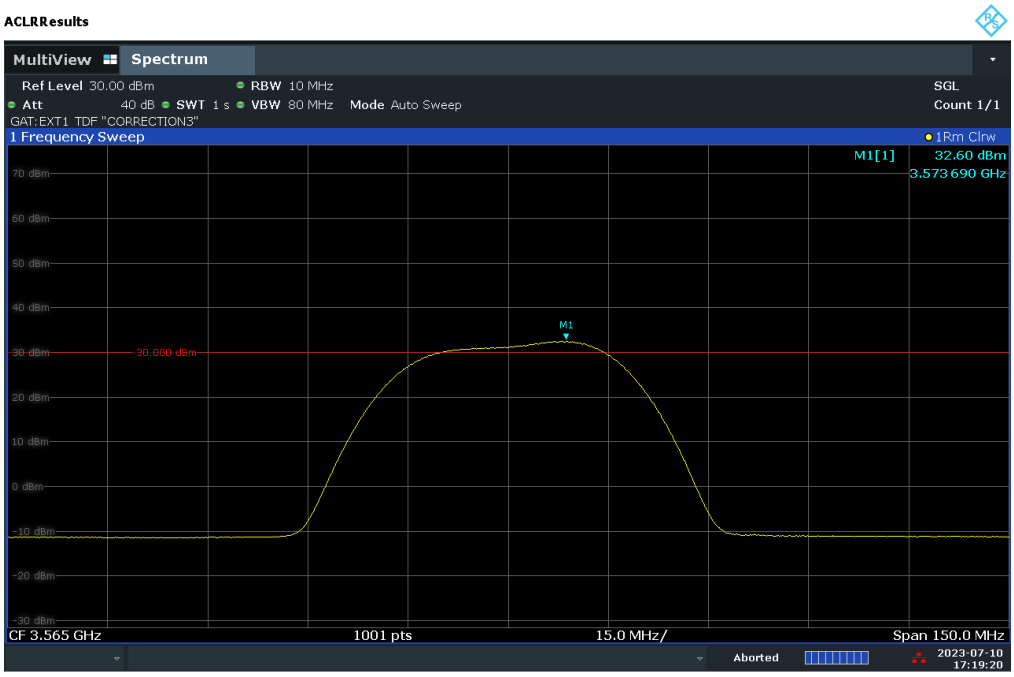
Plot 7.71. Conducted Power / 10MHz Measurement (40MHz BW, Low Channel, 64-QAM)



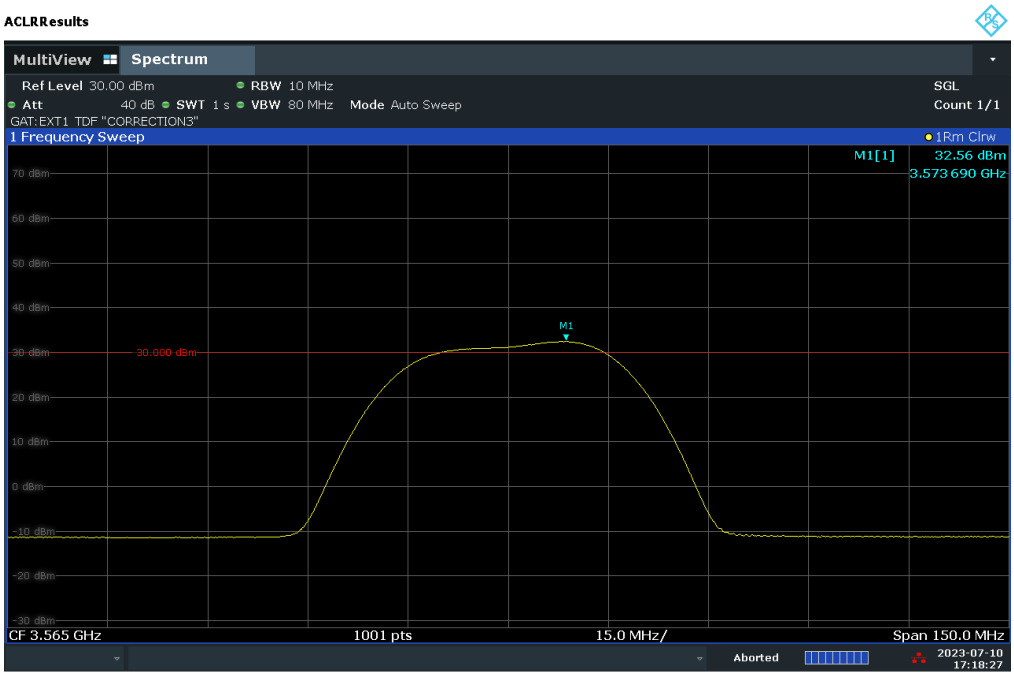
Plot 7.72. Conducted Power / 10MHz Measurement (40MHz BW, Low Channel, 256-QAM)



Plot 7.73. Conducted Power / 10MHz Measurement (30MHz BW, Low Channel, QPSK)



Plot 7.74. Conducted Power / 10MHz Measurement (30MHz BW, Low Channel, 16-QAM)



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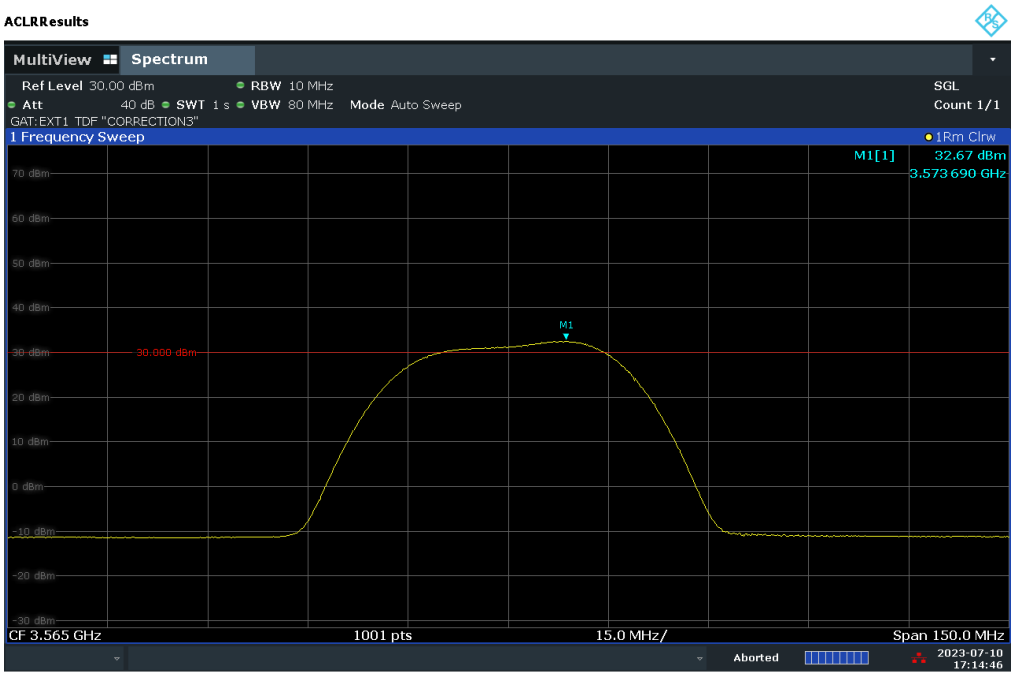
Plot 7.75. Conducted Power / 10MHz Measurement (30MHz BW, Low Channel, 64-QAM)



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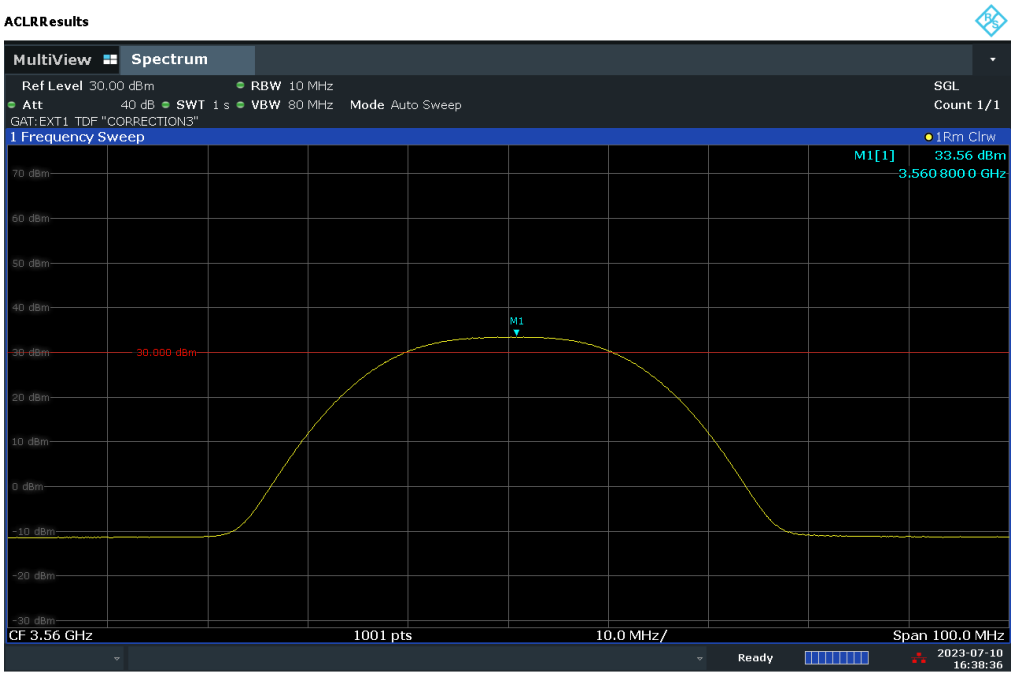
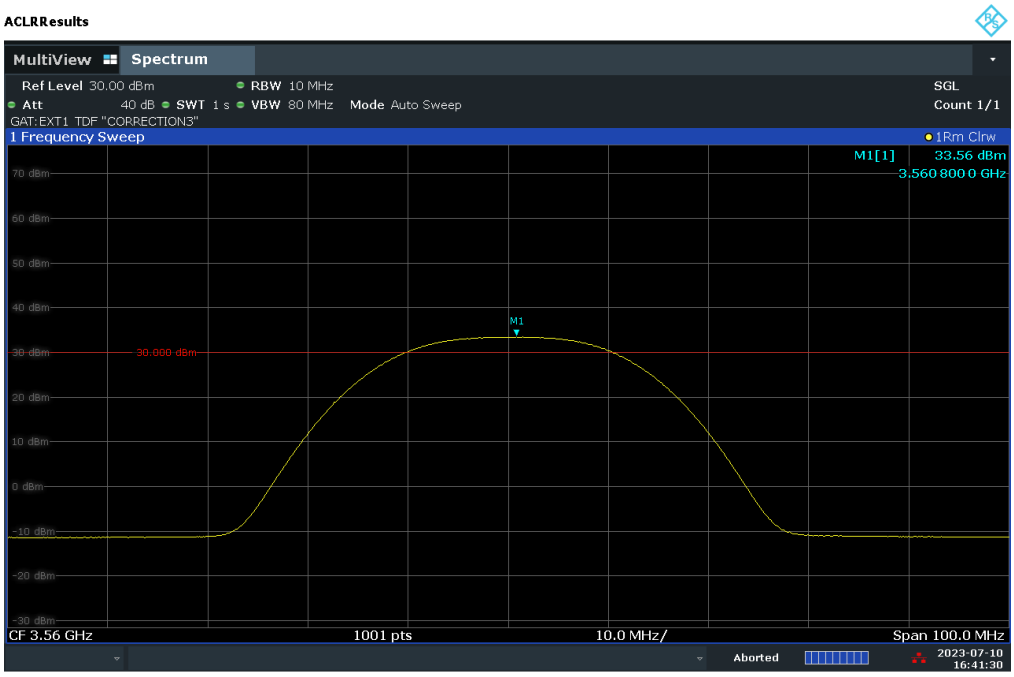
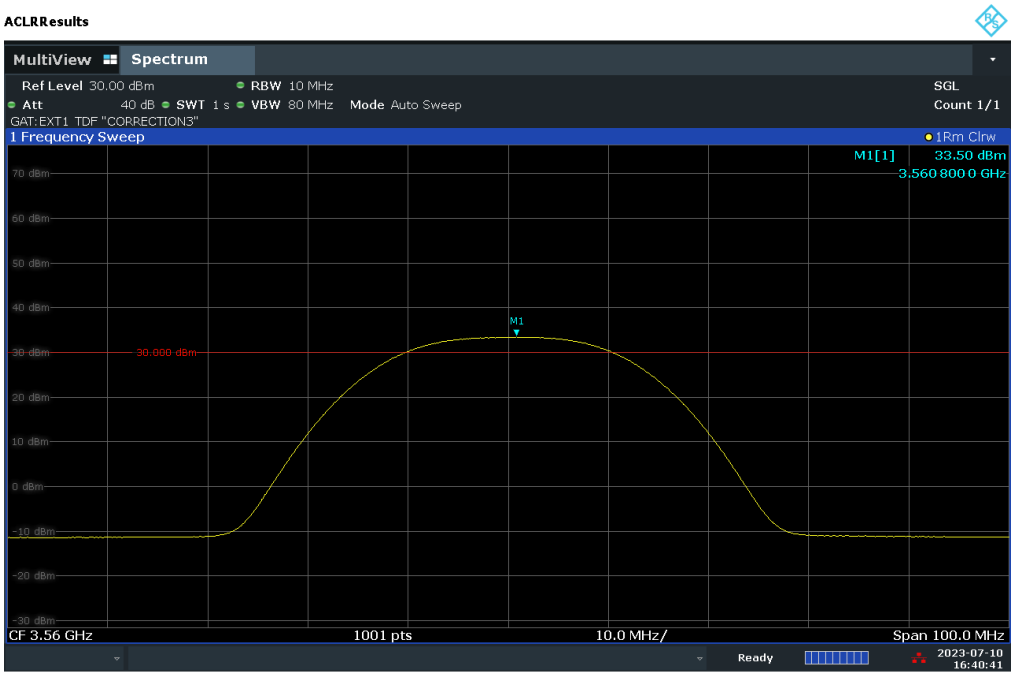
Plot 7.76. Conducted Power / 10MHz Measurement (30MHz BW, Low Channel, 256-QAM)



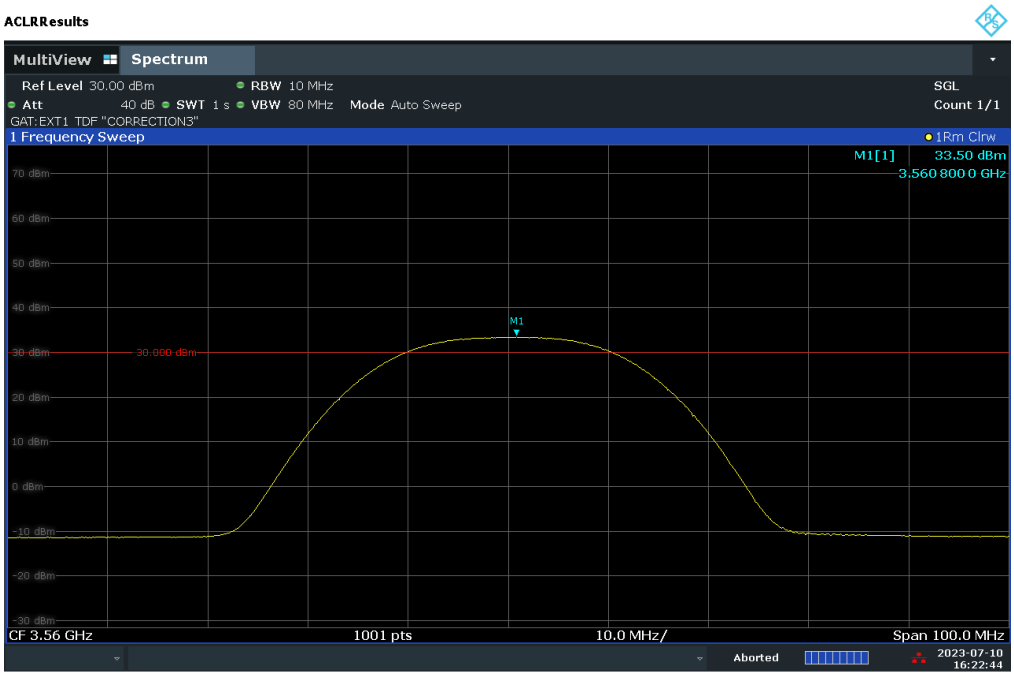
Plot 7.77. Conducted Power / 10MHz Measurement (20MHz BW, Low Channel, QPSK)



Plot 7.78. Conducted Power / 10MHz Measurement (20MHz BW, Low Channel, 16-QAM)



Plot 7.79. Conducted Power / 10MHz Measurement (20MHz BW, Low Channel, 64-QAM)



Plot 7.80. Conducted Power / 10MHz Measurement (20MHz BW, Low Channel, 256-QAM)

Note:

Per ANSI C63.26-2015 Section 5.2.5.3 and KDB 662911 v02r01 Section E)2), it was investigated for port equivalency. And, the Conducted Power / E.I.R.P per 10MHz at Ant 2 and Ant 4 were performed on a single output port. The measured values were then summed in linear power units then converted back to dBm.

Per ANSI C63.26-2015 Section 6.4.6 and KDB 662911 v02r01 Section F.2.c, since the transmissions are either orthogonally polarized or co-polarized, with orthogonally polarized transmission, directional gain is 4dBi. However, with co-polarized transmission as worst scenario, the directional gain is equal to 7 dBi.

Sample MIMO Calculation:

At 3555 MHz in 256-QAM, 10MHz BW mode, the average conducted power per 10MHz was measured to be 35.26 dBm/10MHz for Ant 2 and Ant 4. MIMO Correction factor of 3.01dB is used to calculate MIMO Conducted power per 10MHz

Conducted Power per 10MHz + MIMO Correction factor = MIMO Conducted power per 10MHz

(35.26 dBm/10MHz + 3.01 dB) = 38.27 dBm/10MHz

Sample e.i.r.p / 10MHz Calculation:

At 3555 MHz in 256-QAM, 10MHz mode, the average MIMO conducted power per 10MHz was calculated to be 38.27 dBm/10MHz with the worst directional gain of 7 dBi.

e.i.r.p. per 10MHz (dBm) = MIMO conducted power per 10MHz (dBm) + Directional Ant gain (dBi)

38.27 dBm/10MHz + 7 dBi = 45.27 dBm/10MHz

7.5 Peak Power Spectral Density Measurement

Test Overview

The spectrum analyzer was connected to the antenna terminal while the EUT was operating at its maximum power control level, as defined in ANSI C63.26-2015, and at the appropriate frequencies. The EUT transmits with a duty cycle of approximately 67.847%. The spectrum analyzer was set to trigger and gate so as to only measure powers during periods of maximum output power.

The power spectral density for a Category B CBSD must be less than 37dBm/1MHz e.i.r.p.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2.4.4.1
ANSI C63.26-2015 – Section 5.2.4.5
ANSI C63.26-2015 – Section 6.4.3.2.3

Test Settings

1. Span = 2 x OBW to 3 x OBW
2. RBW = 1MHz
3. VBW ≥ 3 x RBW
4. Number of measurement points in sweep ≥ 2 x span / RBW
5. Sweep = 1 second
6. Trace mode = Clear Write
7. Detector = RMS (power)
8. Trigger was set to enable power measurements only on full power bursts
9. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-4. Test Instrument & Measurement Setup

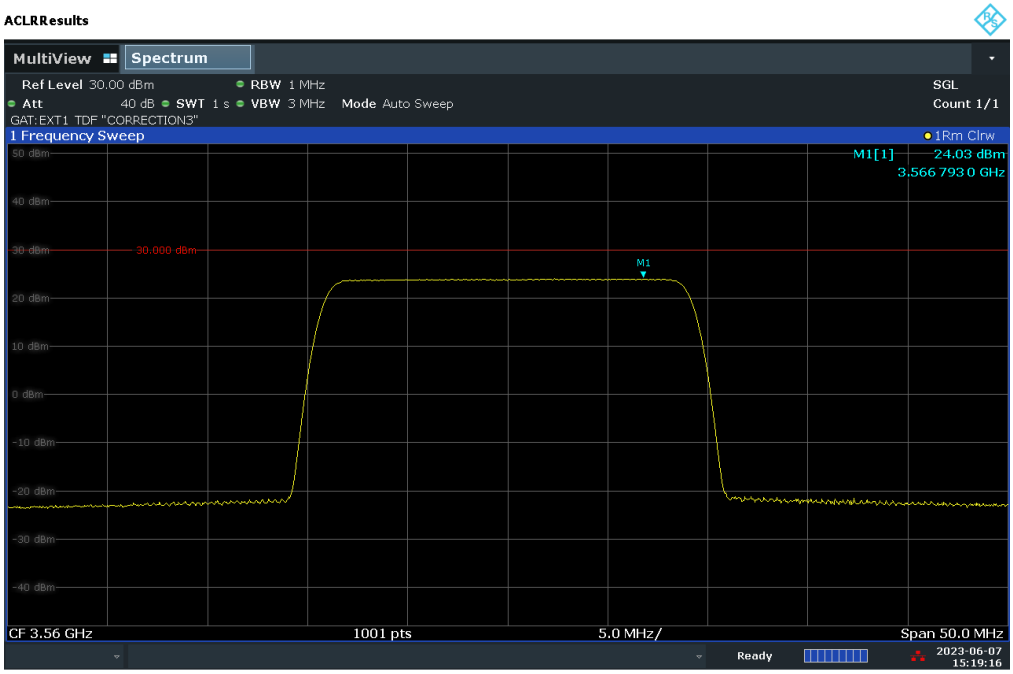
Test Notes

1. The worst case of PSD shown in this section is found with 10MHz BW for 1CC case, and 20MHz BW for 2CC case and Low/Mid/High channels are tested, but only representative worst cases plots from each modulations are shown in this report. And,only low channel for other BW are tested in this session
2. Per ANSI C63.26-2015 Section 5.2.5.3 and KDB 662911 v02r01 Section E)2), it was investigated for port equivalency. And, the PSD at Ant 2 and Ant 4 were performed on a single output port. The measured values were then summed in linear power units then converted back to dBm.

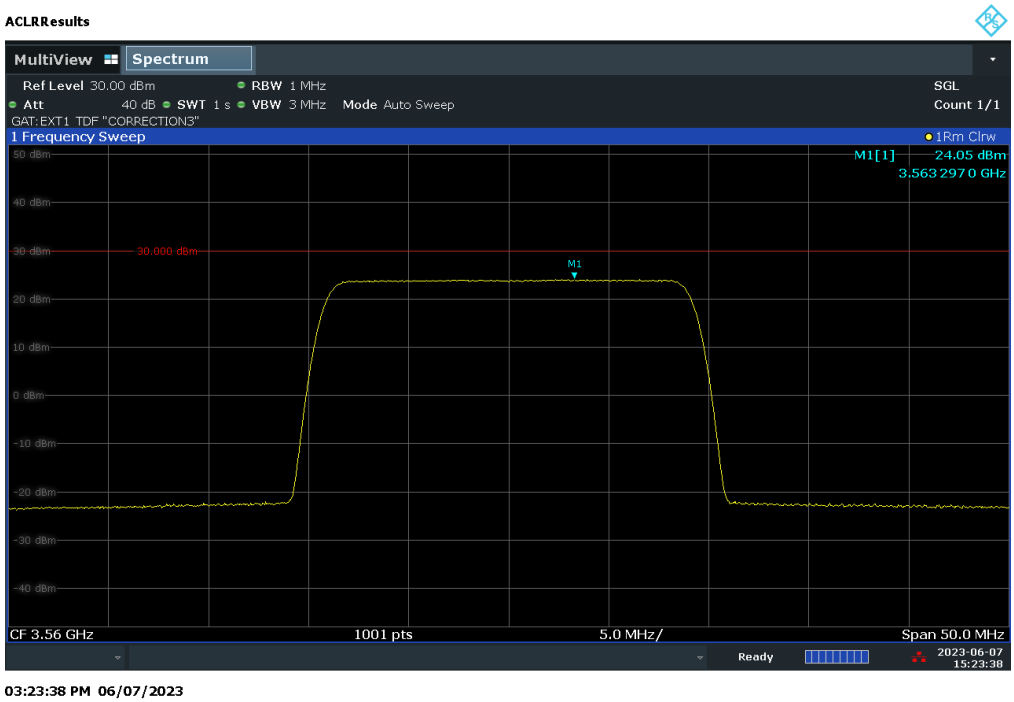
Bandwidth	Modulation	Channel	Frequency [MHz]	Max Conducted PSD [dBm/MHz]	MIMO Correction factor [dB]	Max MIMO Conducted PSD [dBm/MHz]	Directional Ant Gain [dBi]	MIMO Max Radiated PSD [dBm/MHz]	Max PSD Limit [dBm/MHz]	Margin [dB]
20 MHz	QPSK	55340	3560.0	24.03	3.01	27.04	7.00	34.04	37.00	-2.96
	16-QAM	55340	3560.0	24.05	3.01	27.06	7.00	34.06	37.00	-2.94
	64-QAM	55340	3560.0	24.08	3.01	27.09	7.00	34.09	37.00	-2.91
	256-QAM	55340	3560.0	24.10	3.01	27.11	7.00	34.11	37.00	-2.89
10 MHz	QPSK	55290	3555.0	26.92	3.01	29.93	7.00	36.93	37.00	-0.07
		55990	3625.0	26.59	3.01	29.60	7.00	36.60	37.00	-0.40
		56690	3695.0	26.27	3.01	29.28	7.00	36.28	37.00	-0.72
	16-QAM	55290	3555.0	26.92	3.01	29.93	7.00	36.93	37.00	-0.07
		55990	3625.0	26.65	3.01	29.66	7.00	36.66	37.00	-0.34
		56690	3695.0	26.35	3.01	29.36	7.00	36.36	37.00	-0.64
	64-QAM	55290	3555.0	26.90	3.01	29.91	7.00	36.91	37.00	-0.09
		55990	3625.0	26.67	3.01	29.68	7.00	36.68	37.00	-0.32
		56690	3695.0	26.37	3.01	29.38	7.00	36.38	37.00	-0.62
	256-QAM	55290	3555.0	26.92	3.01	29.93	7.00	36.93	37.00	-0.07
		55990	3625.0	26.62	3.01	29.63	7.00	36.63	37.00	-0.37
		56690	3695.0	26.35	3.01	29.36	7.00	36.36	37.00	-0.64

Table 7-8 Peak Power Spectral Density Measurements – LTE BAND 48

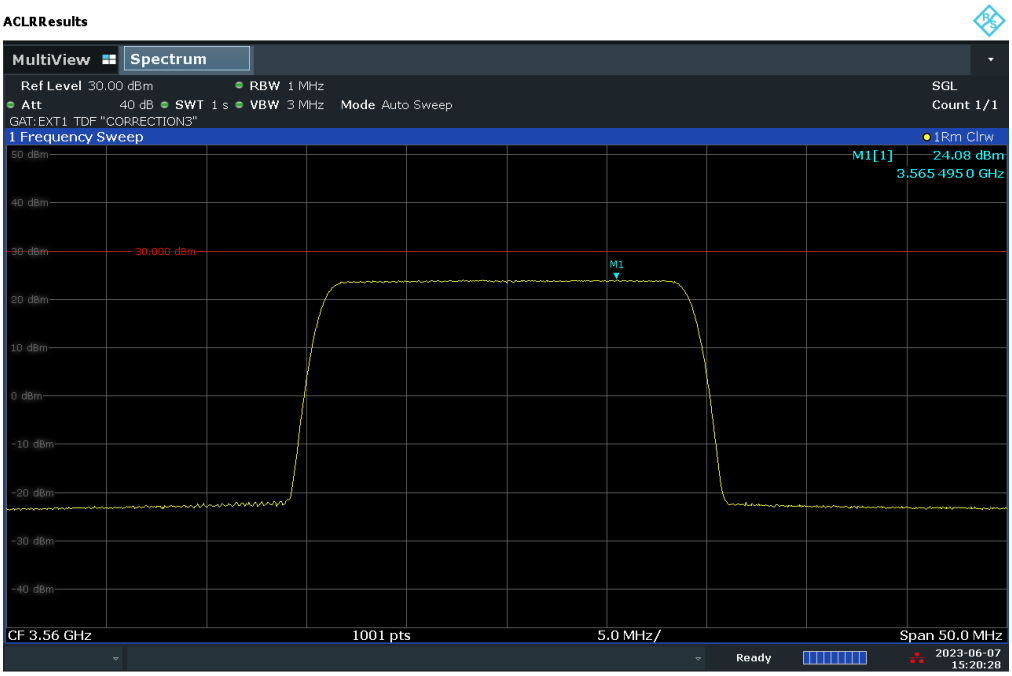
Peak Power Spectral Density – Band 48



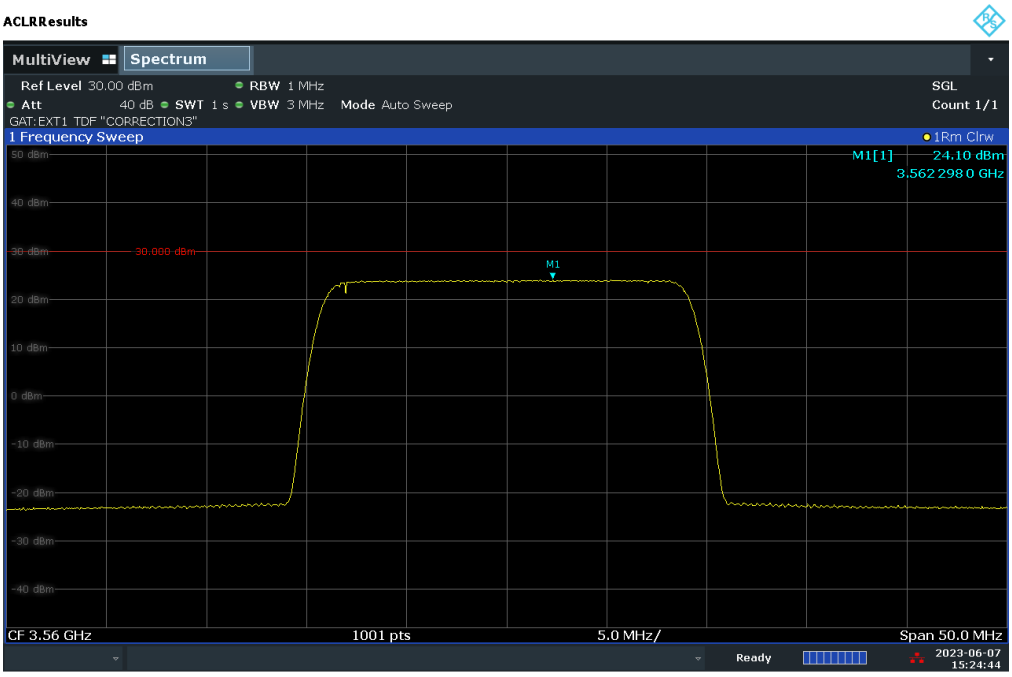
Plot 7.81. Peak Power Spectral Density Measurement (20MHz BW, Low Channel, QPSK)



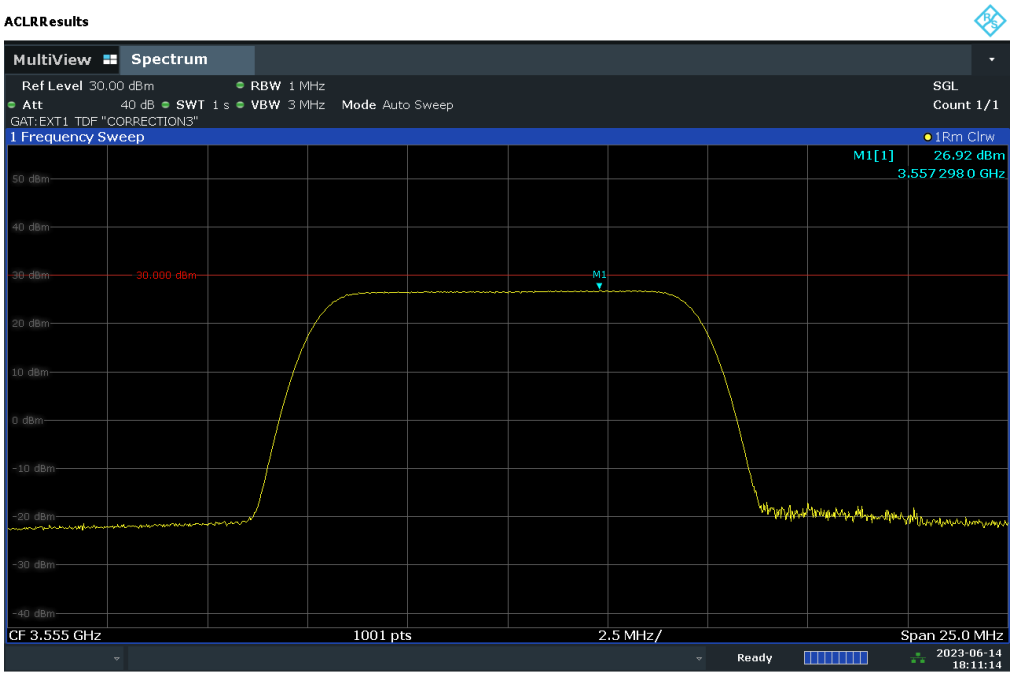
Plot 7.82. Peak Power Spectral Density Measurement (20MHz BW, Low Channel, 16-QAM)



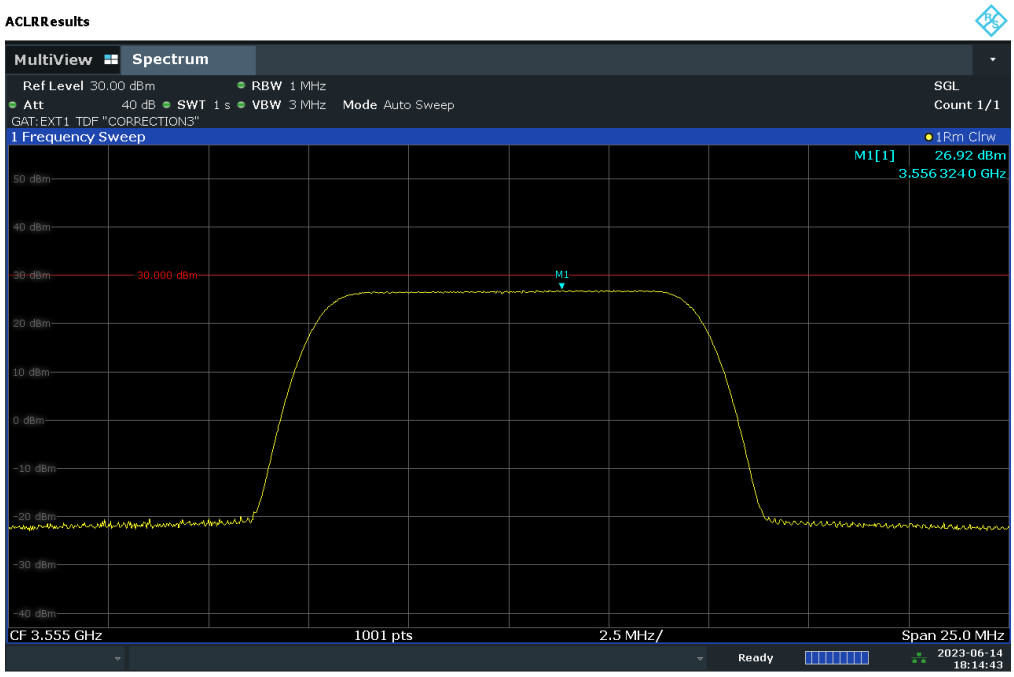
Plot 7.83. Peak Power Spectral Density Measurement (20MHz BW, Low Channel, 64-QAM)



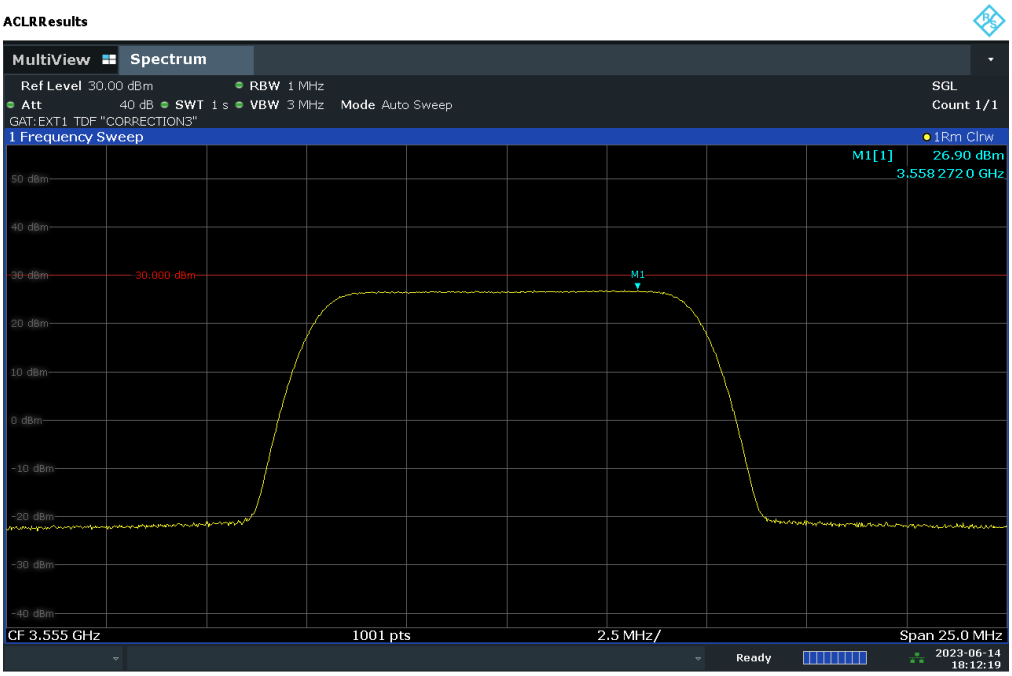
Plot 7.84. Peak Power Spectral Density Measurement (20MHz BW, Low Channel, 256-QAM)



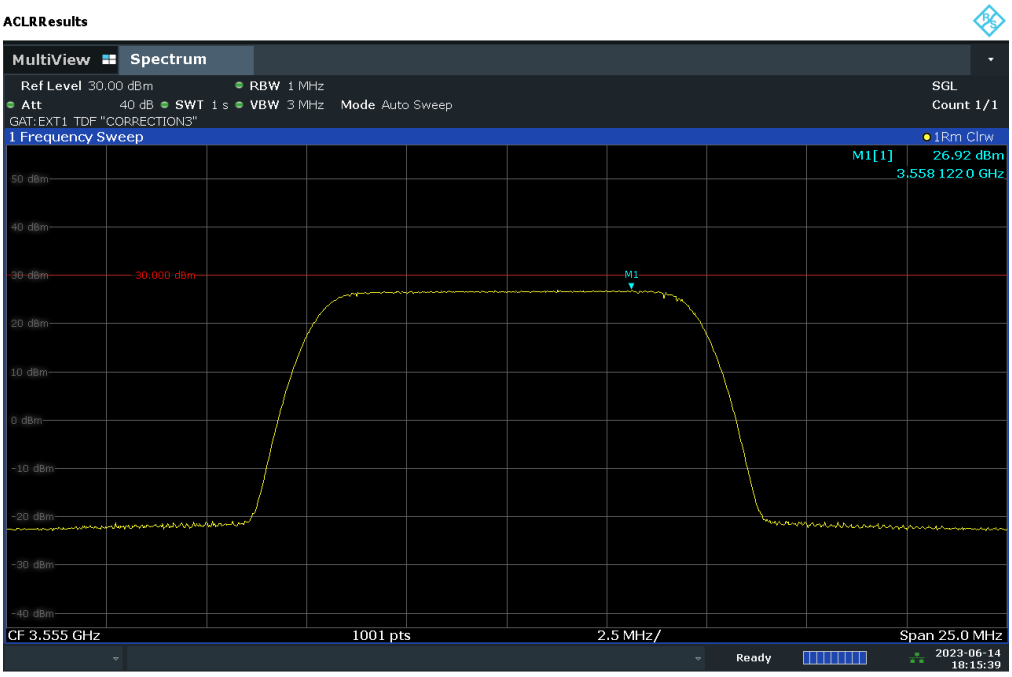
Plot 7.85. Peak Power Spectral Density Measurement (10MHz BW, Low Channel, QPSK)



Plot 7.86. Peak Power Spectral Density Measurement (10MHz BW, Low Channel, 16-QAM)



Plot 7.87. Peak Power Spectral Density Measurement (10MHz BW, Low Channel, 64-QAM)

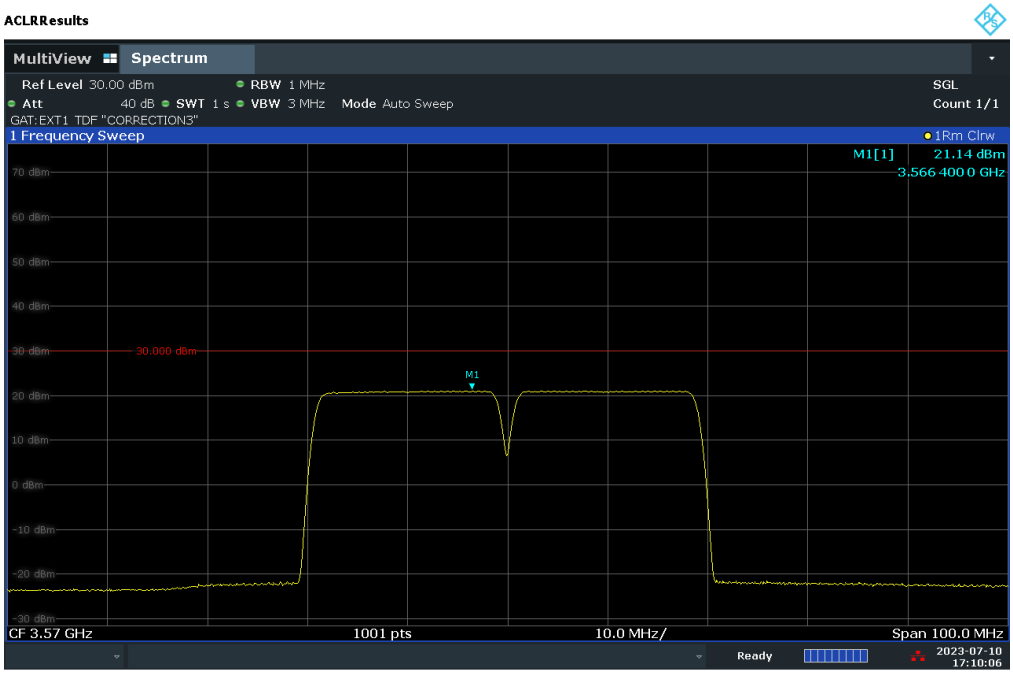


Plot 7.88. Peak Power Spectral Density Measurement (10MHz BW, Low Channel, 256-QAM)

Bandwidth	Modulation	PCC		SCC		Max Conducted PSD [dBm/MHz]	MIMO Correction factor [dB]	Max MIMO Conducted PSD [dBm/MHz]	Directional Ant Gain [dBi]	MIMO Max Radiated PSD [dBm/MHz]	MIMO Max Radiated PSD [Watts]	Max PSD Limit [dBm/MHz]	Margin [dB]
		Bandwidth [MHz]	Frequency [MHz]	Bandwidth [MHz]	Frequency [MHz]								
40 MHz	QPSK	20	3560.0	20	3579.8	21.14	3.01	24.15	7.00	31.15	1.303	37.00	-5.85
	16-QAM	20	3560.0	20	3579.8	21.20	3.01	24.21	7.00	31.21	1.320	37.00	-5.79
	64-QAM	20	3560.0	20	3579.8	21.10	3.01	24.11	7.00	31.11	1.291	37.00	-5.89
	256-QAM	20	3560.0	20	3579.8	21.35	3.01	24.36	7.00	31.36	1.368	37.00	-5.64
30 MHz	QPSK	20	3560.0	10	3574.4	24.06	3.01	27.07	7.00	34.07	2.554	37.00	-2.93
	16-QAM	20	3560.0	10	3574.4	23.93	3.01	26.94	7.00	33.94	2.479	37.00	-3.06
	64-QAM	20	3560.0	10	3574.4	23.95	3.01	26.96	7.00	33.96	2.489	37.00	-3.04
	256-QAM	20	3560.0	10	3574.4	23.86	3.01	26.87	7.00	33.87	2.439	37.00	-3.13
20 MHz	QPSK	10	3555.0	10	3564.9	24.19	3.01	27.20	7.00	34.20	2.628	37.00	-2.80
		10	3625.0	10	3634.9	23.79	3.01	26.80	7.00	33.80	2.402	37.00	-3.20
		10	3695.0	10	3685.1	23.80	3.01	26.81	7.00	33.81	2.403	37.00	-3.19
	16-QAM	10	3555.0	10	3564.9	24.23	3.01	27.24	7.00	34.24	2.657	37.00	-2.76
		10	3625.0	10	3634.9	23.86	3.01	26.87	7.00	33.87	2.437	37.00	-3.13
		10	3695.0	10	3685.1	23.80	3.01	26.81	7.00	33.81	2.405	37.00	-3.19
	64-QAM	10	3555.0	10	3564.9	24.17	3.01	27.18	7.00	34.18	2.620	37.00	-2.82
		10	3625.0	10	3634.9	23.77	3.01	26.78	7.00	33.78	2.388	37.00	-3.22
		10	3695.0	10	3685.1	23.86	3.01	26.87	7.00	33.87	2.440	37.00	-3.13
	256-QAM	10	3555.0	10	3564.9	24.18	3.01	27.19	7.00	34.19	2.626	37.00	-2.81
		10	3625.0	10	3634.9	23.85	3.01	26.86	7.00	33.86	2.432	37.00	-3.14
		10	3695.0	10	3685.1	23.83	3.01	26.84	7.00	33.84	2.419	37.00	-3.16

Table 7-9 Peak Power Spectral Density Measurements – CA LTE BAND 48

Peak Power Spectral Density – CA Band 48



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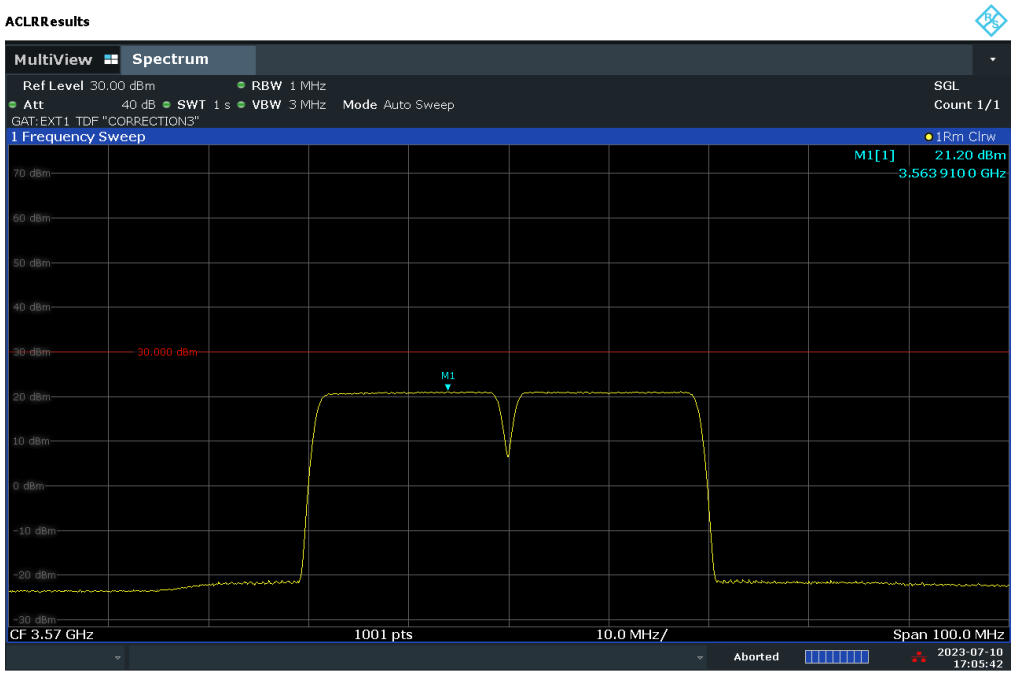
Plot 7.89. Peak Power Spectral Density Measurement (40MHz BW, Low Channel, QPSK)



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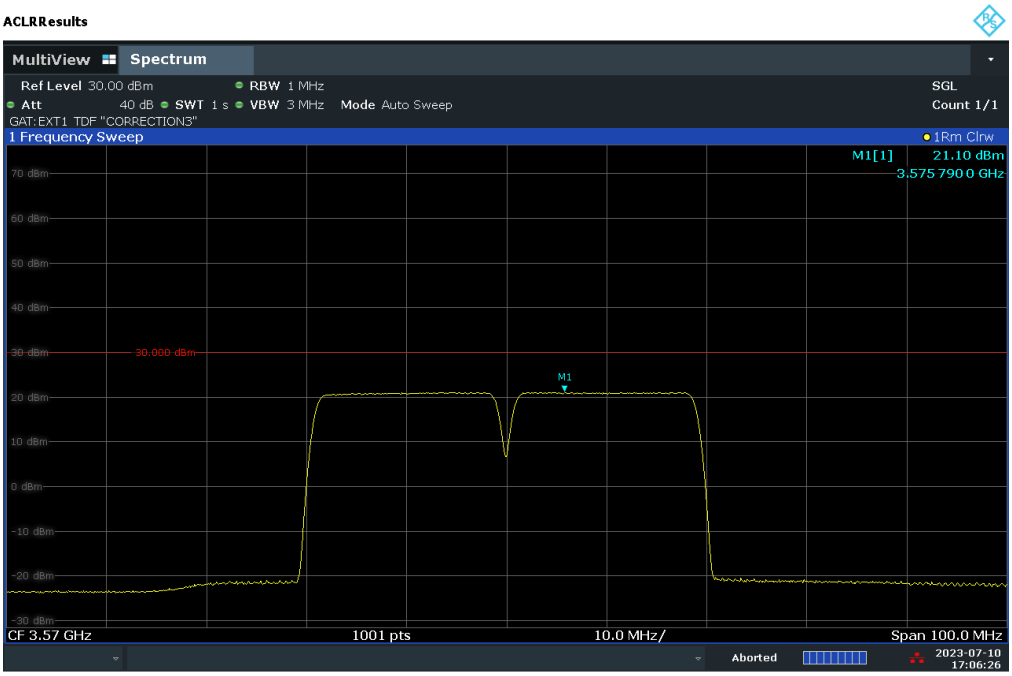
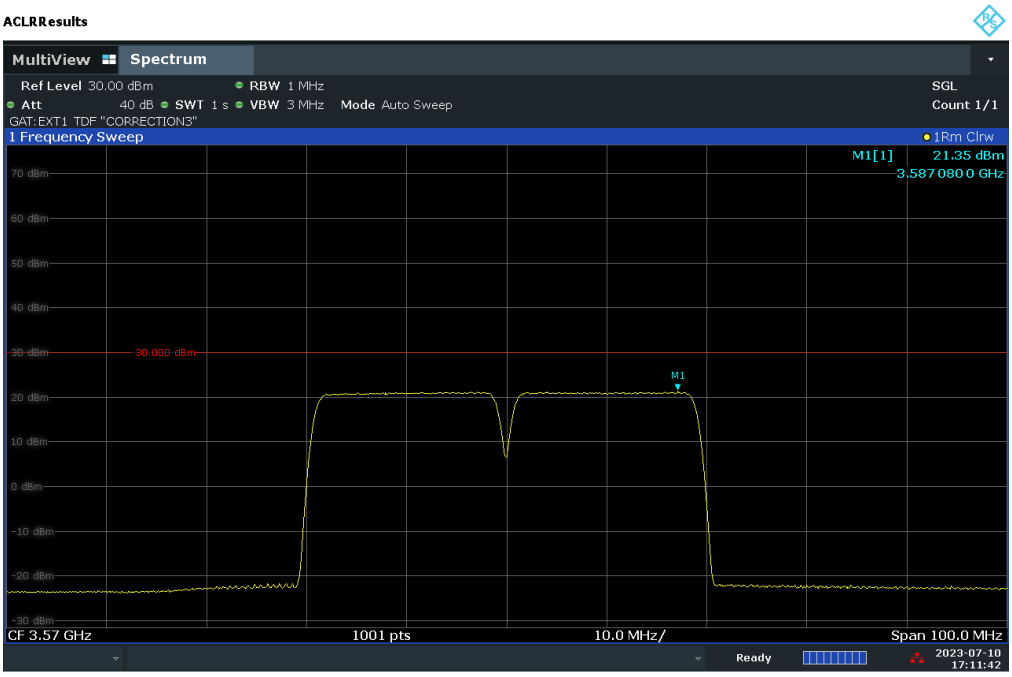
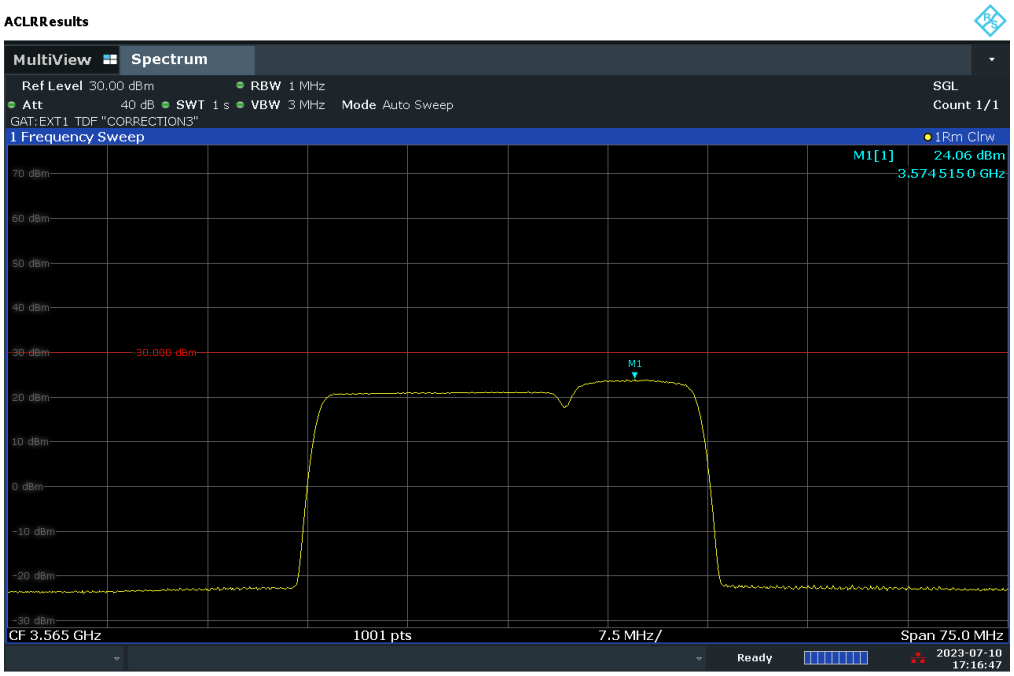
Plot 7.90. Peak Power Spectral Density Measurement (40MHz BW, Low Channel, 16-QAM)



Plot 7.91. Peak Power Spectral Density Measurement (40MHz BW, Low Channel, 64-QAM)



Plot 7.92. Peak Power Spectral Density Measurement (40MHz BW, Low Channel, 256-QAM)



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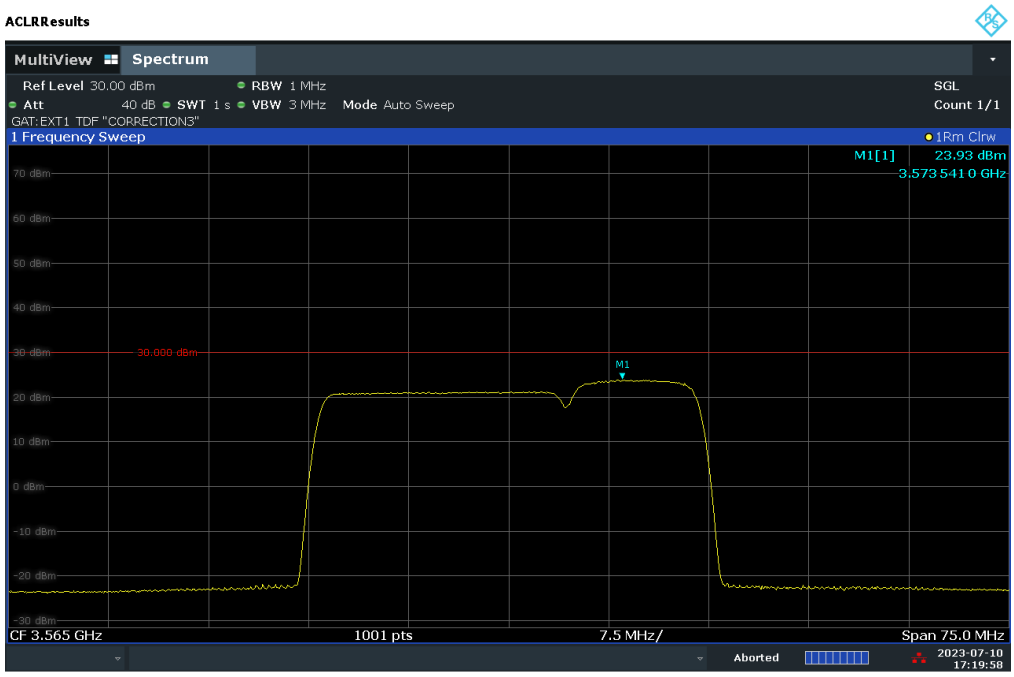
Plot 7.93. Peak Power Spectral Density Measurement (30MHz BW, Low Channel, QPSK)



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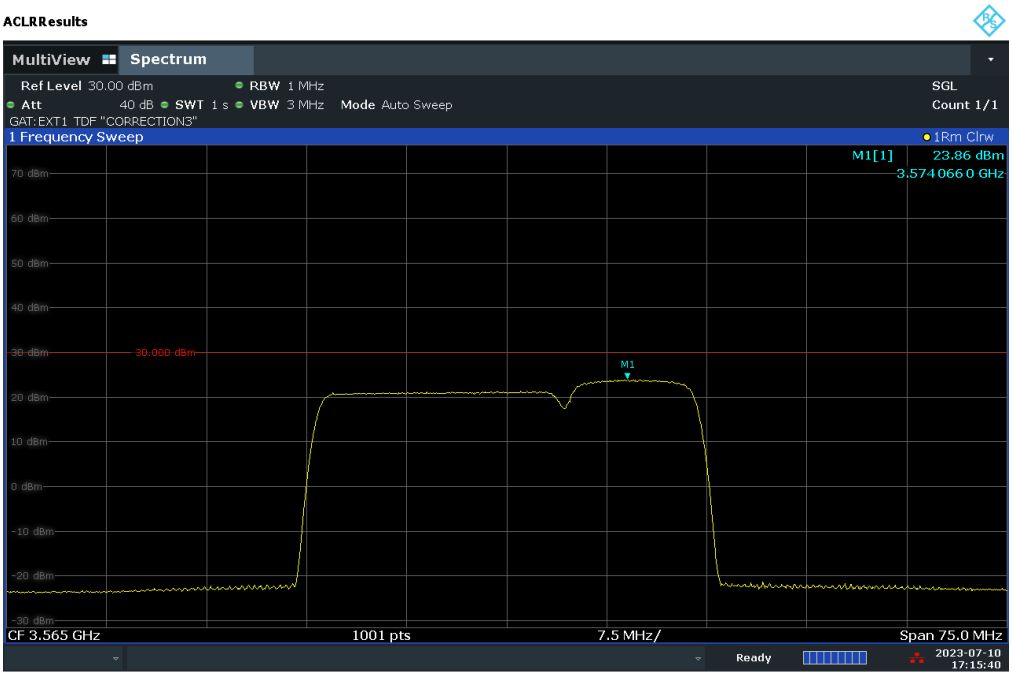
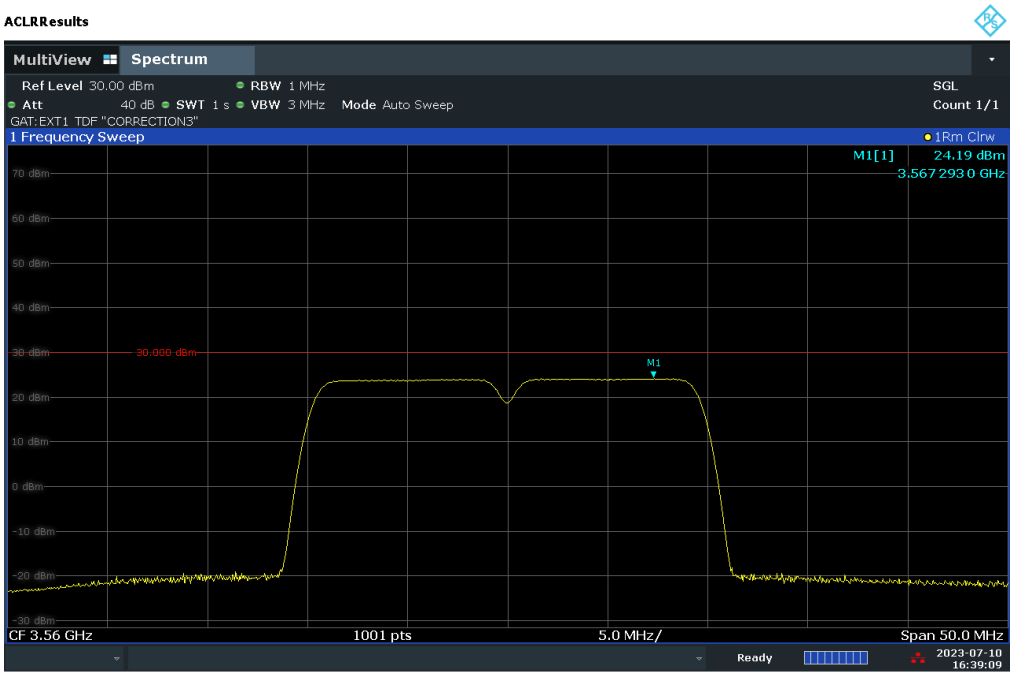
Plot 7.94. Peak Power Spectral Density Measurement (30MHz BW, Low Channel, 16-QAM)

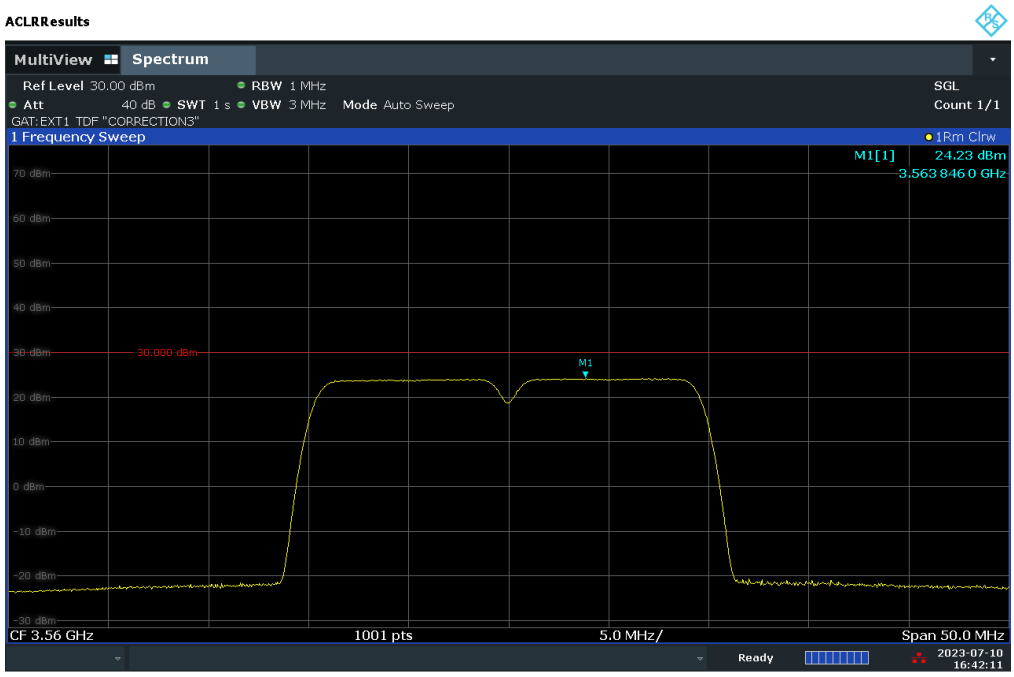
Plot 7.95. Peak Power Spectral Density Measurement (30MHz BW, Low Channel, 64-QAM)



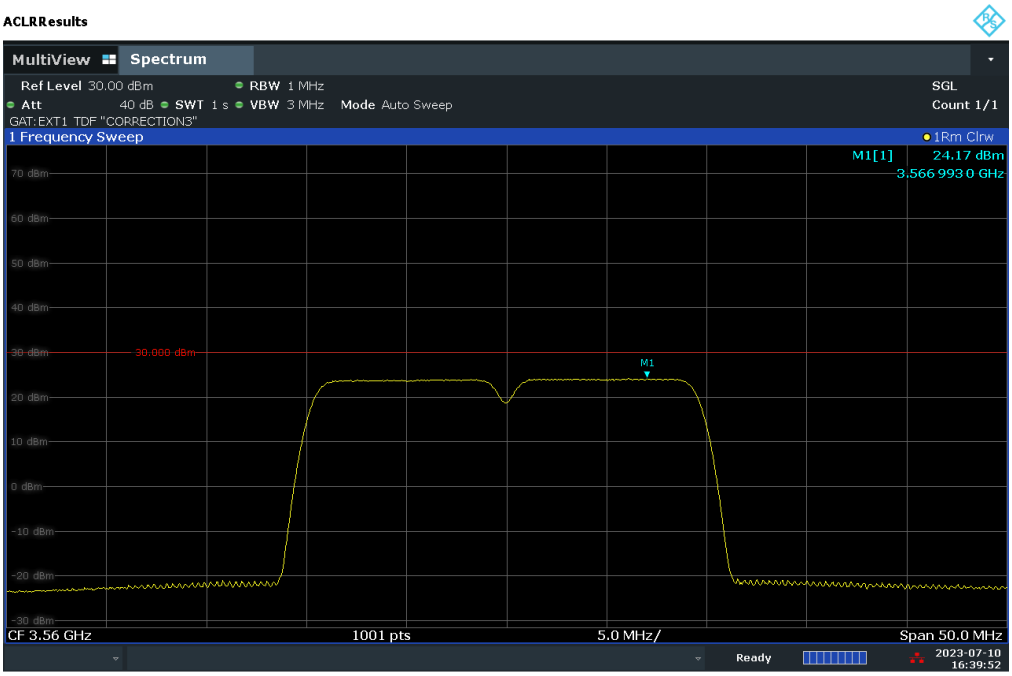
Plot 7.96. Peak Power Spectral Density Measurement (30MHz BW, Low Channel, 256-QAM)



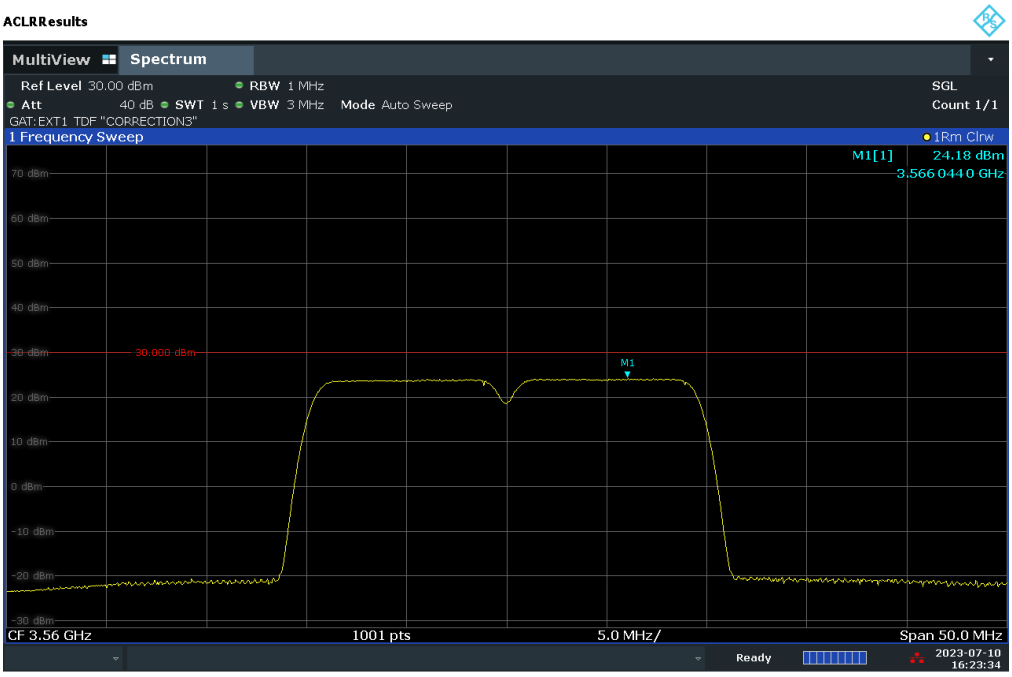
Plot 7.97. Peak Power Spectral Density Measurement (20MHz BW, Low Channel, QPSK)



Plot 7.98. Peak Power Spectral Density Measurement (20MHz BW, Low Channel, 16-QAM)



Plot 7.99. Peak Power Spectral Density Measurement (20MHz BW, Low Channel, 64-QAM)



Plot 7.100. Peak Power Spectral Density Measurement (20MHz BW, Low Channel, 256-QAM)

Note:

Per ANSI C63.26-2015 Section 5.2.5.3 and KDB 662911 v02r01 Section E)2), it was investigated for port equivalency. And, the Peak Power Spectral Density at Ant 2 and Ant 4 were performed on a single output port. The measured values were then summed in linear power units then converted back to dBm.

Per ANSI C63.26-2015 Section 6.4.6 and KDB 662911 v02r01 Section F.2.c, since the transmissions are either orthogonally polarized or co-polarized, with orthogonally polarized transmission, directional gain is 4dBi. However, with co-polarized transmission as worst scenario, the directional gain is equal to 7 dBi.

Sample MIMO Calculation:

At 3555 MHz in 256-QAM, 10MHz BW mode, the average Peak Power Spectral Density was measured to be 26.92 dBm/MHz for Ant 2 and Ant 4. MIMO Correction factor of 3.01dB is used to calculate MIMO Conducted power per 10MHz

Peak Power Spectral Density + MIMO Correction factor = MIMO Peak Power Spectral Density

(26.92 dBm + 3.01 dB) = 29.93 dBm

Sample e.i.r.p Power Spectral Density Calculation:

At 3555 MHz in 256-QAM, 10MHz BW mode, the average MIMO Peak Power Spectral Density was calculated to be 29.93 dBm with the worst directional gain of 7 dBi.

e.i.r.p. Power Spectral Density(dBm) = Power Spectral Density (dBm) + Ant gain (dBi)

29.93 dBm + 7 dBi = 36.93 dBm

7.6 Peak-Average Ratio

Test Overview

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2.3.4

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW ≥ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-5. Test Instrument & Measurement Setup

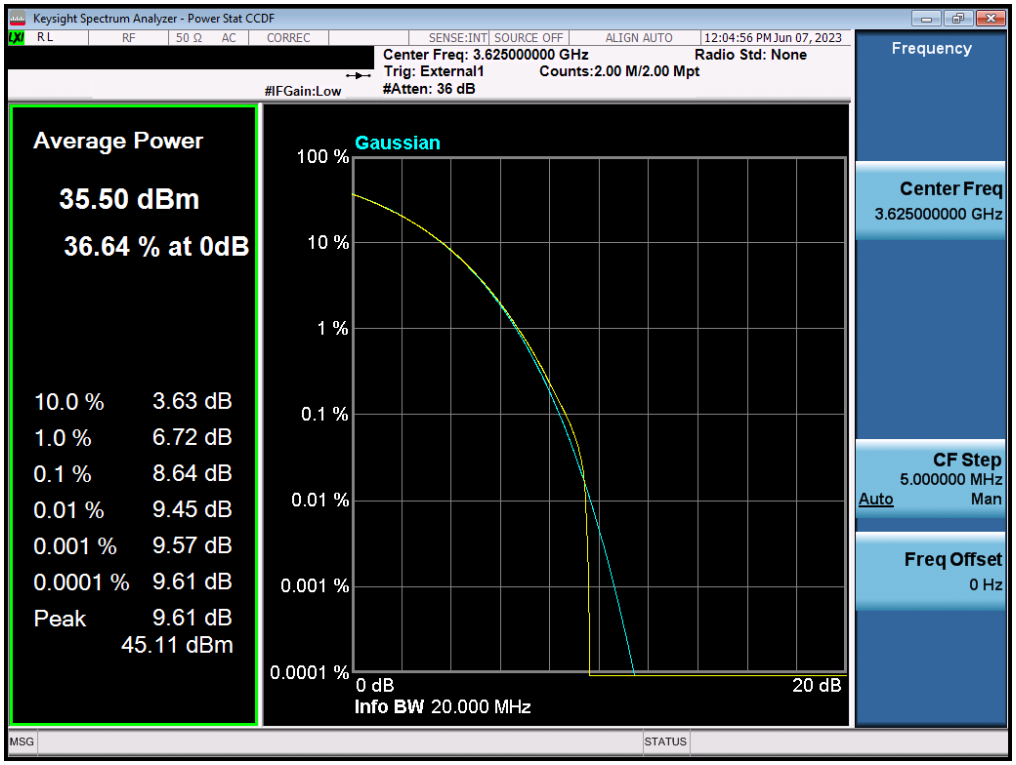
Test Notes

None.

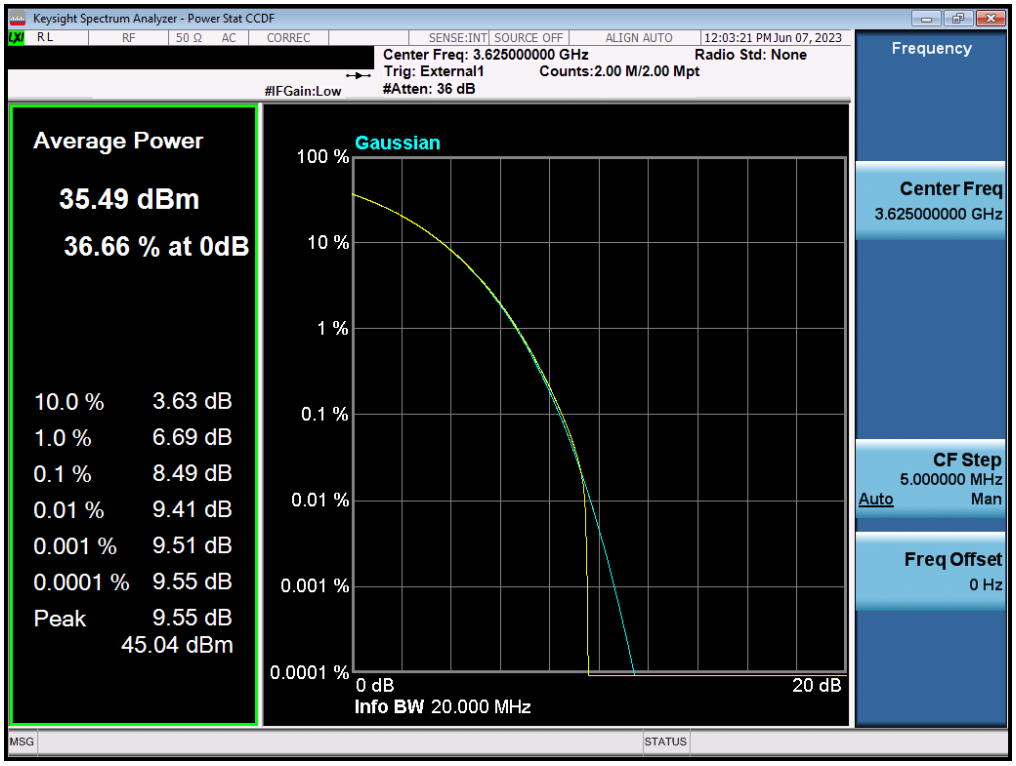
Bandwidth	Modulation	PAR at 0.1% [dB]	PAR Limit [dB]	Margin [dB]
20 MHz	QPSK	8.64	13.0	-4.36
	16QAM	8.49	13.0	-4.51
	64QAM	8.52	13.0	-4.48
	256QAM	8.62	13.0	-4.38
10 MHz	QPSK	8.50	13.0	-4.50
	16QAM	8.58	13.0	-4.42
	64QAM	8.39	13.0	-4.61
	256QAM	8.59	13.0	-4.41

Table 7-10 Peak to Average Power Ratio Measurements

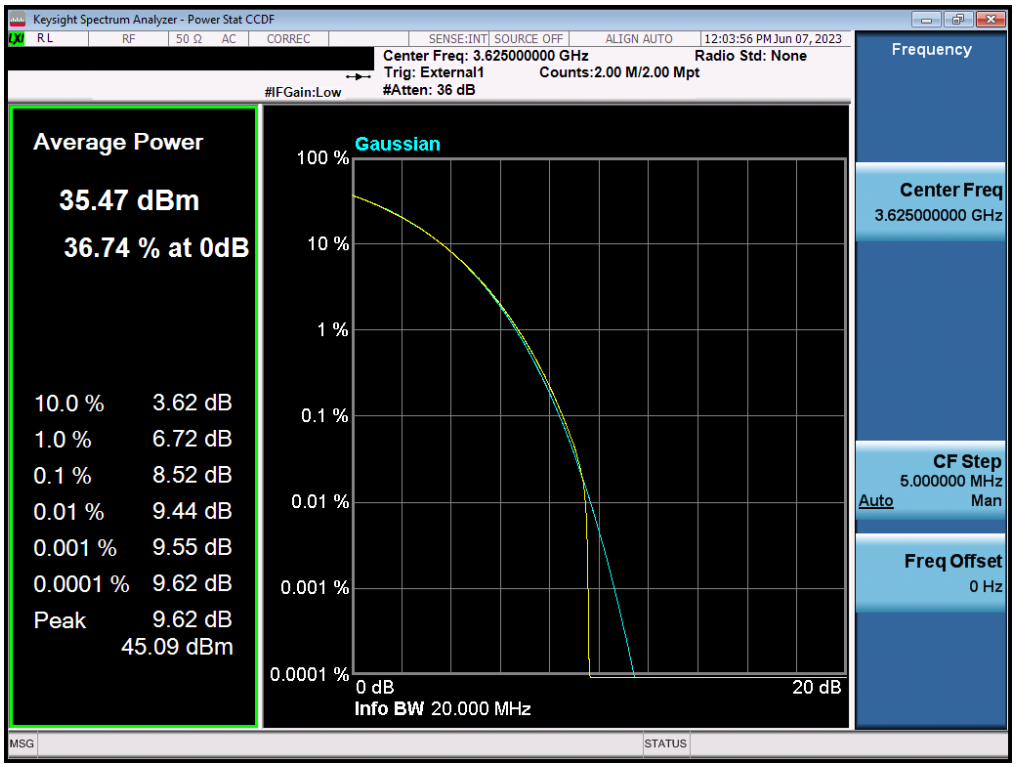
Peak to Average Power Ratio – LTE BAND 48



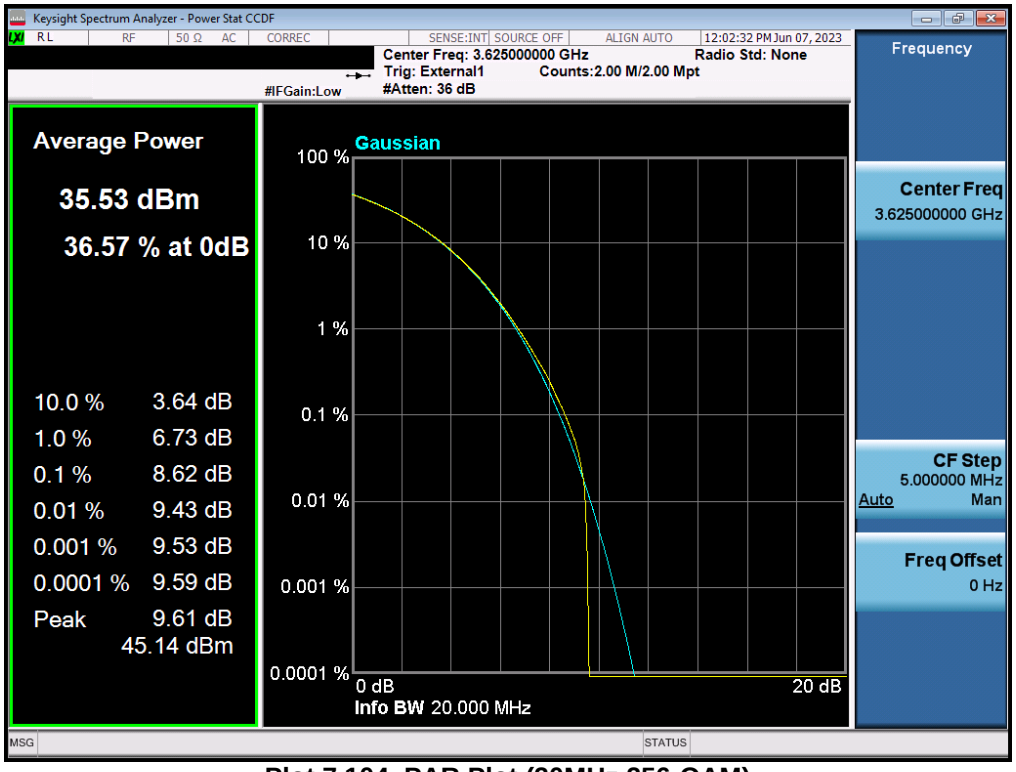
Plot 7.101. PAR Plot (20MHz QPSK)



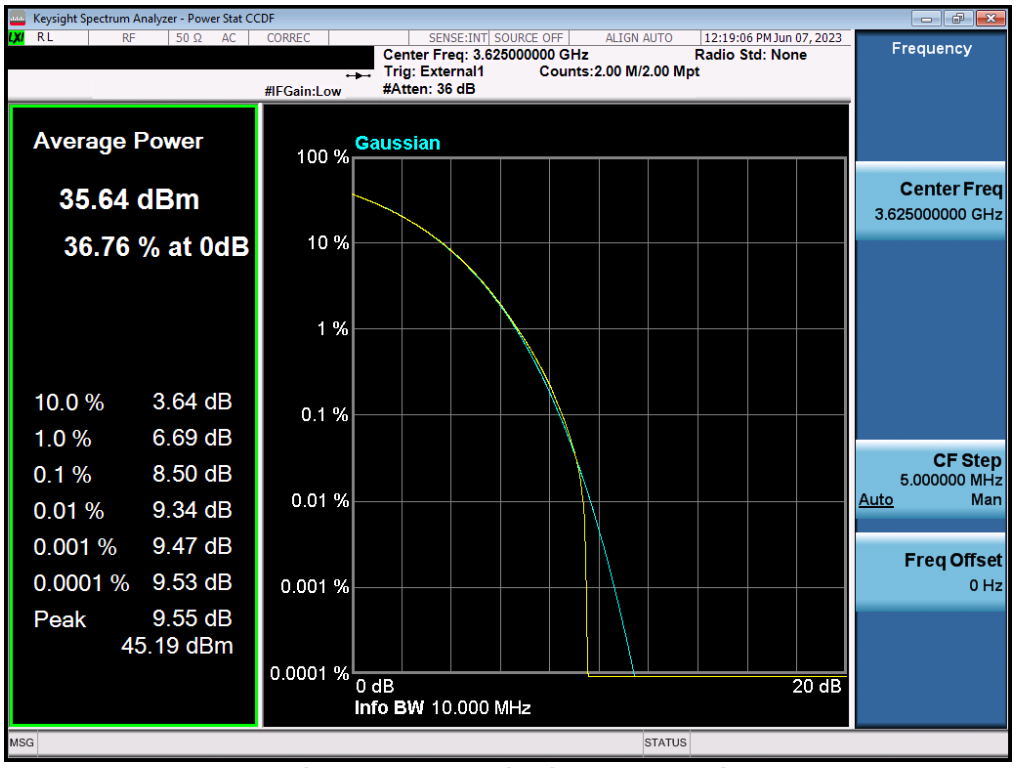
Plot 7.102. PAR Plot (20MHz 16-QAM)



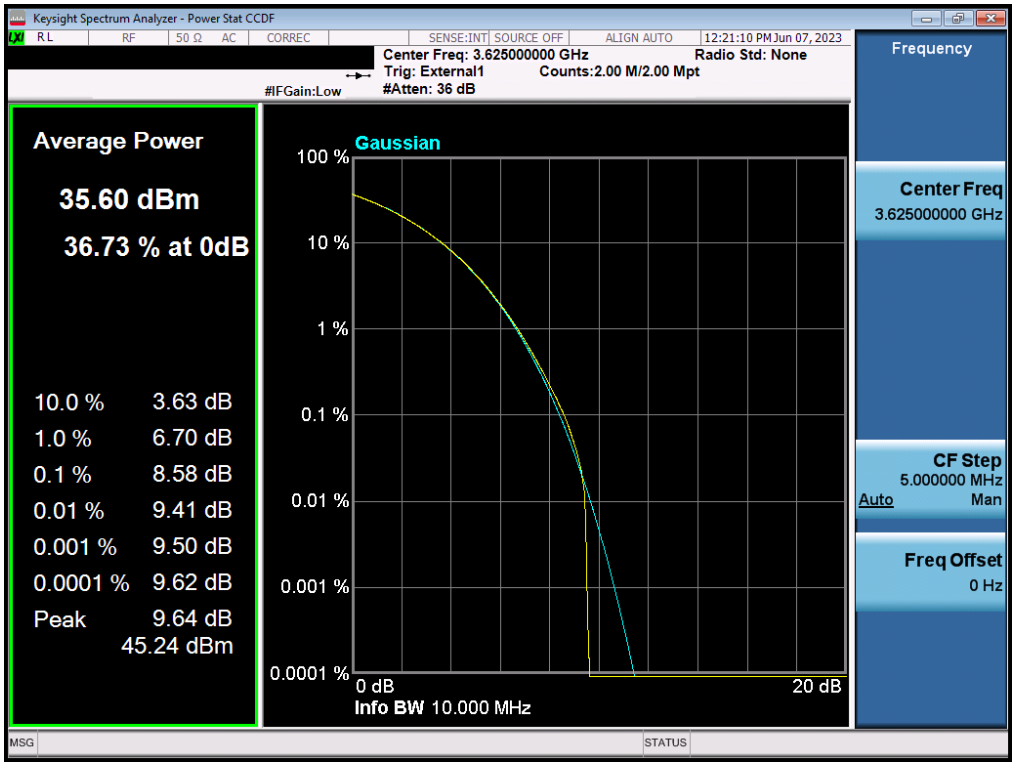
Plot 7.103. PAR Plot (20MHz 64-QAM)



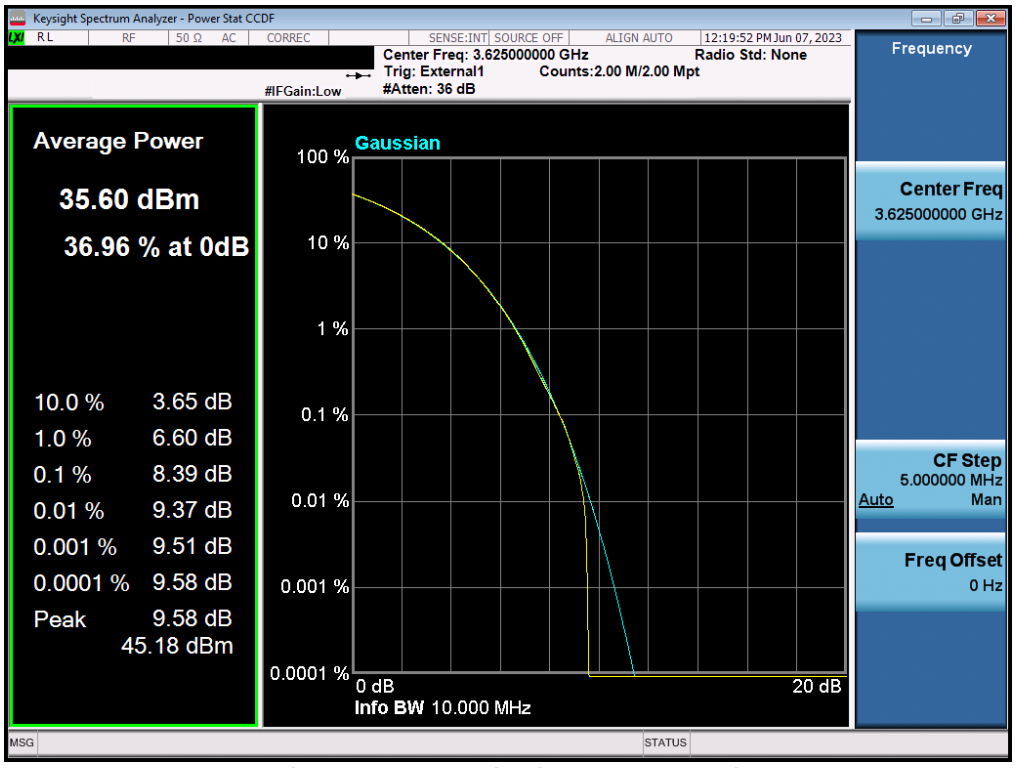
Plot 7.104. PAR Plot (20MHz 256-QAM)



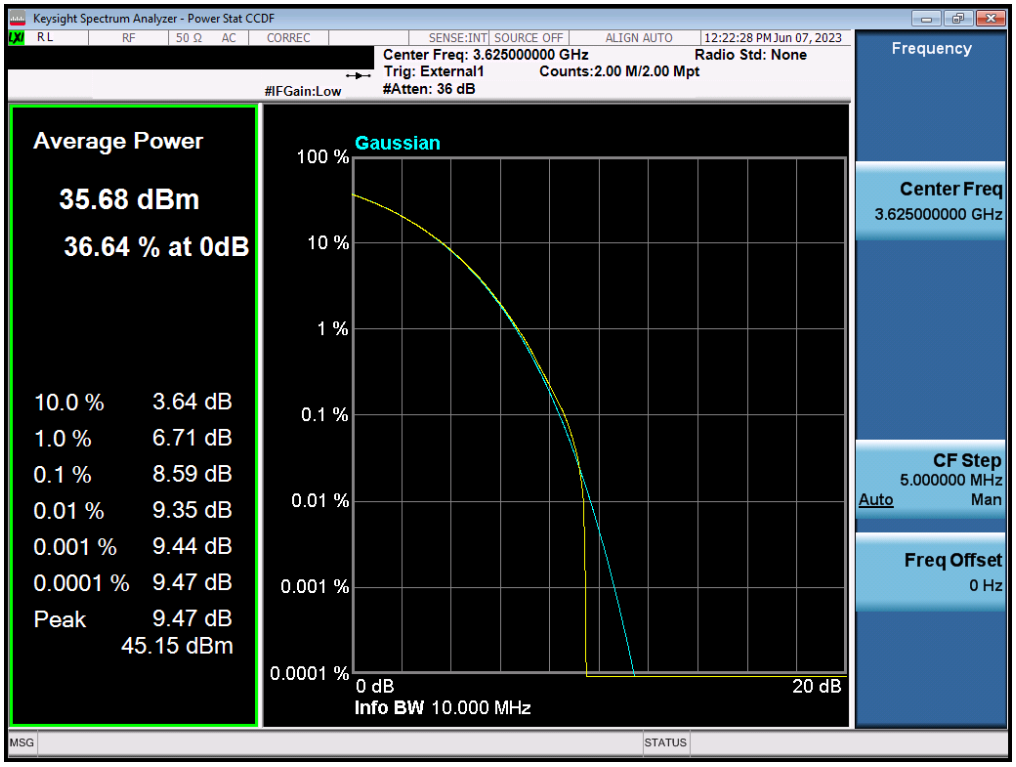
Plot 7.105. PAR Plot (10MHz QPSK)



Plot 7.106. PAR Plot (10MHz 16-QAM)



Plot 7.107. PAR Plot (10MHz 64-QAM)



Plot 7.108. PAR Plot (10MHz 256-QAM)

7.7 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/MHz.

Test Procedure Used

ANSI C63.26-2015 – Section 5.7.4

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = Max Hold
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-6. Test Instrument & Measurement Setup

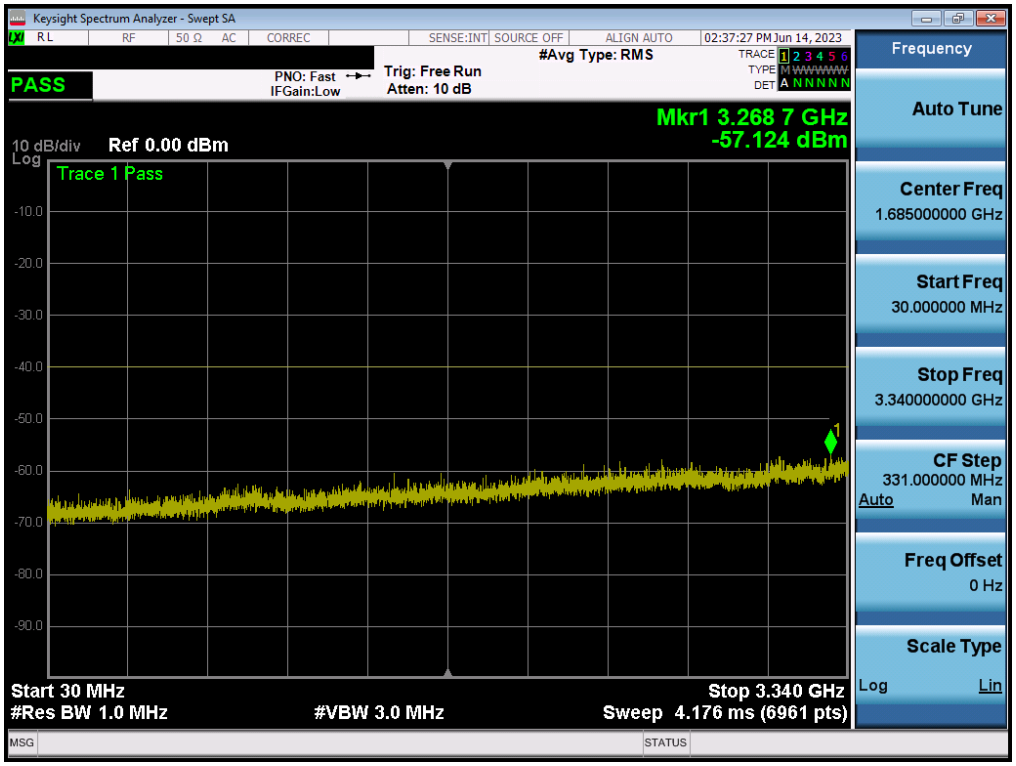
Test Notes

1. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz.
2. The EUT was outfitted with N-Type connectors which are not suitable fore accurate measurement up to 40GHz. As a result, Conducted Spurious and Harmonic Emissions were only tested upto 27GHz. The emissions, above 27GHz, were measured in a radiated test setup for comparison to the Part 96 emissions limits and were reported in section 7.9
3. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

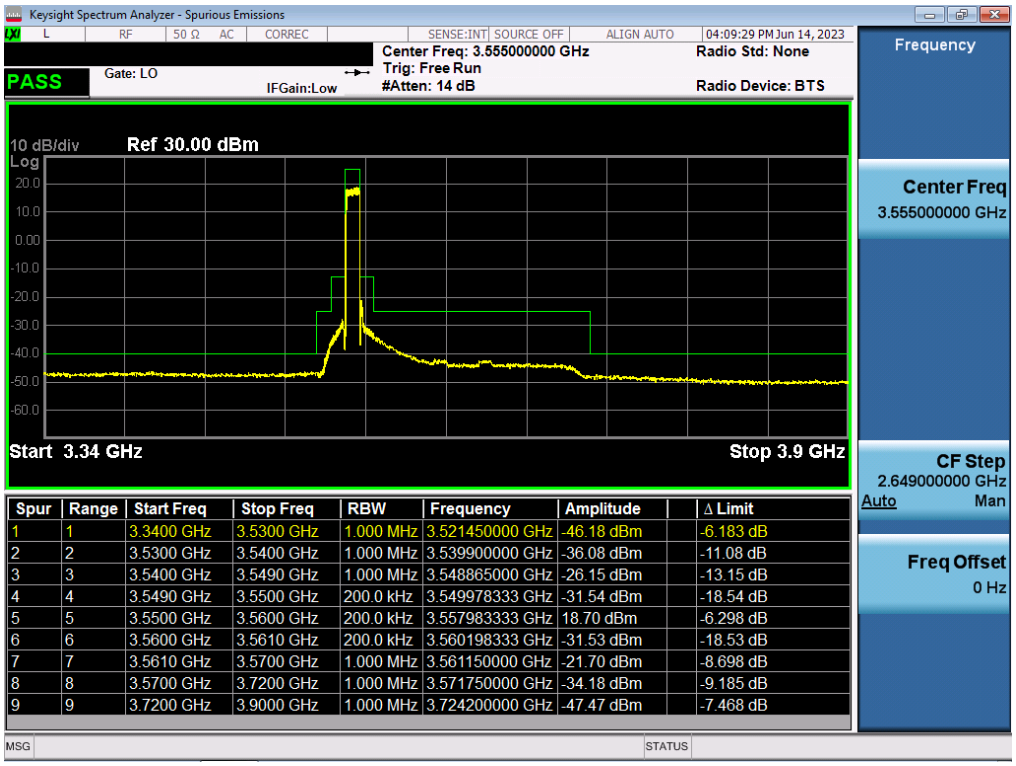
Spurious and Harmonic Emissions – LTE BAND 48

Mode	Bandwidth	Channel	Test Cases	Range [MHz]	CSE Level [dBm]	MIMO Correction [dB]	MIMO CSE Level [dBm]	Limit [dBm]	Margin [dB]
LTE-B48	10 MHz	Low	CSE	30.0 - 3340.0	-57.12	3.01	-54.11	-40	-14.11
			CSE	3340.0 - 3900.0	-46.18	3.01	-43.17	-40	-3.17
			CSE	3900.0 - 15000.0	-55.22	3.01	-52.21	-40	-12.21
			CSE	15000.0 - 27000.0	-	-	-	-40	-
		Mid	CSE	30.0 - 3340.0	-55.55	3.01	-52.54	-40	-12.54
			CSE	3340.0 - 3900.0	-46.35	3.01	-43.34	-40	-3.34
			CSE	3900.0 - 15000.0	-55.68	3.01	-52.67	-40	-12.67
			CSE	15000.0 - 27000.0	-	-	-	-40	-
		High	CSE	30.0 - 3340.0	-56.29	3.01	-53.28	-40	-13.28
			CSE	3340.0 - 3900.0	-46.50	3.01	-43.49	-40	-3.49
			CSE	3900.0 - 15000.0	-51.58	3.01	-48.57	-40	-8.57
			CSE	15000.0 - 27000.0	-	-	-	-40	-

Table 7-11 Spurious and Harmonic Emissions Measurements – LTE BAND 48

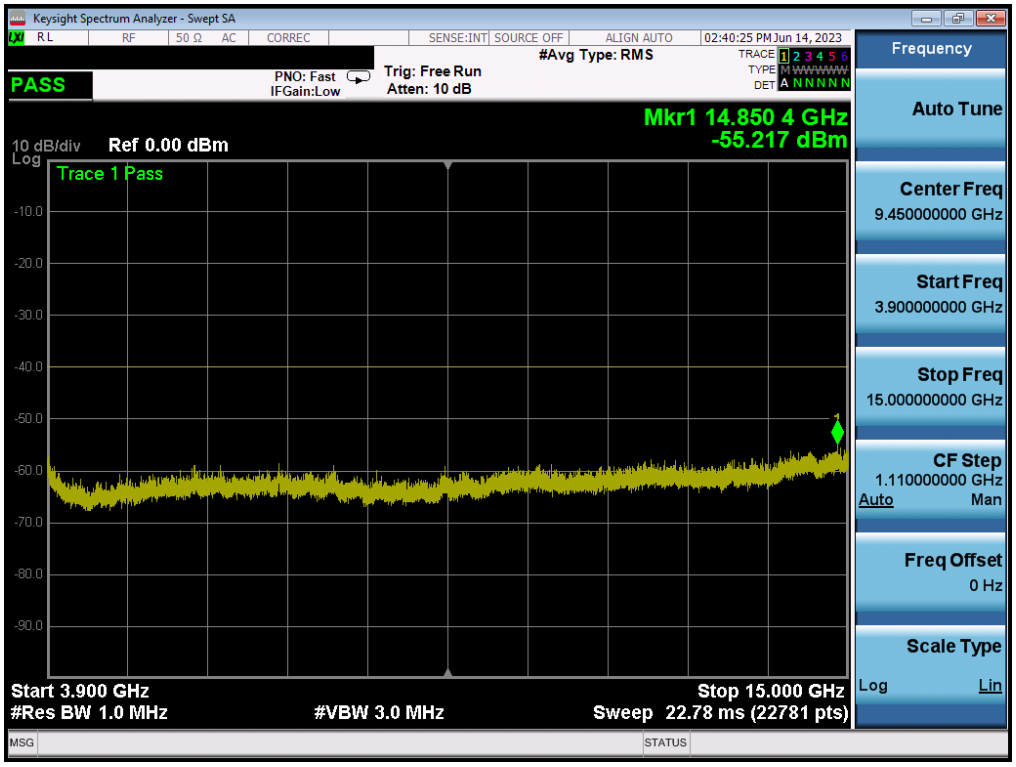


Plot 7.109. Conducted Spurious Plot (10MHz QPSK, Low Channel)

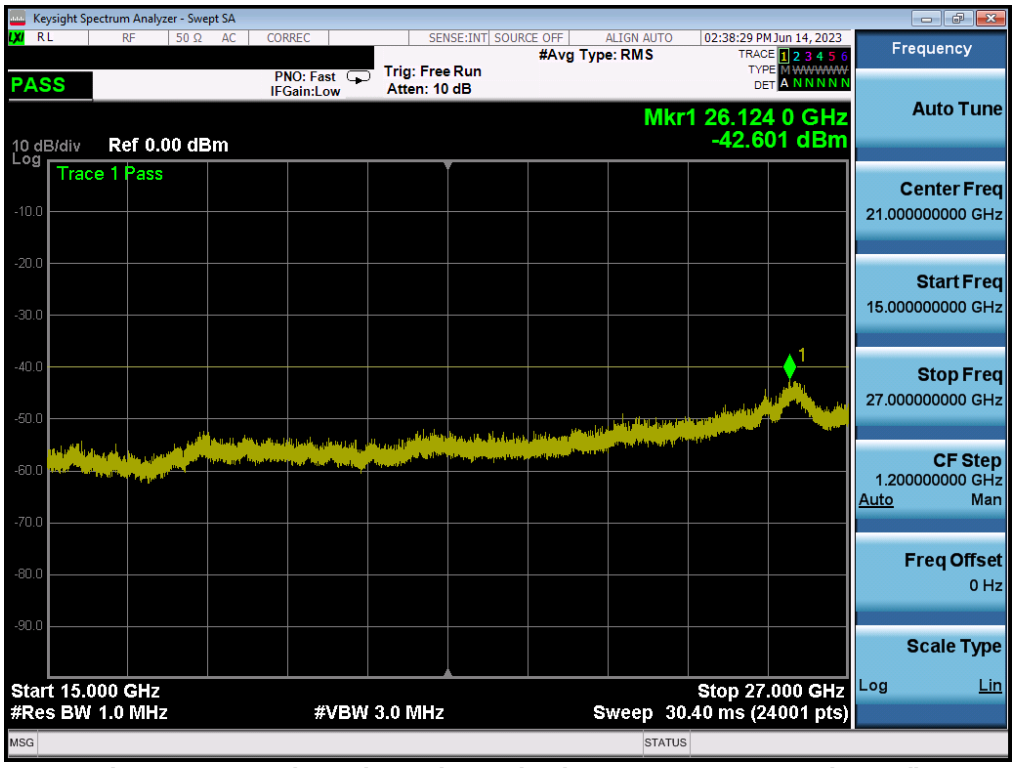


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.3400 GHz	3.5300 GHz	1.000 MHz	3.521450000 GHz	-46.18 dBm	-6.183 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.539900000 GHz	-36.08 dBm	-11.08 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548865000 GHz	-26.15 dBm	-13.15 dB
4	4	3.5490 GHz	3.5500 GHz	200.0 kHz	3.549978333 GHz	-31.54 dBm	-18.54 dB
5	5	3.5500 GHz	3.5600 GHz	200.0 kHz	3.557983333 GHz	18.70 dBm	-6.298 dB
6	6	3.5600 GHz	3.5610 GHz	200.0 kHz	3.560198333 GHz	-31.53 dBm	-18.53 dB
7	7	3.5610 GHz	3.5700 GHz	1.000 MHz	3.561150000 GHz	-21.70 dBm	-8.698 dB
8	8	3.5700 GHz	3.7200 GHz	1.000 MHz	3.571750000 GHz	-34.18 dBm	-9.185 dB
9	9	3.7200 GHz	3.9000 GHz	1.000 MHz	3.724200000 GHz	-47.47 dBm	-7.468 dB

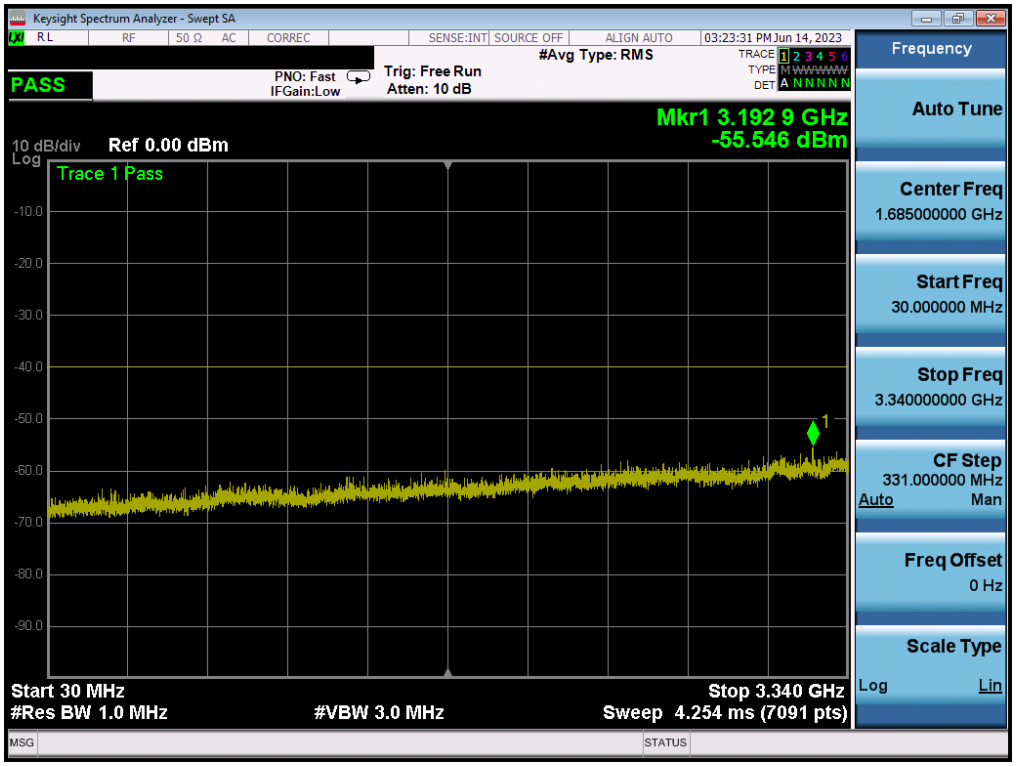
Plot 7.110. Conducted Spurious Plot (10MHz QPSK, Low Channel)



Plot 7.111. Conducted Spurious Plot (10MHz QPSK, Low Channel)



Plot 7.112. Conducted Spurious Plot (10MHz QPSK, Low Channel)



Plot 7.113. Conducted Spurious Plot (10MHz QPSK, Mid Channel)