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PART 27 MEASUREMENT REPORT

Applicant Name:
Samsung Electronics Co., Ltd.
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Gyeonggi-do, 16677, Korea

Date of Testing:
6/15/2023 - 7/13/2023
Test Report Issue Date:
7/18/2023
Test Site/Location:
Element lab. Yongin-Si, Gyeonggi-do, South Korea
Test Report Serial No.:
1M2304260059-05.A3L

FCC ID:	**A3LSMF731JPN**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SC-54D
Additional Model(s):	SCG23
EUT Type:	Portable Handset
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part:	27
Test Procedure(s):	ANSI C63.26-2015, KDB 648474 D03 v01r04

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.

Prepared by

Reviewed by

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Antenna-A								
Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	ERP		EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	Max. Power [W]	Max. Power [dBm]	
LTE Band 12	10 MHz	QPSK	704.0 - 711.0	0.050	17.03	0.083	19.18	9M01G7D
		16QAM	704.0 - 711.0	0.042	16.19	0.068	18.34	9M00W7D
	5 MHz	QPSK	701.5 - 713.5	0.049	16.94	0.081	19.09	4M53G7D
		16QAM	701.5 - 713.5	0.044	16.48	0.073	18.63	4M53W7D
	3 MHz	QPSK	700.5 - 714.5	0.049	16.86	0.080	19.01	2M72G7D
		16QAM	700.5 - 714.5	0.039	15.89	0.064	18.04	2M73W7D
	1.4 MHz	QPSK	699.7 - 715.3	0.048	16.86	0.080	19.01	1M10G7D
		16QAM	699.7 - 715.3	0.043	16.32	0.070	18.47	1M10W7D
LTE Band 13	10 MHz	QPSK	782.0	0.064	18.08	0.105	20.23	9M01G7D
		16QAM	782.0	0.053	17.22	0.086	19.37	9M02W7D
	5 MHz	QPSK	779.5 - 784.5	0.066	18.20	0.108	20.35	4M53G7D
		16QAM	779.5 - 784.5	0.052	17.16	0.085	19.31	4M53W7D

Overview Table (<1GHz Bands)

Antenna-A						
Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 66/4	20 MHz	QPSK	1720.0 - 1770.0	0.100	20.01	17M9G7D
		16QAM	1720.0 - 1770.0	0.084	19.24	18M0W7D
	15 MHz	QPSK	1717.5 - 1772.5	0.101	20.02	13M5G7D
		16QAM	1717.5 - 1772.5	0.081	19.06	13M5W7D
	10 MHz	QPSK	1715.0 - 1775.0	0.104	20.18	9M03G7D
		16QAM	1715.0 - 1775.0	0.081	19.07	9M00W7D
	5 MHz	QPSK	1712.5 - 1777.5	0.103	20.12	4M53G7D
		16QAM	1712.5 - 1777.5	0.081	19.08	4M52W7D
	3 MHz	QPSK	1711.5 - 1778.5	0.107	20.30	2M71G7D
		16QAM	1711.5 - 1778.5	0.079	18.98	2M72W7D
	1.4 MHz	QPSK	1710.7 - 1779.3	0.104	20.19	1M11G7D
		16QAM	1710.7 - 1779.3	0.083	19.17	1M11W7D
NR Band n66	40 MHz	π/2 BPSK	1730.0 - 1760.0	0.072	18.59	39M0G7D
		QPSK	1730.0 - 1760.0	0.072	18.55	38M7G7D
		16QAM	1730.0 - 1760.0	0.054	17.29	38M8W7D
	30 MHz	π/2 BPSK	1725.0 - 1765.0	0.072	18.60	28M8G7D
		QPSK	1725.0 - 1765.0	0.068	18.34	28M7G7D
		16QAM	1725.0 - 1765.0	0.057	17.54	28M7W7D
	25 MHz	π/2 BPSK	1722.5 - 1767.5	0.075	18.78	23M0G7D
		QPSK	1722.5 - 1767.5	0.068	18.30	23M9G7D
		16QAM	1722.5 - 1767.5	0.055	17.42	23M9W7D
	20 MHz	π/2 BPSK	1720.0 - 1770.0	0.072	18.57	18M0G7D
		QPSK	1720.0 - 1770.0	0.068	18.29	19M0G7D
		16QAM	1720.0 - 1770.0	0.051	17.06	19M0W7D
	15 MHz	π/2 BPSK	1717.5 - 1772.5	0.072	18.59	13M5G7D
		QPSK	1717.5 - 1772.5	0.069	18.38	14M2G7D
		16QAM	1717.5 - 1772.5	0.054	17.33	14M2W7D
	10 MHz	π/2 BPSK	1715.0 - 1775.0	0.071	18.54	9M01G7D
		QPSK	1715.0 - 1775.0	0.068	18.31	9M38G7D
		16QAM	1715.0 - 1775.0	0.058	17.60	9M38W7D
	5 MHz	π/2 BPSK	1712.5 - 1777.5	0.072	18.60	4M56G7D
		QPSK	1712.5 - 1777.5	0.066	18.22	4M52G7D
		16QAM	1712.5 - 1777.5	0.054	17.29	4M50W7D

Antenna-I						
Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 66/4	20 MHz	QPSK	1720.0 - 1770.0	0.090	19.54	18M0G7D
		16QAM	1720.0 - 1770.0	0.077	18.89	18M0W7D
	15 MHz	QPSK	1717.5 - 1772.5	0.092	19.65	13M5G7D
		16QAM	1717.5 - 1772.5	0.076	18.78	13M5W7D
	10 MHz	QPSK	1715.0 - 1775.0	0.093	19.68	9M04G7D
		16QAM	1715.0 - 1775.0	0.075	18.75	9M04W7D
	5 MHz	QPSK	1712.5 - 1777.5	0.096	19.81	4M55G7D
		16QAM	1712.5 - 1777.5	0.081	19.11	4M54W7D
	3 MHz	QPSK	1711.5 - 1778.5	0.091	19.61	2M73G7D
		16QAM	1711.5 - 1778.5	0.075	18.73	2M73W7D
	1.4 MHz	QPSK	1710.7 - 1779.3	0.093	19.69	1M11G7D
		16QAM	1710.7 - 1779.3	0.075	18.73	1M11W7D
NR Band n66	40 MHz	π/2 BPSK	1730.0 - 1760.0	0.065	18.13	38M7G7D
		QPSK	1730.0 - 1760.0	0.064	18.04	39M1G7D
		16QAM	1730.0 - 1760.0	0.054	17.35	39M0W7D
	30 MHz	π/2 BPSK	1725.0 - 1765.0	0.069	18.37	28M7G7D
		QPSK	1725.0 - 1765.0	0.068	18.32	29M0G7D
		16QAM	1725.0 - 1765.0	0.061	17.84	29M1W7D
	25 MHz	π/2 BPSK	1725.0 - 1765.0	0.069	18.38	23M0G7D
		QPSK	1725.0 - 1765.0	0.073	18.65	24M1G7D
		16QAM	1725.0 - 1765.0	0.055	17.38	24M1W7D
	20 MHz	π/2 BPSK	1720.0 - 1770.0	0.066	18.18	18M0G7D
		QPSK	1720.0 - 1770.0	0.073	18.65	19M3G7D
		16QAM	1720.0 - 1770.0	0.047	16.73	19M3W7D
	15 MHz	π/2 BPSK	1717.5 - 1772.5	0.065	18.15	13M7G7D
		QPSK	1717.5 - 1772.5	0.063	18.00	14M6G7D
		16QAM	1717.5 - 1772.5	0.052	17.12	14M5W7D
	10 MHz	π/2 BPSK	1715.0 - 1775.0	0.061	17.83	9M12G7D
		QPSK	1715.0 - 1775.0	0.067	18.25	9M59G7D
		16QAM	1715.0 - 1775.0	0.043	16.32	9M63W7D
	5 MHz	π/2 BPSK	1712.5 - 1777.5	0.064	18.06	4M60G7D
		QPSK	1712.5 - 1777.5	0.064	18.07	4M72G7D
		16QAM	1712.5 - 1777.5	0.047	16.71	4M66W7D

Overview Table (>1GHz Bands)

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 and the Innovation, Science and Economic Development Canada.

1.2 Element Test Location

These measurement tests were conducted at the Element Suwon Laboratory located at 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do, 16954, South Korea. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.2 Test Facility / Accreditations

Measurements were performed at Element Materials Technology Suwon, Ltd. located in Yongin-si, Gyeonggi-do, 16954, South Korea.

- Element Materials Technology Suwon, Ltd. is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation(A2LA) with Certificate number 2041.04 for Specific Absorption Rate (SAR), and Electromagnetic Compatibility (EMC) & Telecommunications testing for FCC and Innovation, Science, and Economic Development Canada rules.

- Element Materials Technology Suwon, Ltd. facility is accredited, designated, and recognized in accordance with the provision of Radio Wave Act and International Standard ISO/IEC 17025:2017 under the National Radio Research Agency.

  - Designation Number / CABID: KR0169
  - Test Firm Registration Number of FCC: 417945
  - Test Firm Registration Number of ISED: 26168

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMF731JPN**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 27.

Test Device Serial No.: 0134M, 0165M,0180M, 0214M, 0264M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer

This device uses a tuner circuit that dynamically updates the antenna impedance parameters to optimize antenna performance for certain bands and modes of operation. The tuner for this device was set to simulate a "free space" condition where the transmit antenna is matched to the medium into which it is transmitting and, thus, the power is at its maximum level.

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 supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on an authorized wireless charging pad (WCP) Model: EP-N5100 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

This device supports three configurations: one is with screen open, one is where the screen is half open (90 degrees), and one is with screen closed. All configurations are tested, and the worst case radiated emissions data is shown in this report.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version SC54DOMU0AWEQ 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 Evaluation 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 power and 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	1.95
Radiated Disturbance (<1GHz)	4.10
Radiated Disturbance (>1GHz)	4.82
Radiated Disturbance (>18GHz)	4.96

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
Agilent	N9030A	PXA Signal Analyzer	2023-07-04	Annual	2024-07-03	MY49432391
Anritsu	S820E	Cable and Antenna Analyzer	2023-07-05	Annual	2024-07-04	1839097
Anritsu	MA24106A	USB Power Sensor	2023-07-05	Annual	2024-07-04	1244512
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	2022-10-21	Biennial	2024-10-20	10160045
Com-Power	PAM-118A	Preamplifier	2023-07-05	Annual	2024-07-04	551042
Espec	SH-242	Environmental Chamber	2022-08-26	Annual	2023-08-25	93011064
Fairview Microwave	FM2CP1122-10	2.92mm Directional Coupler	2023-07-04	Annual	2024-07-03	1946
Keysight Technologies	N9030B	MXA Signal Analyzer	2023-07-04	Annual	2024-07-03	MY57143276
Mini-Circuits	BW-N10W5+	Attenuator	2023-07-04	Annual	2024-07-03	1607
Mini-Circuits	BW-N10W5+	Attenuator	2023-07-04	Annual	2024-07-03	1607
Rohde & Schwarz	TS-PR18	Preamplifier	2023-07-05	Annual	2024-07-04	102141
Rohde & Schwarz	SMB100A03	Signal Generator	2023-01-17	Annual	2024-01-16	182487
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	2023-02-17	Annual	2024-02-16	131453
Rohde & Schwarz	FSW43	Signal and Spectrum Analyzer	2023-01-13	Annual	2024-01-12	101955
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2023-02-17	Annual	2024-02-16	102131
Rohde & Schwarz	TC-TA18	VIVALDI-ANT	2021-10-22	Biennial	2023-10-21	101097
Rohde & Schwarz	TC-TA18	VIVALDI-ANT	2021-10-22	Biennial	2023-10-21	101098
Schwarzbeck	VULB9162	Broadband TRILOG Antenna	2023-06-01	Biennial	2025-05-31	9162-217
Schwarzbeck	UHA9105	Dipole Antenna	2022-07-19	Biennial	2024-07-18	91052522
Sunol	DRH-118	Horn Antenna	2023-01-26	Biennial	2025-01-25	A060215

Table 5-1. Test Equipment

Notes:

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.

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 (1564 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) = 50.3 dBc.

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMF731JPN

FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)

Mode(s): NR/LTE

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Transmitter Conducted Output Power*	2.1046(a), 2.1046(c)	N/A	PASS	Section 7.2
	Occupied Bandwidth	2.1049(h)	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions (LTE Band 13)	2.1051, 27.53(c), 27.53(f)	Undesirable emissions must meet the limits detailed in sections 27.53(c) and 27.53(f)	PASS	Sections 7.4, 7.5
	Conducted Band Edge / Spurious Emissions (LTE Band 12)	2.1051, 27.53(g)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Sections 7.4, 7.5
	Conducted Band Edge / Spurious Emissions (LTE Band 4, 66; NR Band n66)	2.1051, 27.53(h)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Sections 7.4, 7.5
	Peak-to-Average Ratio (LTE Band 4, 66; NR Band n66)	27.50(d)(5)	≤ 13 dB	PASS	Section 7.6
	Frequency Stability	2.1055, 27.54	Fundamental emissions stay within authorized frequency block	PASS	Section 7.9
RADIATED	Effective Radiated Power (LTE Band 13)	27.50(b)(10)	≤ 3 Watts max. ERP	PASS	Section 7.7
	Effective Radiated Power (LTE Band 12)	27.50(c)(10)	≤ 3 Watts max. ERP	PASS	Section 7.7
	Equivalent Isotropic Radiated Power (LTE Band 4, 66; NR Band n66)	27.50(d)(4)	≤ 1 Watt max. EIRP	PASS	Section 7.7
	Radiated Spurious Emissions (LTE Band 13)	2.1053, 27.53(c), 27.53(f)	Undesirable emissions must meet the limits detailed in sections 27.53(c) and 27.53(f)	PASS	Section 7.8
	Radiated Spurious Emissions (LTE Band 12)	2.1053, 27.53(g)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Section 7.8
	Radiated Spurious Emissions (LTE Band 4, 66; NR Band n66)	2.1053, 27.53(h)(1)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Section 7.8

* The only transmitter output conducted powers included in this report are those where the Pmax value, per the tune-up document, is higher than any of the DSI power levels. For the remaining conducted power measurements, see the **RF Exposure Report**.

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 shown in Section 7.0 were 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 v1.1.

7.2 Conducted Output Power Data

Test Overview

All 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.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2

Test Settings

1. Span = 2 x OBW to 3 x OBW
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
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.

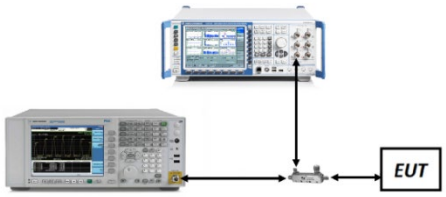


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. Conducted power measurements were evaluated using various combinations of RB size, RB offset, 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. All other conducted power measurements are contained in the RF exposure report for this filing.

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
20 MHz	QPSK	132072	1720.0	1 / 50	23.85
		132322	1745.0	1 / 99	23.55
		132572	1770.0	1 / 99	23.83
	16-QAM	132572	1770.0	1 / 99	23.07
15 MHz	QPSK	132047	1717.5	1 / 74	23.99
		132322	1745.0	1 / 74	23.66
		132597	1772.5	1 / 74	23.85
	16-QAM	132047	1717.5	1 / 74	23.18
10 MHz	QPSK	132022	1715.0	1 / 49	23.96
		132322	1745.0	1 / 25	23.69
		132622	1775.0	1 / 25	23.99
	16-QAM	132622	1775.0	1 / 25	23.13
5 MHz	QPSK	131997	1712.5	1 / 24	24.15
		132322	1745.0	1 / 12	23.82
		132647	1777.5	1 / 12	24.13
	16-QAM	131997	1712.5	1 / 24	23.07
3 MHz	QPSK	131987	1711.5	1 / 7	24.27
		132322	1745.0	1 / 14	23.62
		132657	1778.5	1 / 14	23.97
	16-QAM	131987	1711.5	1 / 7	23.11
1.4 MHz	QPSK	131979	1710.7	1 / 3	23.93
		132322	1745.0	1 / 0	23.70
		132665	1779.3	1 / 3	24.04
	16-QAM	132665	1779.3	1 / 3	23.12

Table 7-2. Conducted Powers (LTE Band 66/4 – Ant I – Max Power)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	346000	1730.0	1 / 108	23.33
		349000	1745.0	1 / 1	23.60
		352000	1760.0	1 / 214	23.29
	QPSK	346000	1730.0	1 / 108	23.51
		349000	1745.0	1 / 1	23.86
		352000	1760.0	1 / 214	23.29
	16-QAM	349000	1745.0	1 / 1	22.57
30 MHz	π/2 BPSK	345000	1725.0	1 / 80	23.51
		349000	1745.0	1 / 1	23.83
		353000	1765.0	1 / 158	23.41
	QPSK	345000	1725.0	1 / 80	23.63
		349000	1745.0	1 / 1	23.57
		353000	1765.0	1 / 158	23.59
	16-QAM	349000	1745.0	1 / 1	23.07
25 MHz	π/2 BPSK	345000	1722.5	1 / 131	23.88
		349000	1745.0	1 / 1	23.65
		353000	1767.5	1 / 131	23.31
	QPSK	345000	1722.5	1 / 131	23.47
		349000	1745.0	1 / 1	23.64
		353000	1767.5	1 / 131	23.92
	16-QAM	353000	1767.5	1 / 131	22.37
20 MHz	π/2 BPSK	344000	1720.0	1 / 104	23.47
		349000	1745.0	1 / 1	23.65
		354000	1770.0	1 / 104	23.31
	QPSK	344000	1720.0	1 / 104	23.47
		349000	1745.0	1 / 1	23.64
		354000	1770.0	1 / 104	23.92
	16-QAM	354000	1770.0	1 / 104	22.37
15 MHz	π/2 BPSK	343500	1717.5	1 / 77	23.33
		349000	1745.0	1 / 1	23.13
		354500	1772.5	1 / 77	23.36
	QPSK	343500	1717.5	1 / 77	23.39
		349000	1745.0	1 / 1	23.35
		354500	1772.5	1 / 77	23.26
	16-QAM	354500	1772.5	1 / 77	22.77
10 MHz	π/2 BPSK	343000	1715.0	1 / 50	23.27
		349000	1745.0	1 / 1	22.94
		355000	1775.0	1 / 50	23.04
	QPSK	343000	1715.0	1 / 50	23.38
		349000	1745.0	1 / 1	23.14
		355000	1775.0	1 / 50	23.51
	16-QAM	355000	1775.0	1 / 50	21.97
5 MHz	π/2 BPSK	342500	1712.5	1 / 23	23.19
		349000	1745.0	1 / 1	22.86
		355500	1777.5	1 / 23	23.27
	QPSK	342500	1712.5	1 / 23	23.32
		349000	1745.0	1 / 1	22.85
		355500	1777.5	1 / 23	23.33
	16-QAM	355500	1777.5	1 / 23	22.35

Table 7-3. Conducted Powers (NR Band n66 – Ant I – Max Power)

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.

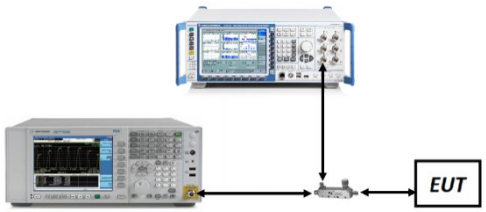


Figure 7-2. Test Instrument & Measurement Setup

Test Notes

None.

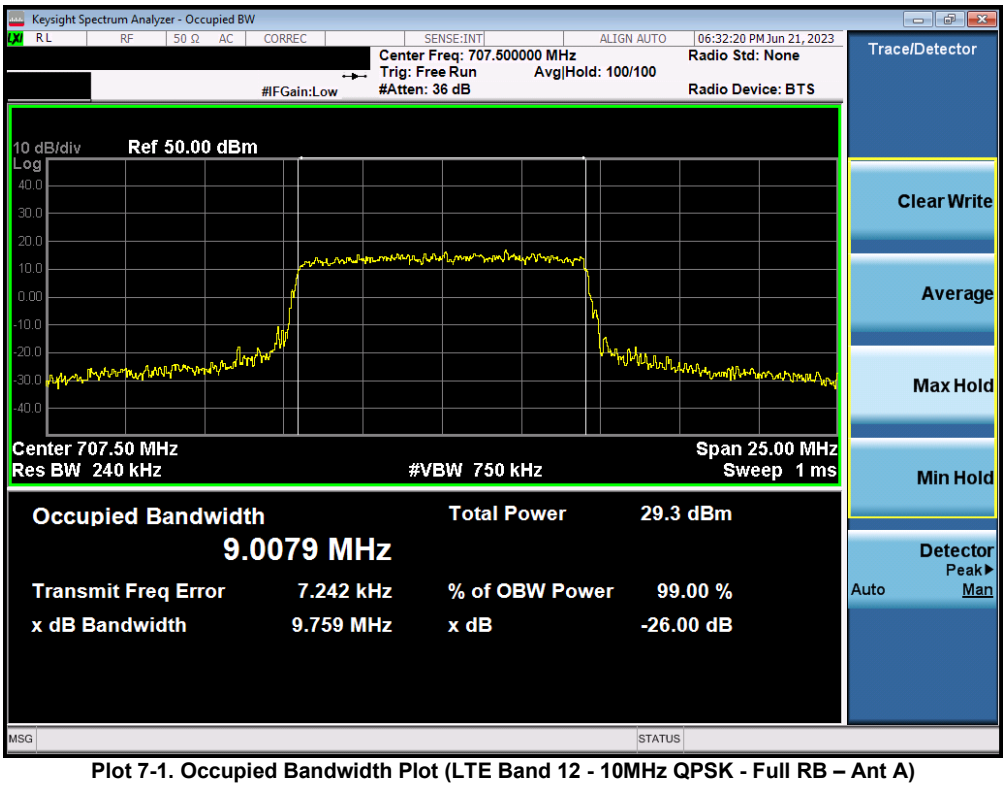
Mode	Bandwidth	Modulation	OBW [MHz]
LTE Band 12/17	10 MHz	QPSK	9.01
		16QAM	9.00
	5 MHz	QPSK	4.53
		16QAM	4.53
	3 MHz	QPSK	2.72
		16QAM	2.73
	1.4 MHz	QPSK	1.10
		16QAM	1.10
LTE Band 13	10 MHz	QPSK	9.01
		16QAM	9.02
	5 MHz	QPSK	4.53
		16QAM	4.53

Table 7-4. Occupied Bandwidth Test Results – Below 1GHz – Ant A

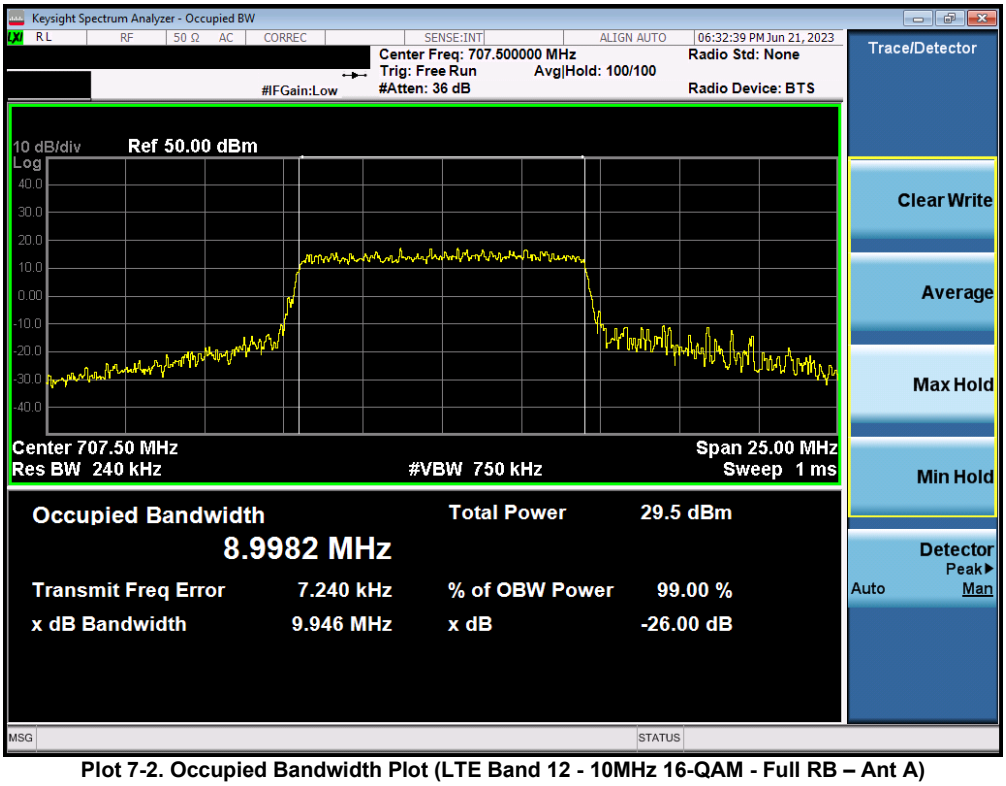
Mode	Bandwidth	Modulation	OBW [MHz]
LTE Band 66/4	20 MHz	QPSK	17.94
		16QAM	17.97
	15 MHz	QPSK	13.51
		16QAM	13.54
	10 MHz	QPSK	9.03
		16QAM	9.00
	5 MHz	QPSK	4.53
		16QAM	4.52
	3 MHz	QPSK	2.71
		16QAM	2.72
	1.4 MHz	QPSK	1.11
		16QAM	1.11
NR Band n66	40 MHz	π/2 BPSK	39.01
		QPSK	38.69
		16QAM	38.79
	30 MHz	π/2 BPSK	28.78
		QPSK	28.70
		16QAM	28.68
	25 MHz	π/2 BPSK	22.96
		QPSK	23.90
		16QAM	23.89
	20 MHz	π/2 BPSK	17.98
		QPSK	19.02
		16QAM	19.00
	15 MHz	π/2 BPSK	13.54
		QPSK	14.19
		16QAM	14.21
	10 MHz	π/2 BPSK	9.01
		QPSK	9.38
		16QAM	9.38
	5 MHz	π/2 BPSK	4.56
		QPSK	4.52
		16QAM	4.50

Table 7-5. Occupied Bandwidth Test Results – Above 1GHz – Ant A

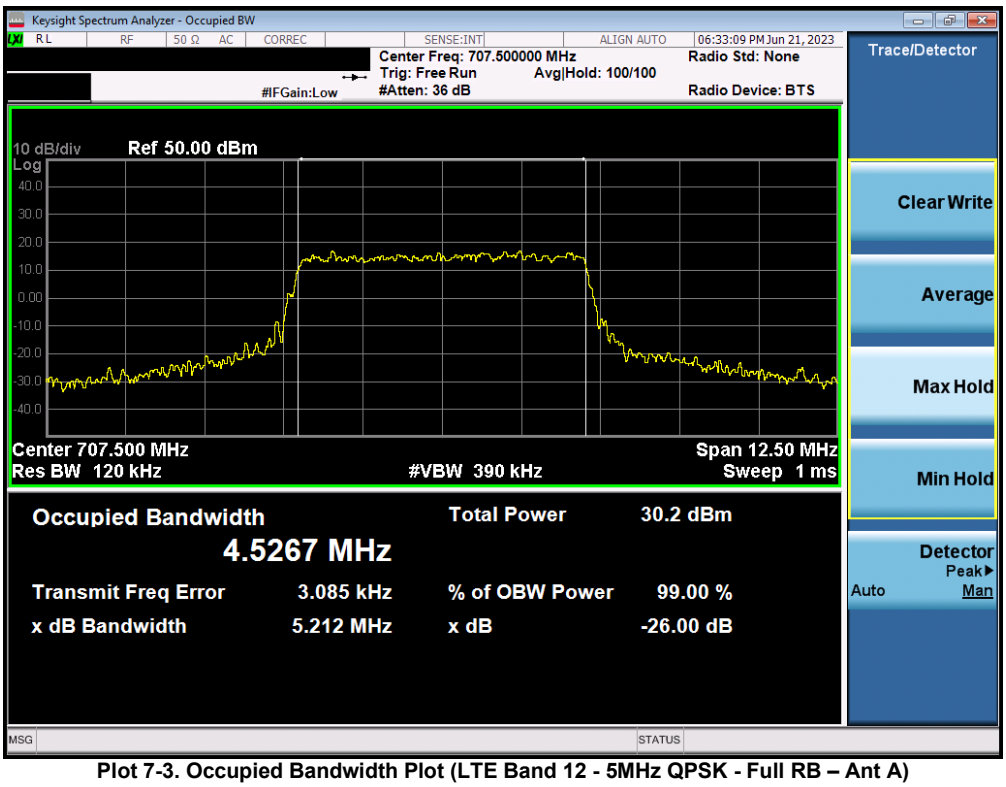
LTE Band 12 – Ant A



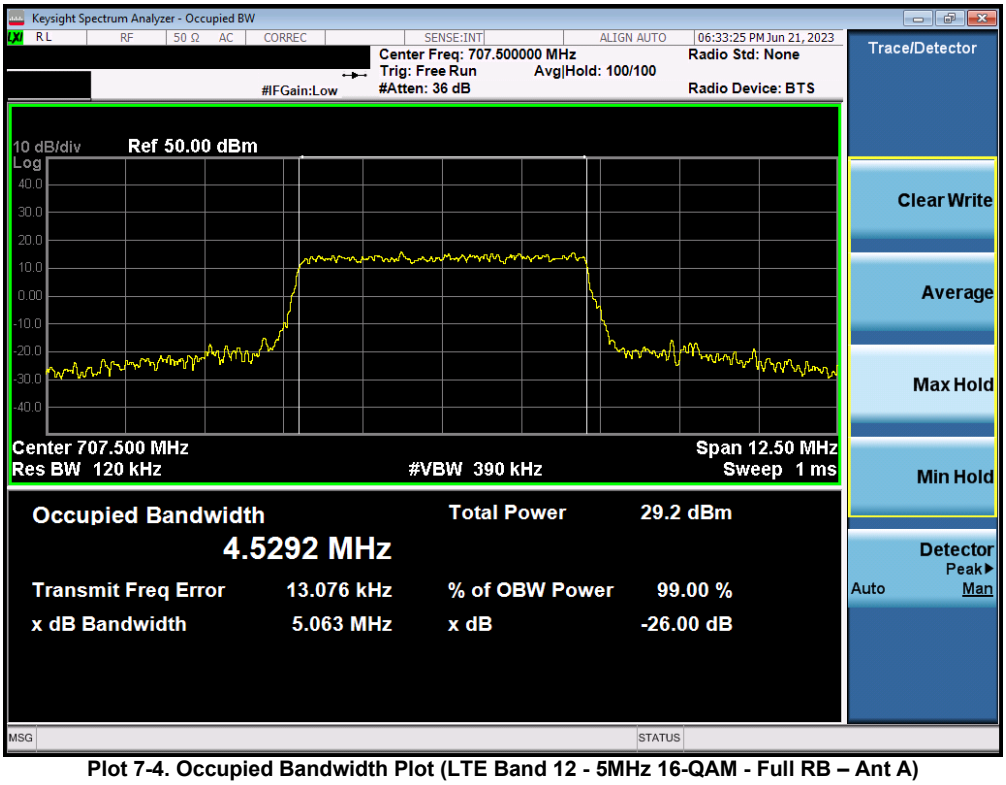
Plot 7-1. Occupied Bandwidth Plot (LTE Band 12 - 10MHz QPSK - Full RB – Ant A)



Plot 7-2. Occupied Bandwidth Plot (LTE Band 12 - 10MHz 16-QAM - Full RB – Ant A)

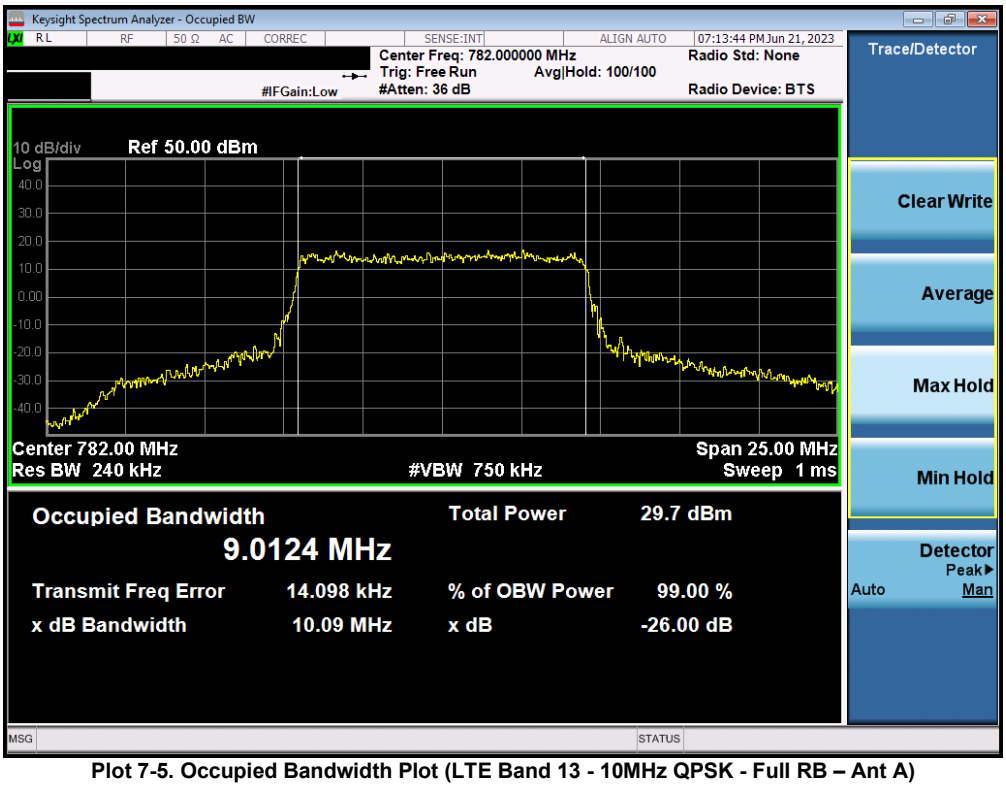


Plot 7-3. Occupied Bandwidth Plot (LTE Band 12 - 5MHz QPSK - Full RB – Ant A)

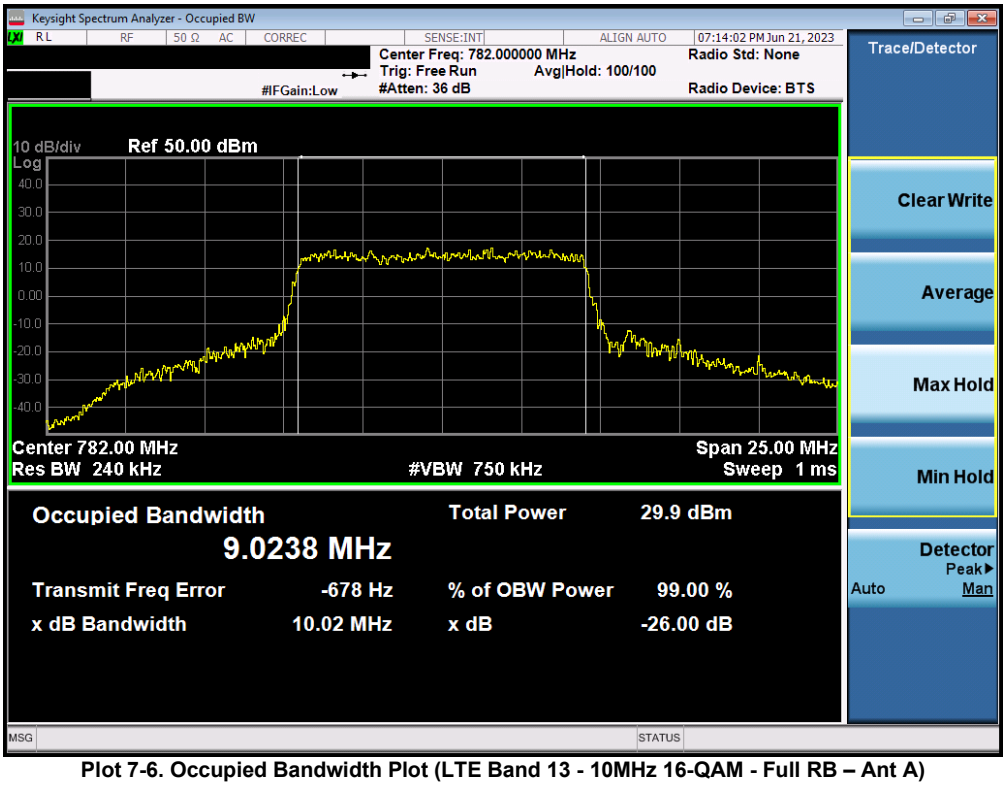


Plot 7-4. Occupied Bandwidth Plot (LTE Band 12 - 5MHz 16-QAM - Full RB – Ant A)

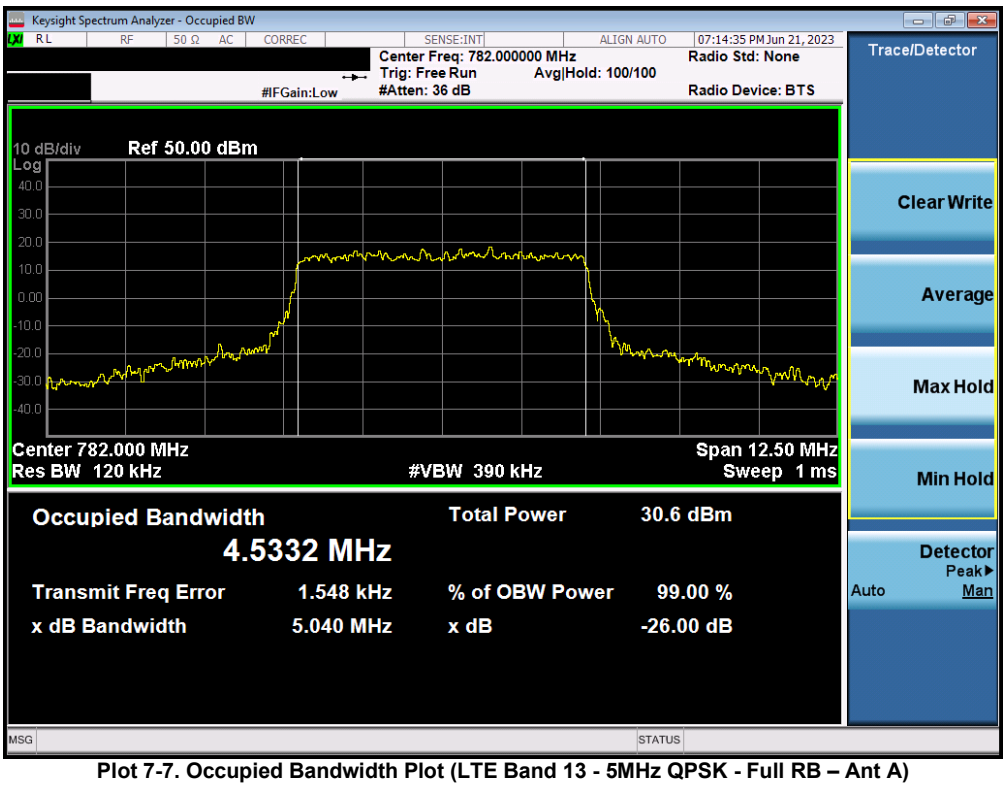
LTE Band 13 – Ant A



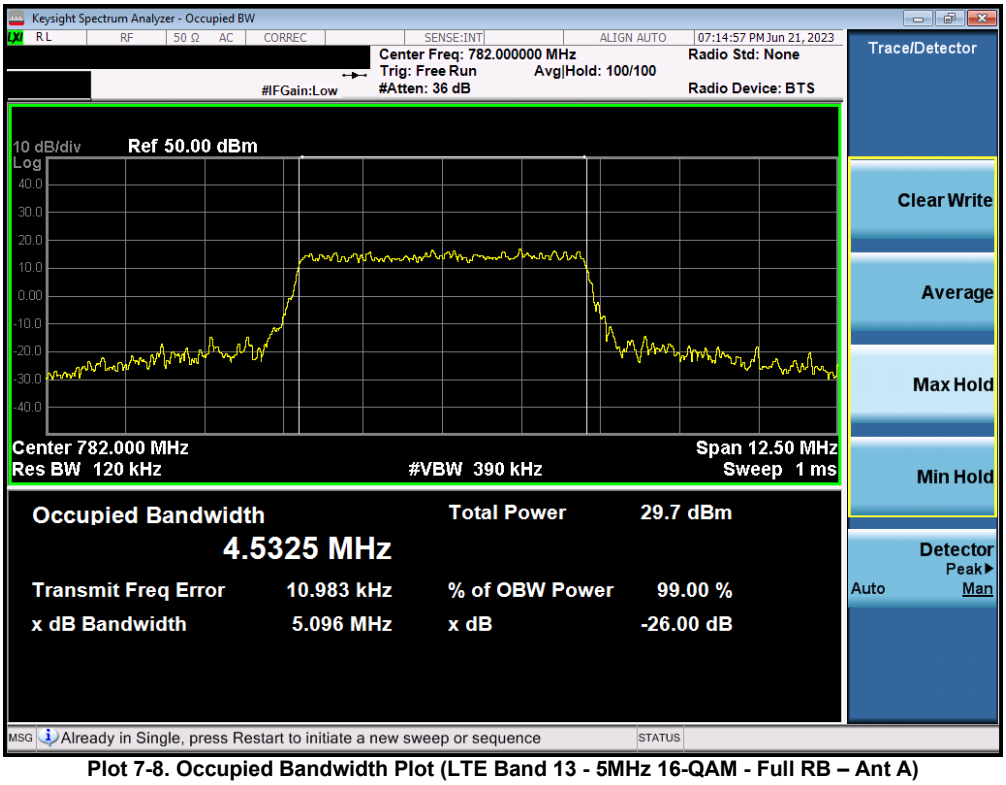
Plot 7-5. Occupied Bandwidth Plot (LTE Band 13 - 10MHz QPSK - Full RB – Ant A)



Plot 7-6. Occupied Bandwidth Plot (LTE Band 13 - 10MHz 16-QAM - Full RB – Ant A)

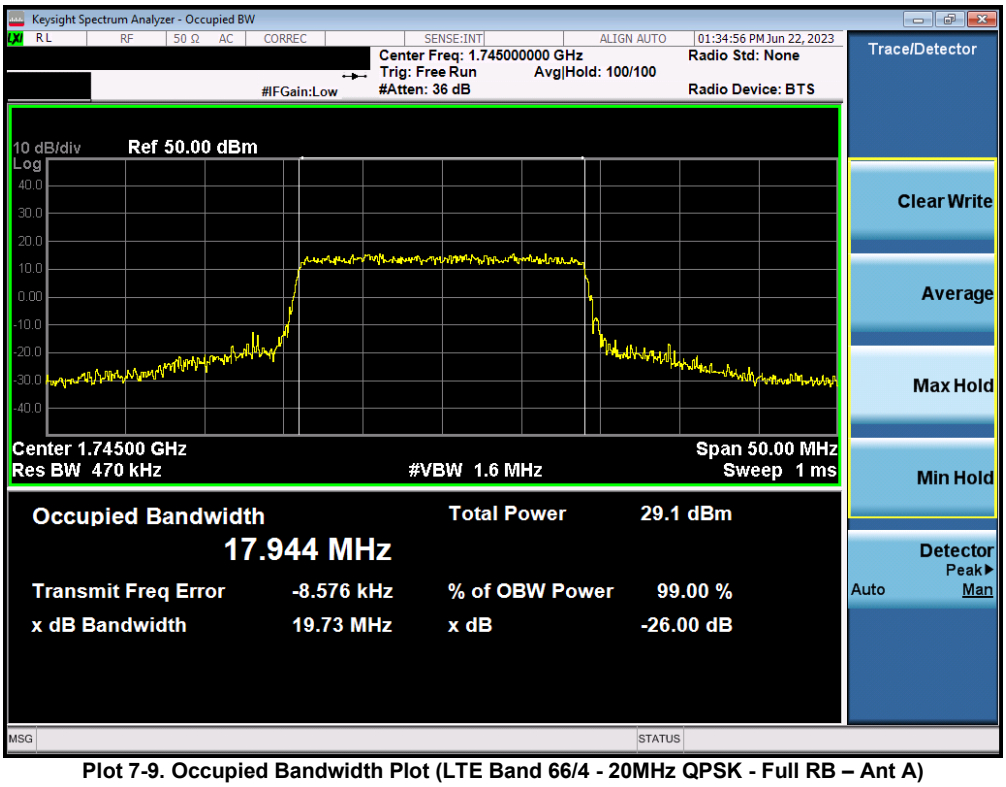


Plot 7-7. Occupied Bandwidth Plot (LTE Band 13 - 5MHz QPSK - Full RB – Ant A)

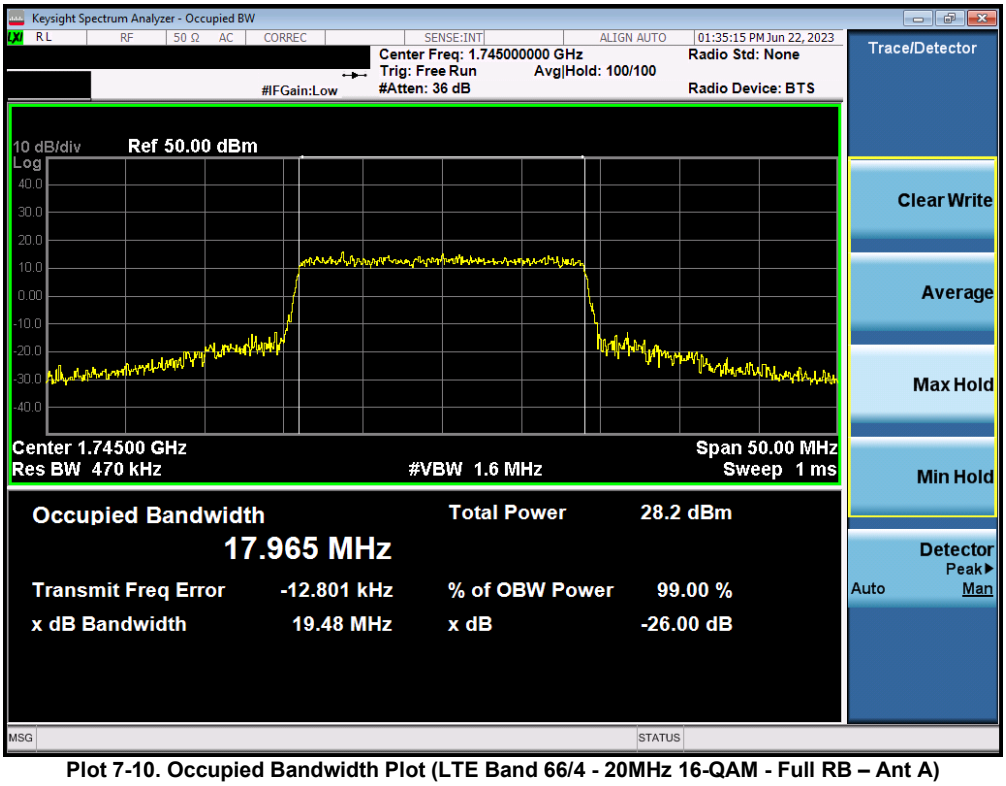


Plot 7-8. Occupied Bandwidth Plot (LTE Band 13 - 5MHz 16-QAM - Full RB – Ant A)

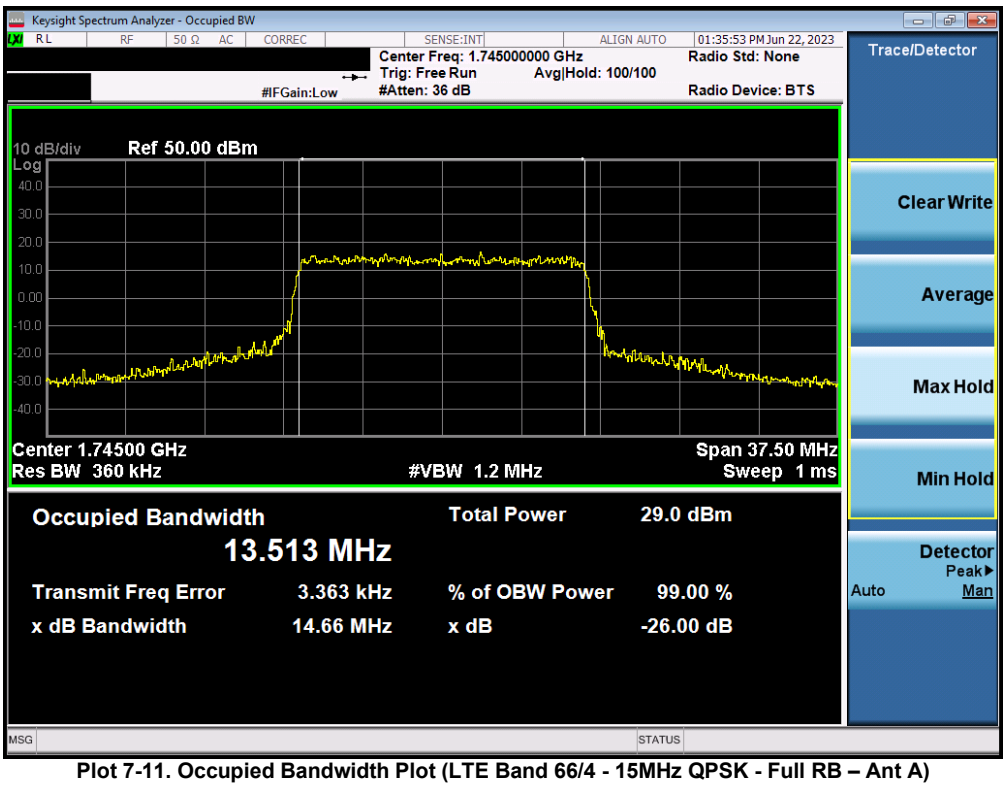
LTE Band 66/4 – Ant A



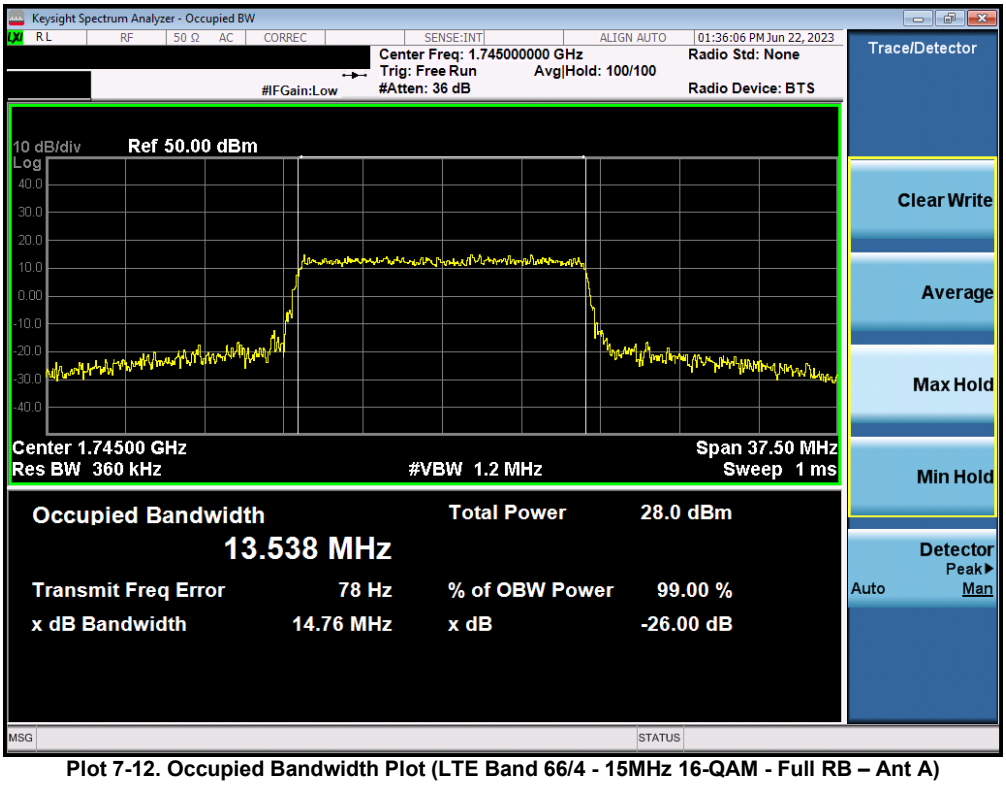
Plot 7-9. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz QPSK - Full RB – Ant A)



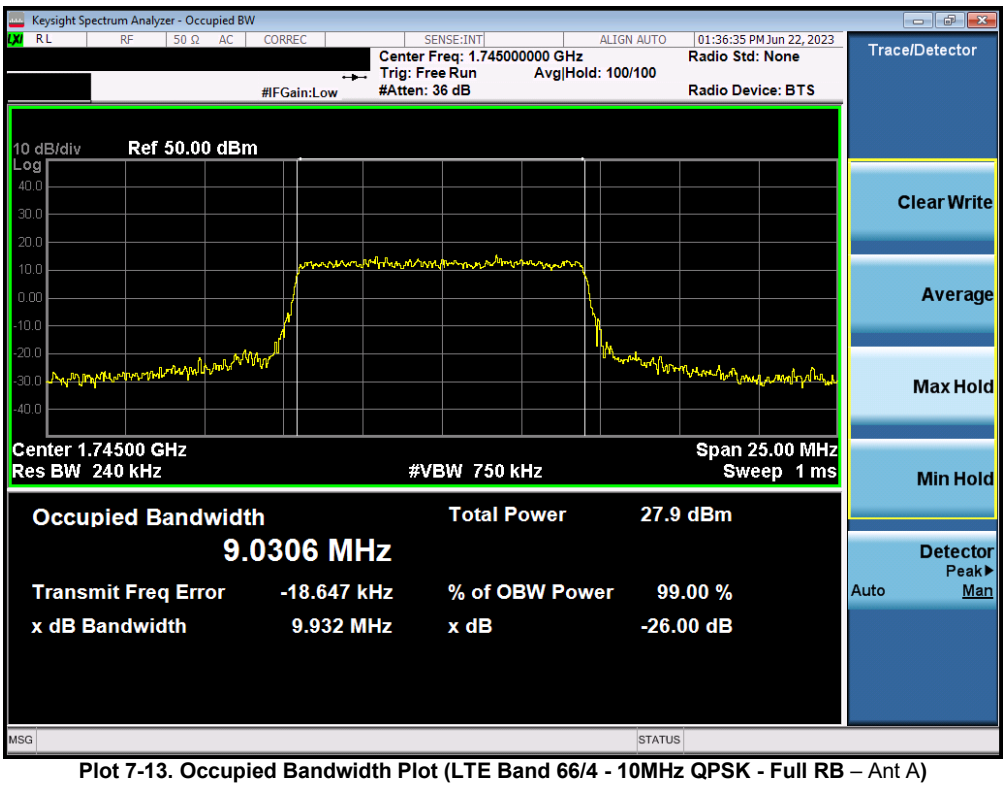
Plot 7-10. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz 16-QAM - Full RB – Ant A)



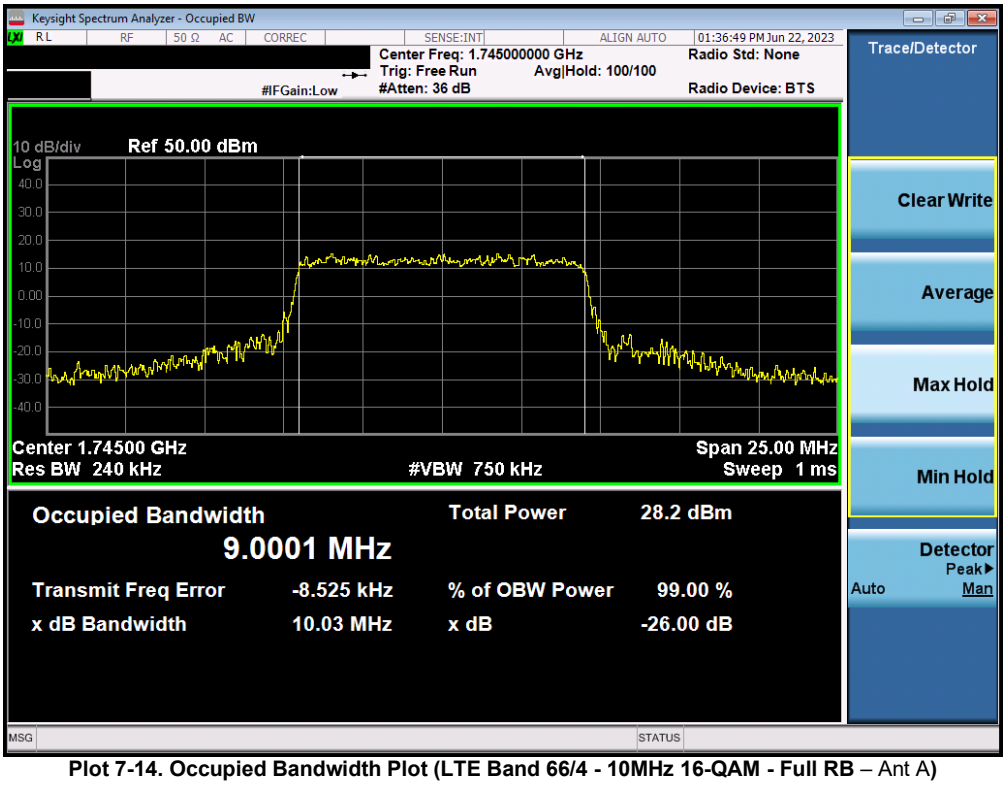
Plot 7-11. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz QPSK - Full RB – Ant A)



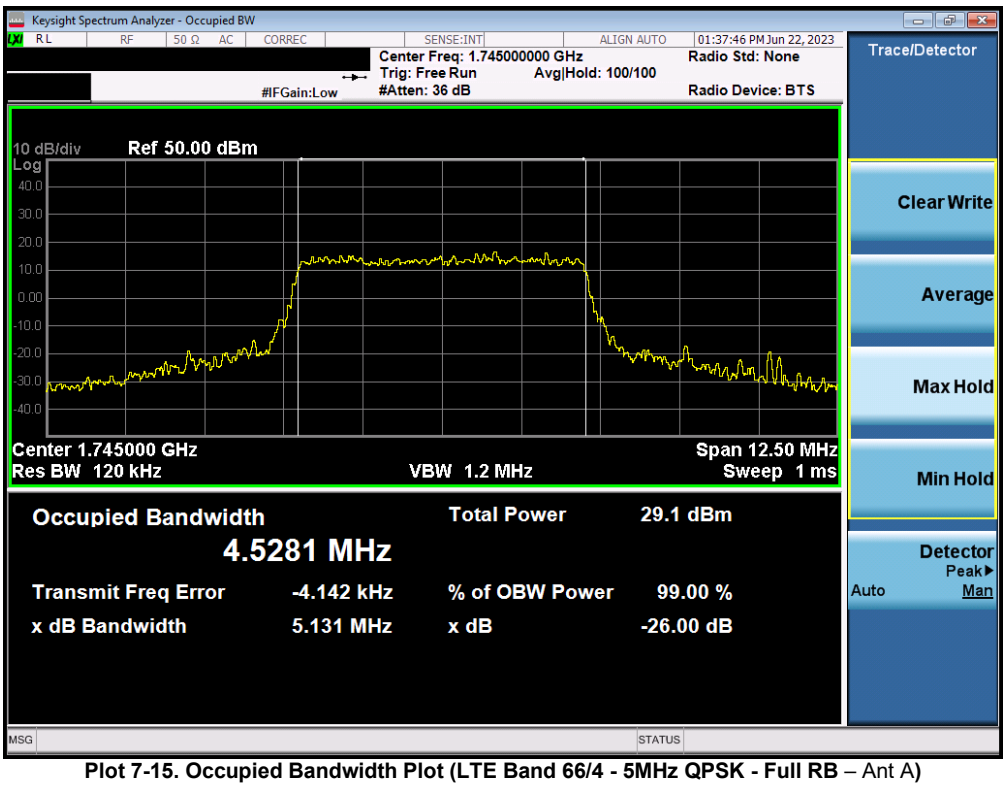
Plot 7-12. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz 16-QAM - Full RB – Ant A)



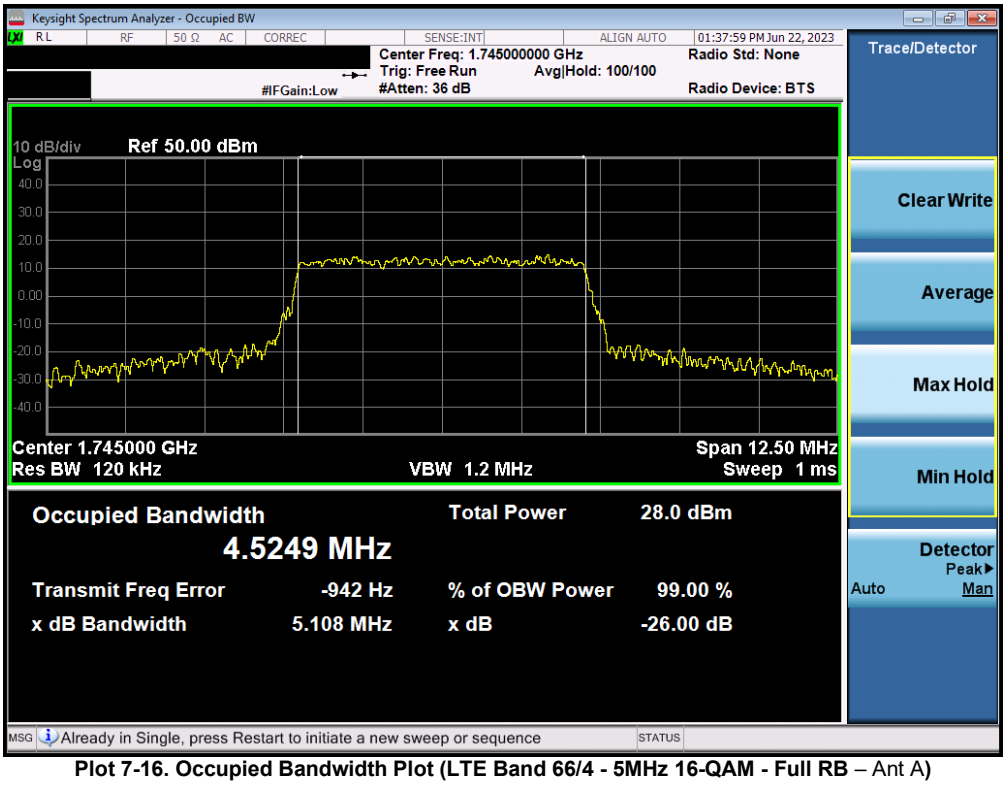
Plot 7-13. Occupied Bandwidth Plot (LTE Band 66/4 - 10MHz QPSK - Full RB – Ant A)



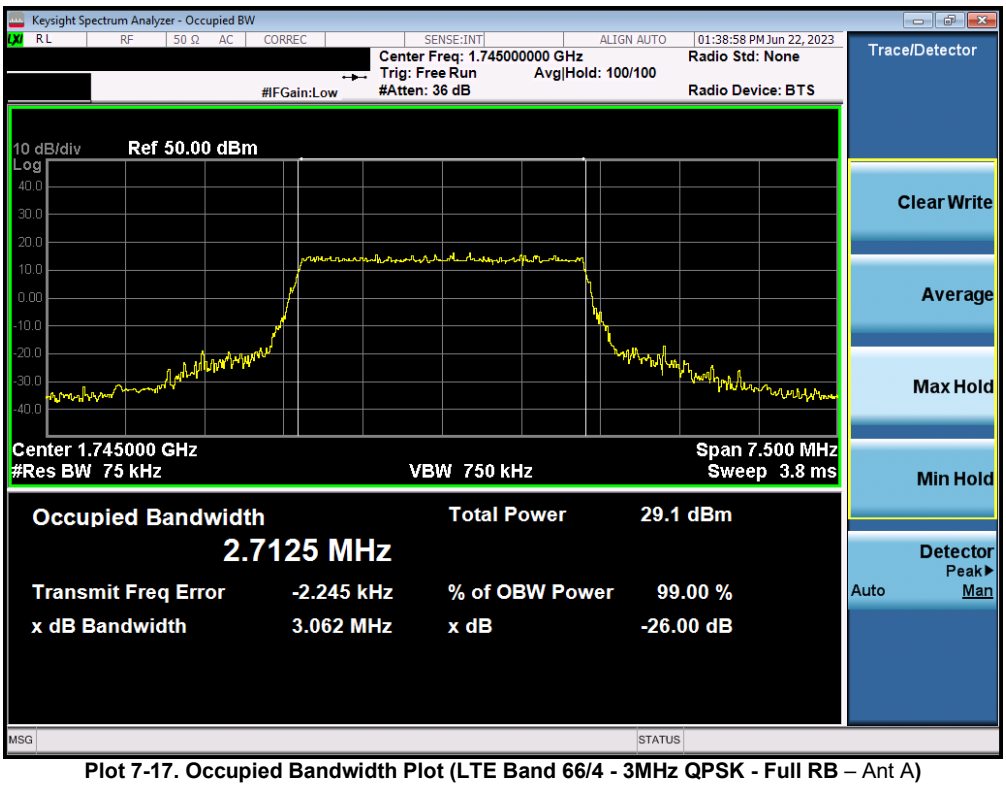
Plot 7-14. Occupied Bandwidth Plot (LTE Band 66/4 - 10MHz 16-QAM - Full RB – Ant A)



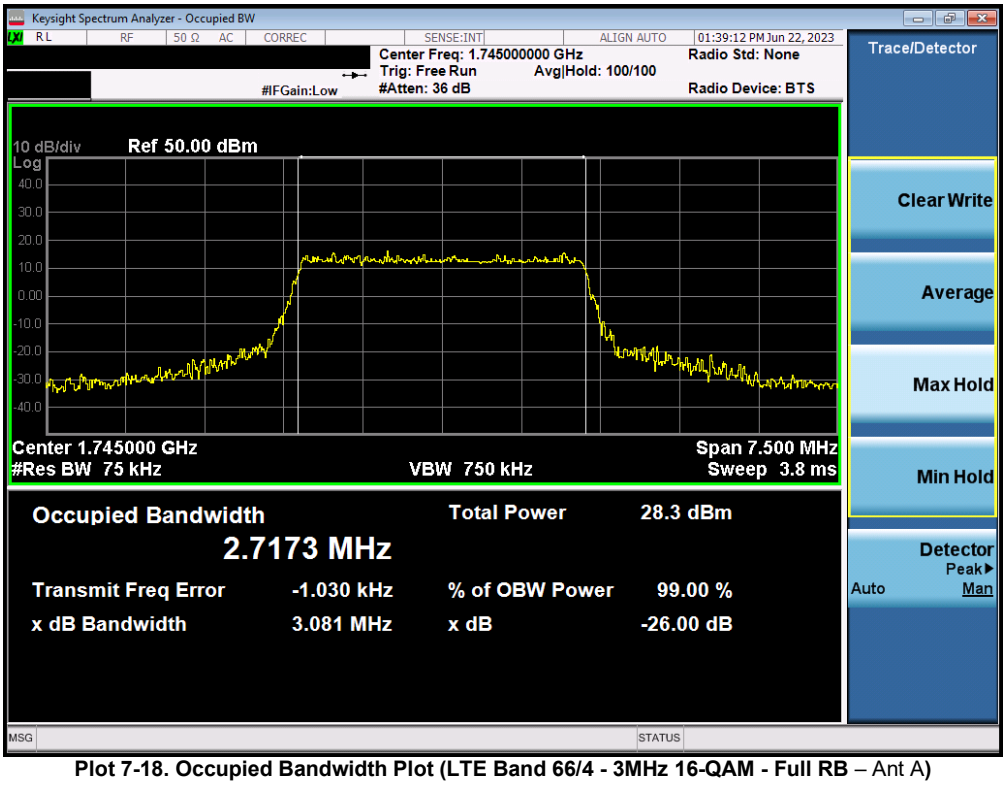
Plot 7-15. Occupied Bandwidth Plot (LTE Band 66/4 - 5MHz QPSK - Full RB – Ant A)



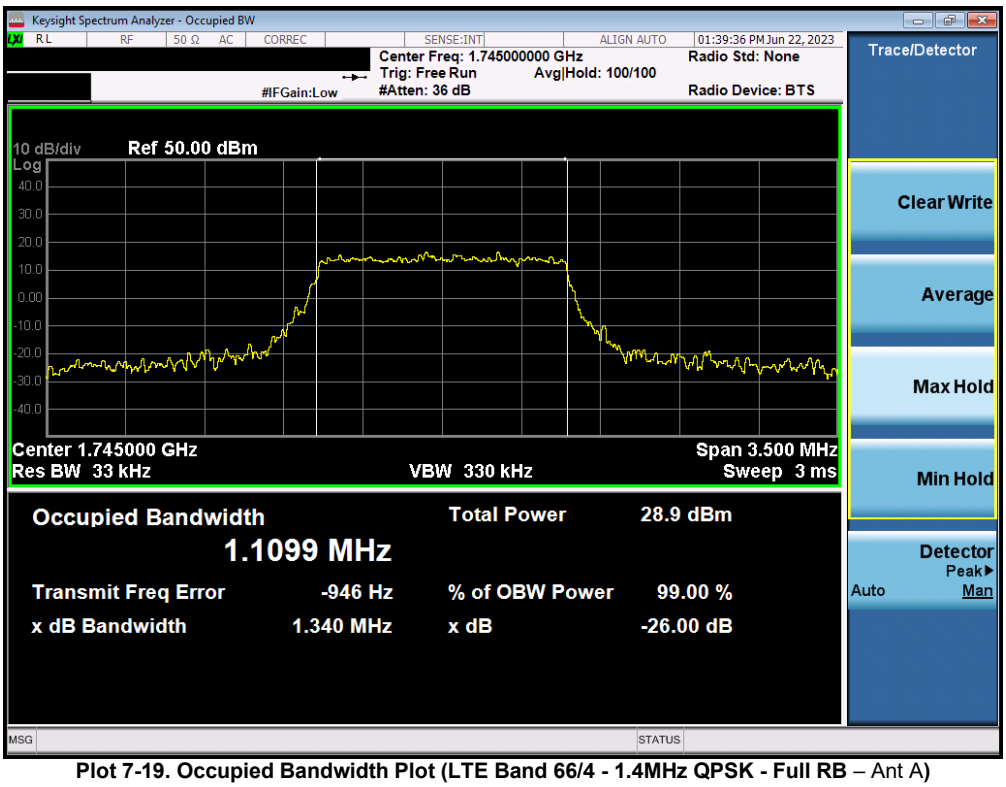
Plot 7-16. Occupied Bandwidth Plot (LTE Band 66/4 - 5MHz 16-QAM - Full RB – Ant A)



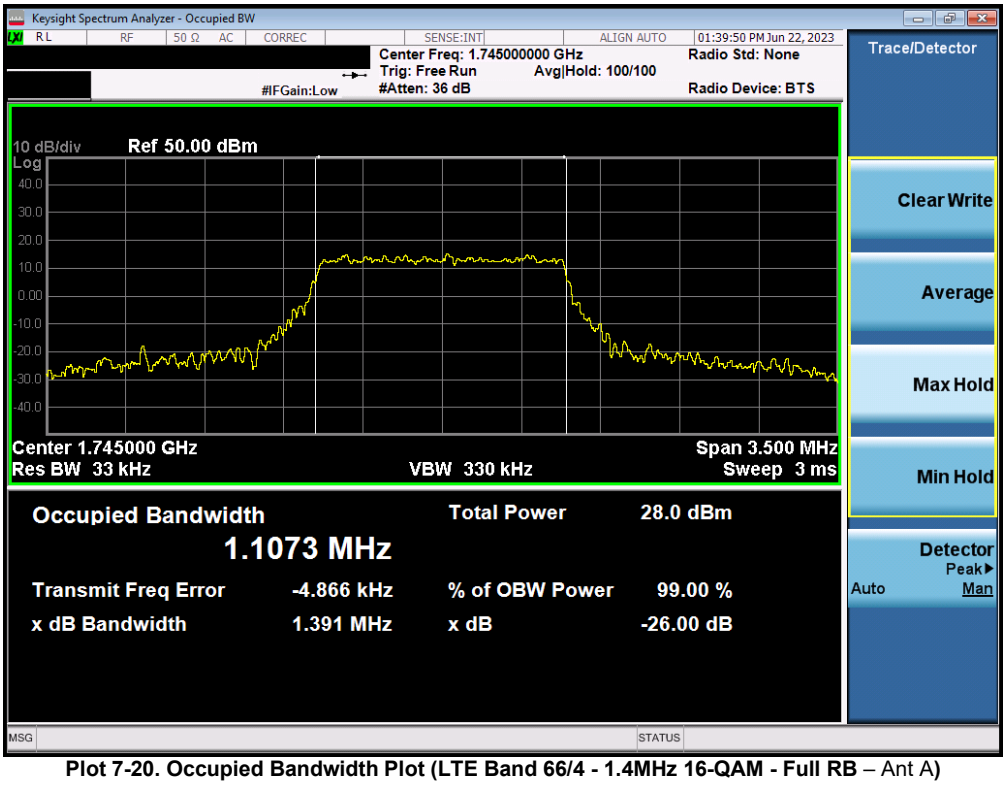
Plot 7-17. Occupied Bandwidth Plot (LTE Band 66/4 - 3MHz QPSK - Full RB – Ant A)



Plot 7-18. Occupied Bandwidth Plot (LTE Band 66/4 - 3MHz 16-QAM - Full RB – Ant A)

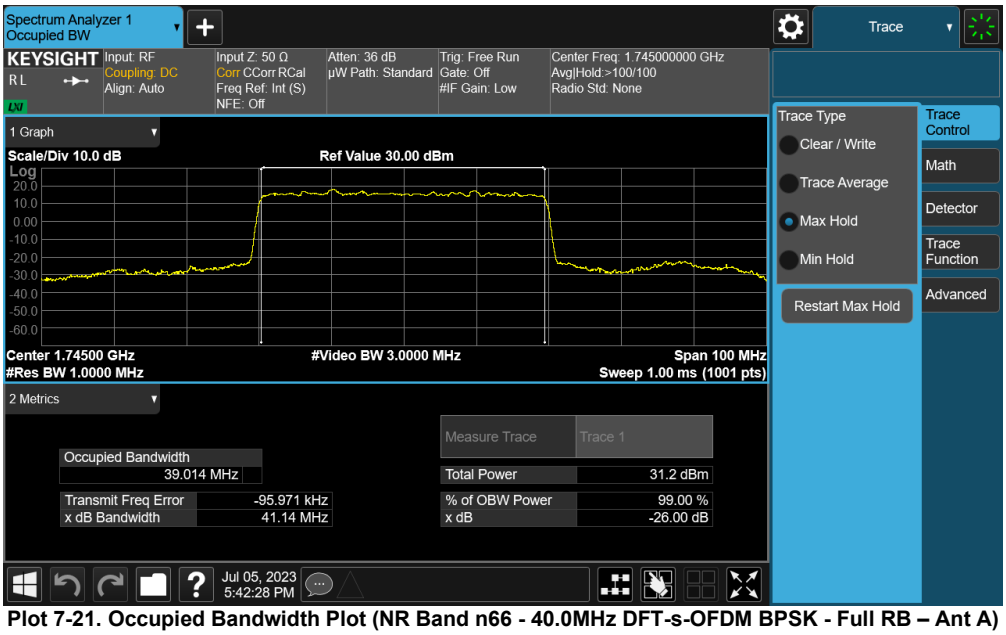


Plot 7-19. Occupied Bandwidth Plot (LTE Band 66/4 - 1.4MHz QPSK - Full RB – Ant A)

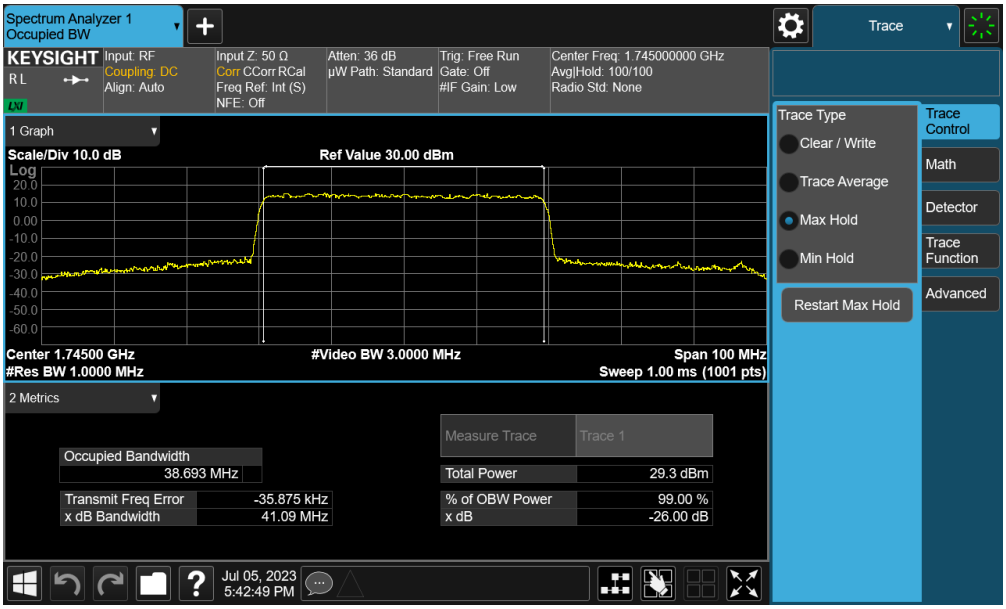


Plot 7-20. Occupied Bandwidth Plot (LTE Band 66/4 - 1.4MHz 16-QAM - Full RB – Ant A)

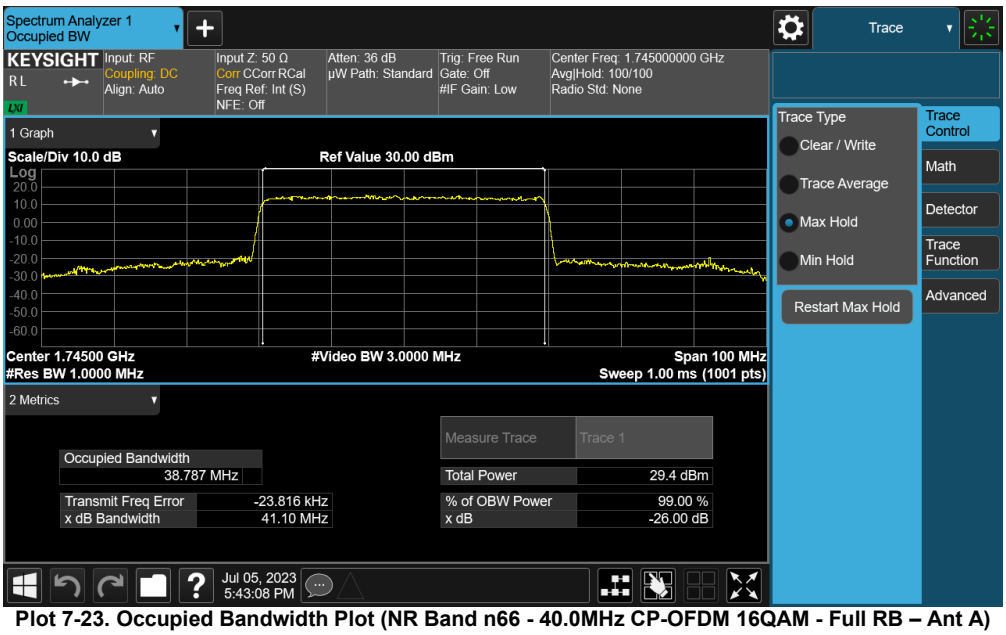
NR Band n66 – Ant A



Plot 7-21. Occupied Bandwidth Plot (NR Band n66 - 40.0MHz DFT-s-OFDM BPSK - Full RB – Ant A)

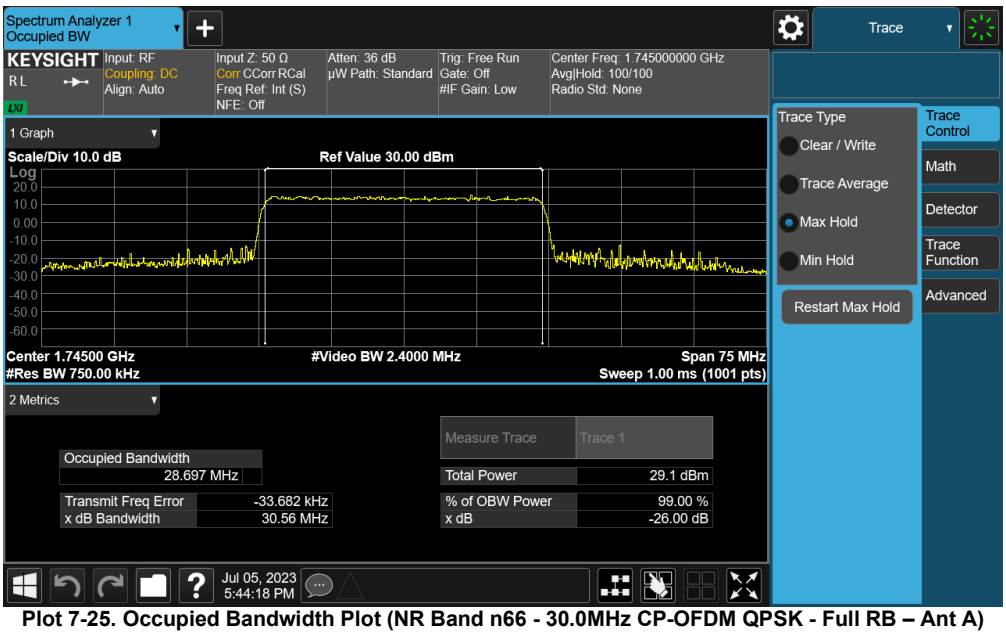


Plot 7-22. Occupied Bandwidth Plot (NR Band n66 - 40.0MHz CP-OFDM QPSK - Full RB – Ant A)

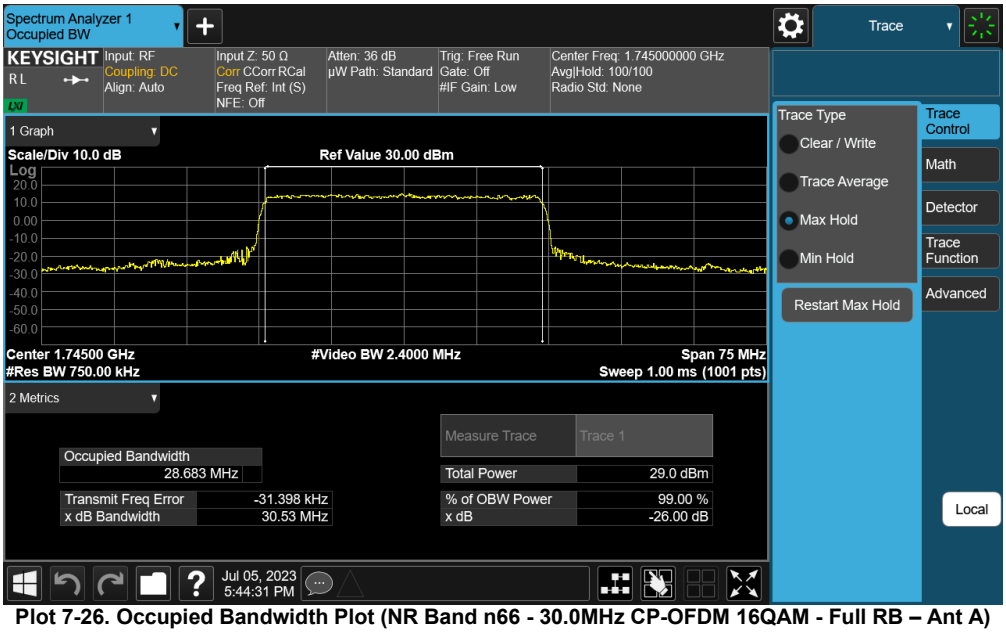


Plot 7-23. Occupied Bandwidth Plot (NR Band n66 - 40.0MHz CP-OFDM 16QAM - Full RB – Ant A)

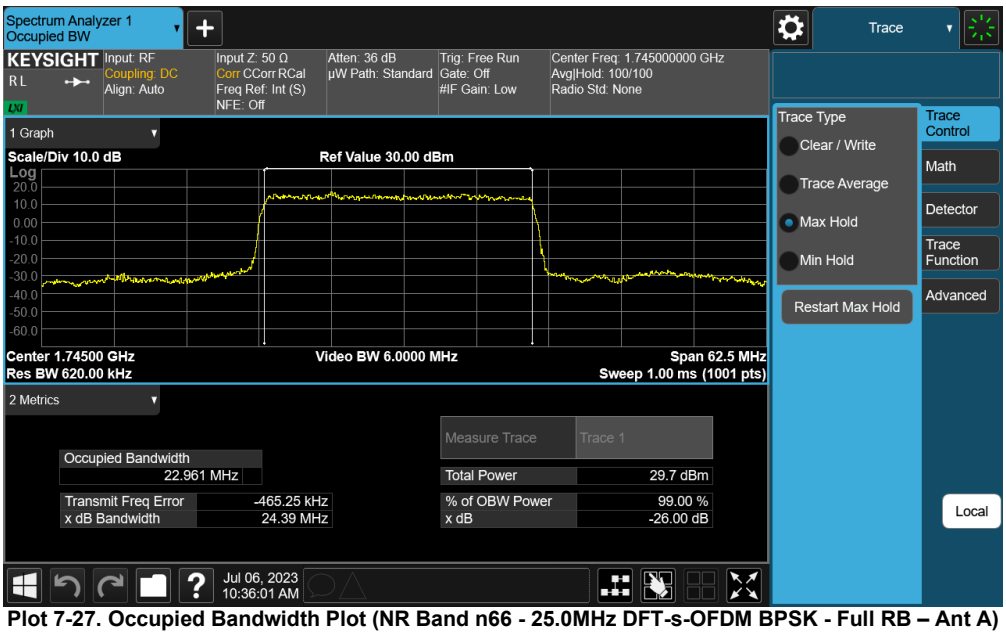
Plot 7-24. Occupied Bandwidth Plot (NR Band n66 - 30.0MHz DFT-s-OFDM BPSK - Full RB – Ant A)



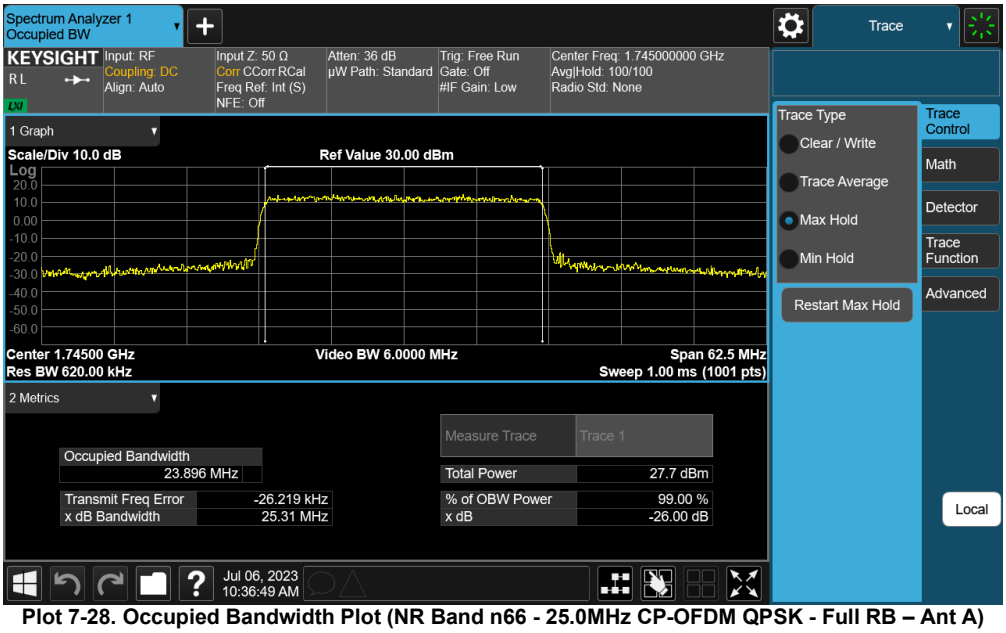
Plot 7-25. Occupied Bandwidth Plot (NR Band n66 - 30.0MHz CP-OFDM QPSK - Full RB – Ant A)



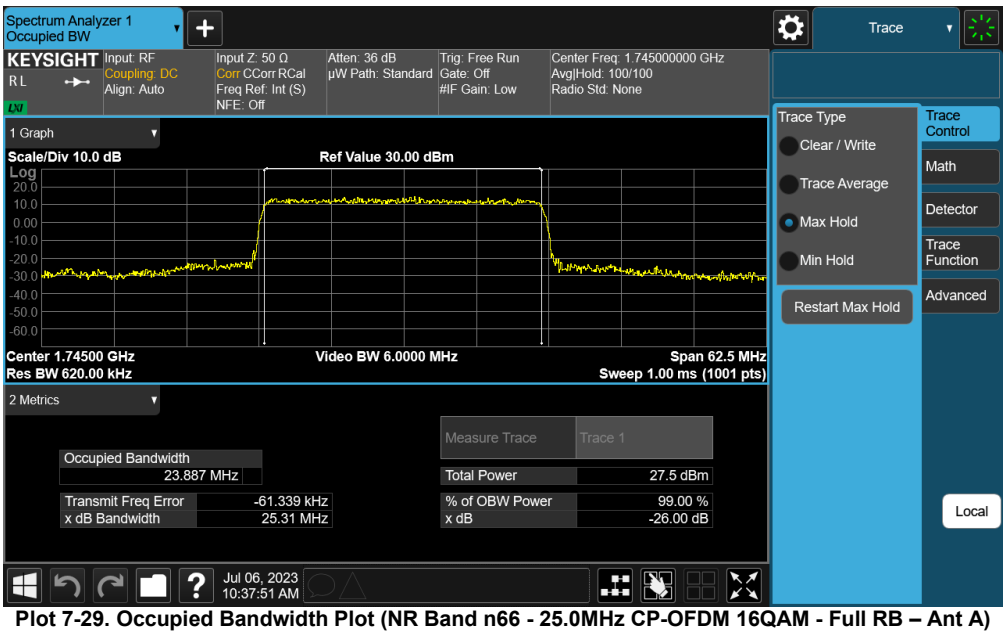
Plot 7-26. Occupied Bandwidth Plot (NR Band n66 - 30.0MHz CP-OFDM 16QAM - Full RB – Ant A)



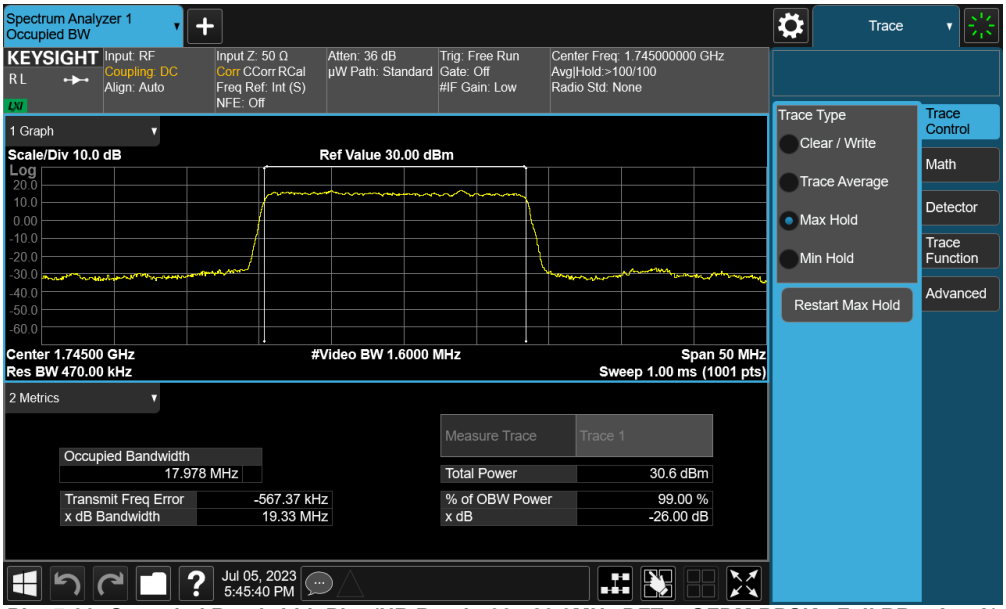
Plot 7-27. Occupied Bandwidth Plot (NR Band n66 - 25.0MHz DFT-s-OFDM BPSK - Full RB – Ant A)



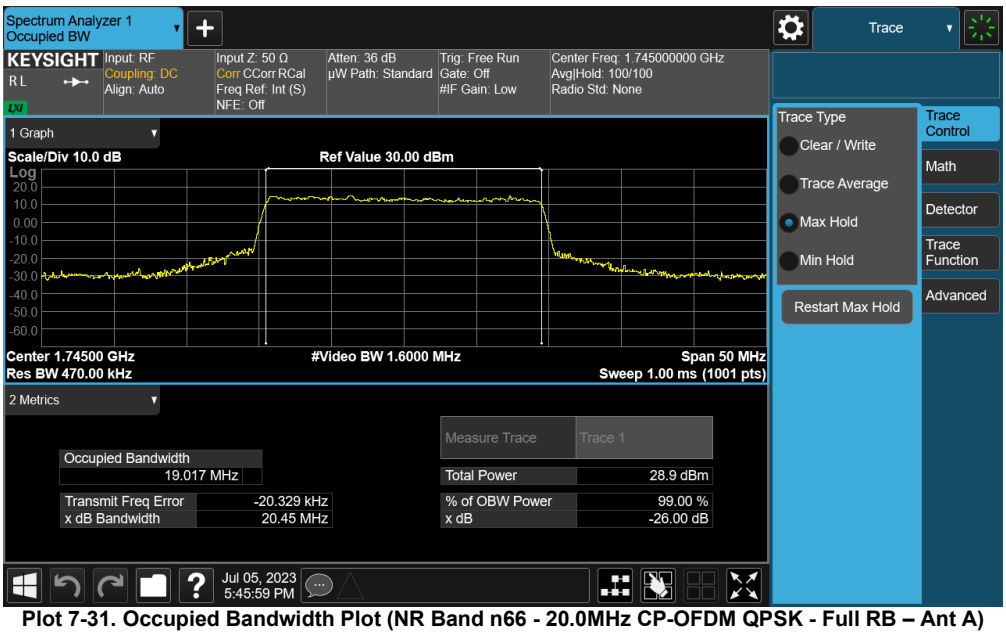
Plot 7-28. Occupied Bandwidth Plot (NR Band n66 - 25.0MHz CP-OFDM QPSK - Full RB – Ant A)



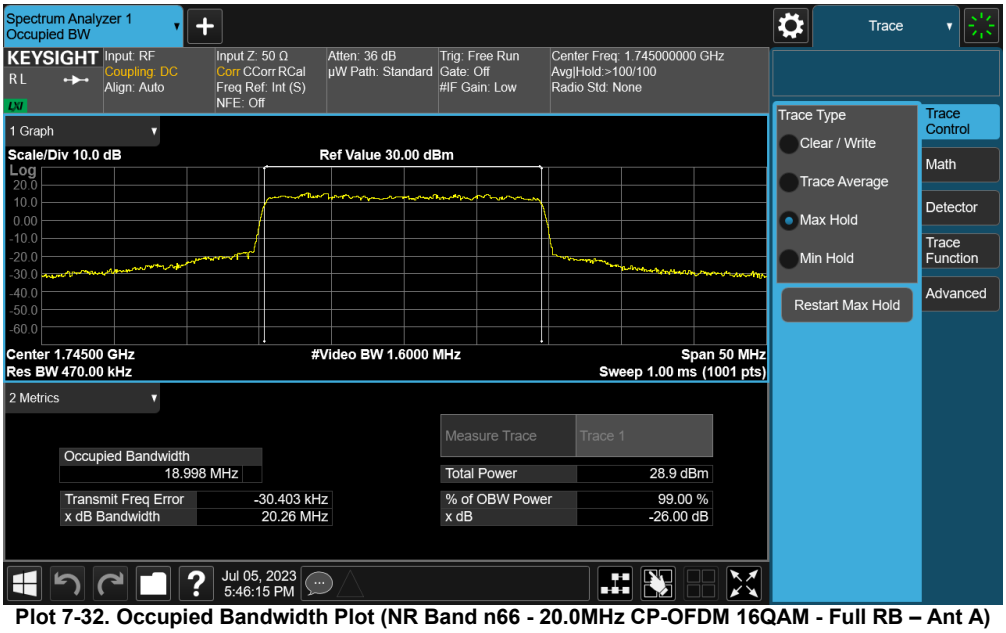
Plot 7-29. Occupied Bandwidth Plot (NR Band n66 - 25.0MHz CP-OFDM 16QAM - Full RB – Ant A)



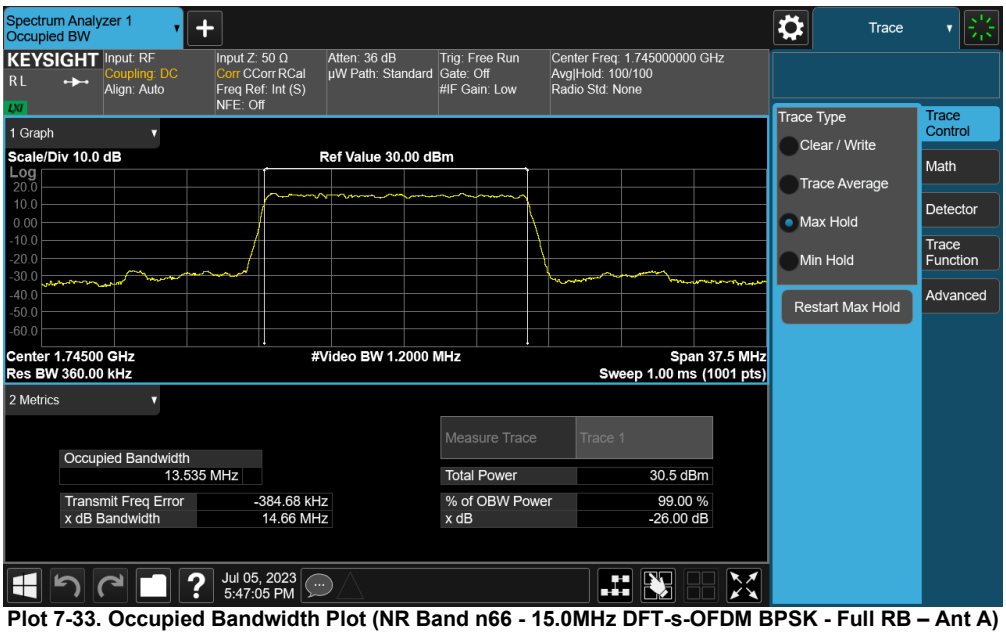
Plot 7-30. Occupied Bandwidth Plot (NR Band n66 - 20.0MHz DFT-s-OFDM BPSK - Full RB – Ant A)



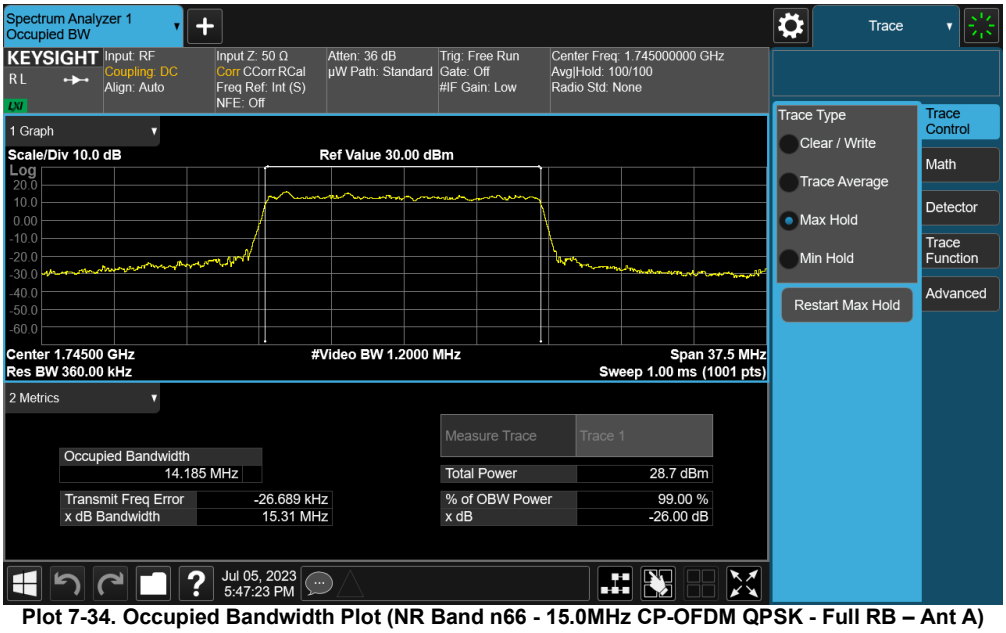
Plot 7-31. Occupied Bandwidth Plot (NR Band n66 - 20.0MHz CP-OFDM QPSK - Full RB – Ant A)



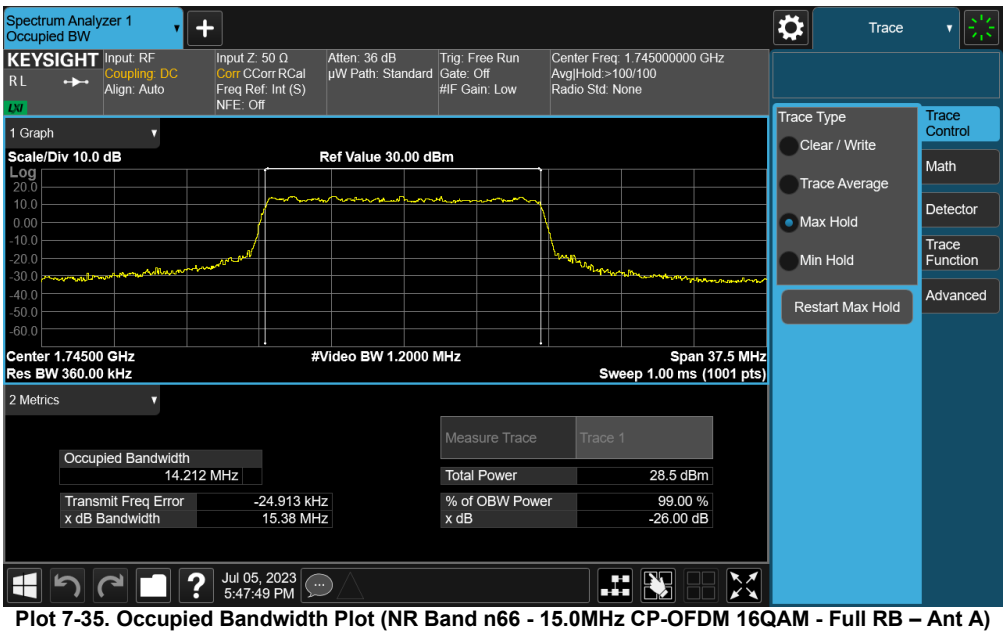
Plot 7-32. Occupied Bandwidth Plot (NR Band n66 - 20.0MHz CP-OFDM 16QAM - Full RB – Ant A)



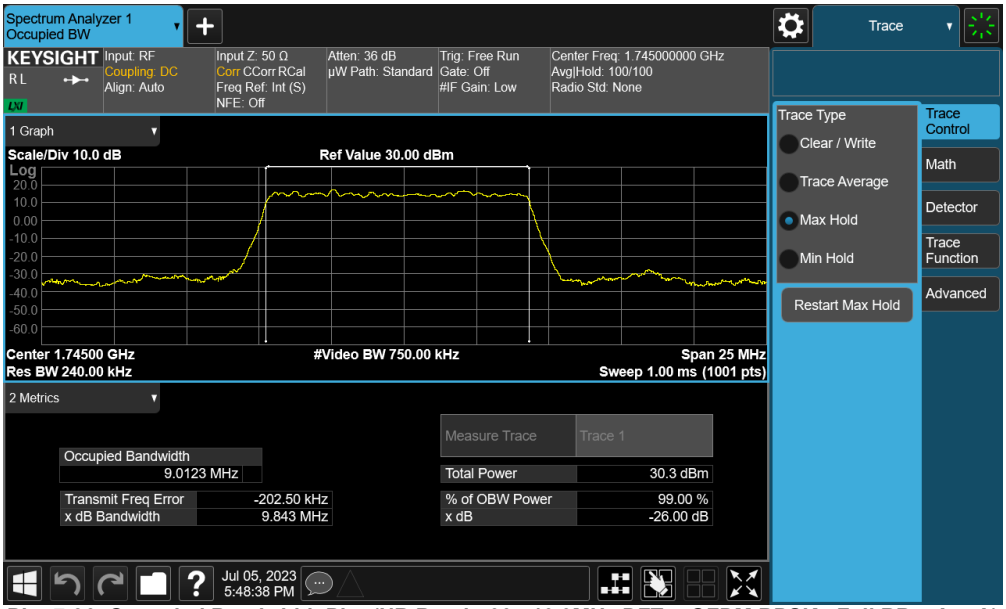
Plot 7-33. Occupied Bandwidth Plot (NR Band n66 - 15.0MHz DFT-s-OFDM BPSK - Full RB – Ant A)



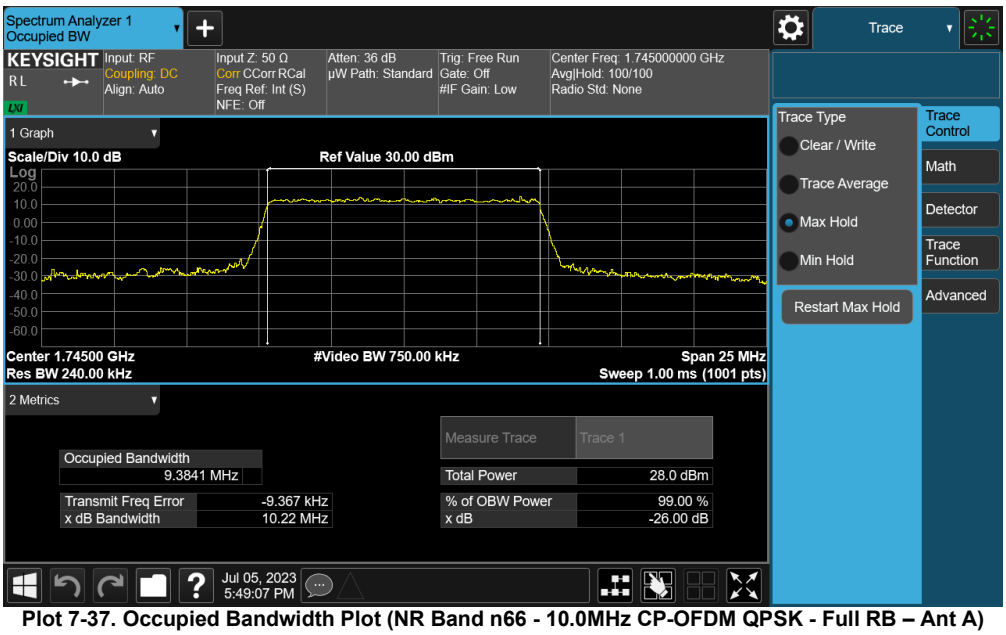
Plot 7-34. Occupied Bandwidth Plot (NR Band n66 - 15.0MHz CP-OFDM QPSK - Full RB – Ant A)



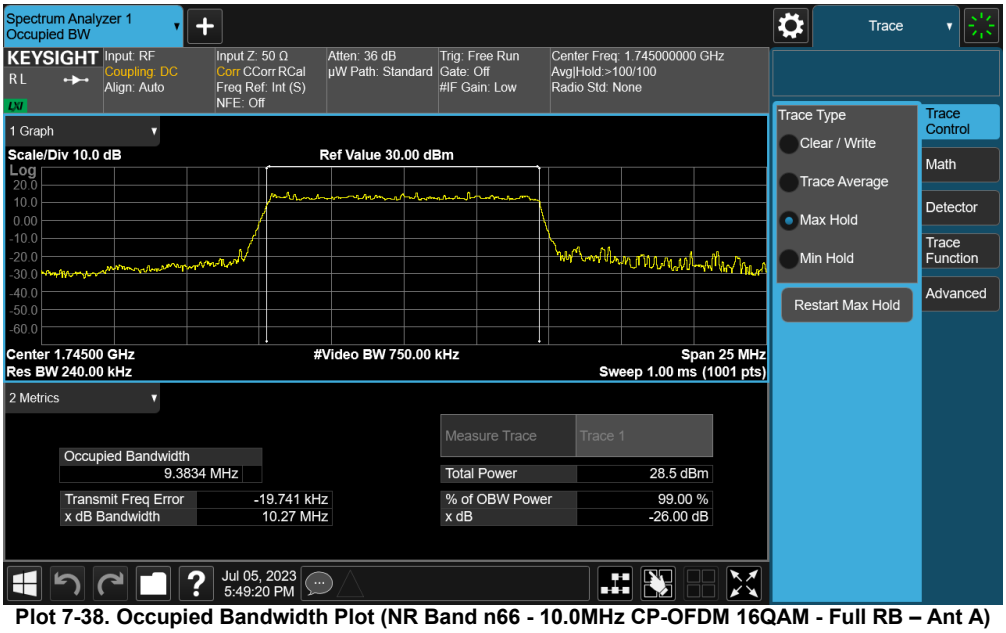
Plot 7-35. Occupied Bandwidth Plot (NR Band n66 - 15.0MHz CP-OFDM 16QAM - Full RB – Ant A)



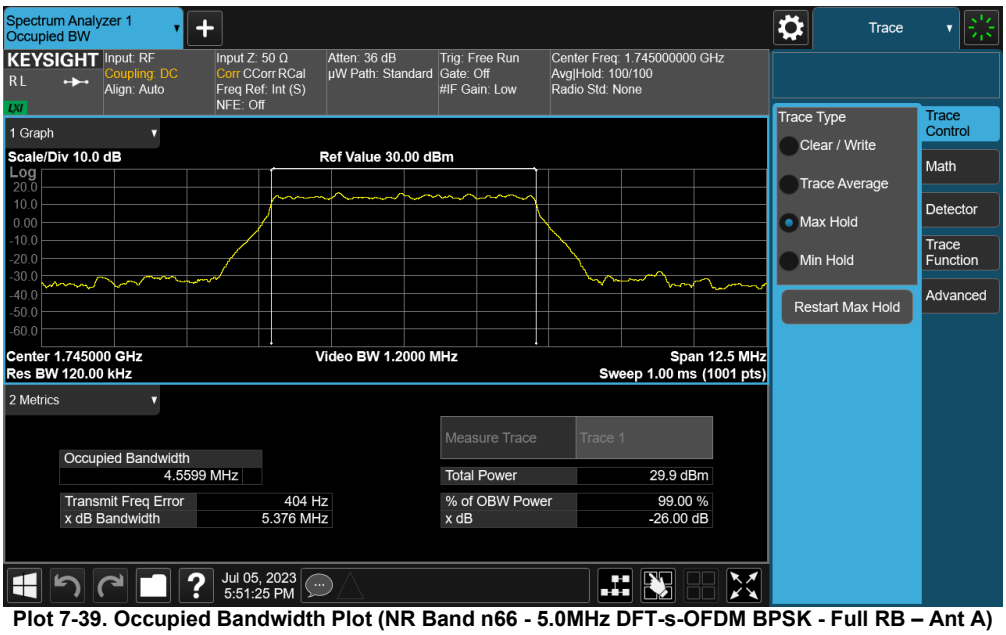
Plot 7-36. Occupied Bandwidth Plot (NR Band n66 - 10.0MHz DFT-s-OFDM BPSK - Full RB – Ant A)



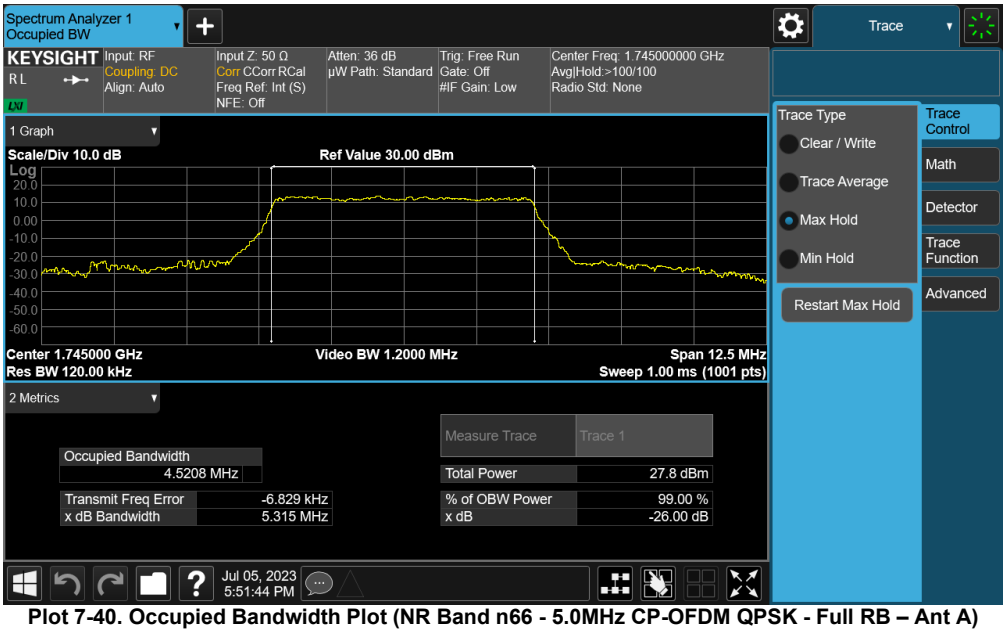
Plot 7-37. Occupied Bandwidth Plot (NR Band n66 - 10.0MHz CP-OFDM QPSK - Full RB – Ant A)



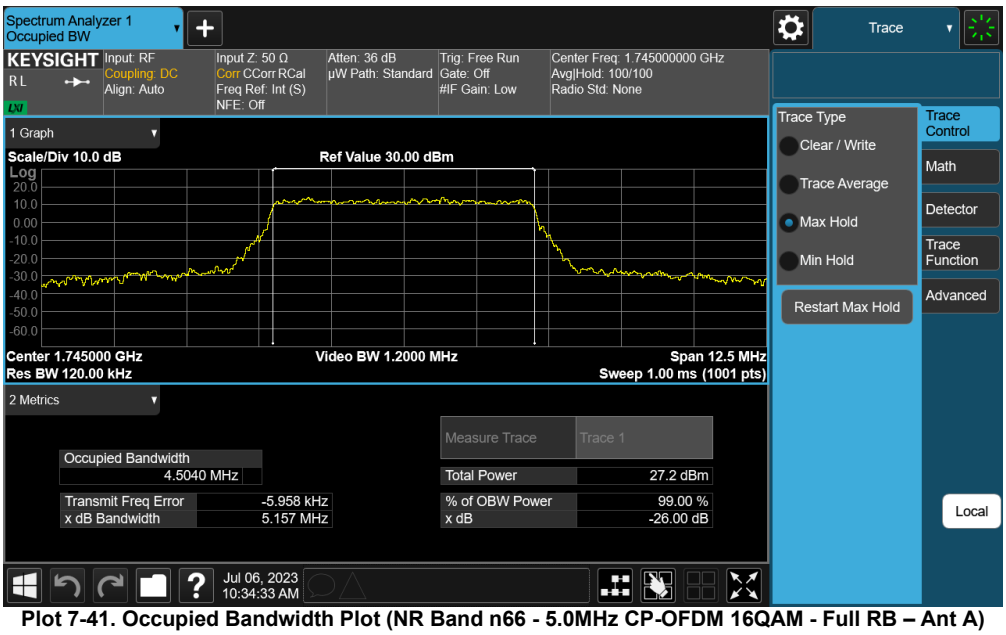
Plot 7-38. Occupied Bandwidth Plot (NR Band n66 - 10.0MHz CP-OFDM 16QAM - Full RB – Ant A)



Plot 7-39. Occupied Bandwidth Plot (NR Band n66 - 5.0MHz DFT-s-OFDM BPSK - Full RB – Ant A)



Plot 7-40. Occupied Bandwidth Plot (NR Band n66 - 5.0MHz CP-OFDM QPSK - Full RB – Ant A)

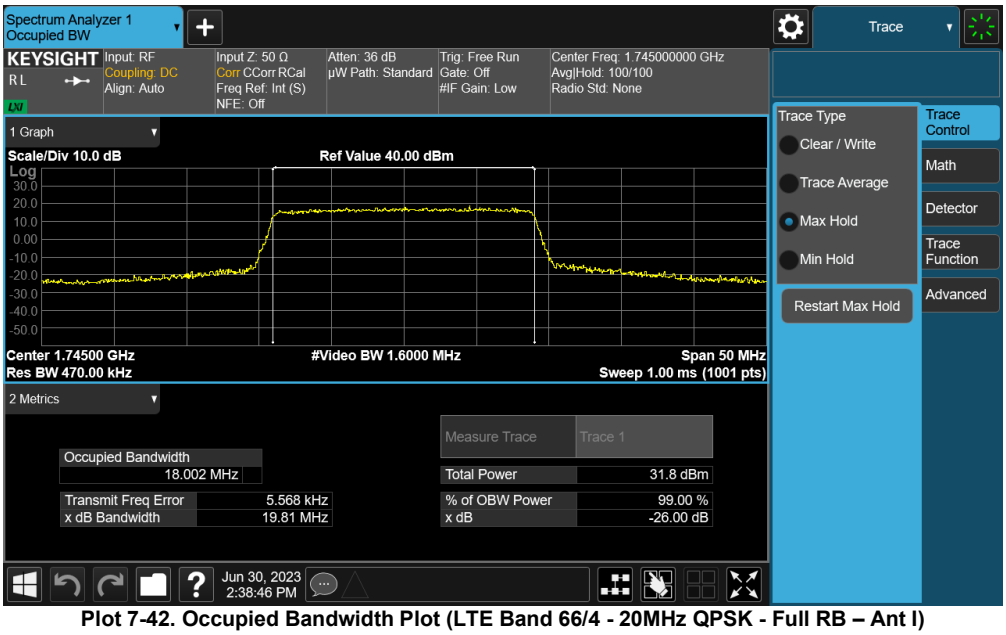


Plot 7-41. Occupied Bandwidth Plot (NR Band n66 - 5.0MHz CP-OFDM 16QAM - Full RB – Ant A)

Mode	Bandwidth	Modulation	OBW [MHz]
LTE Band 66/4	20 MHz	QPSK	18.00
		16QAM	18.03
	15 MHz	QPSK	13.54
		16QAM	13.53
	10 MHz	QPSK	9.04
		16QAM	9.04
	5 MHz	QPSK	4.55
		16QAM	4.54
	3 MHz	QPSK	2.73
		16QAM	2.73
	1.4 MHz	QPSK	1.11
		16QAM	1.11
NR Band n66	40 MHz	π/2 BPSK	38.71
		QPSK	39.08
		16QAM	39.04
	30 MHz	π/2 BPSK	28.72
		QPSK	29.01
		16QAM	29.07
	25 MHz	π/2 BPSK	23.01
		QPSK	24.06
		16QAM	24.10
	20 MHz	π/2 BPSK	18.04
		QPSK	19.31
		16QAM	19.31
	15 MHz	π/2 BPSK	13.66
		QPSK	14.57
		16QAM	14.47
	10 MHz	π/2 BPSK	9.12
		QPSK	9.59
		16QAM	9.63
	5 MHz	π/2 BPSK	4.60
		QPSK	4.72
		16QAM	4.66

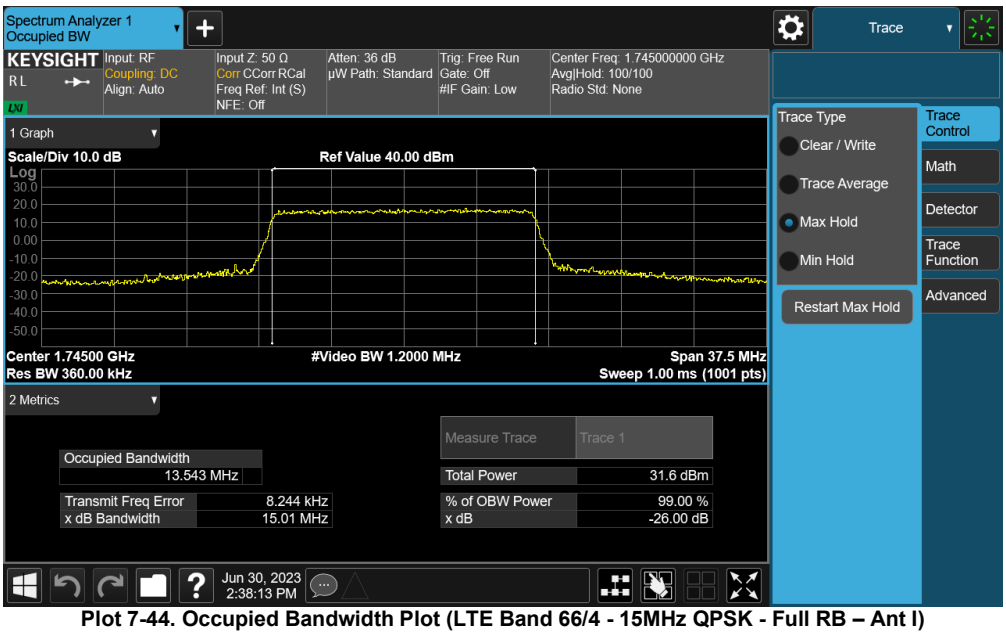
Table 7-6. Occupied Bandwidth Test Results – Above 1GHz – Ant I

LTE Band 66/4 – Ant I

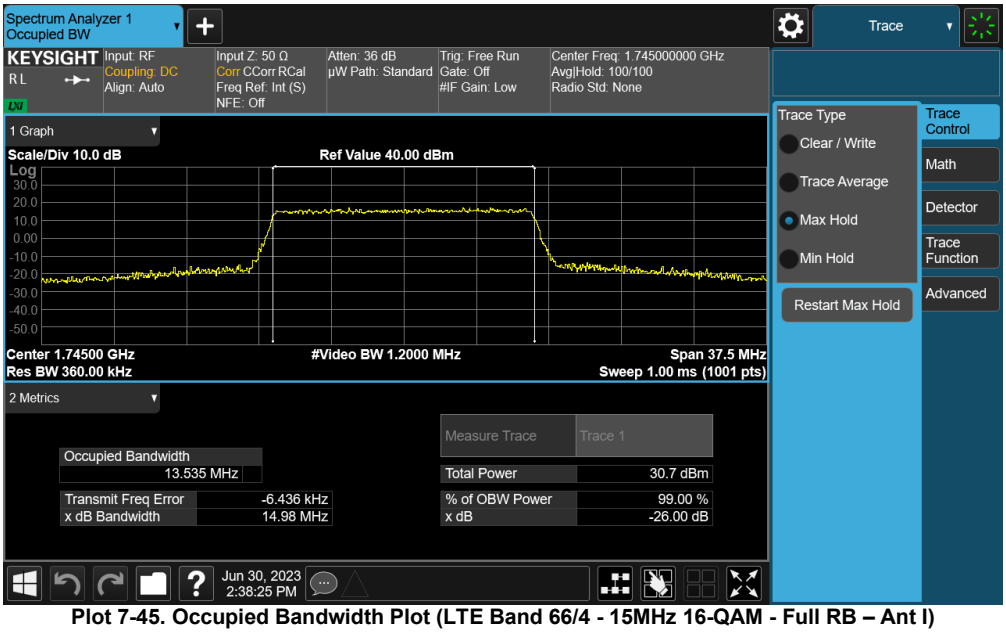


Plot 7-42. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz QPSK - Full RB – Ant I)

Plot 7-43. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz 16-QAM - Full RB – Ant I)



Plot 7-44. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz QPSK - Full RB – Ant I)



Plot 7-45. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz 16-QAM - Full RB – Ant I)