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PART 27 MEASUREMENT REPORT

Applicant Name:
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United States

Date of Testing:
1/31/2024 – 3/25/2024
Test Report Issue Date:
3/27/2024
Test Site/Location:
Element lab., Yongin-Si, Gyeonggi-do, South korea
Test Report Serial No.:
1M2312040120-12.C3K

FCC ID:	**C3K2077**
Applicant Name:	**Microsoft Corporation**

Application Type:	Certification
Model:	2077
EUT Type:	Portable Computing Device
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part:	27
Test Procedure(s):	ANSI C63.26-2015

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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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
NR Band n77 PC2 (3450 - 3550MHz)	100 MHz	π/2 BPSK	3500.0	0.298	24.74	96M9G7D
		QPSK	3500.0	0.314	24.97	97M9G7D
		16QAM	3500.0	0.281	24.49	98M1W7D
	90 MHz	π/2 BPSK	3495.0 - 3505.0	0.293	24.66	87M5G7D
		QPSK	3495.0 - 3505.0	0.322	25.07	88M0G7D
		16QAM	3495.0 - 3505.0	0.309	24.91	88M0W7D
	80 MHz	π/2 BPSK	3490.0 - 3510.0	0.294	24.68	77M4G7D
		QPSK	3490.0 - 3510.0	0.325	25.12	77M8G7D
		16QAM	3490.0 - 3510.0	0.304	24.83	77M9W7D
	70 MHz	π/2 BPSK	3485.0 - 3515.0	0.296	24.71	64M6G7D
		QPSK	3485.0 - 3515.0	0.327	25.15	67M9G7D
		16QAM	3485.0 - 3515.0	0.302	24.80	67M8W7D
	60 MHz	π/2 BPSK	3480.0 - 3520.0	0.304	24.82	58M1G7D
		QPSK	3480.0 - 3520.0	0.329	25.17	58M1G7D
		16QAM	3480.0 - 3520.0	0.314	24.97	58M1W7D
	50 MHz	π/2 BPSK	3475.0 - 3525.0	0.304	24.83	45M9G7D
		QPSK	3475.0 - 3525.0	0.332	25.21	47M6G7D
		16QAM	3475.0 - 3525.0	0.314	24.96	47M7W7D
	40 MHz	π/2 BPSK	3470.0 - 3530.0	0.320	25.05	35M8G7D
		QPSK	3470.0 - 3530.0	0.355	25.51	38M0G7D
		16QAM	3470.0 - 3530.0	0.328	25.16	37M9W7D
	30 MHz	π/2 BPSK	3465.0 - 3535.0	0.324	25.11	26M9G7D
		QPSK	3465.0 - 3535.0	0.353	25.48	28M1G7D
		16QAM	3465.0 - 3535.0	0.333	25.22	28M0W7D
	20 MHz	π/2 BPSK	3460.0 - 3540.0	0.325	25.12	18M0G7D
		QPSK	3460.0 - 3540.0	0.359	25.55	18M4G7D
		16QAM	3460.0 - 3540.0	0.338	25.29	18M3W7D
NR Band n77 PC2 (3700 - 3980MHz)	100 MHz	π/2 BPSK	3750.0 - 3930.0	0.829	29.18	97M1G7D
		QPSK	3750.0 - 3930.0	0.814	29.11	97M8G7D
		16QAM	3750.0 - 3930.0	0.788	28.96	98M1W7D
	90 MHz	π/2 BPSK	3745.0 - 3935.0	0.857	29.33	87M2G7D
		QPSK	3745.0 - 3935.0	0.867	29.38	87M8G7D
		16QAM	3745.0 - 3935.0	0.891	29.50	88M1W7D
	80 MHz	π/2 BPSK	3740.0 - 3940.0	0.859	29.34	77M4G7D
		QPSK	3740.0 - 3940.0	0.876	29.42	77M7G7D
		16QAM	3740.0 - 3940.0	0.836	29.22	77M6W7D
	70 MHz	π/2 BPSK	3735.0 - 3945.0	0.879	29.44	64M8G7D
		QPSK	3735.0 - 3945.0	0.887	29.48	67M7G7D
		16QAM	3735.0 - 3945.0	0.920	29.64	67M7W7D
	60 MHz	π/2 BPSK	3730.0 - 3950.0	0.880	29.44	58M1G7D
		QPSK	3730.0 - 3950.0	0.887	29.48	58M1G7D
		16QAM	3730.0 - 3950.0	0.889	29.49	58M1W7D
	50 MHz	π/2 BPSK	3725.0 - 3955.0	0.888	29.48	46M0G7D
		QPSK	3725.0 - 3955.0	0.889	29.49	47M6G7D
		16QAM	3725.0 - 3955.0	0.890	29.49	47M7W7D
	40 MHz	π/2 BPSK	3720.0 - 3960.0	0.881	29.45	35M9G7D
		QPSK	3720.0 - 3960.0	0.883	29.46	37M9G7D
		16QAM	3720.0 - 3960.0	0.878	29.43	37M9W7D
	30 MHz	π/2 BPSK	3715.0 - 3965.0	0.872	29.40	27M0G7D
		QPSK	3715.0 - 3965.0	0.891	29.50	28M0G7D
		16QAM	3715.0 - 3965.0	0.891	29.50	28M0W7D
	20 MHz	π/2 BPSK	3710.0 - 3970.0	0.868	29.38	18M0G7D
		QPSK	3710.0 - 3970.0	0.873	29.41	18M3G7D
		16QAM	3710.0 - 3970.0	0.881	29.45	18M3W7D

EUT Overview (Ant2)

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
NR Band n77 PC2 (3450 - 3550MHz)	100 MHz	π/2 BPSK	3500.0	0.736	28.67	96M9G7D
		QPSK	3500.0	0.726	28.61	97M8G7D
		16QAM	3500.0	0.574	27.59	97M8W7D
	90 MHz	π/2 BPSK	3495.0 - 3505.0	0.738	28.68	87M3G7D
		QPSK	3495.0 - 3505.0	0.739	28.68	87M9G7D
		16QAM	3495.0 - 3505.0	0.608	27.84	87M8W7D
	80 MHz	π/2 BPSK	3490.0 - 3510.0	0.738	28.68	77M5G7D
		QPSK	3490.0 - 3510.0	0.728	28.62	77M7G7D
		16QAM	3490.0 - 3510.0	0.604	27.81	77M8W7D
	70 MHz	π/2 BPSK	3485.0 - 3515.0	0.739	28.69	64M4G7D
		QPSK	3485.0 - 3515.0	0.736	28.67	67M8G7D
		16QAM	3485.0 - 3515.0	0.639	28.06	67M9W7D
	60 MHz	π/2 BPSK	3480.0 - 3520.0	0.776	28.90	58M1G7D
		QPSK	3480.0 - 3520.0	0.765	28.84	58M1G7D
		16QAM	3480.0 - 3520.0	0.620	27.92	58M1W7D
	50 MHz	π/2 BPSK	3475.0 - 3525.0	0.788	28.97	45M8G7D
		QPSK	3475.0 - 3525.0	0.796	29.01	47M6G7D
		16QAM	3475.0 - 3525.0	0.625	27.96	47M7W7D
	40 MHz	π/2 BPSK	3470.0 - 3530.0	0.762	28.82	35M8G7D
		QPSK	3470.0 - 3530.0	0.764	28.83	37M9G7D
		16QAM	3470.0 - 3530.0	0.618	27.91	38M0W7D
	30 MHz	π/2 BPSK	3465.0 - 3535.0	0.748	28.74	27M0G7D
		QPSK	3465.0 - 3535.0	0.744	28.71	28M0G7D
		16QAM	3465.0 - 3535.0	0.638	28.05	28M1W7D
	20 MHz	π/2 BPSK	3460.0 - 3540.0	0.776	28.90	18M0G7D
		QPSK	3460.0 - 3540.0	0.759	28.80	18M3G7D
		16QAM	3460.0 - 3540.0	0.595	27.74	18M3W7D
NR Band n77 PC2 (3700 - 3980MHz)	100 MHz	π/2 BPSK	3750.0 - 3930.0	0.653	28.15	97M1G7D
		QPSK	3750.0 - 3930.0	0.644	28.09	98M0G7D
		16QAM	3750.0 - 3930.0	0.508	27.06	97M9W7D
	90 MHz	π/2 BPSK	3745.0 - 3935.0	0.630	28.00	87M4G7D
		QPSK	3745.0 - 3935.0	0.576	27.61	87M7G7D
		16QAM	3745.0 - 3935.0	0.451	26.54	87M8W7D
	80 MHz	π/2 BPSK	3740.0 - 3940.0	0.646	28.10	77M5G7D
		QPSK	3740.0 - 3940.0	0.570	27.56	78M0G7D
		16QAM	3740.0 - 3940.0	0.475	26.76	77M7W7D
	70 MHz	π/2 BPSK	3735.0 - 3945.0	0.634	28.02	64M7G7D
		QPSK	3735.0 - 3945.0	0.582	27.65	67M8G7D
		16QAM	3735.0 - 3945.0	0.490	26.90	67M7W7D
	60 MHz	π/2 BPSK	3730.0 - 3950.0	0.634	28.02	58M1G7D
		QPSK	3730.0 - 3950.0	0.587	27.69	58M2G7D
		16QAM	3730.0 - 3950.0	0.437	26.40	58M1W7D
	50 MHz	π/2 BPSK	3725.0 - 3955.0	0.644	28.09	46M0G7D
		QPSK	3725.0 - 3955.0	0.582	27.65	47M7G7D
		16QAM	3725.0 - 3955.0	0.442	26.45	47M7W7D
	40 MHz	π/2 BPSK	3720.0 - 3960.0	0.659	28.19	35M8G7D
		QPSK	3720.0 - 3960.0	0.628	27.98	38M0G7D
		16QAM	3720.0 - 3960.0	0.449	26.52	37M9W7D
	30 MHz	π/2 BPSK	3715.0 - 3965.0	0.654	28.15	26M9G7D
		QPSK	3715.0 - 3965.0	0.612	27.87	27M9G7D
		16QAM	3715.0 - 3965.0	0.476	26.78	28M0W7D
	20 MHz	π/2 BPSK	3710.0 - 3970.0	0.686	28.36	18M0G7D
		QPSK	3710.0 - 3970.0	0.622	27.93	18M3G7D
		16QAM	3710.0 - 3970.0	0.444	26.47	18M4W7D

EUT Overview (Ant3)

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP	
				Max. Power [W]	Max. Power [dBm]
NR Band n77 PC2 (3450 - 3550MHz)	100 MHz	π/2 BPSK	3500.0	0.119	20.77
		QPSK	3500.0	0.121	20.83
		16QAM	3500.0	0.093	19.68
NR Band n77 PC2 (3700 - 3980MHz)	100 MHz	π/2 BPSK	3750.0 - 3930.0	0.054	17.32
		QPSK	3750.0 - 3930.0	0.054	17.29
		16QAM	3750.0 - 3930.0	0.044	16.44

EUT Overview (Ant5)

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP	
				Max. Power [W]	Max. Power [dBm]
NR Band n77 PC2 (3450 - 3550MHz)	100 MHz	π/2 BPSK	3500.0	0.269	24.30
		QPSK	3500.0	0.274	24.38
		16QAM	3500.0	0.222	23.47
NR Band n77 PC2 (3700 - 3980MHz)	100 MHz	π/2 BPSK	3750.0 - 3930.0	0.169	22.27
		QPSK	3750.0 - 3930.0	0.170	22.30
		16QAM	3750.0 - 3930.0	0.126	20.99

EUT Overview (Ant8)

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.

1.3 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 **Microsoft Corporation Portable Computing Device FCC ID: C3K2077**. 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.: 7CCD2, 7CDY2

2.2 Device Capabilities

This device contains the following capabilities:

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

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.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version 2024.111.46 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
Anritsu	MT8000A	Radio Communication Test Station	2023-03-20	Annual	2024-03-19	83985
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	2023-07-05	Annual	2024-07-04	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
NARDA	180-442A-KF	Horn Antenna (small)	2024-01-16	Annual	2025-01-15	T058701-03
Rohde & Schwarz	TS-PR18	Preamplifier	2023-07-05	Annual	2024-07-04	102141
Rohde & Schwarz	SMB100A03	Signal Generator	2024-01-11	Annual	2025-01-10	182487
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	2024-01-11	Annual	2025-01-10	171075
Rohde & Schwarz	FSW43	Signal and Spectrum Analyzer	2024-01-11	Annual	2025-01-10	101955
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2024-01-11	Annual	2025-01-10	102131
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

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

Example: Spurious emission at 3700.40 MHz

The receive 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 analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm – (-24.80) = 50.3 dBc.

7.0 TEST RESULTS

7.1 Summary

Company Name: Microsoft Corporation

FCC ID: C3K2077

FCC Classification: PCS Licensed Transmitter (PCB)

Mode(s): NR

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 (NR Band n77)	2.1051, 27.53(l), 27.53(n)	≤ -13 dBm / MHz	PASS	Sections 7.4, 7.5
	Peak-to-Average Ratio (NR Band n77)	27.50(j)(4), 27.50(k)(4)	≤ 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 / Equivalent Isotropic Radiated Power (NR Band n77)	27.50(j)(3), 27.50(k)(3)	≤ 1 Watt EIRP	PASS	Section 7.7
	Radiated Spurious Emissions (NR Band n77)	2.1053, 27.53(l), 27.53(n)	≤ -13 dBm / MHz	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 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) All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized is EMC Software Tool v1.2.2.

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. Detector = RMS
2. Trace mode = trace average for continuous emissions, max hold for pulse emissions
3. Sweep time = auto couple
4. The trace was allowed to stabilize
5. 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.

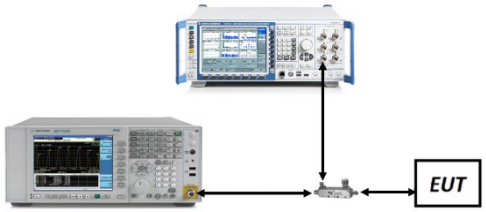


Figure 7-1. Test Instrument & Measurement Setup

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.

3. Conducted power was found to reduce for the higher order QAM modulations when compared to 16QAM. Due to this trend, only the worst-case QAM (16QAM) powers are included in this section.

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
100 MHz	π/2 BPSK	633334	3500.01	1 / 271	25.91
	QPSK	633334	3500.01	1 / 271	25.70
	16-QAM	633334	3500.01	1 / 271	25.46
90 MHz	π/2 BPSK	633000	3495.00	1 / 243	25.76
		633334	3500.01	1 / 243	25.79
		633666	3504.99	1 / 243	25.83
	QPSK	633000	3495.00	1 / 243	25.71
		633334	3500.01	1 / 243	25.77
		633666	3504.99	1 / 243	25.80
	16-QAM	633666	3504.99	1 / 243	25.88
80 MHz	π/2 BPSK	632668	3490.02	1 / 215	25.77
		633334	3500.01	1 / 215	25.73
		634000	3510.00	1 / 215	25.84
	QPSK	632668	3490.02	1 / 215	25.57
		633334	3500.01	1 / 215	25.70
		634000	3510.00	1 / 215	25.85
	16-QAM	634000	3510.00	1 / 215	25.80
70 MHz	π/2 BPSK	632334	3485.01	1 / 187	25.79
		633334	3500.01	1 / 187	25.80
		634332	3514.98	1 / 187	25.88
	QPSK	632334	3485.01	1 / 187	25.79
		633334	3500.01	1 / 187	25.75
		634332	3514.98	1 / 187	25.87
	16-QAM	634332	3514.98	1 / 187	25.78
60 MHz	π/2 BPSK	632000	3480.00	1 / 81	25.94
		633334	3500.01	1 / 160	25.95
		634666	3519.99	1 / 160	25.99
	QPSK	632000	3480.00	1 / 81	25.88
		633334	3500.01	1 / 160	25.90
		634666	3519.99	1 / 160	25.90
	16-QAM	632000	3480.00	1 / 81	25.95
50 MHz	π/2 BPSK	631668	3475.02	1 / 1	25.95
		633334	3500.01	1 / 131	25.91
		635000	3525.00	1 / 131	25.99
	QPSK	631668	3475.02	1 / 1	25.94
		633334	3500.01	1 / 131	25.83
		635000	3525.00	1 / 131	25.80
	16-QAM	635000	3525.00	1 / 131	25.94
40 MHz	π/2 BPSK	631334	3470.01	1 / 1	26.19
		633334	3500.01	1 / 1	26.21
		635332	3529.98	1 / 1	26.20
	QPSK	631334	3470.01	1 / 1	26.17
		633334	3500.01	1 / 1	26.15
		635332	3529.98	1 / 1	26.23
	16-QAM	635332	3529.98	1 / 1	26.14
30 MHz	π/2 BPSK	631000	3465.00	1 / 1	26.19
		633334	3500.01	1 / 1	26.27
		635666	3534.99	1 / 1	26.22
	QPSK	631000	3465.00	1 / 1	26.18
		633334	3500.01	1 / 1	26.21
		635666	3534.99	1 / 1	26.17
	16-QAM	635666	3534.99	1 / 1	26.11
20 MHz	π/2 BPSK	630668	3460.02	1 / 1	26.22
		633334	3500.01	1 / 1	26.22
		636000	3540.00	1 / 1	26.29
	QPSK	630668	3460.02	1 / 1	26.11
		633334	3500.01	1 / 1	26.28
		636000	3540.00	1 / 1	26.14
	16-QAM	636000	3540.00	1 / 1	26.26

Table 7-2. Conducted powers (NR Band n77 DoD Band – Ant2)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
100 MHz	π/2 BPSK	650000	3750.00	1 / 136	25.92
		656000	3840.00	1 / 136	26.11
		662000	3930.00	273 / 0	25.78
	QPSK	650000	3750.00	1 / 136	25.79
		656000	3840.00	1 / 136	26.01
		662000	3930.00	1 / 1	25.45
	16-QAM	656000	3840.00	1 / 136	25.81
90 MHz	π/2 BPSK	649668	3745.02	1 / 122	25.91
		656000	3840.00	1 / 122	26.19
		662332	3934.98	1 / 122	26.04
	QPSK	649668	3745.02	1 / 122	25.84
		656000	3840.00	1 / 122	26.31
		662332	3934.98	1 / 122	25.96
	16-QAM	656000	3840.00	1 / 122	26.35
80 MHz	π/2 BPSK	649334	3740.01	1 / 215	25.88
		656000	3840.00	1 / 108	26.23
		662666	3939.99	1 / 1	26.06
	QPSK	649334	3740.01	1 / 108	25.79
		656000	3840.00	1 / 108	26.19
		662666	3939.99	1 / 108	26.06
	16-QAM	656000	3840.00	1 / 215	26.07
70 MHz	π/2 BPSK	649000	3735.00	1 / 94	26.06
		656000	3840.00	1 / 187	26.37
		663000	3945.00	1 / 1	26.15
	QPSK	649000	3735.00	1 / 187	25.96
		656000	3840.00	1 / 94	26.37
		663000	3945.00	1 / 1	26.11
	16-QAM	656000	3840.00	1 / 1	26.29
60 MHz	π/2 BPSK	648668	3730.02	1 / 81	26.18
		656000	3840.00	1 / 81	26.37
		663332	3949.98	162 / 0	26.16
	QPSK	648668	3730.02	1 / 81	26.09
		656000	3840.00	1 / 81	26.38
		663332	3949.98	1 / 81	26.11
	16-QAM	656000	3840.00	1 / 81	26.31
50 MHz	π/2 BPSK	648334	3725.01	1 / 1	26.20
		656000	3840.00	1 / 1	26.41
		663666	3954.99	1 / 131	26.17
	QPSK	648334	3725.01	1 / 131	26.17
		656000	3840.00	1 / 66	26.40
		663666	3954.99	1 / 66	26.03
	16-QAM	656000	3840.00	1 / 1	26.34
40 MHz	π/2 BPSK	648000	3720.00	1 / 104	26.19
		656000	3840.00	1 / 53	26.19
		664000	3960.00	1 / 1	26.16
	QPSK	648000	3720.00	1 / 104	26.13
		656000	3840.00	1 / 1	26.22
		664000	3960.00	1 / 53	26.09
	16-QAM	656000	3840.00	1 / 104	26.10
30 MHz	π/2 BPSK	647668	3715.02	1 / 1	25.93
		656000	3840.00	1 / 76	26.15
		664332	3964.98	1 / 39	26.12
	QPSK	647668	3715.02	1 / 76	25.91
		656000	3840.00	1 / 76	26.20
		664332	3964.98	1 / 1	26.13
	16-QAM	656000	3840.00	1 / 76	26.19
20 MHz	π/2 BPSK	647334	3710.01	1 / 49	25.98
		656000	3840.00	1 / 49	26.19
		664666	3969.99	1 / 25	26.10
	QPSK	647334	3710.01	1 / 49	25.97
		656000	3840.00	1 / 1	26.17
		664666	3969.99	1 / 1	26.05
	16-QAM	656000	3840.00	1 / 49	26.14

Table 7-3. Conducted powers (NR Band n77 C Band – Ant2)

Bandwidth	Modulation	Channel	Frequency [MHz]	ANT2 RB Size/Offset	ANT2 Conducted Power [dBm]	ANT3 RB Size/Offset	ANT3 Conducted Power [dBm]	UL-MIMO Conducted POWER [dBm]
100 MHz	QPSK	633334	3500.01	1 / 271	21.65	1 / 271	21.67	24.67
	16-QAM	633334	3500.01	1 / 271	21.11	1 / 271	21.36	24.25
	64-QAM	633334	3500.01	1 / 271	19.67	1 / 271	19.54	22.62
	256-QAM	633334	3500.01	1 / 271	16.65	1 / 271	16.61	19.64

Table 7-4. Conducted powers (UL-MIMO NR Band n77 DoD Band – Ant2 and Ant3)

Bandwidth	Modulation	Channel	Frequency [MHz]	ANT2 RB Size/Offset	ANT2 Conducted Power [dBm]	ANT3 RB Size/Offset	ANT3 Conducted Power [dBm]	UL-MIMO Conducted POWER [dBm]
100 MHz	QPSK	650000	3750.00	1 / 136	21.22	1 / 136	21.32	24.28
		656000	3840.00	1 / 136	21.34	1 / 271	21.12	24.24
		662000	3930.00	1 / 136	21.33	1 / 136	21.27	24.31
	16-QAM	650000	3750.00	1 / 136	20.42	1 / 136	20.54	23.49
		656000	3840.00	1 / 136	21.02	1 / 271	20.12	23.60
		662000	3930.00	1 / 136	20.87	1 / 136	20.78	23.84
	64-QAM	650000	3750.00	1 / 136	19.23	1 / 136	18.82	22.04
		656000	3840.00	1 / 136	19.35	1 / 271	19.32	22.35
		662000	3930.00	1 / 136	19.41	1 / 136	19.04	22.24
	256-QAM	650000	3750.00	1 / 136	16.23	1 / 136	16.42	19.34
		656000	3840.00	1 / 136	16.13	1 / 271	16.02	19.09
		662000	3930.00	1 / 136	16.18	1 / 136	16.54	19.37

Table 7-5. Conducted powers (UL-MIMO NR Band n77 C Band – Ant2 and Ant3)

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.

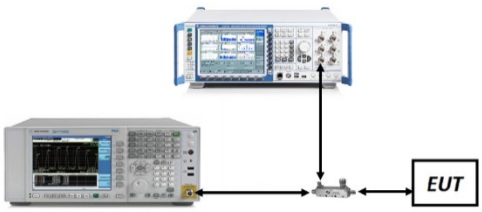


Figure 7-2. Test Instrument & Measurement Setup

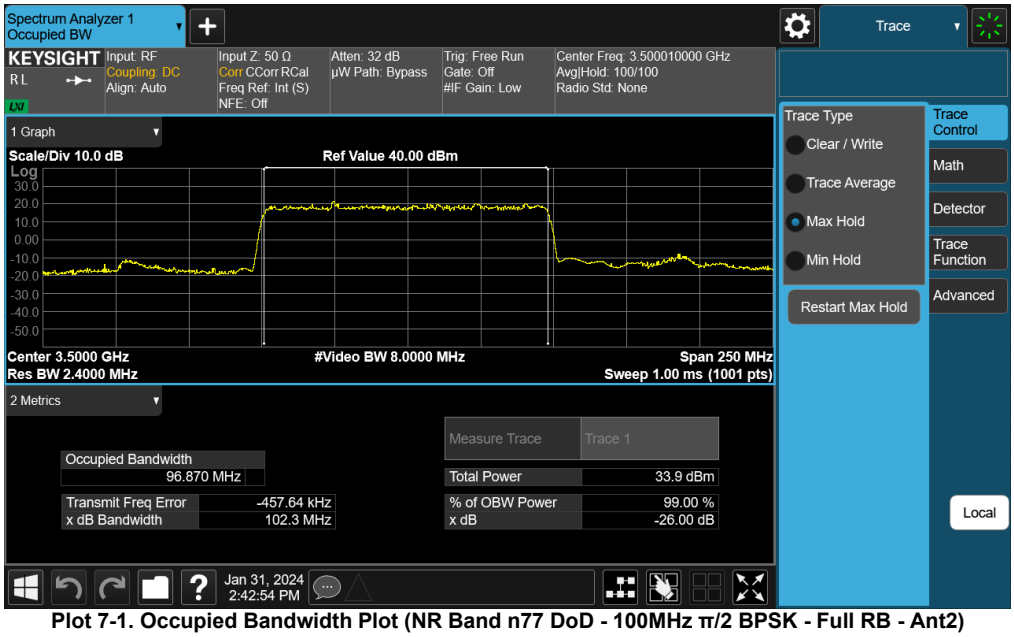
Test Notes

None.

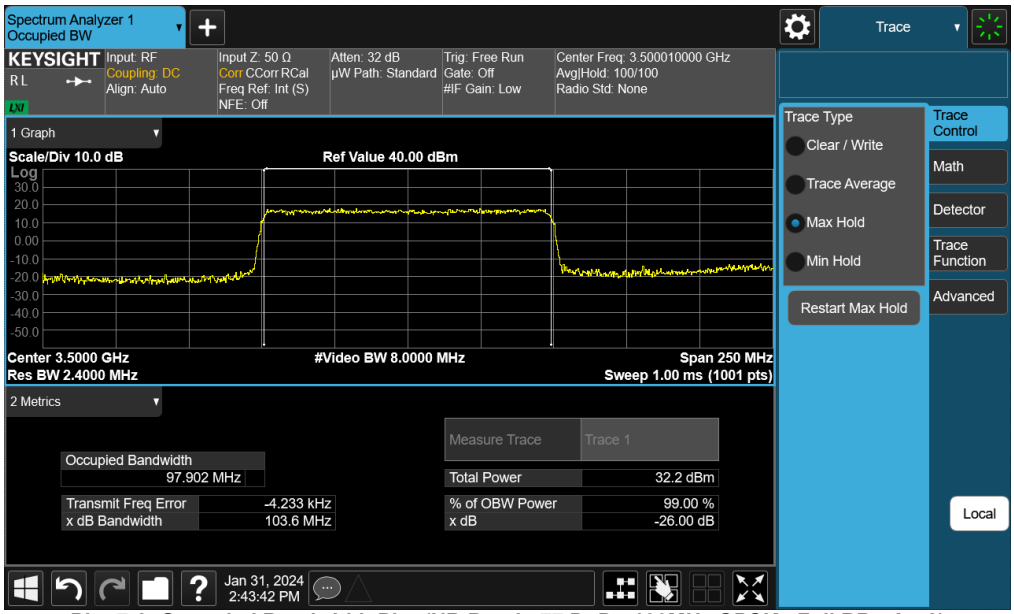
Mode	Bandwidth	Modulation	OBW [MHz]
NR-n77PC2-R1	100MHz	π/2 BPSK	96.87
		QPSK	97.90
		16QAM	98.11
	90MHz	π/2 BPSK	87.52
		QPSK	87.95
		16QAM	87.95
	80MHz	π/2 BPSK	77.41
		QPSK	77.81
		16QAM	77.88
	70MHz	π/2 BPSK	64.63
		QPSK	67.90
		16QAM	67.76
	60MHz	π/2 BPSK	58.14
		QPSK	58.14
		16QAM	58.06
	50MHz	π/2 BPSK	45.95
		QPSK	47.60
		16QAM	47.73
	40MHz	π/2 BPSK	35.77
		QPSK	38.00
		16QAM	37.93
	30MHz	π/2 BPSK	26.93
		QPSK	28.11
		16QAM	28.00
	20MHz	π/2 BPSK	17.96
		QPSK	18.35
		16QAM	18.29

Table 7-6. Occupied Bandwidth Test Results – Ant2

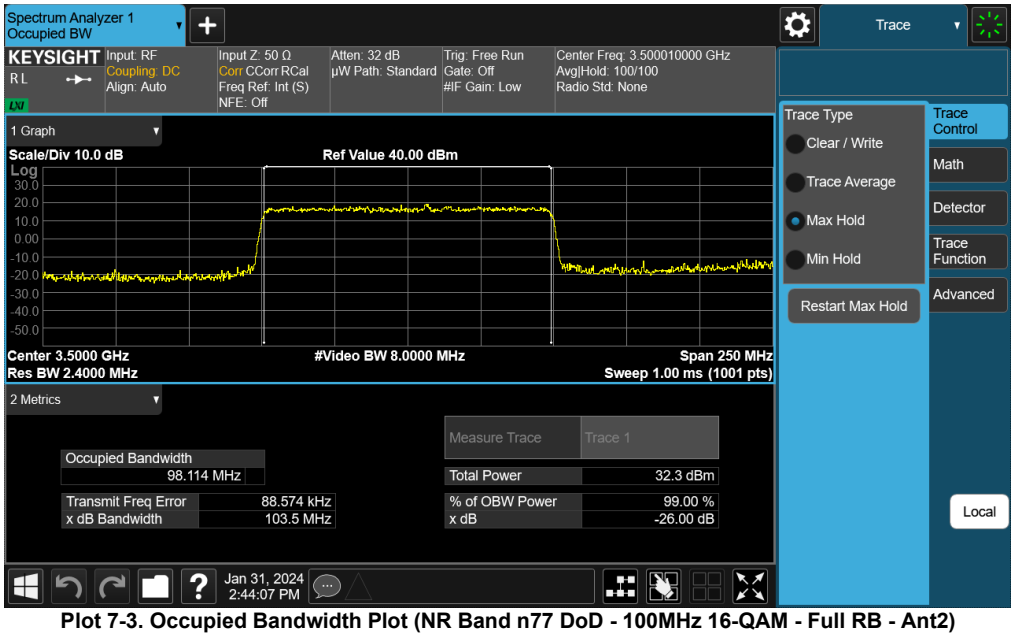
NR Band n77 DoD – Ant2



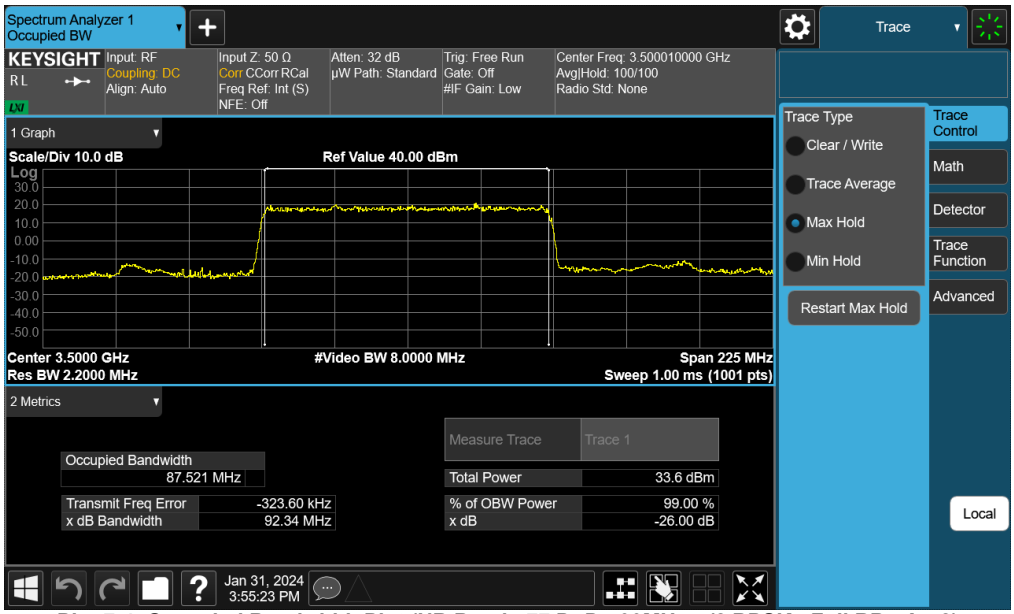
Plot 7-1. Occupied Bandwidth Plot (NR Band n77 DoD - 100MHz π/2 BPSK - Full RB - Ant2)



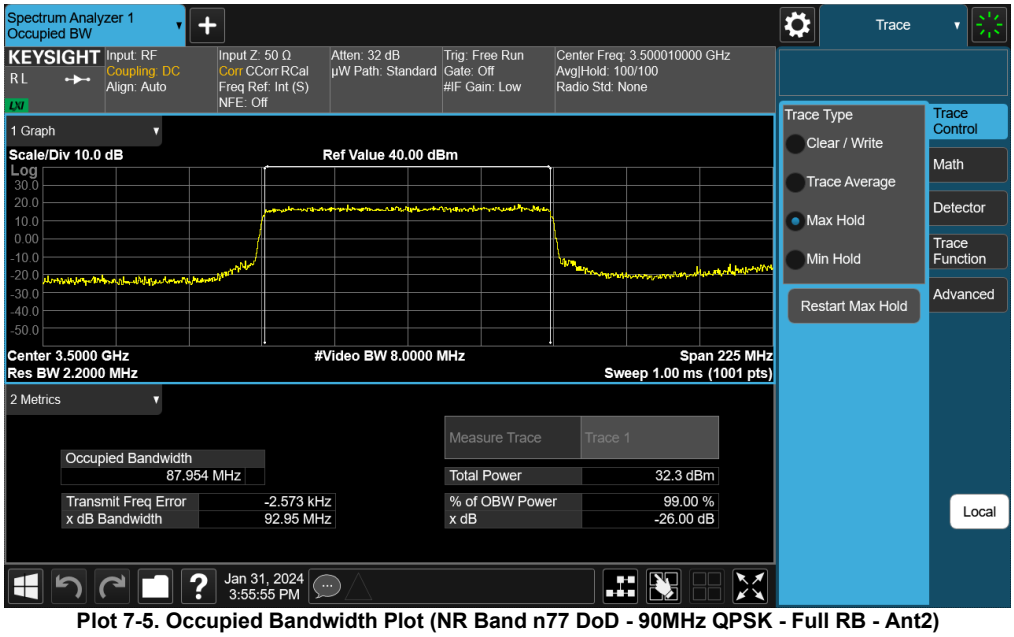
Plot 7-2. Occupied Bandwidth Plot (NR Band n77 DoD - 100MHz QPSK - Full RB - Ant2)



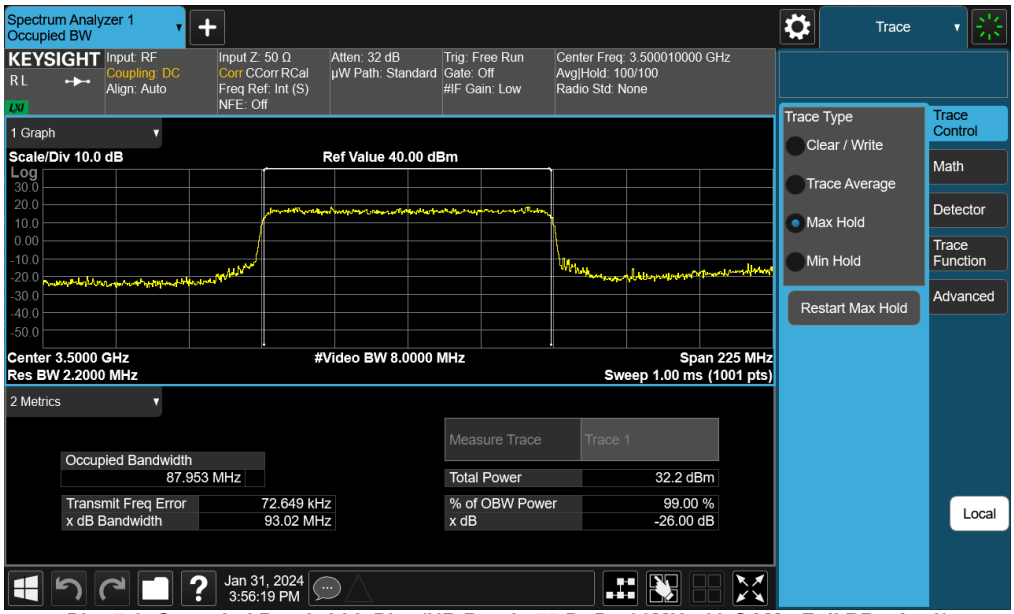
Plot 7-3. Occupied Bandwidth Plot (NR Band n77 DoD - 100MHz 16-QAM - Full RB - Ant2)



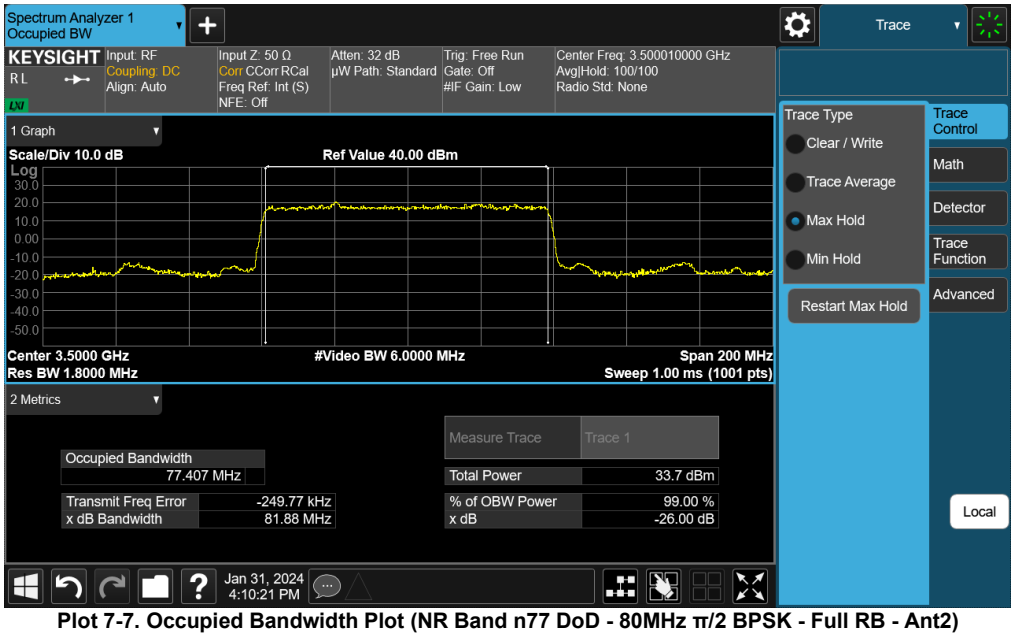
Plot 7-4. Occupied Bandwidth Plot (NR Band n77 DoD - 90MHz π/2 BPSK - Full RB - Ant2)



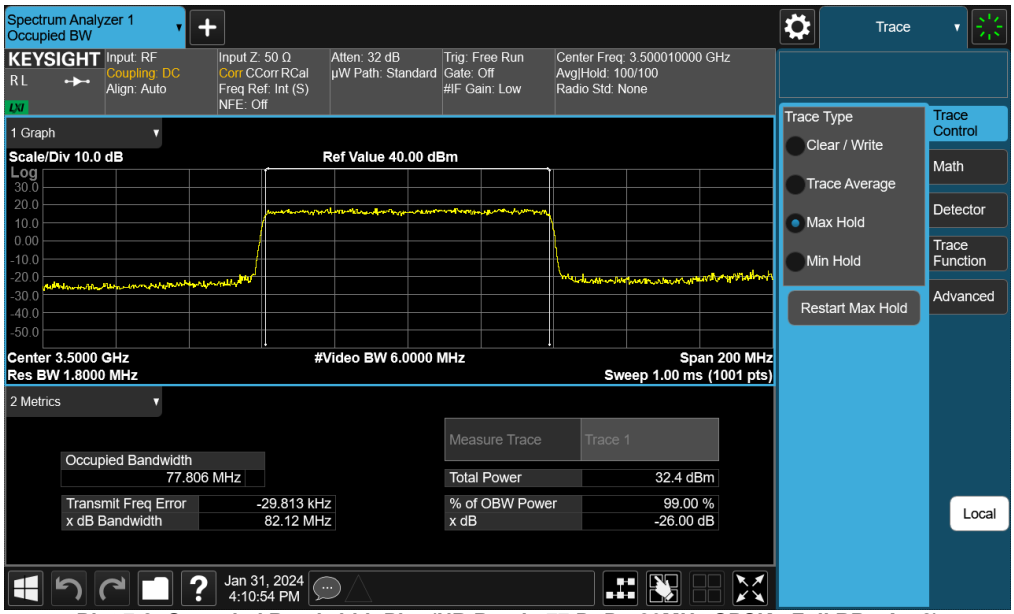
Plot 7-5. Occupied Bandwidth Plot (NR Band n77 DoD - 90MHz QPSK - Full RB - Ant2)



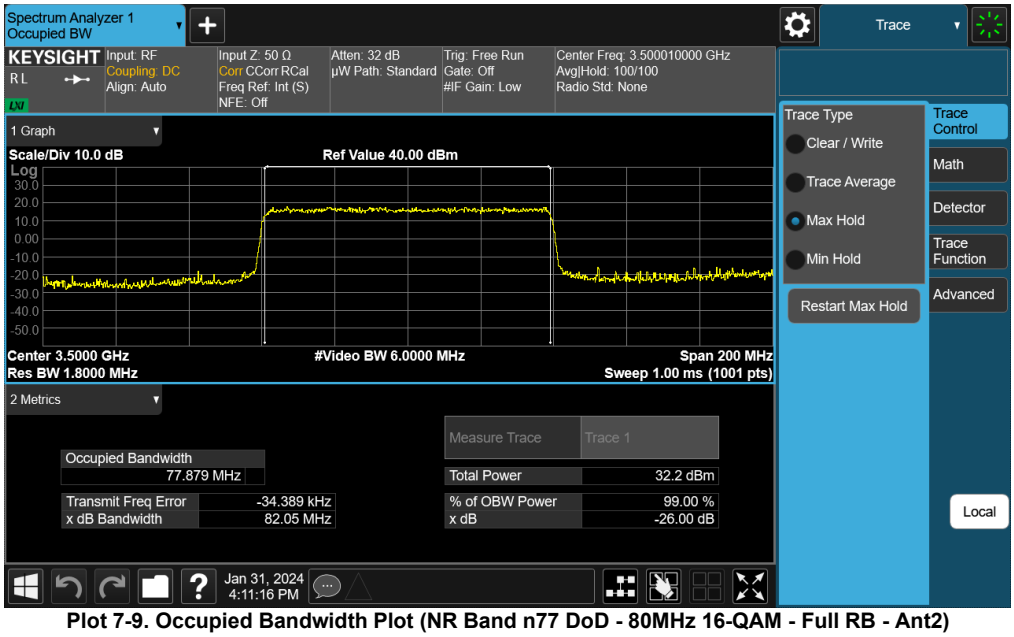
Plot 7-6. Occupied Bandwidth Plot (NR Band n77 DoD - 90MHz 16-QAM - Full RB - Ant2)



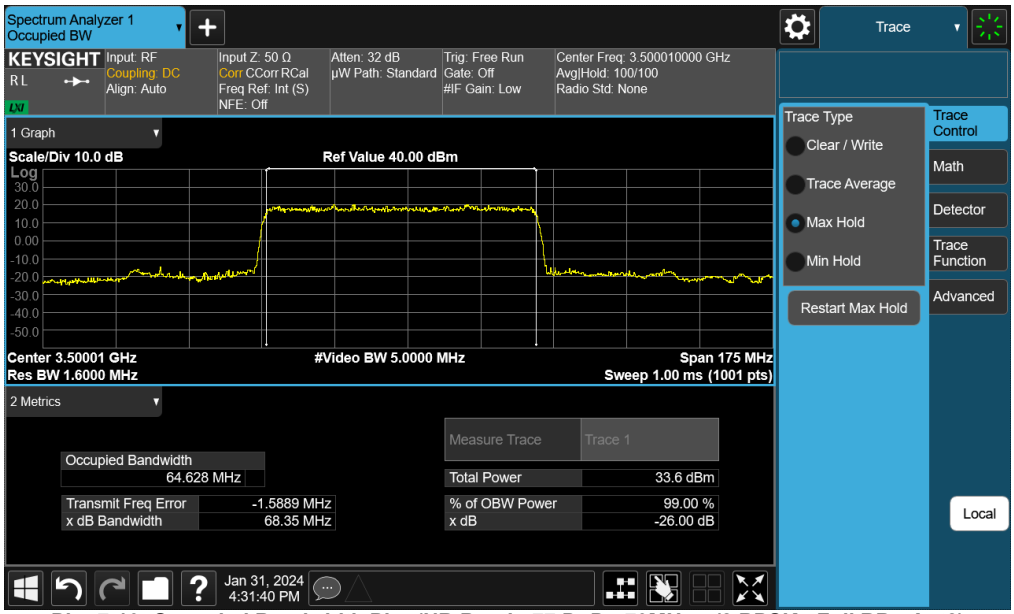
Plot 7-7. Occupied Bandwidth Plot (NR Band n77 DoD - 80MHz π/2 BPSK - Full RB - Ant2)



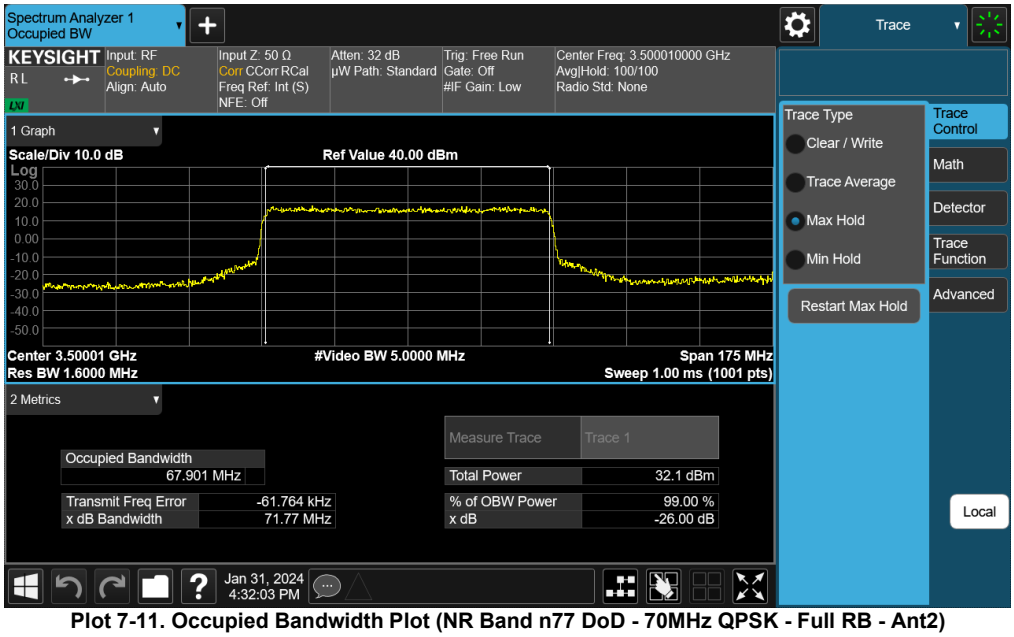
Plot 7-8. Occupied Bandwidth Plot (NR Band n77 DoD - 80MHz QPSK - Full RB - Ant2)



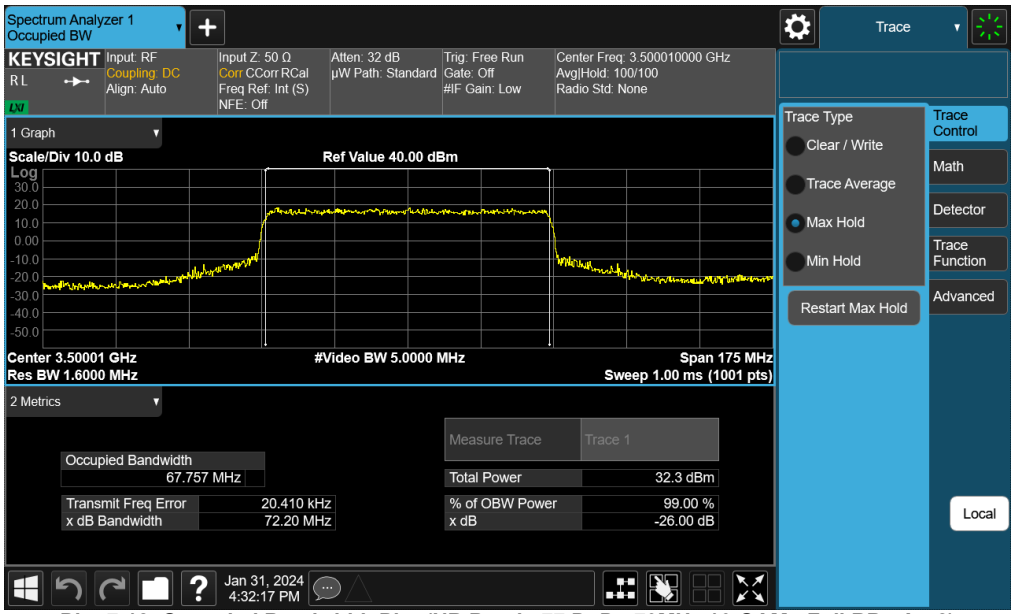
Plot 7-9. Occupied Bandwidth Plot (NR Band n77 DoD - 80MHz 16-QAM - Full RB - Ant2)



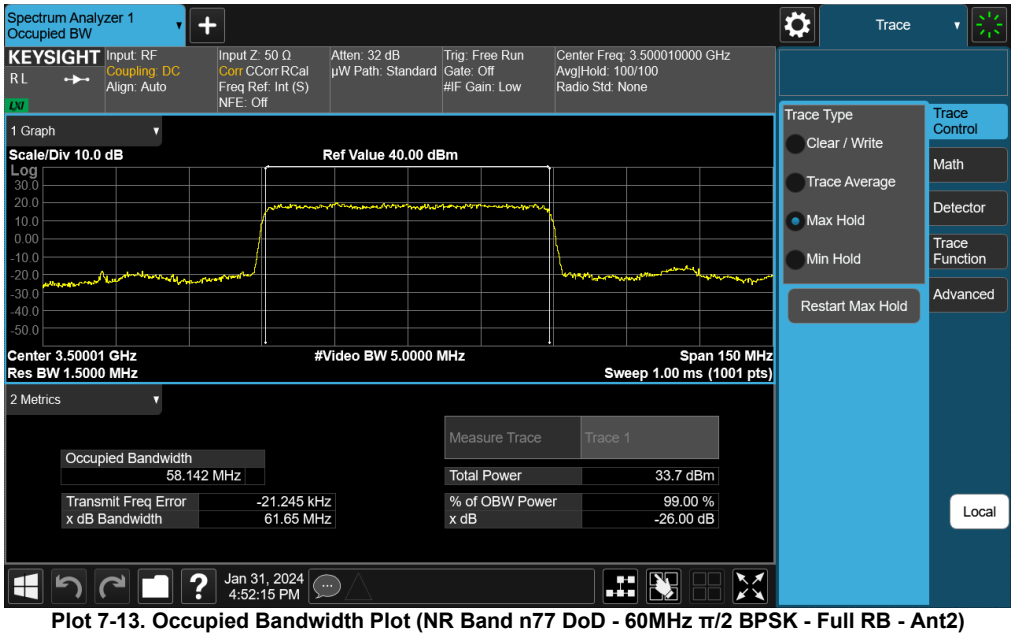
Plot 7-10. Occupied Bandwidth Plot (NR Band n77 DoD - 70MHz π/2 BPSK - Full RB - Ant2)



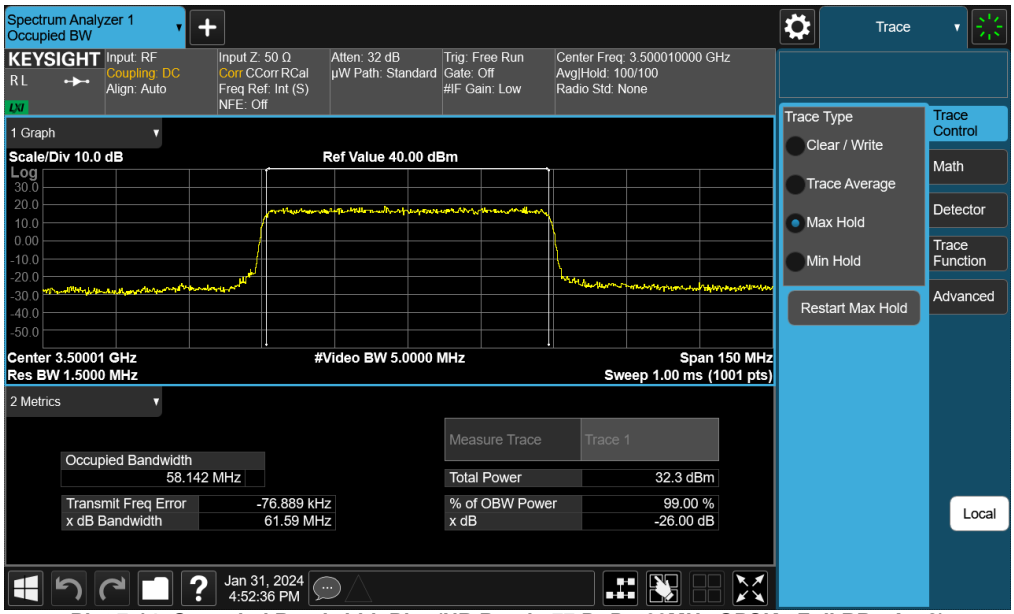
Plot 7-11. Occupied Bandwidth Plot (NR Band n77 DoD - 70MHz QPSK - Full RB - Ant2)



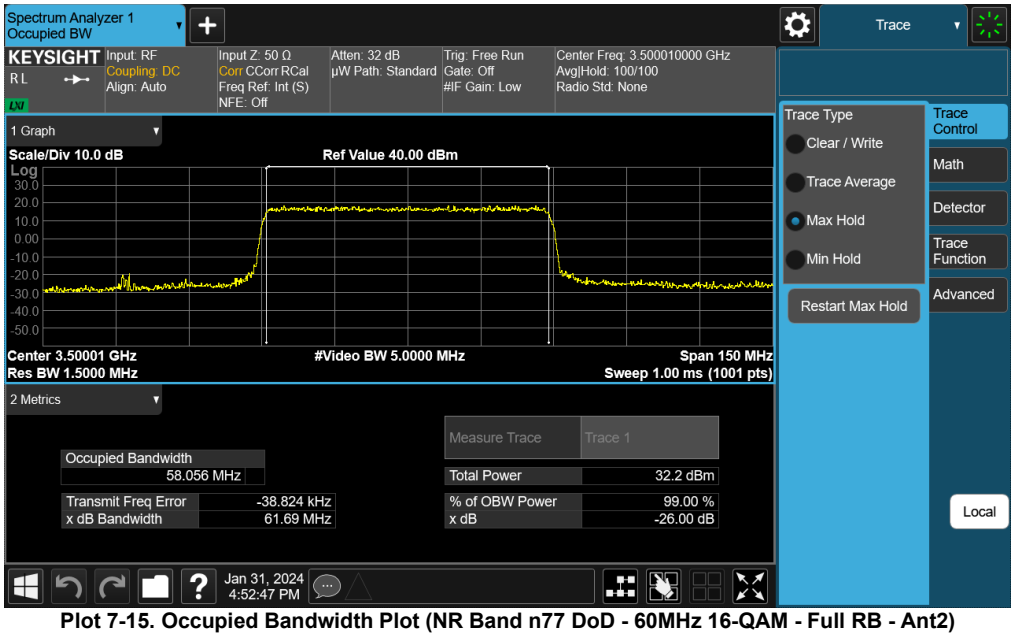
Plot 7-12. Occupied Bandwidth Plot (NR Band n77 DoD - 70MHz 16-QAM - Full RB - Ant2)



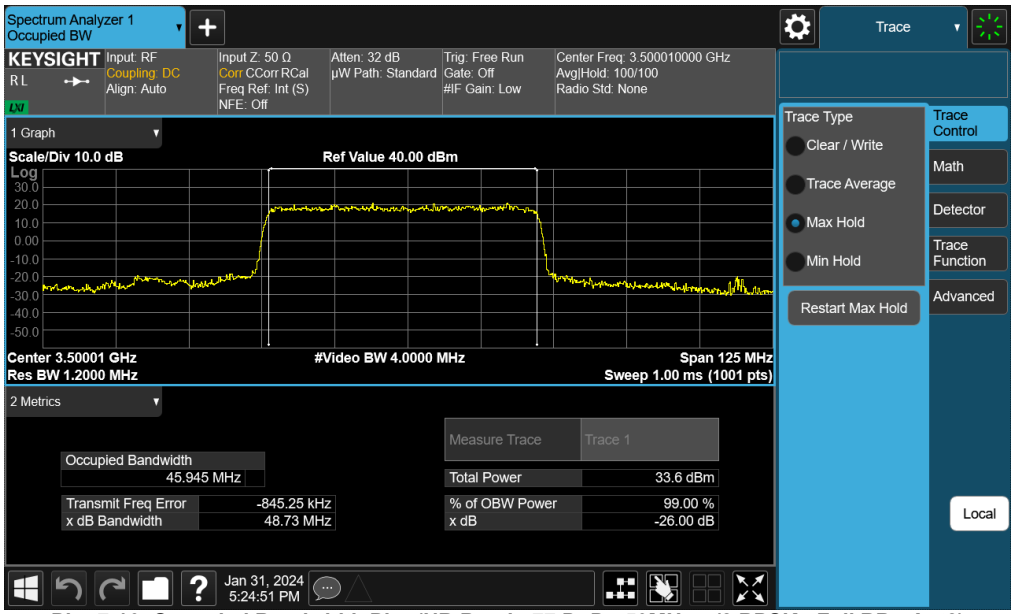
Plot 7-13. Occupied Bandwidth Plot (NR Band n77 DoD - 60MHz π/2 BPSK - Full RB - Ant2)



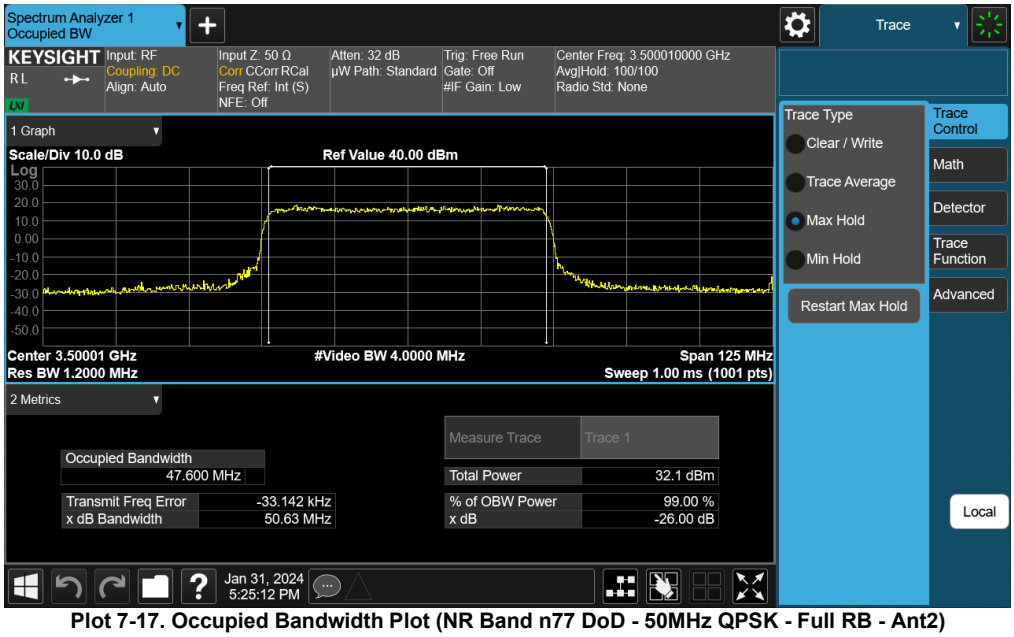
Plot 7-14. Occupied Bandwidth Plot (NR Band n77 DoD - 60MHz QPSK - Full RB - Ant2)



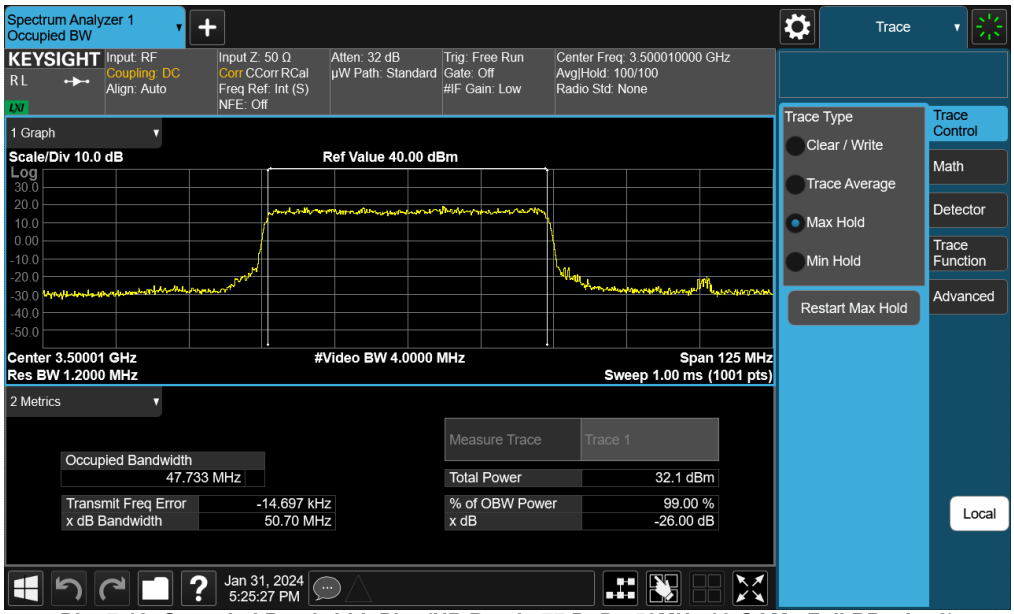
Plot 7-15. Occupied Bandwidth Plot (NR Band n77 DoD - 60MHz 16-QAM - Full RB - Ant2)



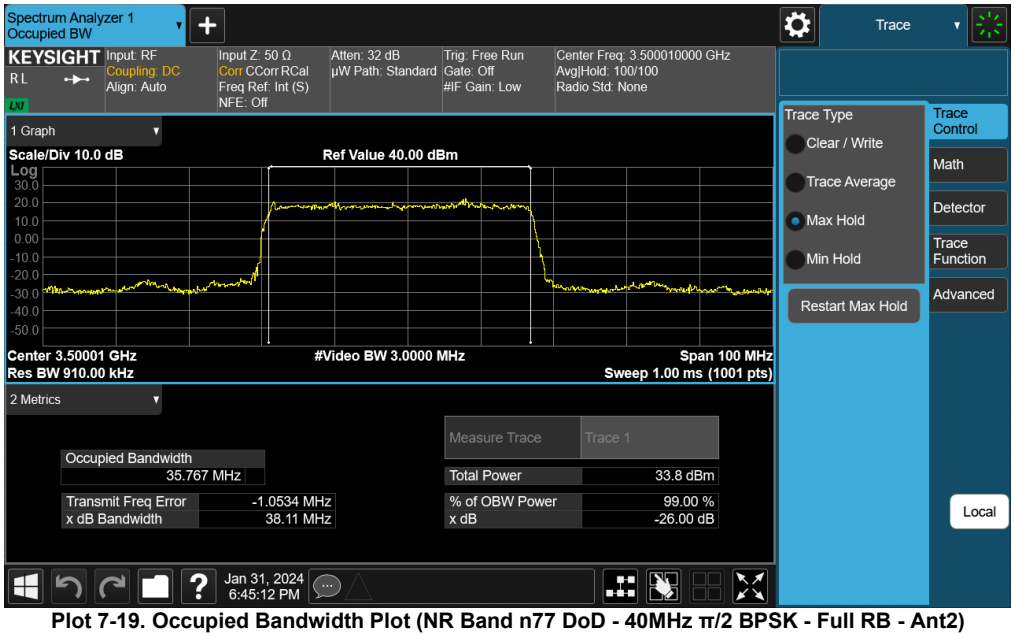
Plot 7-16. Occupied Bandwidth Plot (NR Band n77 DoD - 50MHz π/2 BPSK - Full RB - Ant2)



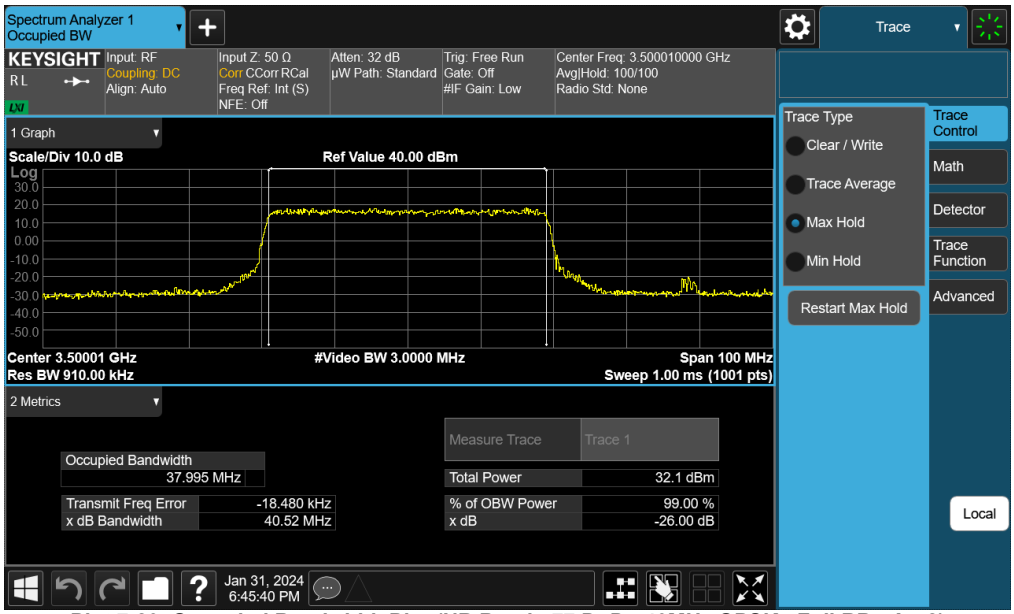
Plot 7-17. Occupied Bandwidth Plot (NR Band n77 DoD - 50MHz QPSK - Full RB - Ant2)



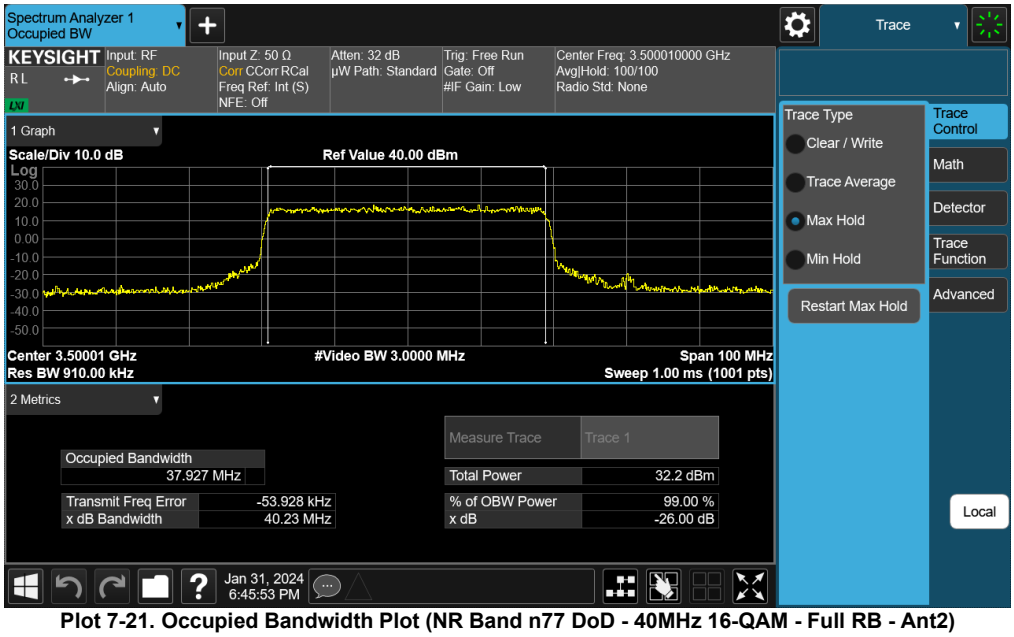
Plot 7-18. Occupied Bandwidth Plot (NR Band n77 DoD - 50MHz 16-QAM - Full RB - Ant2)



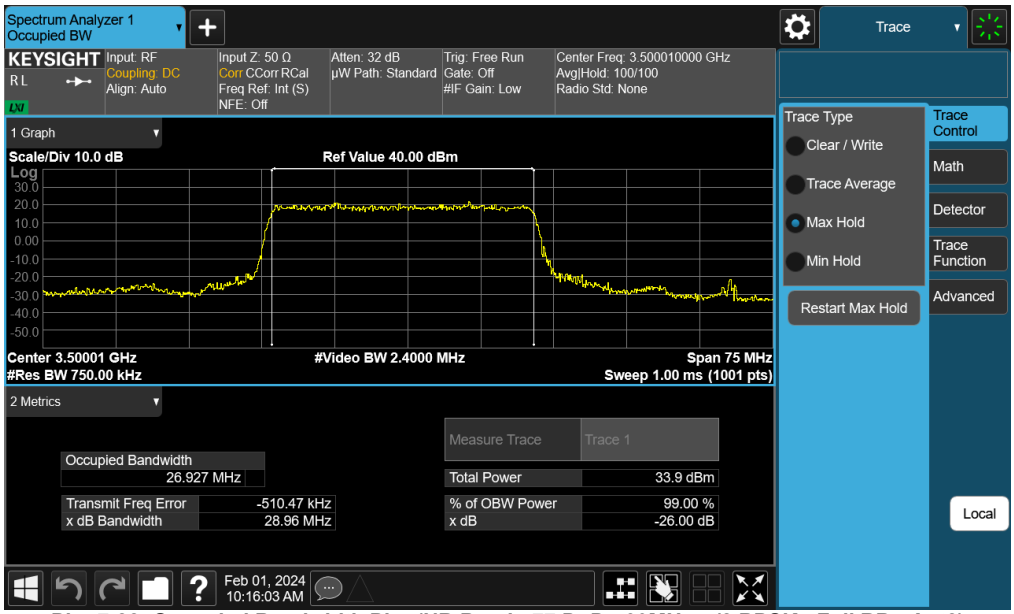
Plot 7-19. Occupied Bandwidth Plot (NR Band n77 DoD - 40MHz π/2 BPSK - Full RB - Ant2)



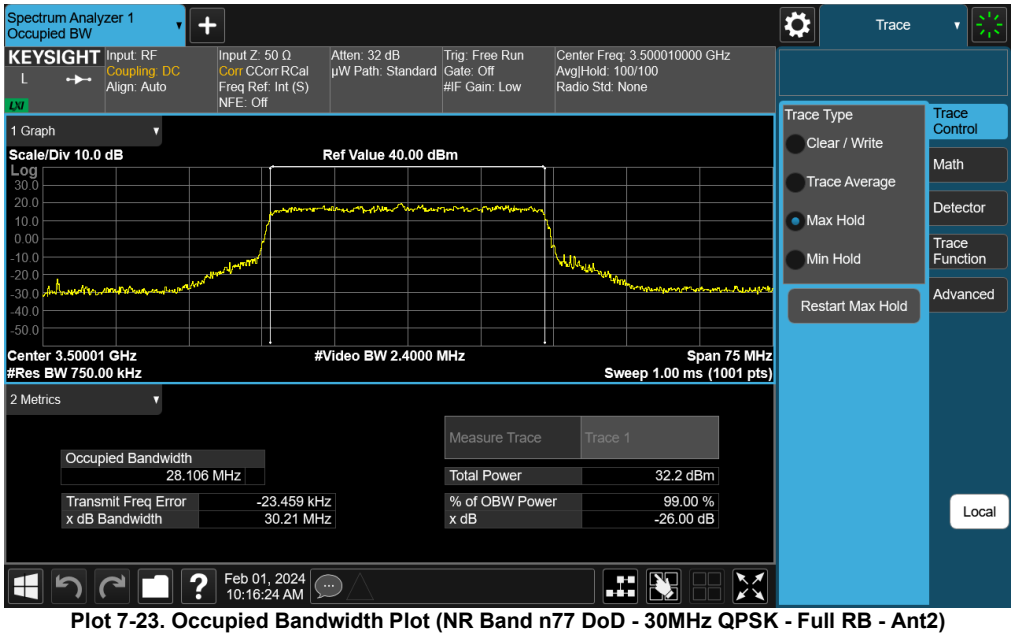
Plot 7-20. Occupied Bandwidth Plot (NR Band n77 DoD - 40MHz QPSK - Full RB - Ant2)



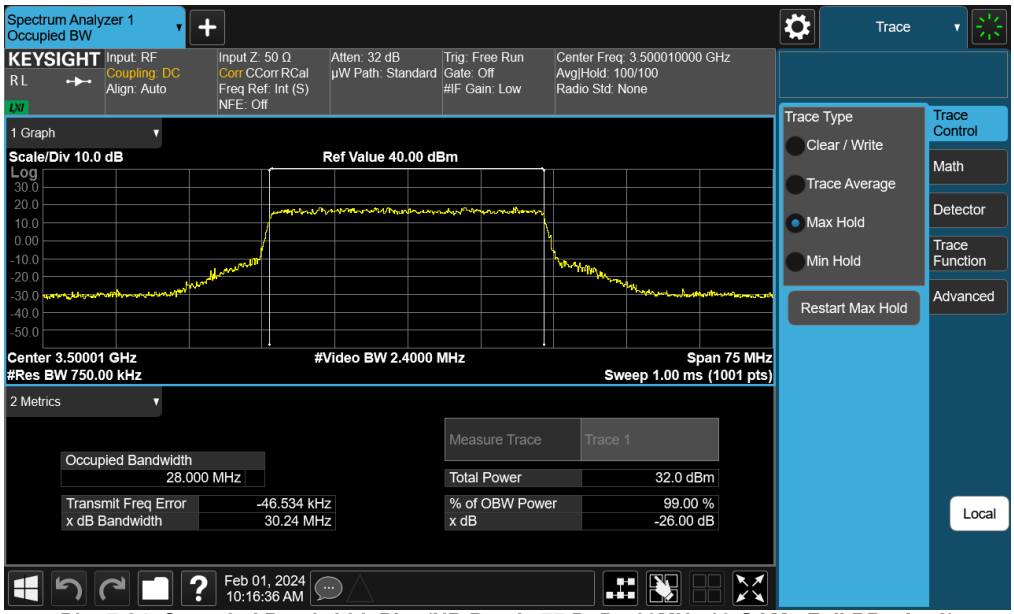
Plot 7-21. Occupied Bandwidth Plot (NR Band n77 DoD - 40MHz 16-QAM - Full RB - Ant2)



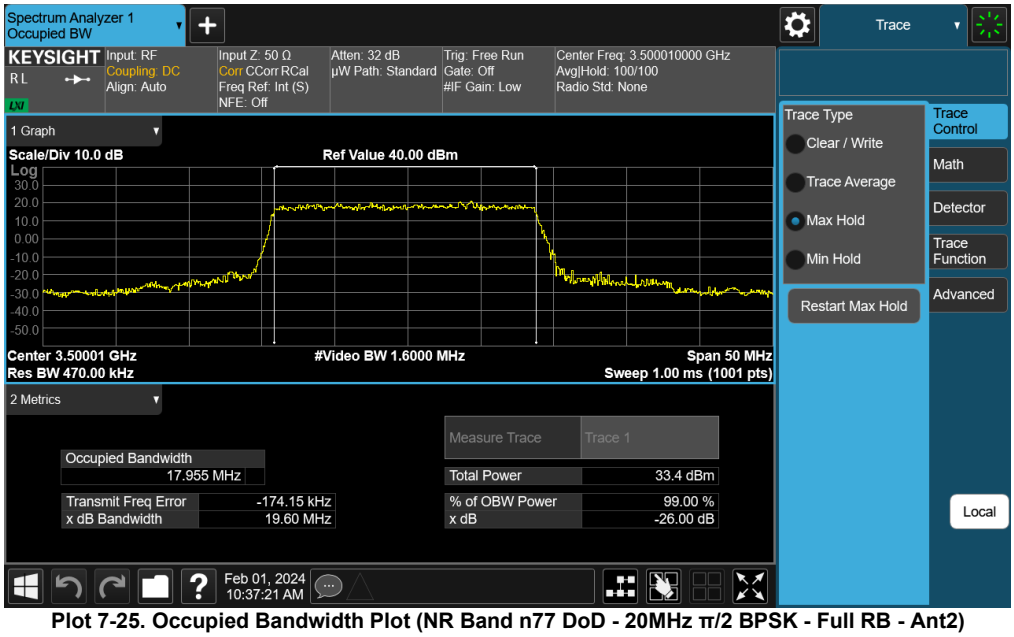
Plot 7-22. Occupied Bandwidth Plot (NR Band n77 DoD - 30MHz π/2 BPSK - Full RB - Ant2)



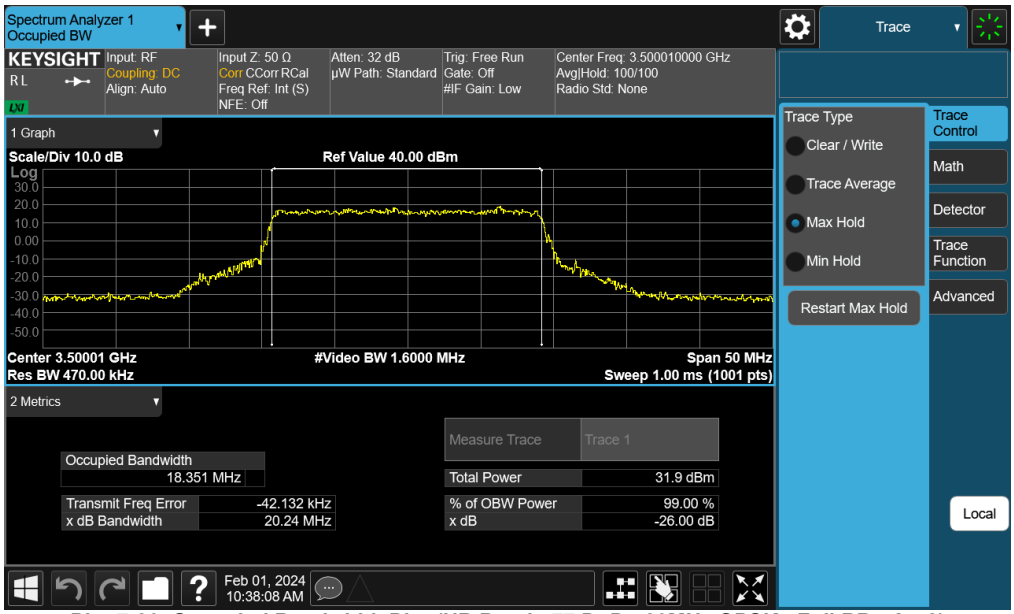
Plot 7-23. Occupied Bandwidth Plot (NR Band n77 DoD - 30MHz QPSK - Full RB - Ant2)



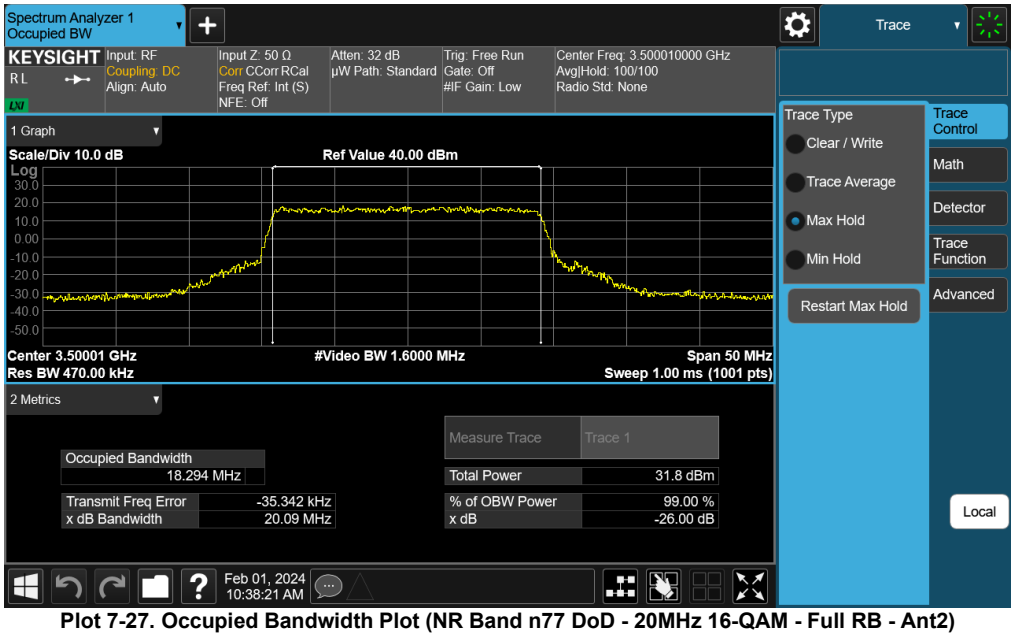
Plot 7-24. Occupied Bandwidth Plot (NR Band n77 DoD - 30MHz 16-QAM - Full RB - Ant2)



Plot 7-25. Occupied Bandwidth Plot (NR Band n77 DoD - 20MHz π/2 BPSK - Full RB - Ant2)



Plot 7-26. Occupied Bandwidth Plot (NR Band n77 DoD - 20MHz QPSK - Full RB - Ant2)

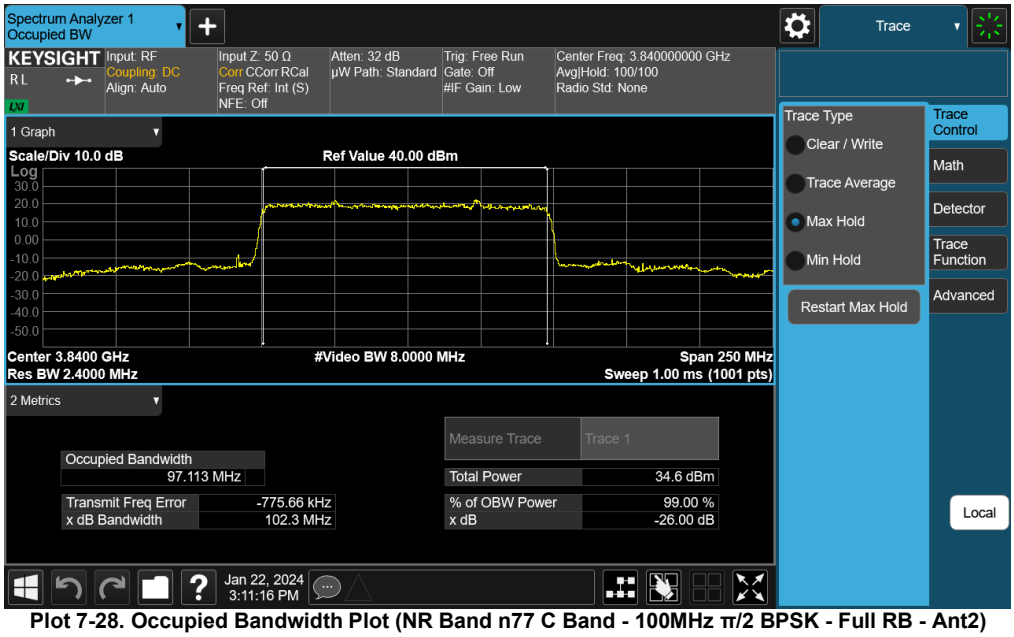


Plot 7-27. Occupied Bandwidth Plot (NR Band n77 DoD - 20MHz 16-QAM - Full RB - Ant2)

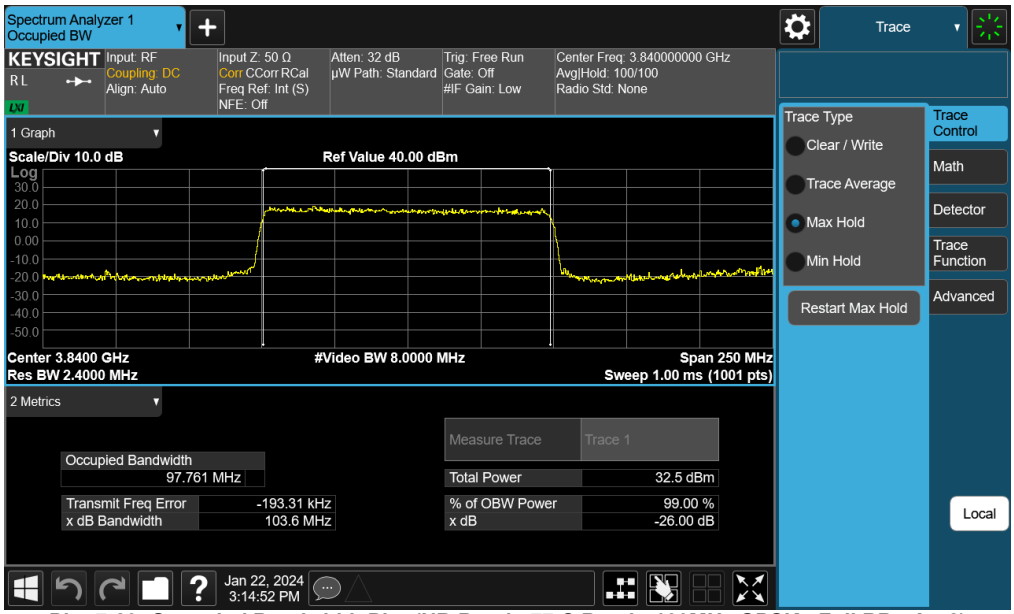
Mode	Bandwidth	Modulation	OBW [MHz]
NR-n77PC2	100MHz	π/2 BPSK	97.11
		QPSK	97.76
		16QAM	98.06
	90MHz	π/2 BPSK	87.16
		QPSK	87.81
		16QAM	88.07
	80MHz	π/2 BPSK	77.42
		QPSK	77.66
		16QAM	77.64
	70MHz	π/2 BPSK	64.81
		QPSK	67.74
		16QAM	67.72
	60MHz	π/2 BPSK	58.09
		QPSK	58.09
		16QAM	58.09
	50MHz	π/2 BPSK	45.96
		QPSK	47.63
		16QAM	47.66
	40MHz	π/2 BPSK	35.94
		QPSK	37.94
		16QAM	37.90
	30MHz	π/2 BPSK	27.01
		QPSK	28.01
		16QAM	27.99
	20MHz	π/2 BPSK	18.02
		QPSK	18.33
		16QAM	18.32

Table 7-7. Occupied Bandwidth Test Results – Ant2

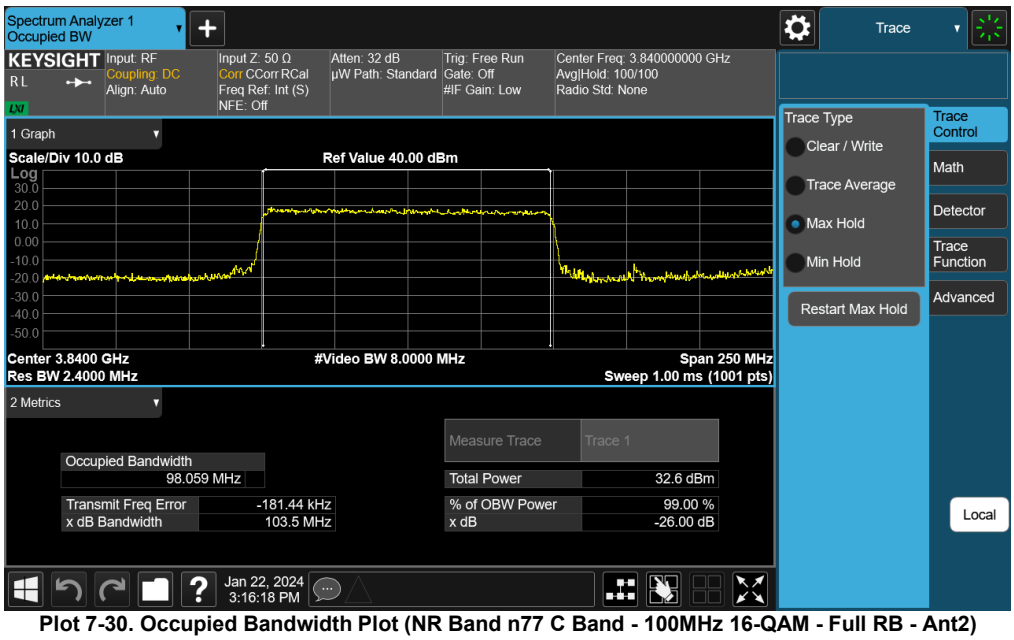
NR Band n77 C Band – Ant2



Plot 7-28. Occupied Bandwidth Plot (NR Band n77 C Band - 100MHz π/2 BPSK - Full RB - Ant2)

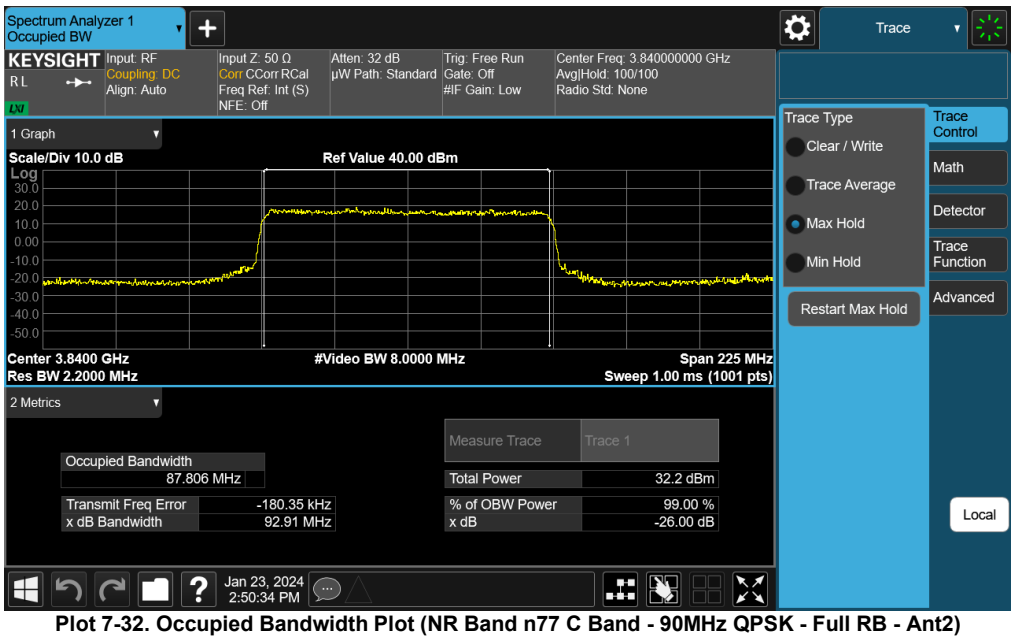


Plot 7-29. Occupied Bandwidth Plot (NR Band n77 C Band - 100MHz QPSK - Full RB - Ant2)

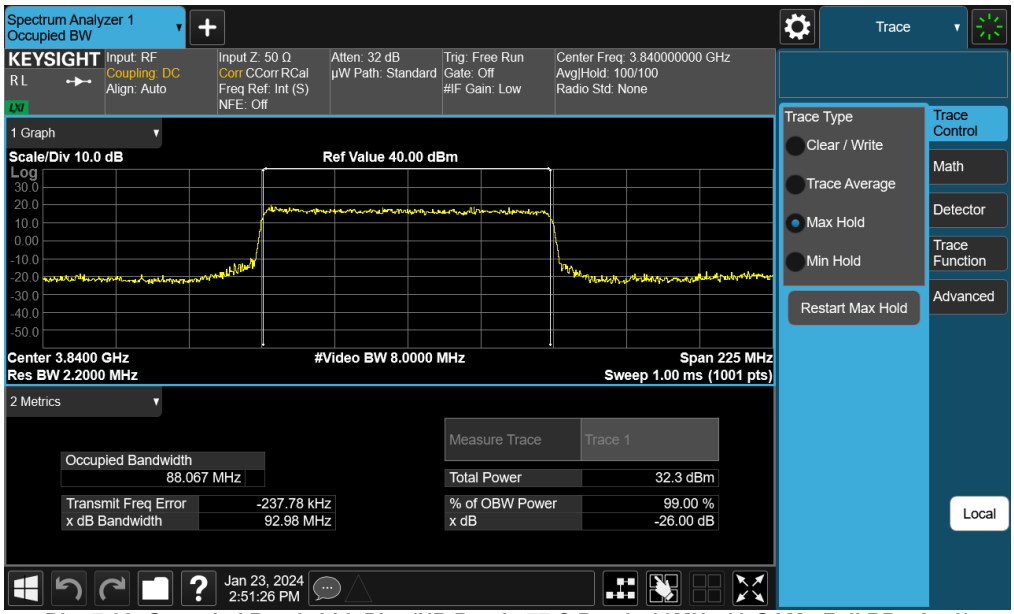


Plot 7-30. Occupied Bandwidth Plot (NR Band n77 C Band - 100MHz 16-QAM - Full RB - Ant2)

Plot 7-31. Occupied Bandwidth Plot (NR Band n77 C Band - 90MHz π/2 BPSK - Full RB - Ant2)



Plot 7-32. Occupied Bandwidth Plot (NR Band n77 C Band - 90MHz QPSK - Full RB - Ant2)



Plot 7-33. Occupied Bandwidth Plot (NR Band n77 C Band - 90MHz 16-QAM - Full RB - Ant2)