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PART 24 MEASUREMENT REPORT

Applicant Name:
Samsung Electronics Co., Ltd.
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Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
5/23/2024 - 7/31/2024
Test Report Issue Date:
8/2/2024
Test Site/Location:
Element lab., Columbia, MD, USA
Test Report Serial No.:
1M2405140039-19.A3L

FCC ID:	**A3LSMX828U**
Applicant Name:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-X828U
EUT Type:	Portable Tablet
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part:	24
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.

RJ Ortanez
Executive Vice President

ACCREDITED
CERT #2041.01

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Antenna-1						
Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
WCDMA	N/A	Spread Spectrum	1852.4 - 1907.6	0.192	22.83	4M17F9W
LTE Band 25/2	20 MHz	QPSK	1860 - 1905	0.259	24.14	17M9G7D
		16QAM	1860 - 1905	0.219	23.41	18M0W7D
	15 MHz	QPSK	1857.5 - 1907.5	0.264	24.22	13M5G7D
		16QAM	1857.5 - 1907.5	0.221	23.44	13M5W7D
	10 MHz	QPSK	1855 - 1910	0.259	24.13	9M02G7D
		16QAM	1855 - 1910	0.215	23.33	8M99W7D
	5 MHz	QPSK	1852.5 - 1912.5	0.260	24.15	4M51G7D
		16QAM	1852.5 - 1912.5	0.235	23.71	4M52W7D
	3 MHz	QPSK	1851.5 - 1913.5	0.257	24.09	2M70G7D
		16QAM	1851.5 - 1913.5	0.212	23.27	2M71W7D
	1.4 MHz	QPSK	1850.7 - 1914.3	0.256	24.08	1M09G7D
		16QAM	1850.7 - 1914.3	0.216	23.35	1M10W7D
NR Band n25/2	40 MHz	π/2 BPSK	1870 - 1895	0.195	22.91	38M8G7D
		QPSK	1870 - 1895	0.194	22.88	38M8G7D
		16QAM	1870 - 1895	0.153	21.84	38M7W7D
	35 MHz	π/2 BPSK	1867.5 - 1897.5	0.210	23.23	32M4G7D
		QPSK	1867.5 - 1897.5	0.207	23.17	33M7G7D
		16QAM	1867.5 - 1897.5	0.168	22.26	33M7W7D
	30 MHz	π/2 BPSK	1865 - 1900	0.199	22.99	28M7G7D
		QPSK	1865 - 1900	0.200	23.01	28M7G7D
		16QAM	1865 - 1900	0.157	21.96	28M7W7D
	25 MHz	π/2 BPSK	1862.5 - 1902.5	0.204	23.09	23M0G7D
		QPSK	1862.5 - 1902.5	0.202	23.04	23M8G7D
		16QAM	1862.5 - 1902.5	0.153	21.84	23M9W7D
	20 MHz	π/2 BPSK	1860 - 1905	0.202	23.06	18M0G7D
		QPSK	1860 - 1905	0.204	23.10	19M0G7D
		16QAM	1860 - 1905	0.155	21.91	19M0W7D
	15 MHz	π/2 BPSK	1857.5 - 1907.5	0.199	22.99	13M5G7D
		QPSK	1857.5 - 1907.5	0.200	23.02	14M1G7D
		16QAM	1857.5 - 1907.5	0.151	21.79	14M2W7D
	10 MHz	π/2 BPSK	1855 - 1910	0.199	23.00	9M00G7D
		QPSK	1855 - 1910	0.187	22.72	9M33G7D
		16QAM	1855 - 1910	0.145	21.62	9M35W7D
	5 MHz	π/2 BPSK	1852.5 - 1912.5	0.197	22.94	4M48G7D
		QPSK	1852.5 - 1912.5	0.200	23.01	4M50G7D
		16QAM	1852.5 - 1912.5	0.153	21.84	4M50W7D

Antenna-2						
Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 25/2	20 MHz	QPSK	1860 - 1905	0.139	21.44	18M0G7D
		16QAM	1860 - 1905	0.120	20.78	18M0W7D
	15 MHz	QPSK	1857.5 - 1907.5	0.141	21.50	13M5G7D
		16QAM	1857.5 - 1907.5	0.121	20.84	13M5W7D
	10 MHz	QPSK	1855 - 1910	0.145	21.62	9M01G7D
		16QAM	1855 - 1910	0.121	20.85	8M98W7D
	5 MHz	QPSK	1852.5 - 1912.5	0.145	21.61	4M51G7D
		16QAM	1852.5 - 1912.5	0.125	20.97	4M49W7D
	3 MHz	QPSK	1851.5 - 1913.5	0.141	21.48	2M70G7D
		16QAM	1851.5 - 1913.5	0.124	20.95	2M70W7D
	1.4 MHz	QPSK	1850.7 - 1914.3	0.142	21.52	1M10G7D
		16QAM	1850.7 - 1914.3	0.127	21.05	1M10W7D

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 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 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 **Samsung Portable Tablet FCC ID: A3LSMX828U**. 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 24.

Test Device Serial No.: 27174, 18223, 18066, 25343, 18074, 18207, 18231

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1 and FR2), 802.11b/g/n/ac/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), 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.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version X828USQU0AXFE 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	1.13
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
-	AP2	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	AP2
-	LTx2	Licensed Transmitter Cable Set	4/2/2024	Annual	4/2/2025	LTx2
-	LTx3	LIcensed Transmitter Cable Set	4/2/2024	Annual	4/2/2025	LTx3
-	LTx5	LIcensed Transmitter Cable Set	4/2/2024	Annual	4/2/2025	LTx5
Agilent	N9030A	50GHz PXA Signal Analyzer	4/23/2024	Annual	4/23/2025	US51350301
Anritsu	MT8821C	Radio Communication Analyzer	N/A			6201381794
Com-Power	AL-130R	Active Loop Antenna	2/22/2024	Biennial	2/22/2026	121085
Emco	3115	Horn Antenna (1-18GHz)	8/8/2022	Biennial	8/8/2024	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	7/5/2023	Triennial	7/5/2025	9203-2178
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	2/22/2024	Biennial	2/22/2026	125518
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	3/29/2023	Biennial	3/29/2025	128337
ETS Lindgren	3164-10	Quad Ridge Horn 400MHz - 10000MHz	7/13/2023	Biennial	7/13/2025	166283
ETS Lindgren	3816/2NM	LISN	8/11/2022	Biennial	8/11/2024	114451
Keysight Technologies	N9020A	MXA Signal Analyzer	4/11/2024	Annual	4/11/2025	MY54500644
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	8/29/2023	Annual	8/29/2024	MY49430494
Keysight Technologies	N9030A	PXA Signal Analyzer	8/7/2023	Annual	8/7/2024	MY54490576
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11403100002
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			100976
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	9/25/2023	Annual	9/25/2024	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	9/11/2023	Annual	9/11/2024	100348
Rohde & Schwarz	FSW26	2Hz-26.5GHz Signal and Spectrum Analyzer	3/8/2024	Annual	3/8/2025	103187
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	8/30/2022	Biennial	8/30/2024	A051107

Table 5-1. Test Equipment

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

WCDMA Emission Designator

Emission Designator = 4M16F9W
WCDMA BW = 4.16 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)

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: Samsung Electronics Co., Ltd.

FCC ID: A3LSMX828U

FCC Classification: PCS Licensed Transmitter (PCB)

Mode(s): WCDMA/LTE/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	See RF Exposure Report
	Occupied Bandwidth	2.1049(h)	N/A	PASS	Section 7.2
	Conducted Band Edge / Spurious Emissions	2.1051, 24.238(a)	> 43 + 10log10(P[Watts]) at Band Edge and for all out-of-band emissions	PASS	Sections 7.3, 7.4
	Peak-to-Average Ratio	24.232(d)	≤ 13 dB	PASS	Section 7.5
	Frequency Stability	2.1055, 24.235	Fundamental emissions stay within authorized frequency block **Carrier frequency shall not depart from the reference frequency in excess of +2.5 ppm	PASS	Section 7.8
RADIATED	Equivalent Isotropic Radiated Power	24.232(c)	< 2 Watts max. EIRP	PASS	Section 7.6
	Radiated Spurious Emissions	2.1053, 24.238(a)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power **Spurious emissions from receivers shall not exceed the limits detailed in RSS-Gen(7.3)	PASS	Section 7.7

* 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 v2.3.0.

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.

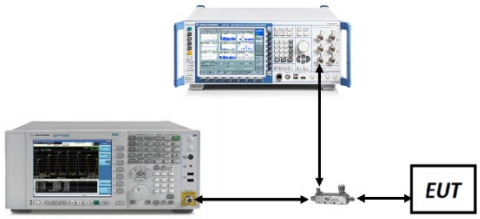


Figure 7-1. Test Instrument & Measurement Setup

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]
20 MHz	QPSK	26140	1860.0	1 / 0	24.25
		26365	1882.5	1 / 0	24.19
		26590	1905.0	1 / 0	24.18
	16-QAM	26365	1882.5	1 / 0	23.45
15 MHz	QPSK	26115	1857.5	1 / 0	24.28
		26365	1882.5	1 / 0	24.26
		26615	1907.5	1 / 0	24.21
	16-QAM	26365	1882.5	1 / 0	23.48
10 MHz	QPSK	26090	1855.0	1 / 0	24.29
		26365	1882.5	1 / 0	24.18
		26640	1910.0	1 / 0	24.14
	16-QAM	26365	1882.5	1 / 0	23.37
5 MHz	QPSK	26065	1852.5	1 / 0	24.30
		26365	1882.5	1 / 0	24.20
		26665	1912.5	1 / 0	24.18
	16-QAM	26365	1882.5	1 / 0	23.75
3 MHz	QPSK	26055	1851.5	1 / 14	24.33
		26365	1882.5	1 / 0	24.14
		26675	1913.5	1 / 7	24.26
	16-QAM	26365	1882.5	1 / 14	23.30
1.4 MHz	QPSK	26047	1850.7	1 / 3	24.32
		26365	1882.5	1 / 0	24.12
		26683	1914.3	1 / 3	24.13
	16-QAM	26365	1882.5	1 / 0	23.39

Table 7-2. Conducted Powers – LTE – Band 25/2 – Ant1

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
20 MHz	QPSK	26140	1860.0	1 / 0	23.40
		26365	1882.5	1 / 50	23.51
		26590	1905.0	1 / 50	23.74
	16-QAM	26140	1860.0	1 / 0	22.59
15 MHz	QPSK	26115	1857.5	1 / 37	23.45
		26365	1882.5	1 / 74	23.54
		26615	1907.5	1 / 0	23.61
	16-QAM	26115	1857.5	1 / 74	22.64
10 MHz	QPSK	26090	1855.0	1 / 25	23.58
		26365	1882.5	1 / 49	23.65
		26640	1910.0	1 / 25	23.71
	16-QAM	26090	1855.0	1 / 25	22.65
5 MHz	QPSK	26065	1852.5	1 / 12	23.56
		26365	1882.5	1 / 12	23.66
		26665	1912.5	1 / 0	23.75
	16-QAM	26065	1852.5	1 / 12	22.78
3 MHz	QPSK	26055	1851.5	1 / 0	23.43
		26365	1882.5	1 / 7	23.65
		26675	1913.5	1 / 0	23.66
	16-QAM	26055	1851.5	1 / 0	22.76
1.4 MHz	QPSK	26047	1850.7	1 / 3	23.48
		26365	1882.5	1 / 5	23.58
		26683	1914.3	1 / 0	23.58
	16-QAM	26047	1850.7	1 / 3	22.86

Table 7-3. Conducted Powers – LTE – Band 25/2 – Ant2

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	374000	1870.0	1 / 1	24.36
		376500	1882.5	1 / 108	24.33
		379000	1895.0	1 / 108	24.41
	QPSK	374000	1870.0	1 / 1	24.26
		376500	1882.5	1 / 108	24.25
		379000	1895.0	1 / 108	24.25
	16-QAM	374000	1870.0	1 / 1	23.20
35 MHz	π/2 BPSK	373500	1867.5	1 / 94	24.68
		376500	1882.5	1 / 94	24.42
		379500	1897.5	1 / 1	24.29
	QPSK	373500	1867.5	1 / 94	24.57
		376500	1882.5	1 / 94	24.49
		379500	1897.5	1 / 186	24.30
	16-QAM	373500	1867.5	1 / 94	23.63
30 MHz	π/2 BPSK	372000	1865.0	1 / 1	24.44
		376500	1882.5	1 / 80	24.36
		381000	1900.0	1 / 80	24.49
	QPSK	372000	1865.0	1 / 1	24.41
		376500	1882.5	1 / 80	24.31
		381000	1900.0	1 / 80	24.33
	16-QAM	372000	1865.0	1 / 1	23.32
25 MHz	π/2 BPSK	372000	1862.5	1 / 1	24.54
		376500	1882.5	1 / 131	24.33
		381000	1902.5	1 / 131	24.30
	QPSK	372000	1862.5	1 / 1	24.45
		376500	1882.5	1 / 131	24.38
		381000	1902.5	1 / 131	24.42
	16-QAM	372000	1862.5	1 / 1	23.20
20 MHz	π/2 BPSK	372000	1860.0	1 / 53	24.51
		376500	1882.5	1 / 1	24.42
		381000	1905.0	1 / 1	24.48
	QPSK	372000	1860.0	1 / 53	24.50
		376500	1882.5	1 / 1	24.24
		381000	1905.0	1 / 1	24.36
	16-QAM	372000	1860.0	1 / 53	23.27
15 MHz	π/2 BPSK	371500	1857.5	1 / 77	24.45
		376500	1882.5	1 / 39	24.33
		381500	1907.5	1 / 77	24.29
	QPSK	371500	1857.5	1 / 77	24.34
		376500	1882.5	1 / 39	24.39
		381500	1907.5	1 / 77	24.33
	16-QAM	376500	1882.5	1 / 39	23.09
10 MHz	π/2 BPSK	371000	1855.0	1 / 26	24.36
		376500	1882.5	1 / 1	24.44
		382000	1910.0	1 / 50	24.38
	QPSK	371000	1855.0	1 / 26	24.13
		376500	1882.5	1 / 1	23.24
		382000	1910.0	1 / 50	24.40
	16-QAM	371000	1855.0	1 / 26	22.98
5 MHz	π/2 BPSK	370500	1852.5	1 / 23	24.35
		376500	1882.5	1 / 12	24.38
		382500	1912.5	1 / 12	24.41
	QPSK	370500	1852.5	1 / 23	24.41
		376500	1882.5	1 / 12	24.17
		382500	1912.5	1 / 12	24.38
	16-QAM	376500	1882.5	1 / 12	23.14

Table 7-4. Conducted Powers – NR – Band n25/2

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.

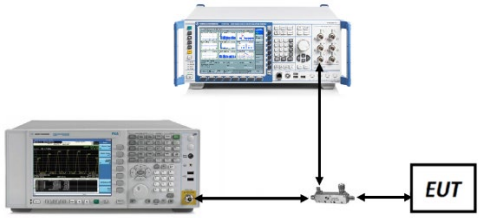


Figure 7-2. Test Instrument & Measurement Setup

Test Notes

None.

Mode	Bandwidth	Modulation	OBW [MHz]
WCDMA-PCS	N/A	Spread Spectrum	4.165
LTE-B25-2	20MHz	QPSK	17.93
		16QAM	17.97
	15MHz	QPSK	13.48
		16QAM	13.50
	10MHz	QPSK	9.02
		16QAM	8.99
	5MHz	QPSK	4.51
		16QAM	4.52
	3MHz	QPSK	2.70
		16QAM	2.71
	1.4MHz	QPSK	1.09
		16QAM	1.10

Table 7-5. Occupied Bandwidth Summary – Antenna 1

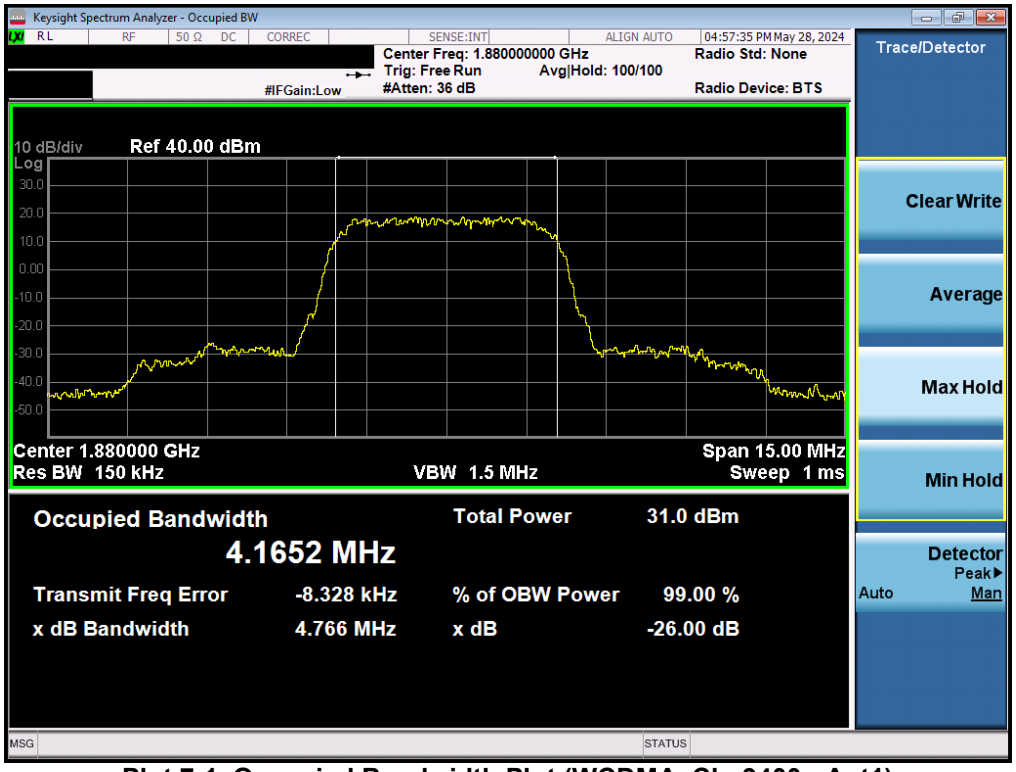
Mode	Bandwidth	Modulation	OBW [MHz]
LTE-B25-2	20MHz	QPSK	17.99
		16QAM	17.98
	15MHz	QPSK	13.49
		16QAM	13.49
	10MHz	QPSK	9.01
		16QAM	8.98
	5MHz	QPSK	4.51
		16QAM	4.49
	3MHz	QPSK	2.70
		16QAM	2.70
	1.4MHz	QPSK	1.10
		16QAM	1.10

Table 7-6. Occupied Bandwidth Summary – Antenna 2

Mode	Bandwidth	Modulation	OBW [MHz]
NR-n25-2	40MHz	BPSK	38.82
		QPSK	38.78
		16QAM	38.73
	35MHz	BPSK	32.40
		QPSK	33.72
		16QAM	33.68
	30MHz	BPSK	28.68
		QPSK	28.65
		16QAM	28.71
	25MHz	BPSK	22.99
		QPSK	23.84
		16QAM	23.91
	20MHz	BPSK	17.97
		QPSK	19.05
		16QAM	18.99
	15MHz	BPSK	13.46
		QPSK	14.14
		16QAM	14.16
	10MHz	BPSK	9.00
		QPSK	9.33
		16QAM	9.35
	5MHz	BPSK	4.48
		QPSK	4.50
		16QAM	4.50

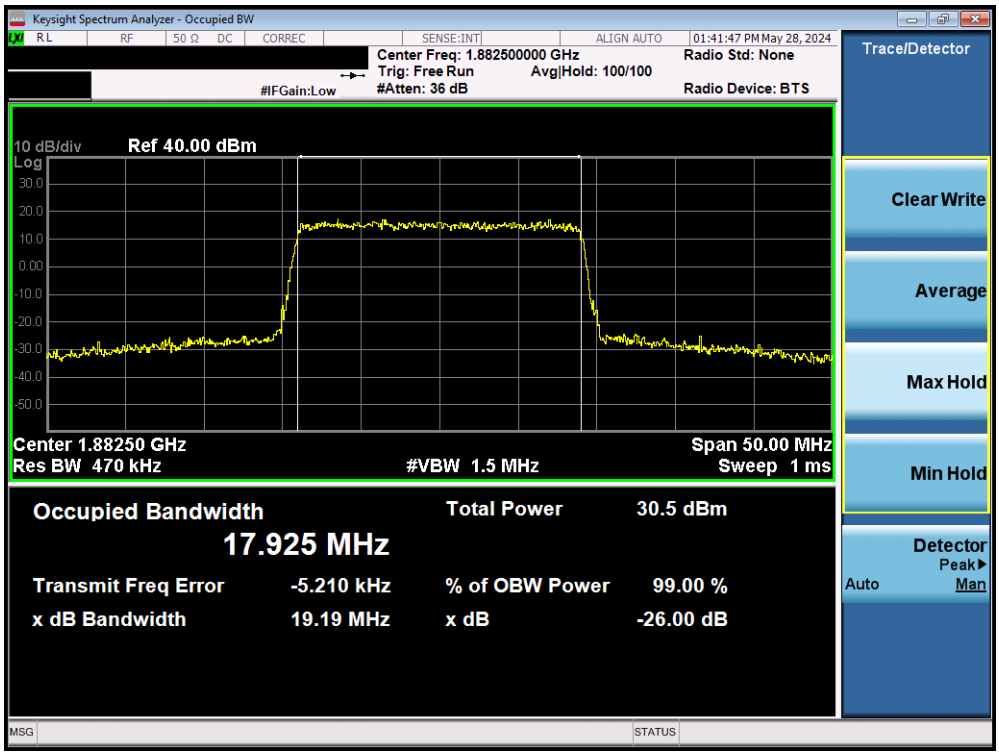
Table 7-7. Occupied Bandwidth Summary – Antenna 1

WCDMA PCS – Ant1

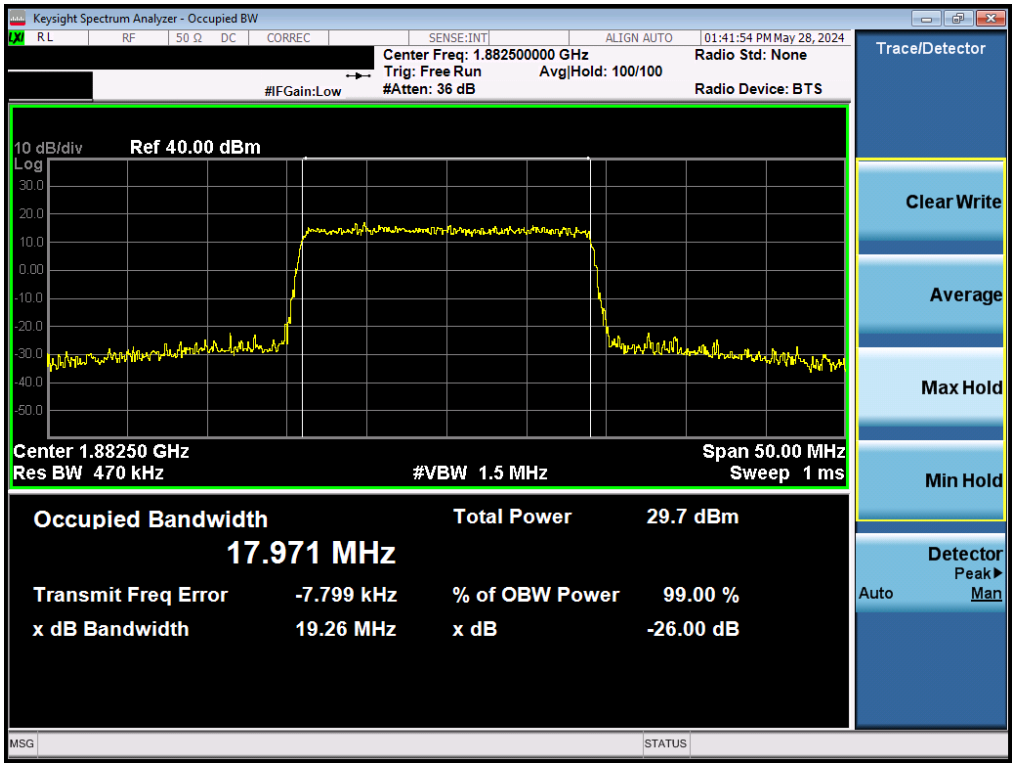


Plot 7-1. Occupied Bandwidth Plot (WCDMA, Ch. 9400 - Ant1)

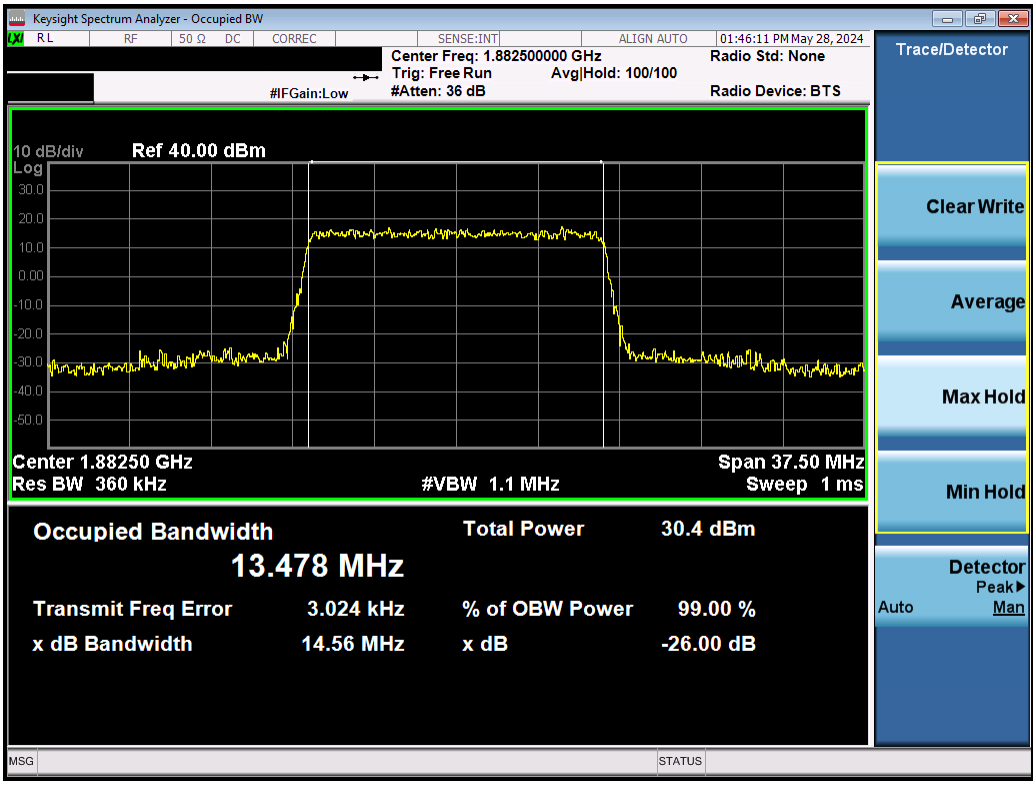
LTE Band 25/2 – Ant1



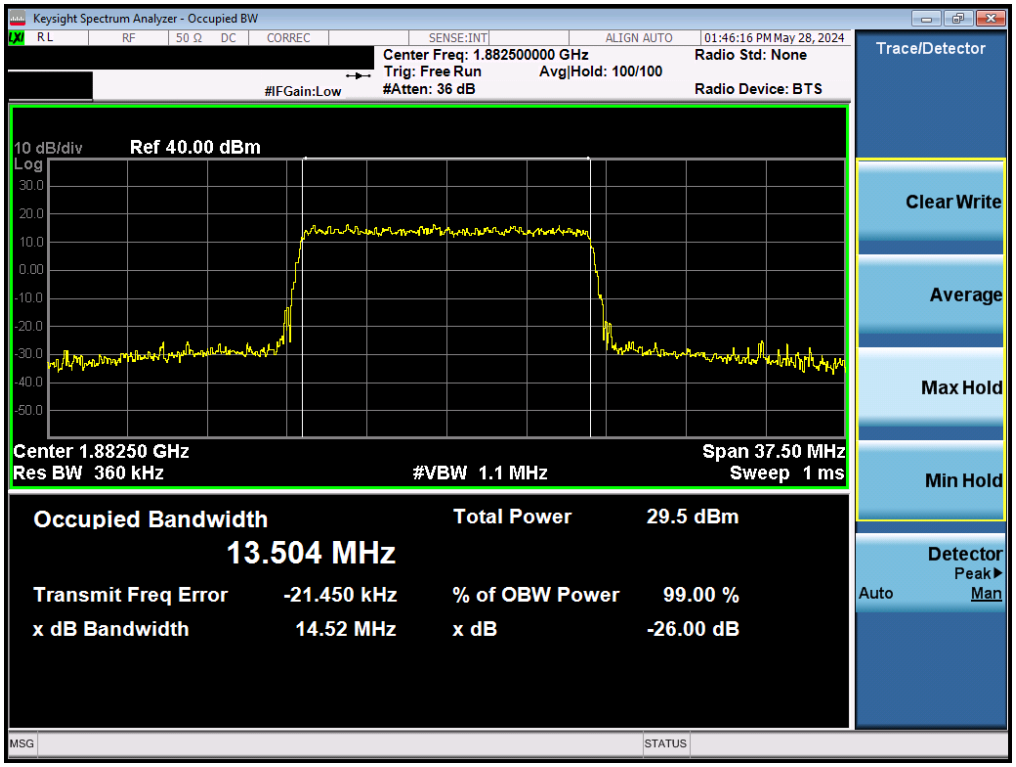
Plot 7-2. Occupied Bandwidth Plot (LTE Band 25/2 - 20MHz QPSK - Full RB - Ant1)



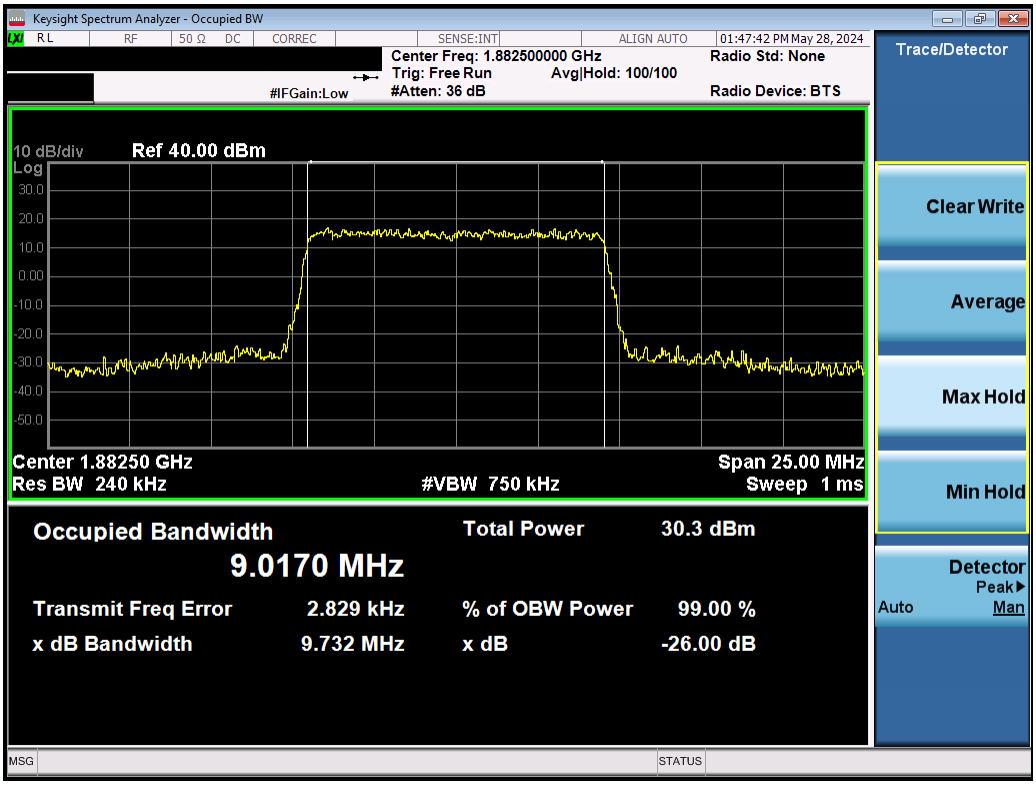
Plot 7-3. Occupied Bandwidth Plot (LTE Band 25/2 - 20MHz 16-QAM - Full RB - Ant1)



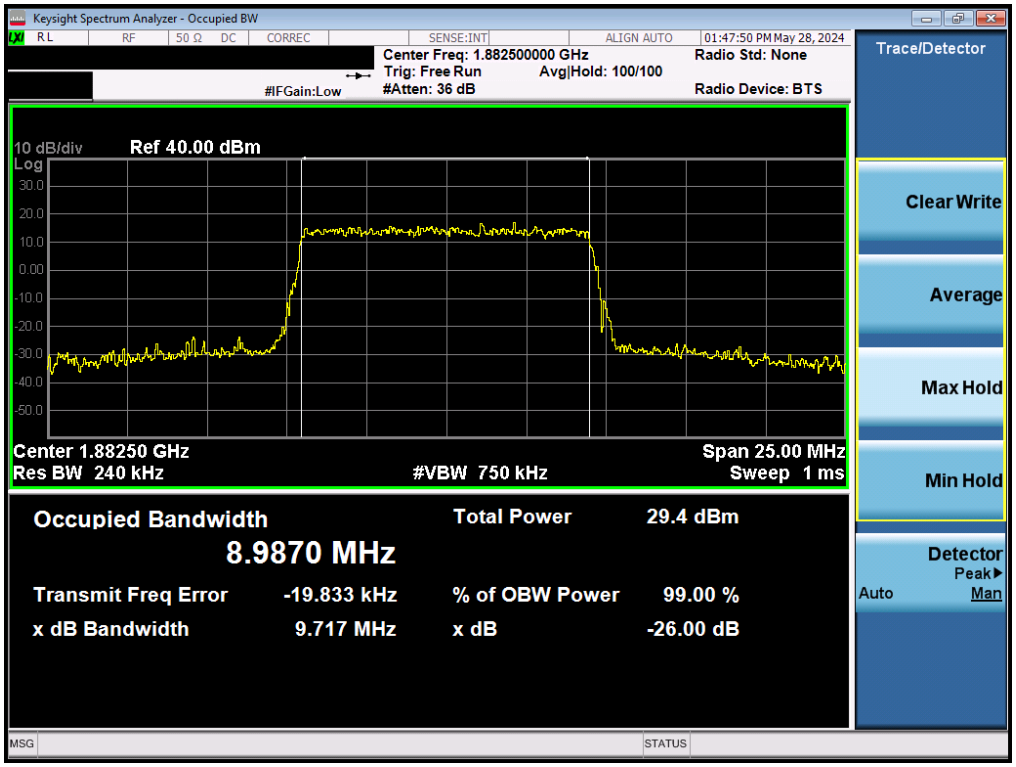
Plot 7-4. Occupied Bandwidth Plot (LTE Band 25/2 - 15MHz QPSK - Full RB - Ant1)



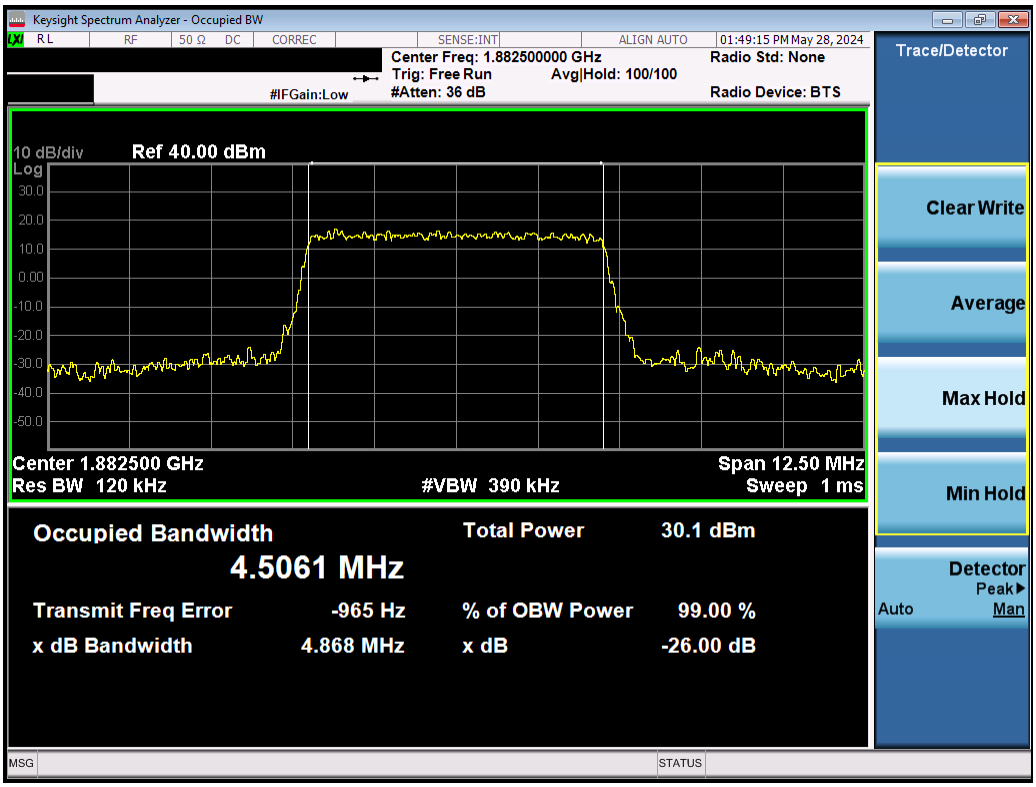
Plot 7-5. Occupied Bandwidth Plot (LTE Band 25/2 - 15MHz 16-QAM - Full RB - Ant1)



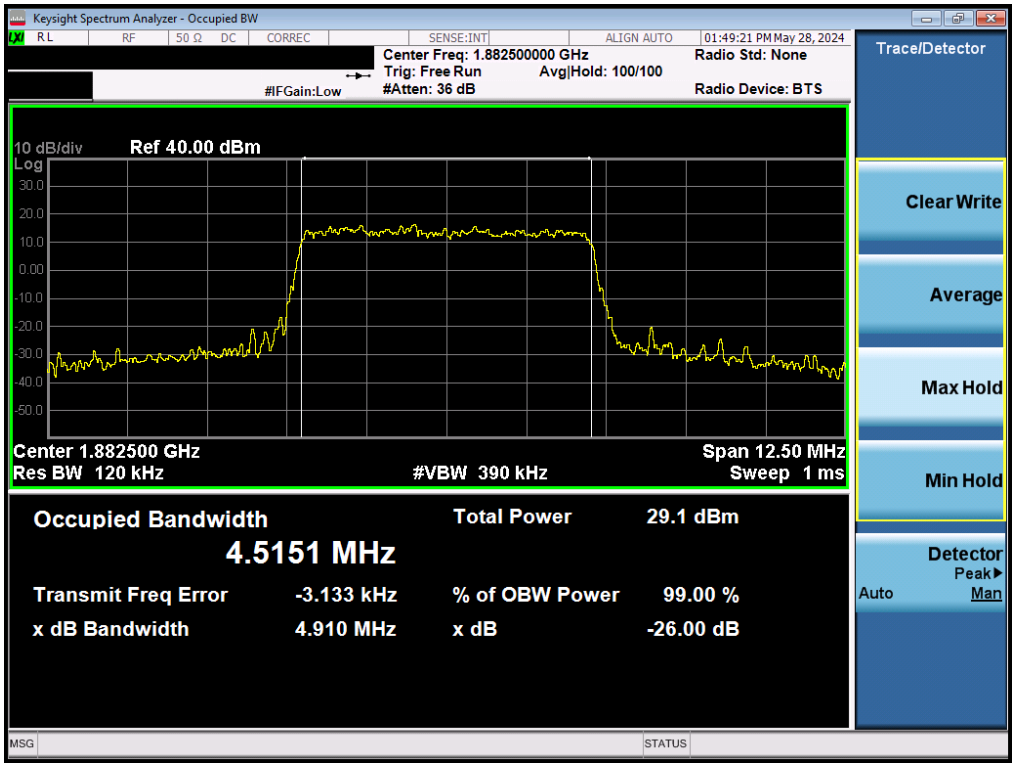
Plot 7-6. Occupied Bandwidth Plot (LTE Band 25/2 - 10MHz QPSK - Full RB - Ant1)



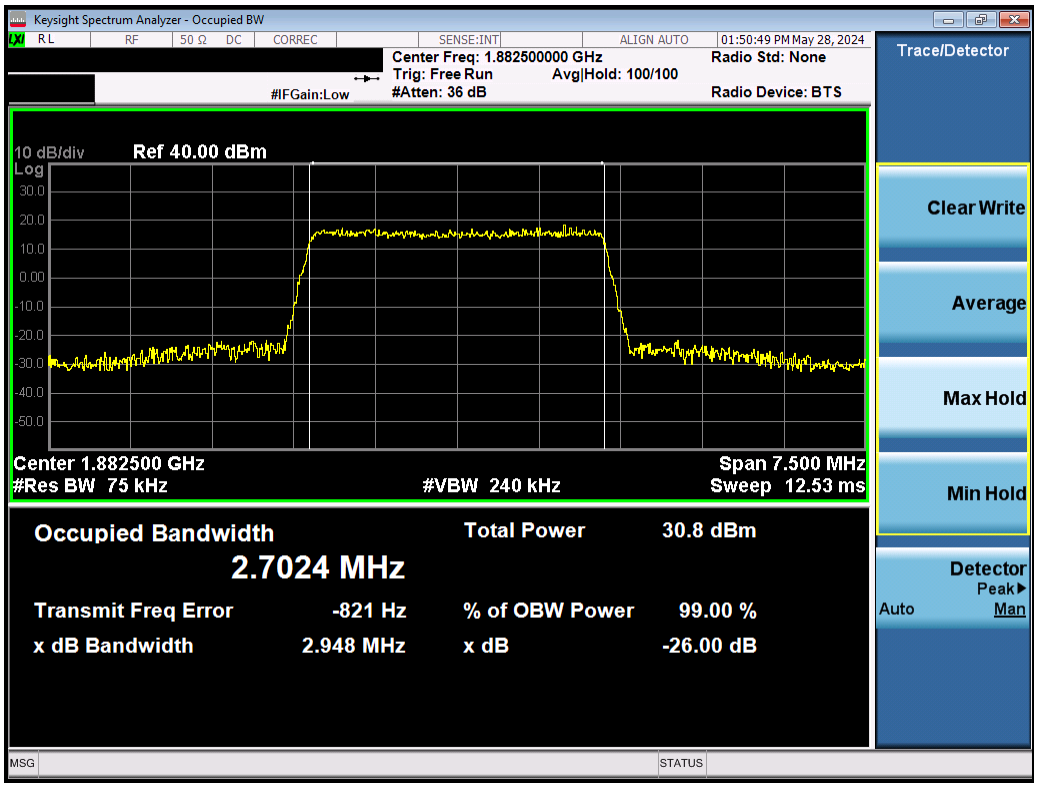
Plot 7-7. Occupied Bandwidth Plot (LTE Band 25/2 - 10MHz 16-QAM - Full RB - Ant1)



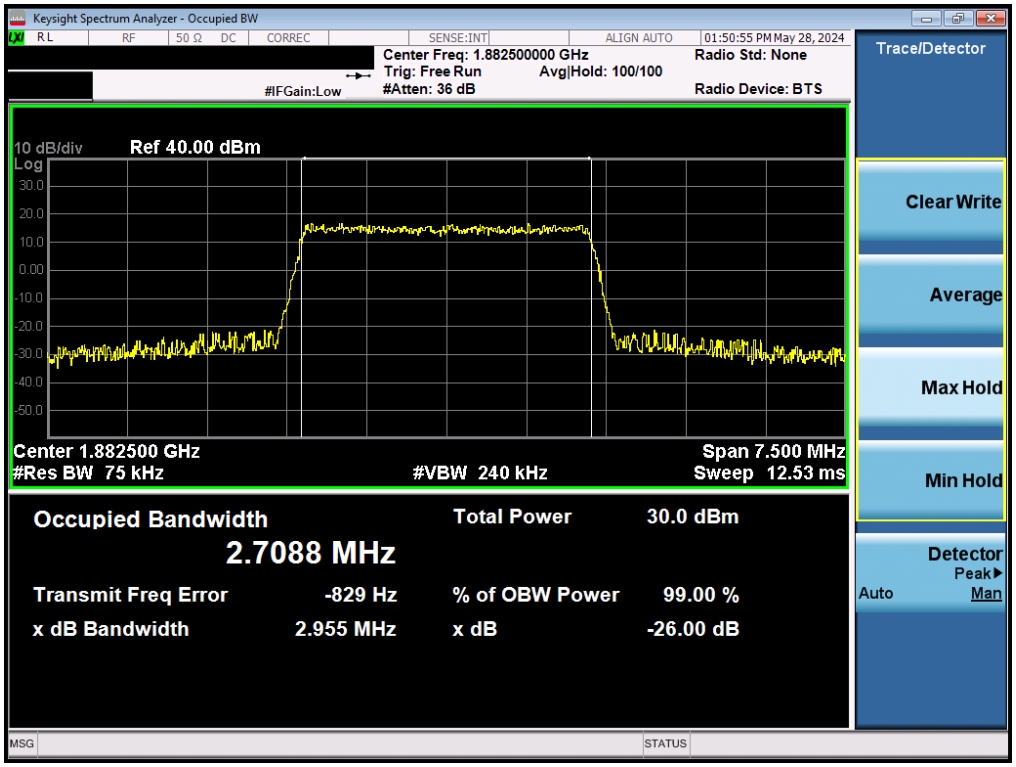
Plot 7-8. Occupied Bandwidth Plot (LTE Band 25/2 - 5MHz QPSK - Full RB - Ant1)



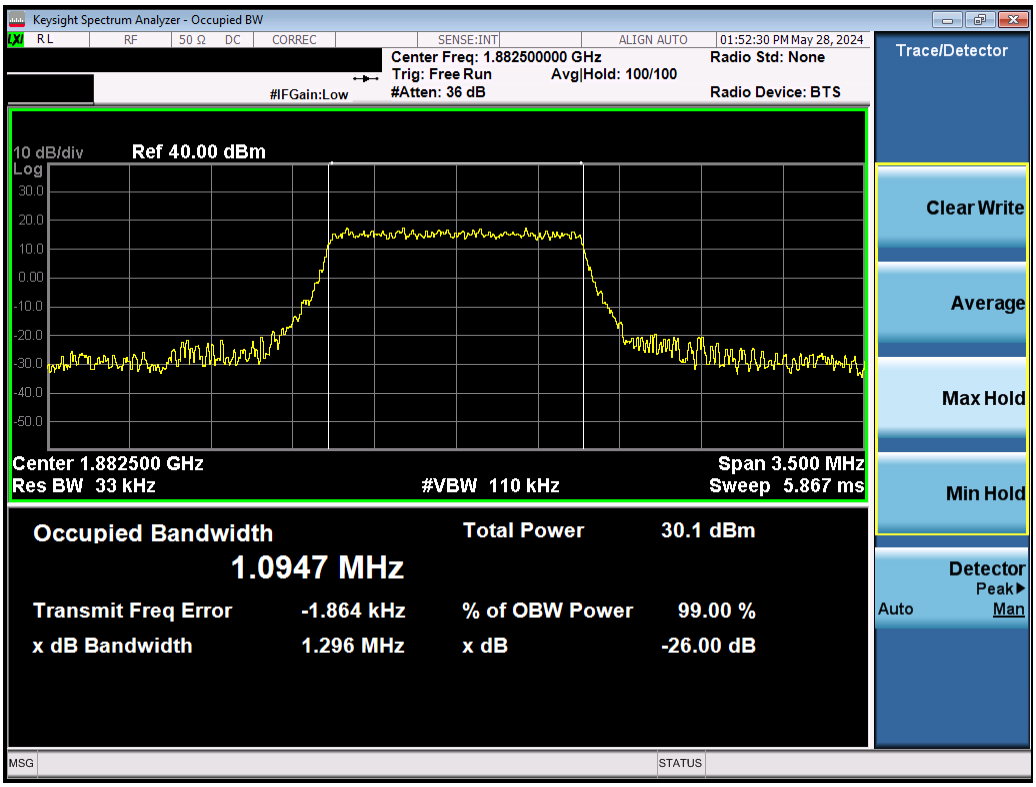
Plot 7-9. Occupied Bandwidth Plot (LTE Band 25/2 - 5MHz 16-QAM - Full RB - Ant1)



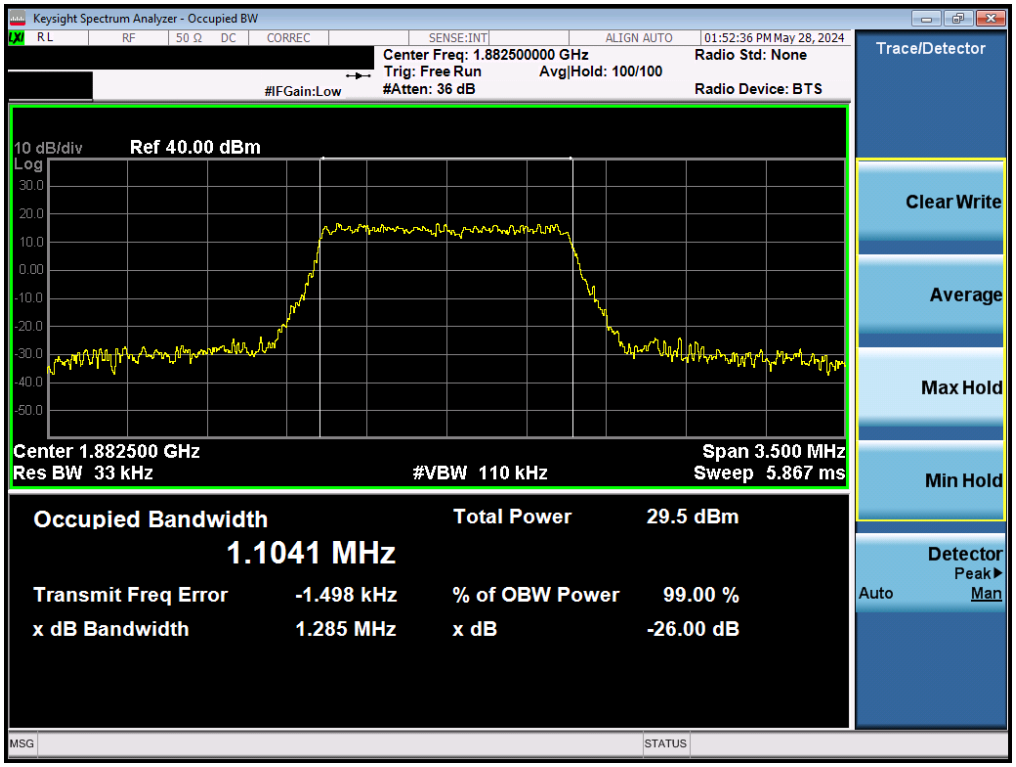
Plot 7-10. Occupied Bandwidth Plot (LTE Band 25/2 - 3MHz QPSK - Full RB - Ant1)



Plot 7-11. Occupied Bandwidth Plot (LTE Band 25/2 - 3MHz 16-QAM - Full RB - Ant1)

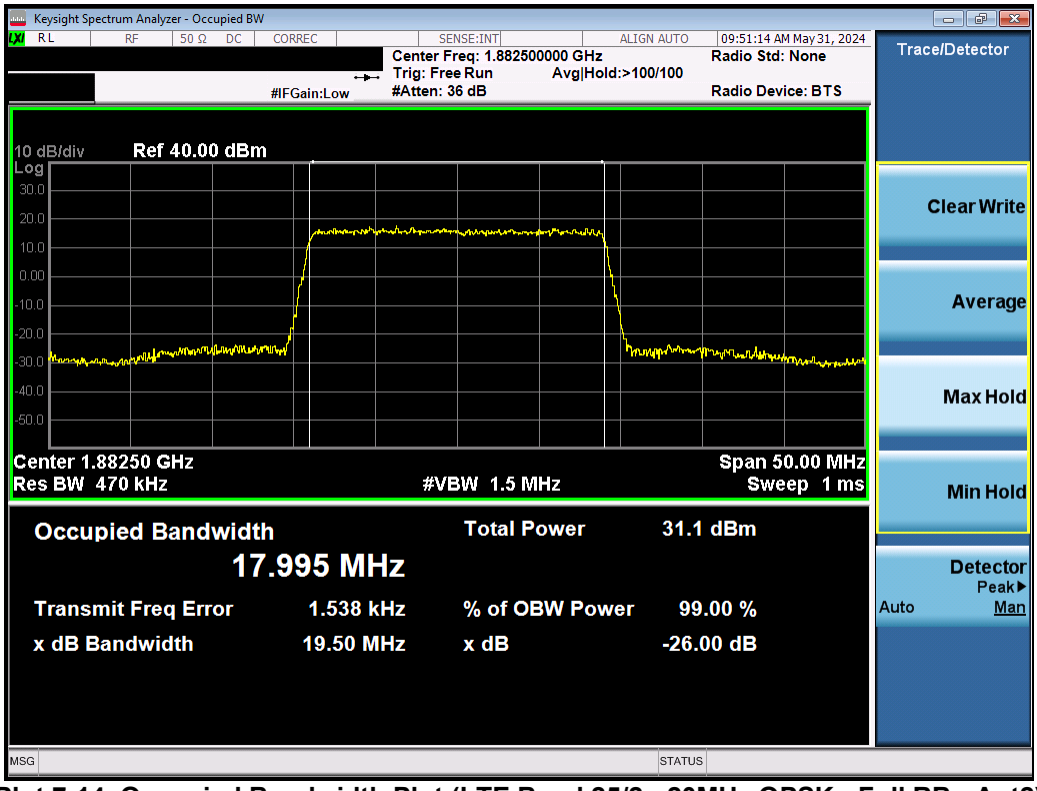


Plot 7-12. Occupied Bandwidth Plot (LTE Band 25/2 - 1.4MHz QPSK - Full RB - Ant1)

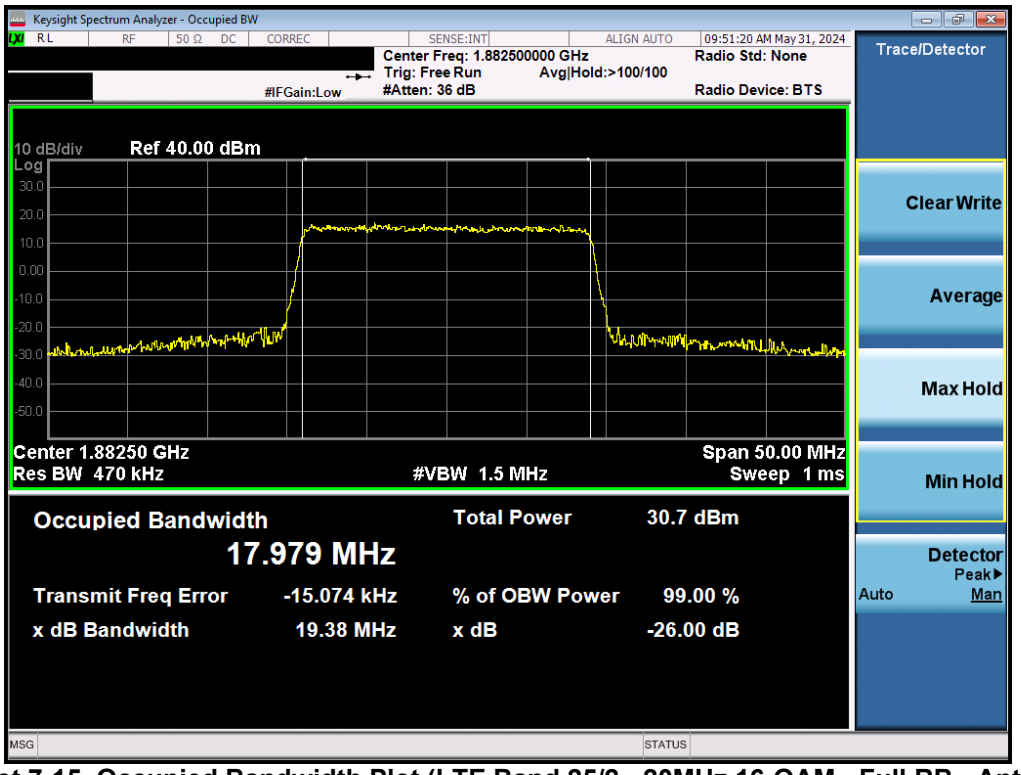


Plot 7-13. Occupied Bandwidth Plot (LTE Band 25/2 - 1.4MHz 16-QAM - Full RB - Ant1)

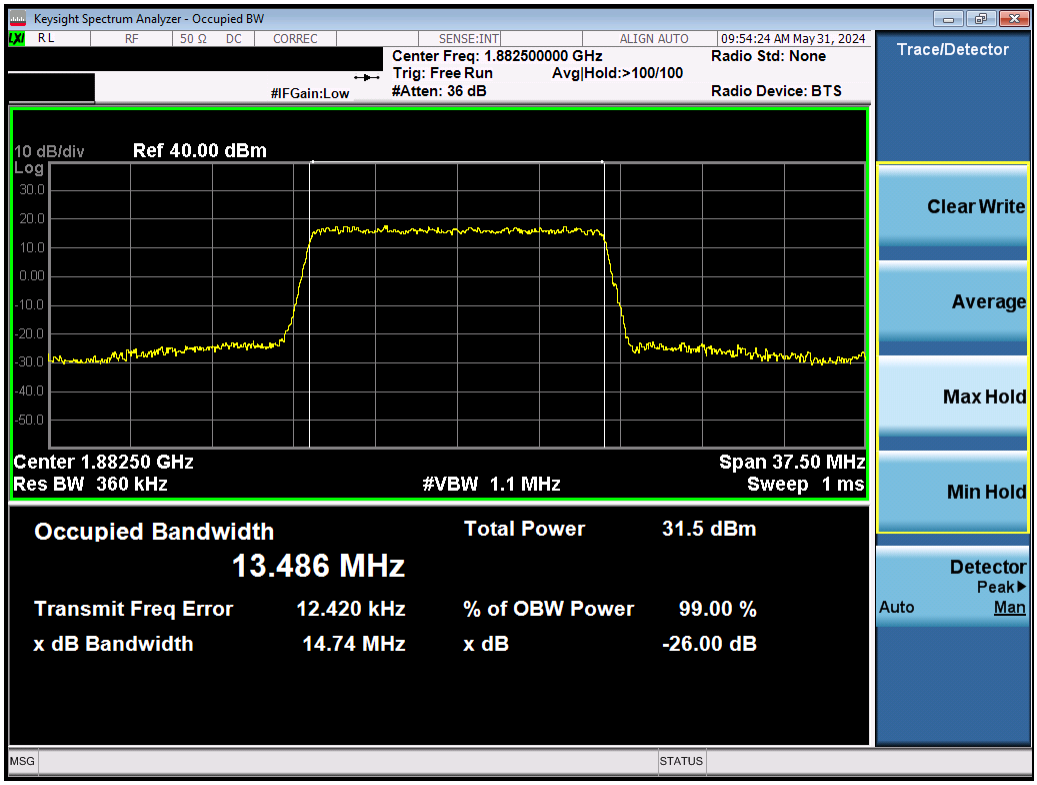
LTE Band 25/2 – Ant2



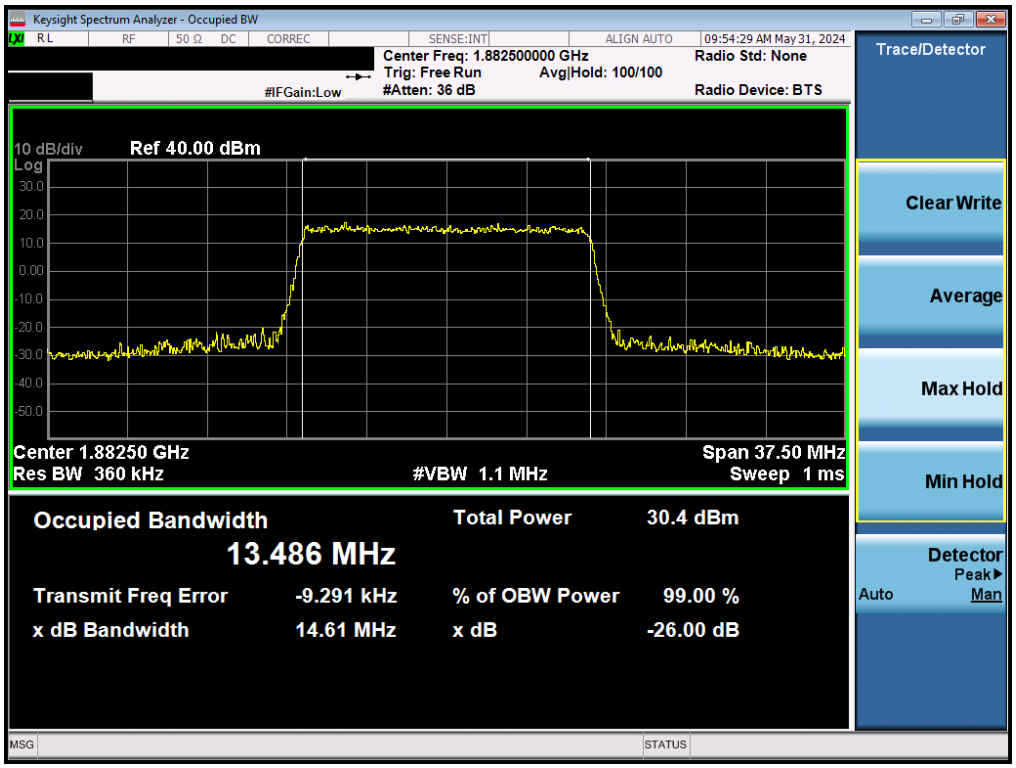
Plot 7-14. Occupied Bandwidth Plot (LTE Band 25/2 - 20MHz QPSK - Full RB - Ant2)



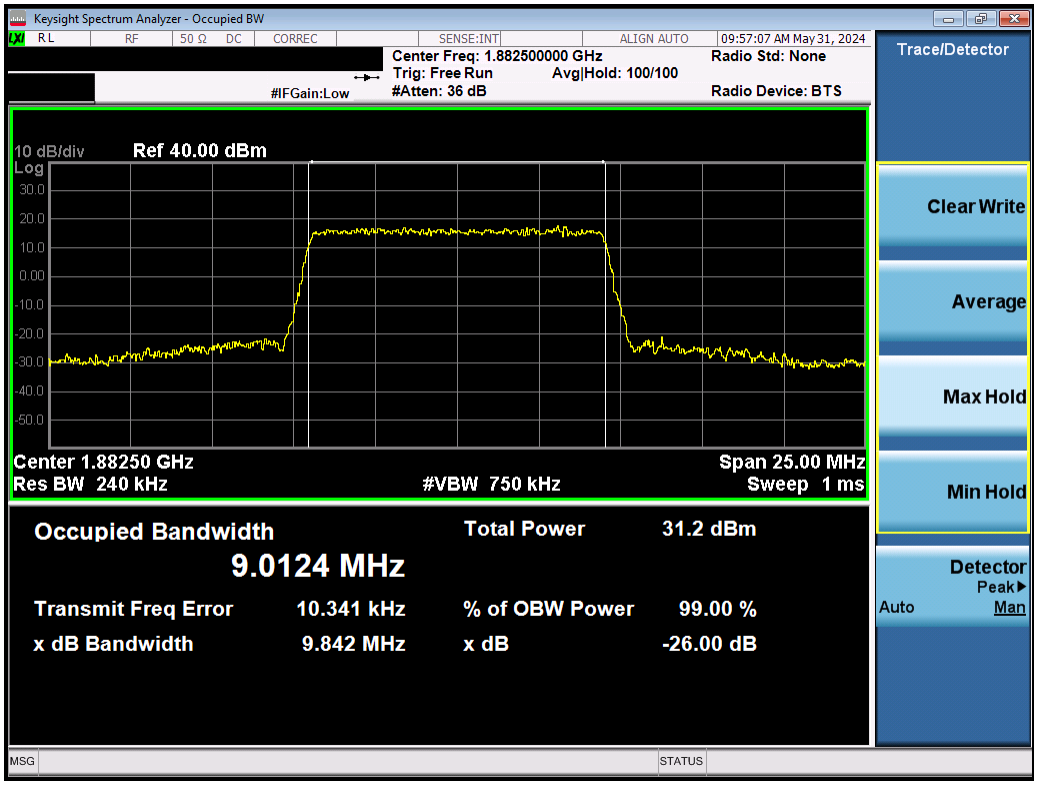
Plot 7-15. Occupied Bandwidth Plot (LTE Band 25/2 - 20MHz 16-QAM - Full RB - Ant2)



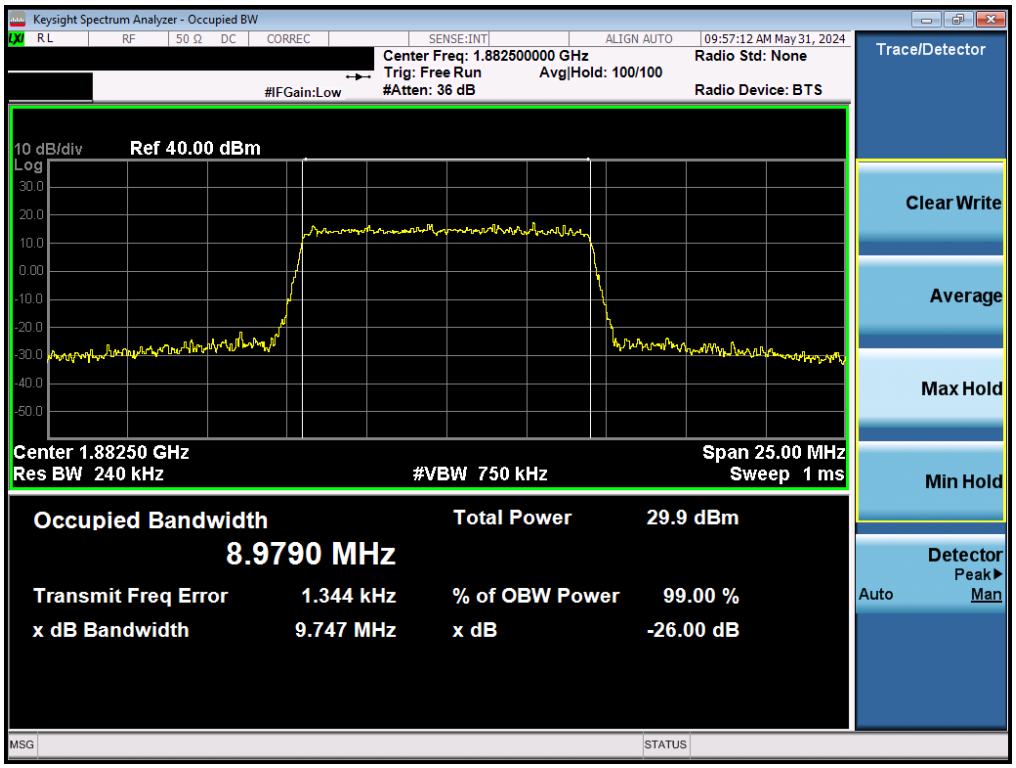
Plot 7-16. Occupied Bandwidth Plot (LTE Band 25/2 - 15MHz QPSK - Full RB - Ant2)



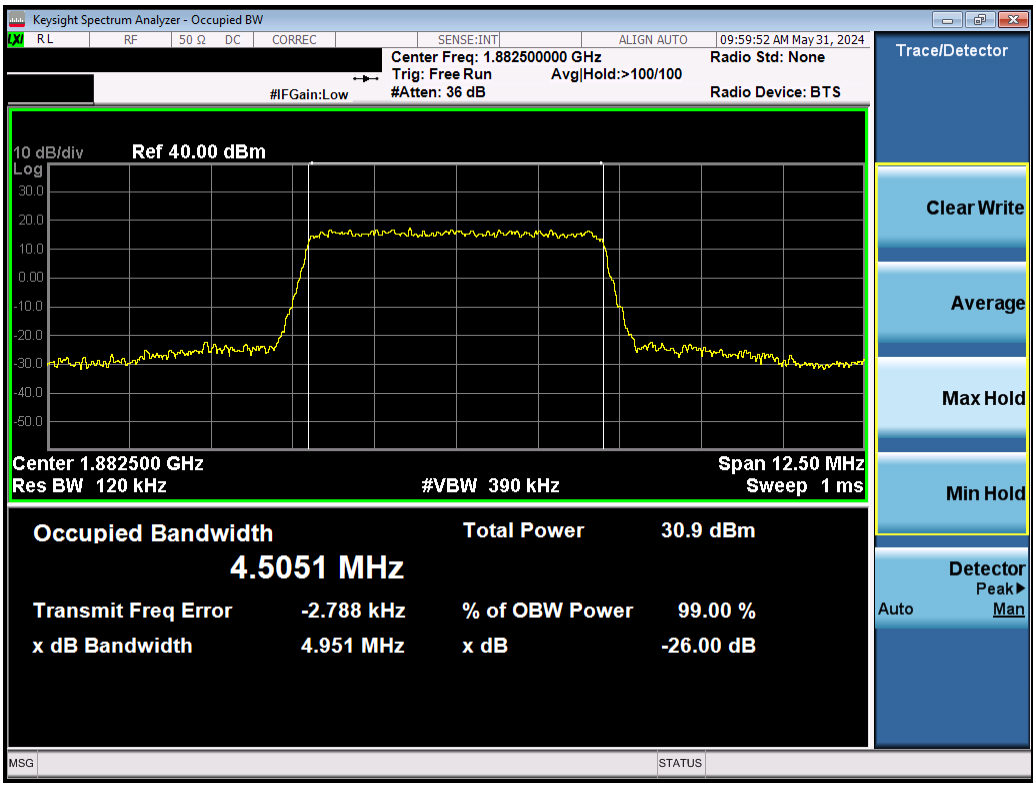
Plot 7-17. Occupied Bandwidth Plot (LTE Band 25/2 - 15MHz 16-QAM - Full RB - Ant2)



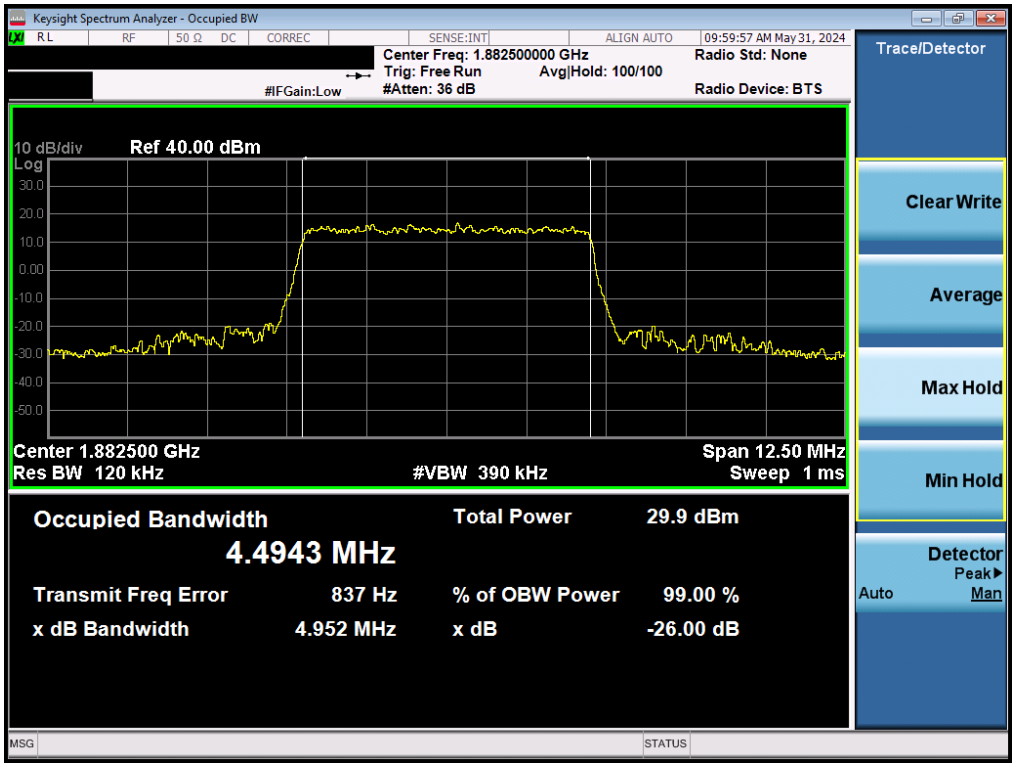
Plot 7-18. Occupied Bandwidth Plot (LTE Band 25/2 - 10MHz QPSK - Full RB - Ant2)



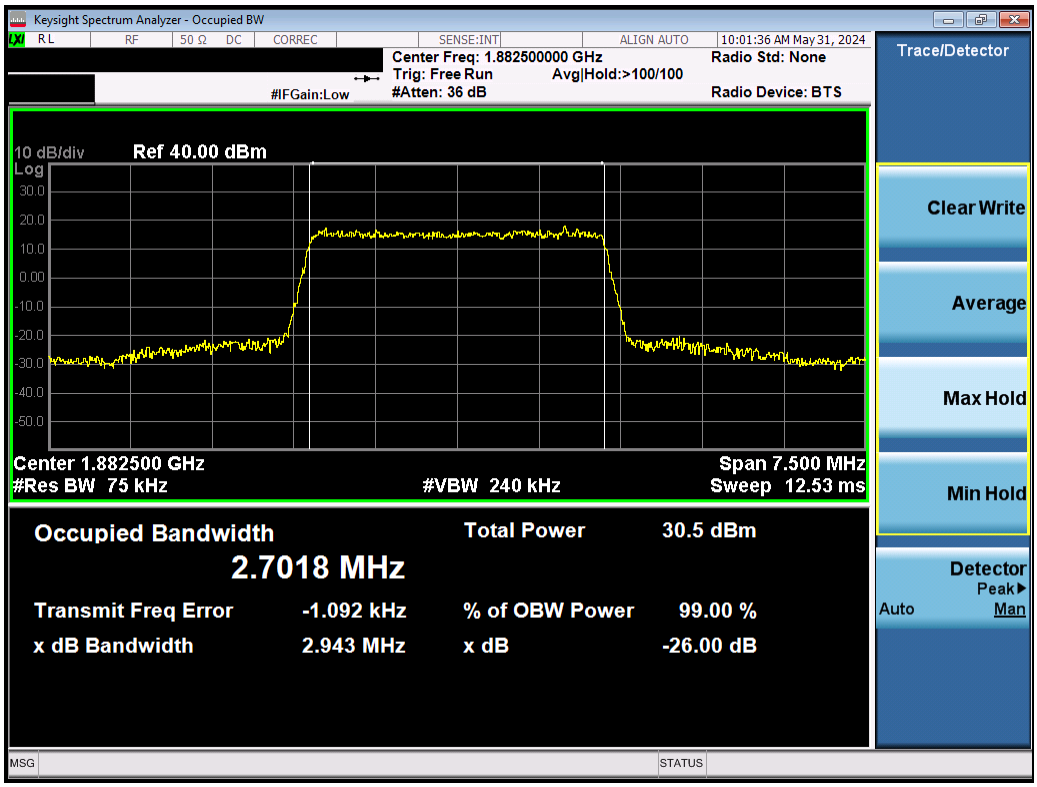
Plot 7-19. Occupied Bandwidth Plot (LTE Band 25/2 - 10MHz 16-QAM - Full RB - Ant2)



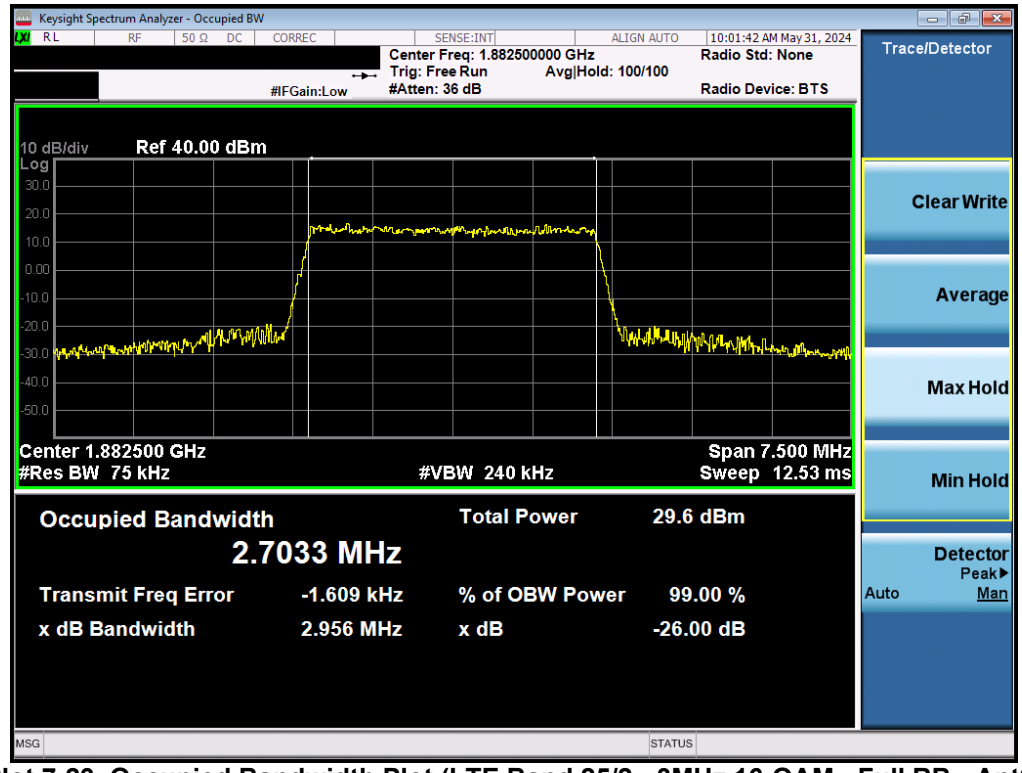
Plot 7-20. Occupied Bandwidth Plot (LTE Band 25/2 - 5MHz QPSK - Full RB - Ant2)



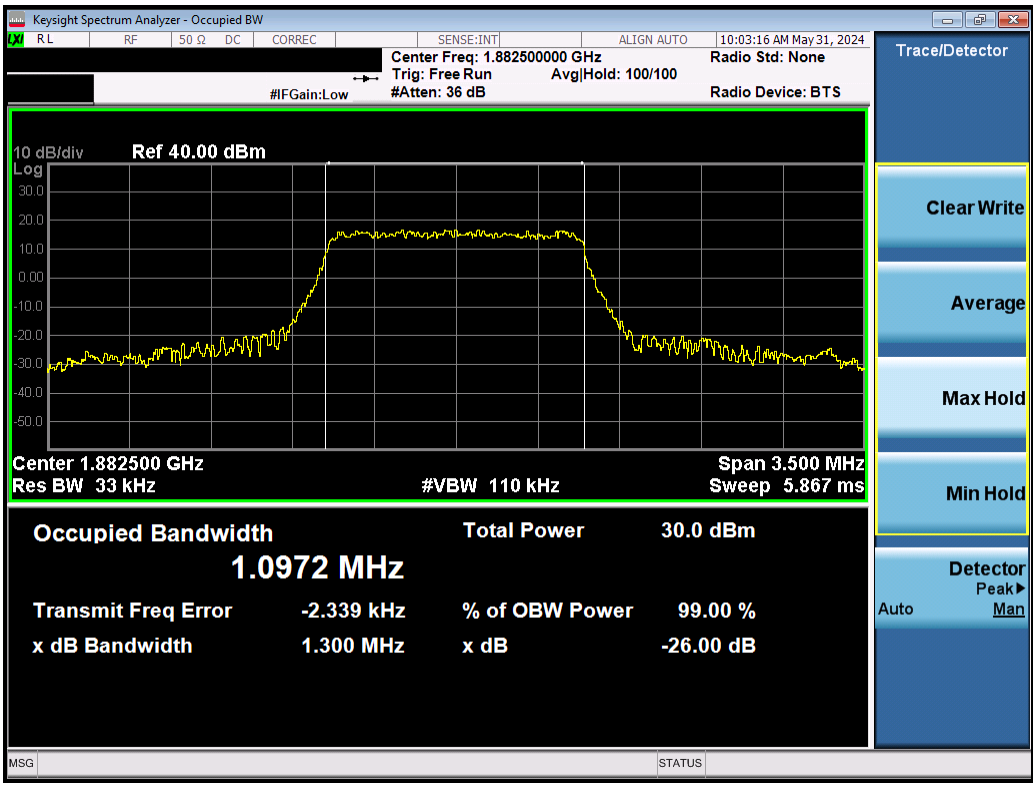
Plot 7-21. Occupied Bandwidth Plot (LTE Band 25/2 - 5MHz 16-QAM - Full RB - Ant2)



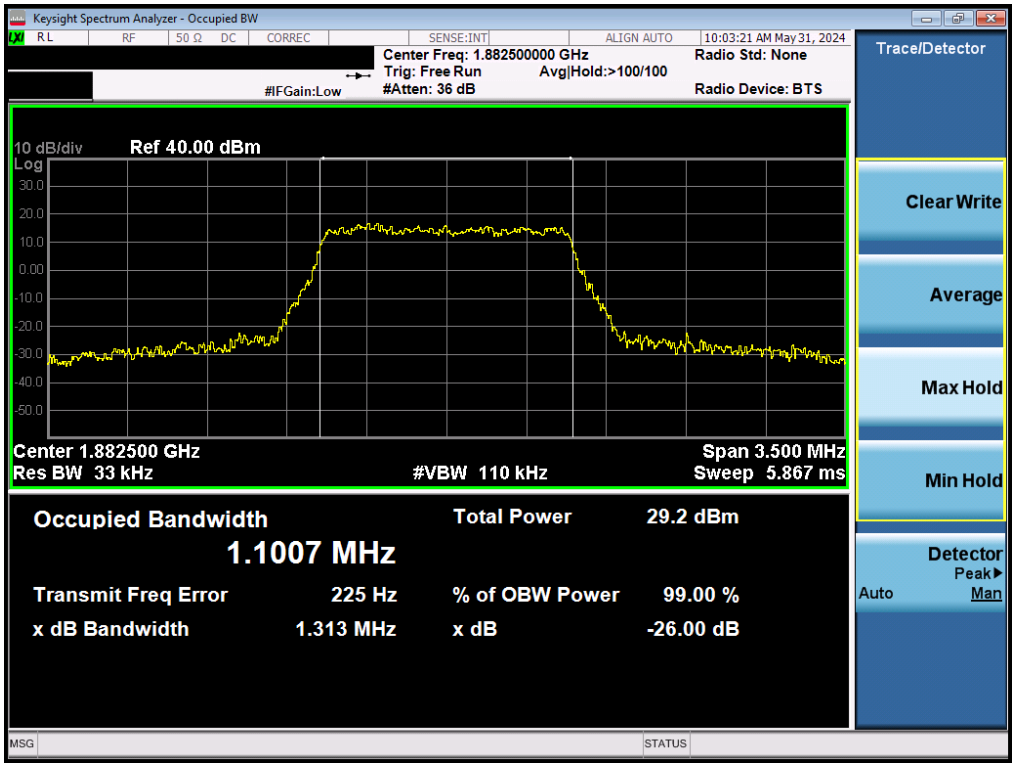
Plot 7-22. Occupied Bandwidth Plot (LTE Band 25/2 - 3MHz QPSK - Full RB - Ant2)



Plot 7-23. Occupied Bandwidth Plot (LTE Band 25/2 - 3MHz 16-QAM - Full RB - Ant2)

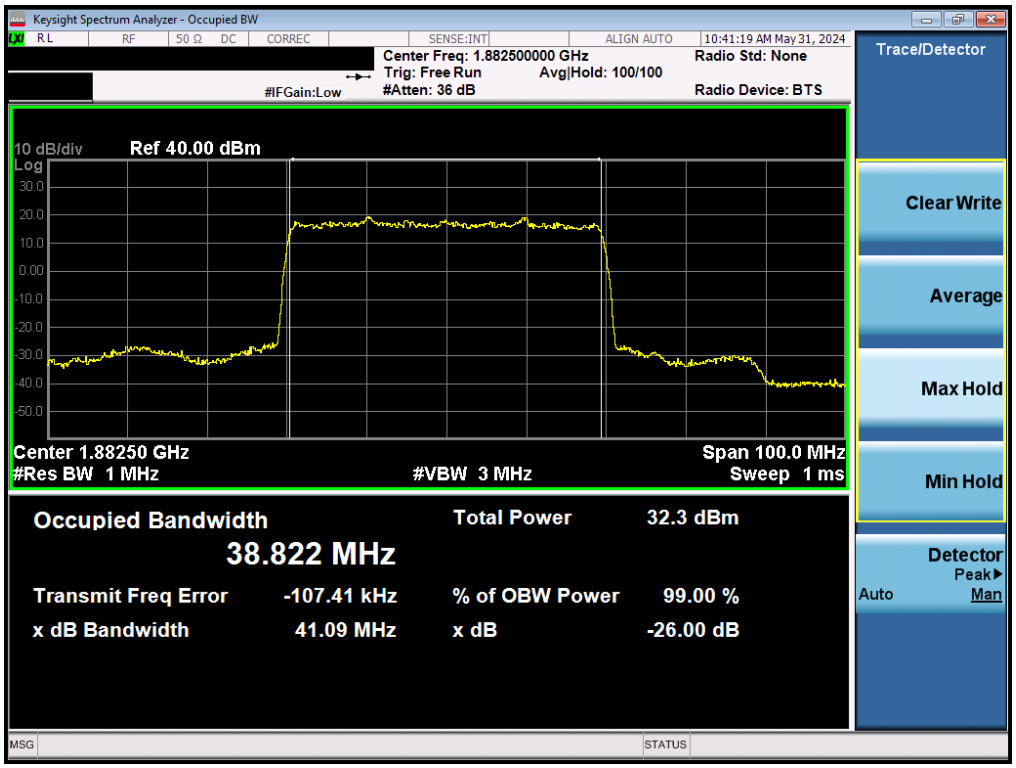


Plot 7-24. Occupied Bandwidth Plot (LTE Band 25/2 - 1.4MHz QPSK - Full RB - Ant2)



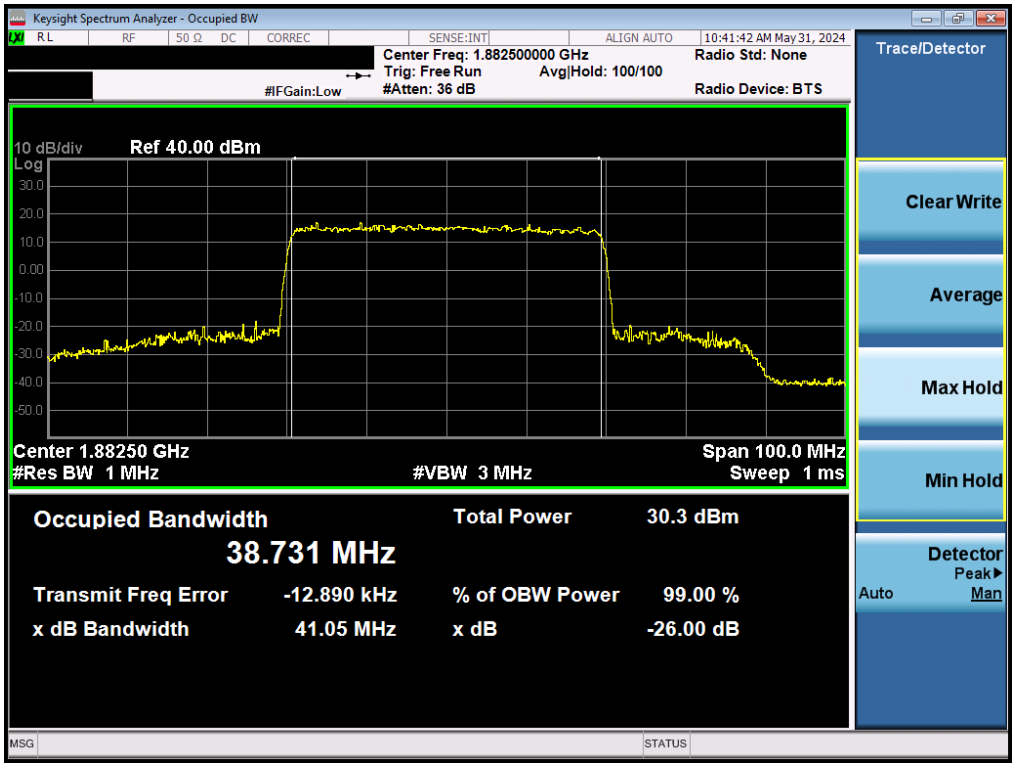
Plot 7-25. Occupied Bandwidth Plot (LTE Band 25/2 - 1.4MHz 16-QAM - Full RB - Ant2)

NR Band n25/2 – Ant1

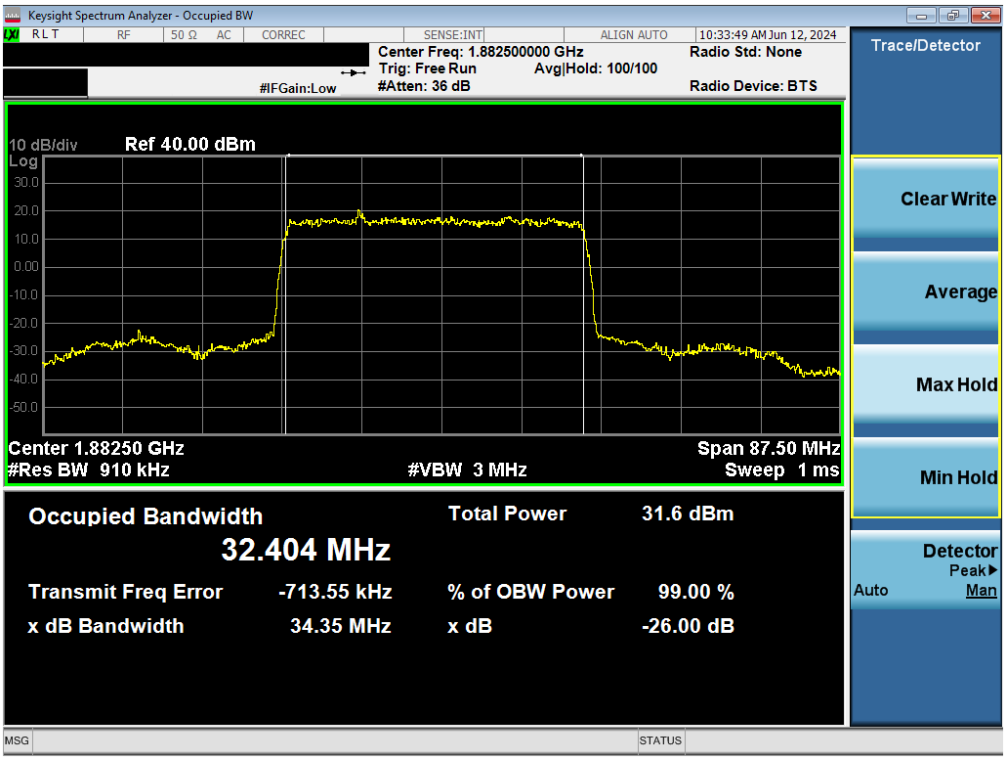


Plot 7-26. Occupied Bandwidth Plot (NR Band n25/2 - 40.0MHz DFT-s-OFDM BPSK - Full RB - ANT1)

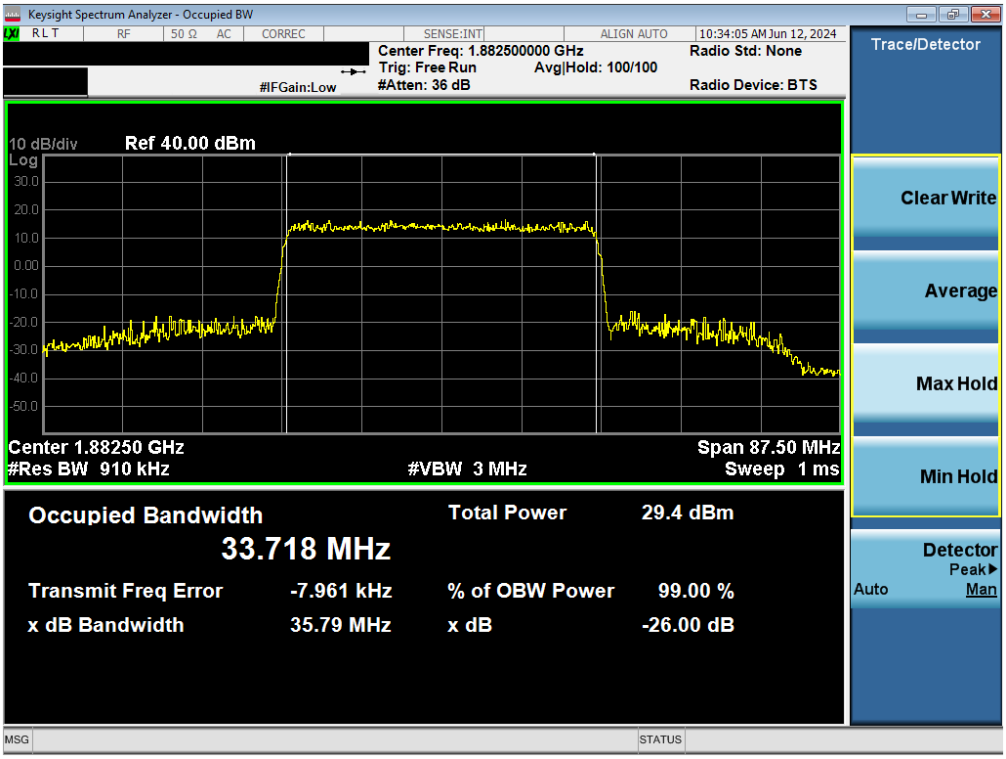
Plot 7-27. Occupied Bandwidth Plot (NR Band n25/2 - 40.0MHz CP-OFDM QPSK - Full RB - ANT1)



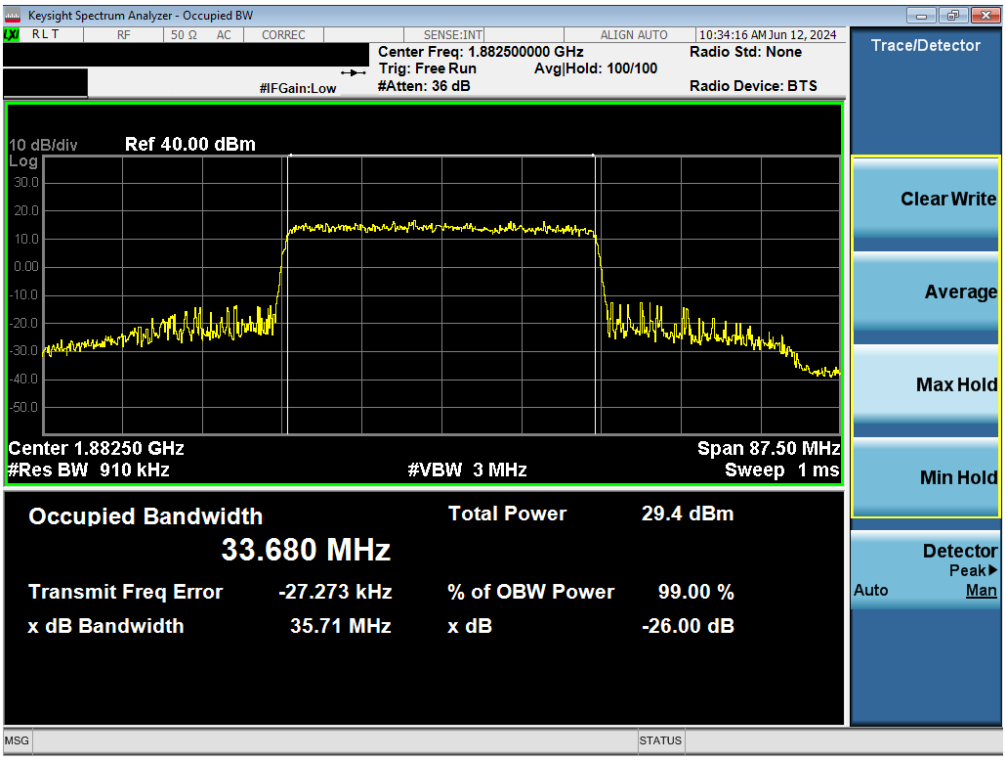
Plot 7-28. Occupied Bandwidth Plot (NR Band n25/2 - 40.0MHz CP-OFDM 16QAM - Full RB - ANT1)



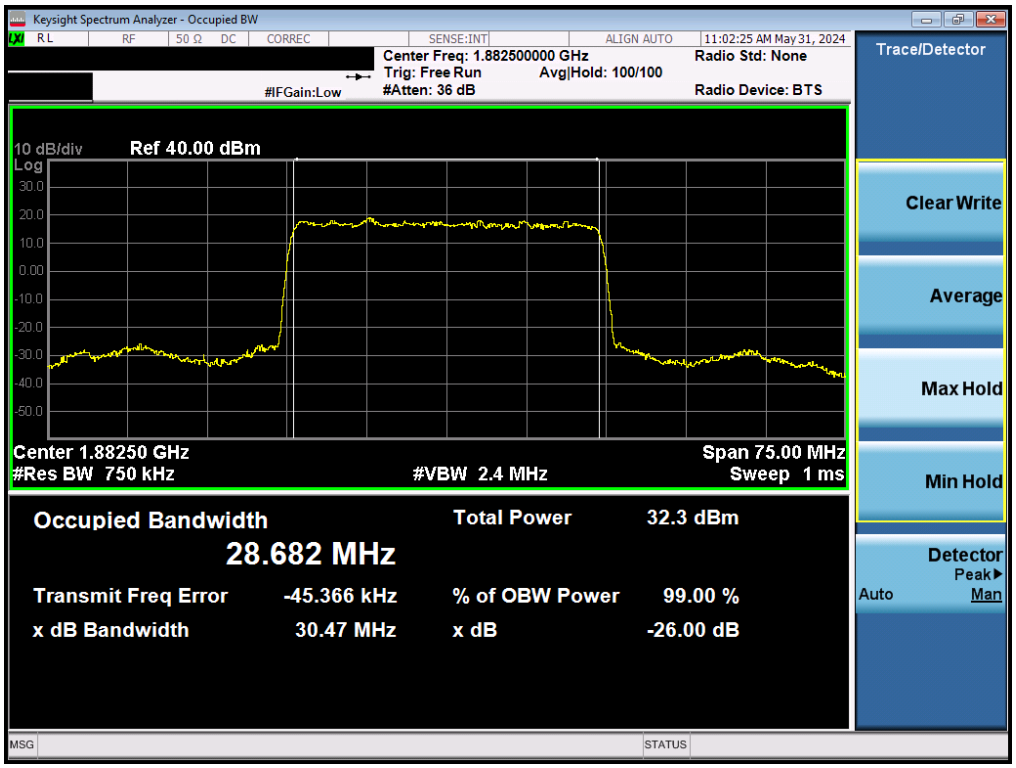
Plot 7-29. Occupied Bandwidth Plot (NR Band n25/2 - 35.0MHz DFT-s-OFDM BPSK - Full RB - ANT1)



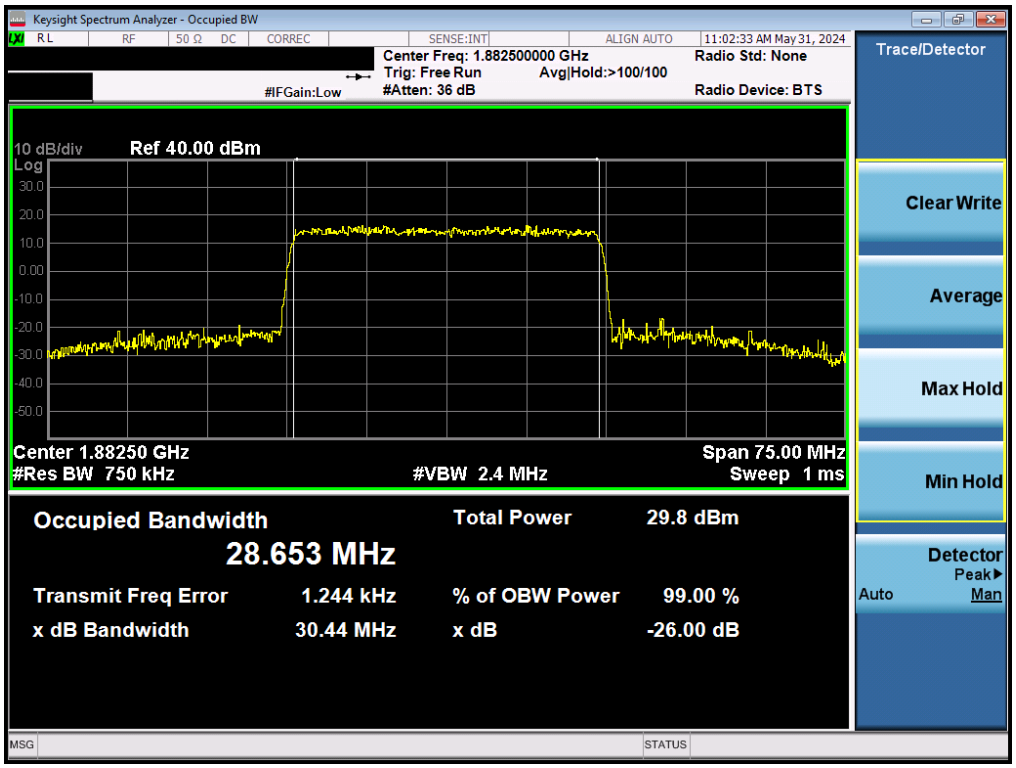
Plot 7-30. Occupied Bandwidth Plot (NR Band n25/2 - 35.0MHz CP-OFDM QPSK - Full RB - ANT1)



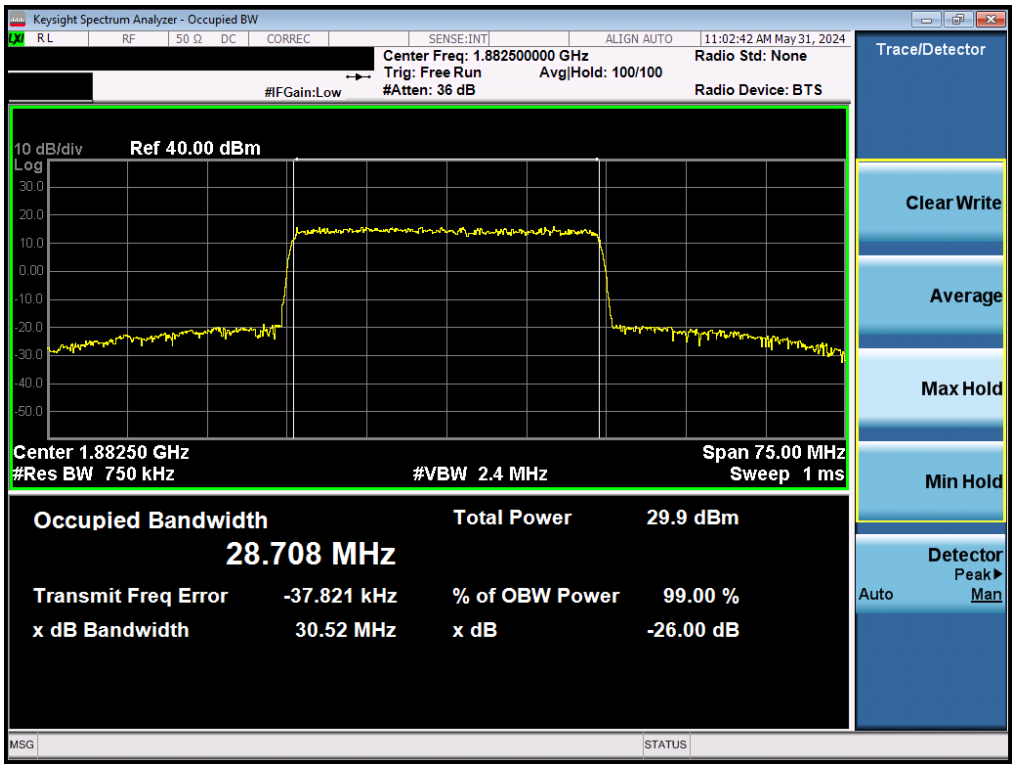
Plot 7-31. Occupied Bandwidth Plot (NR Band n25/2 - 35.0MHz CP-OFDM 16QAM - Full RB - ANT1)



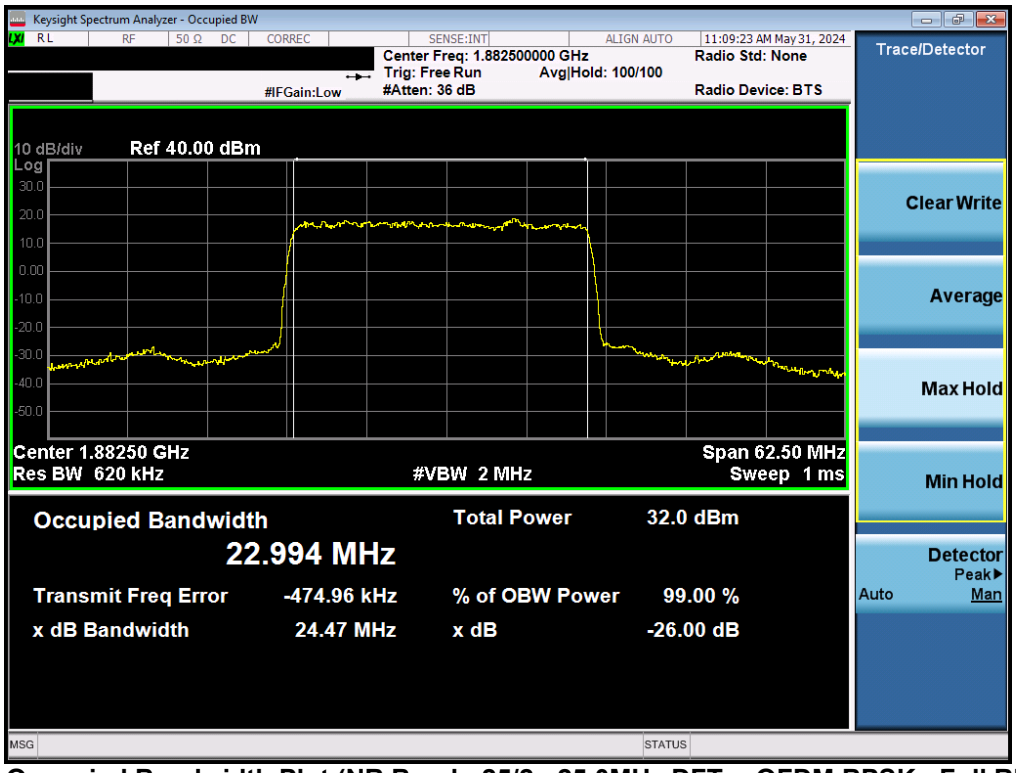
Plot 7-32. Occupied Bandwidth Plot (NR Band n25/2 - 30.0MHz DFT-s-OFDM BPSK - Full RB - ANT1)



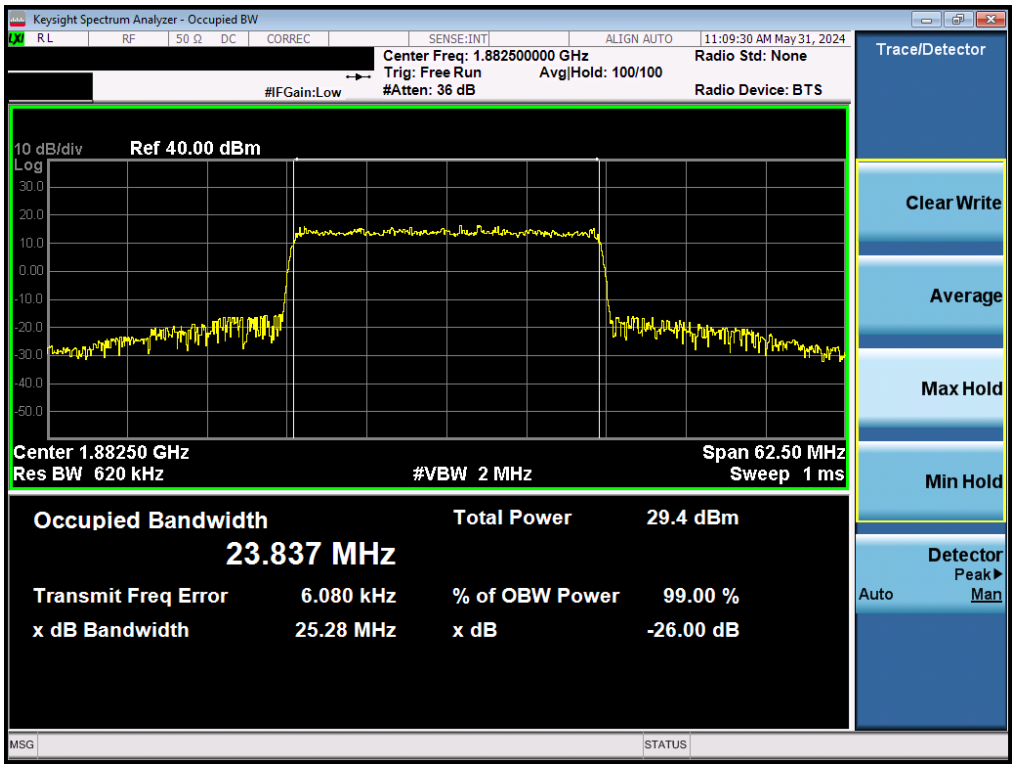
Plot 7-33. Occupied Bandwidth Plot (NR Band n25/2 - 30.0MHz CP-OFDM QPSK - Full RB - ANT1)



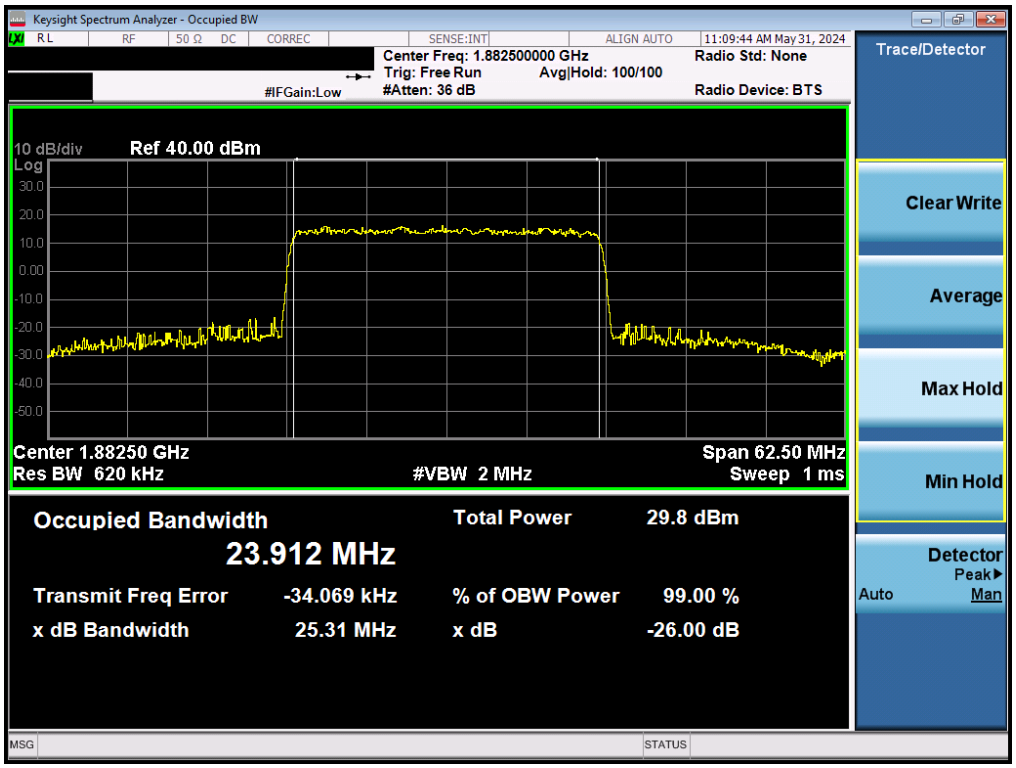
Plot 7-34. Occupied Bandwidth Plot (NR Band n25/2 - 30.0MHz CP-OFDM 16QAM - Full RB - ANT1)



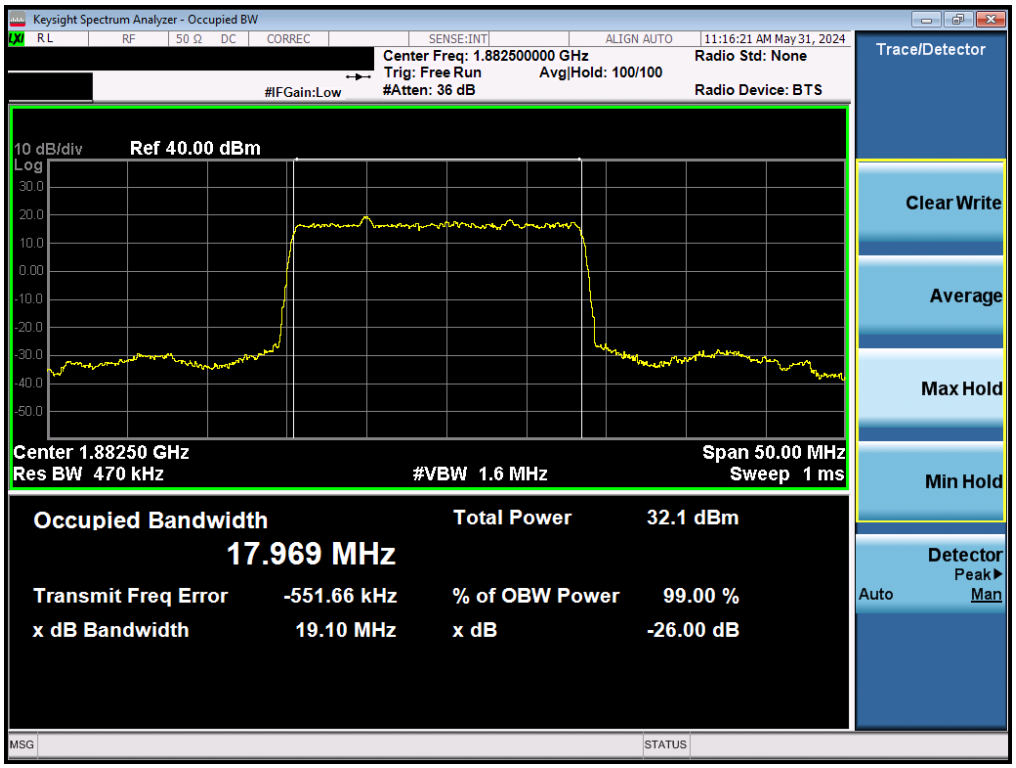
Plot 7-35. Occupied Bandwidth Plot (NR Band n25/2 - 25.0MHz DFT-s-OFDM BPSK - Full RB - ANT1)



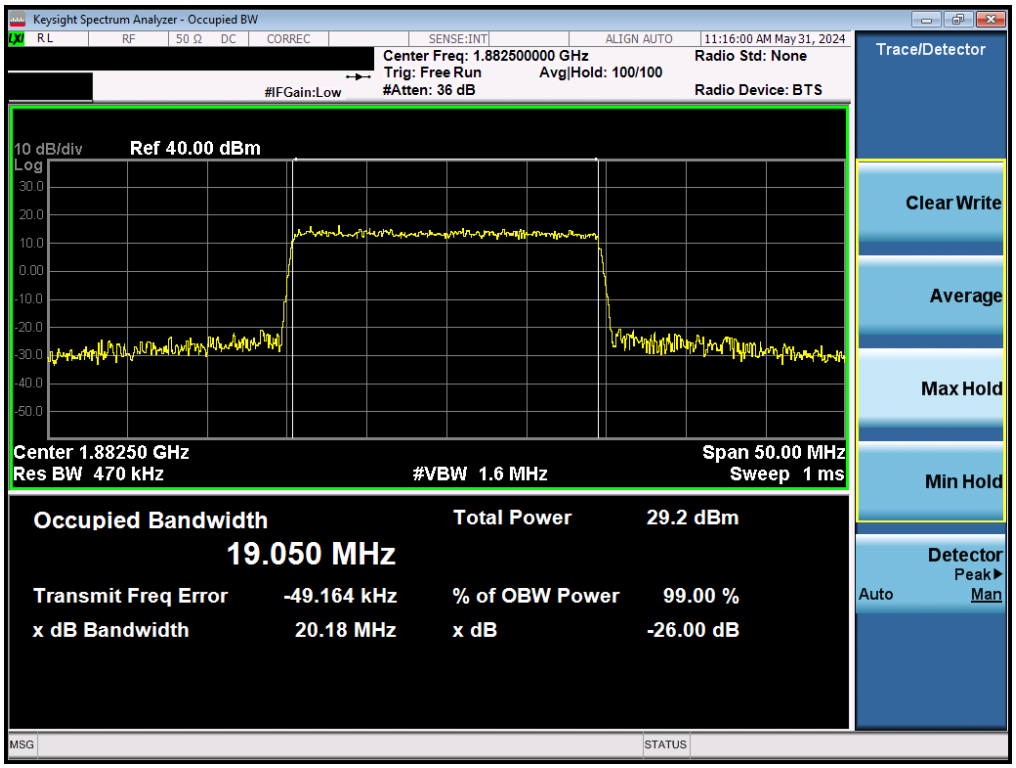
Plot 7-36. Occupied Bandwidth Plot (NR Band n25/2 - 25.0MHz CP-OFDM QPSK - Full RB - ANT1)



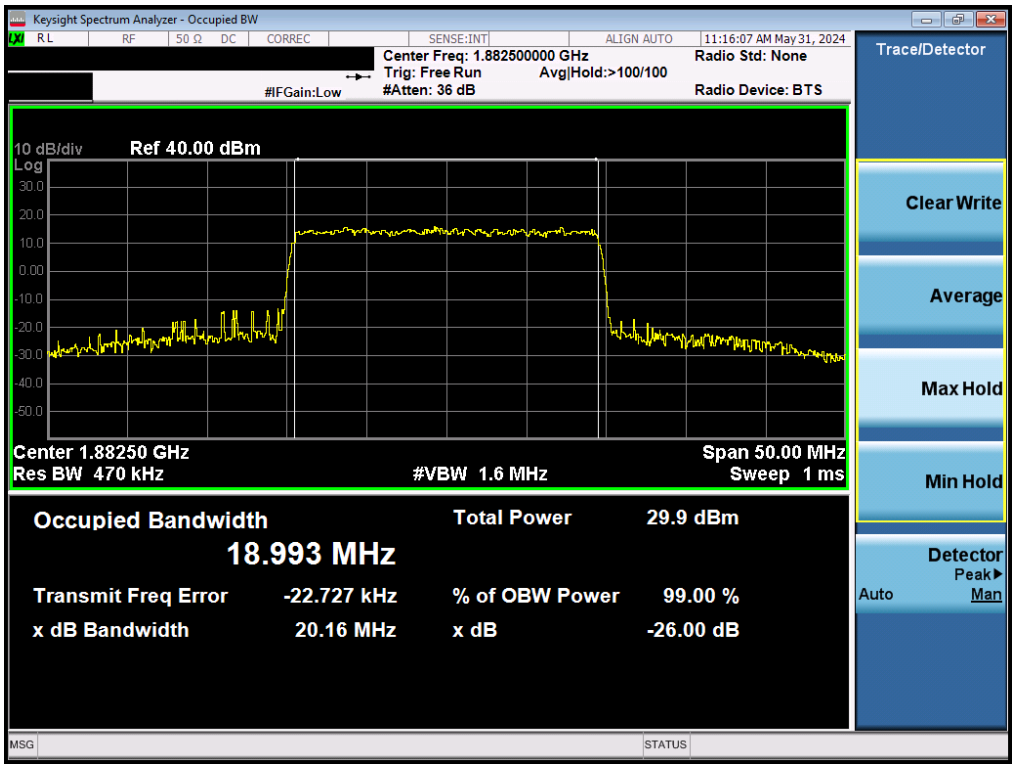
Plot 7-37. Occupied Bandwidth Plot (NR Band n25/2 - 25.0MHz CP-OFDM 16QAM - Full RB - ANT1)



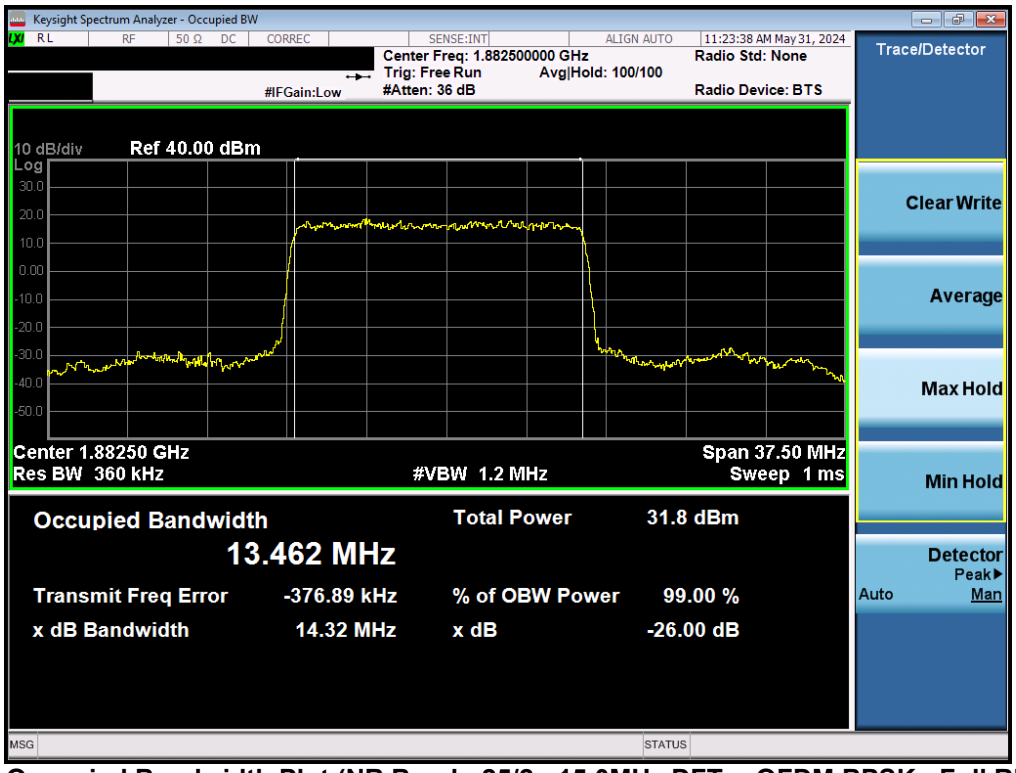
Plot 7-38. Occupied Bandwidth Plot (NR Band n25/2 - 20.0MHz DFT-s-OFDM BPSK - Full RB - ANT1)



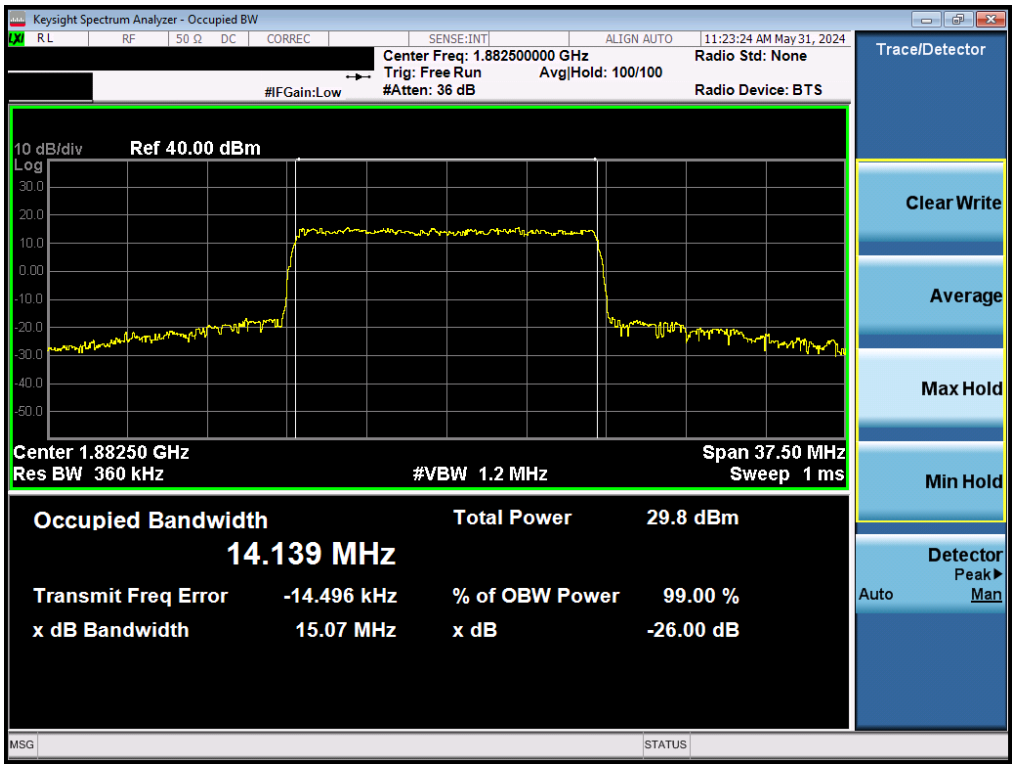
Plot 7-39. Occupied Bandwidth Plot (NR Band n25/2 - 20.0MHz CP-OFDM QPSK - Full RB - ANT1)



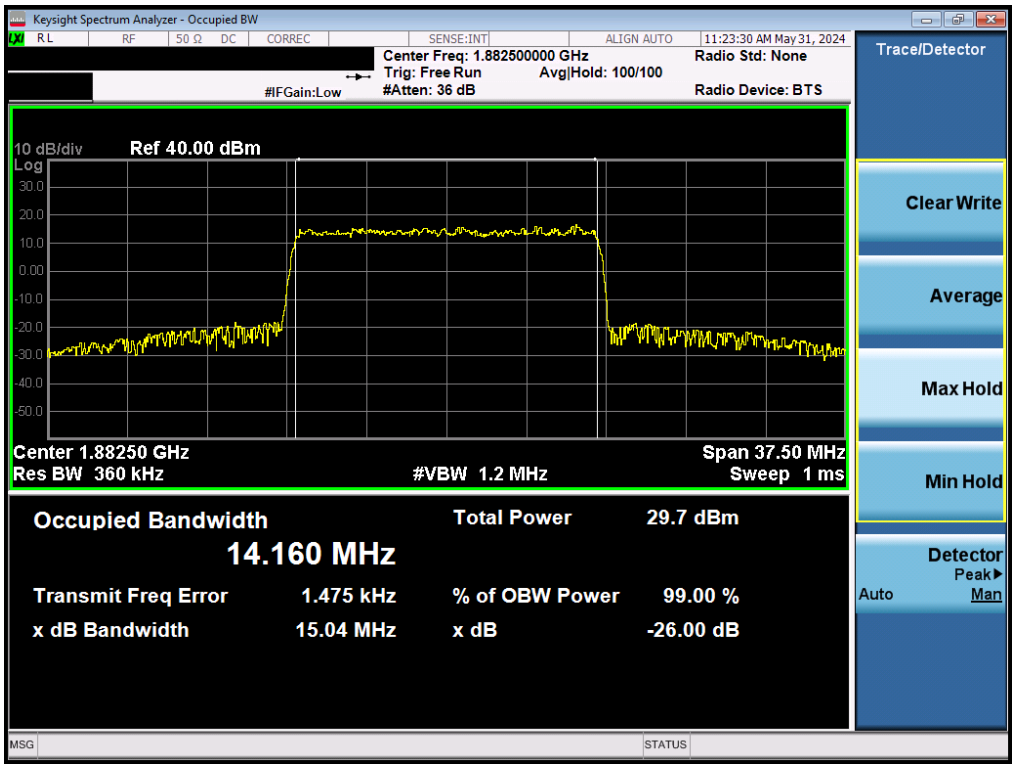
Plot 7-40. Occupied Bandwidth Plot (NR Band n25/2 - 20.0MHz CP-OFDM 16QAM - Full RB - ANT1)



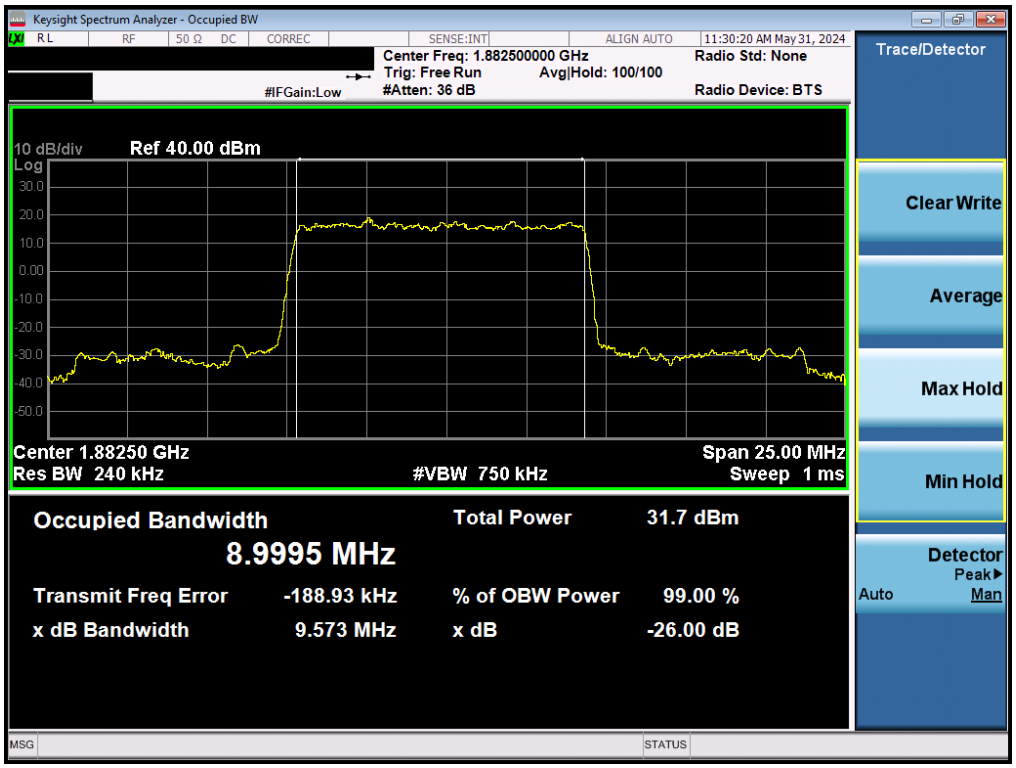
Plot 7-41. Occupied Bandwidth Plot (NR Band n25/2 - 15.0MHz DFT-s-OFDM BPSK - Full RB - ANT1)



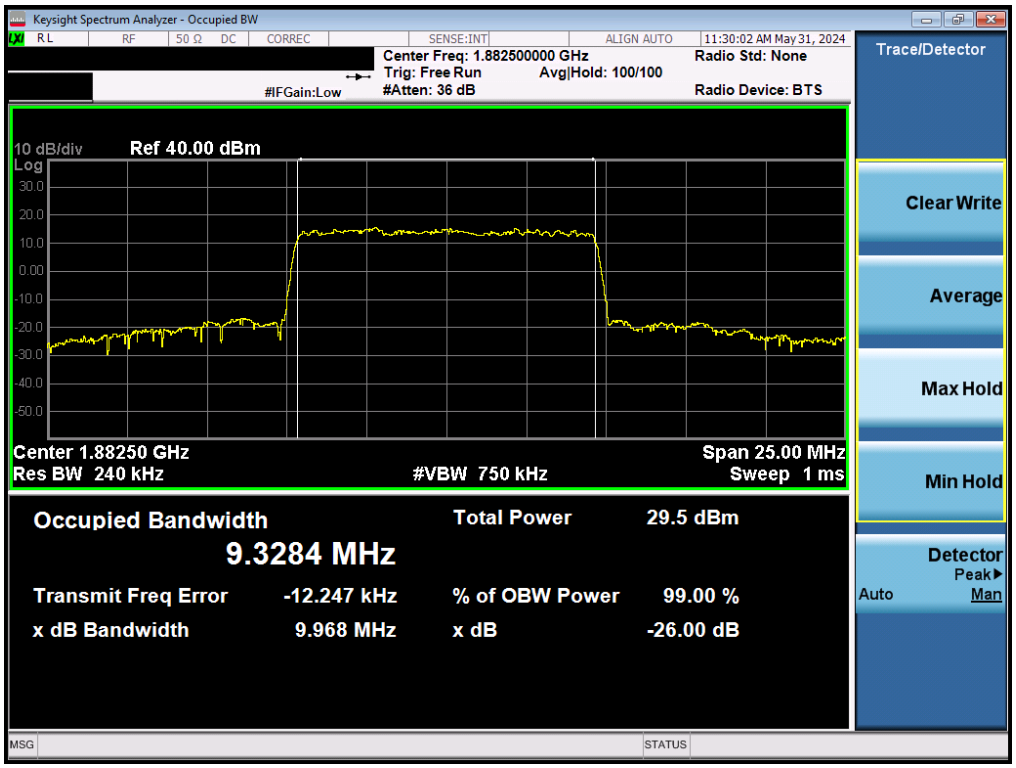
Plot 7-42. Occupied Bandwidth Plot (NR Band n25/2 - 15.0MHz CP-OFDM QPSK - Full RB - ANT1)



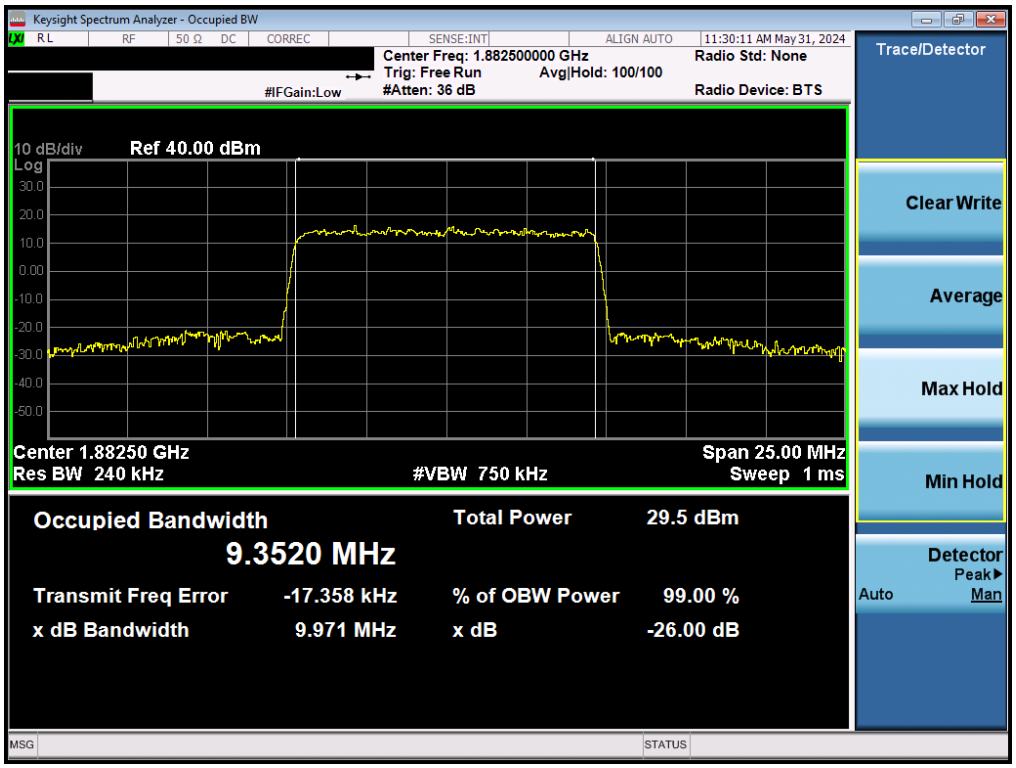
Plot 7-43. Occupied Bandwidth Plot (NR Band n25/2 - 15.0MHz CP-OFDM 16QAM - Full RB - ANT1)



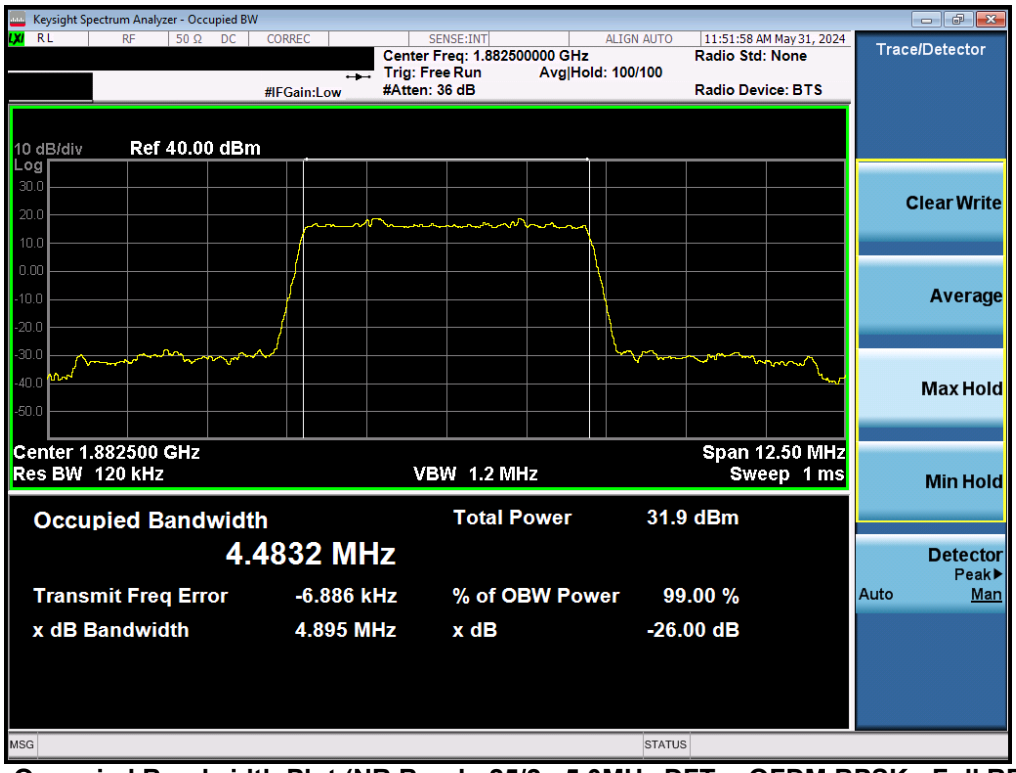
Plot 7-44. Occupied Bandwidth Plot (NR Band n25/2 - 10.0MHz DFT-s-OFDM BPSK - Full RB - ANT1)



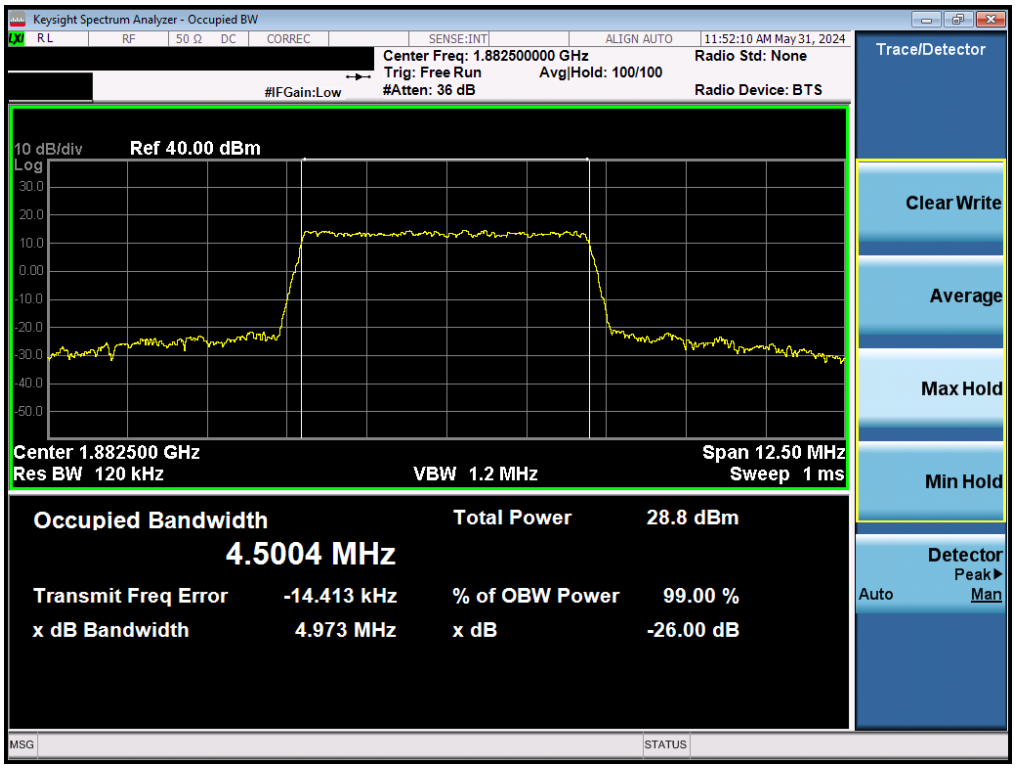
Plot 7-45. Occupied Bandwidth Plot (NR Band n25/2 - 10.0MHz CP-OFDM QPSK - Full RB - ANT1)



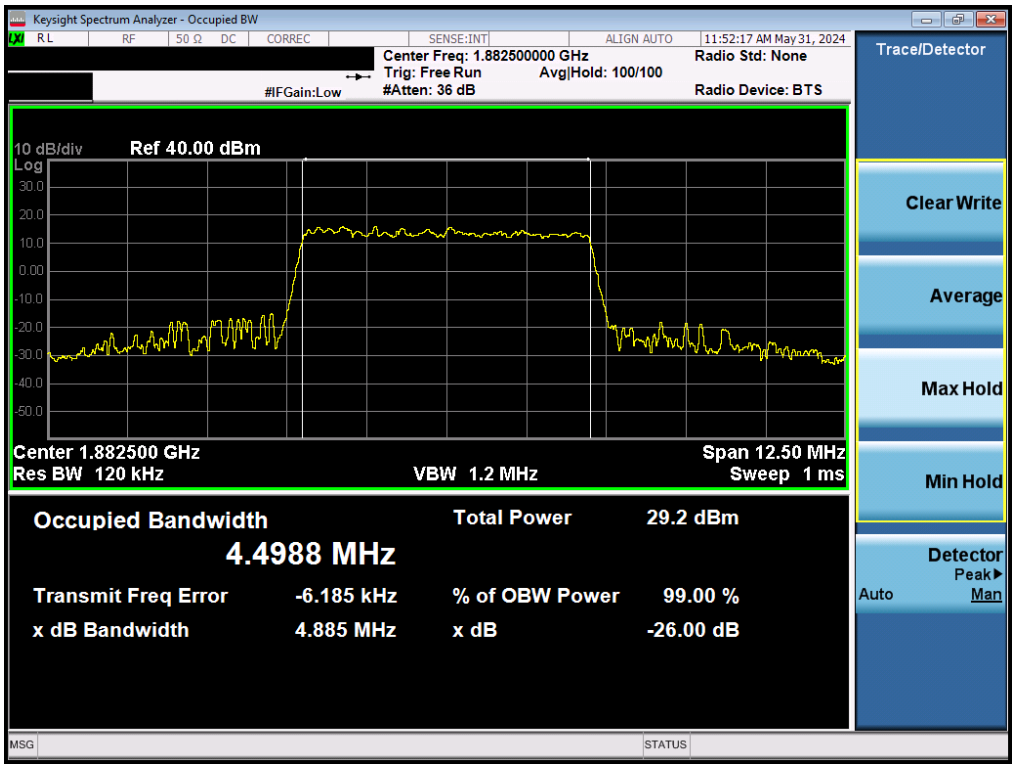
Plot 7-46. Occupied Bandwidth Plot (NR Band n25/2 - 10.0MHz CP-OFDM 16QAM - Full RB - ANT1)



Plot 7-47. Occupied Bandwidth Plot (NR Band n25/2 - 5.0MHz DFT-s-OFDM BPSK - Full RB - ANT1)



Plot 7-48. Occupied Bandwidth Plot (NR Band n25/2 - 5.0MHz CP-OFDM QPSK - Full RB - ANT1)



Plot 7-49. Occupied Bandwidth Plot (NR Band n25/2 - 5.0MHz CP-OFDM 16QAM - Full RB - ANT1)

7.4 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 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 minimum permissible attenuation level of any spurious emission is 43 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

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 20GHz (separated into at least two plots per channel)
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.

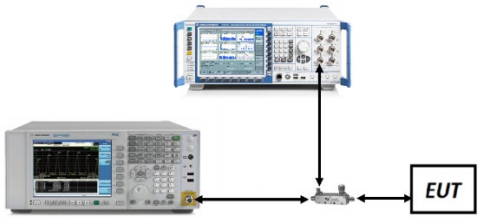


Figure 7-3. Test Instrument & Measurement Setup

Test Notes

1. Per Part 24, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
WCDMA-PCS	5MHz	Low	30.0 - 1845.0	-45.07	-13	-32.07
		Low	1910.0 - 10000.0	-46.88	-13	-33.88
		Low	10000.0 - 20000.0	-62.27	-13	-49.27
		Mid	30.0 - 1850.0	-53.67	-13	-40.67
		Mid	1910.0 - 10000.0	-46.69	-13	-33.69
		Mid	10000.0 - 20000.0	-62.69	-13	-49.69
		High	30.0 - 1850.0	-53.50	-13	-40.50
		High	1915.0 - 10000.0	-45.40	-13	-32.40
		High	10000.0 - 20000.0	-62.50	-13	-49.50
LTE-B25-2	20MHz	Low	30.0 - 1849.0	-46.38	-13	-33.38
		Low	1915.0 - 10000.0	-46.72	-13	-33.72
		Low	10000.0 - 20000.0	-62.41	-13	-49.41
		Mid	30.0 - 1850.0	-53.04	-13	-40.04
		Mid	1915.0 - 10000.0	-47.24	-13	-34.24
		Mid	10000.0 - 20000.0	-62.51	-13	-49.51
		High	30.0 - 1850.0	-53.50	-13	-40.50
		High	1916.0 - 10000.0	-46.94	-13	-33.94
		High	10000.0 - 20000.0	-62.60	-13	-49.60

Table 7-8. Spurious Emissions Test Summary – Antenna 1

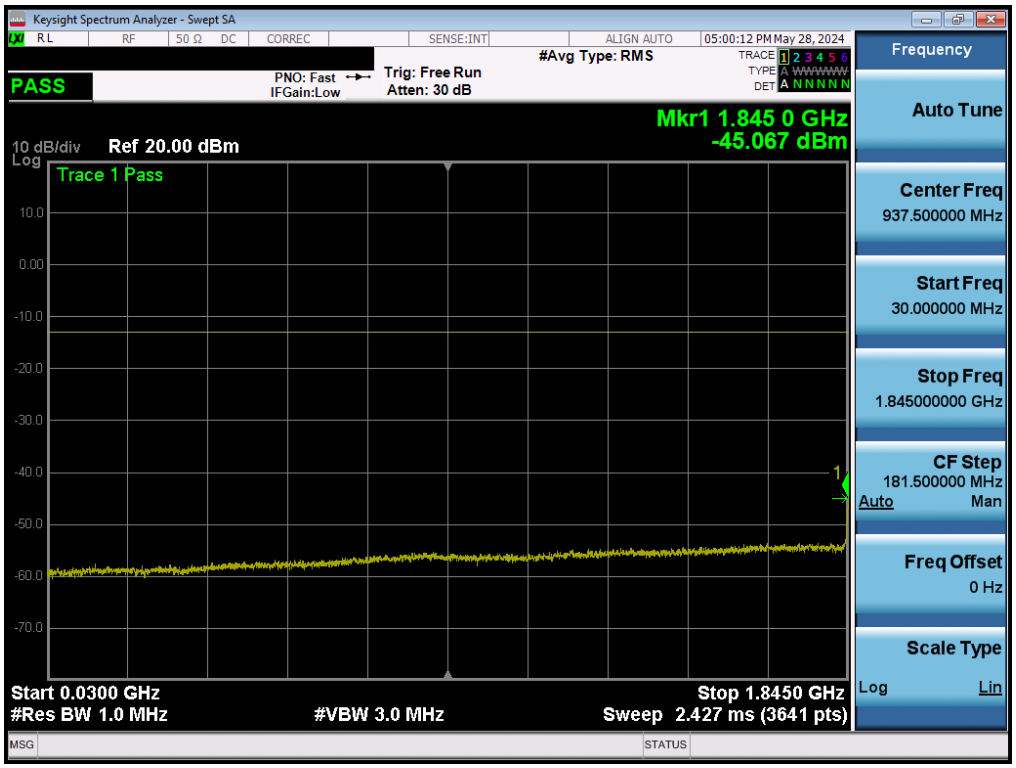
Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
LTE-B25-2	20MHz	Low	30.0 - 1849.0	-48.19	-13	-35.19
		Low	1915.0 - 10000.0	-47.17	-13	-34.17
		Low	10000.0 - 20000.0	-62.67	-13	-49.66
		Mid	30.0 - 1850.0	-53.70	-13	-40.70
		Mid	1915.0 - 10000.0	-47.06	-13	-34.06
		Mid	10000.0 - 20000.0	-62.34	-13	-49.34
		High	30.0 - 1850.0	-53.69	-13	-40.69
		High	1916.0 - 10000.0	-46.20	-13	-33.20
		High	10000.0 - 20000.0	-61.86	-13	-48.86

Table 7-9. Spurious Emissions Test Summary – Antenna 2

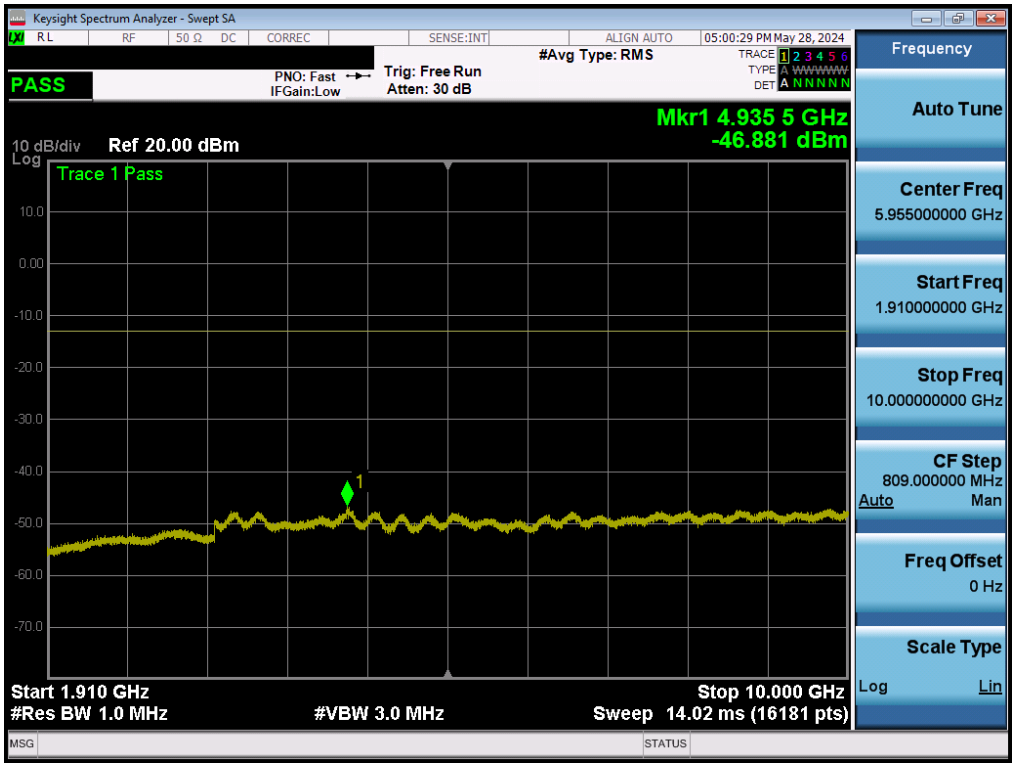
Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
NR-n25-2	40MHz	Low	30.0 - 1849.0	-49.23	-13	-36.23
		Low	1915.0 - 10000.0	-46.57	-13	-33.57
		Low	10000.0 - 20000.0	-62.39	-13	-49.39
		Mid	30.0 - 1850.0	-51.42	-13	-38.42
		Mid	1915.0 - 10000.0	-46.29	-13	-33.29
		Mid	10000.0 - 20000.0	-62.04	-13	-49.04
		High	30.0 - 1850.0	-53.44	-13	-40.44
		High	1916.0 - 10000.0	-46.83	-13	-33.83
		High	10000.0 - 20000.0	-61.88	-13	-48.88

Table 7-10. Spurious Emissions Test Summary – Antenna 1

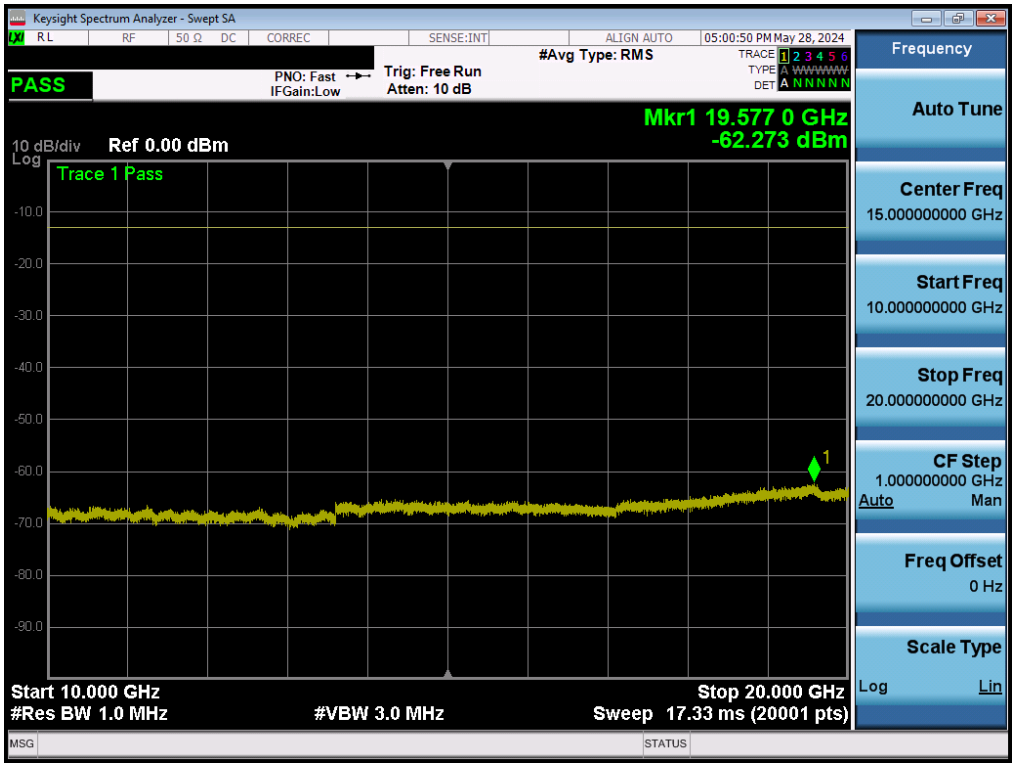
WCDMA PCS – Ant1



Plot 7-50. Conducted Spurious Plot (WCDMA Ch. 9400 - Ant1)



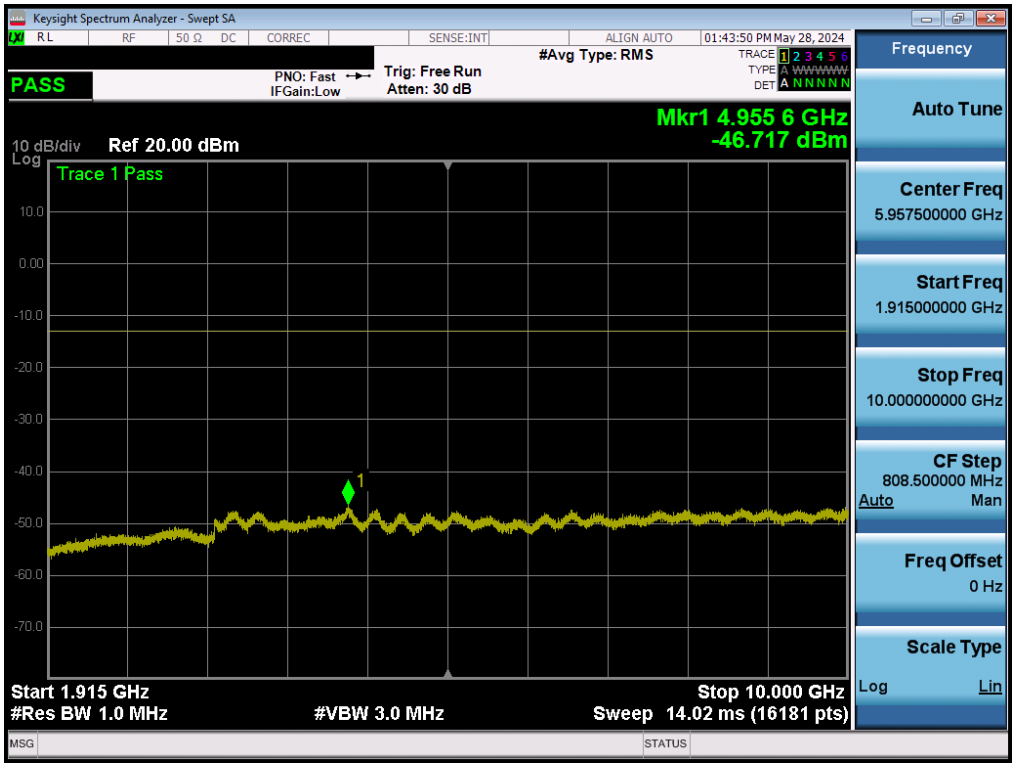
Plot 7-51. Conducted Spurious Plot (WCDMA Ch. 9400 - Ant1)



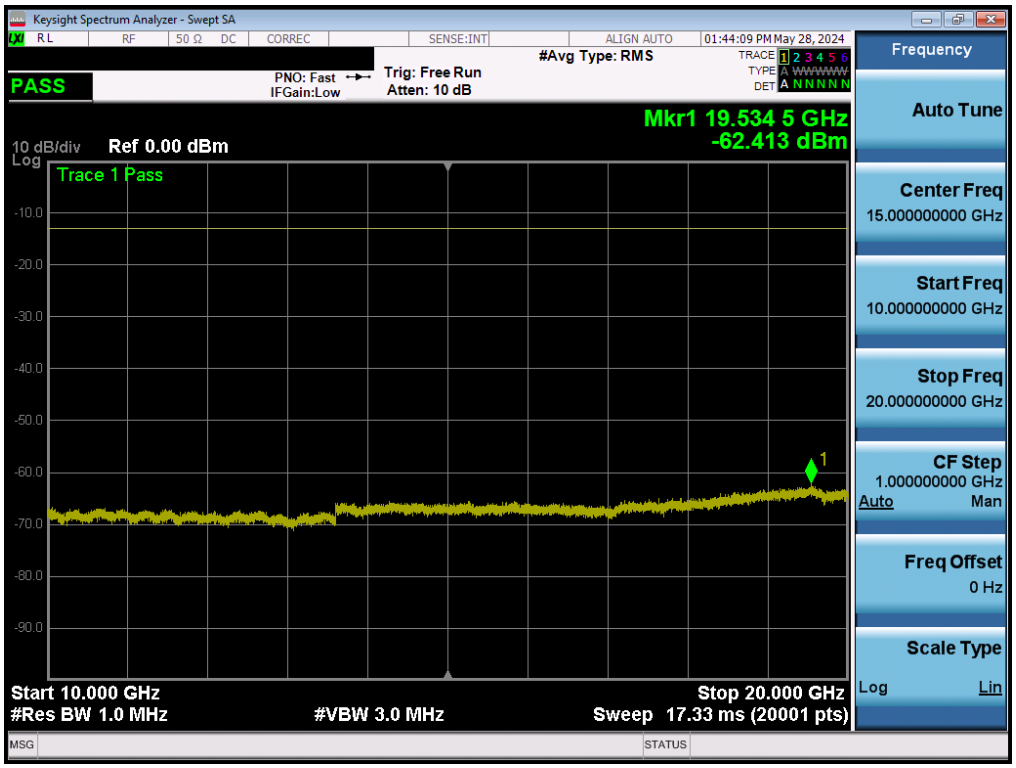
Plot 7-52. Conducted Spurious Plot (WCDMA Ch. 9400 - Ant1)

LTE Band 25/2 – Ant1

Plot 7-53. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - 1RB - Low Channel - Ant1)



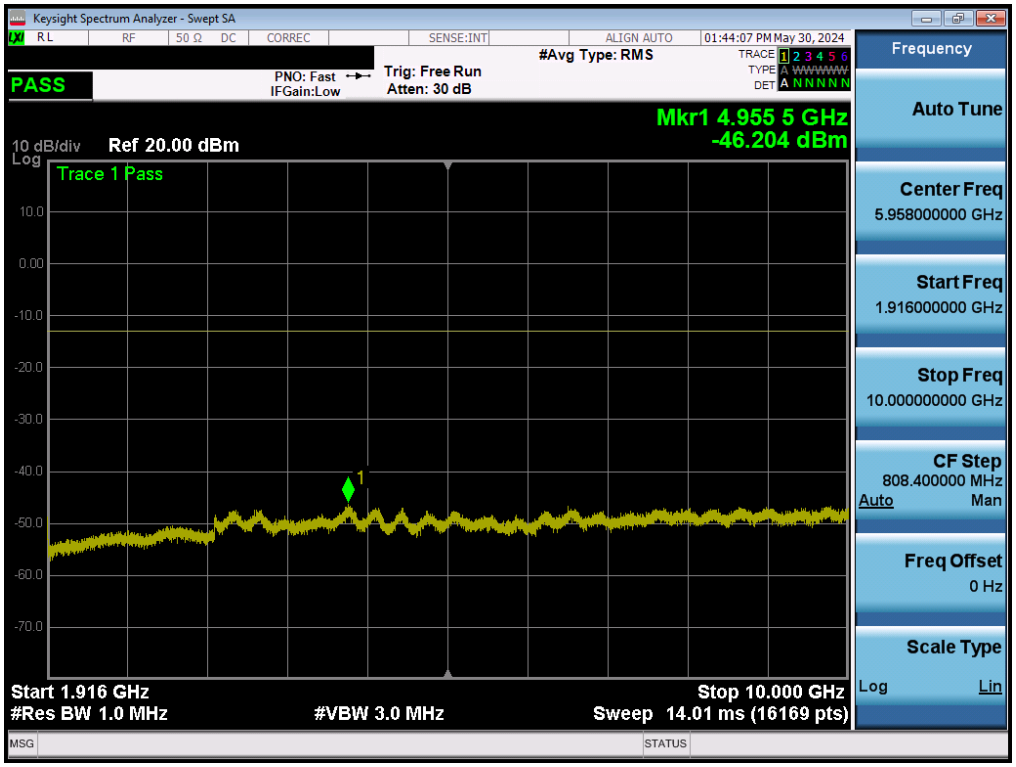
Plot 7-54. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - 1RB - Low Channel - Ant1)



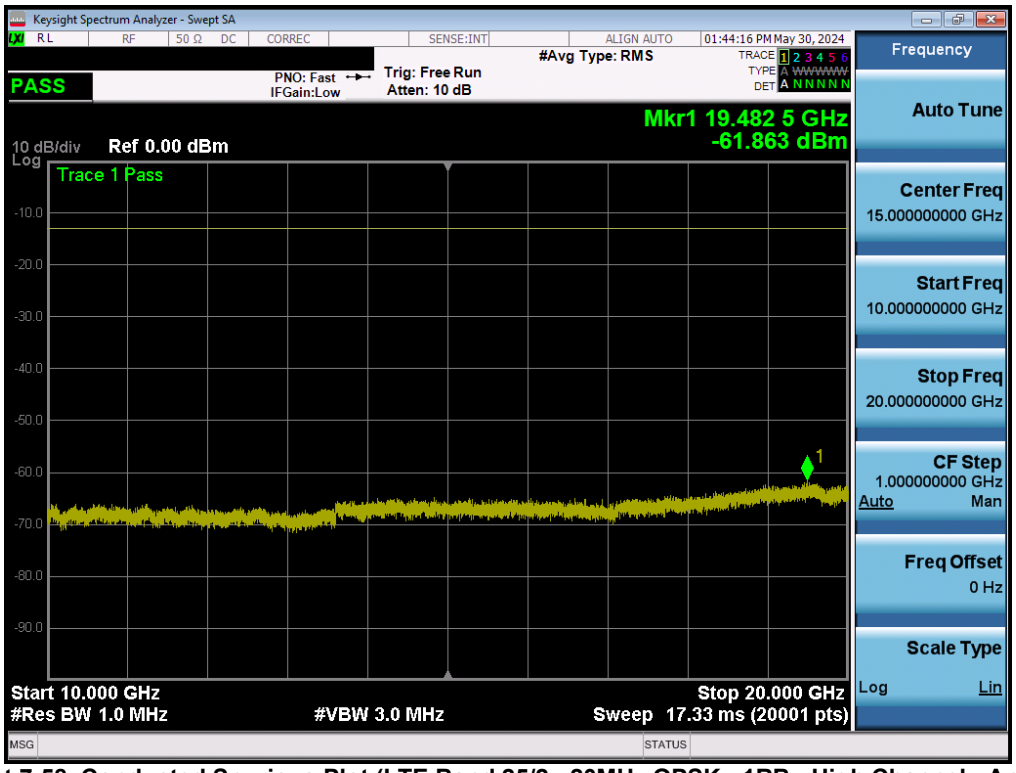
Plot 7-55. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - 1RB - Low Channel - Ant1)

LTE Band 25/2 – Ant2

Plot 7-56. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - 1RB - High Channel - Ant2)

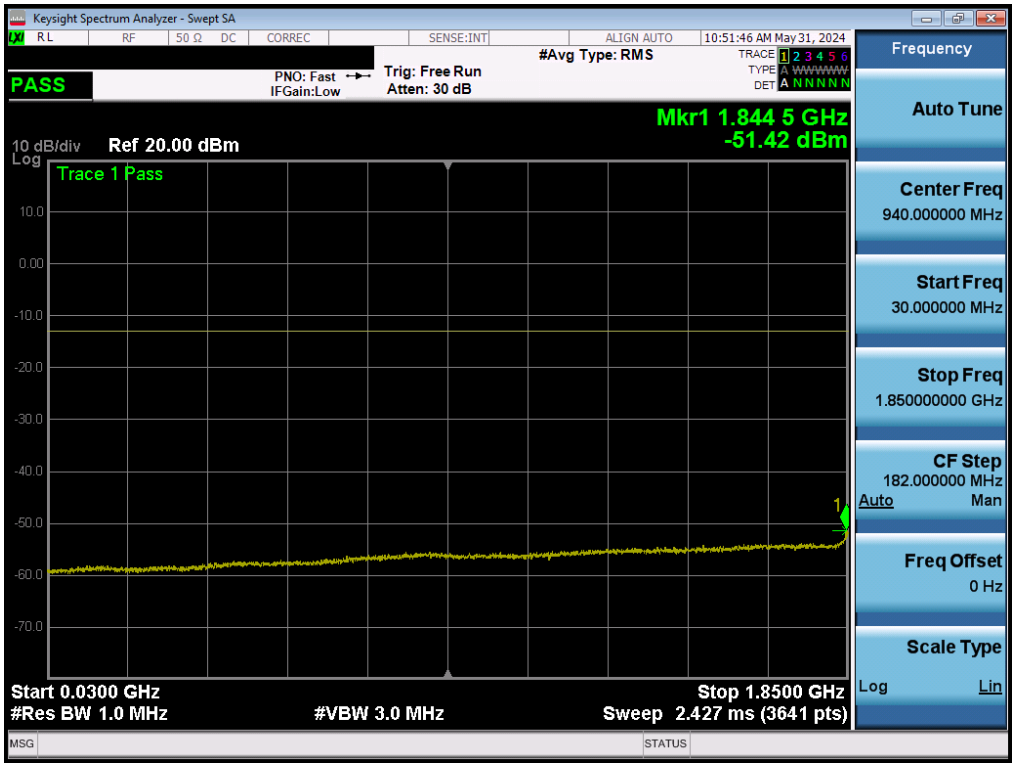


Plot 7-57. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - 1RB - High Channel - Ant2)

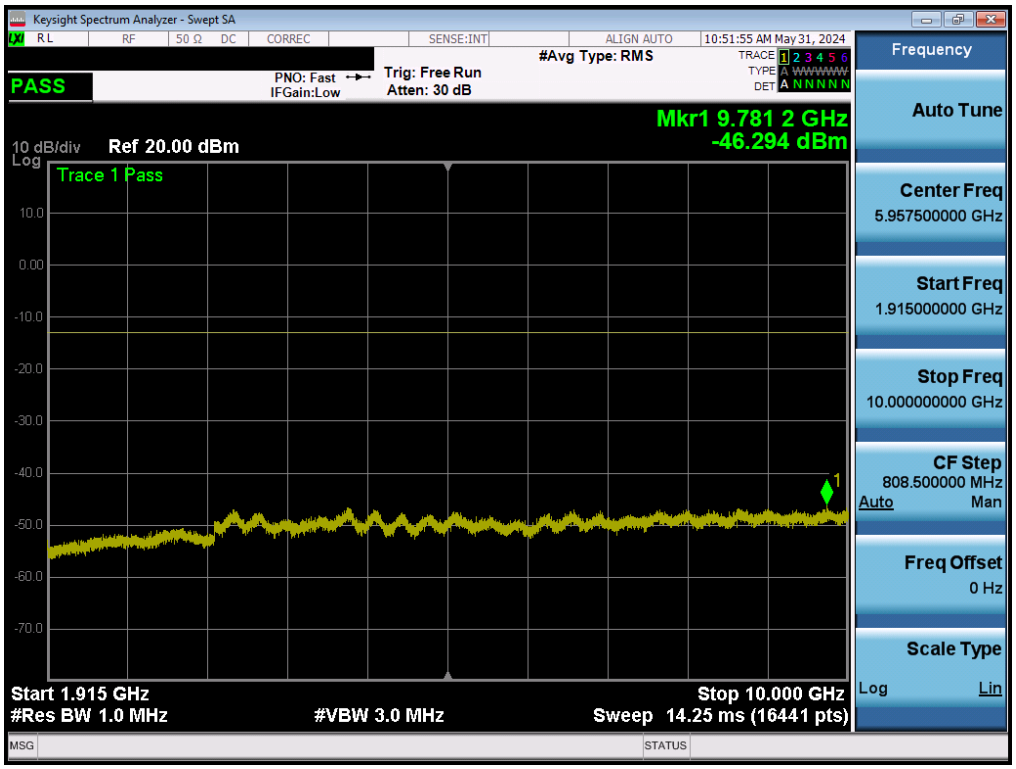


Plot 7-58. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - 1RB - High Channel - Ant2)

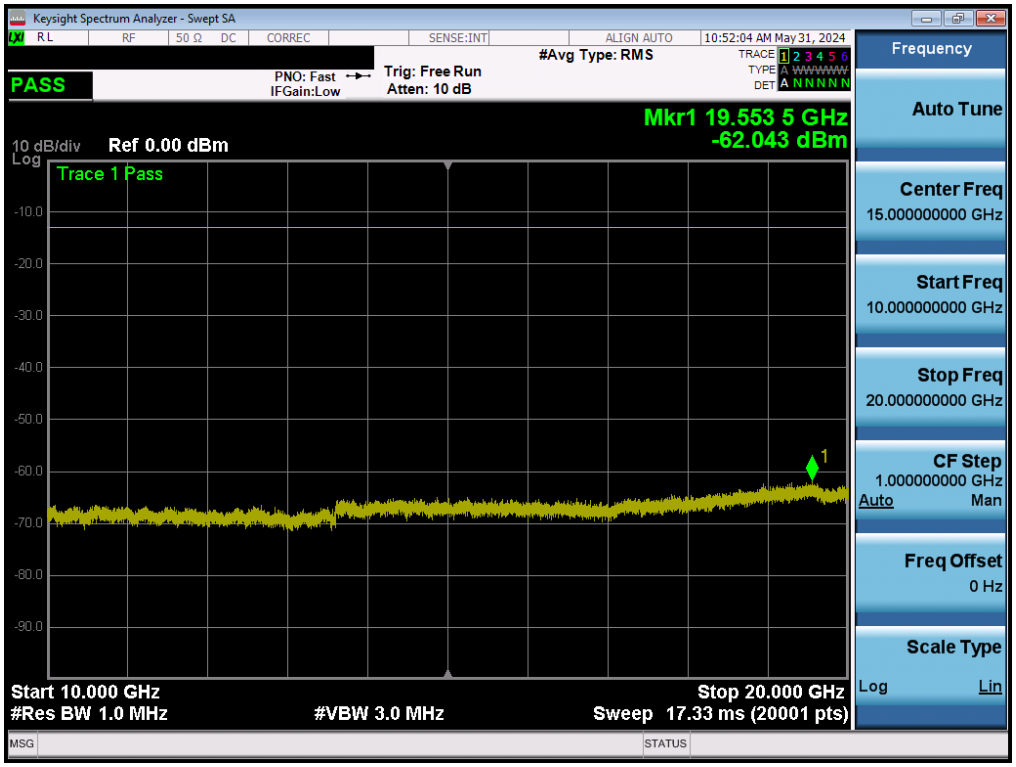
NR Band n25/2 – Ant1



Plot 7-59. Conducted Spurious Plot (NR Band n25/2 - 40.0MHz - 1RB - Mid Channel - Ant1)



Plot 7-60. Conducted Spurious Plot (NR Band n25/2 - 40.0MHz - 1RB - Mid Channel - Ant1)



Plot 7-61. Conducted Spurious Plot (NR Band n25/2 - 40.0MHz - 1RB - Mid Channel - Ant1)

7.5 Band Edge Emissions at Antenna Terminal

Test Overview

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 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 minimum permissible attenuation level of any spurious emission is 43 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

ANSI C63.26-2015 – Section 5.7.3

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

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

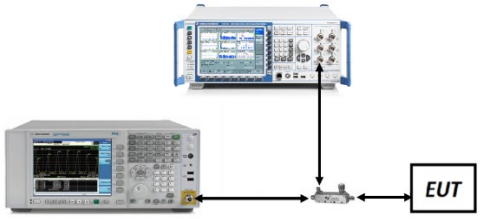


Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1. Per 24.238(b)), in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
WCDMA-PCS	5MHz	Low	Band Edge	-24.16	-13	-11.16
		Low	Extended	-15.21	-13	-2.21
		High	Band Edge	-24.89	-13	-11.89
		High	Extended	-16.36	-13	-3.36
LTE-B25-2	20MHz	Low	Band Edge	-35.67	-13	-22.67
		Low	Extended	-29.39	-13	-16.39
		High [B2]	Band Edge	-37.57	-13	-24.57
		High [B25]	Band Edge	-37.28	-13	-24.28
		High [B2]	Extended	-32.03	-13	-19.03
		High [B25]	Extended	-32.31	-13	-19.31
	15MHz	Low	Band Edge	-33.67	-13	-20.67
		Low	Extended	-29.15	-13	-16.15
		High [B2]	Band Edge	-36.59	-13	-23.59
		High [B25]	Band Edge	-35.65	-13	-22.65
		High [B2]	Extended	-30.27	-13	-17.27
		High [B25]	Extended	-30.66	-13	-17.66
	10MHz	Low	Band Edge	-33.57	-13	-20.57
		Low	Extended	-24.41	-13	-11.41
		High [B2]	Band Edge	-35.75	-13	-22.74
		High [B25]	Band Edge	-35.74	-13	-22.74
		High [B2]	Extended	-25.42	-13	-12.42
		High [B25]	Extended	-25.55	-13	-12.55
	5MHz	Low	Band Edge	-29.51	-13	-16.51
		Low	Extended	-27.13	-13	-14.13
		High [B2]	Band Edge	-30.72	-13	-17.72
		High [B25]	Band Edge	-32.39	-13	-19.39
		High [B2]	Extended	-28.70	-13	-15.70
		High [B25]	Extended	-28.41	-13	-15.41
	3MHz	Low	Band Edge	-32.33	-13	-19.33
		Low	Extended	-25.94	-13	-12.94
		High [B2]	Band Edge	-31.90	-13	-18.90
		High [B25]	Band Edge	-31.14	-13	-18.14
		High [B2]	Extended	-26.77	-13	-13.77
		High [B25]	Extended	-25.25	-13	-12.25
	1.4MHz	Low	Band Edge	-29.51	-13	-16.51
		Low	Extended	-30.27	-13	-17.27
		High [B2]	Band Edge	-30.02	-13	-17.02
		High [B25]	Band Edge	-30.26	-13	-17.26
		High [B2]	Extended	-30.08	-13	-17.08
		High [B25]	Extended	-29.76	-13	-16.76

Table 7-11. Band Edge Summary – Antenna 1

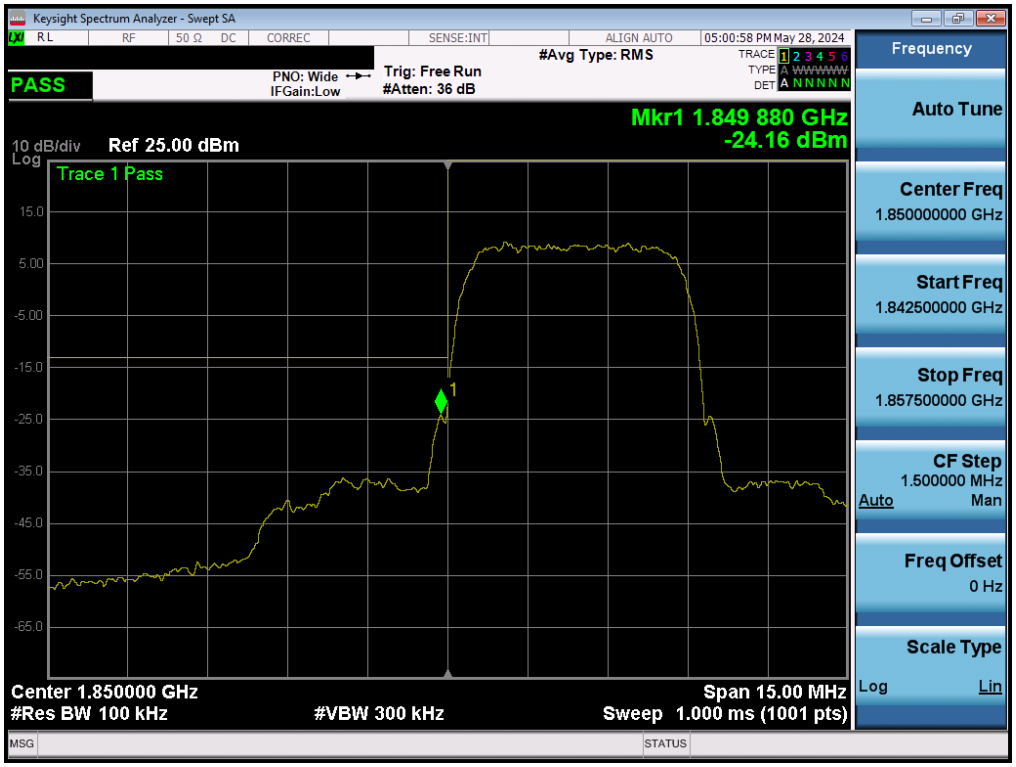
Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
LTE-B25-2	20MHz	Low	Band Edge	-37.68	-13	-24.68
		Low	Extended	-33.30	-13	-20.30
		High [B2]	Band Edge	-38.35	-13	-25.35
		High [B25]	Band Edge	-38.39	-13	-25.39
		High [B2]	Extended	-34.06	-13	-21.06
		High [B25]	Extended	-33.46	-13	-20.46
	15MHz	Low	Band Edge	-36.87	-13	-23.87
		Low	Extended	-31.24	-13	-18.24
		High [B2]	Band Edge	-38.17	-13	-25.17
		High [B25]	Band Edge	-35.69	-13	-22.69
		High [B2]	Extended	-32.77	-13	-19.76
		High [B25]	Extended	-30.77	-13	-17.77
	10MHz	Low	Band Edge	-35.29	-13	-22.29
		Low	Extended	-25.69	-13	-12.69
		High [B2]	Band Edge	-35.98	-13	-22.98
		High [B25]	Band Edge	-34.37	-13	-21.37
		High [B2]	Extended	-26.71	-13	-13.71
		High [B25]	Extended	-24.50	-13	-11.50
	5MHz	Low	Band Edge	-31.71	-13	-18.71
		Low	Extended	-28.71	-13	-15.71
		High [B2]	Band Edge	-31.07	-13	-18.07
		High [B25]	Band Edge	-26.83	-10	-17.18
		High [B2]	Extended	-27.71	-13	-14.71
		High [B25]	Extended	-16.49	-4	-12.38
	3MHz	Low	Band Edge	-34.50	-13	-21.50
		Low	Extended	-26.70	-13	-13.70
		High [B2]	Band Edge	-32.80	-13	-19.80
		High [B25]	Band Edge	-30.34	-13	-17.34
		High [B2]	Extended	-25.64	-13	-12.64
		High [B25]	Extended	-23.75	-13	-10.75
	1.4MHz	Low	Band Edge	-30.92	-13	-17.92
		Low	Extended	-31.43	-13	-18.43
		High [B2]	Band Edge	-30.32	-13	-17.32
		High [B25]	Band Edge	-28.22	-13	-15.22
		High [B2]	Extended	-30.33	-13	-17.33
		High [B25]	Extended	-29.82	-13	-16.82

Table 7-12. Band Edge Summary – Antenna 2

Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
NR-n25-2	40MHz	Low	Band Edge	-27.49	-13	-14.48
		Low	Extended	-31.57	-13	-18.57
		High [n25]	Band Edge	-28.80	-13	-15.80
		High [n25]	Extended	-34.79	-13	-21.79
	35MHz	Low	Band Edge	-31.03	-13	-18.03
		Low	Extended	-29.36	-13	-16.36
		High [n25]	Band Edge	-33.54	-13	-20.54
		High [n25]	Extended	-31.68	-13	-18.68
	30MHz	Low	Band Edge	-33.70	-13	-20.70
		Low	Extended	-31.05	-13	-18.05
		High [n25]	Band Edge	-36.10	-13	-23.10
		High [n25]	Extended	-33.44	-13	-20.44
	25MHz	Low	Band Edge	-35.60	-13	-22.60
		Low	Extended	-28.47	-13	-15.47
		High [n25]	Band Edge	-38.14	-13	-25.14
		High [n25]	Extended	-31.45	-13	-18.45
	20MHz	Low	Band Edge	-34.86	-13	-21.86
		Low	Extended	-25.70	-13	-12.70
		High [n2]	Band Edge	-36.75	-13	-23.75
		High [n25]	Band Edge	-36.89	-13	-23.89
		High [n2]	Extended	-29.10	-13	-16.10
		High [n25]	Extended	-28.95	-13	-15.95
	15MHz	Low	Band Edge	-34.13	-13	-21.13
		Low	Extended	-21.43	-13	-8.42
		High [n2]	Band Edge	-36.19	-13	-23.19
		High [n25]	Band Edge	-35.52	-13	-22.52
		High [n2]	Extended	-25.41	-13	-12.41
		High [n25]	Extended	-25.06	-13	-12.06
	10MHz	Low	Band Edge	-25.05	-5	-20.01
		Low	Extended	-18.24	-14	-4.00
		High [n2]	Band Edge	-28.68	-5	-24.13
		High [n25]	Band Edge	-25.03	-2	-22.77
		High [n2]	Extended	-19.74	-12	-8.18
		High [n25]	Extended	-21.25	-13	-8.25
	5MHz	Low	Band Edge	-33.81	-13	-20.81
		Low	Extended	-29.17	-13	-16.17
		High [n2]	Band Edge	-34.07	-13	-21.07
		High [n25]	Band Edge	-34.25	-13	-21.25
		High [n2]	Extended	-29.34	-13	-16.34
		High [n25]	Extended	-30.43	-13	-17.43

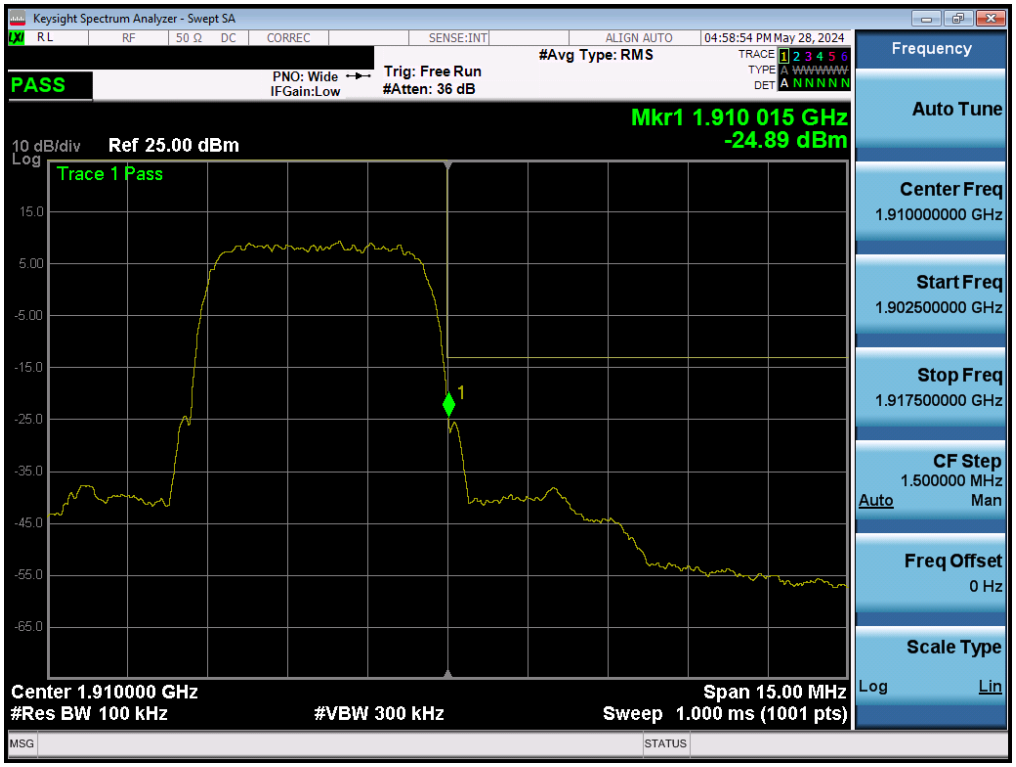
Table 7-13. Band Edge Summary – Antenna 1

WCDMA PCS – Ant1



Plot 7-62. Lower Band Edge Plot (WCDMA PCS – Ch. 9262 - Ant1)

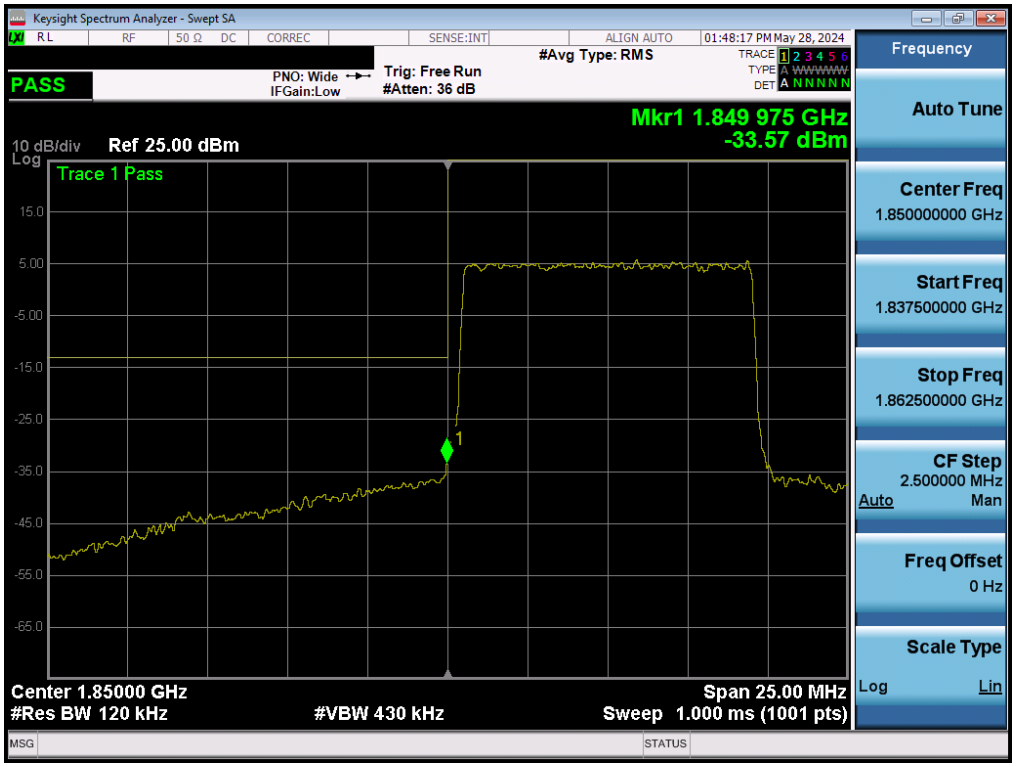
Plot 7-63. Lower Extended Band Edge Plot (WCDMA PCS – Ch. 9262 - Ant1)



Plot 7-64. Upper Band Edge Plot (WCDMA PCS – Ch. 9538 - Ant1)

Plot 7-65. Upper Extended Band Edge Plot (WCDMA PCS – Ch. 9538 - Ant1)

LTE Band 25/2 – Ant1

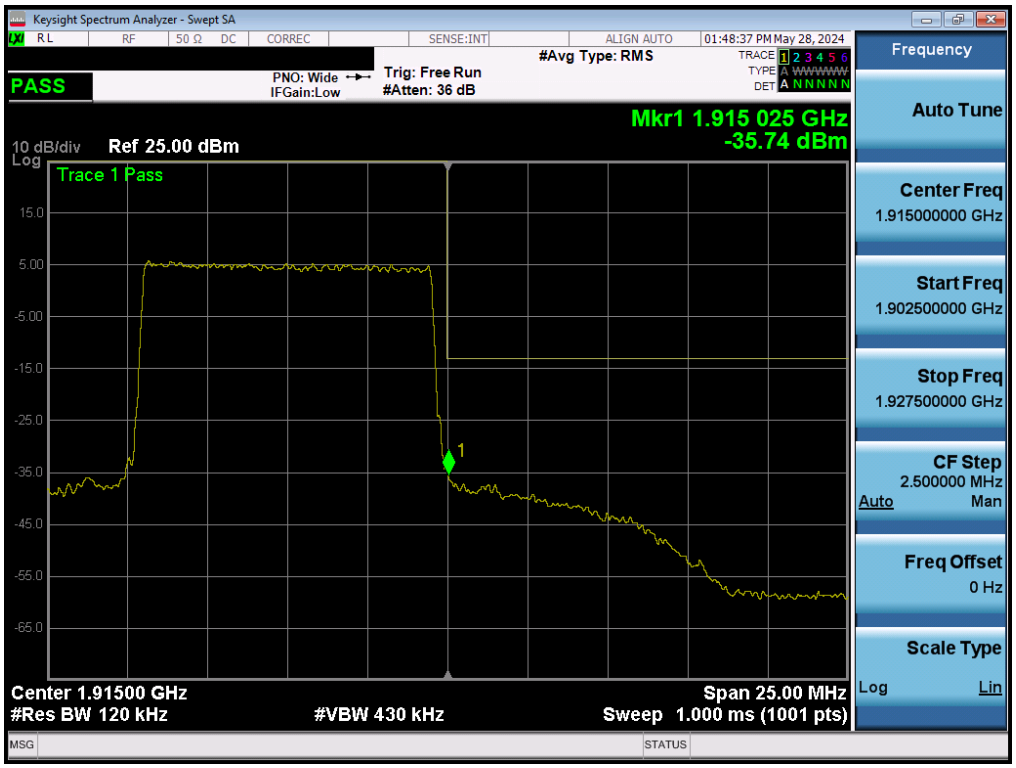


Plot 7-66. Lower Band Edge Plot (LTE Band 25/2 - 10MHz QPSK – Full RB - Ant1)

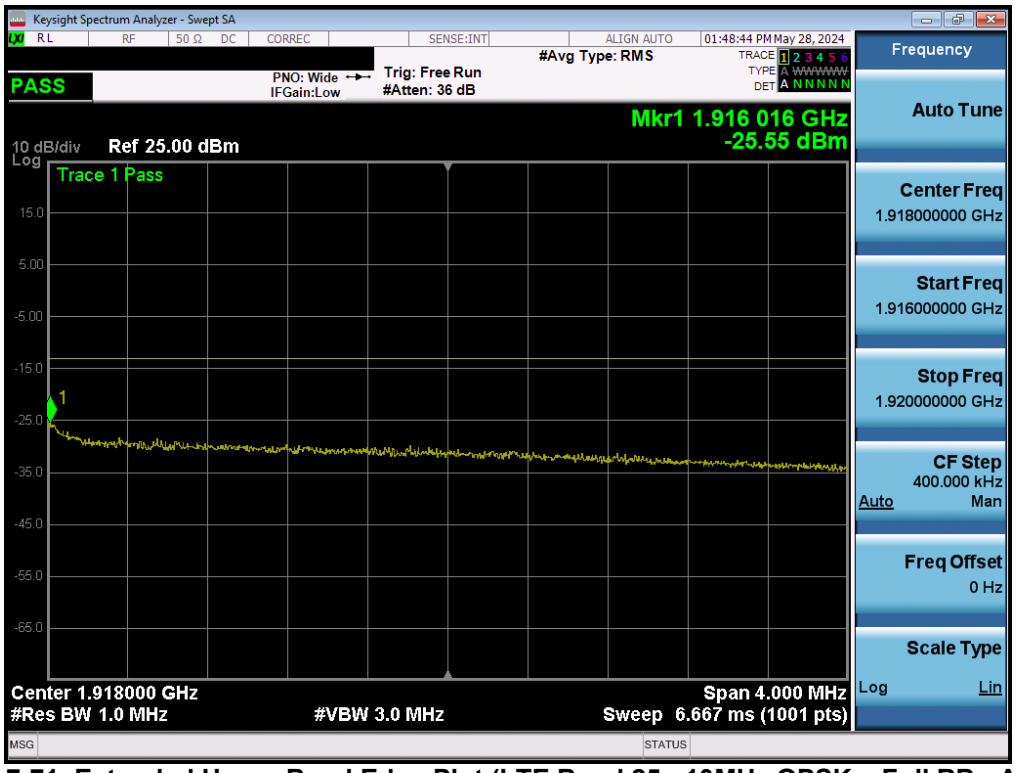
Plot 7-67. Extended Lower Band Edge Plot (LTE Band 25/2 - 10MHz QPSK – Full RB - Ant1)

Plot 7-68. Upper Band Edge Plot (LTE Band 2 - 10MHz QPSK – Full RB - Ant1)

Plot 7-69. Extended Upper Band Edge Plot (LTE Band 2 - 10MHz QPSK – Full RB - Ant1)

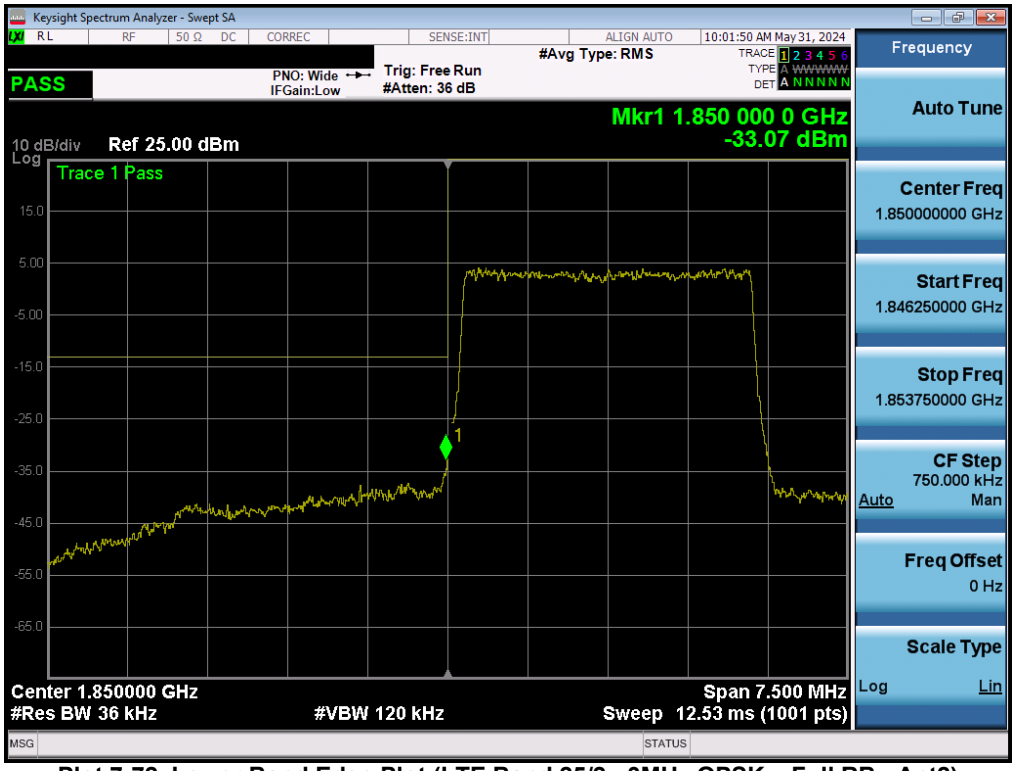


Plot 7-70. Upper Band Edge Plot (LTE Band 25 - 10MHz QPSK – Full RB - Ant1)

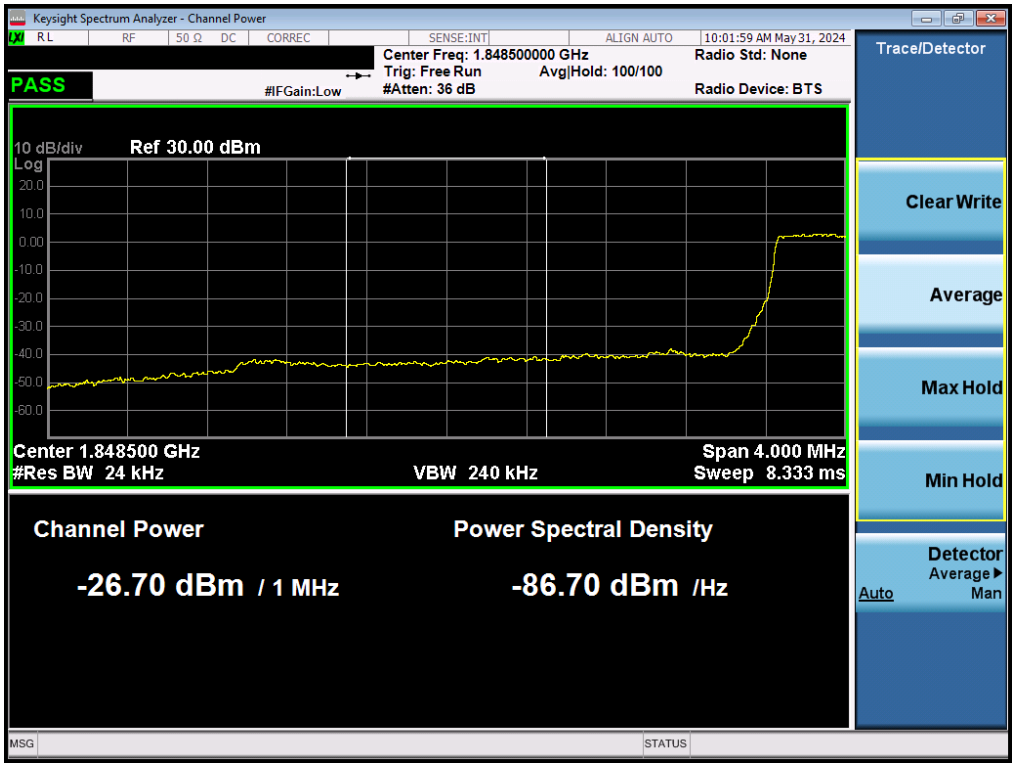


Plot 7-71. Extended Upper Band Edge Plot (LTE Band 25 - 10MHz QPSK – Full RB - Ant1)

LTE Band 25/2 – Ant2

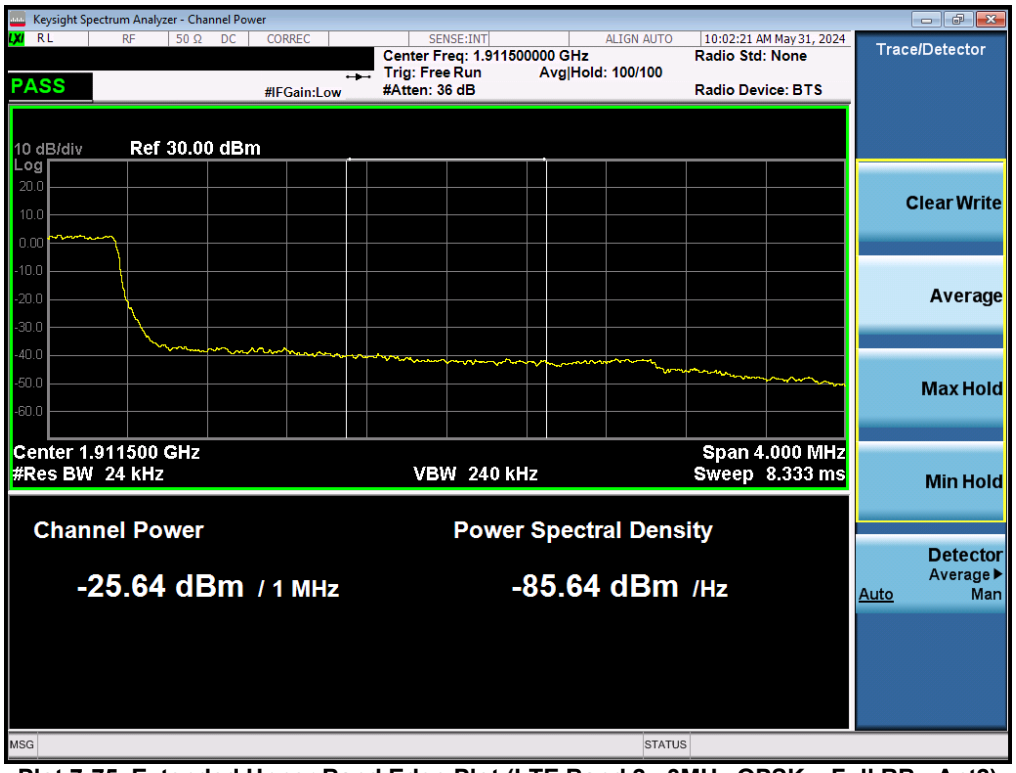


Plot 7-72. Lower Band Edge Plot (LTE Band 25/2 - 3MHz QPSK – Full RB - Ant2)

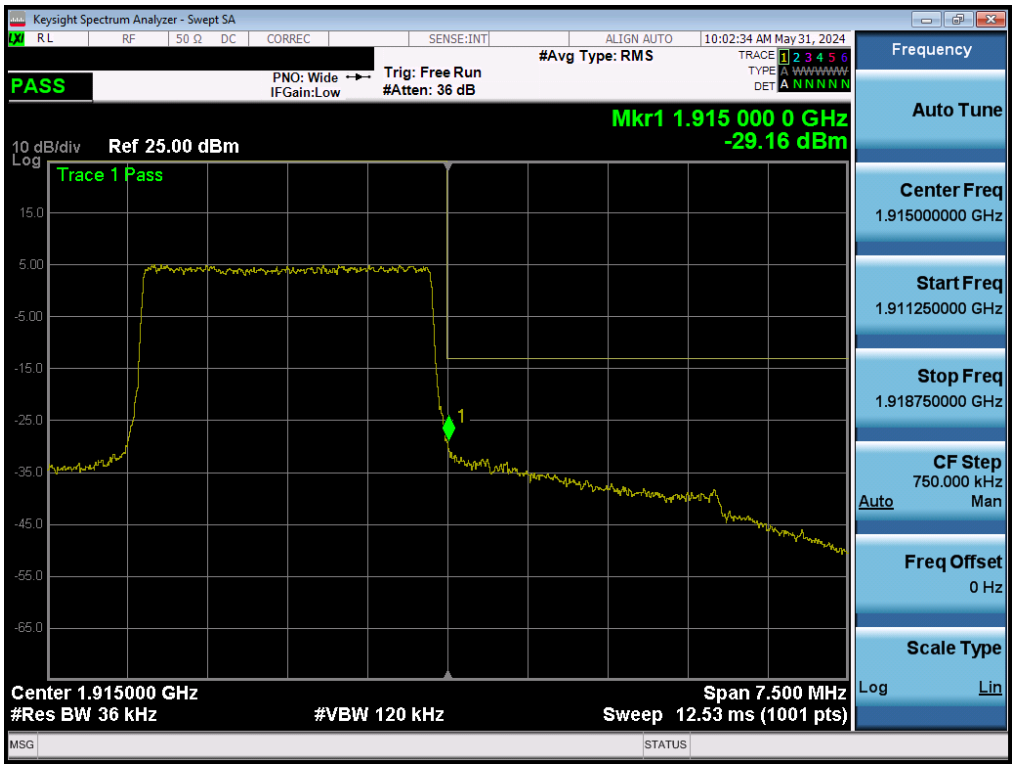


Plot 7-73. Extended Lower Band Edge Plot (LTE Band 25/2 - 3MHz QPSK – Full RB - Ant2)

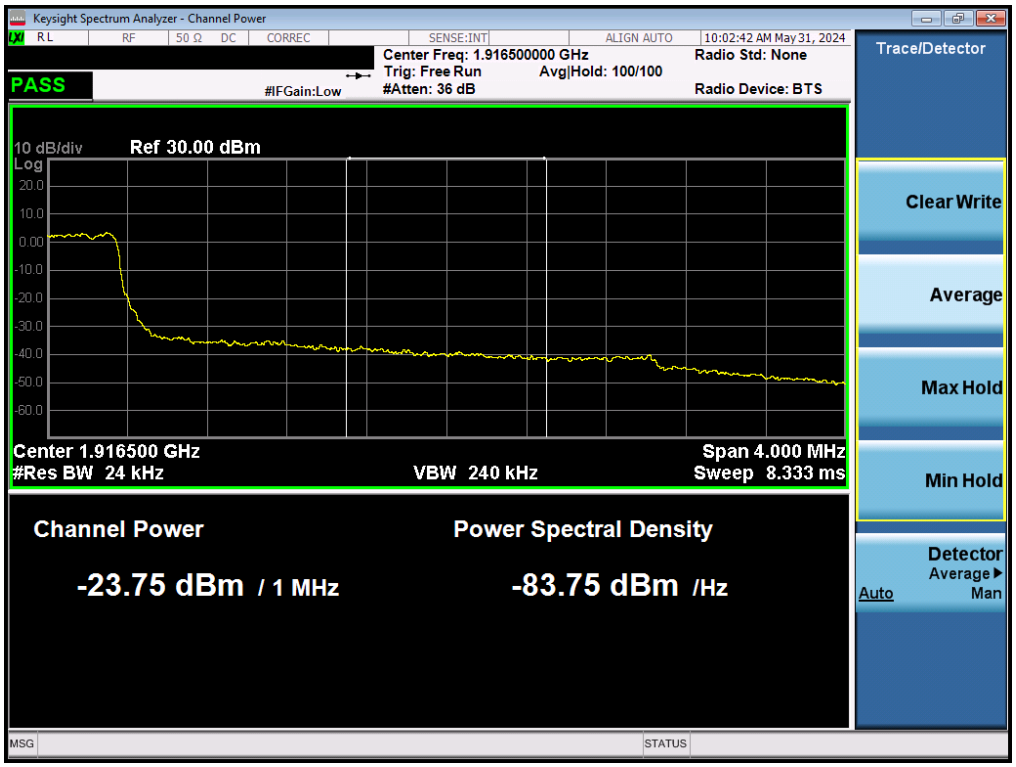
Plot 7-74. Upper Band Edge Plot (LTE Band 2 - 3MHz QPSK – Full RB - Ant2)



Plot 7-75. Extended Upper Band Edge Plot (LTE Band 2 - 3MHz QPSK – Full RB - Ant2)



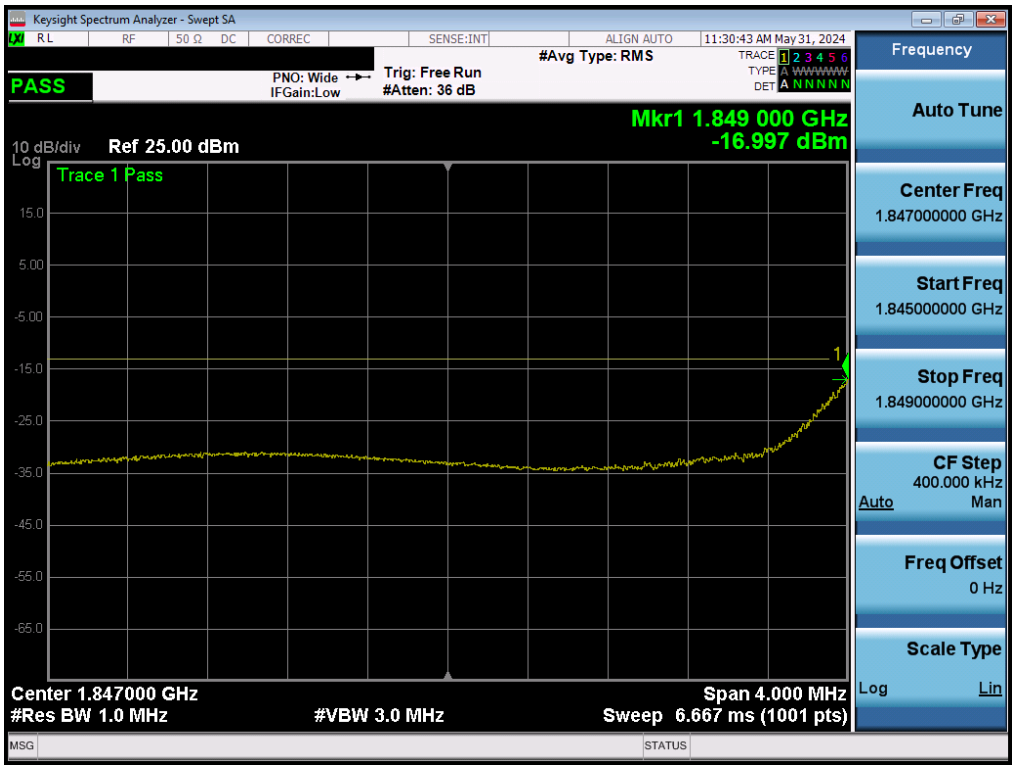
Plot 7-76. Upper Band Edge Plot (LTE Band 25 - 3MHz QPSK – Full RB - Ant2)



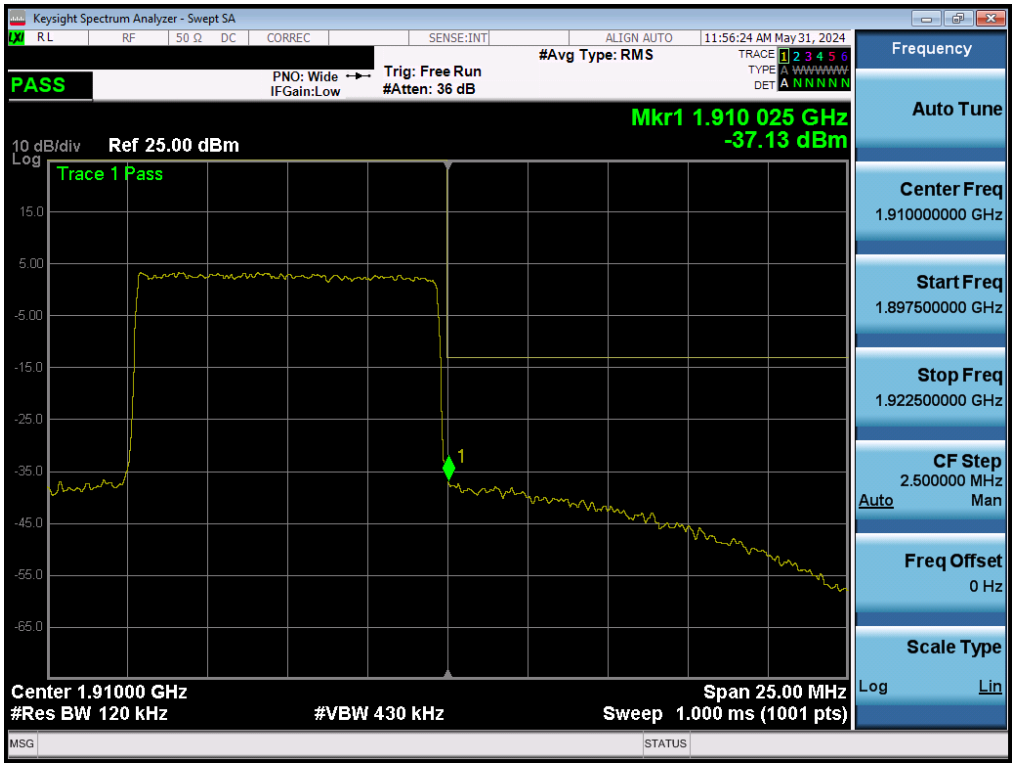
Plot 7-77. Extended Upper Band Edge Plot (LTE Band 25 - 3MHz QPSK – Full RB - Ant2)

NR Band n25/2 – Ant1

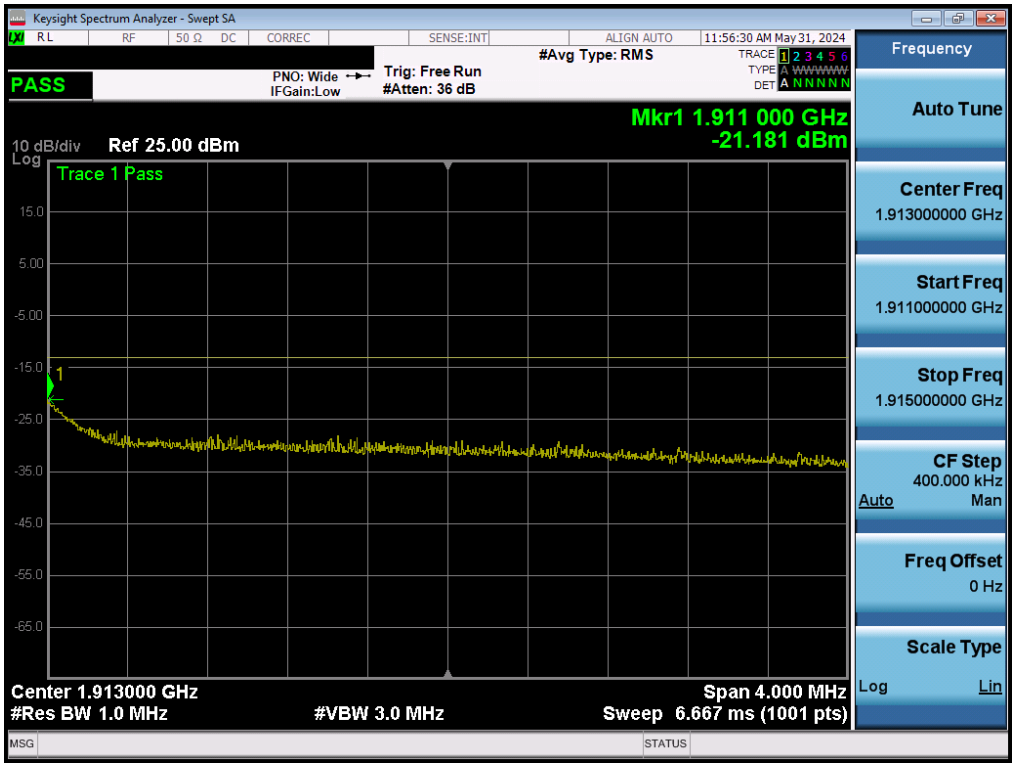
Plot 7-78. Lower Band Edge Plot (NR Band n25 - 10MHz QPSK – Full RB - Ant1)



Plot 7-79. Extended Lower Band Edge Plot (NR Band n25 - 10MHz QPSK – Full RB - Ant1)

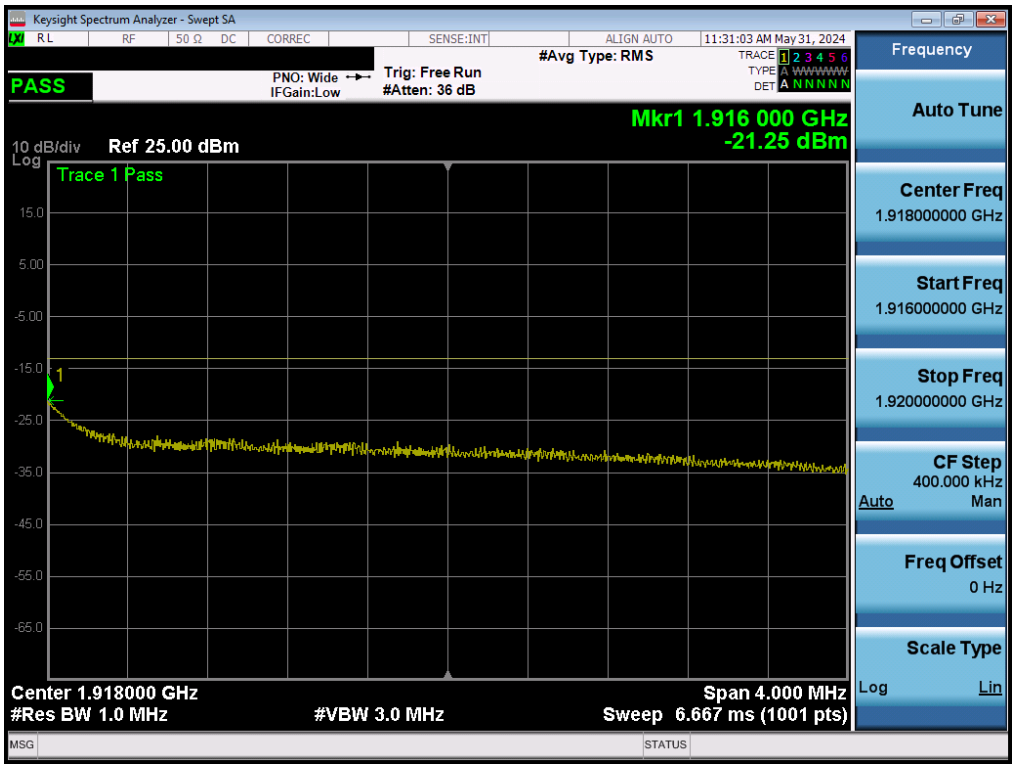


Plot 7-80. Upper Band Edge Plot (NR Band n2 - 10MHz QPSK – Full RB - Ant1)



Plot 7-81. Extended Upper Band Edge Plot (NR Band n2 - 10MHz QPSK – Full RB - Ant1)

Plot 7-82. Upper Band Edge Plot (NR Band n25 - 10MHz QPSK – Full RB - Ant1)



Plot 7-83. Extended Upper Band Edge Plot (NR Band n25 - 10MHz QPSK – Full RB - Ant1)

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.

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

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 measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, 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.

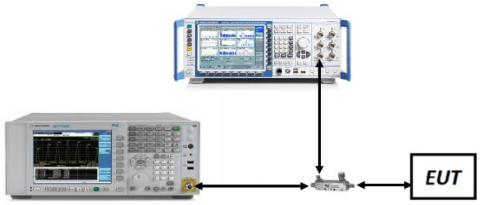


Figure 7-5. Test Instrument & Measurement Setup

Test Notes

For the QAM modulations, 256QAM was found to have the worst-case peak-to-average ratio so it is the only QAM measurement included in this section.

Mode	Bandwidth	Modulation	Average Power [dBm]	PAR at 0.1% [dB]	PAR Limit [dB]	Margin [dB]
WCDMA-PCS	N/A	Spread Spectrum	23.64	3.18	13	-9.82
LTE-B25-2	20MHz	QPSK	23.07	5.70	13	-7.30
		256QAM	19.33	6.80	13	-6.20
	15MHz	QPSK	23.02	5.76	13	-7.24
		256QAM	19.26	6.77	13	-6.23
	10MHz	QPSK	23.07	5.80	13	-7.20
		256QAM	19.31	6.71	13	-6.29
	5MHz	QPSK	23.04	5.75	13	-7.25
		256QAM	19.29	6.71	13	-6.29
	3MHz	QPSK	23.01	5.90	13	-7.10
		256QAM	19.30	6.75	13	-6.25
	1.4MHz	QPSK	23.02	5.82	13	-7.18
		256QAM	19.25	6.89	13	-6.11

Table 7-14. Peak-Average Ratio Summary – Antenna 1

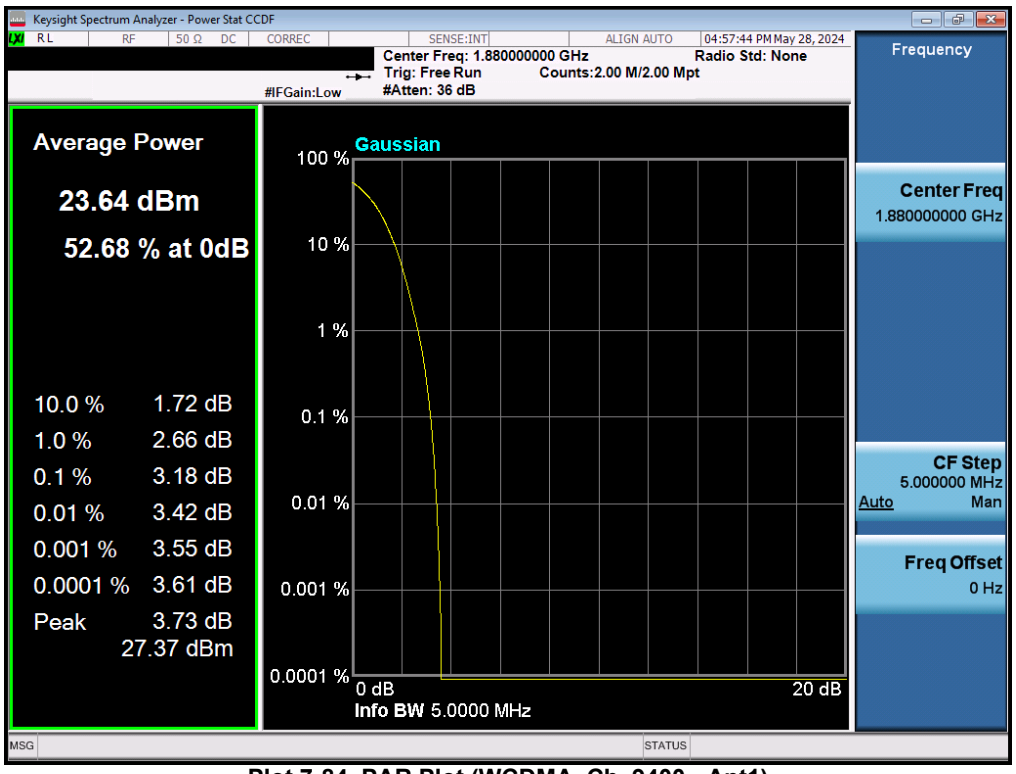
Mode	Bandwidth	Modulation	Average Power [dBm]	PAR at 0.1% [dB]	PAR Limit [dB]	Margin [dB]
LTE-B25-2	20MHz	QPSK	22.47	5.49	13	-7.51
		256QAM	18.39	6.84	13	-6.16
	15MHz	QPSK	22.52	5.55	13	-7.45
		256QAM	18.38	6.86	13	-6.14
	10MHz	QPSK	22.53	5.61	13	-7.39
		256QAM	18.38	6.80	13	-6.20
	5MHz	QPSK	22.53	5.59	13	-7.41
		256QAM	18.43	6.78	13	-6.22
	3MHz	QPSK	22.52	5.71	13	-7.29
		256QAM	18.45	6.84	13	-6.16
	1.4MHz	QPSK	22.44	5.70	13	-7.30
		256QAM	18.42	6.99	13	-6.01

Table 7-15. Peak-Average Ratio Summary – Antenna 2

Mode	Bandwidth	Modulation	Average Power [dBm]	PAR at 0.1% [dB]	PAR Limit [dB]	Margin [dB]
NR-n25-2	40MHz	BPSK	23.65	4.94	13	-8.06
		QPSK	21.14	8.33	13	-4.67
		256QAM	17.92	8.65	13	-4.35
	35MHz	BPSK	23.97	4.52	13	-8.48
		QPSK	21.39	8.33	13	-4.67
		256QAM	18.19	8.72	13	-4.28
	30MHz	BPSK	23.68	4.47	13	-8.53
		QPSK	21.13	8.28	13	-4.72
		256QAM	17.90	8.55	13	-4.45
	25MHz	BPSK	23.61	4.70	13	-8.30
		QPSK	21.03	8.33	13	-4.67
		256QAM	17.88	8.74	13	-4.26
	20MHz	BPSK	23.83	4.54	13	-8.46
		QPSK	21.25	8.27	13	-4.73
		256QAM	18.13	8.60	13	-4.40
	15MHz	BPSK	23.79	4.56	13	-8.44
		QPSK	21.24	8.48	13	-4.52
		256QAM	18.08	8.64	13	-4.36
	10MHz	BPSK	23.76	4.51	13	-8.49
		QPSK	21.19	8.29	13	-4.71
		256QAM	18.06	8.41	13	-4.59
	5MHz	BPSK	23.74	4.72	13	-8.28
		QPSK	21.15	8.37	13	-4.63
		256QAM	18.00	8.52	13	-4.48

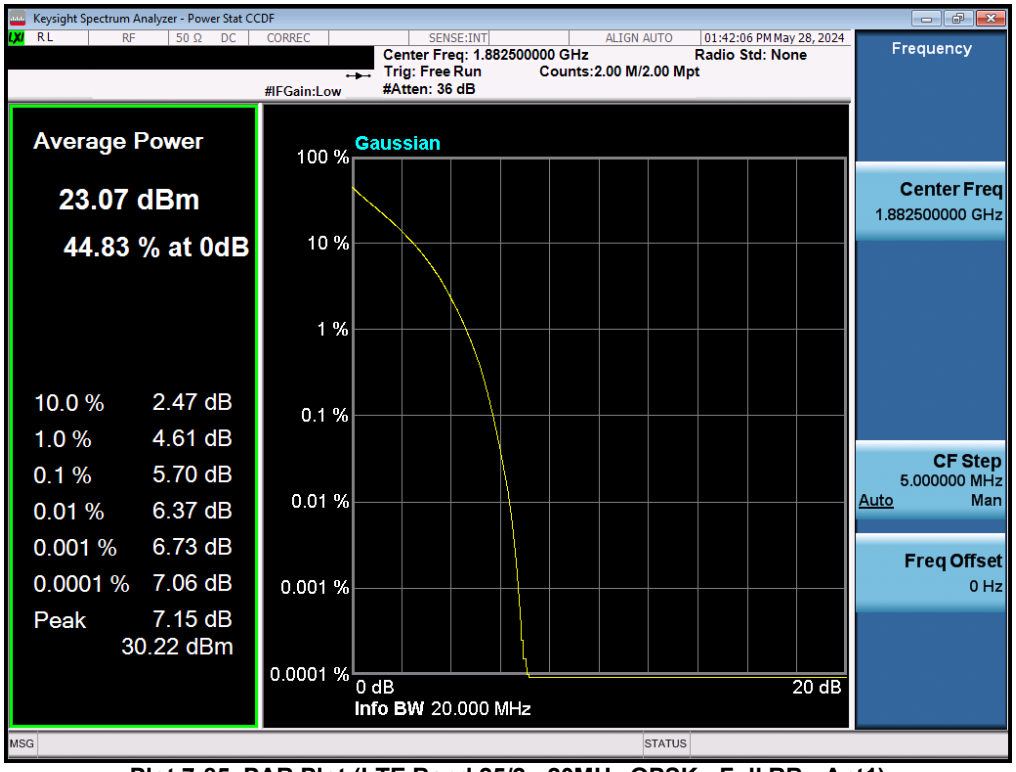
Table 7-16. Peak-Average Ratio Summary – Antenna 1

WCDMA PCS – Ant1

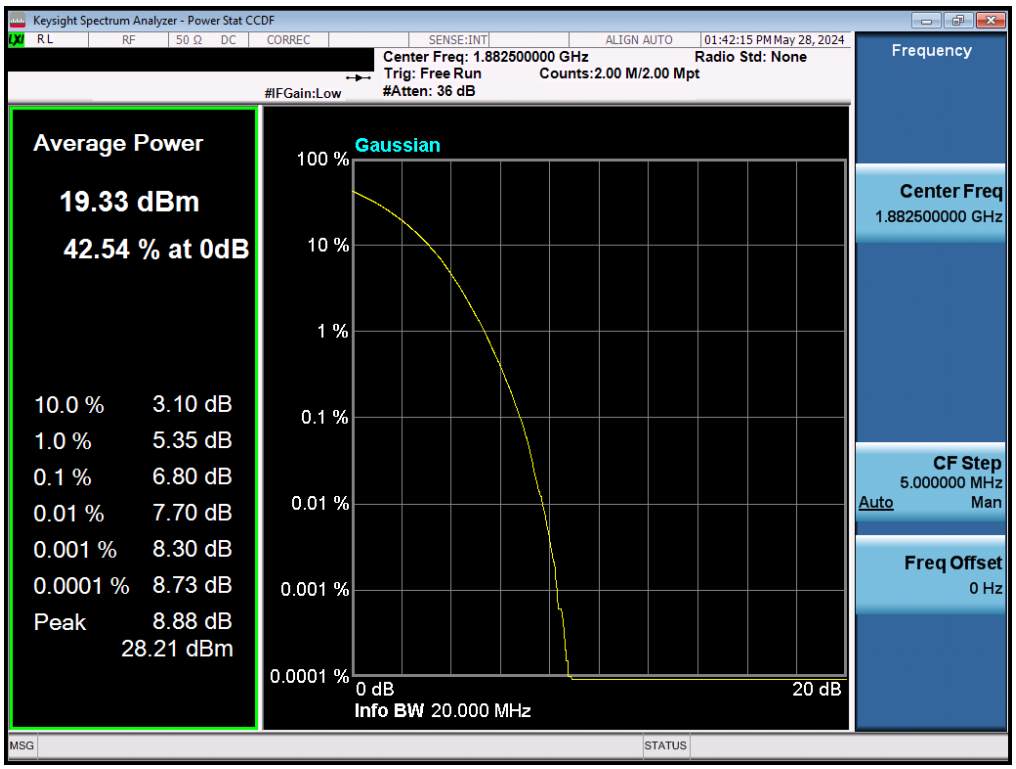


Plot 7-84. PAR Plot (WCDMA, Ch. 9400 - Ant1)

LTE Band 25/2 – Ant1



Plot 7-85. PAR Plot (LTE Band 25/2 - 20MHz QPSK - Full RB - Ant1)



Plot 7-86. PAR Plot (LTE Band 25/2 - 20MHz 256-QAM - Full RB - Ant1)