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PART 27 / RSS-130 & RSS-139 MEASUREMENT REPORT

Applicant Name:
Telit Communications S.p.A.
Viale Stazione di Prosecco 5/b
Trieste, 34010
Italy

Date of Testing:
03/21/2023 - 03/31/2023
Test Report Issue Date:
04/21/2023
Test Site/Location:
Element Lab., Columbia, MD, USA
Test Report Serial No.:
1M2303070020-03-R1.RI7

FCC ID:	**RI7LE910C1SNX**
IC:	**5131A-LE910C1SNX**
APPLICANT:	**Telit Communications S.p.A.**

Application Type:	Certification
Model/HVIN:	LE910C1-SNX
Additional Model/HVIN:	LE910C1-SNXD
EUT Type:	Module
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part:	27
ISED Specification:	RSS-130 Issue 2, RSS-139 Issue 4
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.

Note: This revised Test Report (S/N: 1M2303070020-03-R1.RI7) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	ERP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 12	10 MHz	QPSK	704.0 - 711.0	0.185	22.67	9M01G7D
		16QAM	704.0 - 711.0	0.150	21.75	5M14W7D
	5 MHz	QPSK	701.5 - 713.5	0.173	22.37	4M58G7D
		16QAM	701.5 - 713.5	0.150	21.76	4M54W7D
	3 MHz	QPSK	700.5 - 714.5	0.188	22.73	2M72G7D
		16QAM	700.5 - 714.5	0.144	21.58	2M72W7D
	1.4 MHz	QPSK	699.7 - 715.3	0.182	22.61	1M11G7D
		16QAM	699.7 - 715.3	0.142	21.51	1M11W7D
LTE Band 13	10 MHz	QPSK	782.0	0.179	22.54	8M97G7D
		16QAM	782.0	0.140	21.45	5M09W7D
	5 MHz	QPSK	779.5 - 784.5	0.177	22.49	4M57G7D
		16QAM	779.5 - 784.5	0.137	21.37	4M53W7D

EUT Overview (<1GHz)

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 66/4	20 MHz	QPSK	1720.0 - 1770.0	0.499	26.98	18M0G7D
		16QAM	1720.0 - 1770.0	0.348	25.42	5M81W7D
	15 MHz	QPSK	1717.5 - 1772.5	0.483	26.84	13M5G7D
		16QAM	1717.5 - 1772.5	0.424	26.28	5M56W7D
	10 MHz	QPSK	1715.0 - 1775.0	0.513	27.10	9M02G7D
		16QAM	1715.0 - 1775.0	0.430	26.33	5M12W7D
	5 MHz	QPSK	1712.5 - 1777.5	0.491	26.91	4M58G7D
		16QAM	1712.5 - 1777.5	0.382	25.82	4M54W7D
	3 MHz	QPSK	1711.5 - 1778.5	0.485	26.86	2M72G7D
		16QAM	1711.5 - 1778.5	0.385	25.86	2M72W7D
	1.4 MHz	QPSK	1710.7 - 1779.3	0.497	26.96	1M10G7D
		16QAM	1710.7 - 1779.3	0.387	25.87	1M11W7D

EUT Overview (>1GHz)

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 **Telit Module FCC ID: RI7LE910C1SNX / IC: 5131A-LE910C1SNX**. 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, RSS-130, and RSS-139. This device is tested as mobile equipment.

Test Device Serial No.: 350515859998620, 350515859998729

2.2 Device Capabilities

This device contains the following capabilities:

Multi-Band LTE

Note: The EUT is a Category 1 LTE module. For 16QAM operation, the Category 1 designation limits the maximum bandwidth of the module to 27RB's which is about 4.86MHz.

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.

For radiated testing, a GPS antenna (SN: 2J4301MPGF) and two LTE magnetic antennas (Model: WE14-LF-07) are connected to the output of the module simultaneously as the worst case.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version M0F.333006 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
-	ETS	EMC Cable and Switch System	1/12/2023	Annual	1/12/2024	ETS
-	LTx1	Licensed Transmitter Cable Set	1/13/2023	Annual	1/13/2024	LTx1
Anritsu	MT8821C	Radio Communication Analyzer	N/A			6201525694
Espec	SCP-220	Environmental Chamber	5/25/2022	Annual	5/25/2023	OCPS5H0612K05
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	4/20/2021	Biennial	4/20/2023	00125518
Keysight Technologies	N9030A	PXA Signal Analyzer	9/6/2022	Annual	9/6/2023	MY54490576
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	8/29/2022	Annual	8/29/2023	100342
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	8/30/2022	Biennial	8/30/2023	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

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

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

QAM Modulation

Emission Designator = 8M45W7D

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

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

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

7.0 TEST RESULTS

7.1 Summary

Company Name: Telit Communications S.p.A.

FCC ID: RI7LE910C1SNX

FCC Classification: PCS Licensed Transmitter (PCB)

Mode(s): LTE

Test Condition	Test Description	FCC Part Section(s)	RSS Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Transmitter Conducted Output Power Effective Radiated Power (LTE Band 13) Effective Radiated Power (LTE Band 12) Equivalent Isotropic Radiated Power (LTE Band 4, 66)	2.1046(a), 2.1046 27.50(b)(10) 27.50(c)(10) 27.50(d)(4)	RSS-Gen(6.12) RSS-130(4.6) RSS-130(4.6) RSS-139(5.5)	≤ 3 Watts max. ERP (LTE B12, 13) ≤ 1 Watt max. EIRP (LTE B66/4)	PASS	Section 7.2
	Occupied Bandwidth	2.1049(h)	RSS-Gen(6.7)	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions (LTE Band 13)	2.1051, 27.53(c)	RSS-Gen(6.13), RSS-130(4.7)	Undesirable emissions must meet the limits detailed in sections 27.53(c)	PASS	Sections 7.4, 7.5
	Conducted Band Edge / Spurious Emissions (LTE Band 12)	2.1051, 27.53(g)	RSS-Gen(6.13), RSS-130(4.7)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Sections 7.4, 7.5
	Conducted Band Edge / Spurious Emissions(LTE Band 4, 66)	2.1051, 27.53(h)	RSS-Gen(6.13), RSS-139(5.6)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Sections 7.4, 7.5
	Peak-to-Average Ratio (LTE Band 12, 13)	N/A	RSS-130(4.6.1)	≤ 13 dB	PASS	Section 7.6
	Peak-to-Average Ratio (LTE Band 4, 66)	27.50(d)(5)	RSS-139(5.5)	≤ 13 dB	PASS	Section 7.6
	Frequency Stability	2.1055, 27.54	RSS-Gen(6.11), RSS-130(4.5), RSS-139(5.4)	Fundamental emissions stay within authorized frequency block	PASS	Section 7.8
RADIATED	Radiated Spurious Emissions (LTE Band 13)	2.1053, 27.53(c), 27.53(f)	RSS-Gen(6.13), RSS-130(4.7)	Undesirable emissions must meet the limits detailed in sections 27.53(c) and 27.53(f)	PASS	Section 7.7
	Radiated Spurious Emissions (LTE Band 12)	2.1053, 27.53(g)	RSS-Gen(6.13), RSS-130(4.7)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Section 7.7
	Radiated Spurious Emissions (LTE Band 4, 66)	2.1053, 27.53(h)(1)	RSS-Gen(6.13), RSS-139(5.6)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Section 7.7

Table 7-1. Summary Table

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is EMC Software Tool v1.0.
5) For FCC compliance, ERP requirements are provided in 27.50(b)(10) and 27.50(c)(10) for LTE Band 13 and 12, respectively. In both cases, the limit for mobile devices is 30W ERP, however, compliance is addressed in this report by applying the tighter 3W ERP limit that corresponds to portable stations.

7.2 Conducted Output Power Data and ERP/EIRP

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.

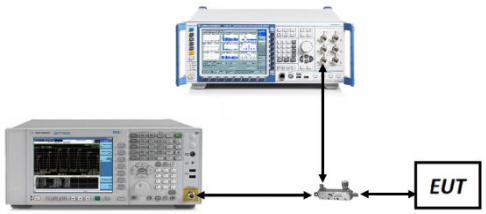


Figure 7-1. Test Instrument & Measurement Setup

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. ERP/EIRP is calculated with conducted power and antenna gain.

3. This module is classified as Category 1 LTE which means that 16QAM only supports up to a maximum of 27RB's.

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Ant Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
10 MHz	QPSK	23060	704.0	1 / 49	23.32	1.50	22.67	0.185	34.77	-12.10
		23095	707.5	1 / 25	23.22	1.50	22.57	0.181	34.77	-12.20
		23130	711.0	1 / 25	23.11	1.50	22.46	0.176	34.77	-12.31
	16-QAM	23060	704.0	1 / 49	22.33	1.50	21.68	0.147	34.77	-13.09
		23095	707.5	1 / 49	22.13	1.50	21.48	0.141	34.77	-13.29
		23130	711.0	1 / 0	22.40	1.50	21.75	0.150	34.77	-13.02
5 MHz	QPSK	23035	701.5	1 / 0	22.82	1.50	22.17	0.165	34.77	-12.60
		23095	707.5	1 / 12	23.02	1.50	22.37	0.173	34.77	-12.40
		23155	713.5	1 / 12	22.87	1.50	22.22	0.167	34.77	-12.55
	16-QAM	23035	701.5	1 / 12	21.87	1.50	21.22	0.132	34.77	-13.55
		23095	707.5	1 / 24	21.94	1.50	21.29	0.134	34.77	-13.48
		23155	713.5	1 / 12	22.41	1.50	21.76	0.150	34.77	-13.01
3 MHz	QPSK	23025	700.5	1 / 7	22.99	1.50	22.34	0.171	34.77	-12.43
		23095	707.5	1 / 7	23.38	1.50	22.73	0.188	34.77	-12.04
		23165	714.5	1 / 7	23.17	1.50	22.52	0.179	34.77	-12.25
	16-QAM	23025	700.5	1 / 7	22.03	1.50	21.38	0.138	34.77	-13.39
		23095	707.5	1 / 0	22.13	1.50	21.48	0.141	34.77	-13.29
		23165	714.5	1 / 7	22.23	1.50	21.58	0.144	34.77	-13.19
1.4 MHz	QPSK	23017	699.7	1 / 0	22.64	1.50	21.99	0.158	34.77	-12.78
		23095	707.5	1 / 3	23.06	1.50	22.41	0.174	34.77	-12.36
		23173	715.3	1 / 3	23.26	1.50	22.61	0.182	34.77	-12.16
	16-QAM	23017	699.7	1 / 0	21.56	1.50	20.91	0.123	34.77	-13.86
		23095	707.5	1 / 0	22.16	1.50	21.51	0.142	34.77	-13.26
		23173	715.3	1 / 5	22.03	1.50	21.38	0.137	34.77	-13.39

Table 7-2. Conducted power measurements – B12

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Ant Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
10 MHz	QPSK	23230	782.0	1 / 25	23.19	1.50	22.54	0.179	34.77	-12.23
	16-QAM	23230	782.0	1 / 25	22.10	1.50	21.45	0.140	34.77	-13.32
5 MHz	QPSK	23205	779.5	1 / 12	22.86	1.50	22.21	0.166	34.77	-12.56
		23230	782.0	1 / 12	23.14	1.50	22.49	0.177	34.77	-12.28
		23255	784.5	1 / 12	22.85	1.50	22.20	0.166	34.77	-12.57
	16-QAM	23205	779.5	1 / 12	21.62	1.50	20.97	0.125	34.77	-13.80
		23230	782.0	1 / 12	21.98	1.50	21.33	0.136	34.77	-13.44
		23255	784.5	1 / 12	22.02	1.50	21.37	0.137	34.77	-13.40

Table 7-3. Conducted power measurements – B13

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
20 MHz	QPSK	132072	1720.0	1 / 50	23.48	3.50	26.98	0.499	30.00	-3.02
		132322	1745.0	1 / 50	23.24	3.50	26.74	0.472	30.00	-3.26
		132572	1770.0	1 / 50	22.89	3.50	26.39	0.435	30.00	-3.61
	16-QAM	132072	1720.0	1 / 50	21.90	3.50	25.40	0.347	30.00	-4.60
		132322	1745.0	1 / 50	21.92	3.50	25.42	0.348	30.00	-4.58
		132572	1770.0	1 / 50	21.82	3.50	25.32	0.341	30.00	-4.68
15 MHz	QPSK	132047	1717.5	1 / 37	23.33	3.50	26.83	0.482	30.00	-3.17
		132322	1745.0	1 / 37	23.34	3.50	26.84	0.483	30.00	-3.16
		132597	1772.5	1 / 37	22.75	3.50	26.25	0.422	30.00	-3.75
	16-QAM	132047	1717.5	1 / 37	22.52	3.50	26.02	0.400	30.00	-3.98
		132322	1745.0	1 / 74	22.78	3.50	26.28	0.424	30.00	-3.72
		132597	1772.5	1 / 0	22.13	3.50	25.63	0.366	30.00	-4.37
10 MHz	QPSK	132022	1715.0	1 / 25	23.60	3.50	27.10	0.513	30.00	-2.90
		132322	1745.0	1 / 25	23.04	3.50	26.54	0.451	30.00	-3.46
		132622	1775.0	1 / 25	22.86	3.50	26.36	0.432	30.00	-3.64
	16-QAM	132022	1715.0	1 / 25	22.51	3.50	26.01	0.399	30.00	-3.99
		132322	1745.0	1 / 25	22.83	3.50	26.33	0.430	30.00	-3.67
		132622	1775.0	1 / 0	21.58	3.50	25.08	0.322	30.00	-4.92
5 MHz	QPSK	131997	1712.5	1 / 12	23.41	3.50	26.91	0.491	30.00	-3.09
		132322	1745.0	1 / 24	23.31	3.50	26.81	0.480	30.00	-3.19
		132647	1777.5	1 / 0	22.85	3.50	26.35	0.431	30.00	-3.65
	16-QAM	131997	1712.5	1 / 24	22.32	3.50	25.82	0.382	30.00	-4.18
		132322	1745.0	1 / 12	22.15	3.50	25.65	0.368	30.00	-4.35
		132647	1777.5	1 / 12	21.84	3.50	25.34	0.342	30.00	-4.66
3 MHz	QPSK	131987	1711.5	1 / 14	23.36	3.50	26.86	0.485	30.00	-3.14
		132322	1745.0	1 / 7	23.32	3.50	26.82	0.481	30.00	-3.18
		132657	1778.5	1 / 7	22.64	3.50	26.14	0.411	30.00	-3.86
	16-QAM	131987	1711.5	1 / 7	22.35	3.50	25.85	0.385	30.00	-4.15
		132322	1745.0	1 / 14	22.36	3.50	25.86	0.385	30.00	-4.14
		132657	1778.5	1 / 7	21.84	3.50	25.34	0.342	30.00	-4.66
1.4 MHz	QPSK	131979	1710.7	1 / 3	23.46	3.50	26.96	0.497	30.00	-3.04
		132322	1745.0	1 / 3	23.30	3.50	26.80	0.479	30.00	-3.20
		132665	1779.3	1 / 3	22.61	3.50	26.11	0.408	30.00	-3.89
	16-QAM	131979	1710.7	1 / 0	22.37	3.50	25.87	0.387	30.00	-4.13
		132322	1745.0	1 / 3	22.12	3.50	25.62	0.365	30.00	-4.38
		132665	1779.3	1 / 3	21.60	3.50	25.10	0.323	30.00	-4.90

Table 7-4. Conducted power measurements – B66/4

7.3 Occupied Bandwidth

Test Overview

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

Test Procedure Used

ANSI C63.26-2015 – Section 5.4.4

Test Settings

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

Test Setup

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

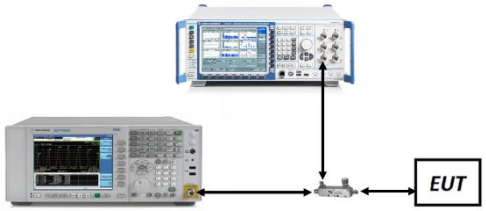
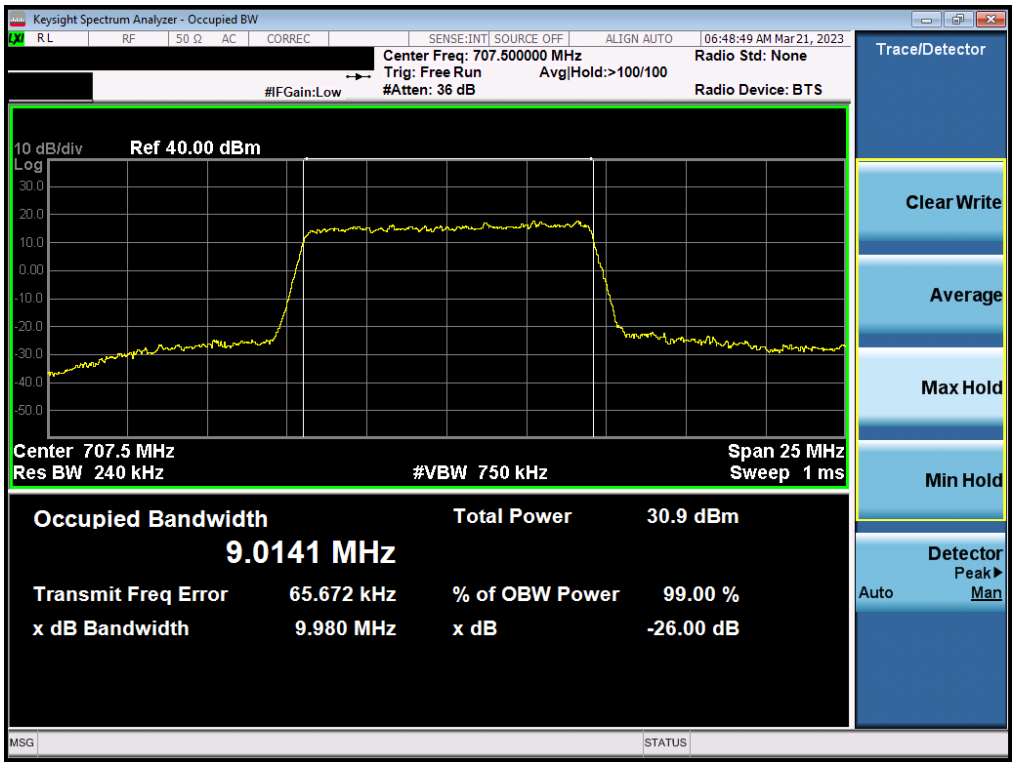


Figure 7-2. Test Instrument & Measurement Setup

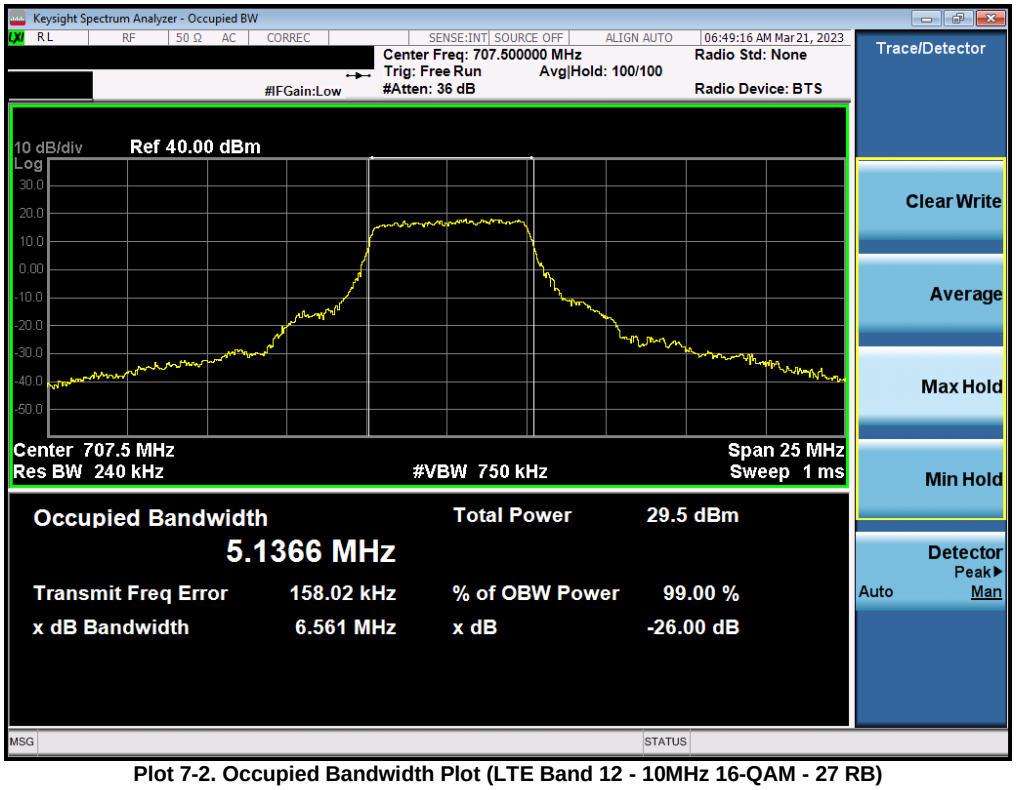
Test Notes

None.

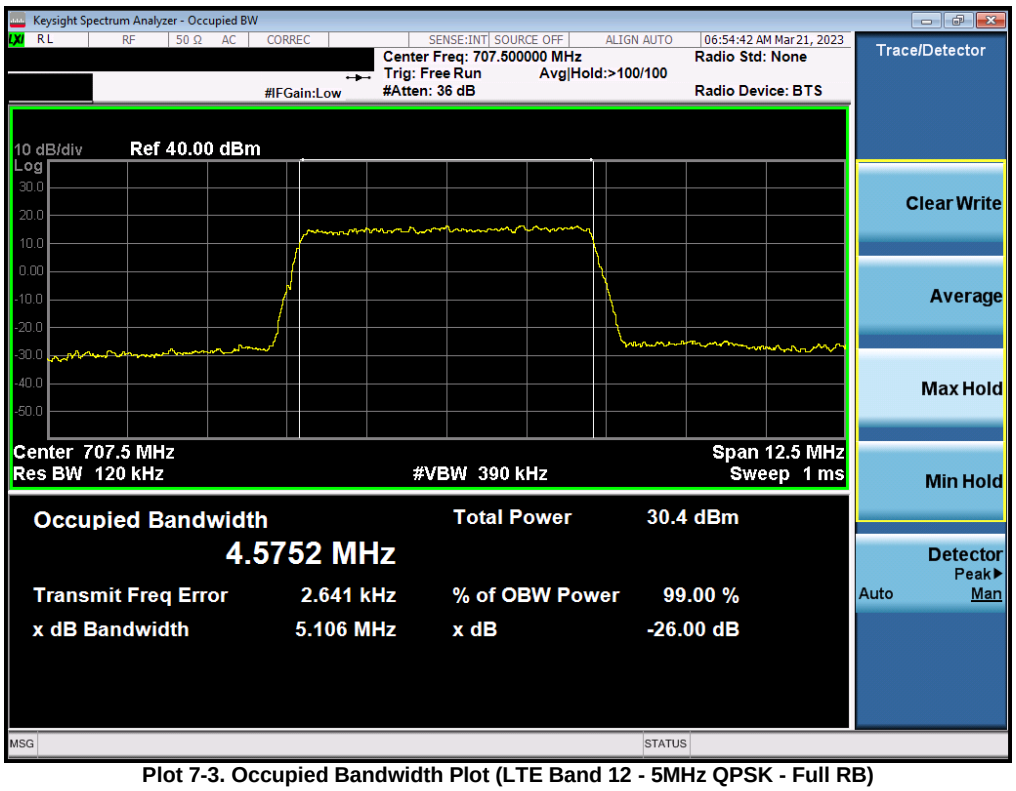
LTE Band 12



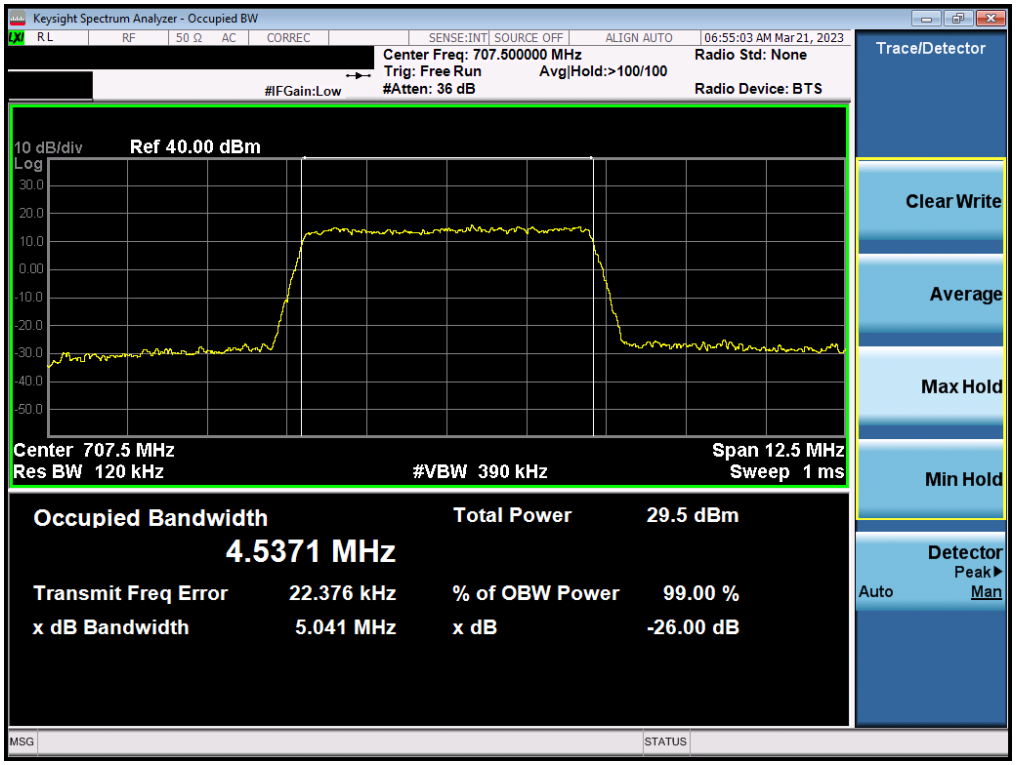
Plot 7-1. Occupied Bandwidth Plot (LTE Band 12 - 10MHz QPSK - Full RB)



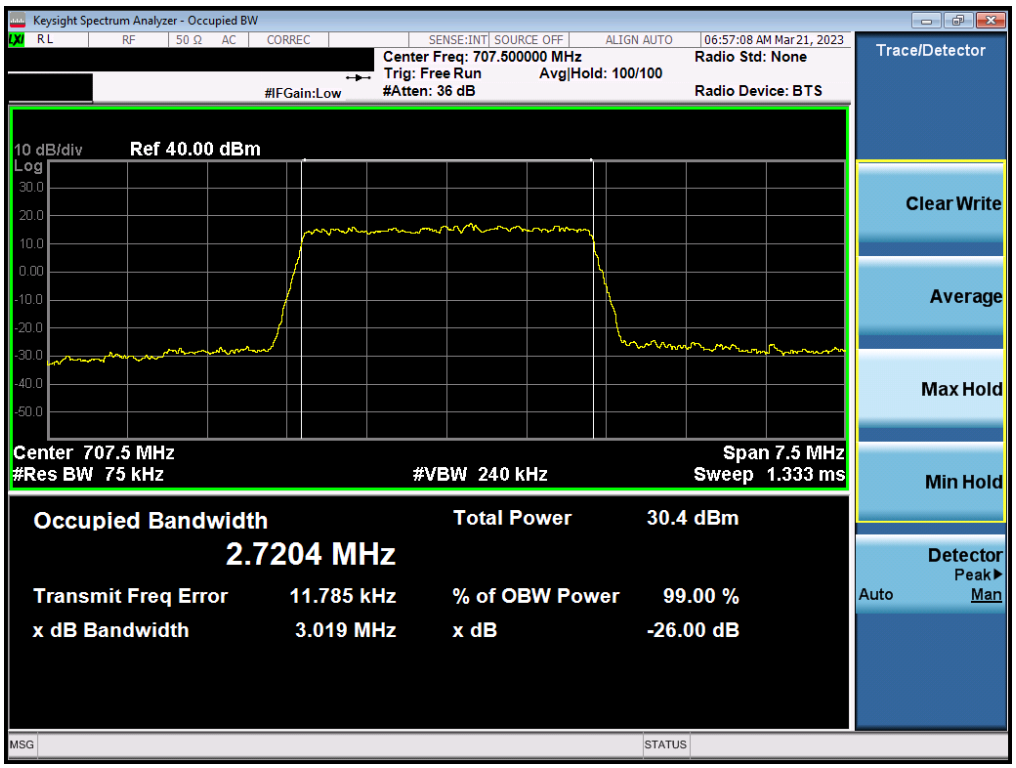
Plot 7-2. Occupied Bandwidth Plot (LTE Band 12 - 10MHz 16-QAM - 27 RB)



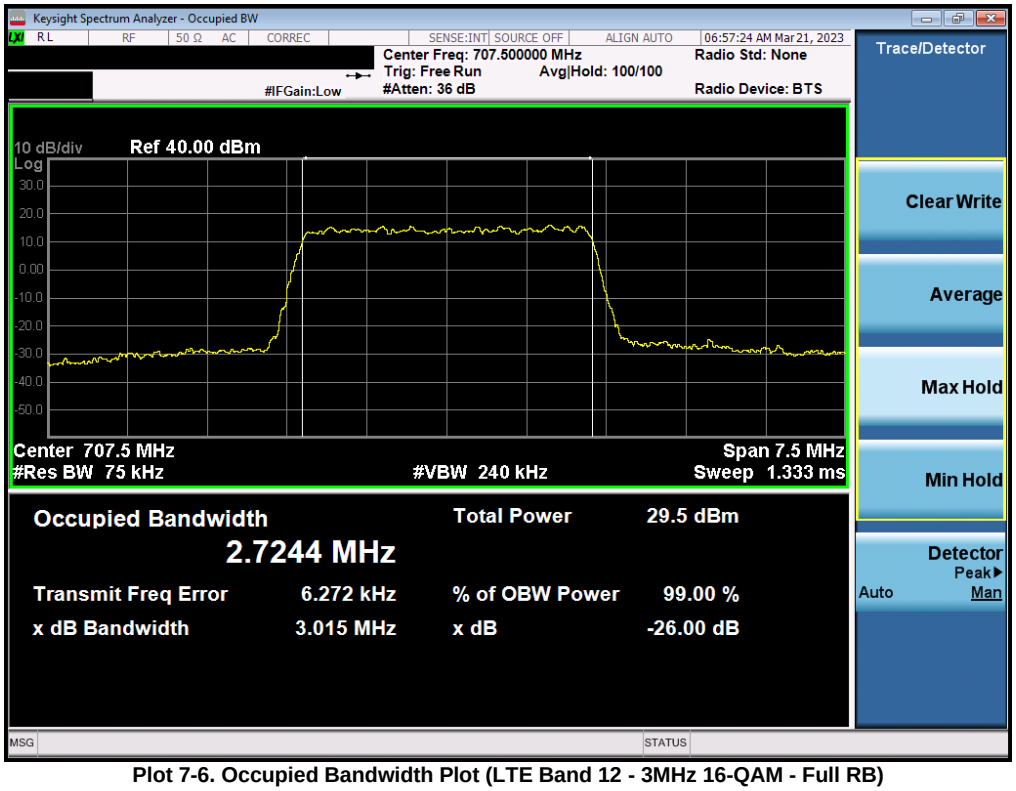
Plot 7-3. Occupied Bandwidth Plot (LTE Band 12 - 5MHz QPSK - Full RB)



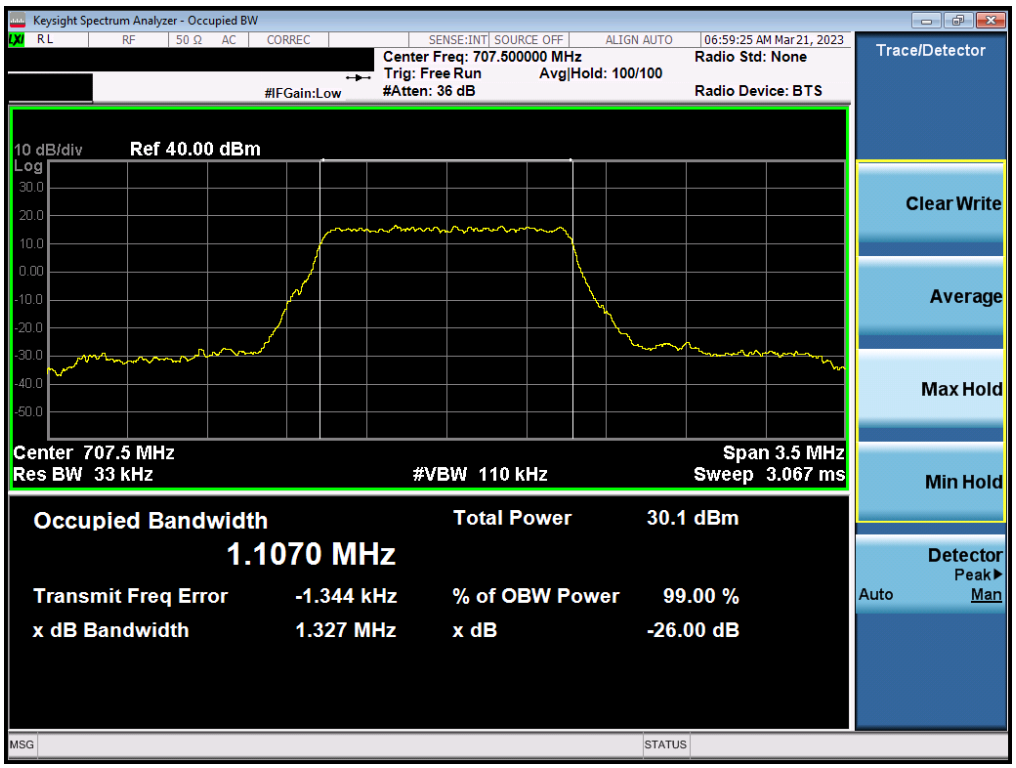
Plot 7-4. Occupied Bandwidth Plot (LTE Band 12 - 5MHz 16-QAM - Full RB)



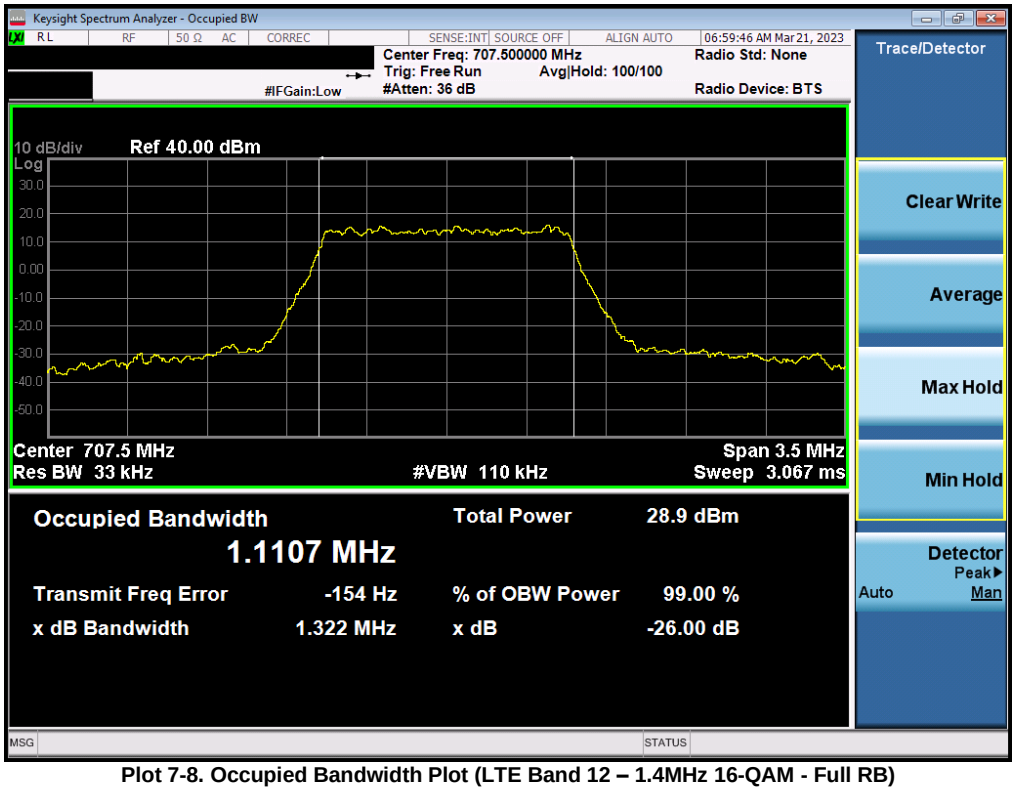
Plot 7-5. Occupied Bandwidth Plot (LTE Band 12 - 3MHz QPSK - Full RB)



Plot 7-6. Occupied Bandwidth Plot (LTE Band 12 - 3MHz 16-QAM - Full RB)

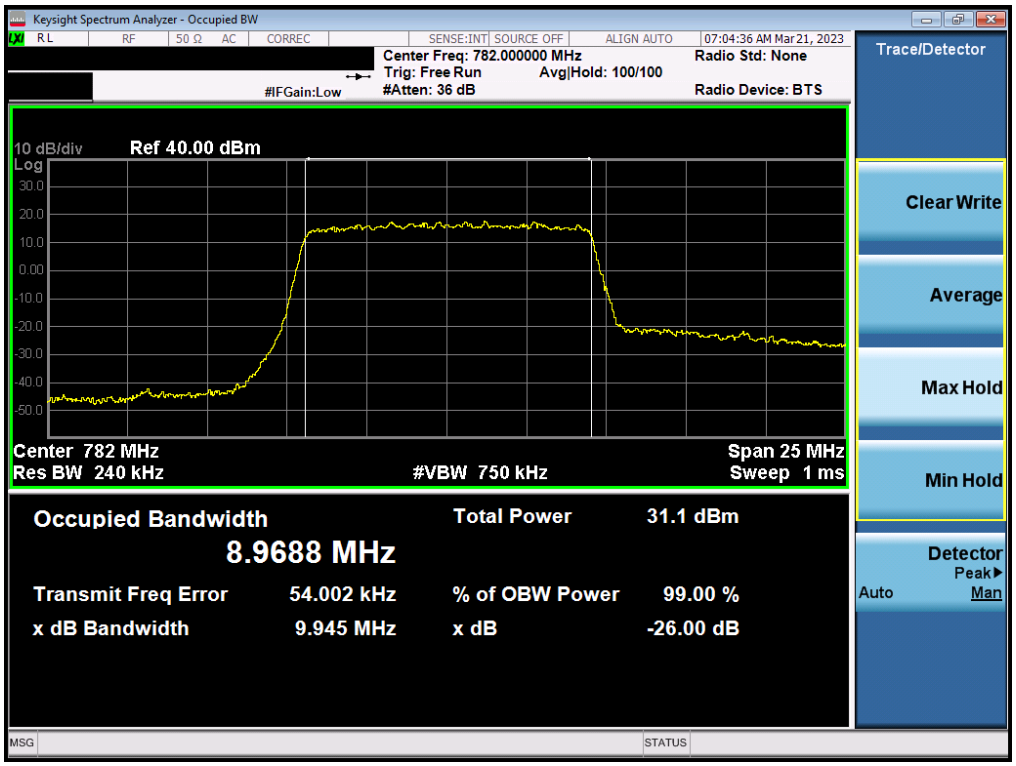


Plot 7-7. Occupied Bandwidth Plot (LTE Band 12 – 1.4MHz QPSK - Full RB)

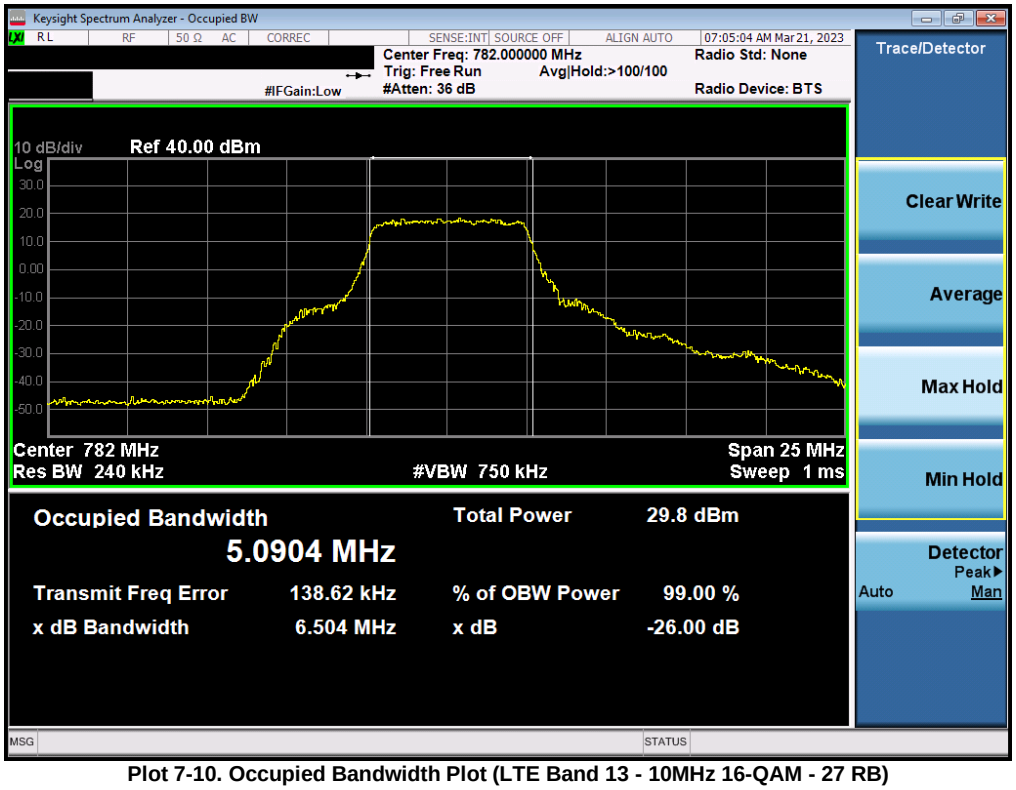


Plot 7-8. Occupied Bandwidth Plot (LTE Band 12 – 1.4MHz 16-QAM - Full RB)

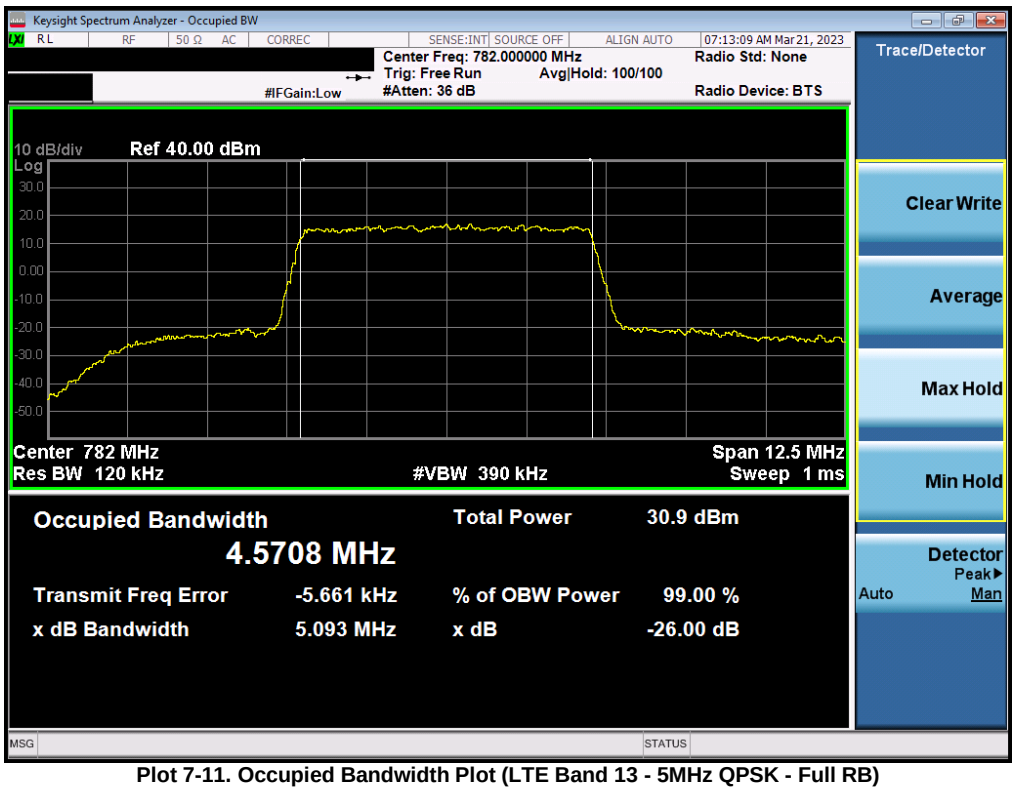
LTE Band 13



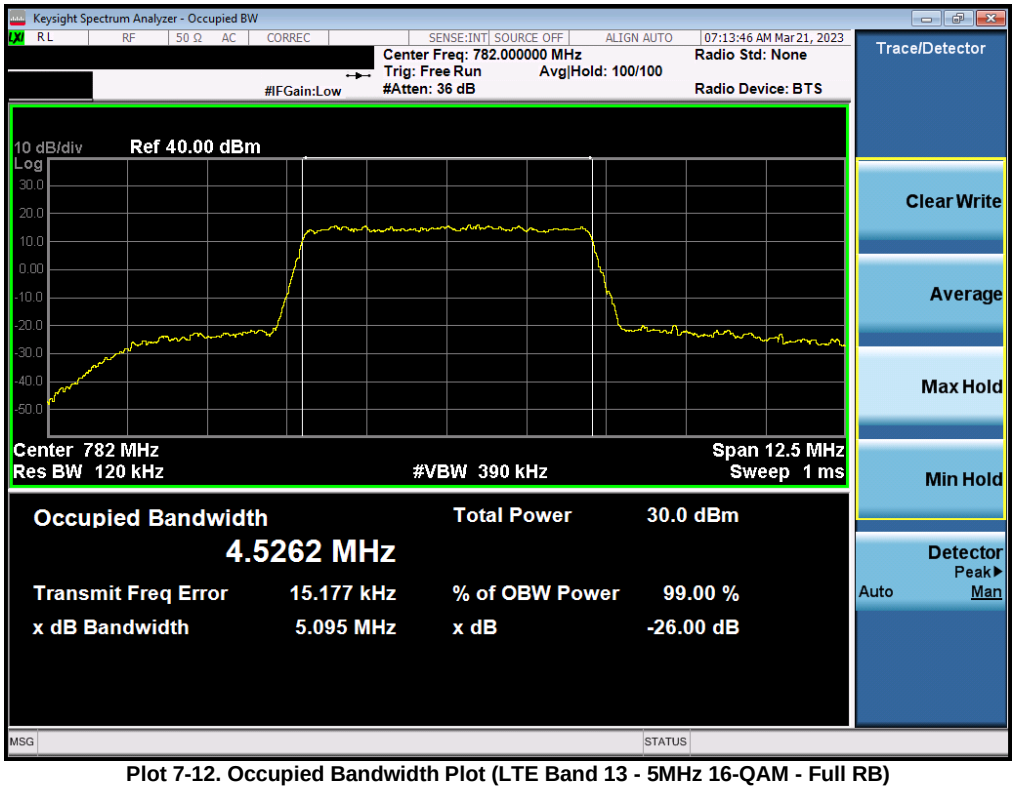
Plot 7-9. Occupied Bandwidth Plot (LTE Band 13 - 10MHz QPSK - Full RB)



Plot 7-10. Occupied Bandwidth Plot (LTE Band 13 - 10MHz 16-QAM - 27 RB)

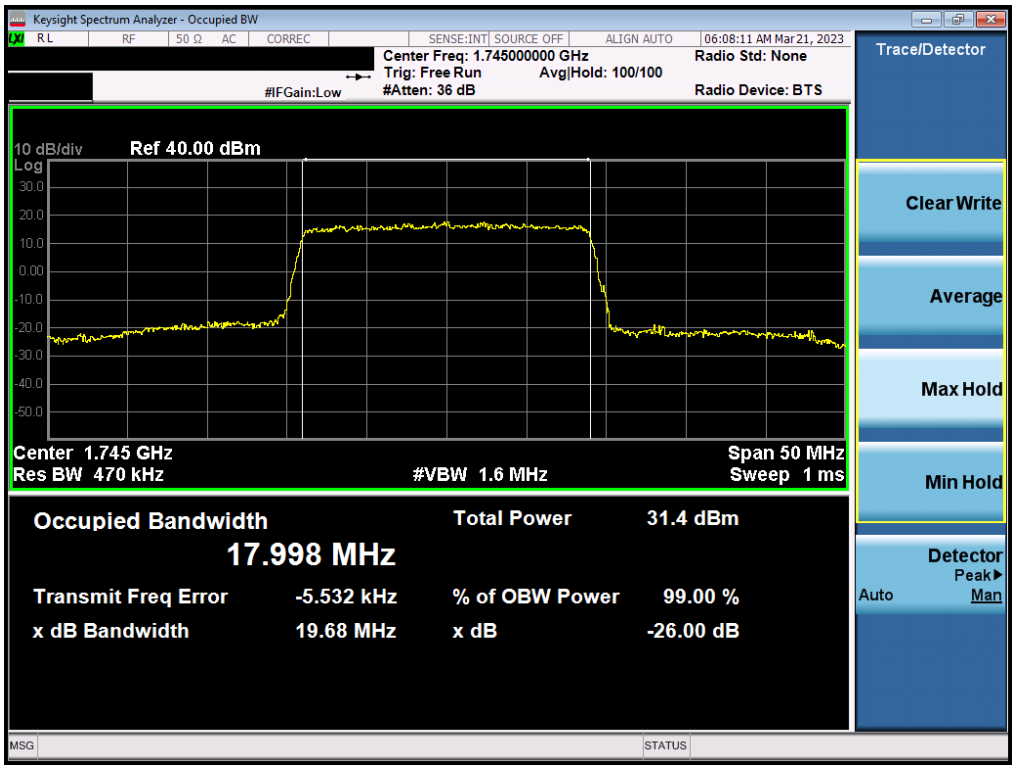


Plot 7-11. Occupied Bandwidth Plot (LTE Band 13 - 5MHz QPSK - Full RB)

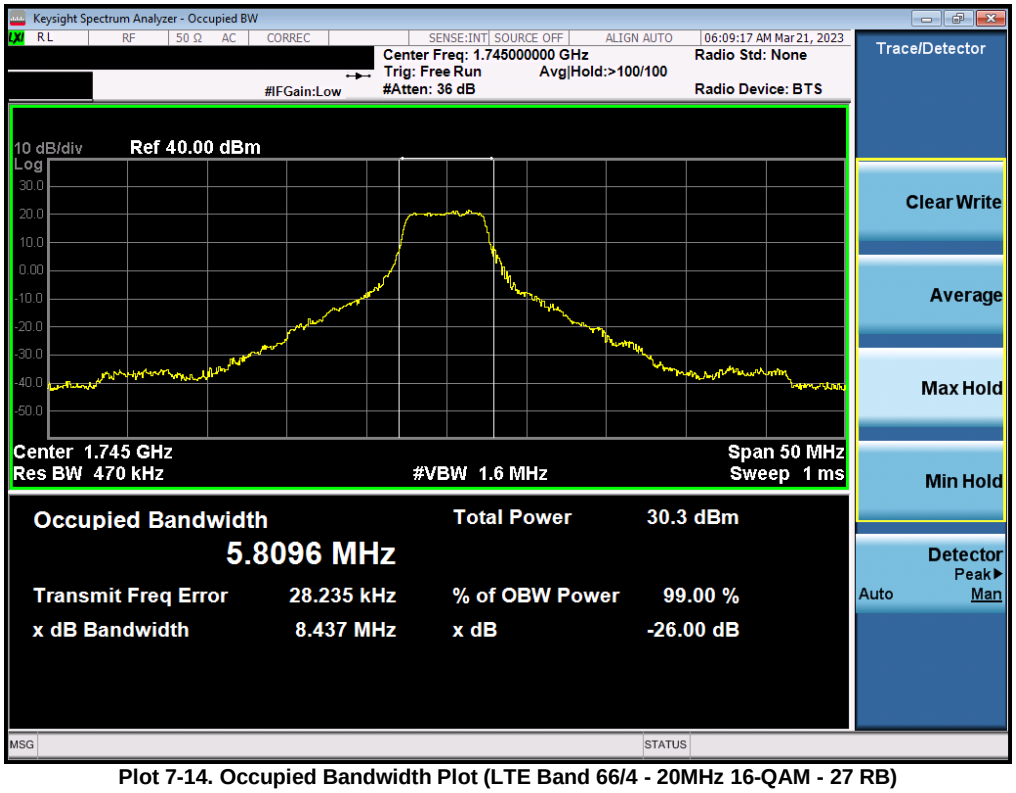


Plot 7-12. Occupied Bandwidth Plot (LTE Band 13 - 5MHz 16-QAM - Full RB)

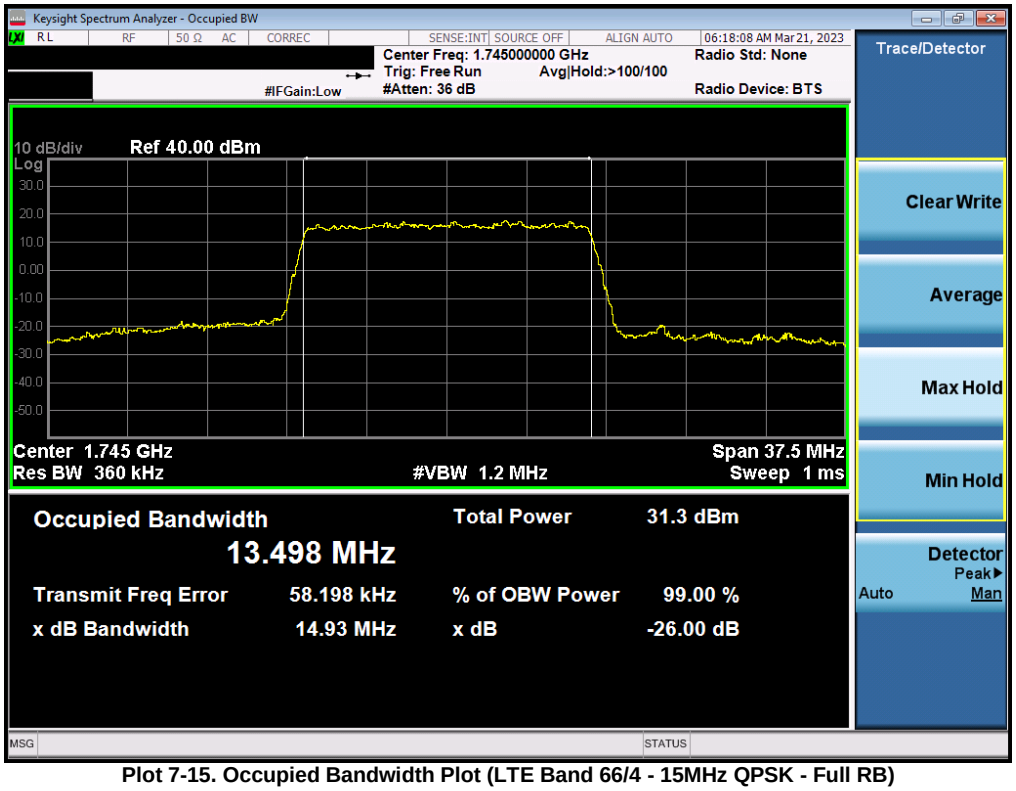
LTE Band 66/4



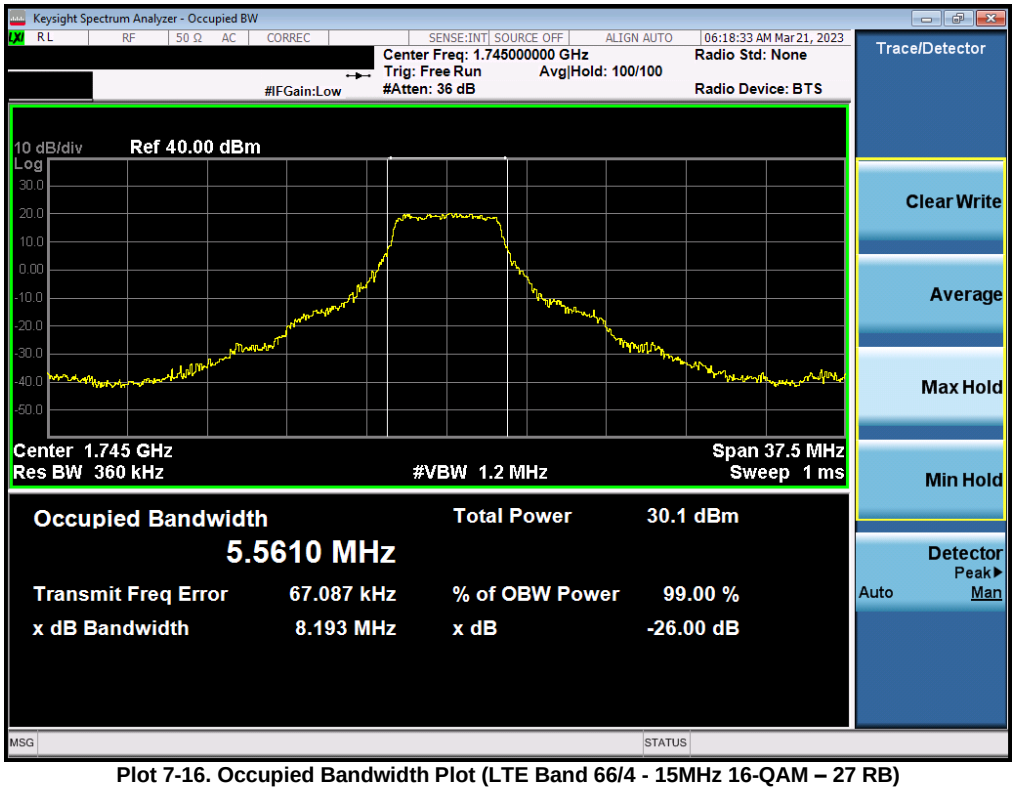
Plot 7-13. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz QPSK - Full RB)



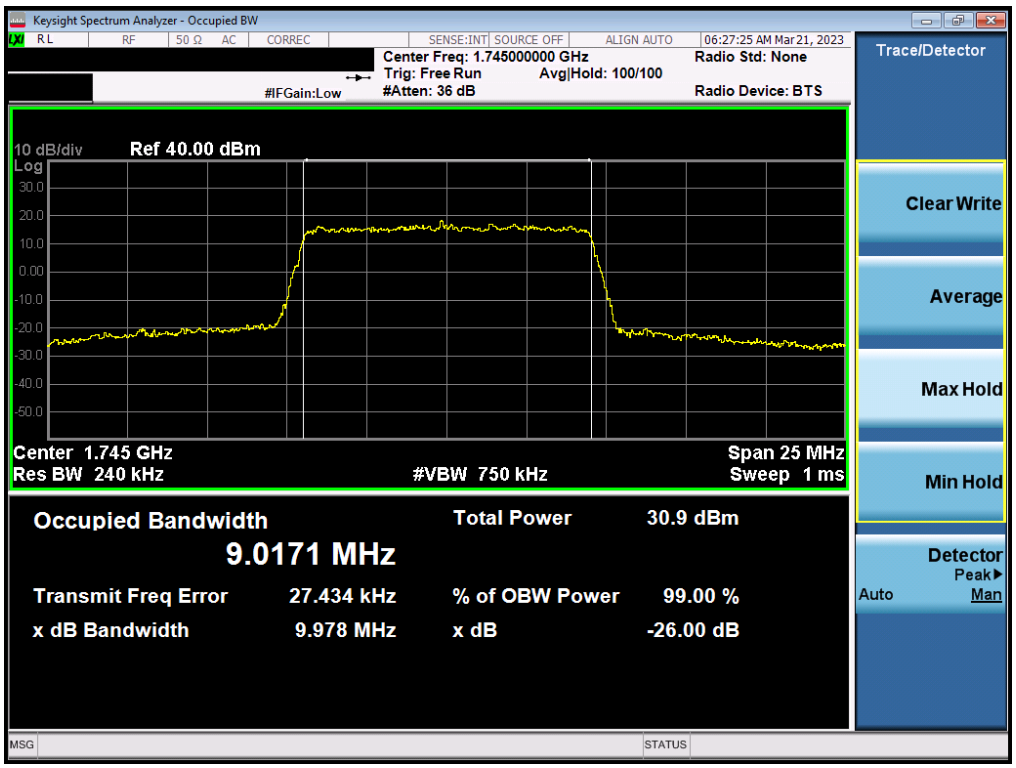
Plot 7-14. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz 16-QAM - 27 RB)



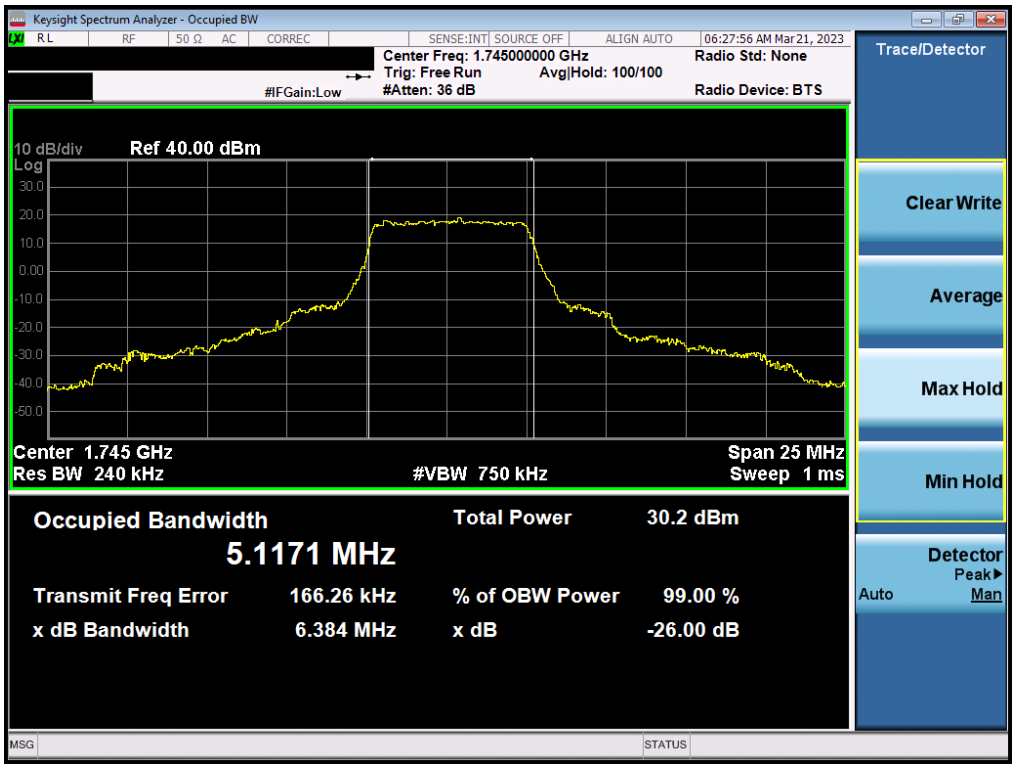
Plot 7-15. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz QPSK - Full RB)



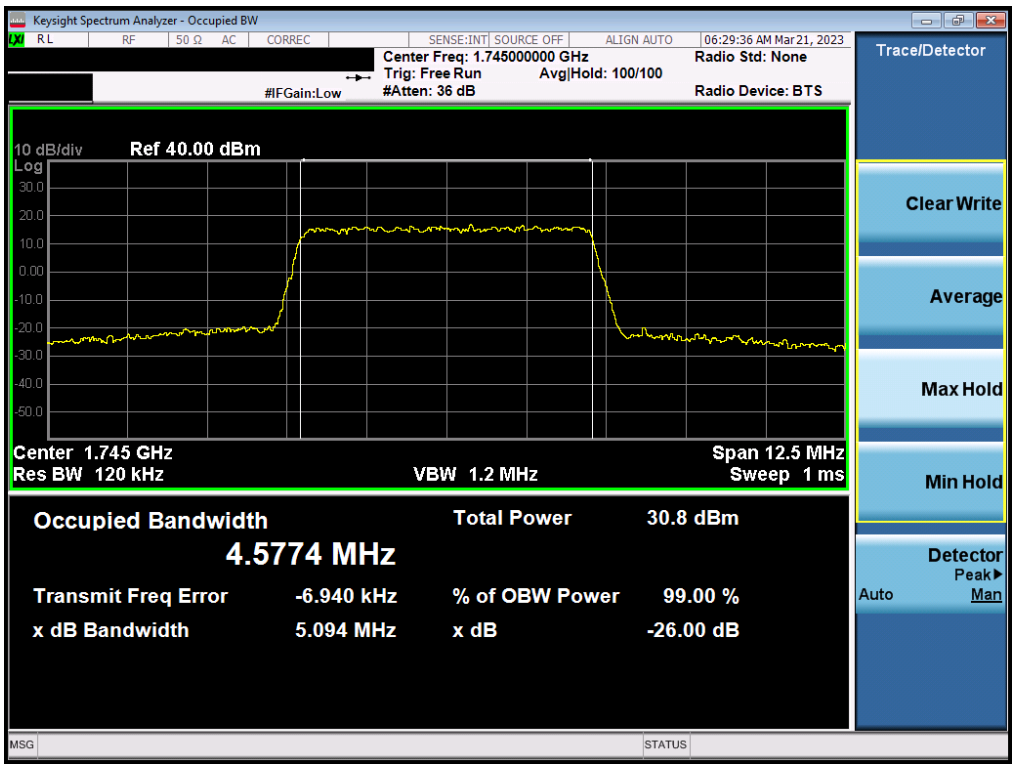
Plot 7-16. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz 16-QAM – 27 RB)



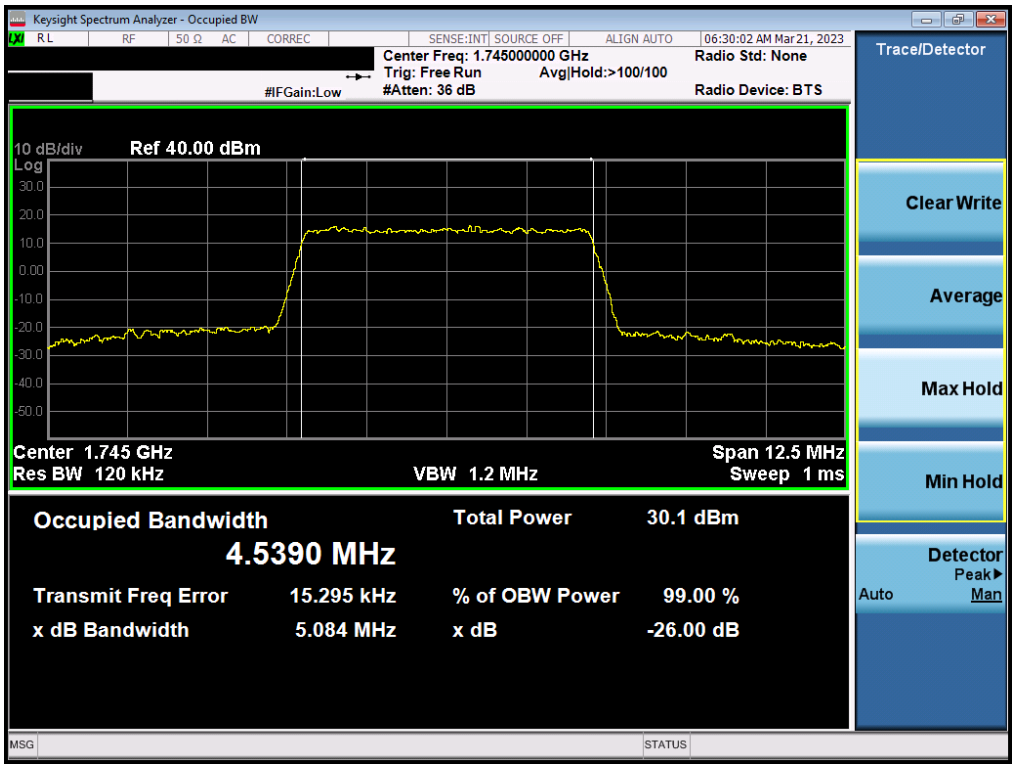
Plot 7-17. Occupied Bandwidth Plot (LTE Band 66/4 - 10MHz QPSK - Full RB)



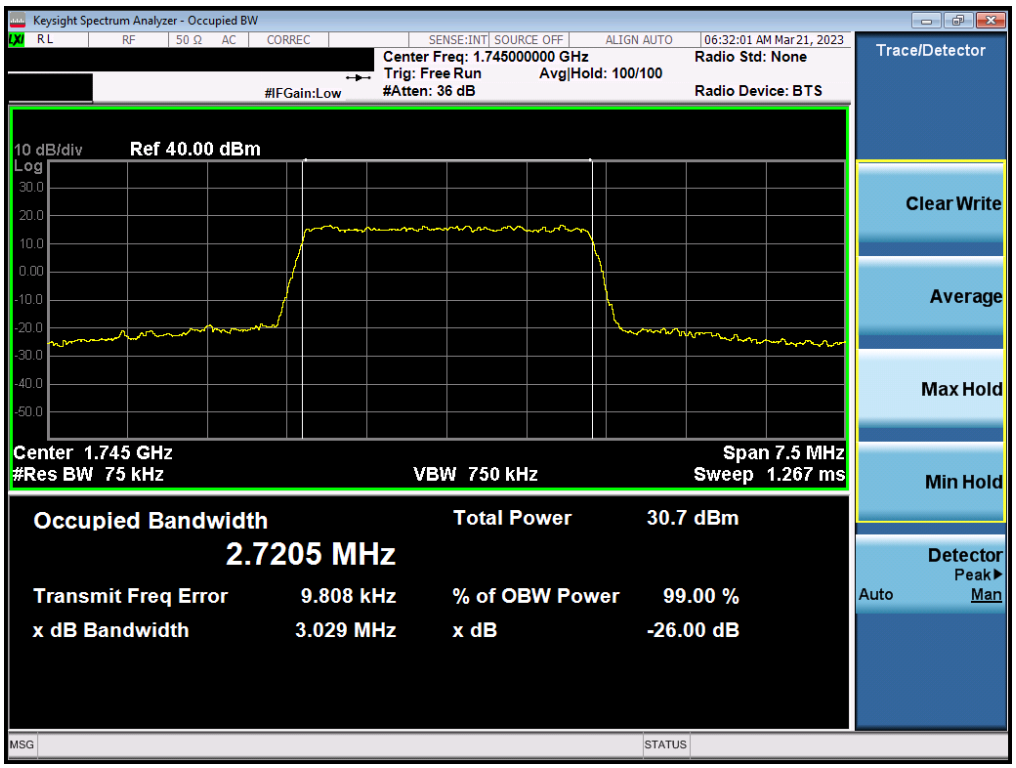
Plot 7-18. Occupied Bandwidth Plot (LTE Band 66/4 - 10MHz 16-QAM - 27 RB)



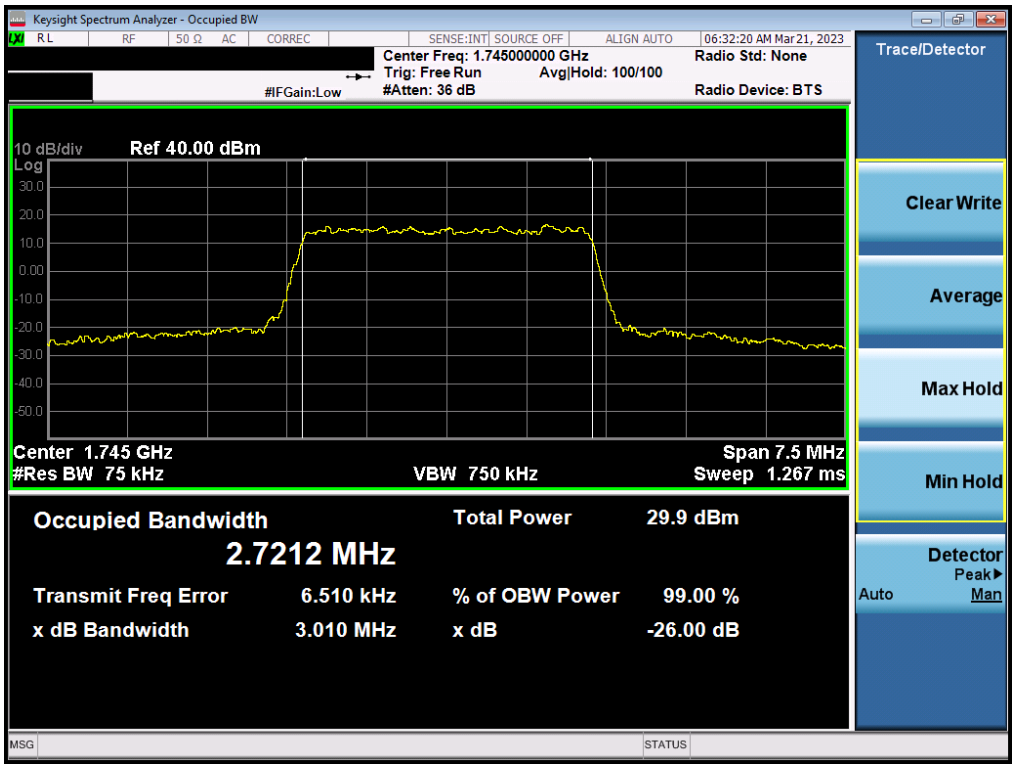
Plot 7-19. Occupied Bandwidth Plot (LTE Band 66/4 - 5MHz QPSK - Full RB)



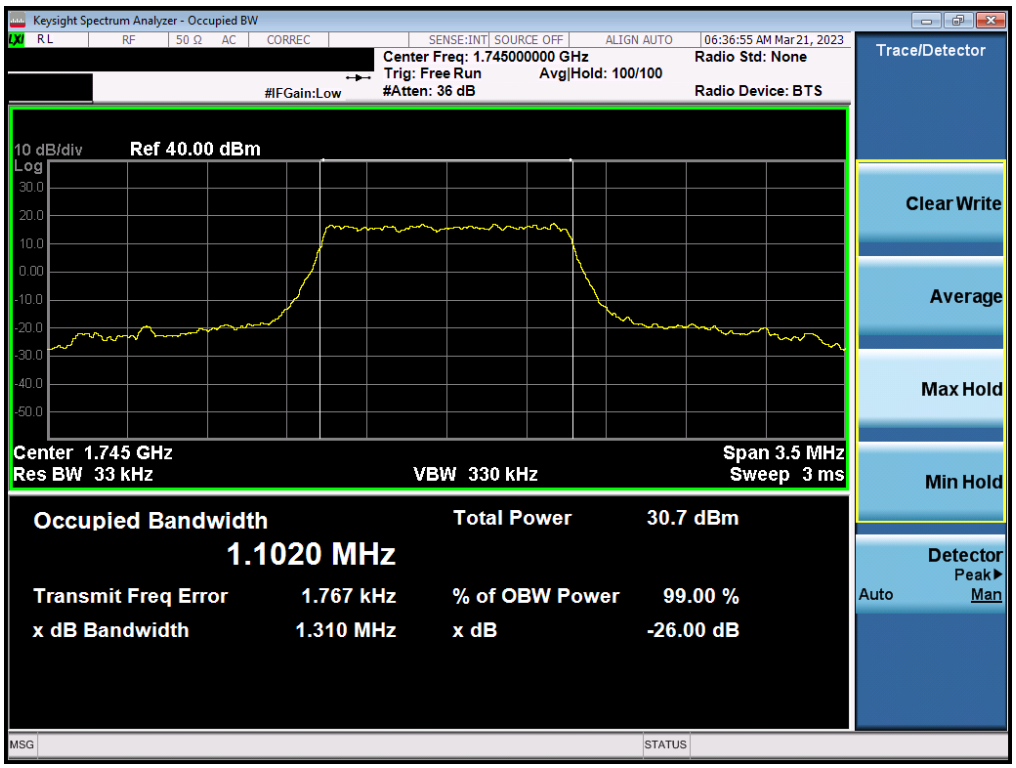
Plot 7-20. Occupied Bandwidth Plot (LTE Band 66/4 - 5MHz 16-QAM - Full RB)



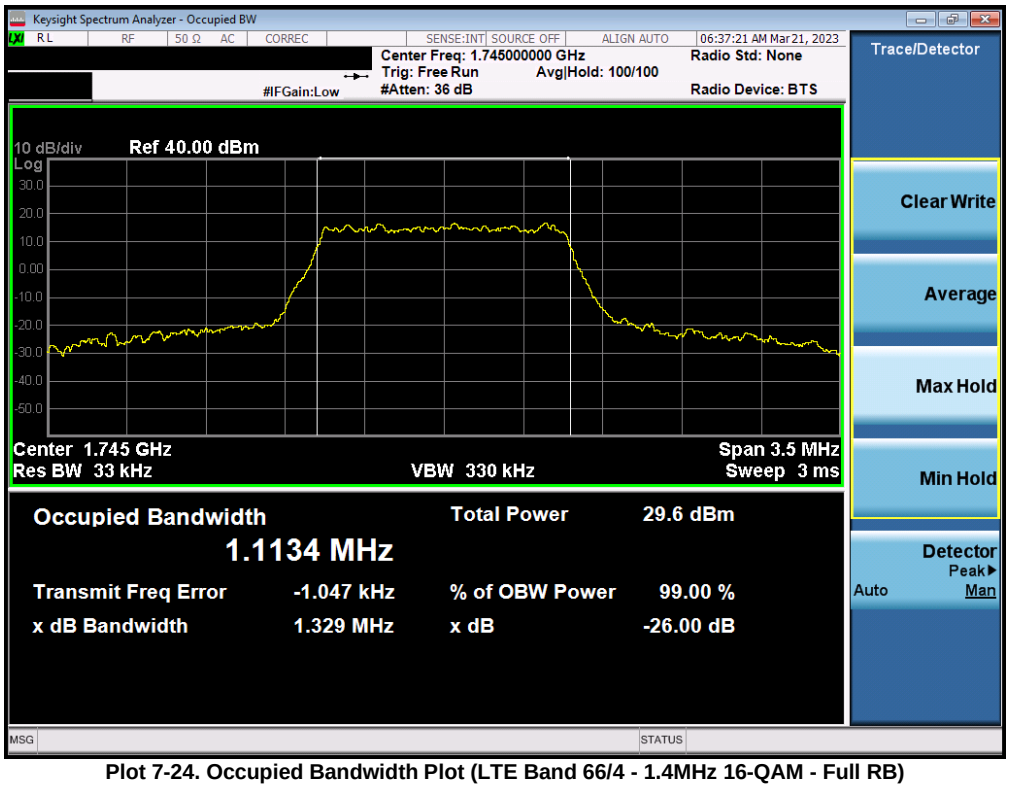
Plot 7-21. Occupied Bandwidth Plot (LTE Band 66/4 - 3MHz QPSK - Full RB)



Plot 7-22. Occupied Bandwidth Plot (LTE Band 66/4 - 3MHz 16-QAM - Full RB)



Plot 7-23. Occupied Bandwidth Plot (LTE Band 66/4 - 1.4MHz QPSK - Full RB)



Plot 7-24. Occupied Bandwidth Plot (LTE Band 66/4 - 1.4MHz 16-QAM - Full RB)

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 18GHz (separated into at least two plots per channel)
2. RBW ≥ 100kHz
3. VBW ≥ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

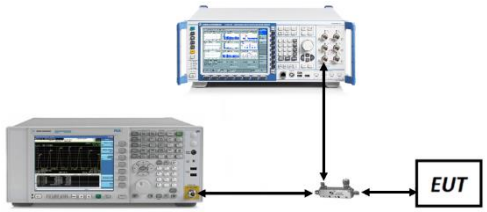
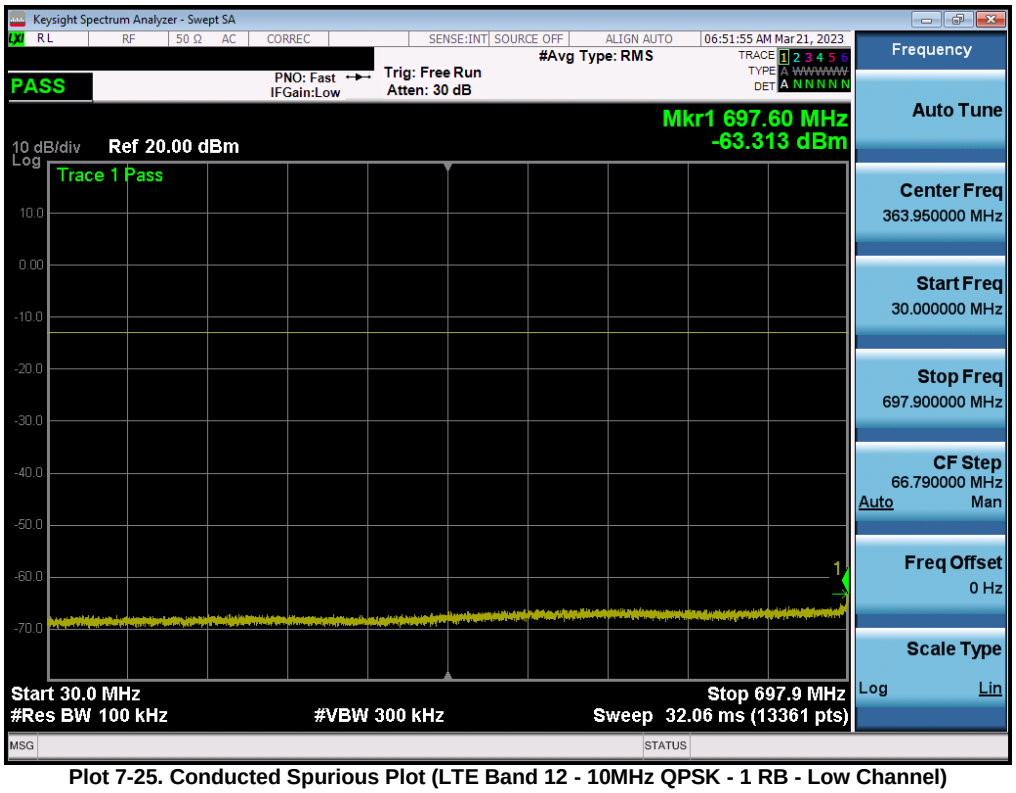


Figure 7-3. Test Instrument & Measurement Setup

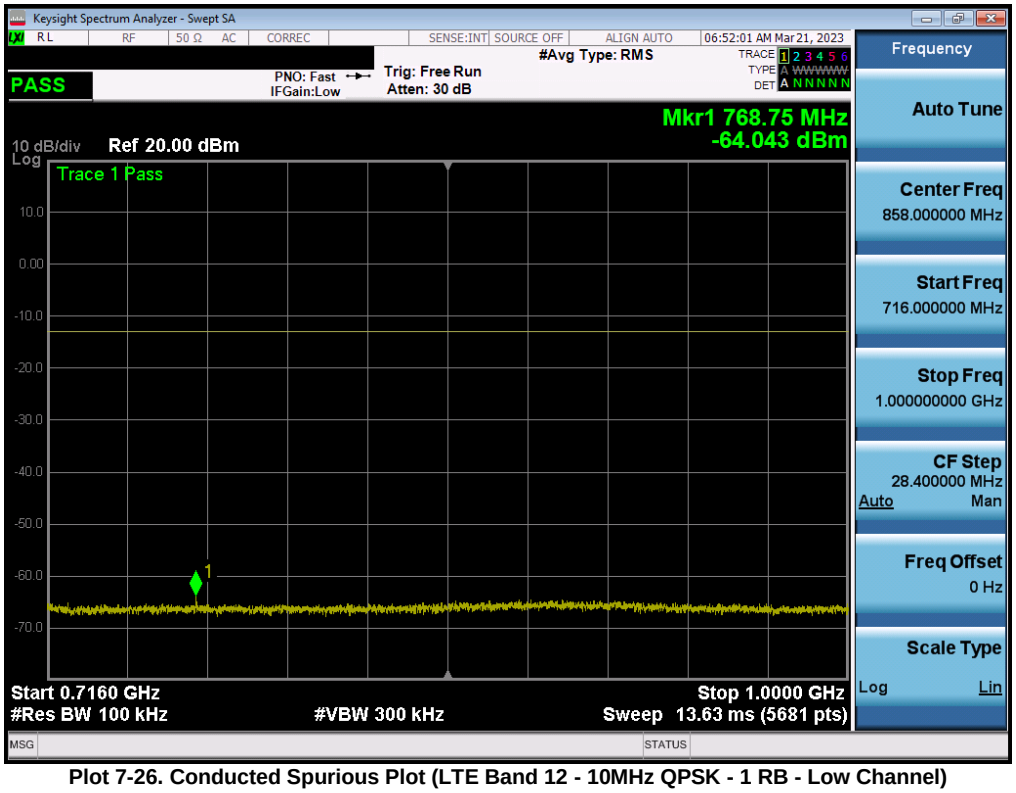
Test Notes

Per Part 27 and RSS-139, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for B12 and B13, 1MHz for B66/4.

LTE Band 12

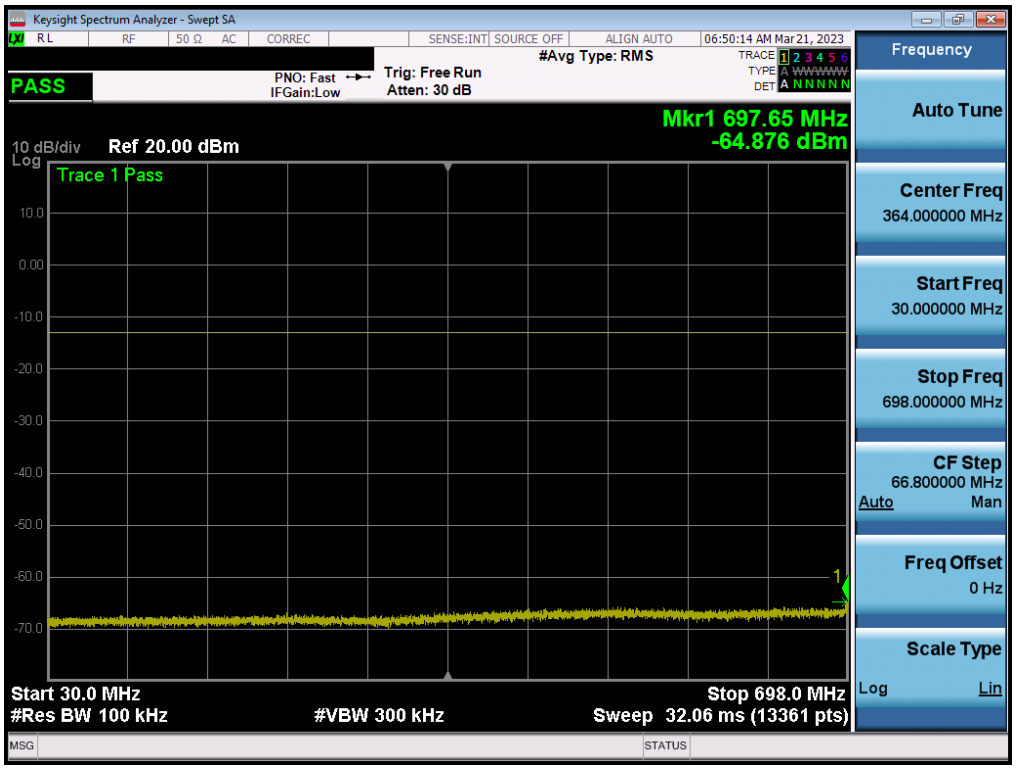


Plot 7-25. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Low Channel)

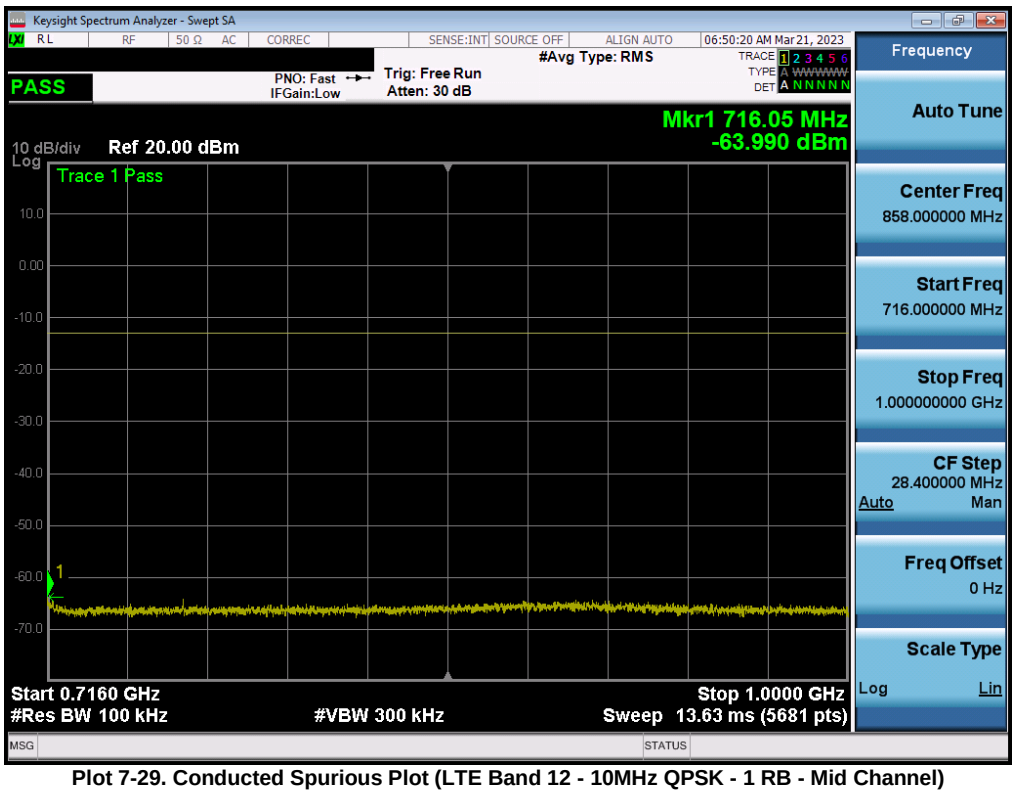


Plot 7-26. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Low Channel)

Plot 7-27. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Low Channel)

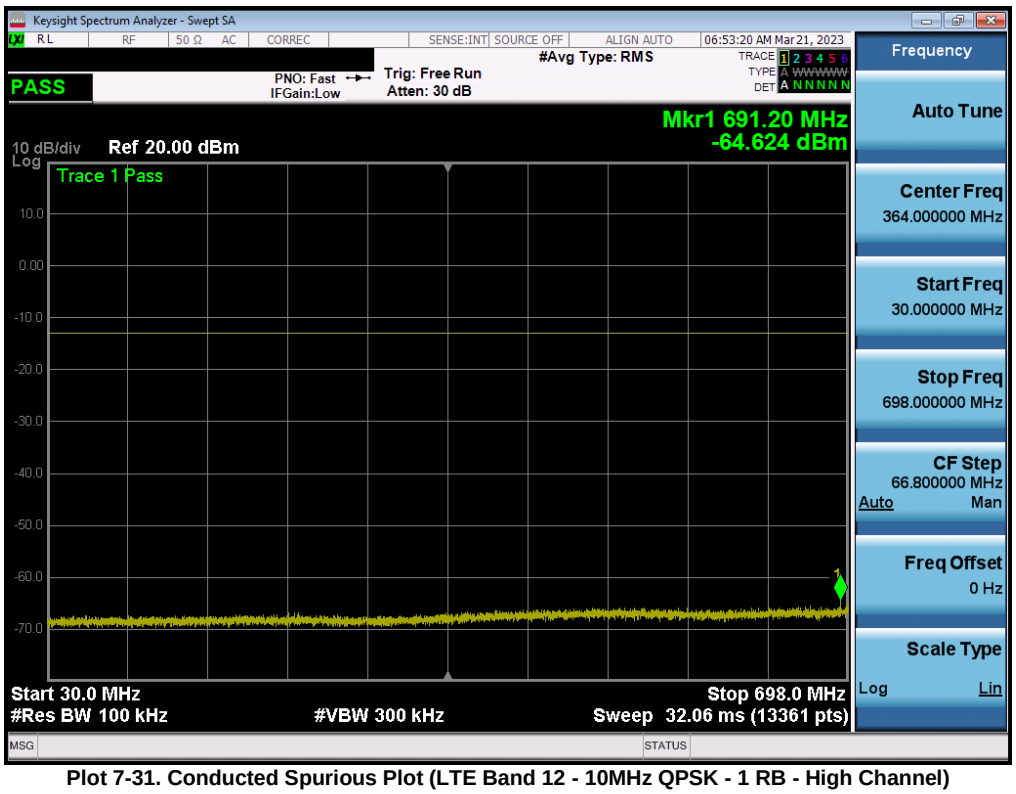


Plot 7-28. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Mid Channel)

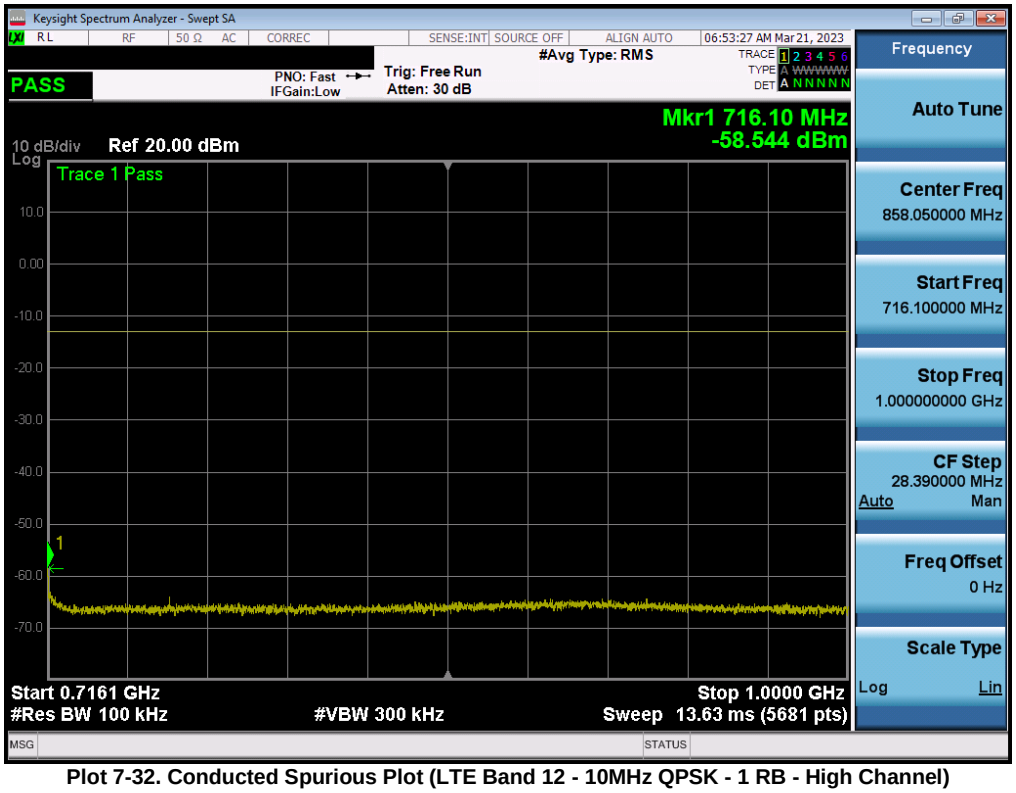


Plot 7-29. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Mid Channel)

Plot 7-30. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Mid Channel)



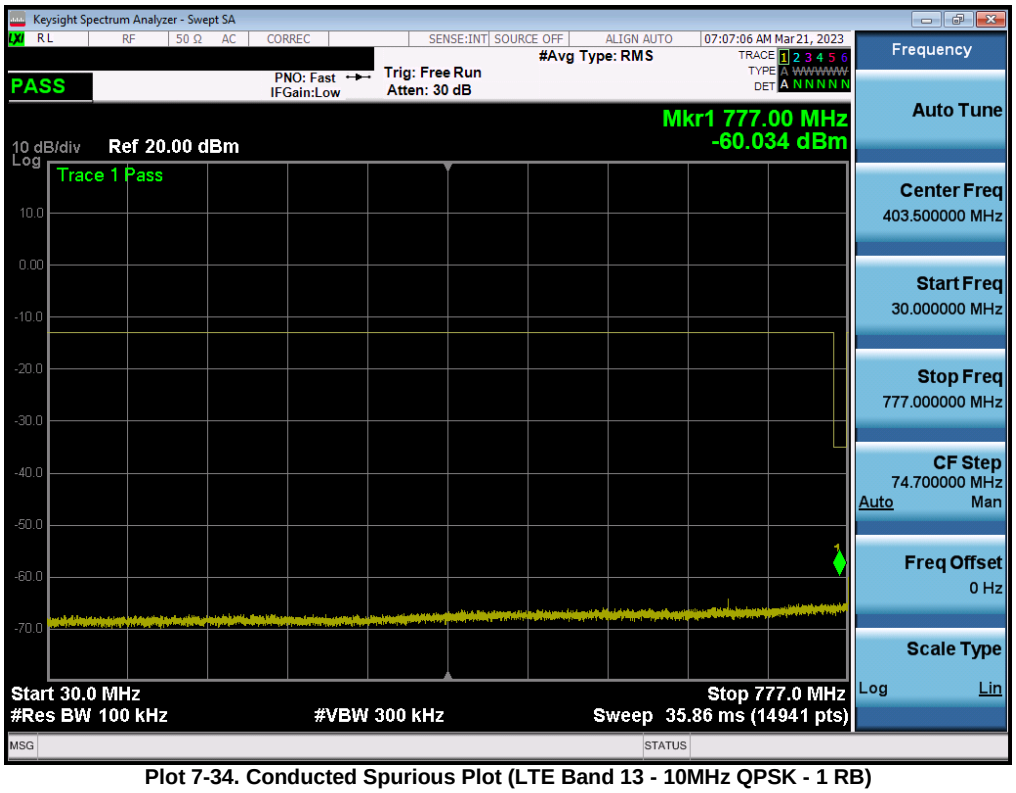
Plot 7-31. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - High Channel)



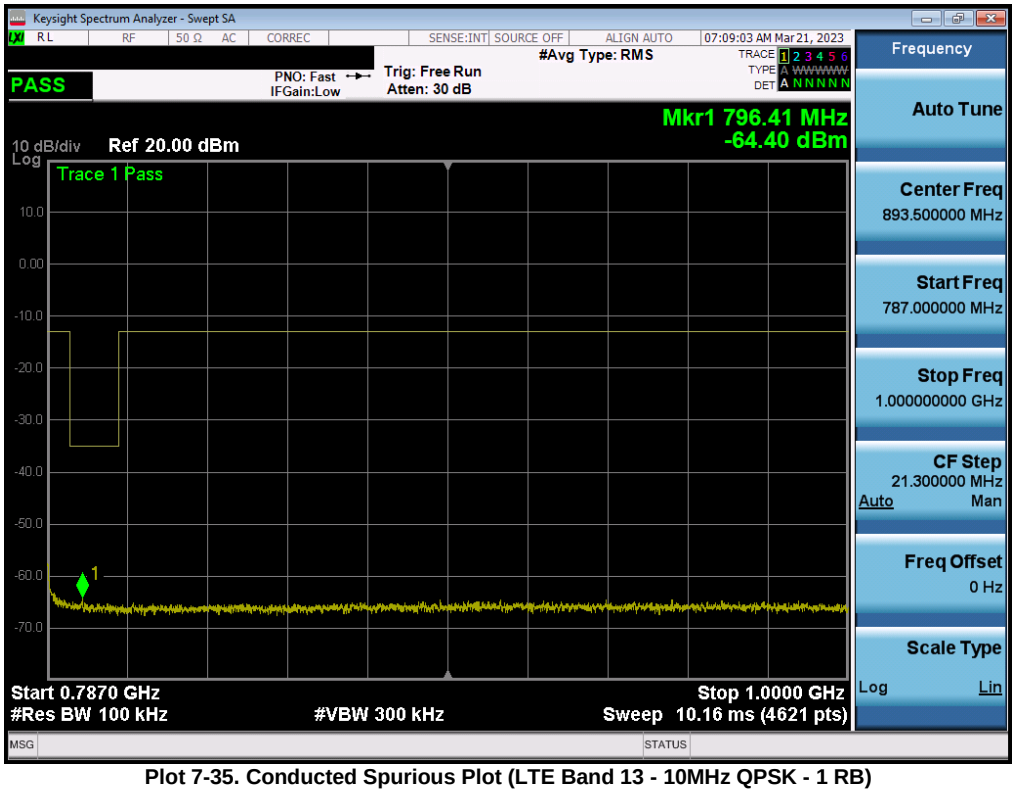
Plot 7-32. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - High Channel)

Plot 7-33. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - High Channel)

LTE Band 13



Plot 7-34. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - 1 RB)

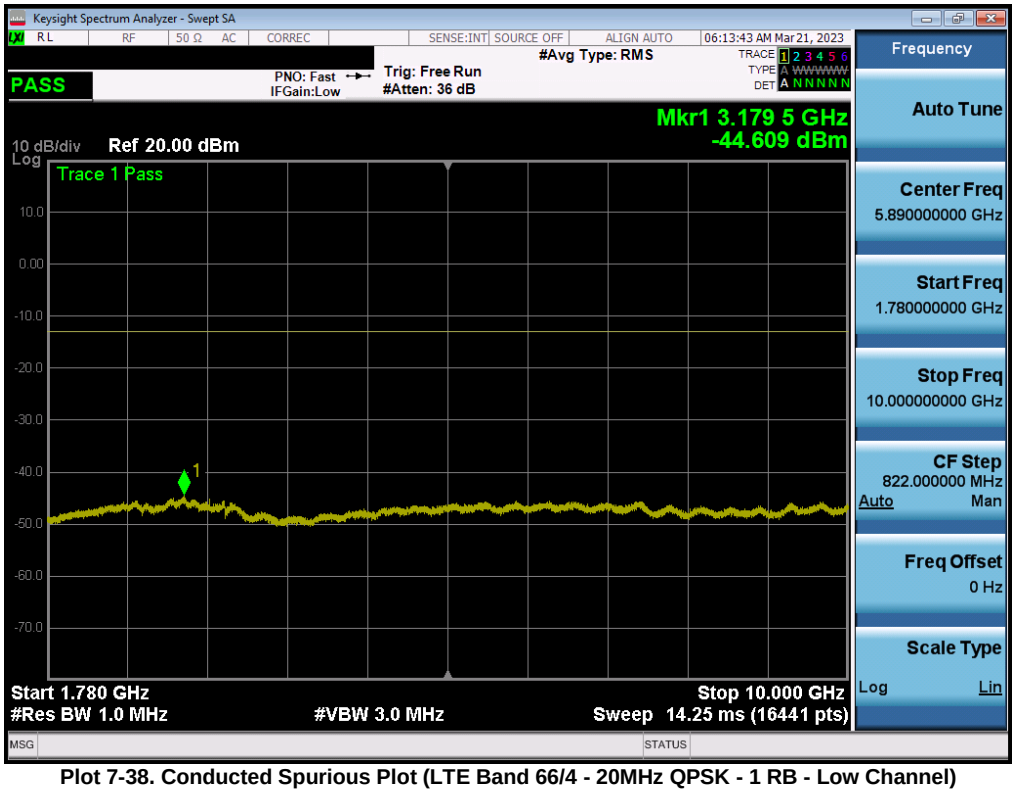


Plot 7-35. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - 1 RB)

Plot 7-36. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - 1 RB)

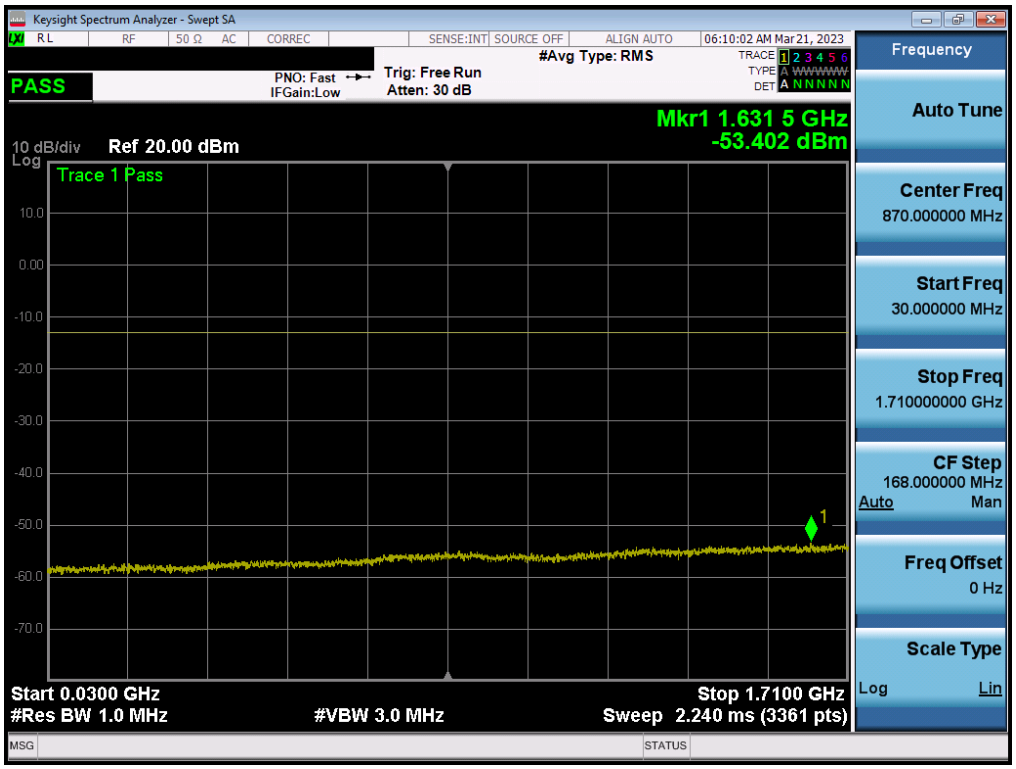
LTE Band 66/4

Plot 7-37. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - Low Channel)

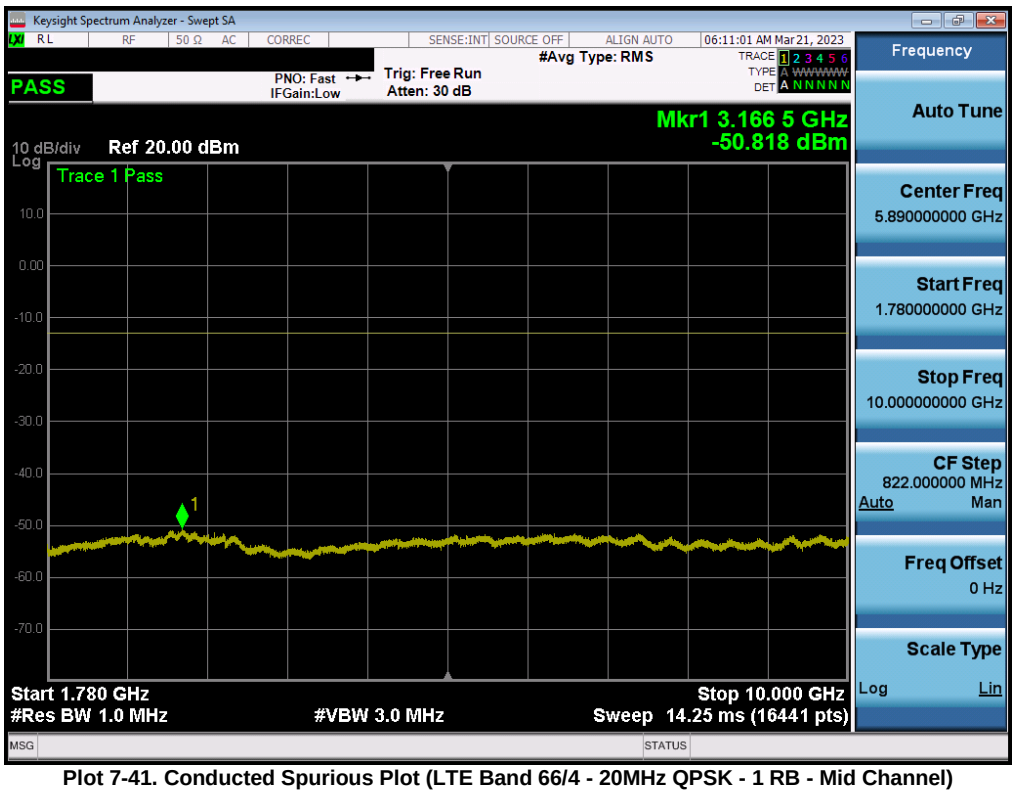


Plot 7-38. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - Low Channel)

Plot 7-39. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - Low Channel)



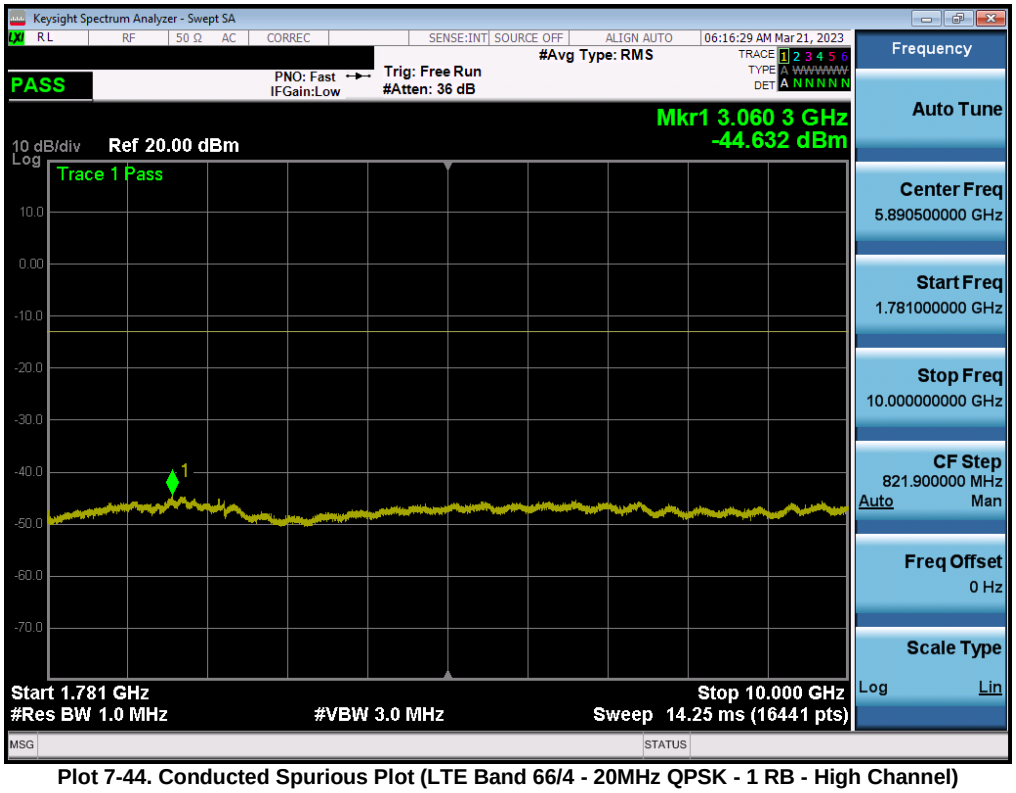
Plot 7-40. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - Mid Channel)



Plot 7-41. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - Mid Channel)

Plot 7-42. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - Mid Channel)

Plot 7-43. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - High Channel)



Plot 7-44. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - High Channel)

Plot 7-45. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - High Channel)

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 its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

The 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.

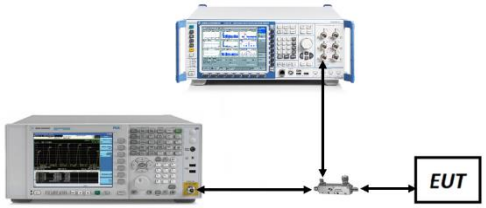


Figure 7-4. Test Instrument & Measurement Setup

Test Notes

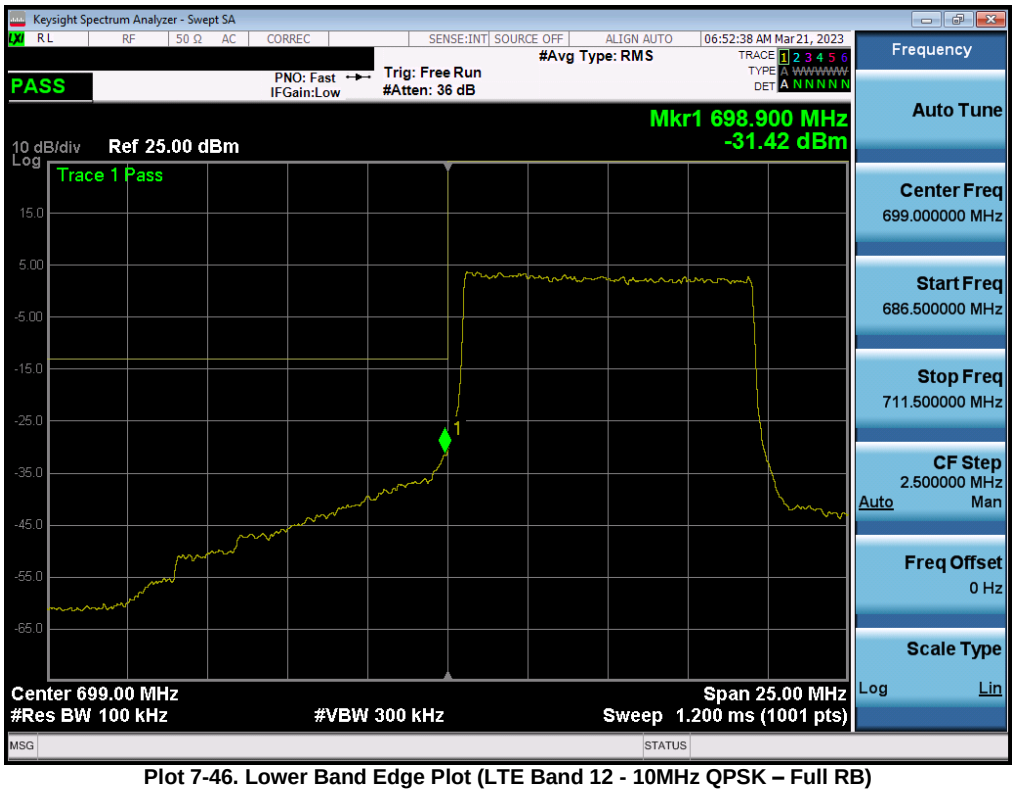
1. Per 27.53(h) for FCC and RSS-139(5.6) for ISED for AWS band operation, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance 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. Per 27.53(g) for FCC and RSS-130(4.7.1) for ISED for operations in the 663 - 698 MHz and 698 – 746MHz bands, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

3. Per 27.53(c)(5) for FCC and RSS-130(4.7.2) for ISED for operations in the 776-788 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

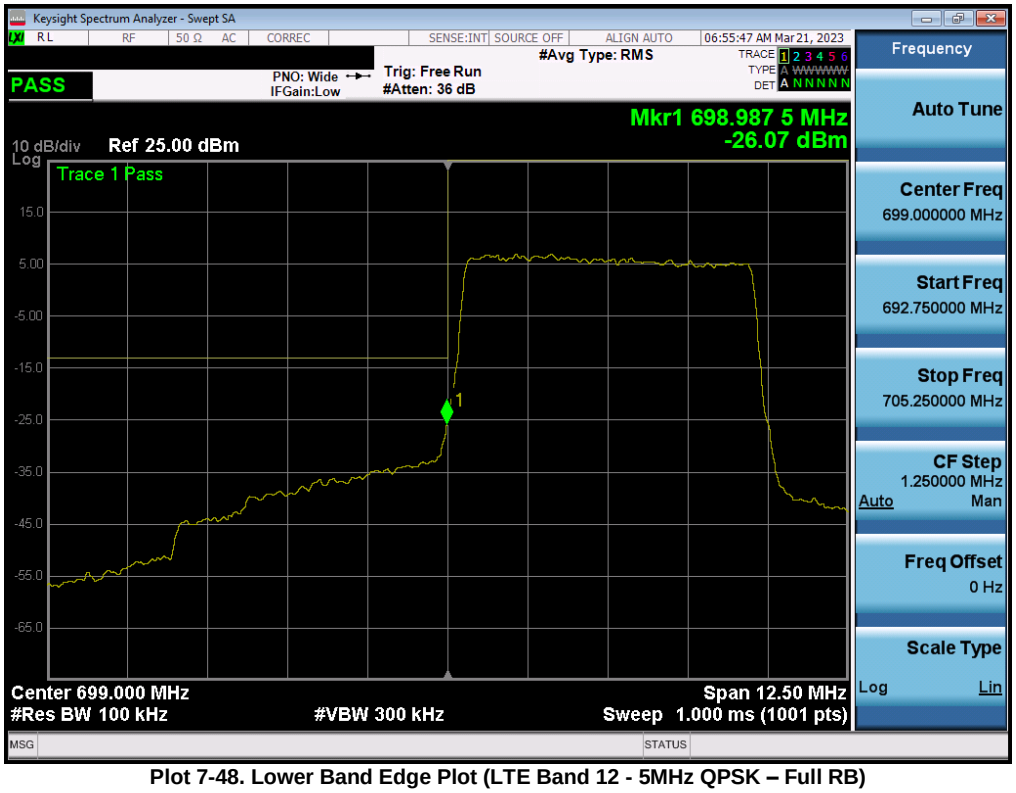
4. For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c)(4) and ISED limit per RSS-130(4.7.2) is 65 + 10 $\log_{10}$(P) = -35dBm in a 6.25kHz bandwidth.

LTE Band 12

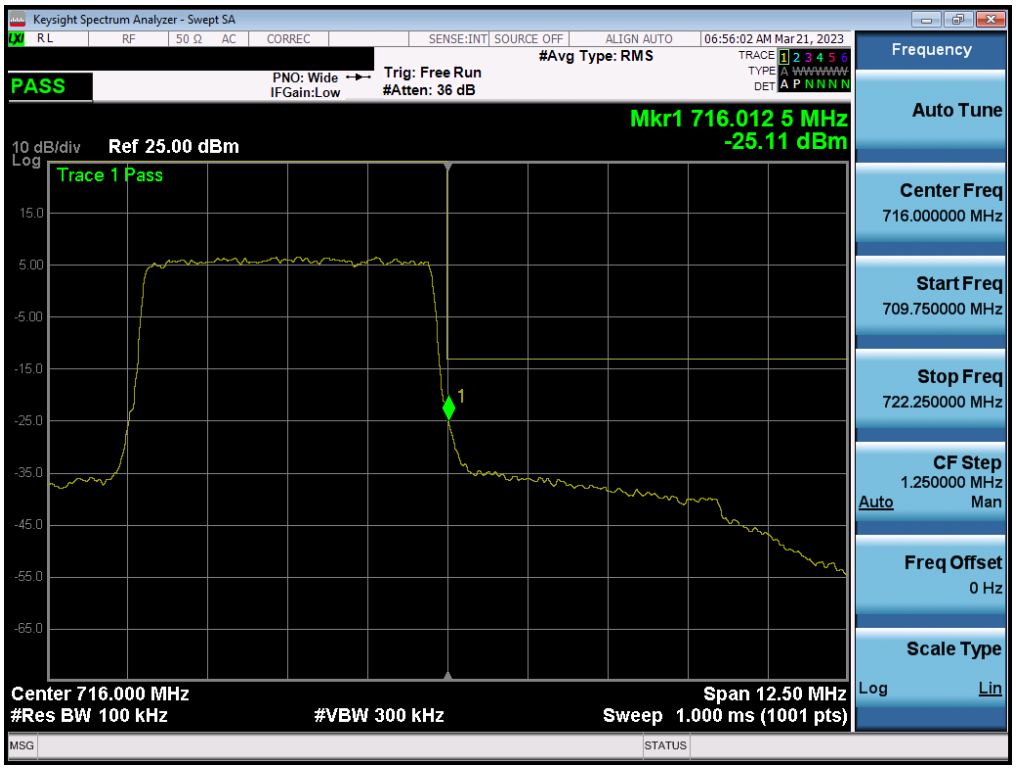


Plot 7-46. Lower Band Edge Plot (LTE Band 12 - 10MHz QPSK – Full RB)

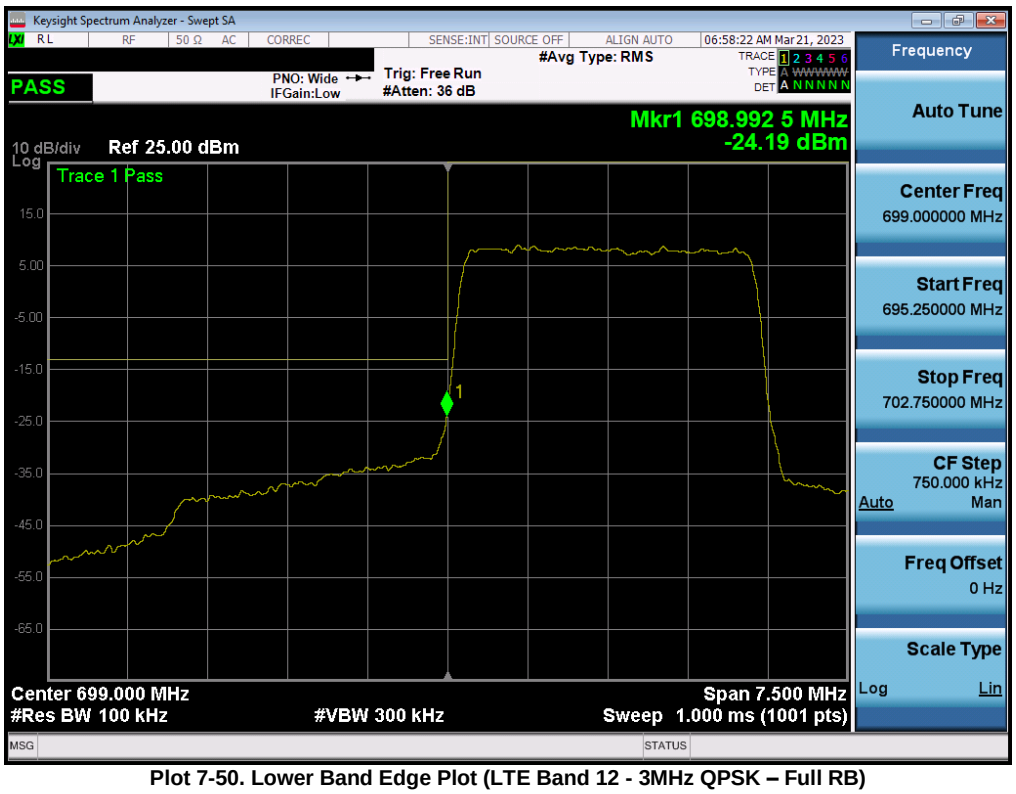
Plot 7-47. Upper Band Edge Plot (LTE Band 12 - 10MHz QPSK – Full RB)



Plot 7-48. Lower Band Edge Plot (LTE Band 12 - 5MHz QPSK – Full RB)

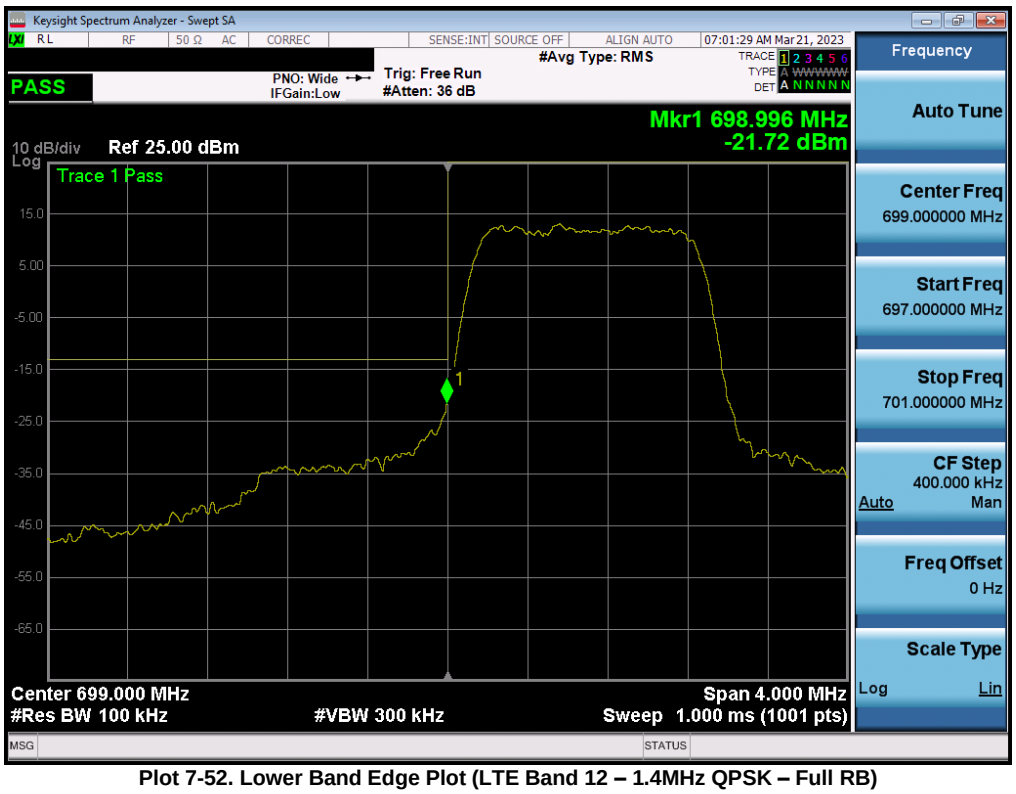


Plot 7-49. Upper Band Edge Plot (LTE Band 12 - 5MHz QPSK – Full RB)



Plot 7-50. Lower Band Edge Plot (LTE Band 12 - 3MHz QPSK – Full RB)

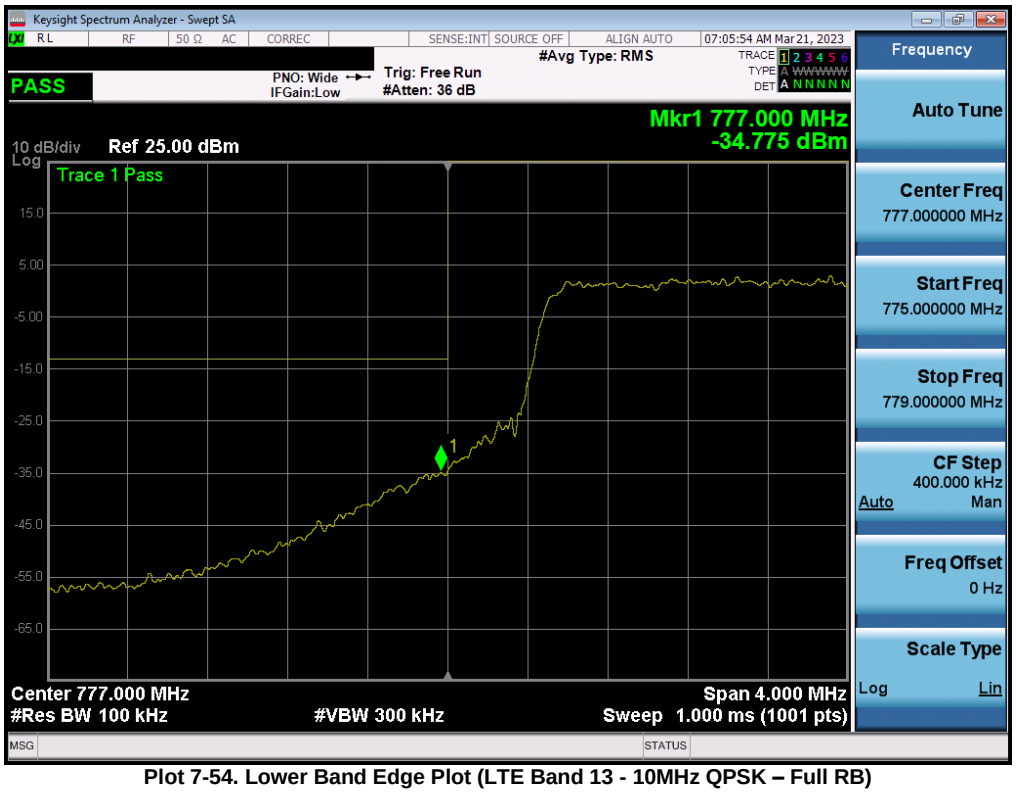
Plot 7-51. Upper Band Edge Plot (LTE Band 12 - 3MHz QPSK – Full RB)



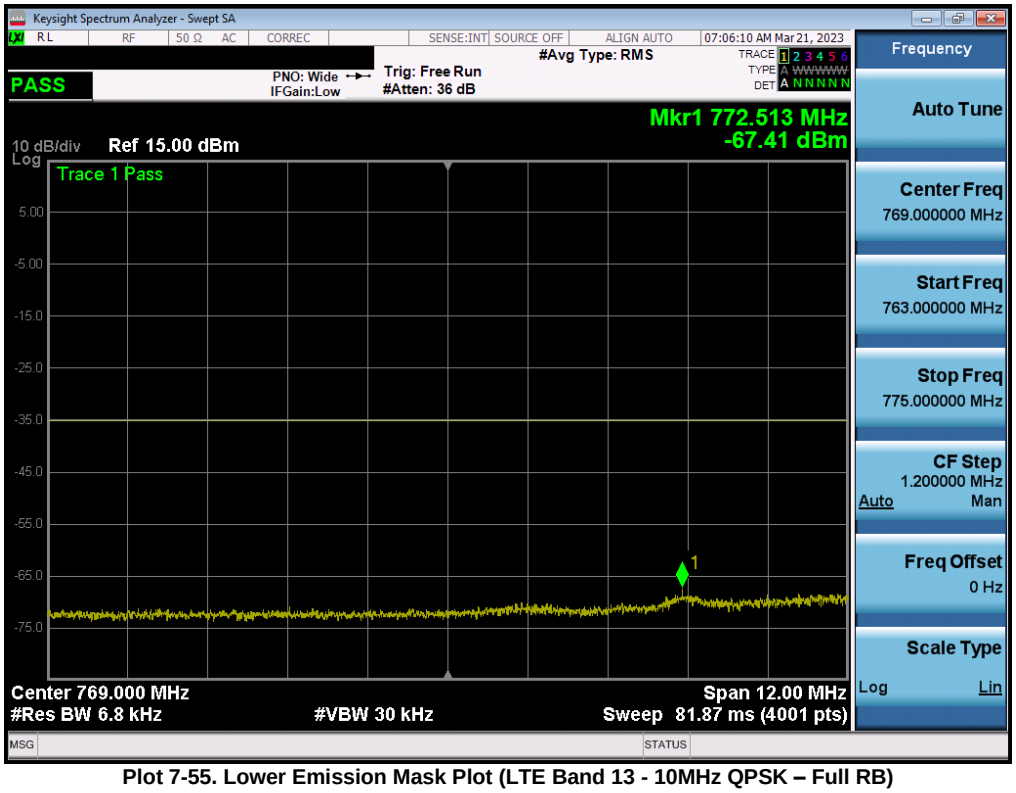
Plot 7-52. Lower Band Edge Plot (LTE Band 12 – 1.4MHz QPSK – Full RB)

Plot 7-53. Upper Band Edge Plot (LTE Band 12 – 1.4MHz QPSK – Full RB)

LTE Band 13

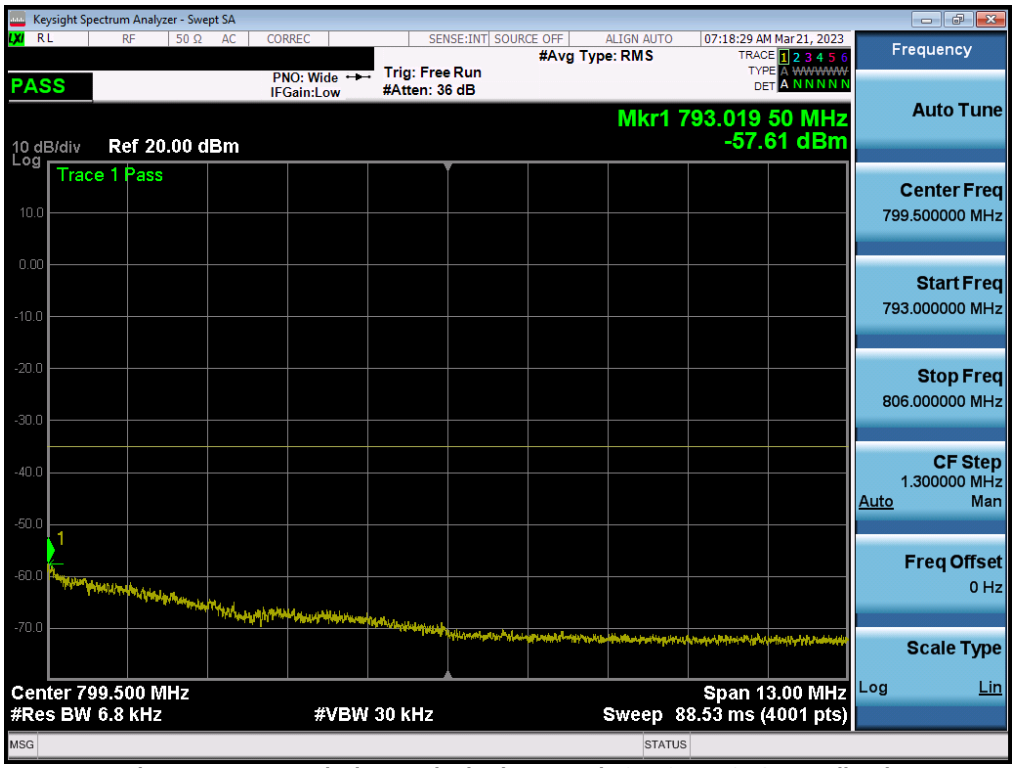


Plot 7-54. Lower Band Edge Plot (LTE Band 13 - 10MHz QPSK – Full RB)

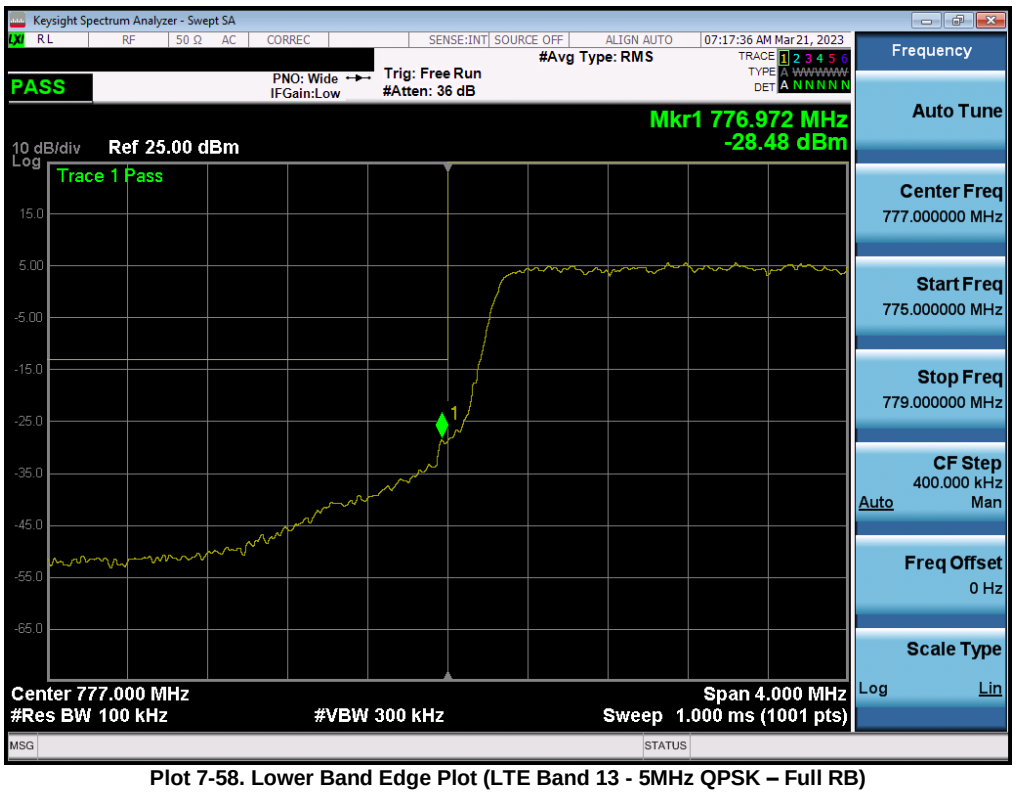


Plot 7-55. Lower Emission Mask Plot (LTE Band 13 - 10MHz QPSK – Full RB)

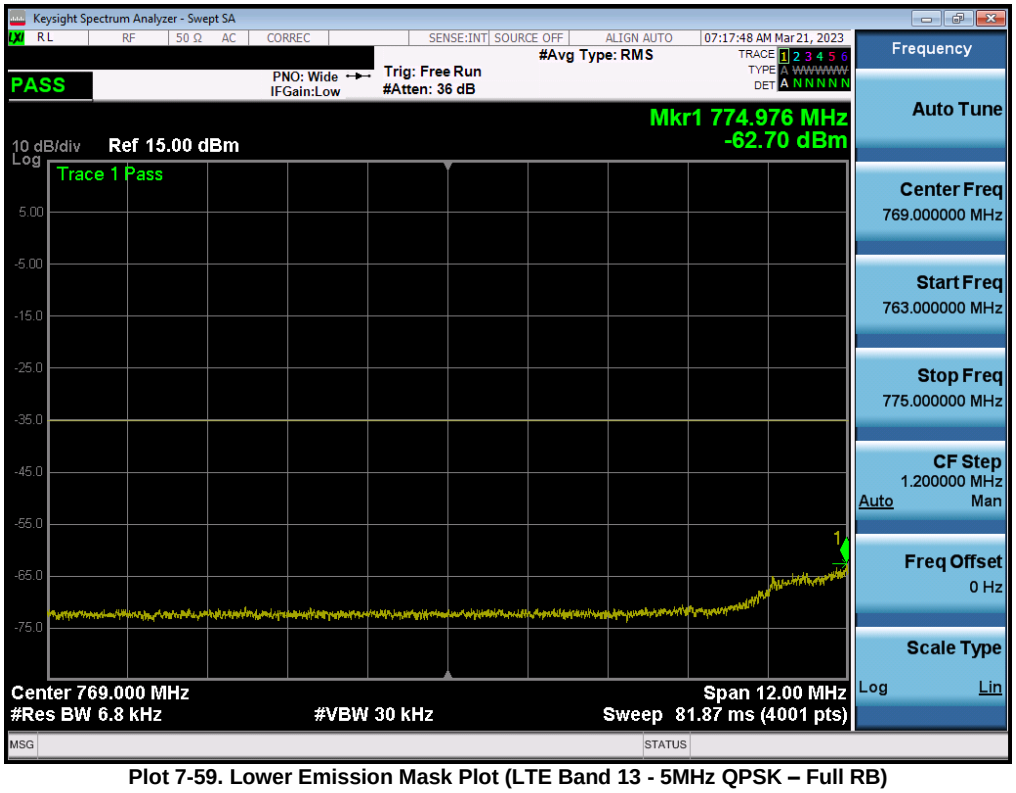
Plot 7-56. Upper Band Edge Plot (LTE Band 13 - 10MHz QPSK – Full RB)



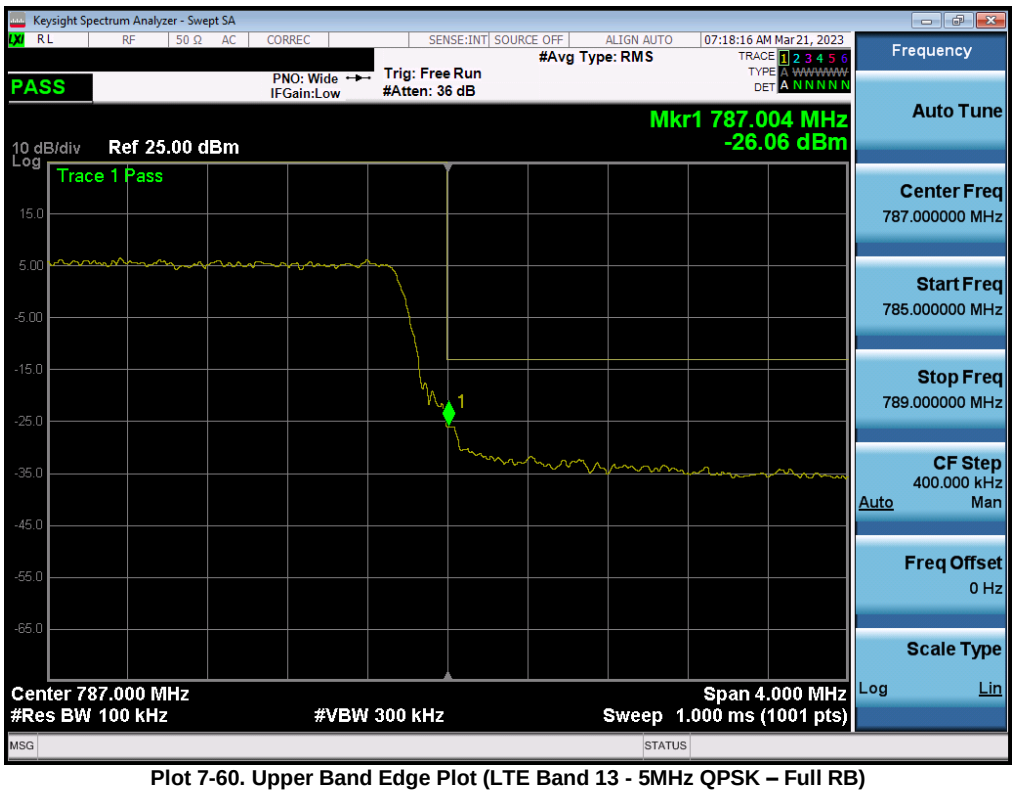
Plot 7-57. Upper Emission Mask Plot (LTE Band 13 - 10MHz QPSK – Full RB)



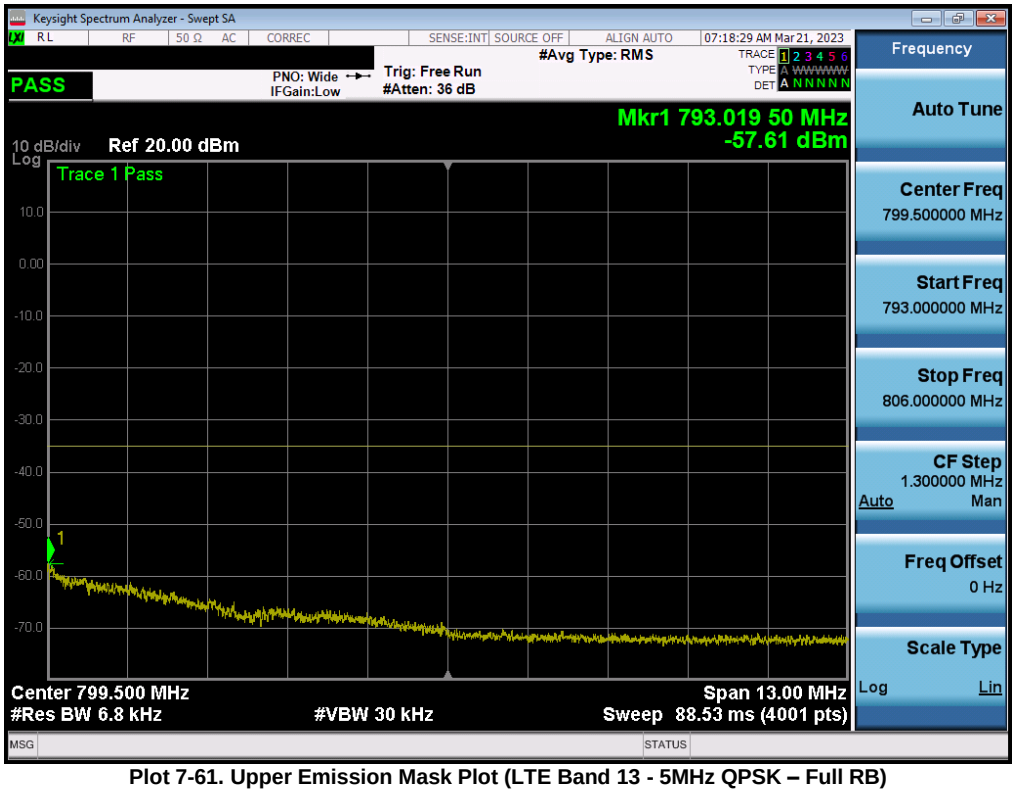
Plot 7-58. Lower Band Edge Plot (LTE Band 13 - 5MHz QPSK – Full RB)



Plot 7-59. Lower Emission Mask Plot (LTE Band 13 - 5MHz QPSK – Full RB)

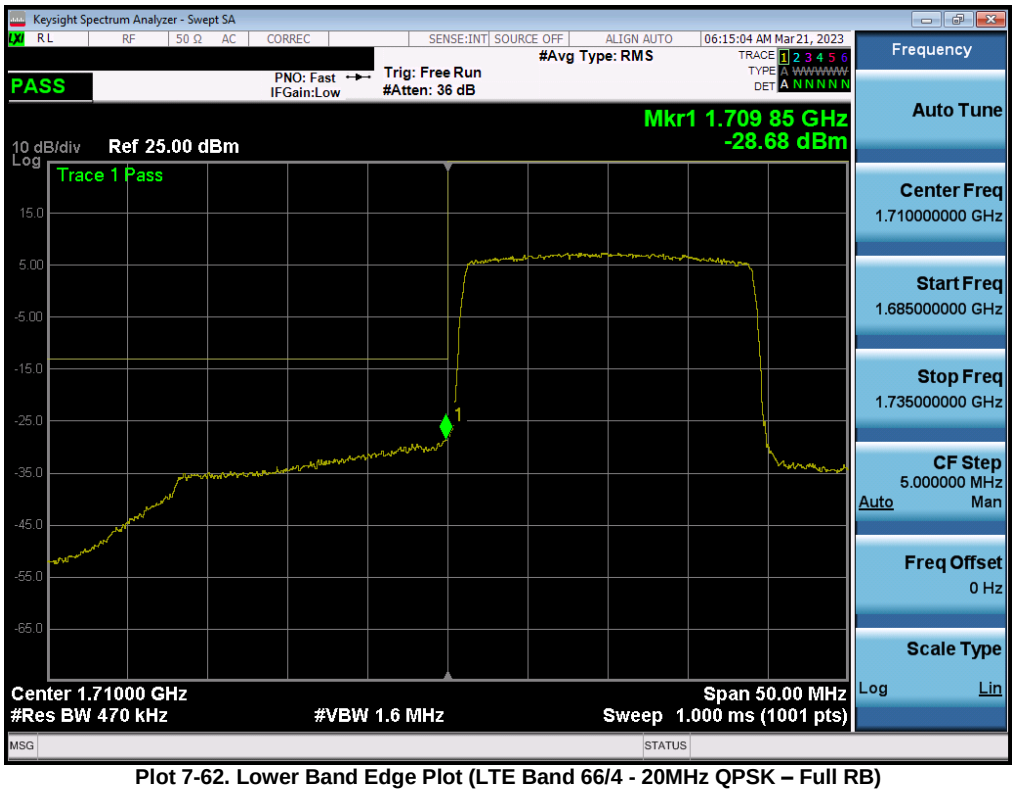


Plot 7-60. Upper Band Edge Plot (LTE Band 13 - 5MHz QPSK – Full RB)



Plot 7-61. Upper Emission Mask Plot (LTE Band 13 - 5MHz QPSK – Full RB)

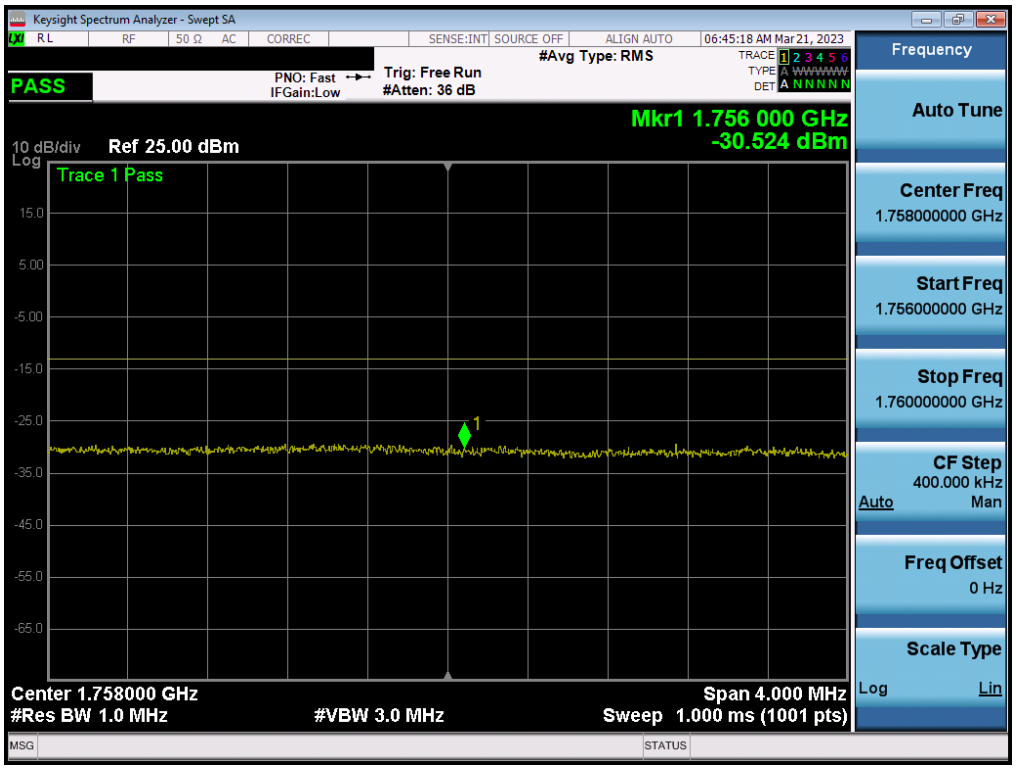
LTE Band 66/4



Plot 7-62. Lower Band Edge Plot (LTE Band 66/4 - 20MHz QPSK – Full RB)

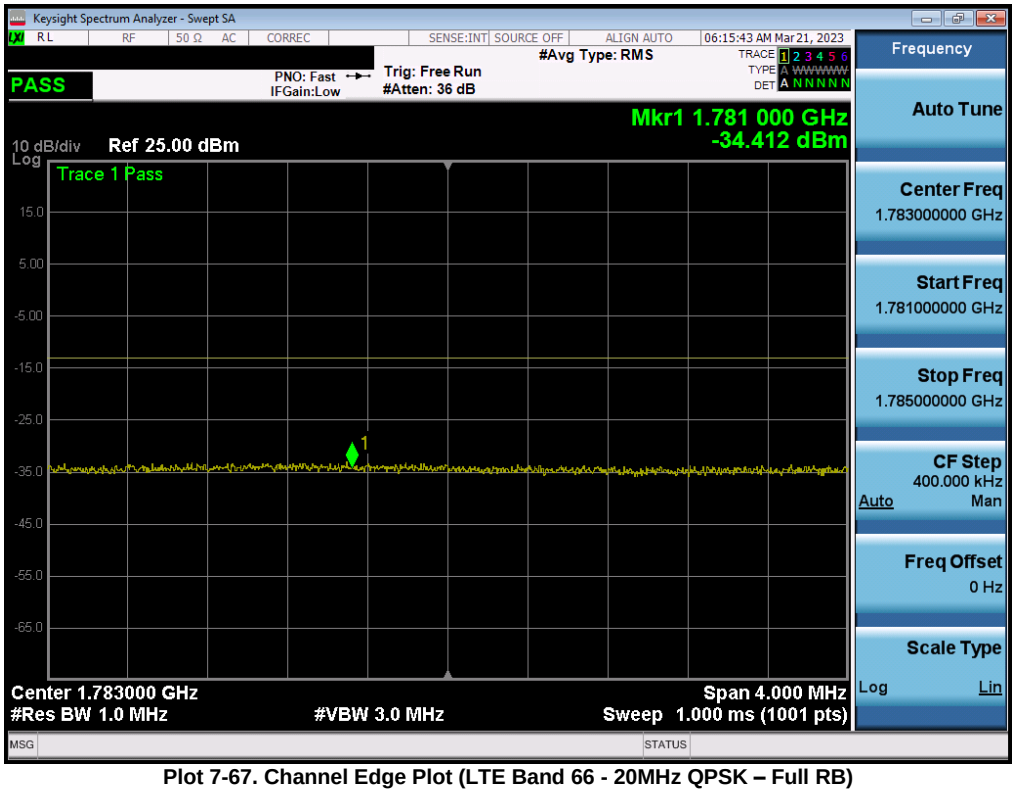
Plot 7-63. Lower Extended Band Edge Plot (LTE Band 66/4 - 20MHz QPSK – Full RB)

Plot 7-64. Upper Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)

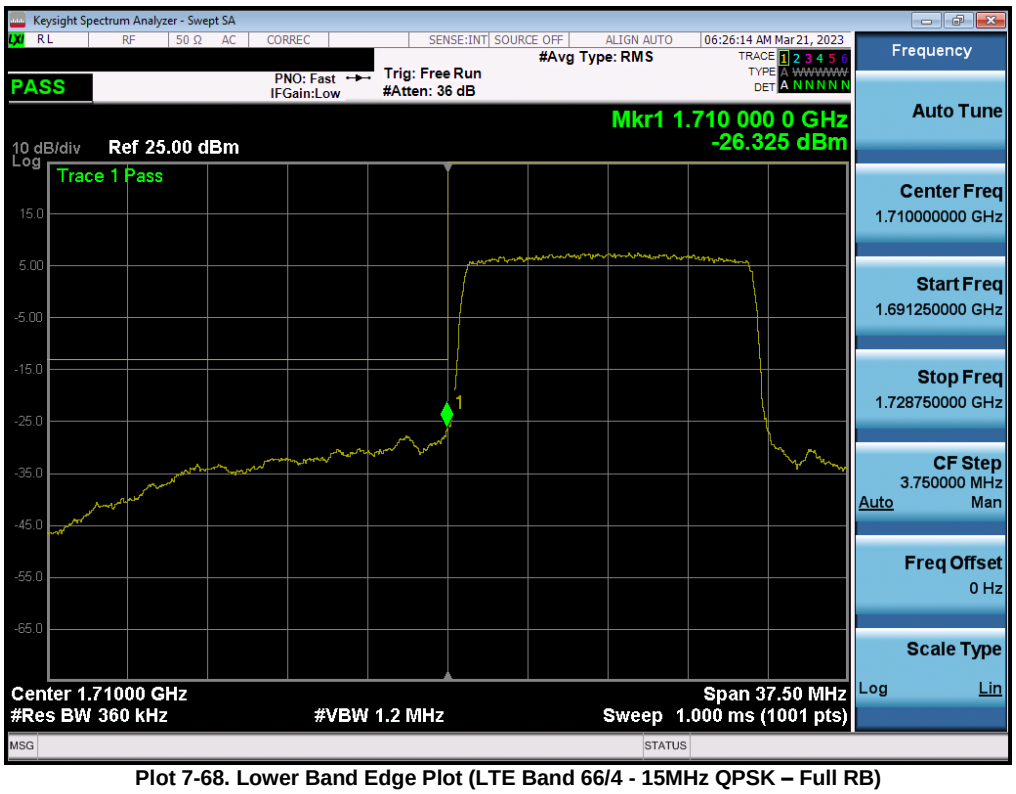


Plot 7-65. Upper Extended Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)

Plot 7-66. Upper Band Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)



Plot 7-67. Channel Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)



Plot 7-68. Lower Band Edge Plot (LTE Band 66/4 - 15MHz QPSK – Full RB)

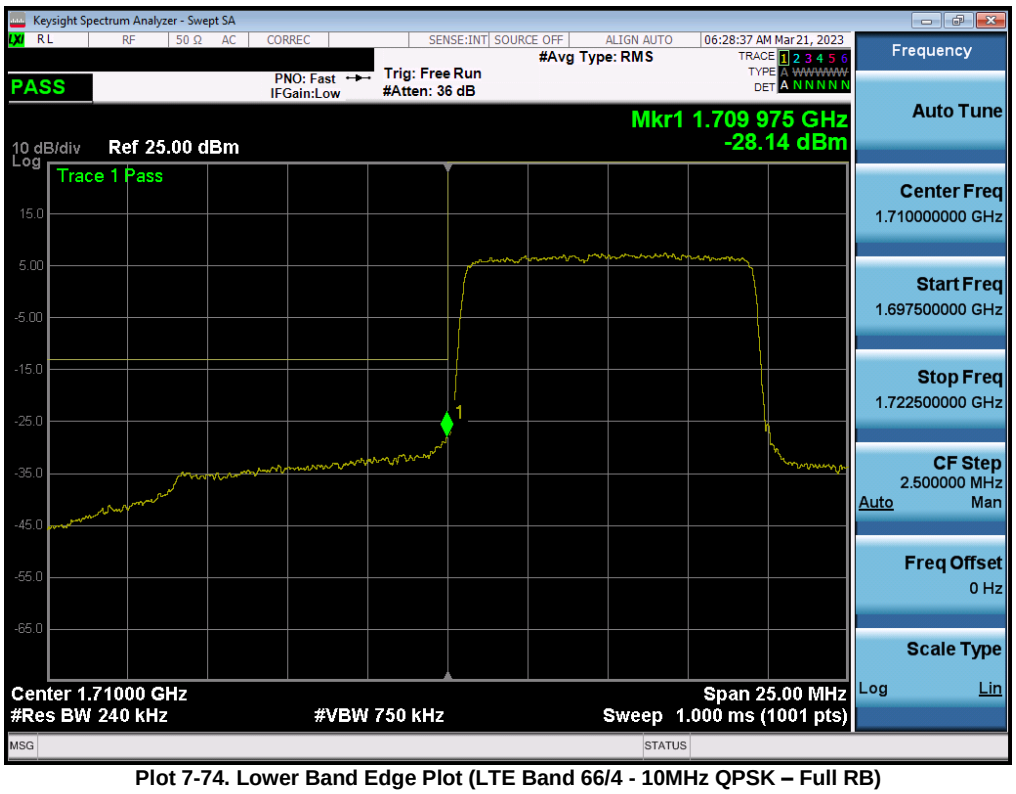
Plot 7-69. Lower Extended Band Edge Plot (LTE Band 66/4 - 15MHz QPSK – Full RB)

Plot 7-70. Upper Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)

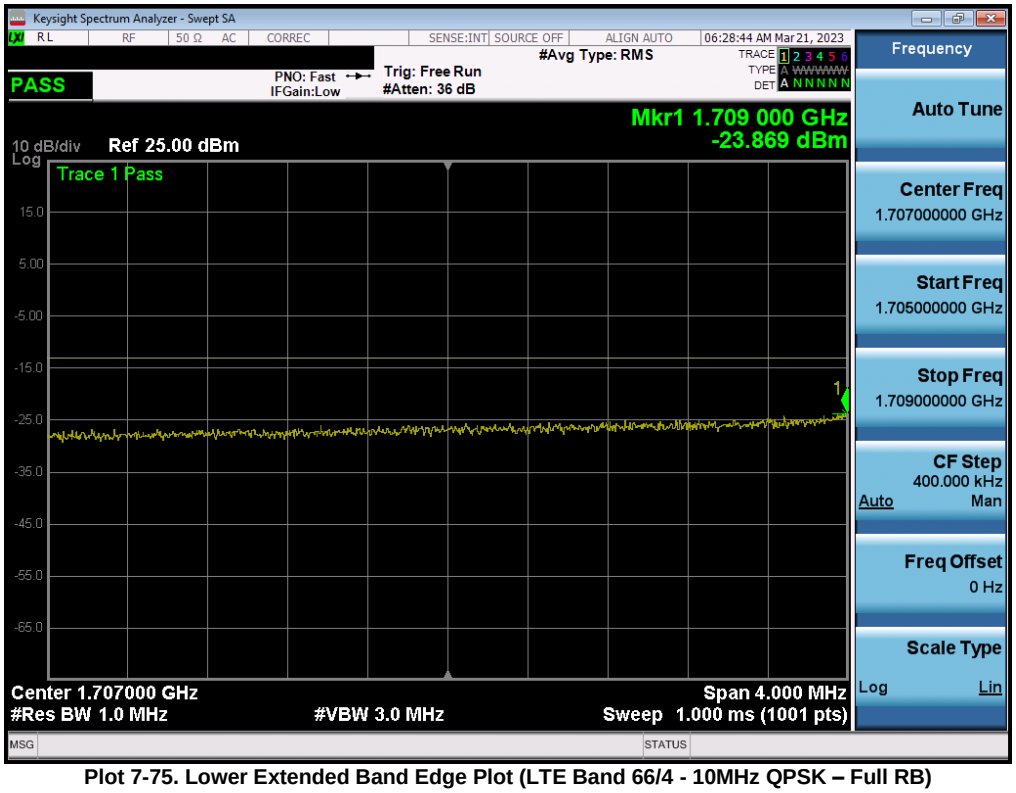
Plot 7-71. Upper Extended Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)

Plot 7-72. Upper Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)

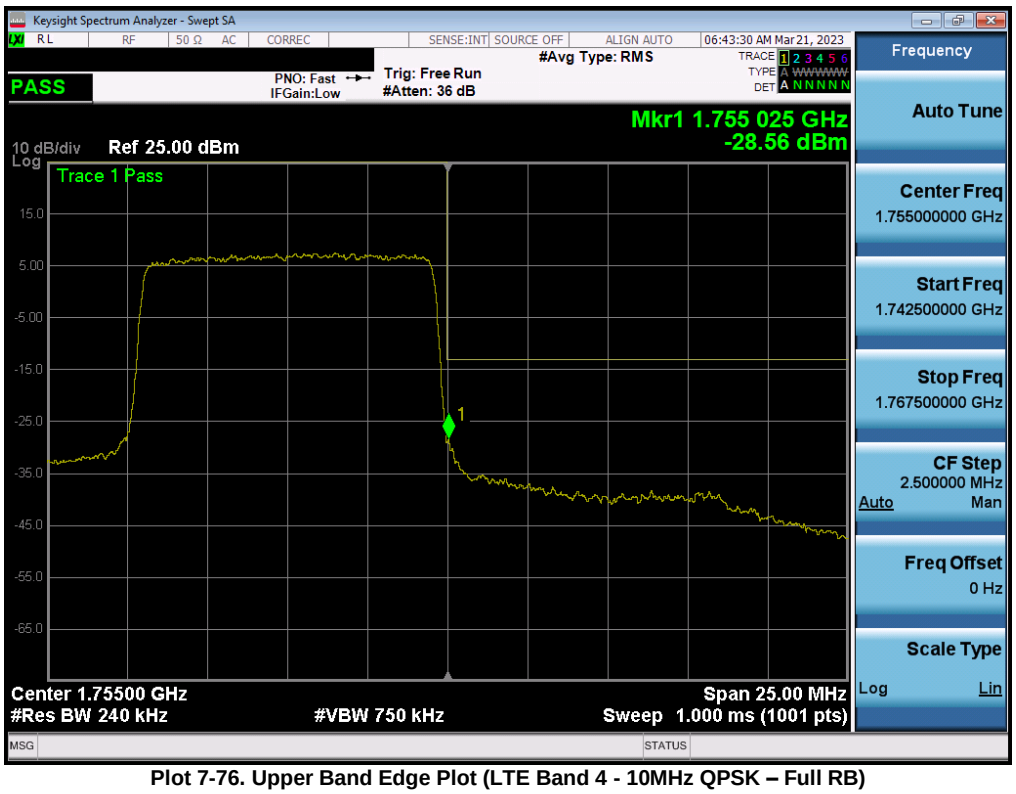
Plot 7-73. Upper Extended Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)



Plot 7-74. Lower Band Edge Plot (LTE Band 66/4 - 10MHz QPSK – Full RB)



Plot 7-75. Lower Extended Band Edge Plot (LTE Band 66/4 - 10MHz QPSK – Full RB)

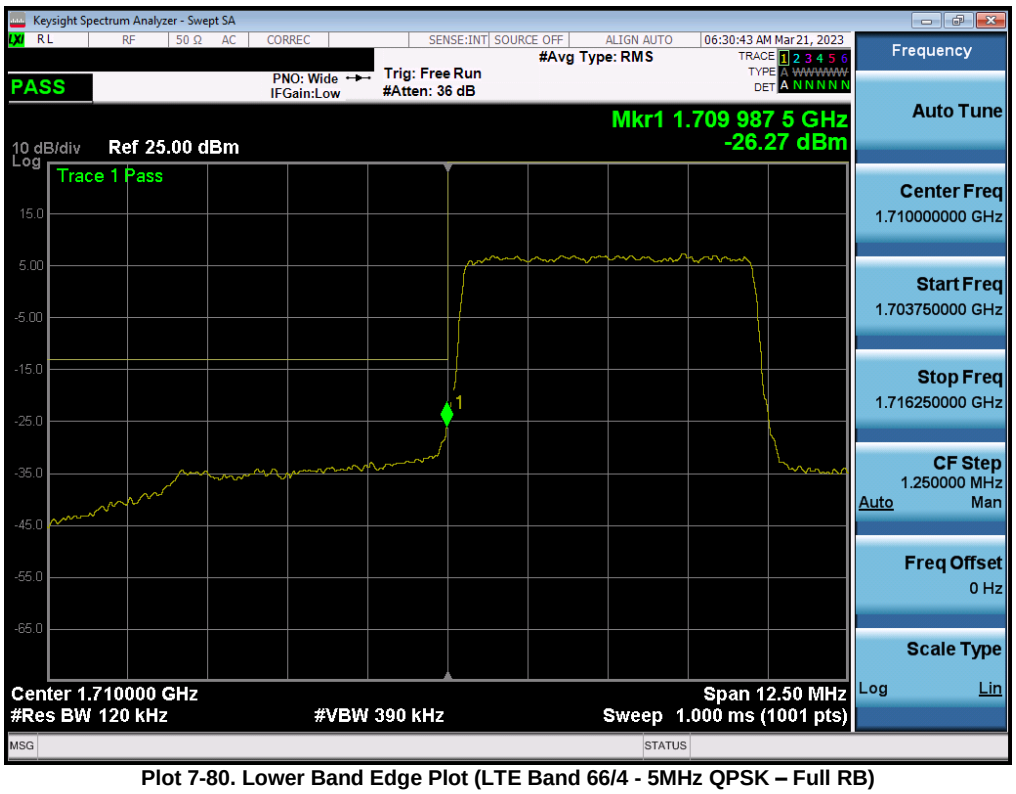


Plot 7-76. Upper Band Edge Plot (LTE Band 4 - 10MHz QPSK – Full RB)

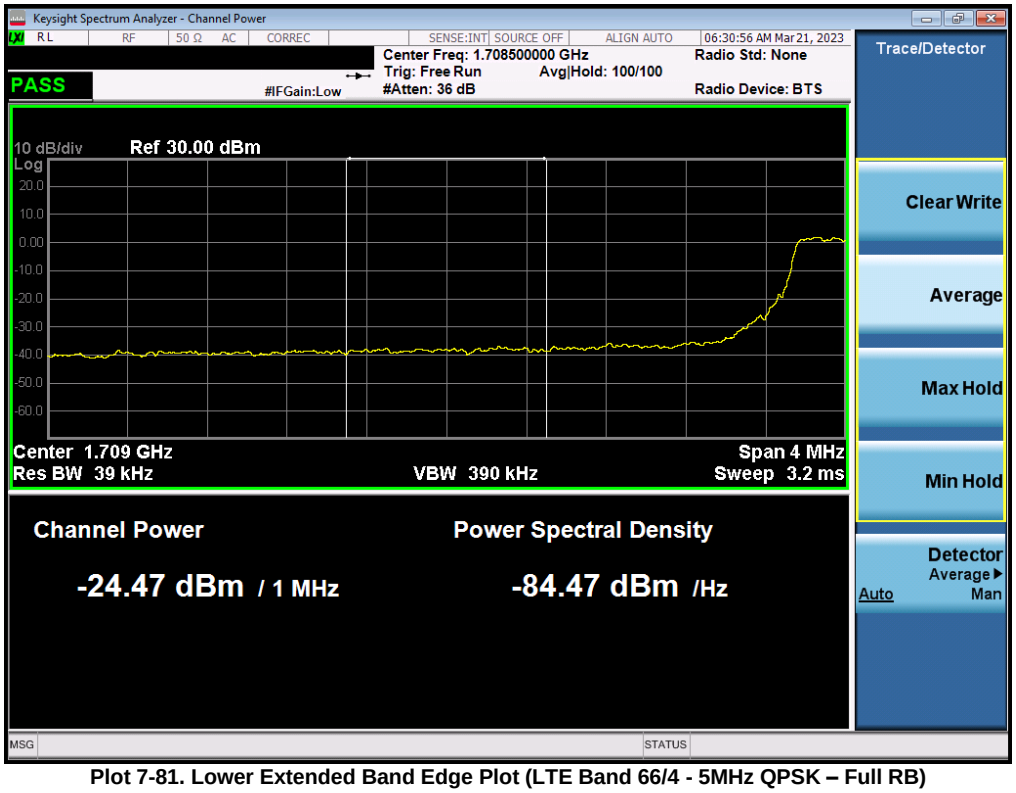
Plot 7-77. Upper Extended Band Edge Plot (LTE Band 4 - 10MHz QPSK – Full RB)

Plot 7-78. Upper Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)

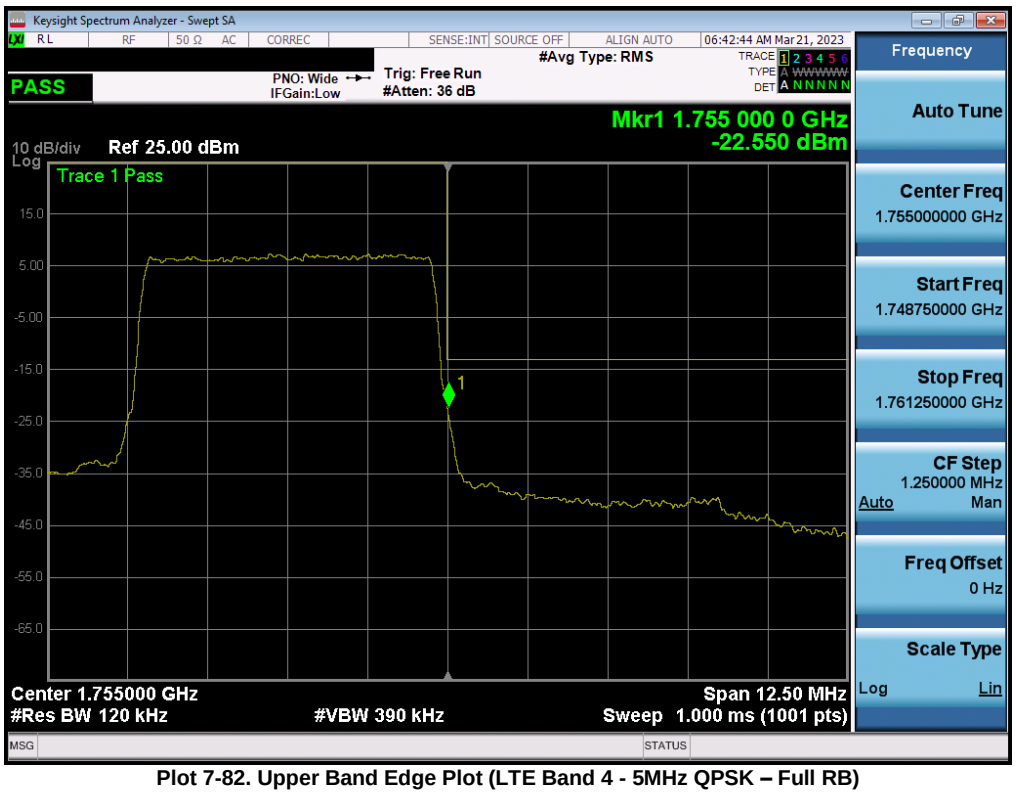
Plot 7-79. Upper Extended Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)



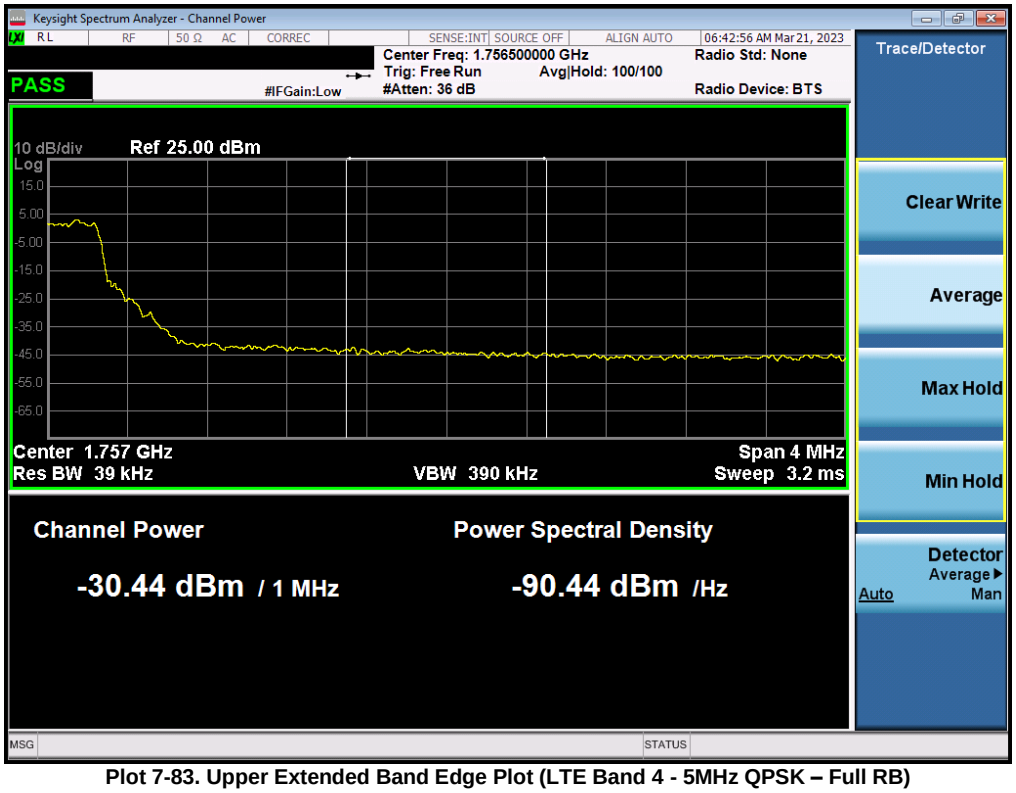
Plot 7-80. Lower Band Edge Plot (LTE Band 66/4 - 5MHz QPSK – Full RB)



Plot 7-81. Lower Extended Band Edge Plot (LTE Band 66/4 - 5MHz QPSK – Full RB)

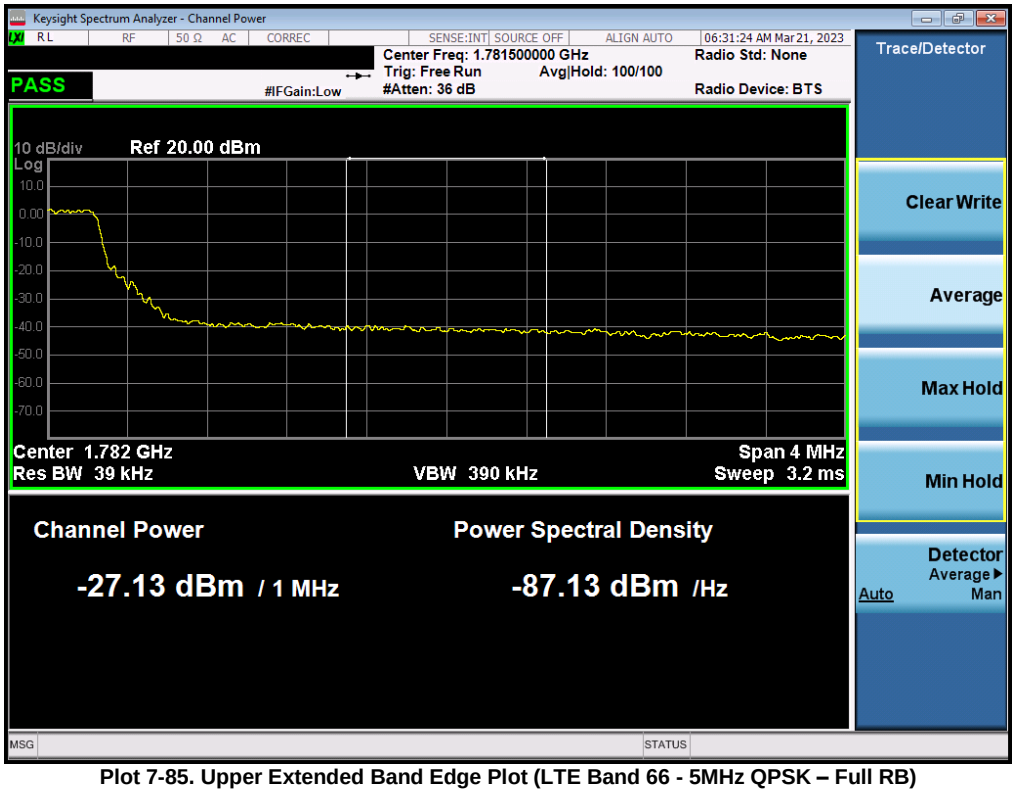


Plot 7-82. Upper Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)

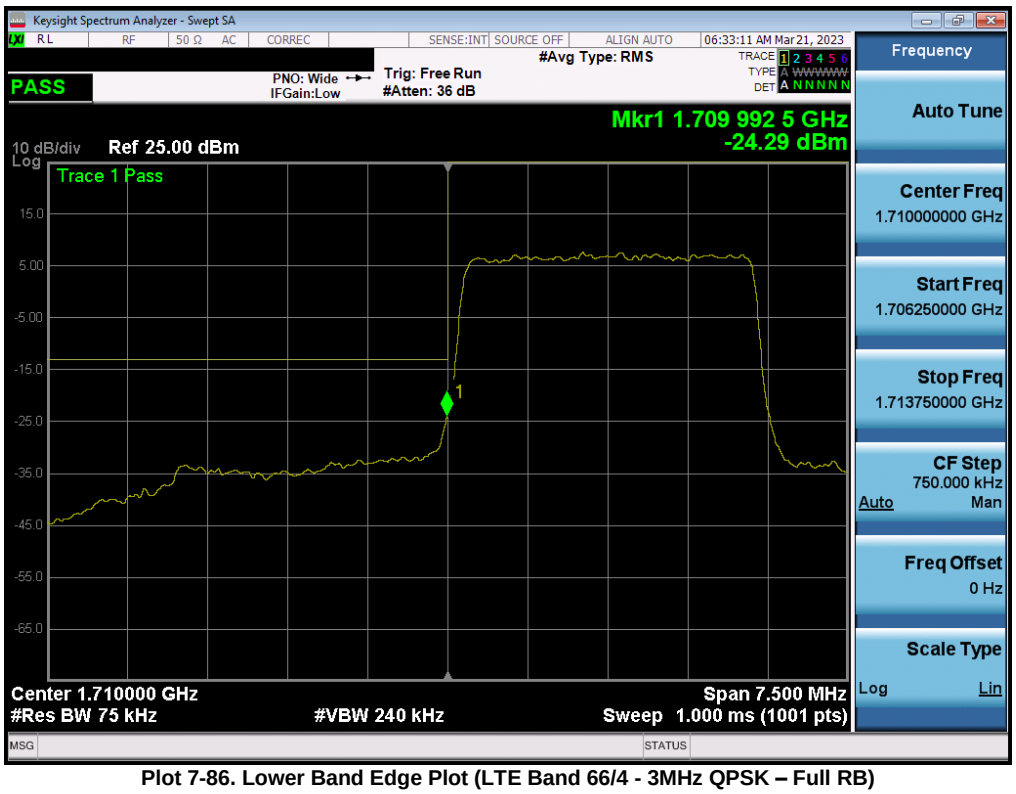


Plot 7-83. Upper Extended Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)

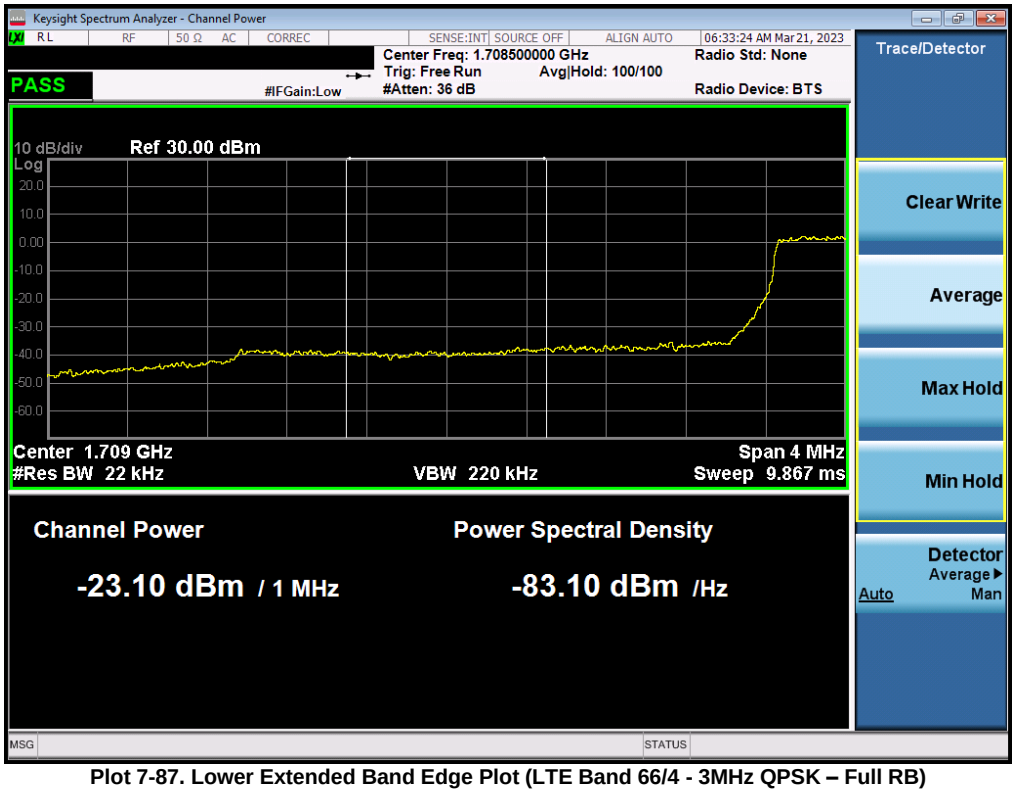
Plot 7-84. Upper Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)



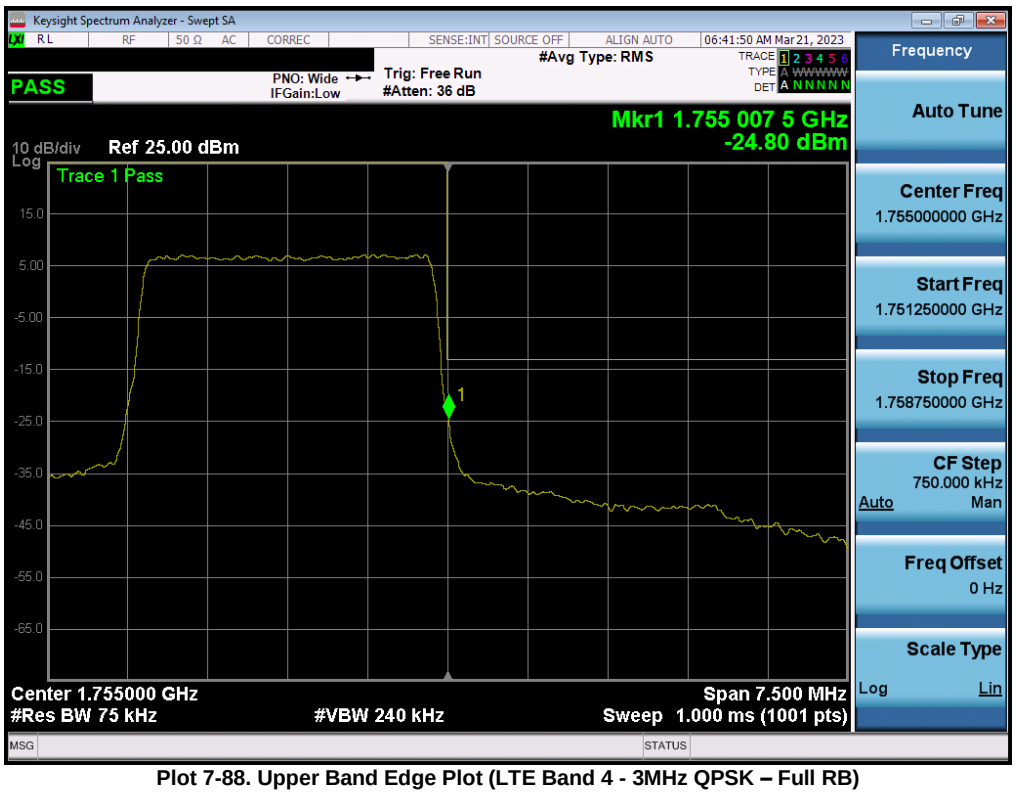
Plot 7-85. Upper Extended Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)



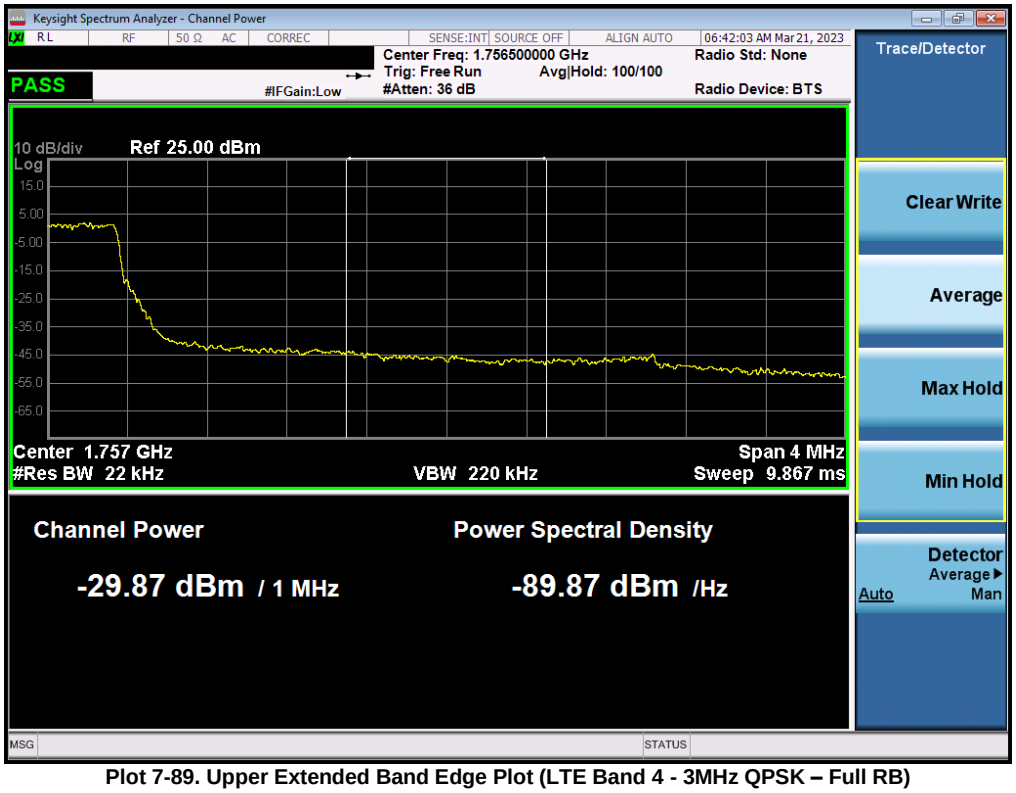
Plot 7-86. Lower Band Edge Plot (LTE Band 66/4 - 3MHz QPSK – Full RB)



Plot 7-87. Lower Extended Band Edge Plot (LTE Band 66/4 - 3MHz QPSK – Full RB)

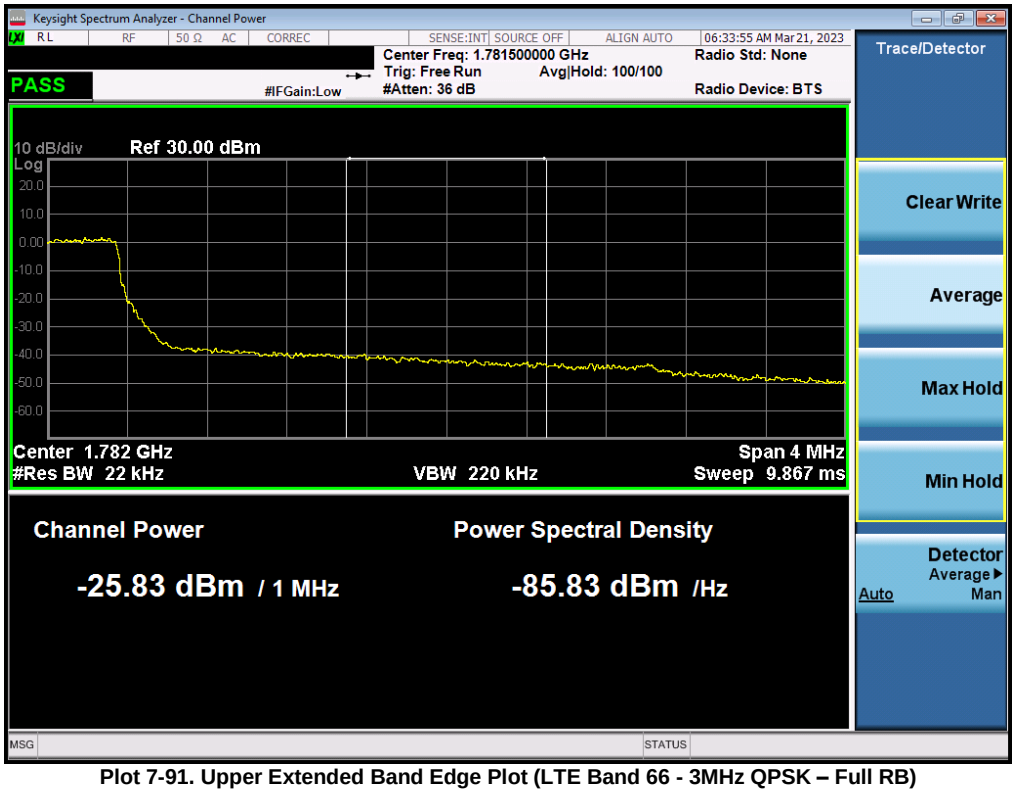


Plot 7-88. Upper Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)

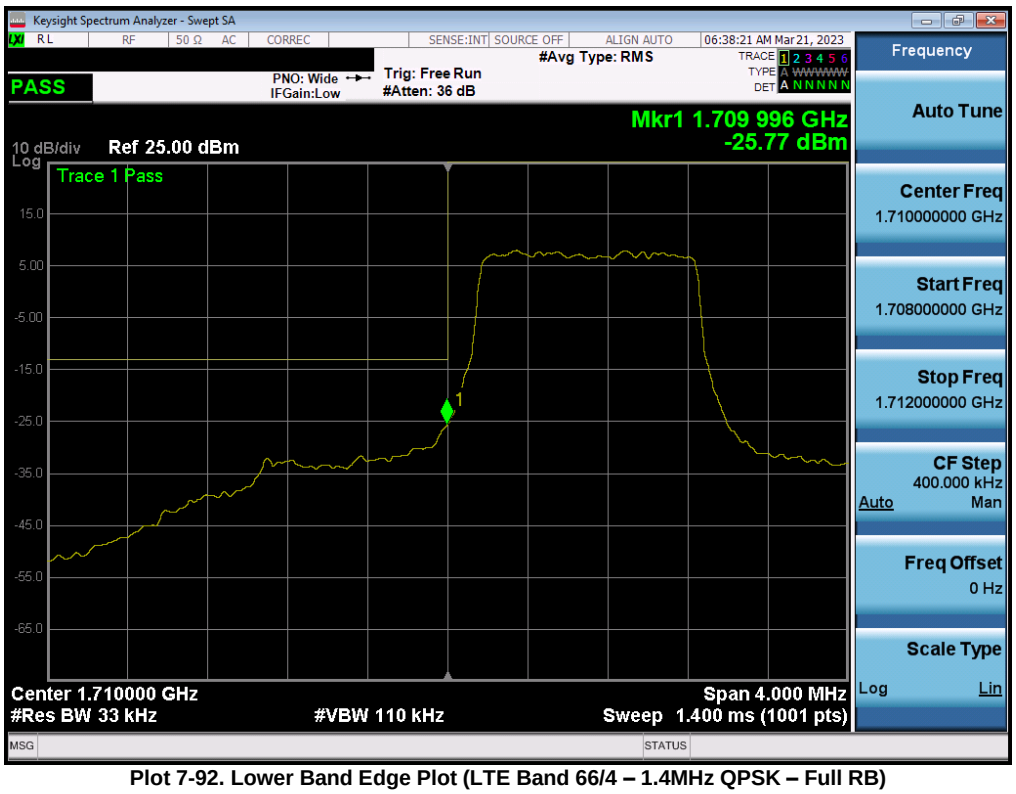


Plot 7-89. Upper Extended Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)

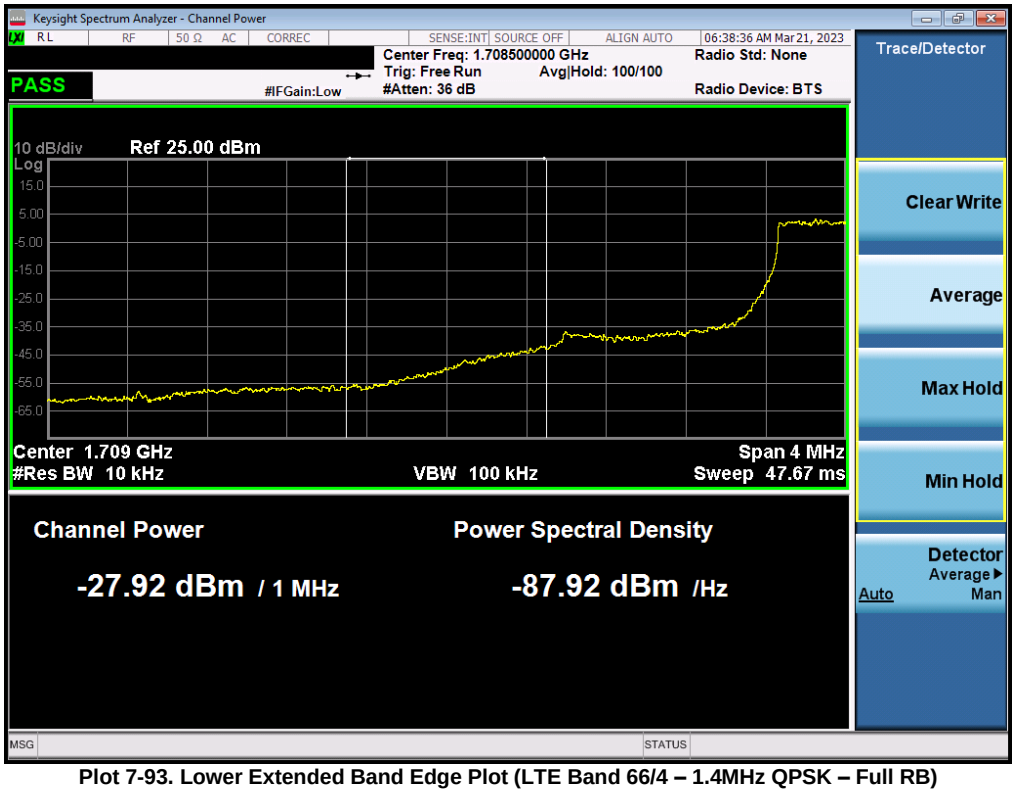
Plot 7-90. Upper Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)



Plot 7-91. Upper Extended Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)

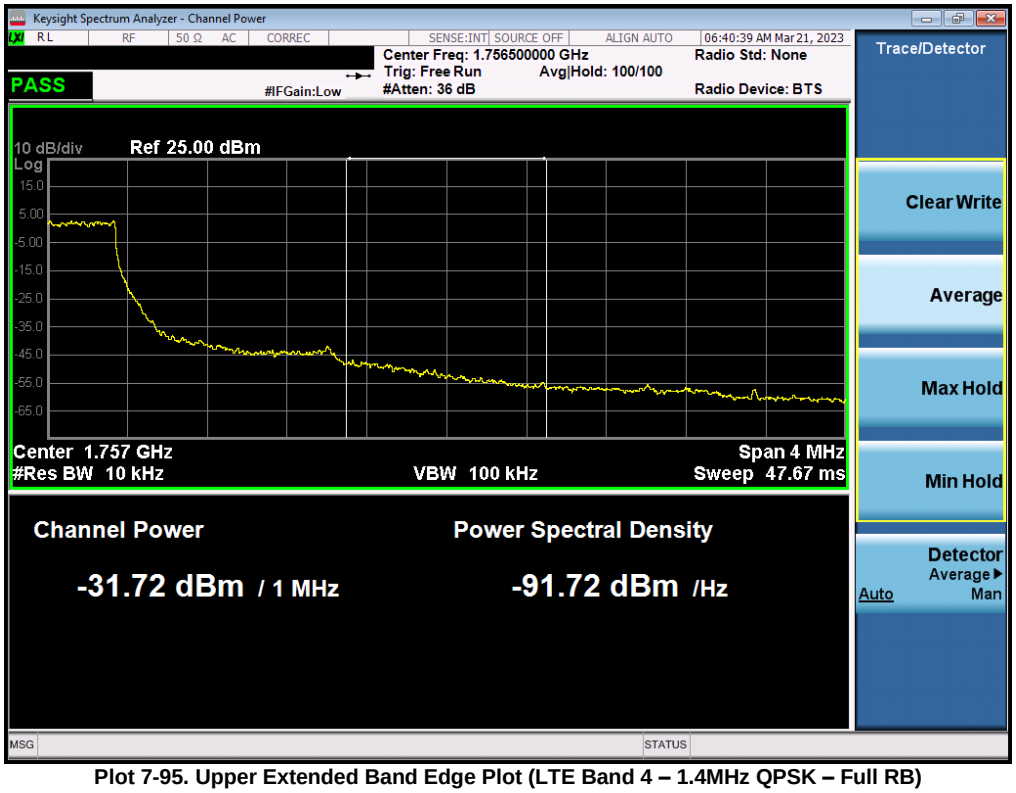


Plot 7-92. Lower Band Edge Plot (LTE Band 66/4 – 1.4MHz QPSK – Full RB)



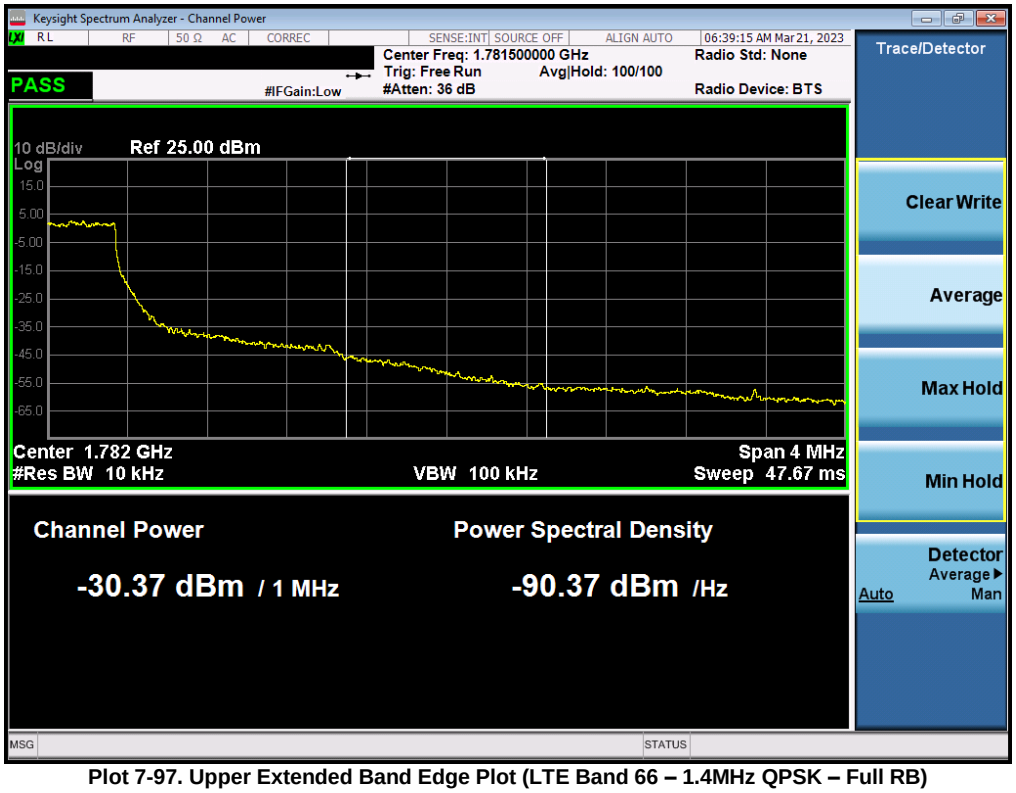
Plot 7-93. Lower Extended Band Edge Plot (LTE Band 66/4 – 1.4MHz QPSK – Full RB)

Plot 7-94. Upper Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)



Plot 7-95. Upper Extended Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)

Plot 7-96. Upper Band Edge Plot (LTE Band 66 – 1.4MHz QPSK – Full RB)



Plot 7-97. Upper Extended Band Edge Plot (LTE Band 66 – 1.4MHz QPSK – Full RB)

7.6 Peak-Average Ratio

Test Overview

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

Test Procedure Used

ANSI C63.26-2015 – Section 5.2.3.4

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW ≥ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The 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.

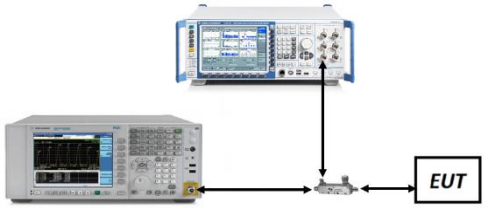
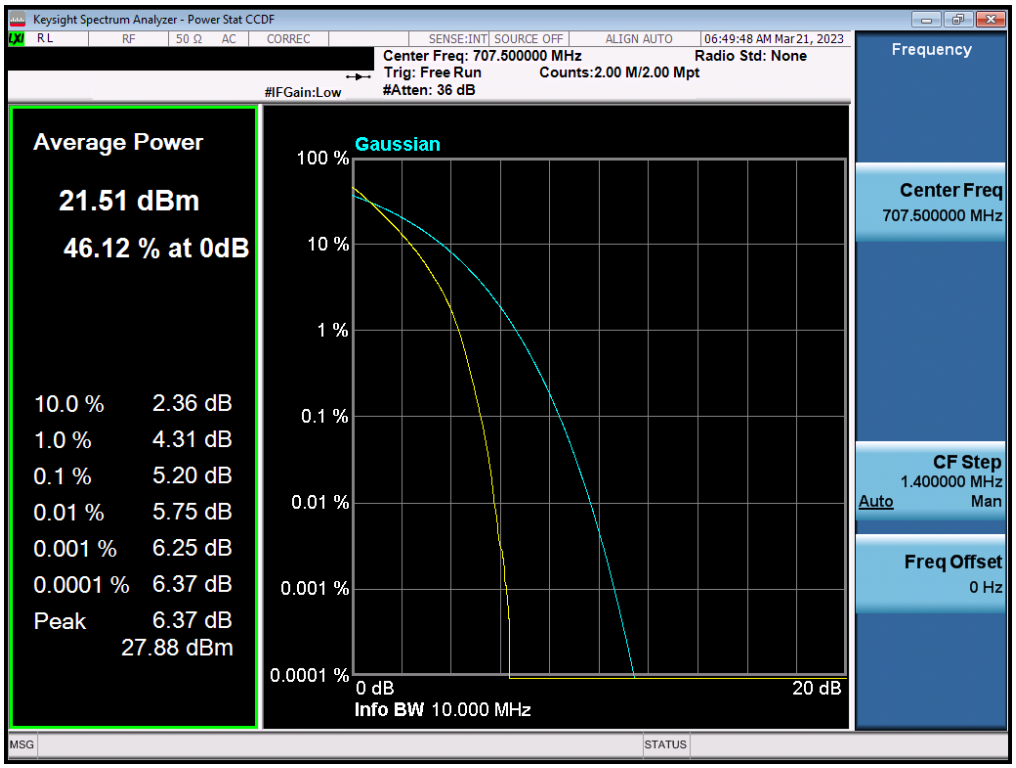


Figure 7-5. Test Instrument & Measurement Setup

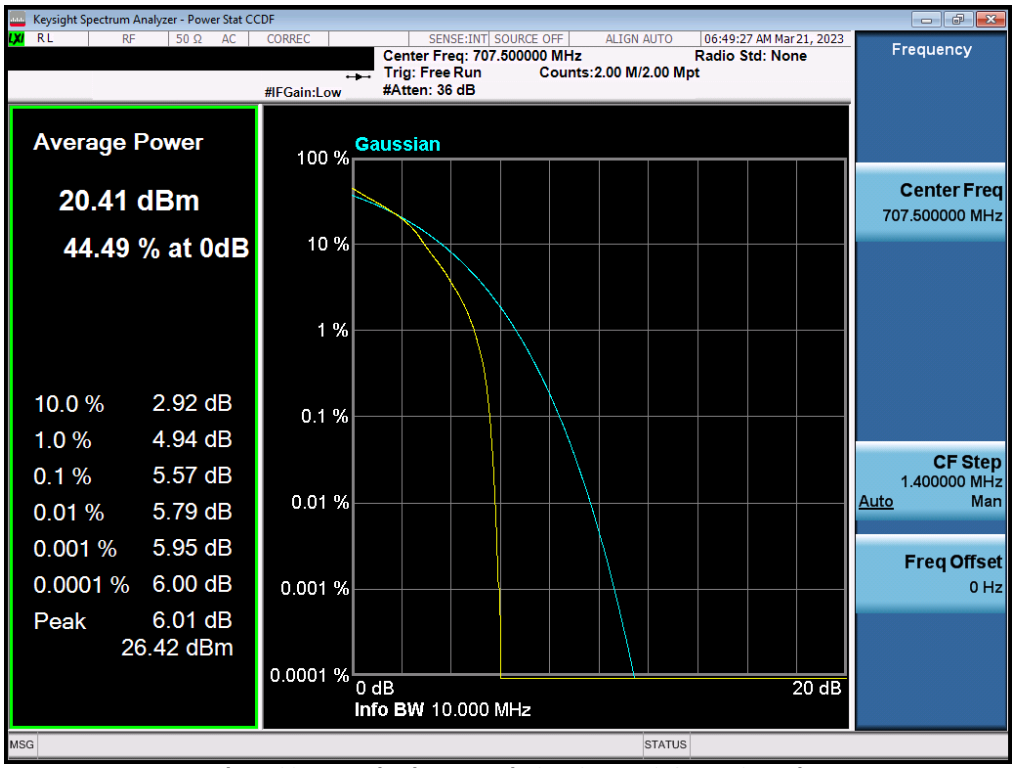
Test Notes

None.

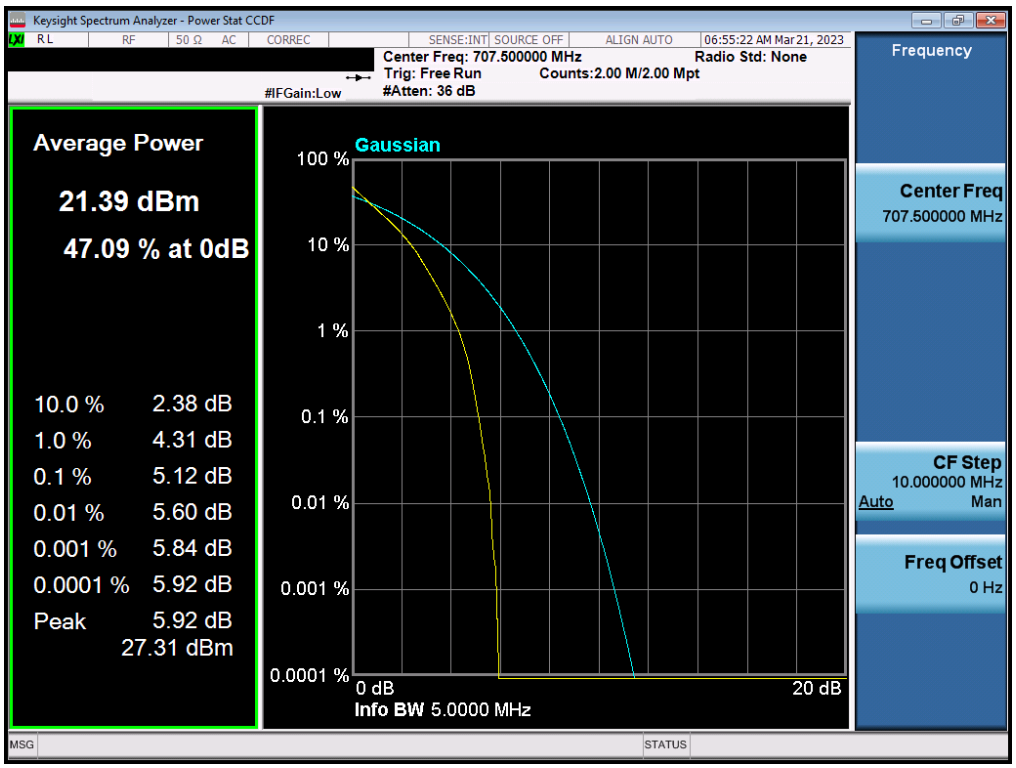
LTE Band 12



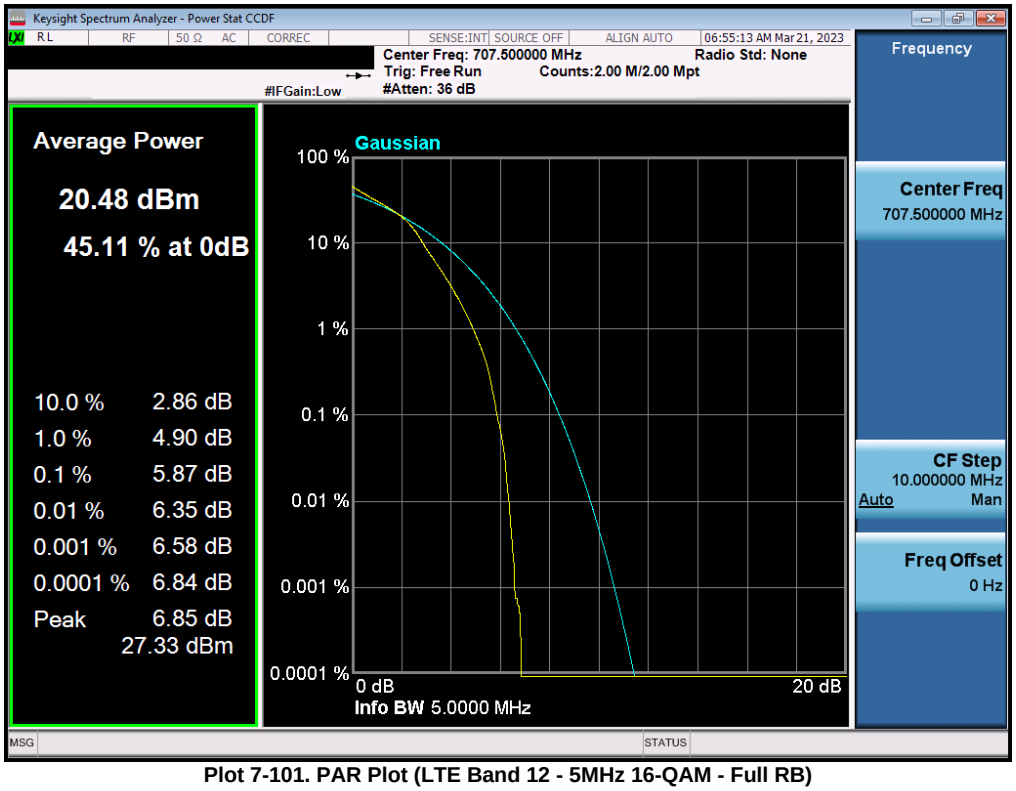
Plot 7-98. PAR Plot (LTE Band 12 - 10MHz QPSK - Full RB)



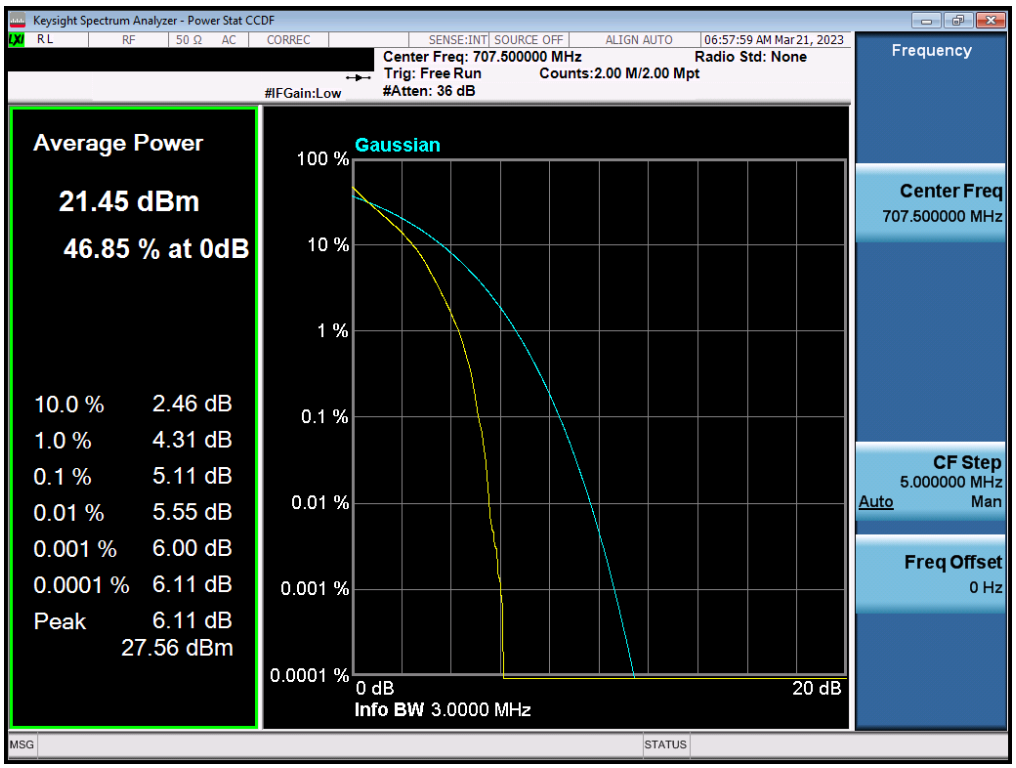
Plot 7-99. PAR Plot (LTE Band 12 - 10MHz 16-QAM - 27 RB)



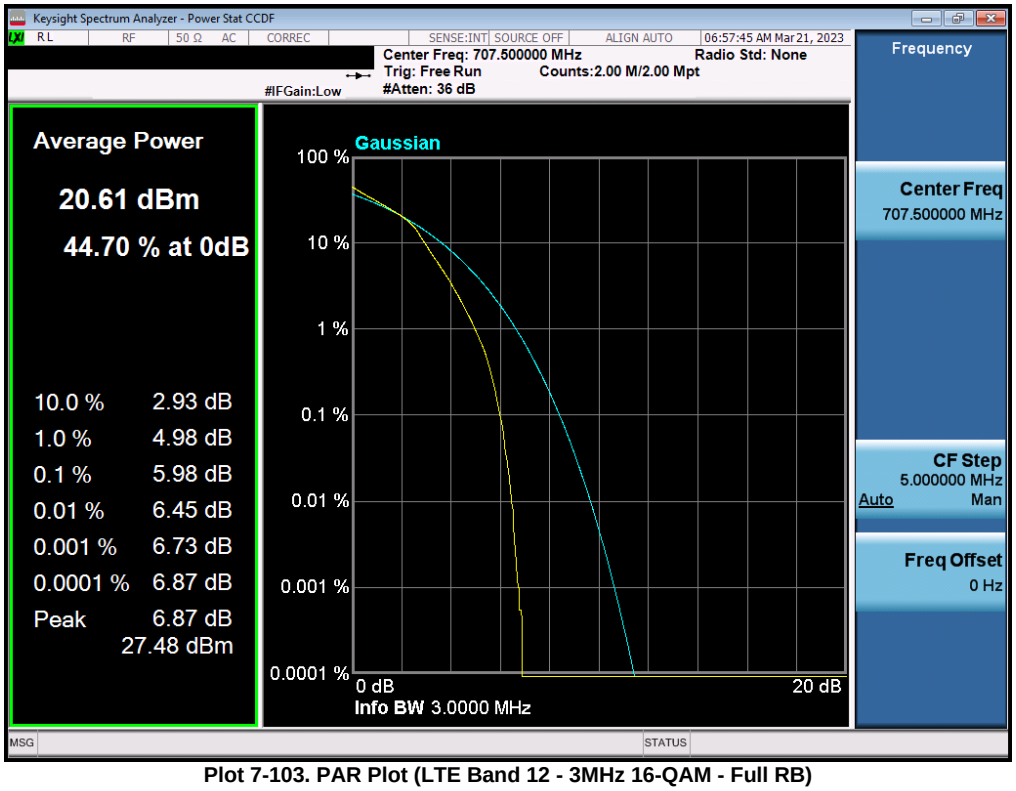
Plot 7-100. PAR Plot (LTE Band 12 - 5MHz QPSK - Full RB)



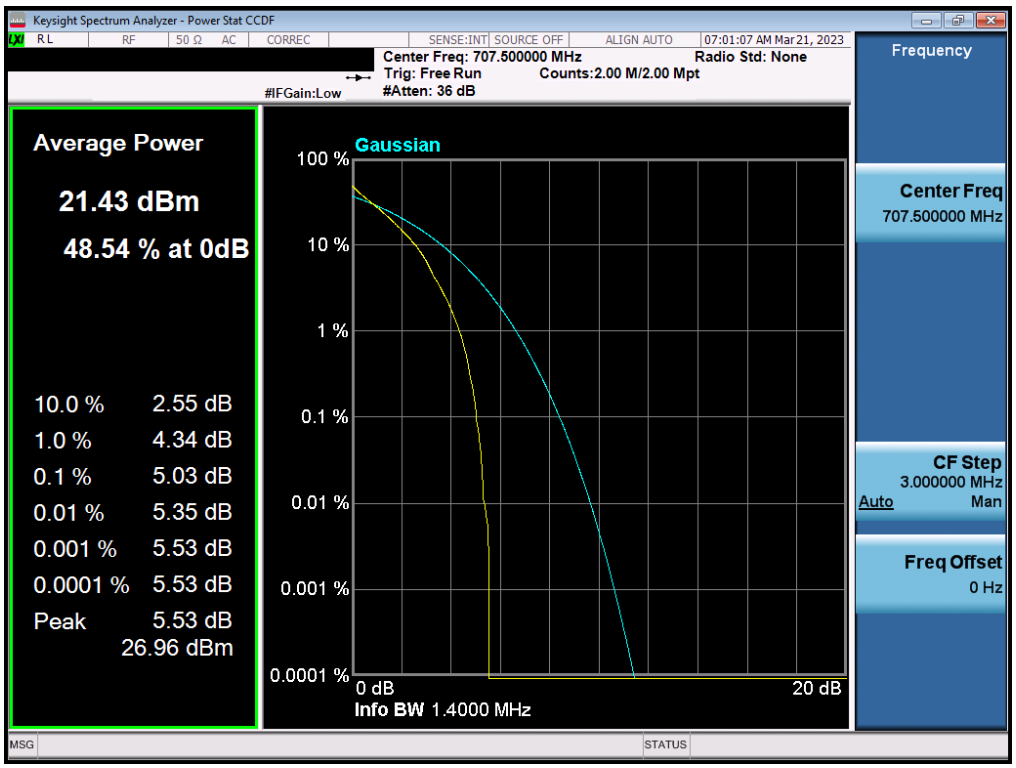
Plot 7-101. PAR Plot (LTE Band 12 - 5MHz 16-QAM - Full RB)



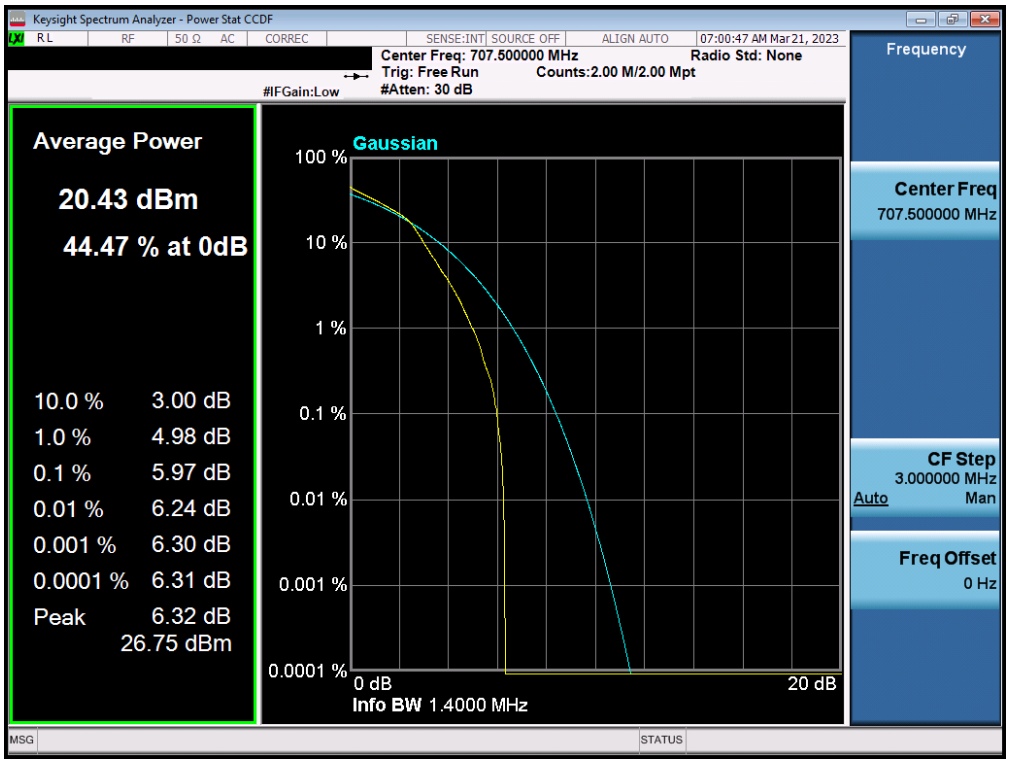
Plot 7-102. PAR Plot (LTE Band 12 - 3MHz QPSK - Full RB)



Plot 7-103. PAR Plot (LTE Band 12 - 3MHz 16-QAM - Full RB)

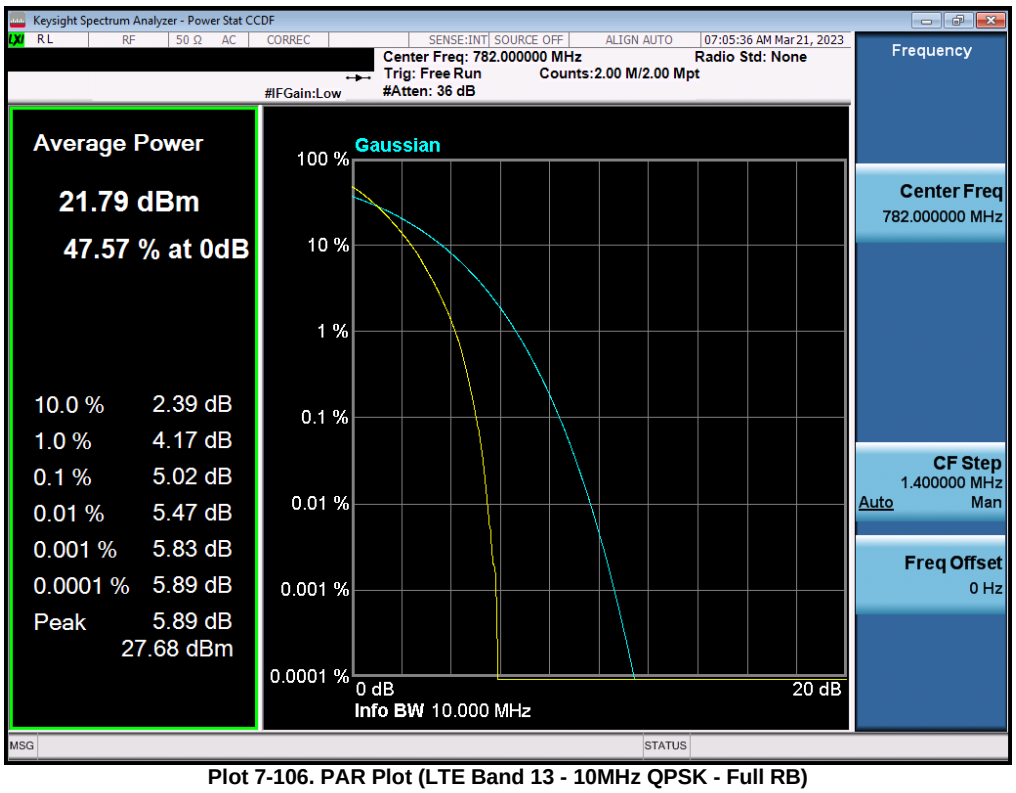


Plot 7-104. PAR Plot (LTE Band 12 - 1.4MHz QPSK - Full RB)

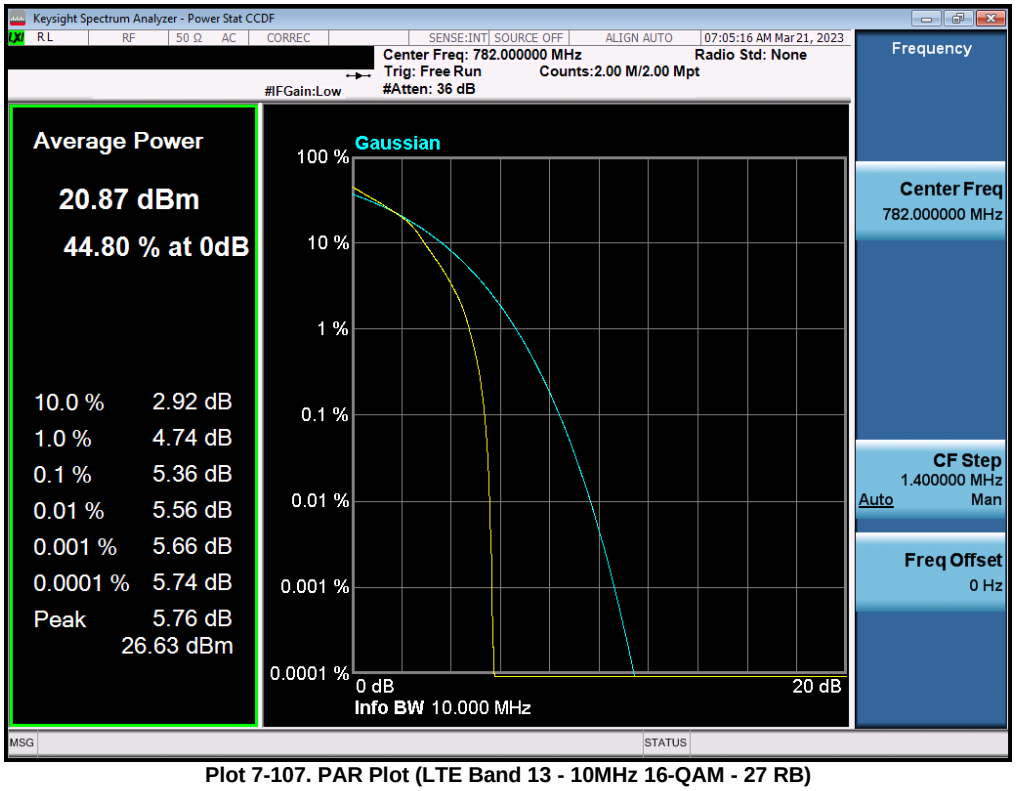


Plot 7-105. PAR Plot (LTE Band 12 - 1.4MHz 16-QAM - Full RB)

LTE Band 13



Plot 7-106. PAR Plot (LTE Band 13 - 10MHz QPSK - Full RB)



Plot 7-107. PAR Plot (LTE Band 13 - 10MHz 16-QAM - 27 RB)