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PART 27 MEASUREMENT REPORT

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

Date of Testing:
12/13/2022 - 12/23/2022
Test Report Issue Date:
02/24/2023
Test Site/Location:
Element lab., Columbia, MD, USA
Test Report Serial No.:
1M2212080136-03-R1.A3L

FCC ID:	**A3LSMS911JPN**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model(s):	SC-51D, SCG19
EUT Type:	Portable Handset
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part:	27
Test Procedure(s):	ANSI C63.26-2015, KDB 648474 D03 v01r04

Note: This revised Test Report (S/N: 1M2212080136-03-R1.A3L) 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.

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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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	ERP		EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	Max. Power [W]	Max. Power [dBm]	
LTE Band 12	10 MHz	QPSK	704.0 - 711.0	0.067	18.27	0.110	20.42	9M00G7D
		16QAM	704.0 - 711.0	0.059	17.70	0.097	19.85	9M04W7D
	5 MHz	QPSK	701.5 - 713.5	0.068	18.30	0.111	20.45	4M53G7D
		16QAM	701.5 - 713.5	0.058	17.66	0.096	19.81	4M52W7D
	3 MHz	QPSK	700.5 - 714.5	0.068	18.32	0.111	20.47	2M73G7D
		16QAM	700.5 - 714.5	0.059	17.73	0.097	19.88	2M73W7D
	1.4 MHz	QPSK	699.7 - 715.3	0.067	18.27	0.110	20.42	1M11G7D
		16QAM	699.7 - 715.3	0.058	17.66	0.096	19.81	1M11W7D
LTE Band 13	10 MHz	QPSK	782.0	0.100	20.00	0.164	22.15	9M00G7D
		16QAM	782.0	0.082	19.16	0.135	21.31	9M00W7D
	5 MHz	QPSK	779.5 - 784.5	0.103	20.12	0.169	22.27	4M54G7D
		16QAM	779.5 - 784.5	0.093	19.68	0.152	21.83	4M54W7D

Overview Table (<1GHz Bands)

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	0.168	22.26	18M1G7D
		16QAM	1720.0 - 1770.0	0.133	21.23	18M0W7D
	15 MHz	QPSK	1717.5 - 1772.5	0.171	22.34	13M5G7D
		16QAM	1717.5 - 1772.5	0.128	21.08	13M5W7D
	10 MHz	QPSK	1715.0 - 1775.0	0.178	22.50	9M02G7D
		16QAM	1715.0 - 1775.0	0.133	21.22	9M06W7D
	5 MHz	QPSK	1712.5 - 1777.5	0.172	22.35	4M55G7D
		16QAM	1712.5 - 1777.5	0.133	21.24	4M53W7D
	3 MHz	QPSK	1711.5 - 1778.5	0.177	22.47	2M72G7D
		16QAM	1711.5 - 1778.5	0.134	21.28	2M72W7D
	1.4 MHz	QPSK	1710.7 - 1779.3	0.175	22.43	1M11G7D
		16QAM	1710.7 - 1779.3	0.135	21.30	1M11W7D

Overview Table (>1GHz Bands)

1.0 INTRODUCTION

1.1 Scope

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

1.2 Element Test Location

These measurement tests were conducted at the Element 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 Handset FCC ID: A3LSMS911JPN**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 27.

Test Device Serial No.: 1048M, 1062M

2.2 Device Capabilities

This device contains the following capabilities:

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

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

2.3 Test Configuration

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

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

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version S911USQU0AVJM 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
-	AP1-002	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	AP1-002
-	AP2-001	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	AP2-001
-	AP2-002	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	AP2-002
-	ETS-001	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-001
-	ETS-002	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-002
-	LTx1	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	LTx1
-	LTx2	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	LTx2
-	LTx3	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	LTx3
-	LTx4	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	LTx4
-	LTx5	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	LTx5
-	LTx6-40	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	LTx6-40
Agilent	N9020A	MXA Signal Analyzer	4/26/2022	Annual	4/26/2023	MY56470202
Agilent	N9030A	PXA Signal Analyzer (44GHz)	8/18/2022	Annual	8/18/2023	MY49430494
Anritsu	MT8821C	Radio Communication Analyzer	5/24/2022	Annual	5/24/2023	6201144418
Anritsu	MT8821C	Radio Communication Analyzer	6/27/2022	Annual	6/27/2023	6261895213
Anritsu	MT8821C	Radio Communication Analyzer	5/11/2022	Annual	5/11/2023	6262044715
Anritsu	MT8821C	Radio Communication Analyzer	1/10/2023	Annual	1/10/2024	6201524637
Anritsu	MT8821C	Radio Communication Analyzer	11/28/2022	Annual	11/28/2023	6262150047
Com-Power	AL-130R	9kHz - 30MHz Loop Antenna	1/19/2022	Biennial	1/19/2024	121085
Emco	3115	Horn Antenna (1-18GHz)	8/8/2022	Biennial	8/8/2024	9704-5182
ESPEC	SU-241	Temperature Chamber	11/10/2022	Annual	11/10/2023	93011064
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	8/11/2022	Biennial	8/11/2024	00114451
Keysight Technologies	N9038A	MXE EMI Receiver	1/21/2022	Annual	1/21/2023	US46470561
Pasternack	NMLC-2	Line Conducted Emissions Cable (NM)	1/11/2023	Annual	1/11/2024	NMLC-2
Rohde & Schwarz	CMW500	Radio Communication Analyzer	10/10/2022	Annual	10/10/2023	101072
Rohde & Schwarz	CMW500	Radio Communication Analyzer	4/12/2022	Annual	4/12/2023	100059
Rohde & Schwarz	CMW500	Radio Communication Analyzer	5/17/2022	Annual	5/17/2023	100854
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	8/29/2022	Annual	8/29/2023	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	8/25/2022	Annual	8/25/2023	100348
Sunol Sciences	DRH-118	Horn Antenna (1-18GHz)	1/14/2022	Biennial	1/14/2024	A042511
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

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

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

QAM Modulation

Emission Designator = 8M45W7D

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

Spurious Radiated Emission – LTE Band

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

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80) = 50.3 dBc.

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMS911JPN

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

Mode(s): LTE

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

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

Table 7-1. Summary of Test Results (FCC)

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is EMC Software Tool v1.1.

7.2 Conducted Output Power Data

Test Overview

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

Test Procedure Used

ANSI C63.26-2015 – Section 5.2

Test Settings

1. 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. Uplink carrier aggregation is only supported in this EUT while operating in Power Class 3.

2. 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.

3. All other conducted power measurements are contained in the RF exposure report for this filing.

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
20 MHz	QPSK	132072	1720.0	1 / 0	23.62
		132322	1745.0	1 / 50	23.52
		132572	1770.0	1 / 50	23.30
	16-QAM	132322	1745.0	1 / 50	22.75
15 MHz	QPSK	132047	1717.5	1 / 0	23.73
		132322	1745.0	1 / 37	23.60
		132597	1772.5	1 / 37	23.39
	16-QAM	132322	1745.0	1 / 37	22.60
10 MHz	QPSK	132022	1715.0	1 / 49	23.74
		132322	1745.0	1 / 25	23.76
		132622	1775.0	1 / 25	23.49
	16-QAM	132322	1745.0	1 / 25	22.74
5 MHz	QPSK	131997	1712.5	1 / 24	23.73
		132322	1745.0	1 / 24	23.61
		132647	1777.5	1 / 0	23.46
	16-QAM	132322	1745.0	1 / 24	22.76
3 MHz	QPSK	131987	1711.5	1 / 7	23.86
		132322	1745.0	1 / 7	23.73
		132657	1778.5	1 / 7	23.48
	16-QAM	132322	1745.0	1 / 7	22.80
1.4 MHz	QPSK	131979	1710.7	1 / 0	23.71
		132322	1745.0	1 / 0	23.69
		132665	1779.3	1 / 3	23.37
	16-QAM	132322	1745.0	1 / 0	22.82

Table 7-2. Conducted Powers (LTE Band 66/4)

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

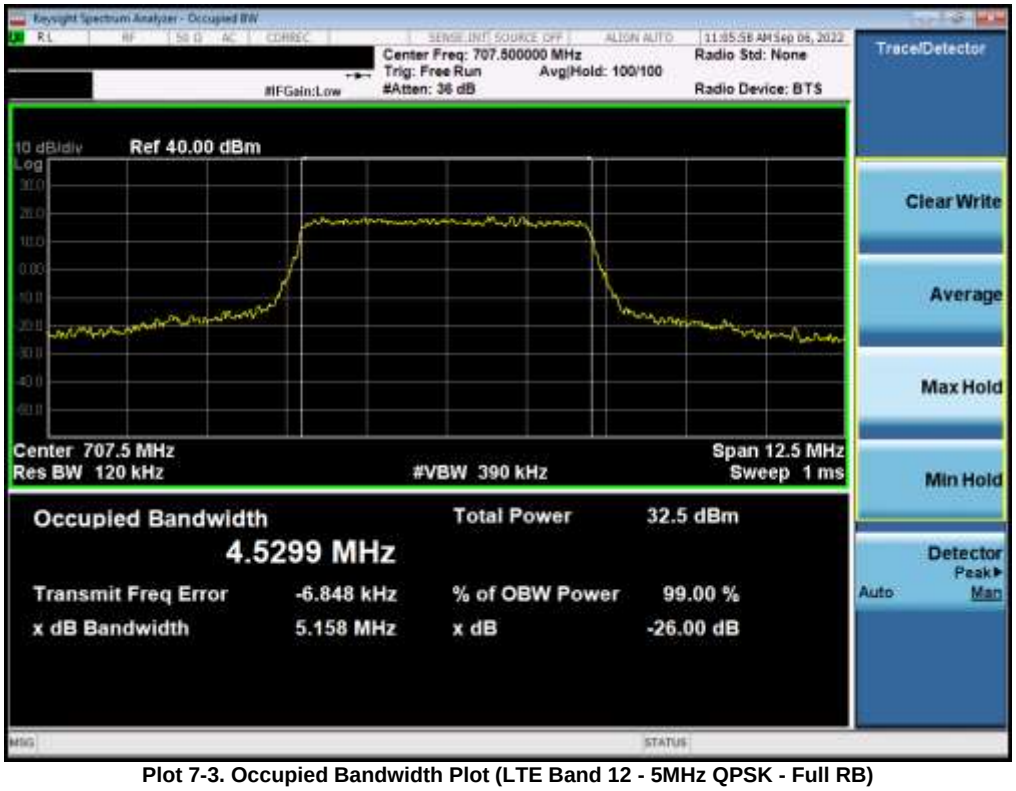
Test Notes

None.

LTE Band 12

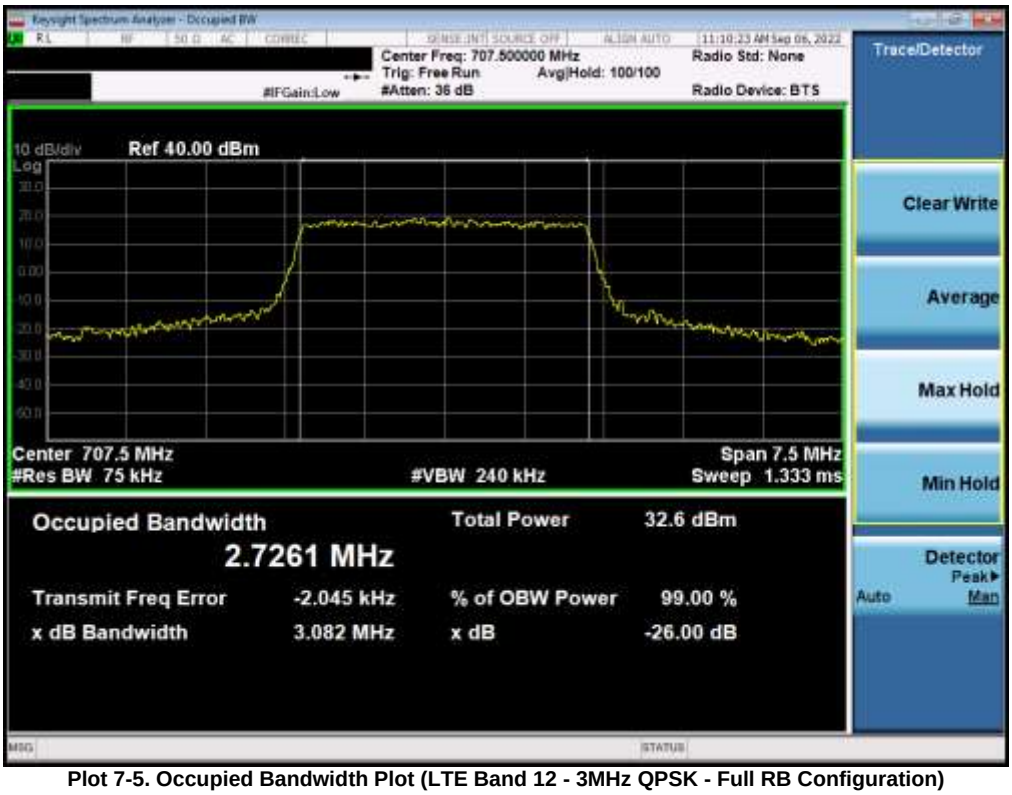
Plot 7-1. Occupied Bandwidth Plot (LTE Band 12 - 10MHz QPSK - Full RB)

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

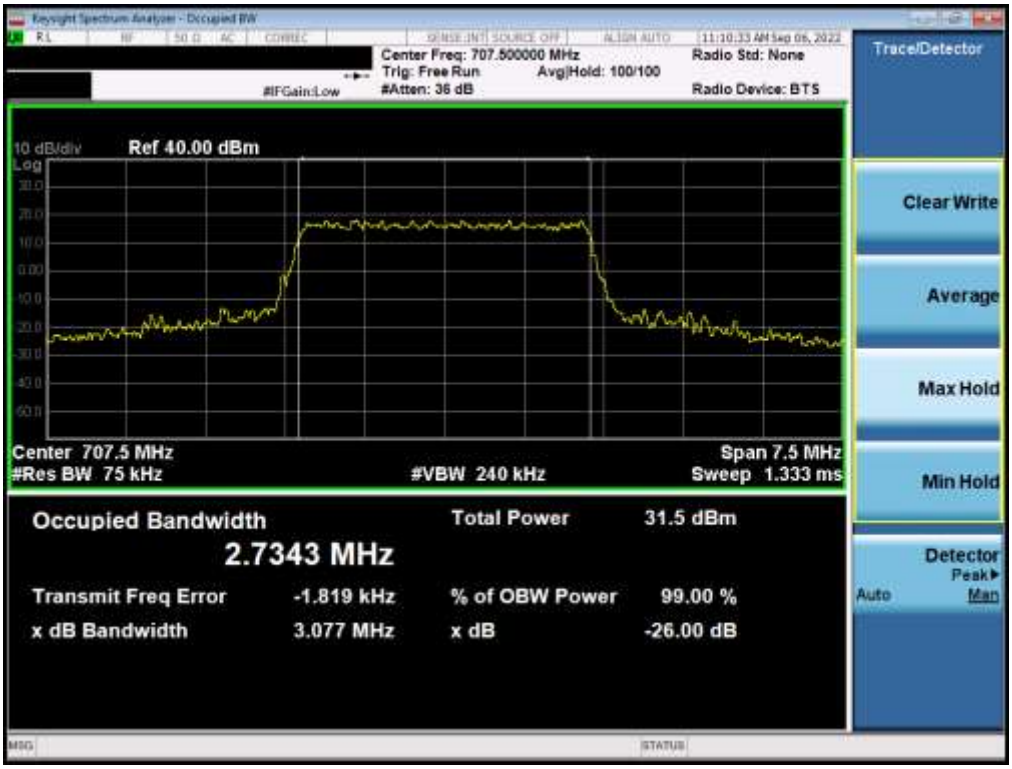


Plot 7-3. Occupied Bandwidth Plot (LTE Band 12 - 5MHz QPSK - Full RB)

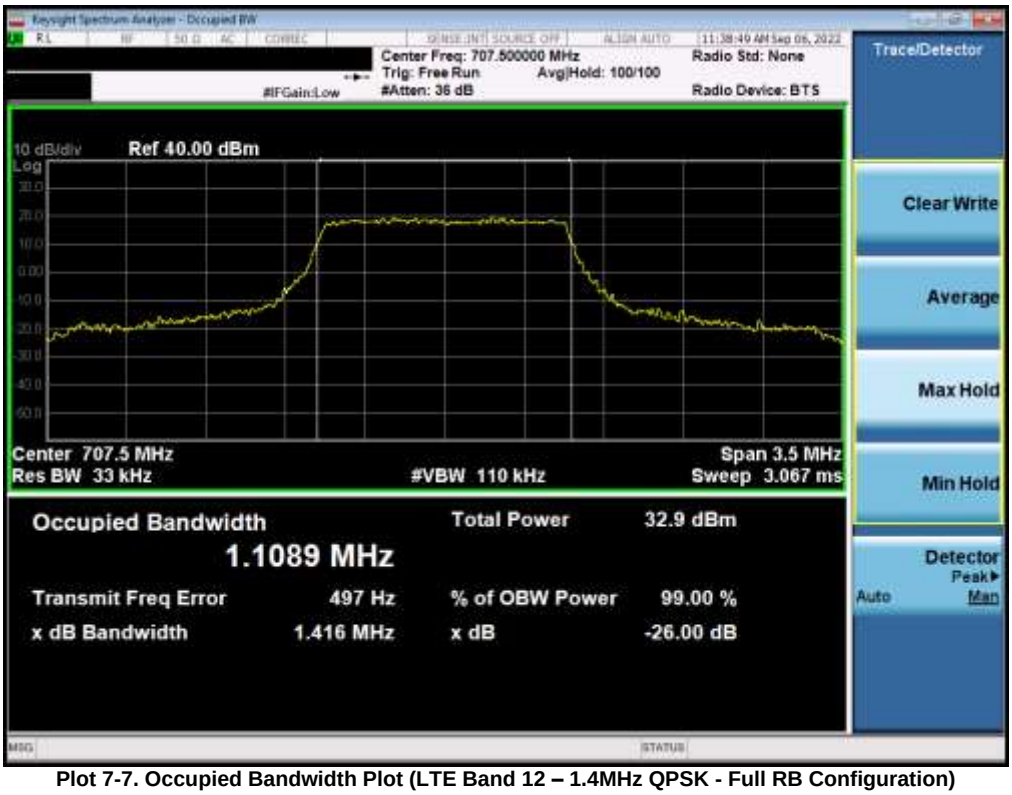
Plot 7-4. Occupied Bandwidth Plot (LTE Band 12 - 5MHz 16-QAM - Full RB)



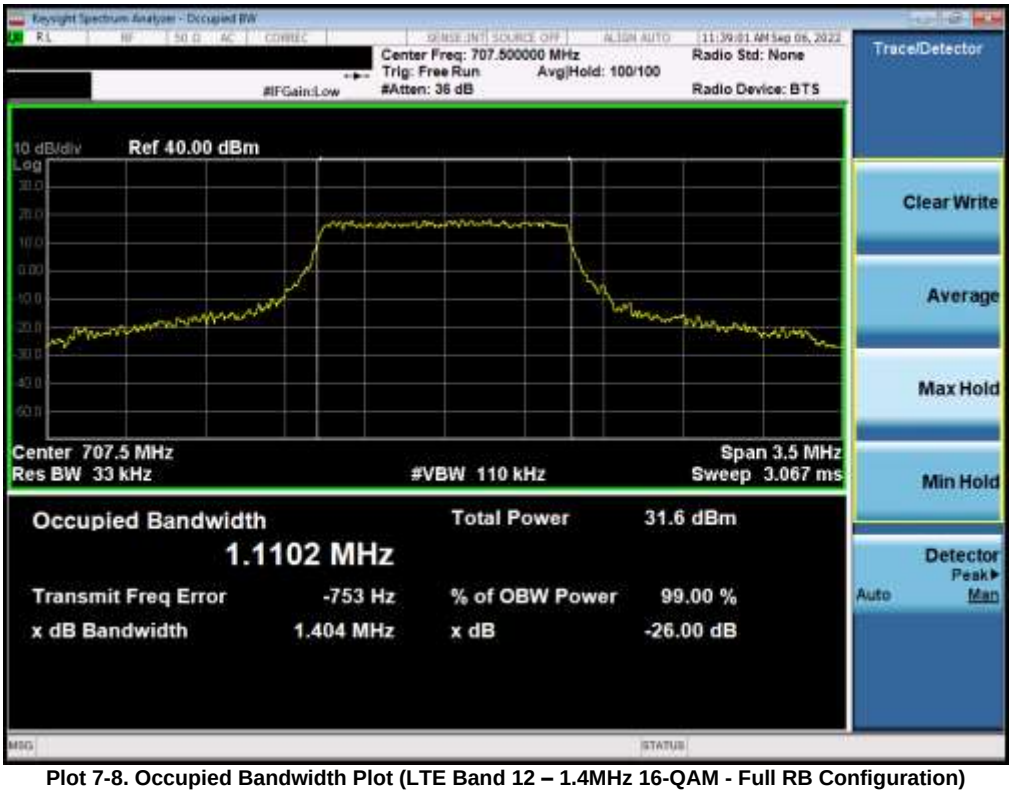
Plot 7-5. Occupied Bandwidth Plot (LTE Band 12 - 3MHz QPSK - Full RB Configuration)



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



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

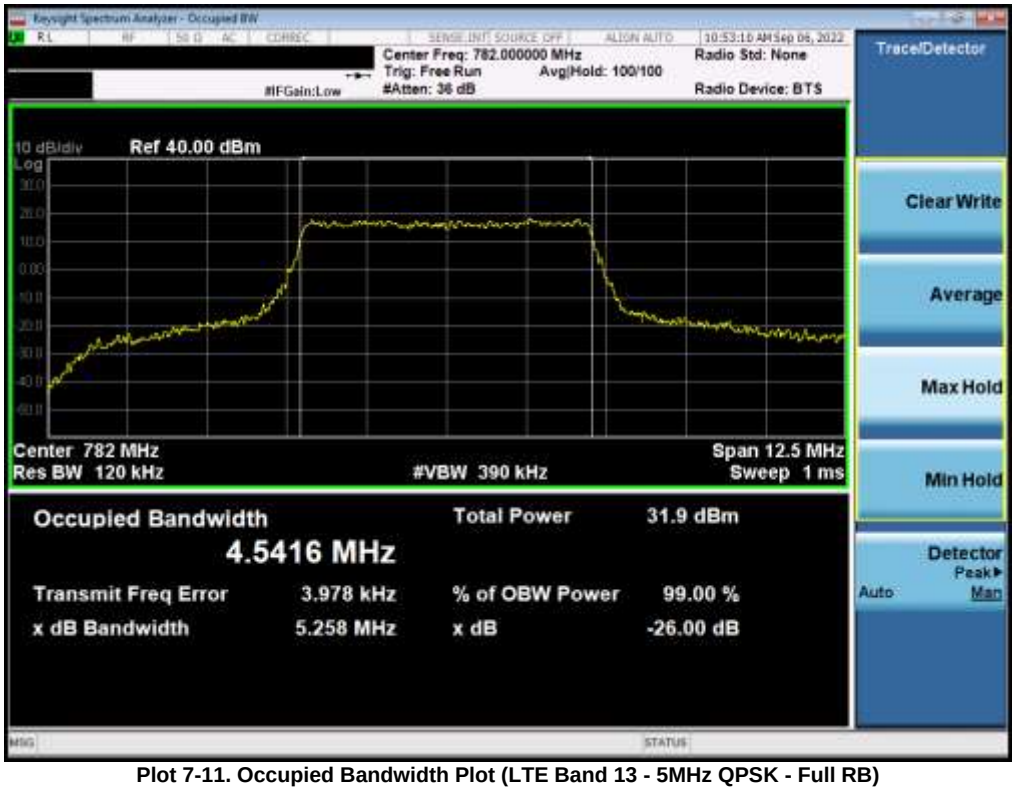


Plot 7-8. Occupied Bandwidth Plot (LTE Band 12 – 1.4MHz 16-QAM - Full RB Configuration)

LTE Band 13

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

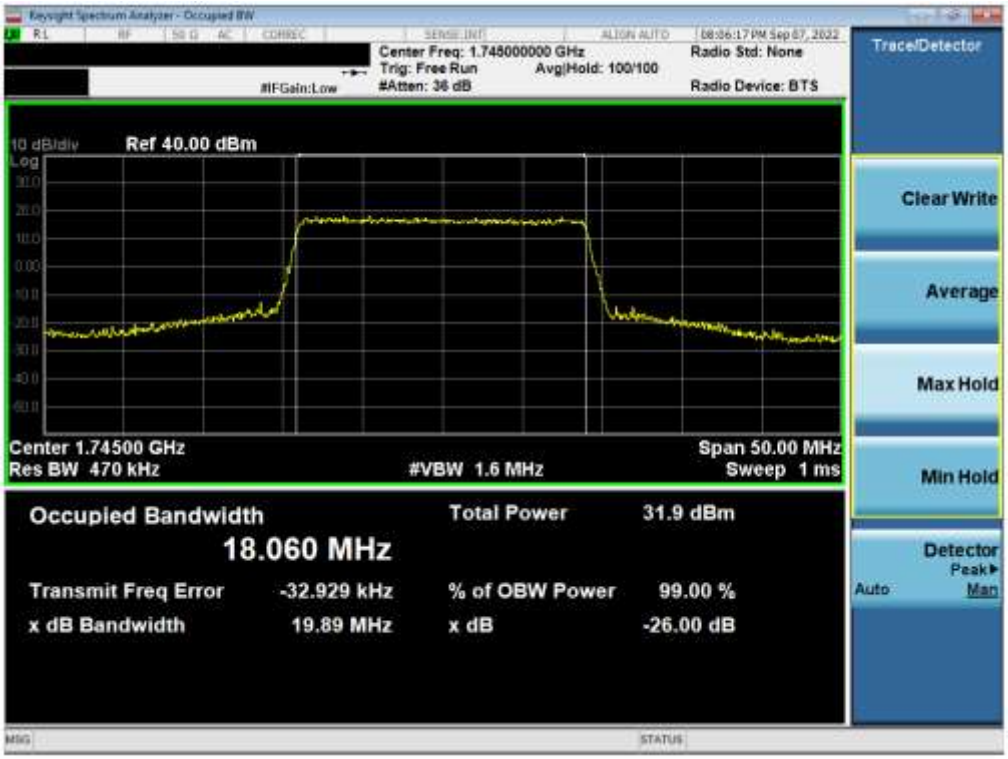
Plot 7-10. Occupied Bandwidth Plot (LTE Band 13 - 10MHz 16-QAM - Full RB)



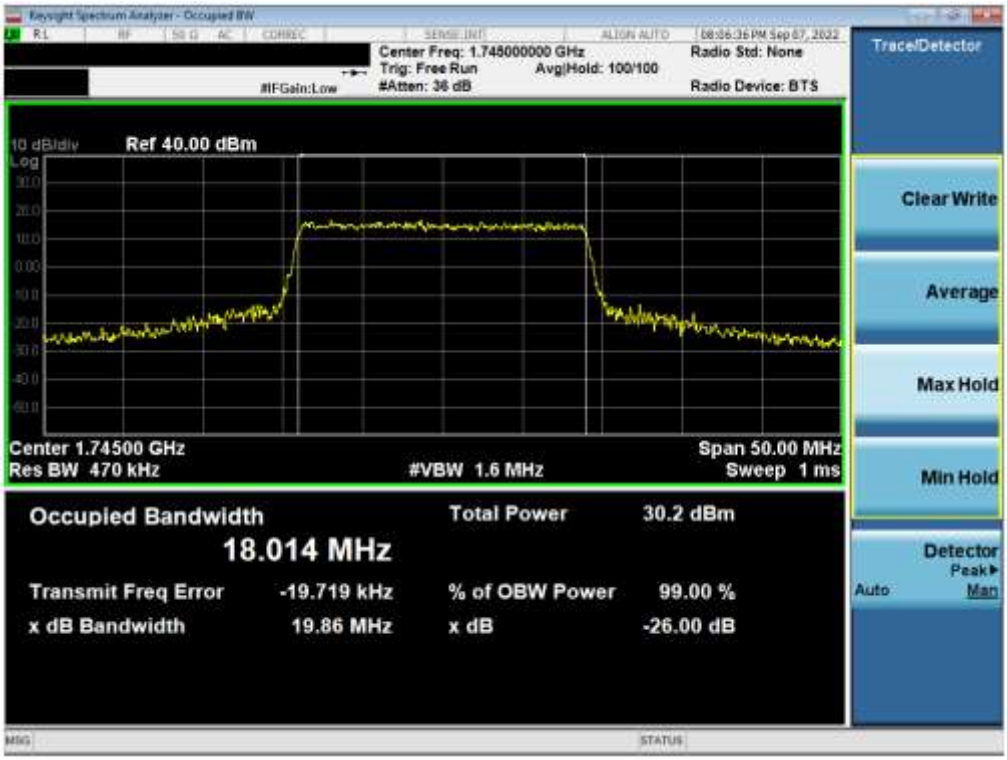
Plot 7-11. Occupied Bandwidth Plot (LTE Band 13 - 5MHz QPSK - Full RB)

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

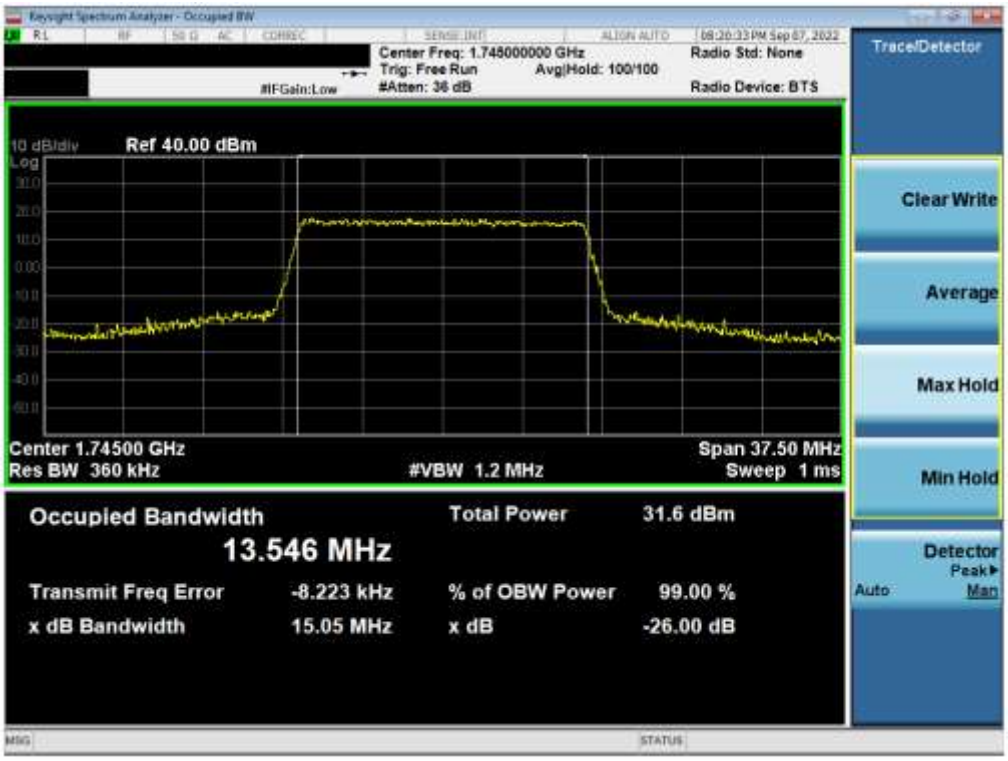
LTE Band 66/4



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



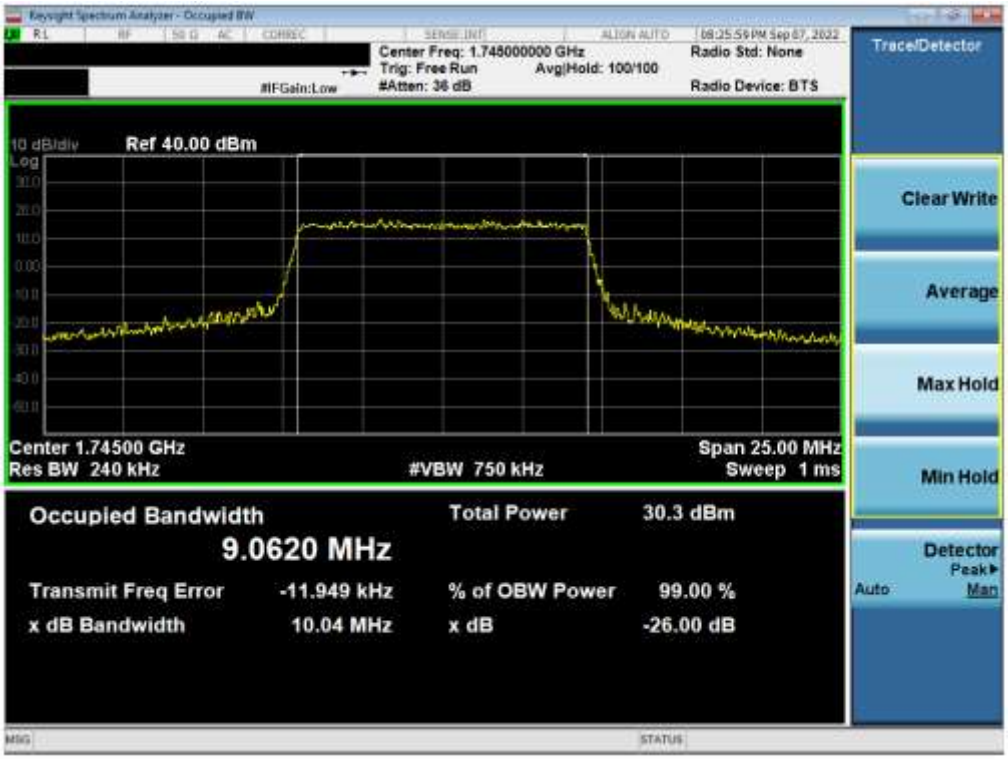
Plot 7-14. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz 16-QAM - Full RB)



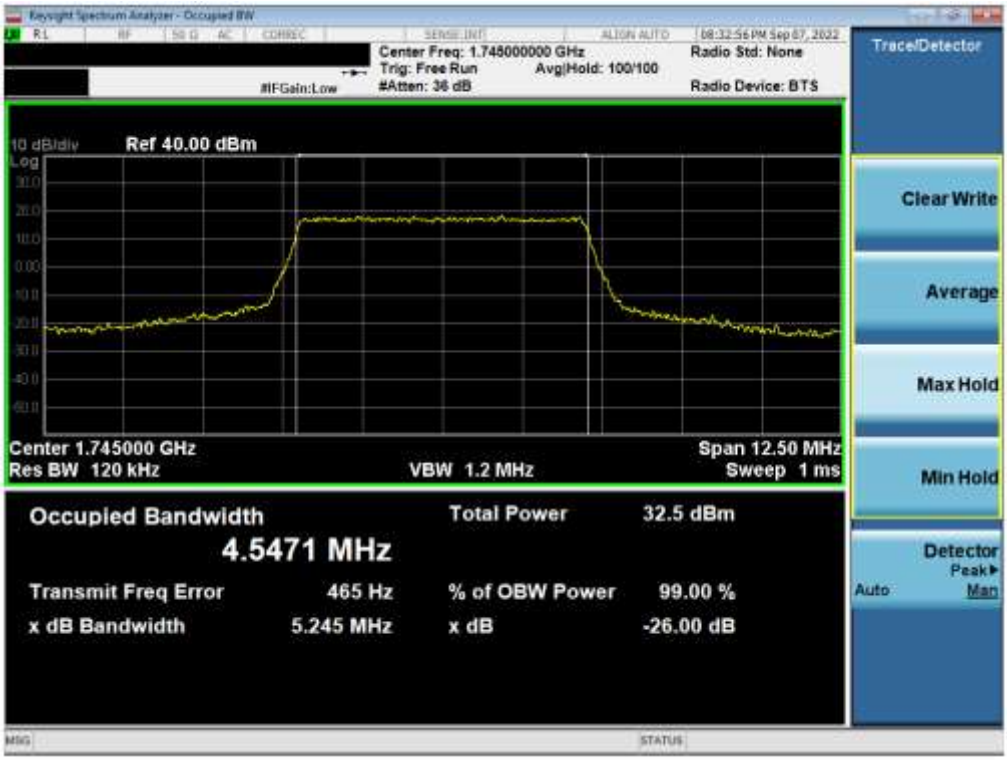
Plot 7-15. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz QPSK - Full RB)

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

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



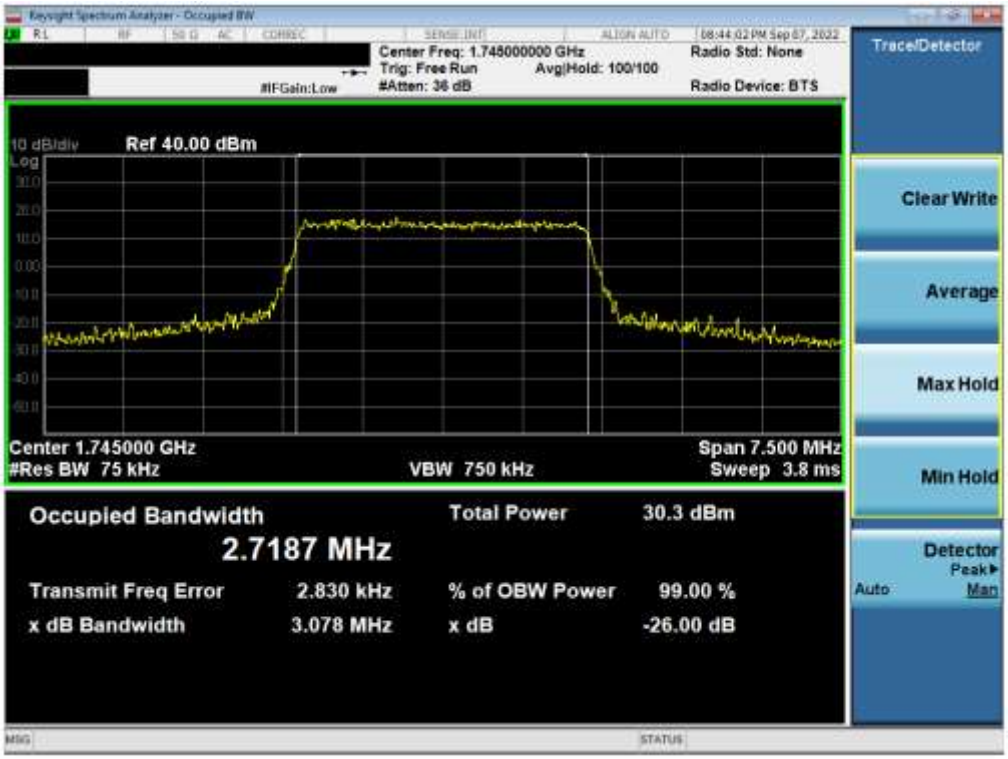
Plot 7-18. Occupied Bandwidth Plot (LTE Band 66/4 - 10MHz 16-QAM - Full RB)



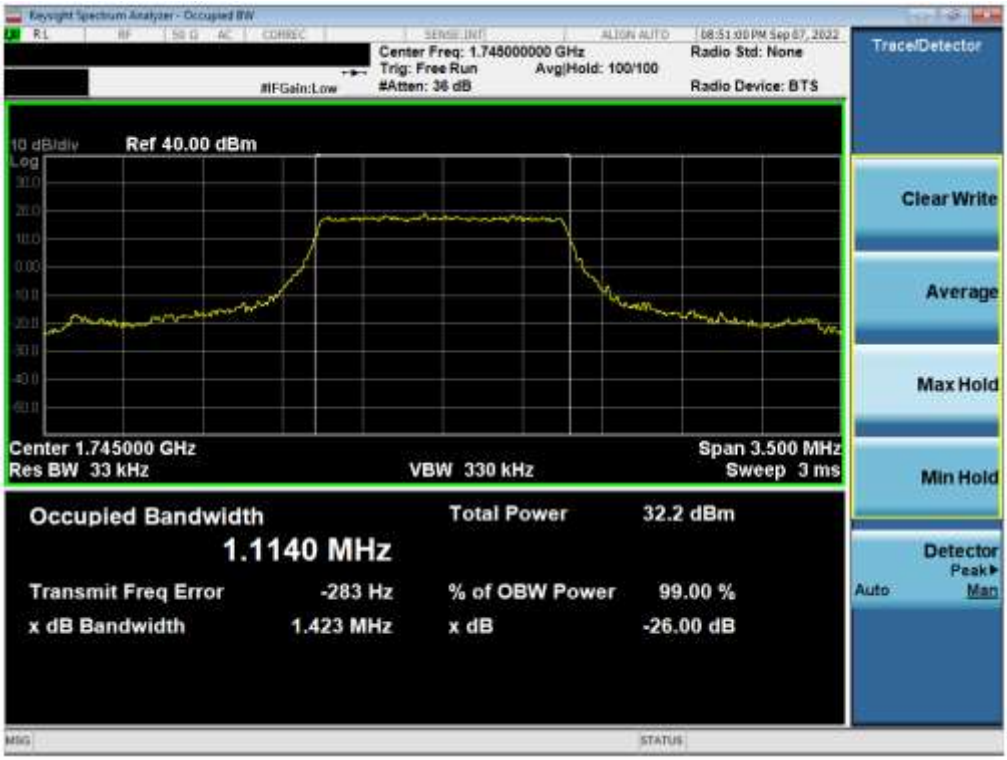
Plot 7-19. Occupied Bandwidth Plot (LTE Band 66/4 - 5MHz QPSK - Full RB)

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

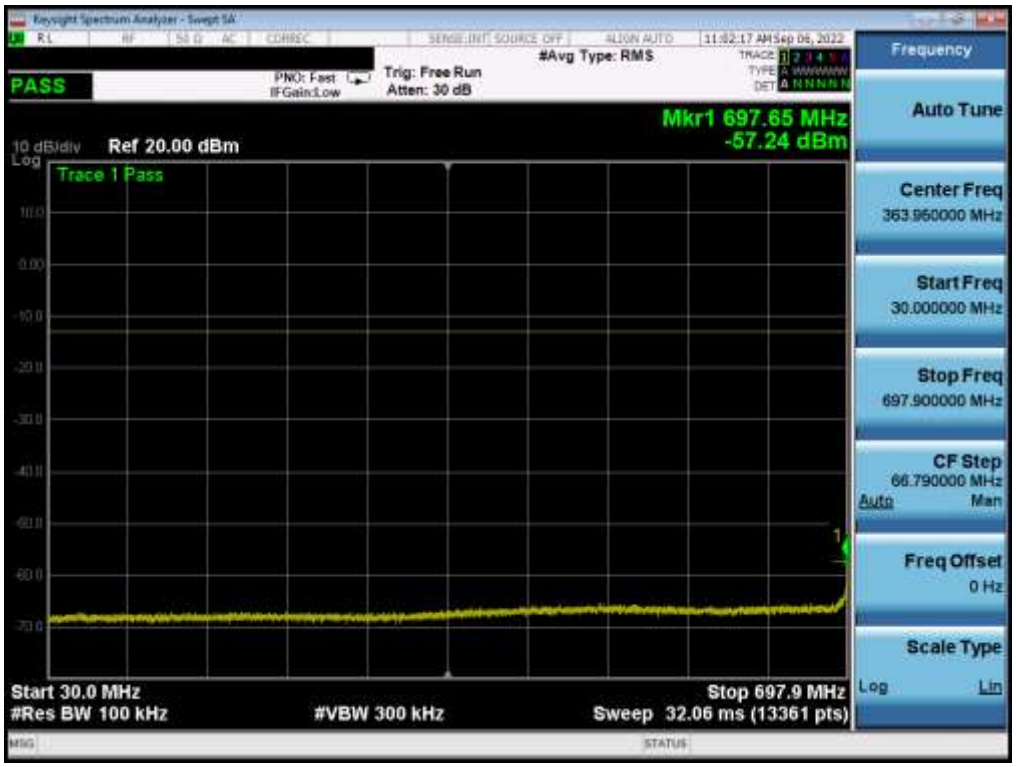
The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

Per Part 27, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz.

LTE Band 12

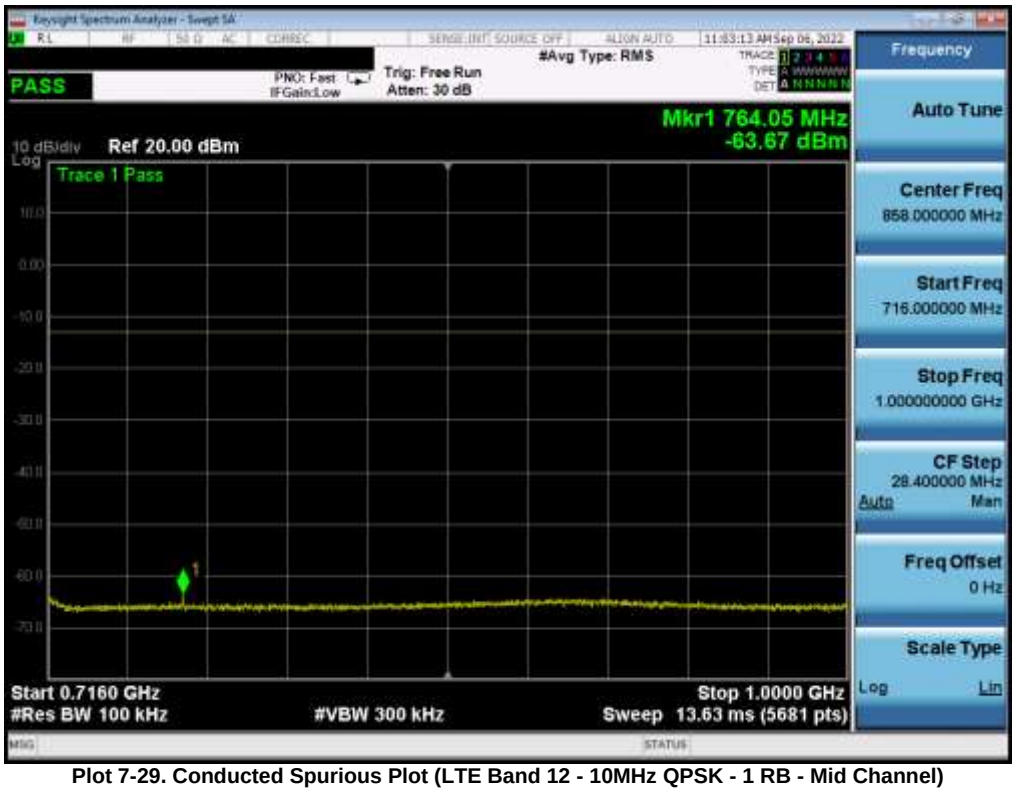


Plot 7-25. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Low Channel)

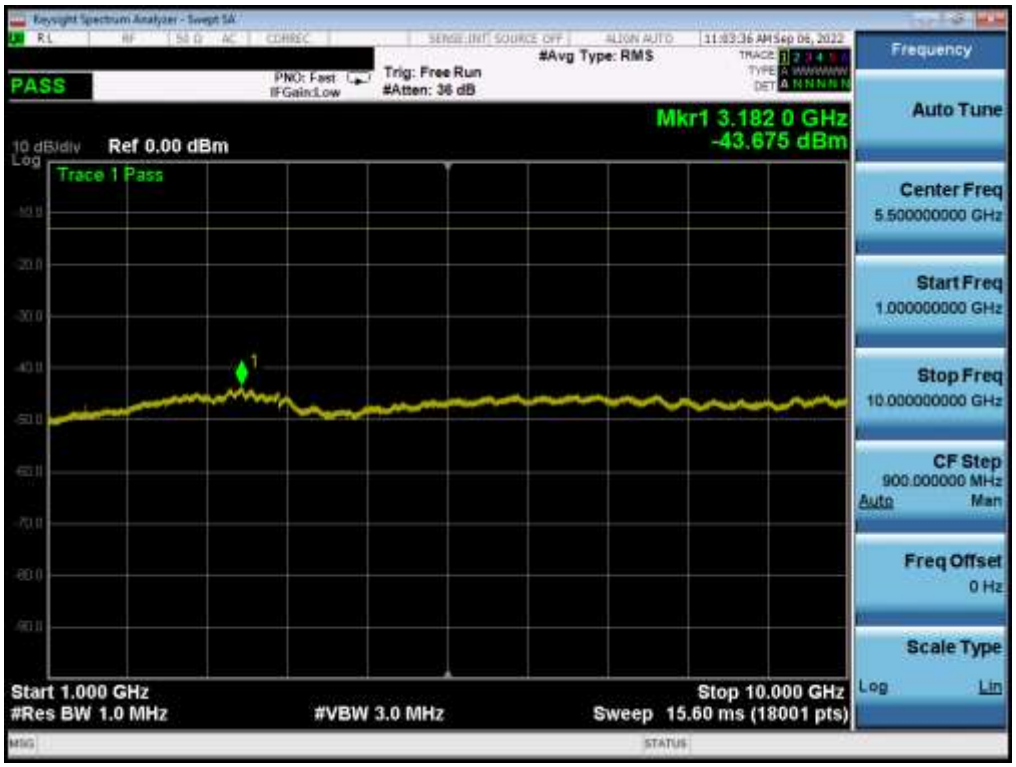
Plot 7-26. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Low Channel)

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

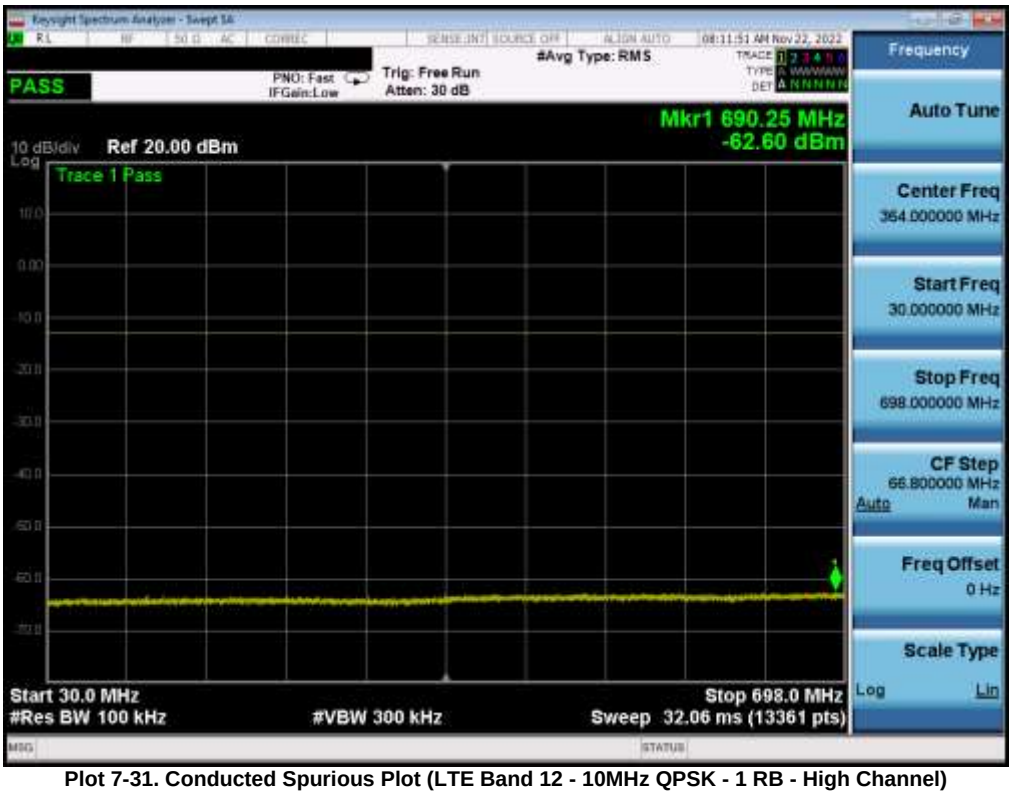
Plot 7-28. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Mid Channel)



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

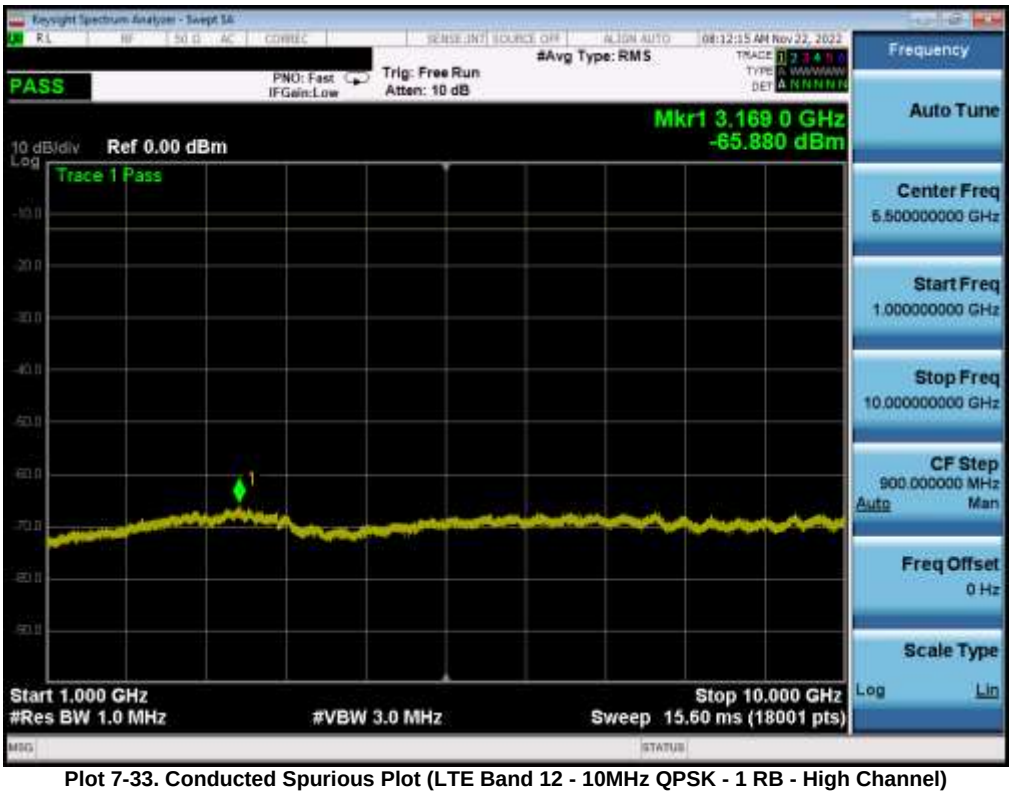


Plot 7-30. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - Mid Channel)



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

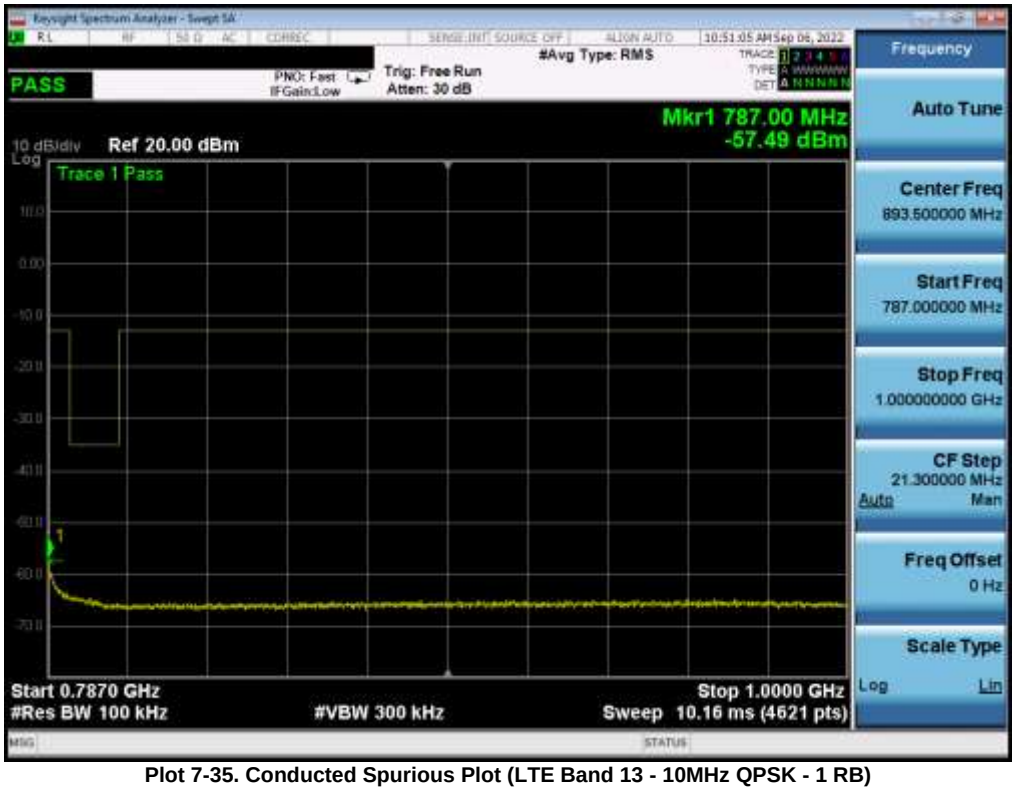
Plot 7-32. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - High Channel)



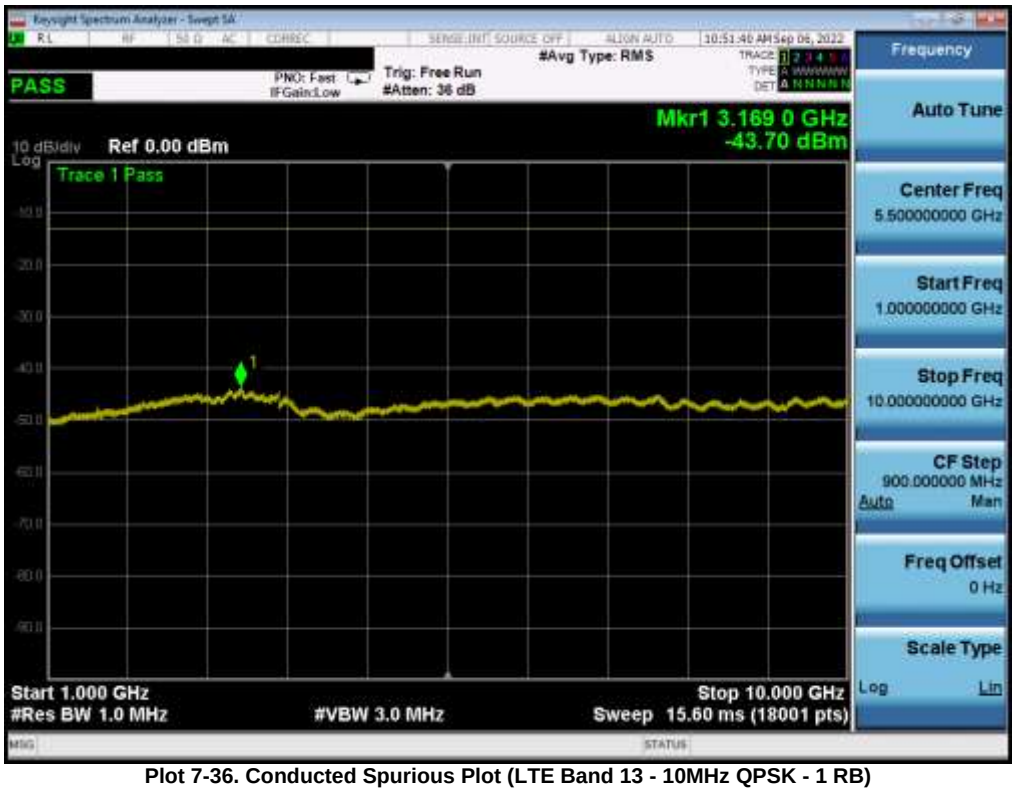
Plot 7-33. Conducted Spurious Plot (LTE Band 12 - 10MHz QPSK - 1 RB - High Channel)

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)



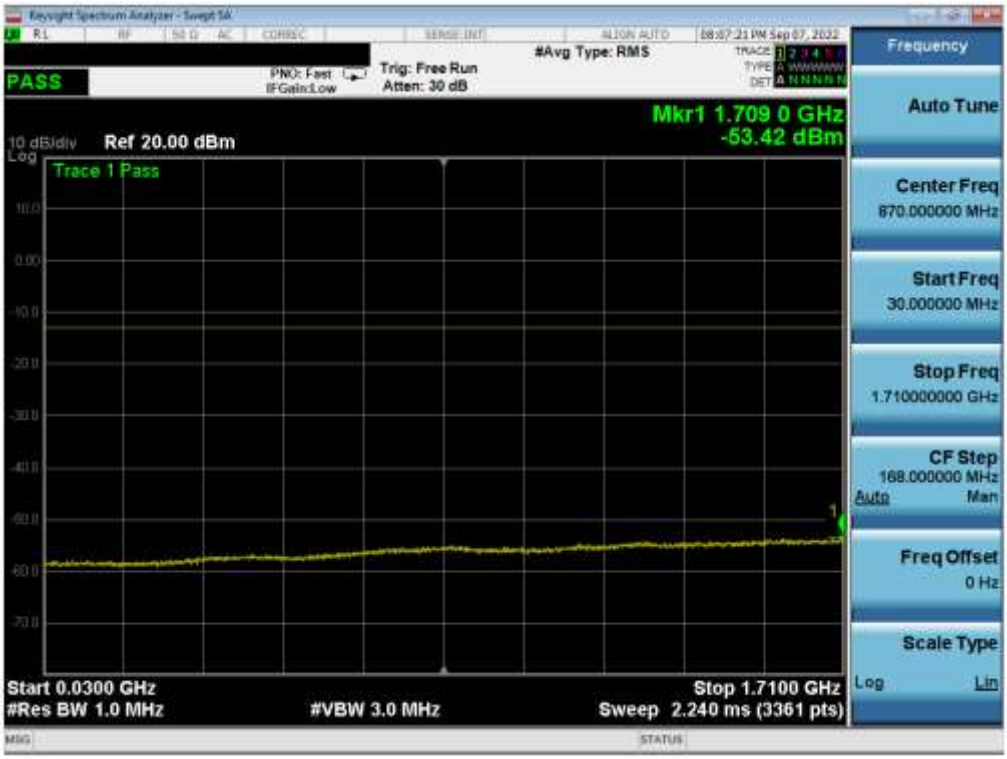
Plot 7-36. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - 1 RB)

LTE Band 66/4

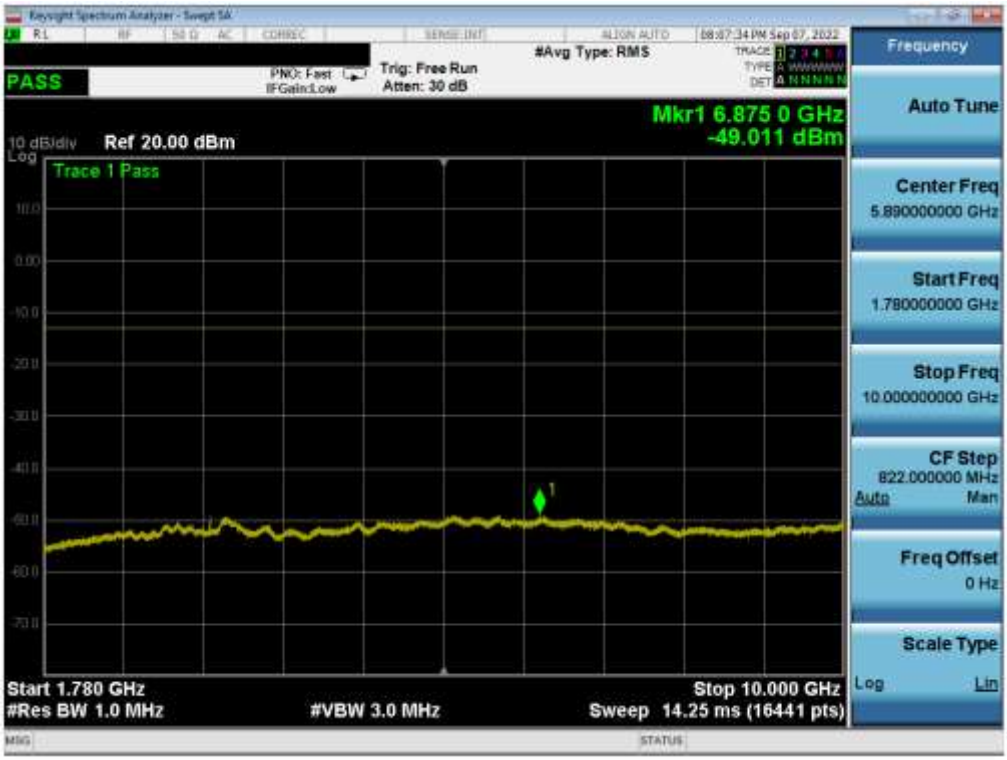
Plot 7-37. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - Low Channel)

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)

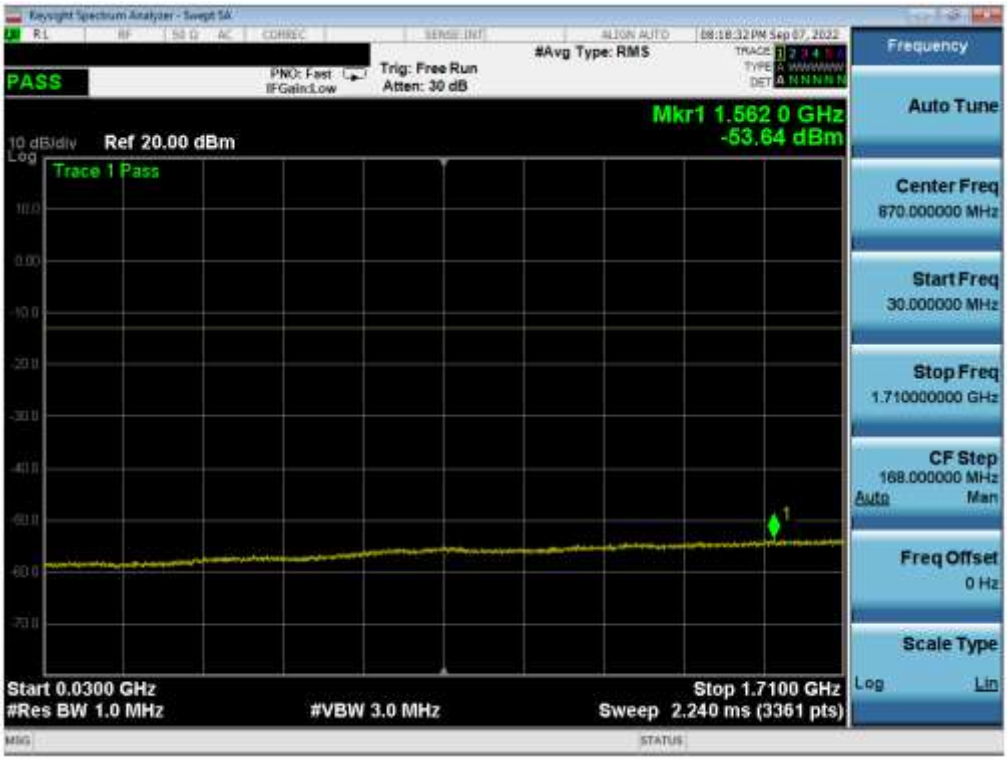


Plot 7-40. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - 1 RB - Mid Channel)



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 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 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 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) is $65 + 10 \log_{10}(P) = -35$dBm 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)

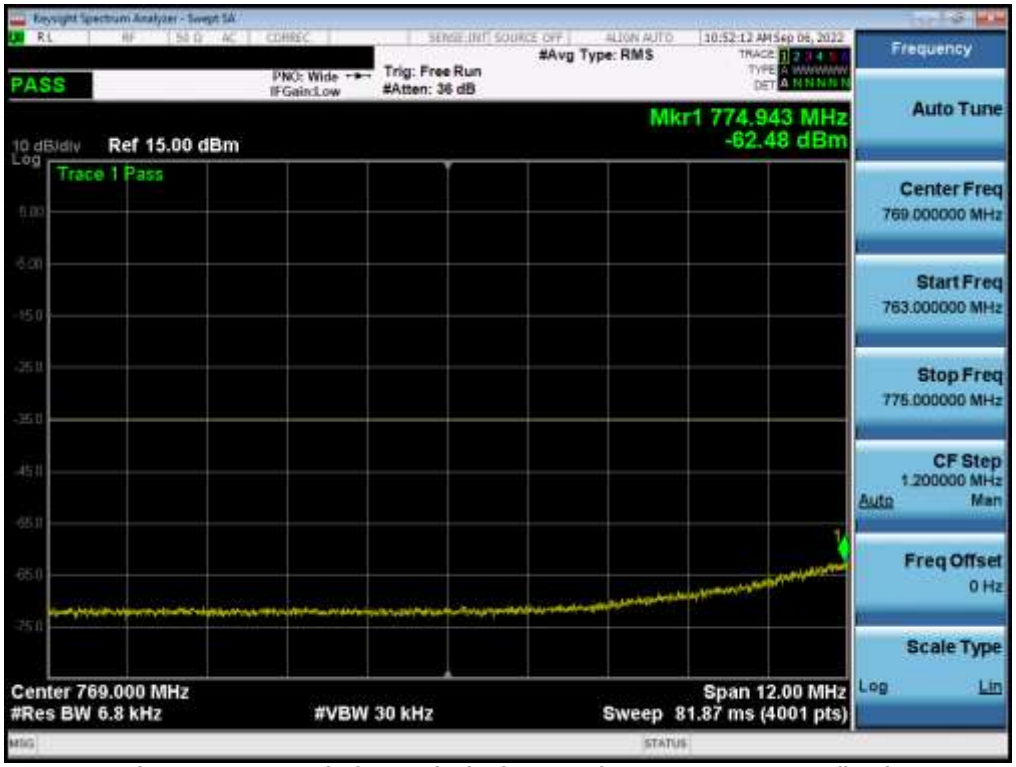
Plot 7-51. Upper Band Edge Plot (LTE Band 12 - 3MHz QPSK – Full RB)

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)

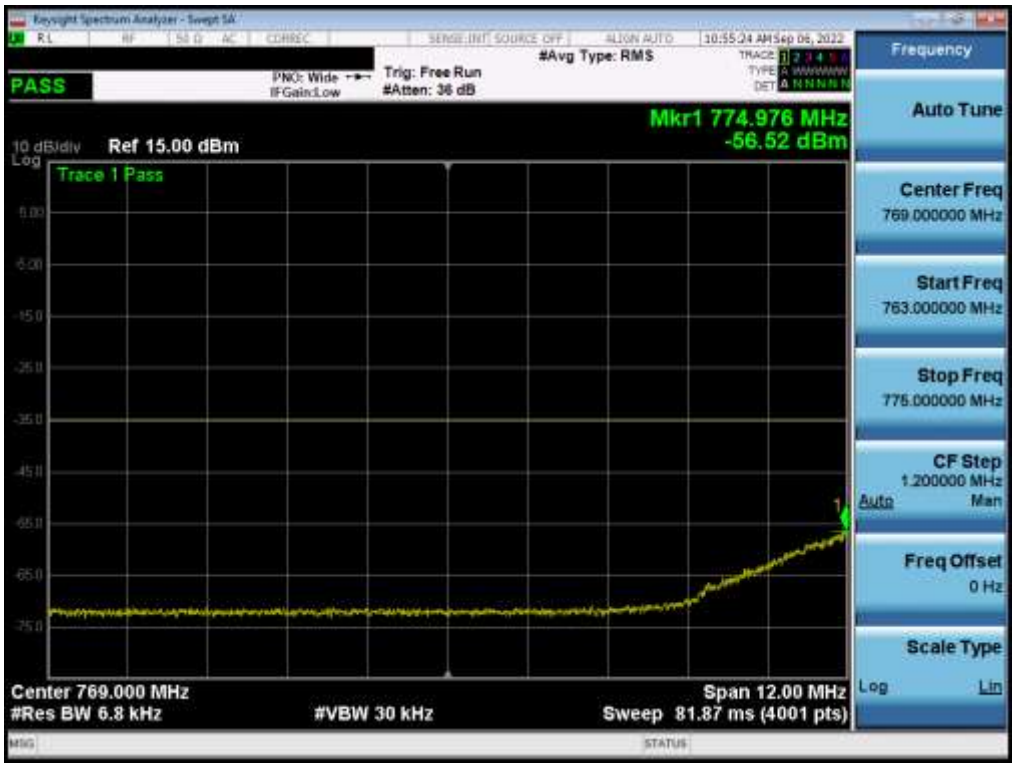


Plot 7-55. Lower Emission Mask Plot (LTE Band 13 - 10MHz QPSK – Full RB)

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)



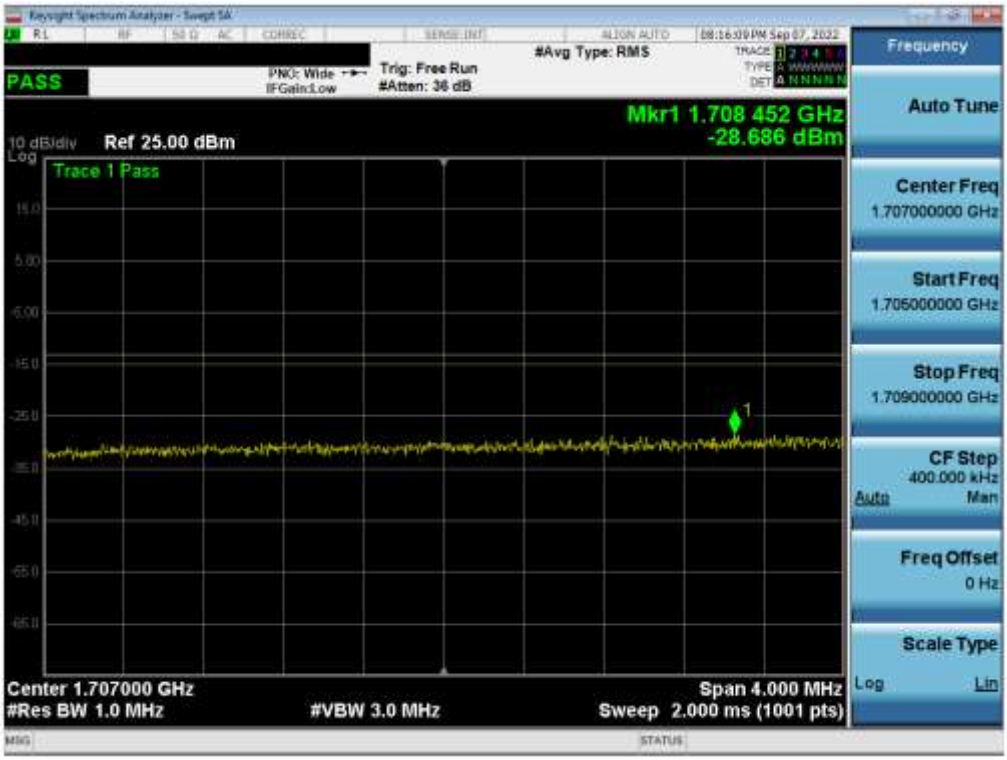
Plot 7-59. Lower Emission Mask Plot (LTE Band 13 - 5MHz QPSK – Full RB)

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)

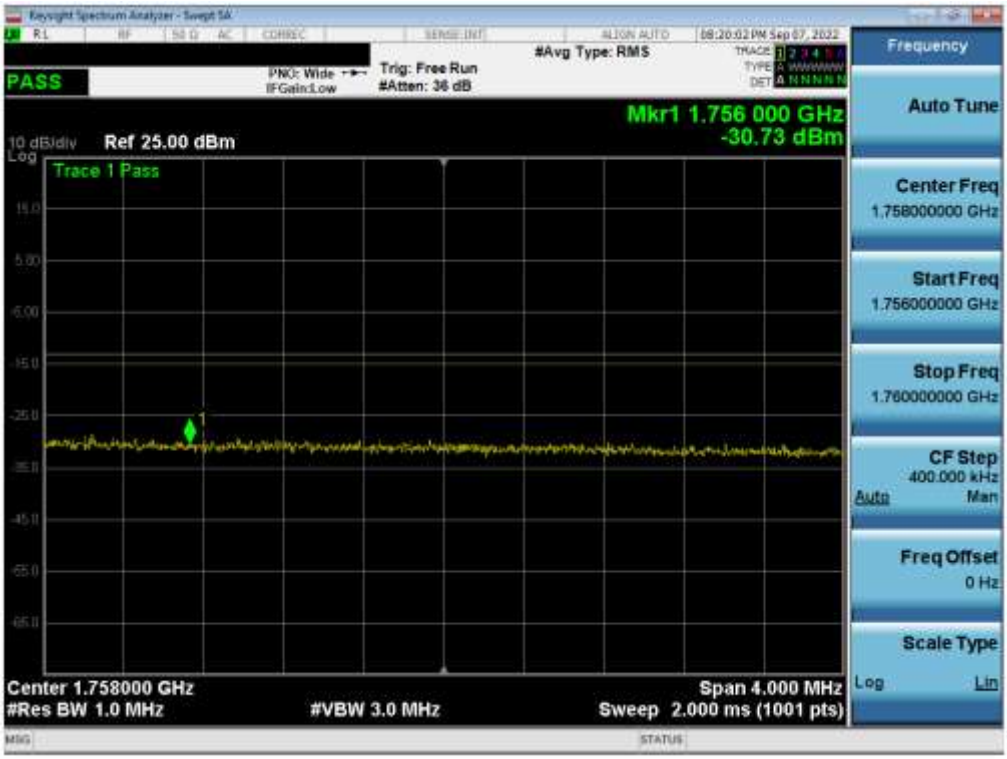
LTE Band 66/4

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



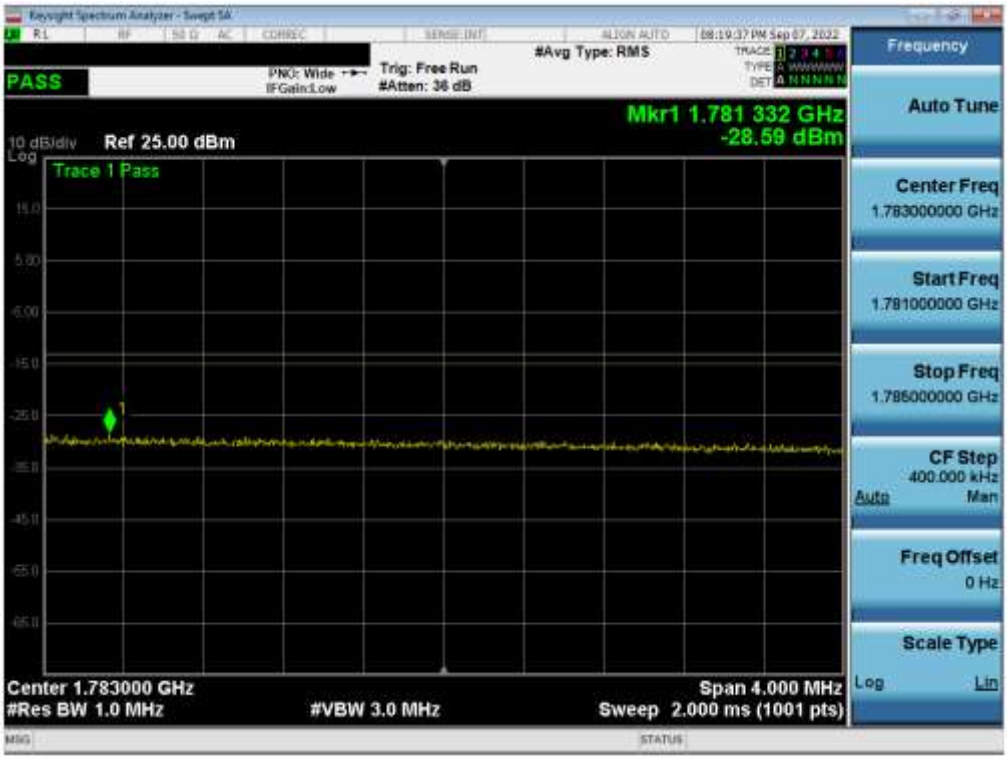
Plot 7-63. Lower Extended Band Edge Plot (LTE Band 66/4 - 20MHz QPSK – Full RB)

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



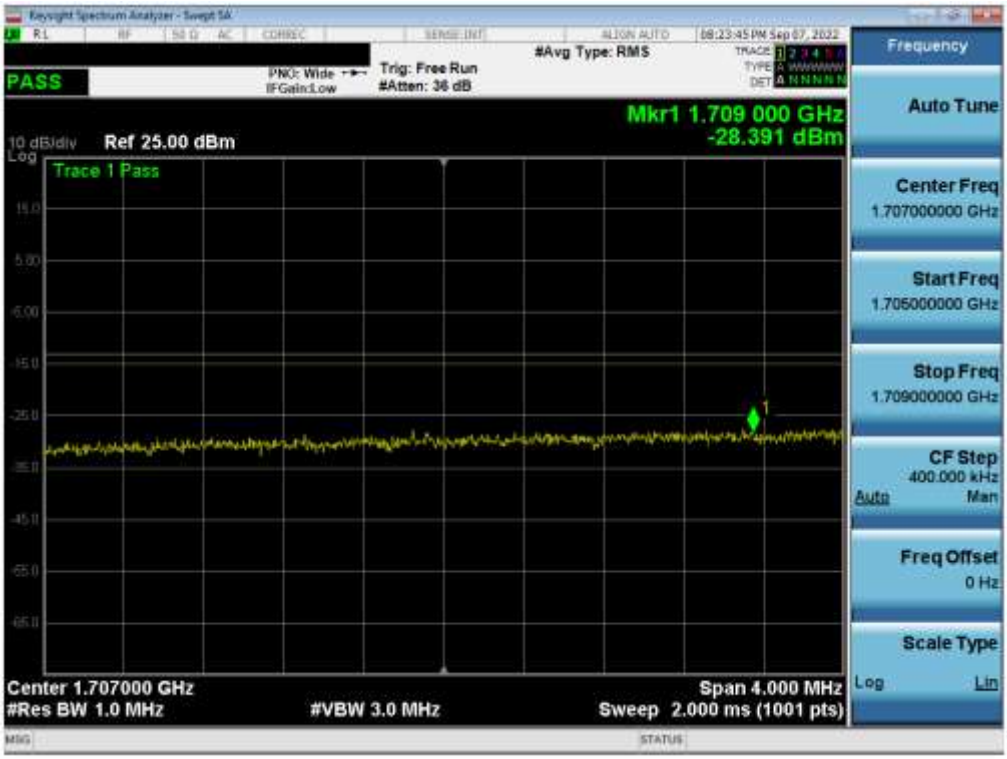
Plot 7-65. Upper Extended Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)

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



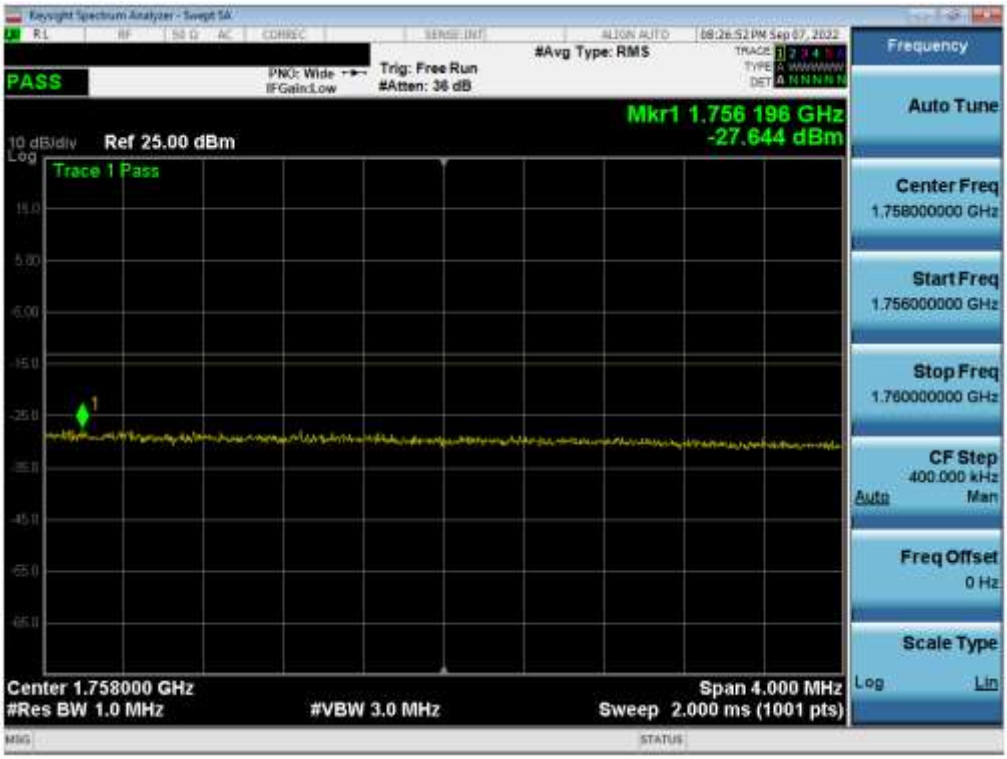
Plot 7-67. Channel Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)

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



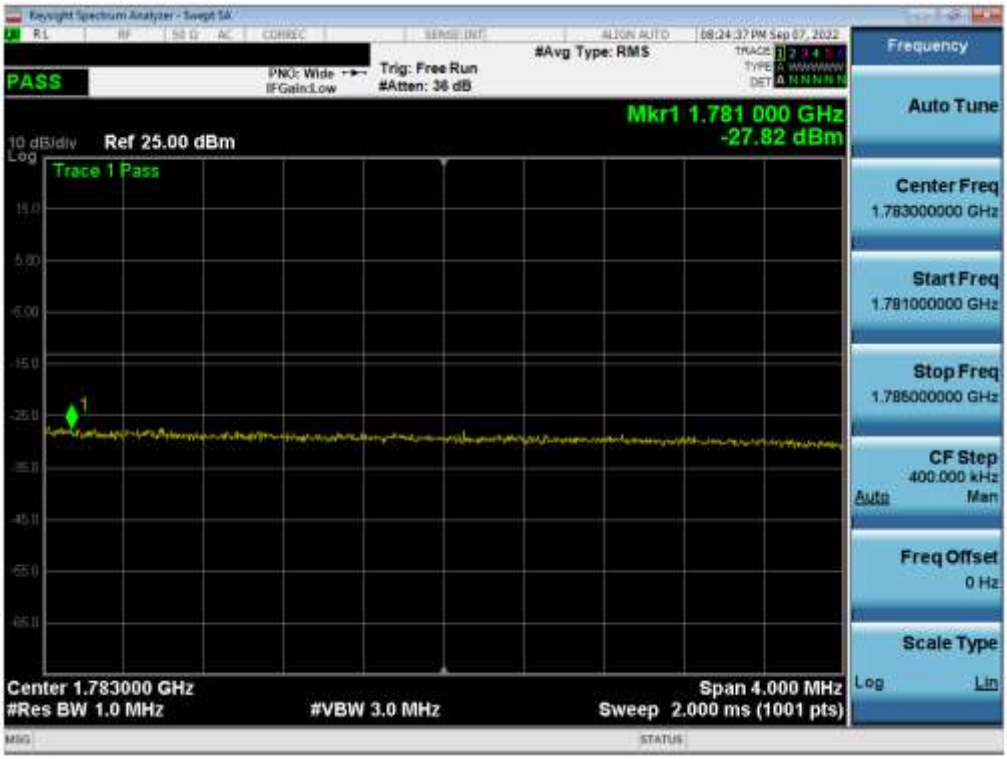
Plot 7-69. Lower Extended Band Edge Plot (LTE Band 66/4 - 15MHz QPSK – Full RB)

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



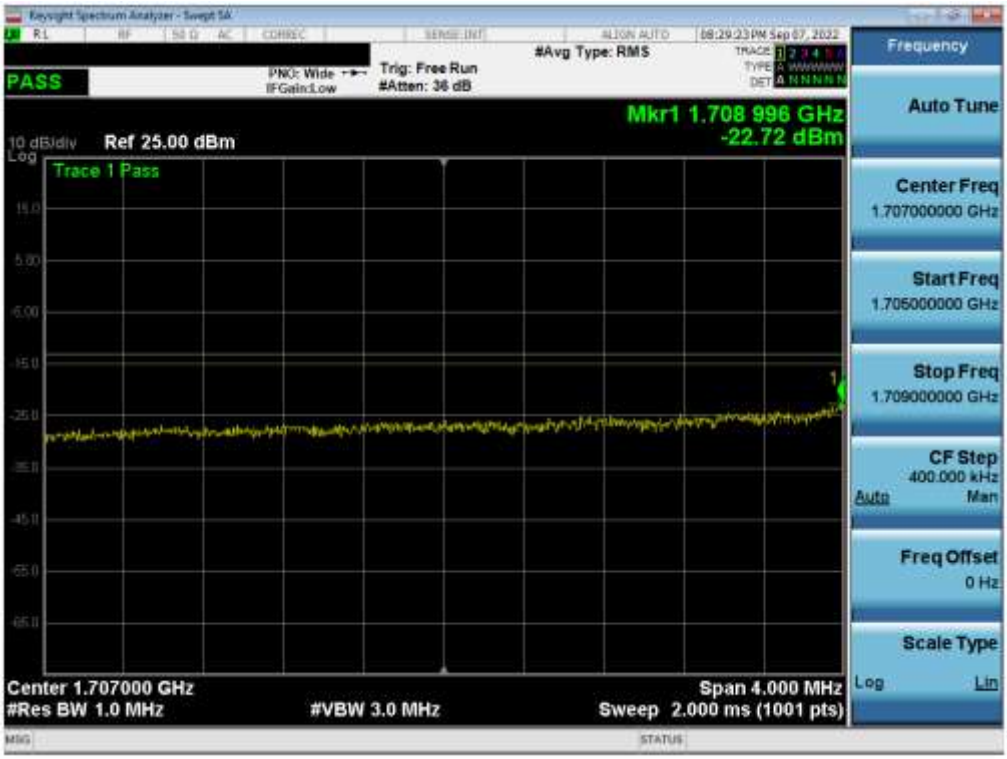
Plot 7-71. Upper Extended Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)

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)

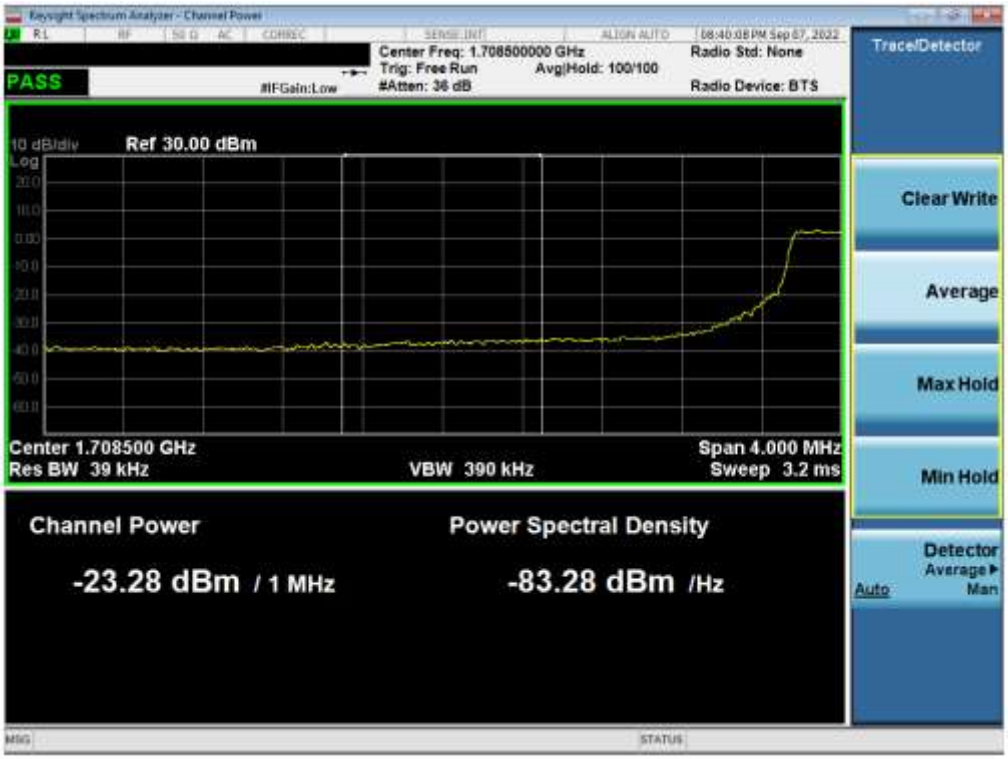
Plot 7-76. Upper Band Edge Plot (LTE Band 4 - 10MHz QPSK – Full RB)

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)

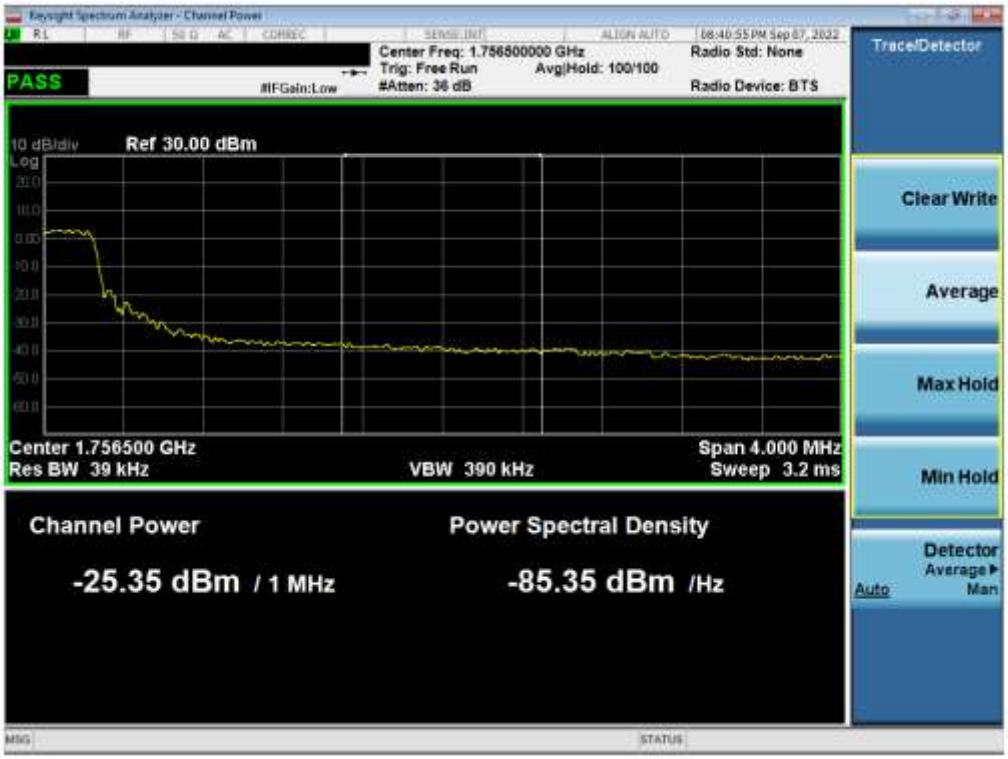
Plot 7-79. Upper Extended Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)

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



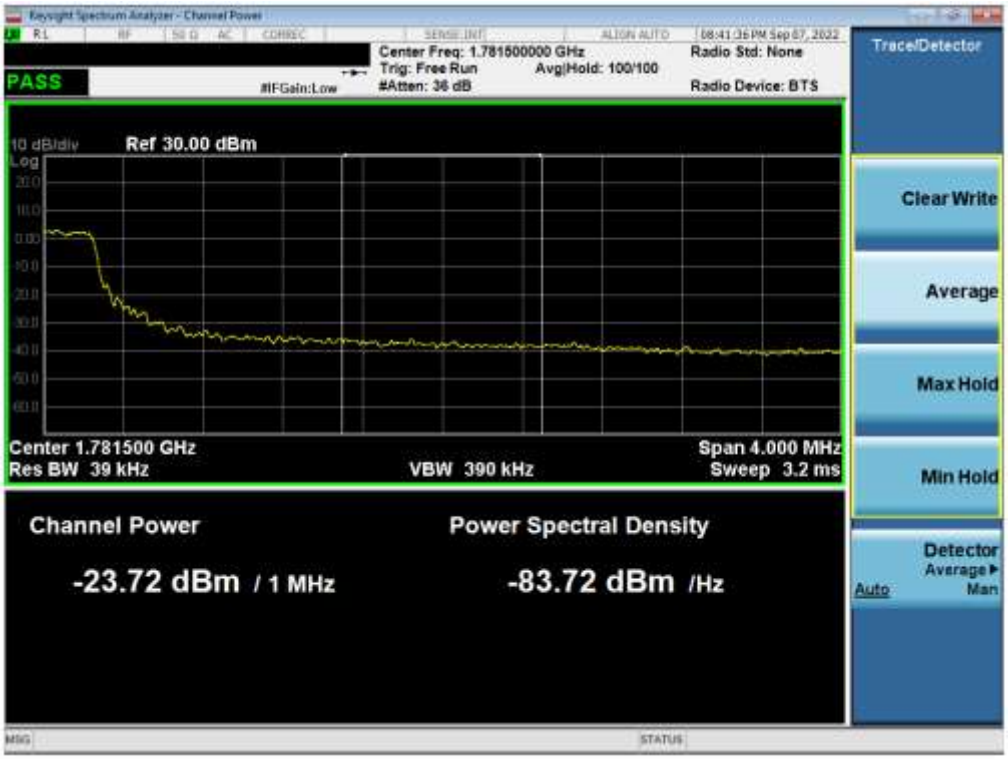
Plot 7-81. Lower Extended Band Edge Plot (LTE Band 66/4 - 5MHz QPSK – Full RB)

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



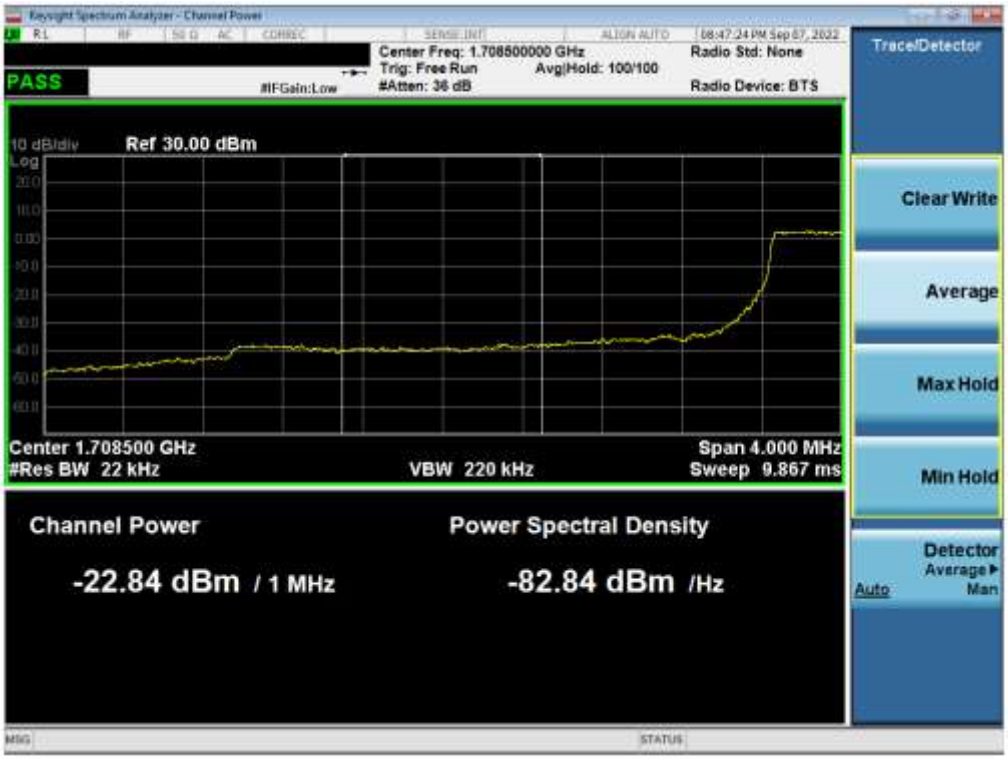
Plot 7-83. Upper Extended Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)

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



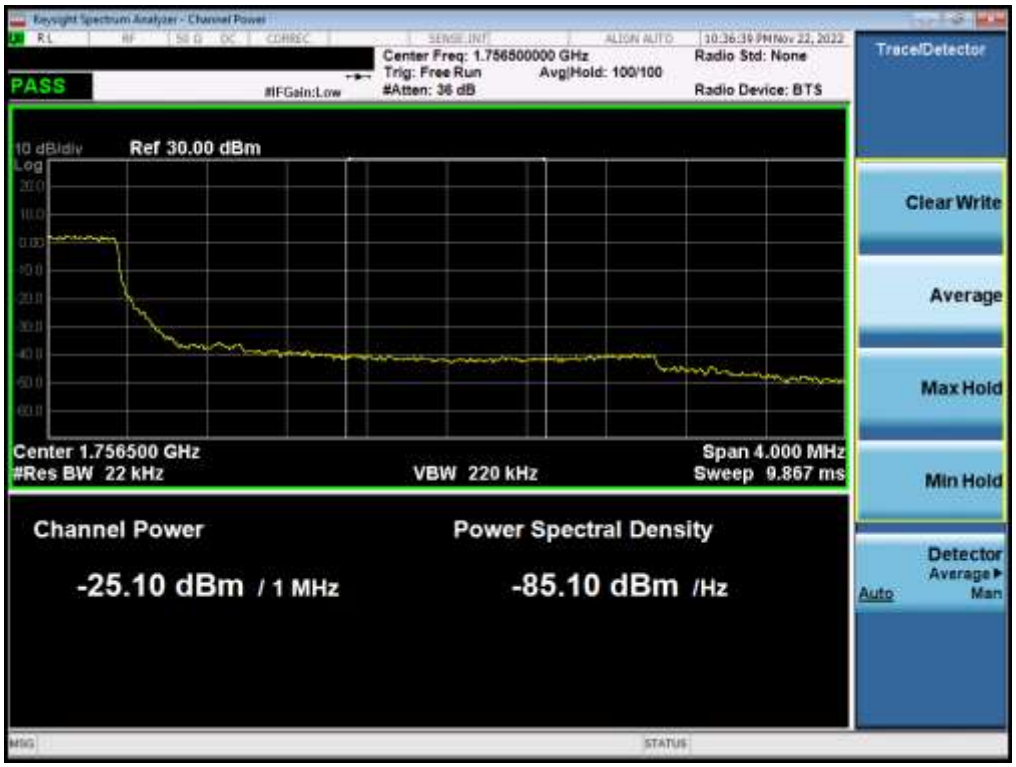
Plot 7-85. Upper Extended Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)

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



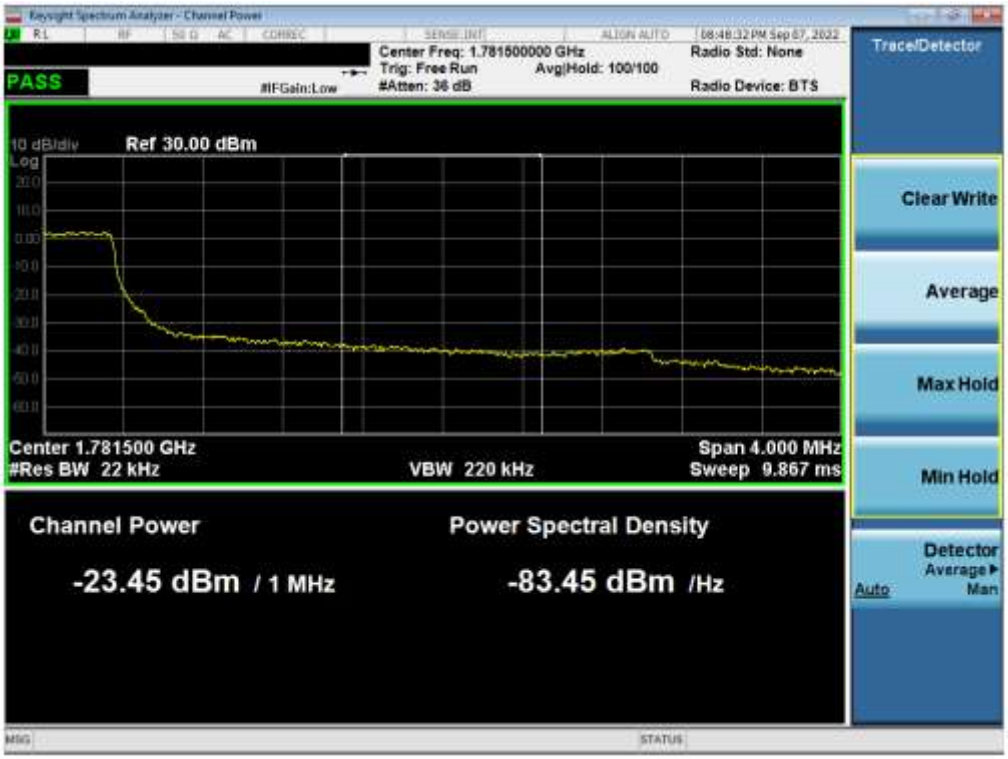
Plot 7-87. Lower Extended Band Edge Plot (LTE Band 66/4 - 3MHz QPSK – Full RB)

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



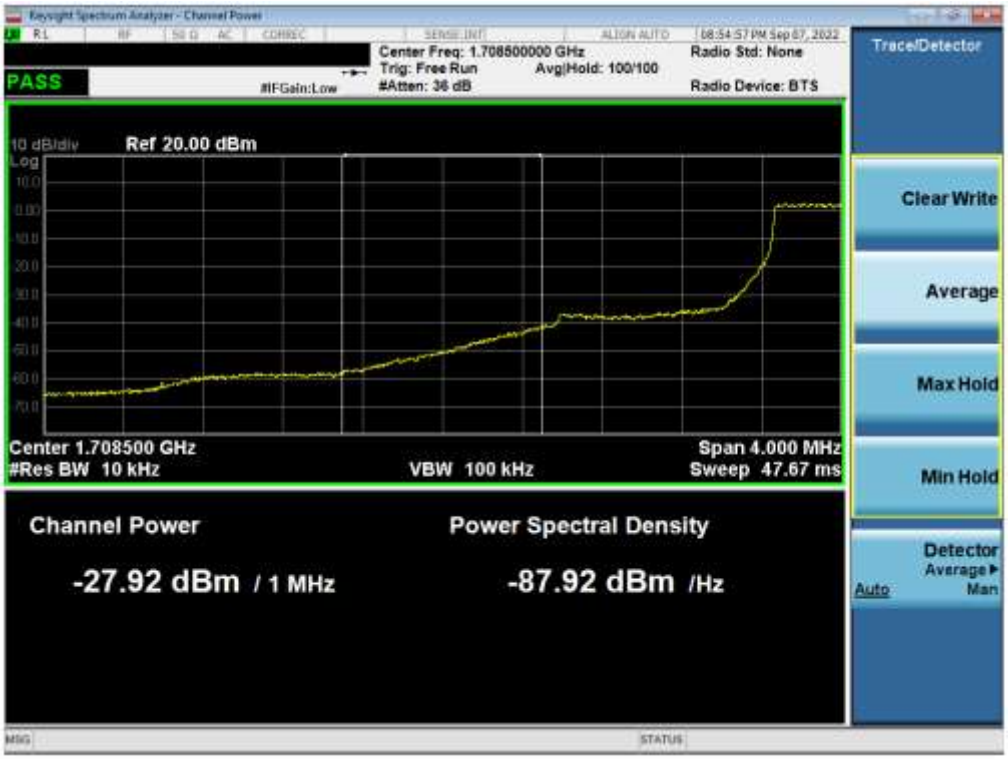
Plot 7-89. Upper Extended Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)

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



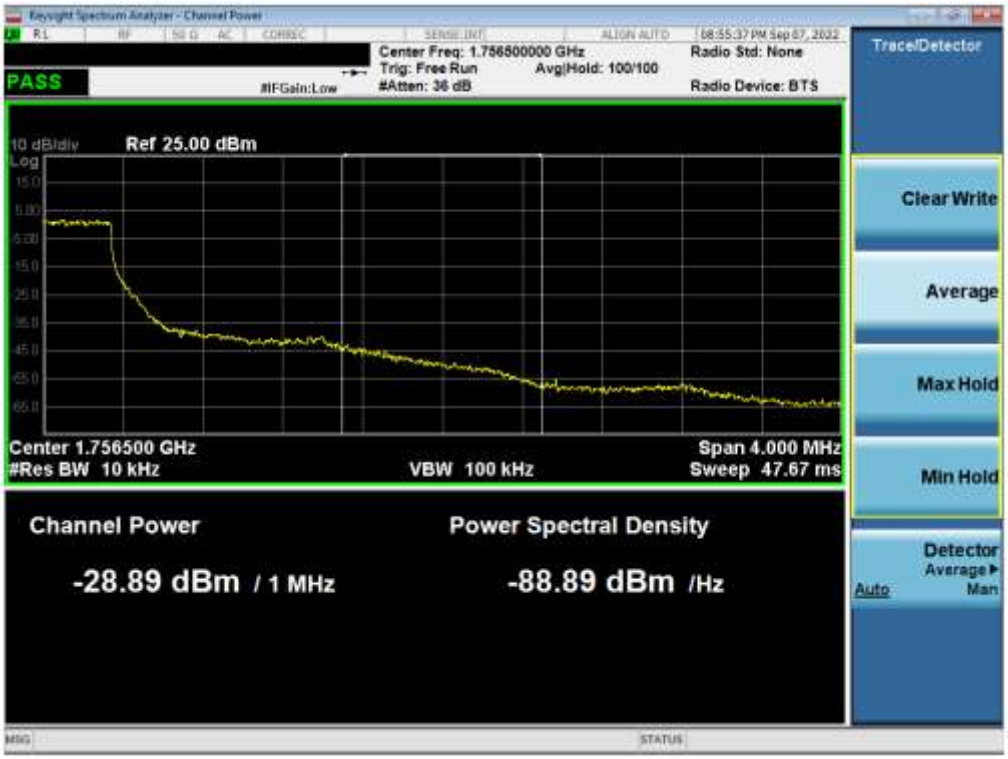
Plot 7-91. Upper Extended Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)

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



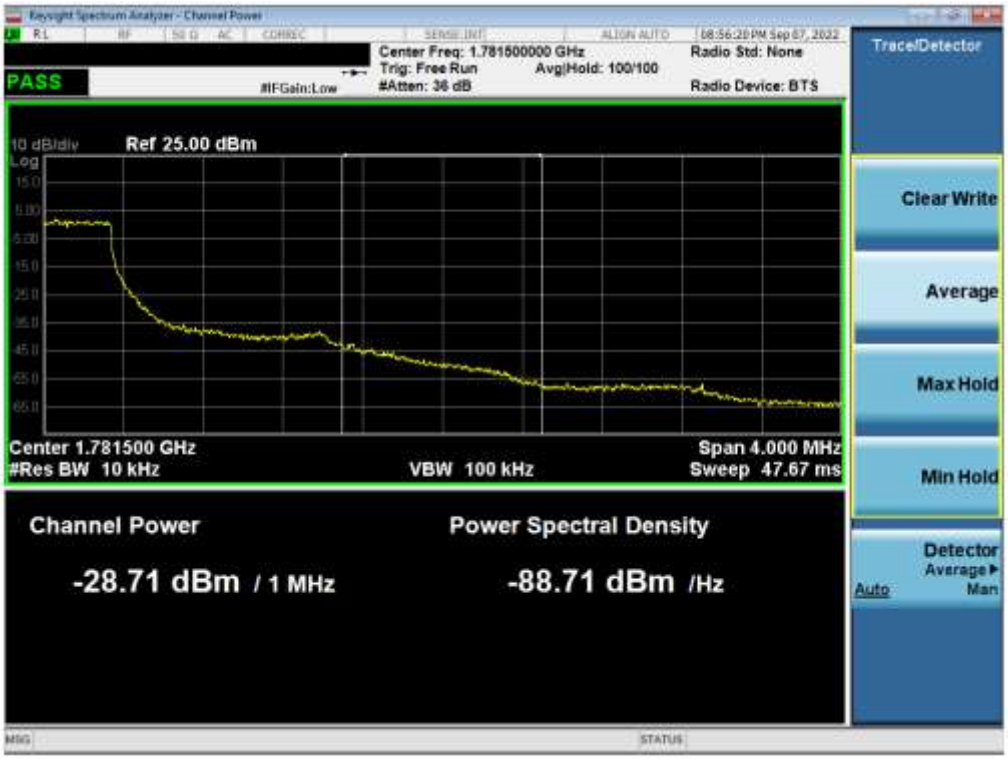
Plot 7-93. Lower Extended Band Edge Plot (LTE Band 66/4 – 1.4MHz QPSK – Full RB)

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

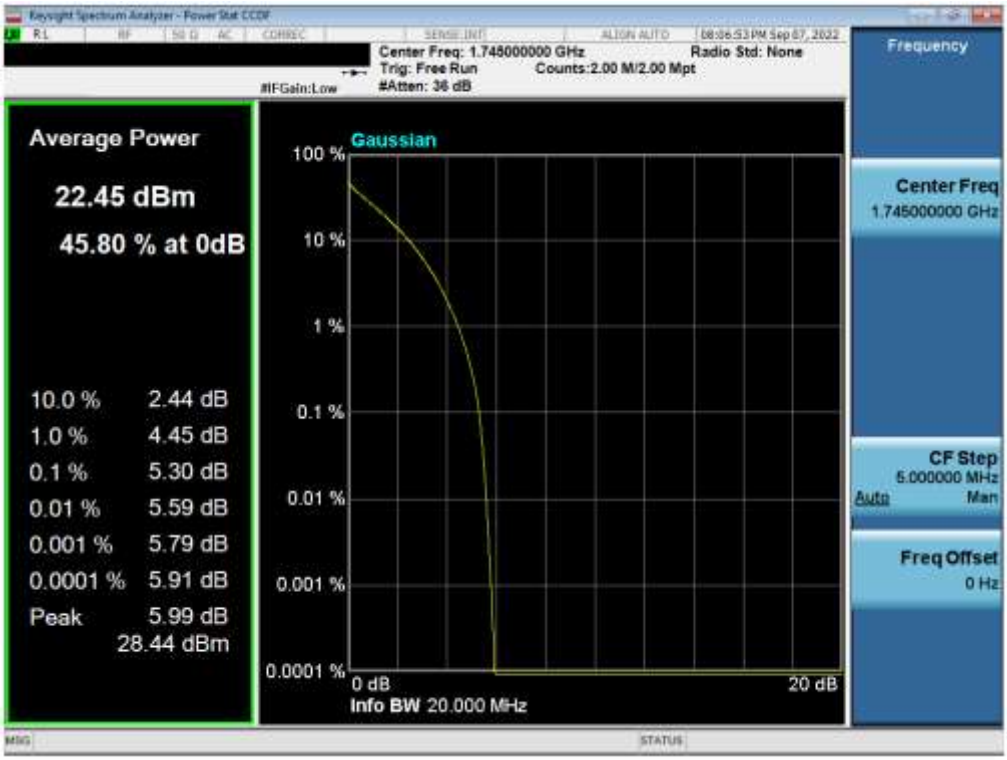
The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-5. Test Instrument & Measurement Setup

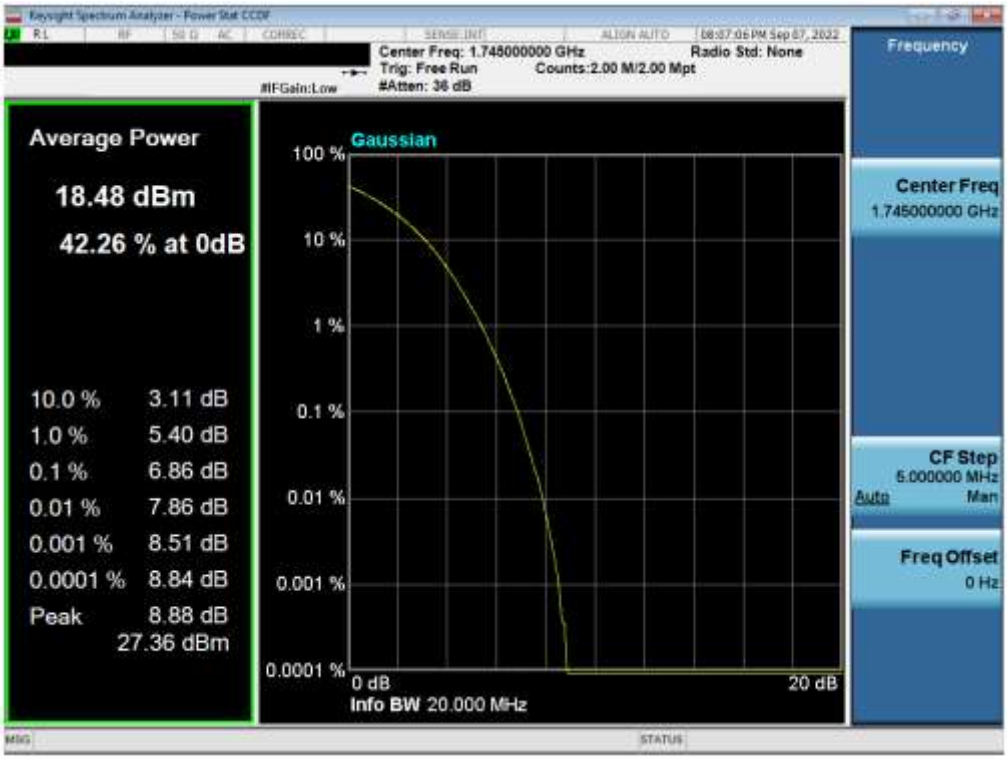
Test Notes

None.

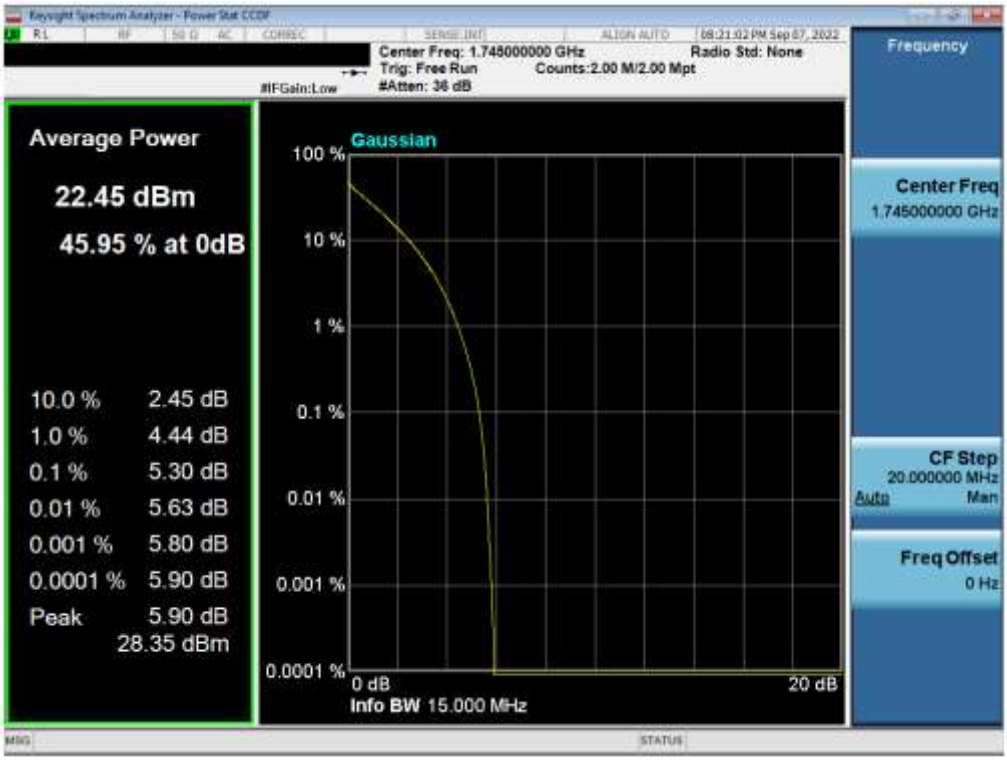
LTE Band 66/4



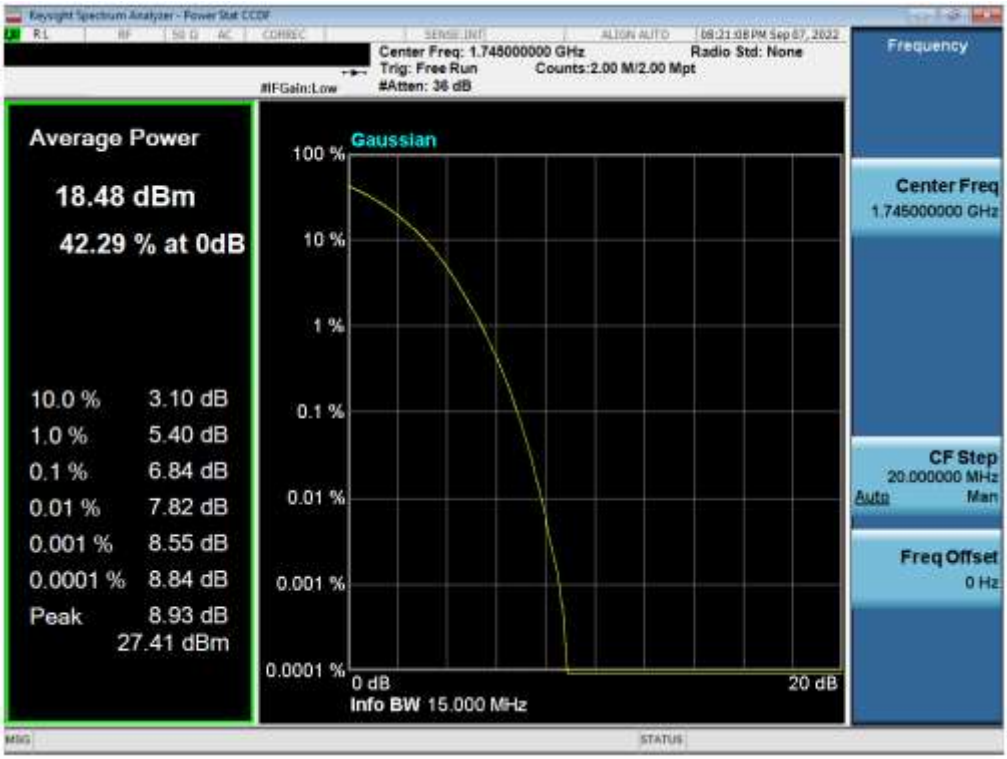
Plot 7-98. PAR Plot (LTE Band 66/4 - 20MHz QPSK - Full RB)



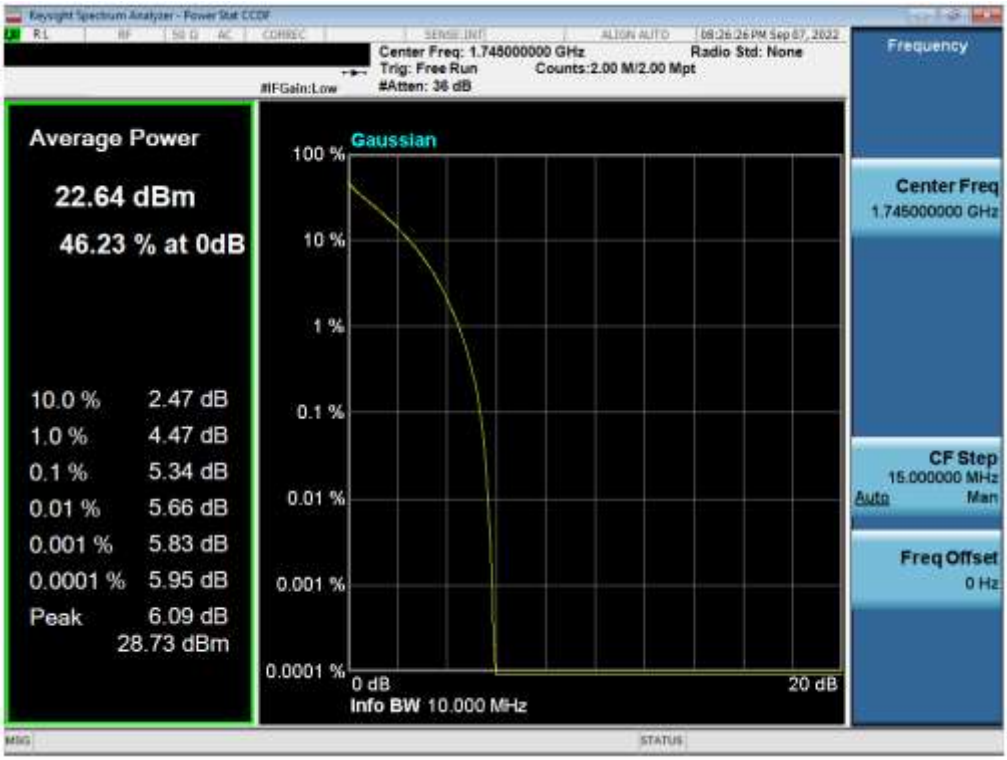
Plot 7-99. PAR Plot (LTE Band 66/4 - 20MHz 256-QAM - Full RB)



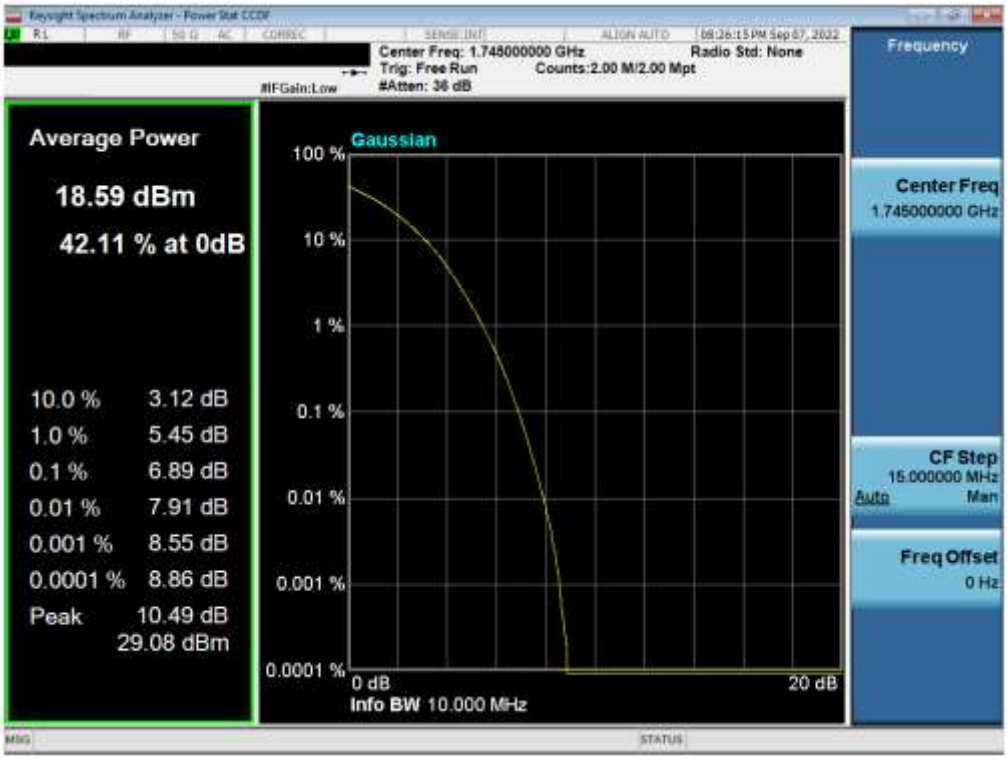
Plot 7-100. PAR Plot (LTE Band 66/4 - 15MHz QPSK - Full RB)



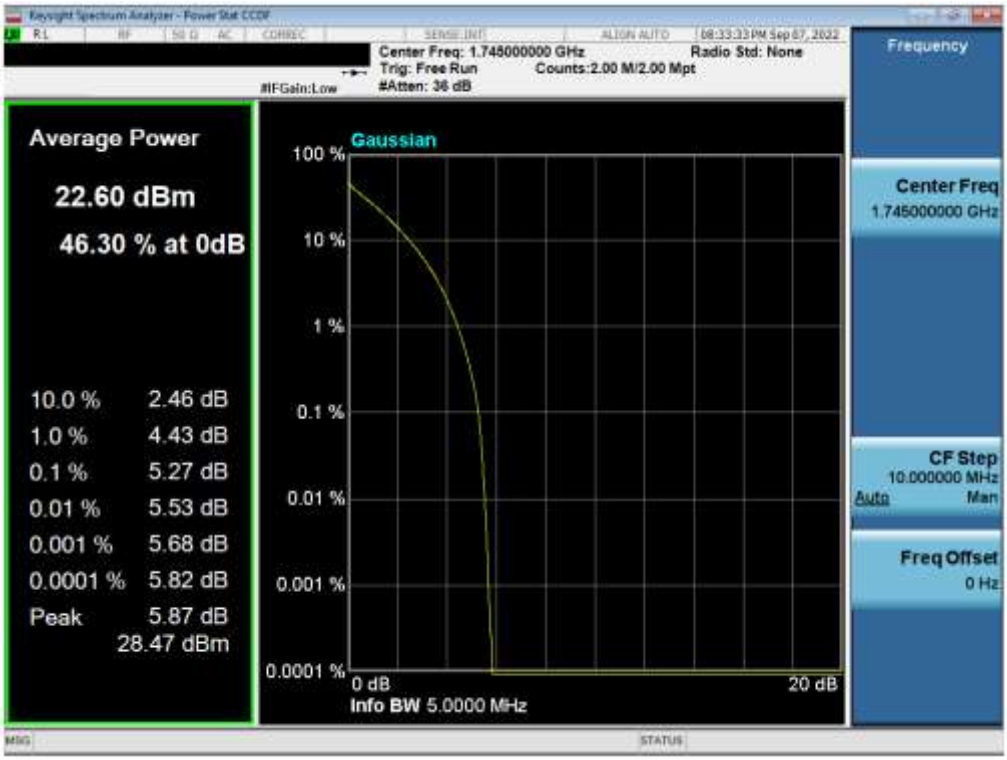
Plot 7-101. PAR Plot (LTE Band 66/4 - 15MHz 256-QAM - Full RB)



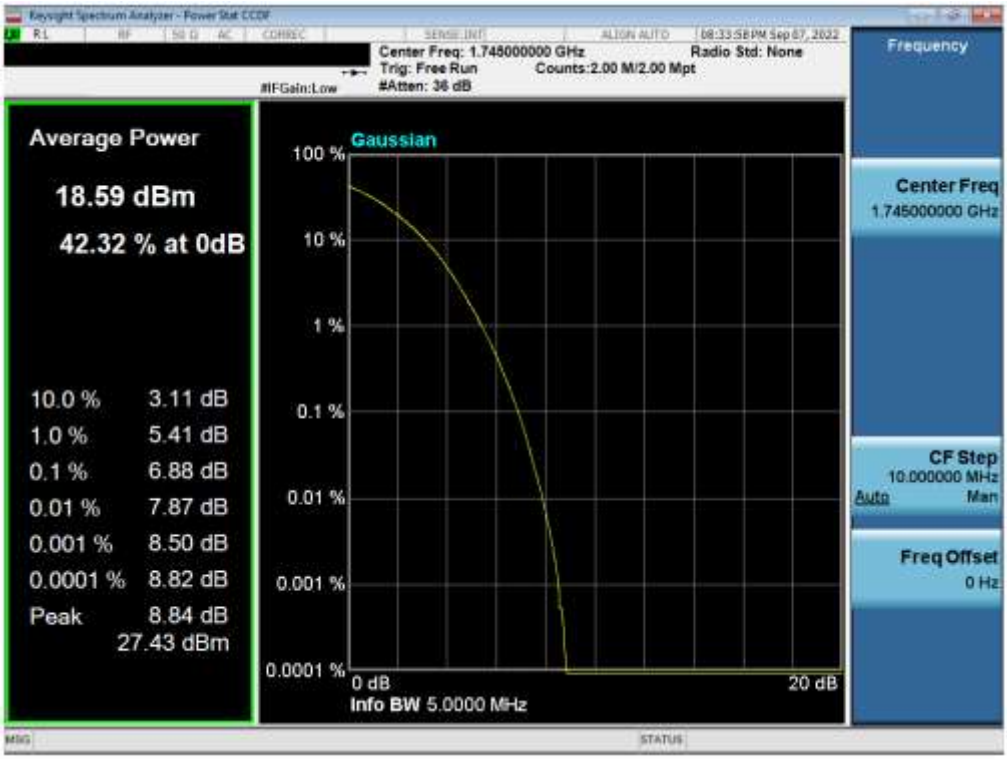
Plot 7-102. PAR Plot (LTE Band 66/4 - 10MHz QPSK - Full RB)



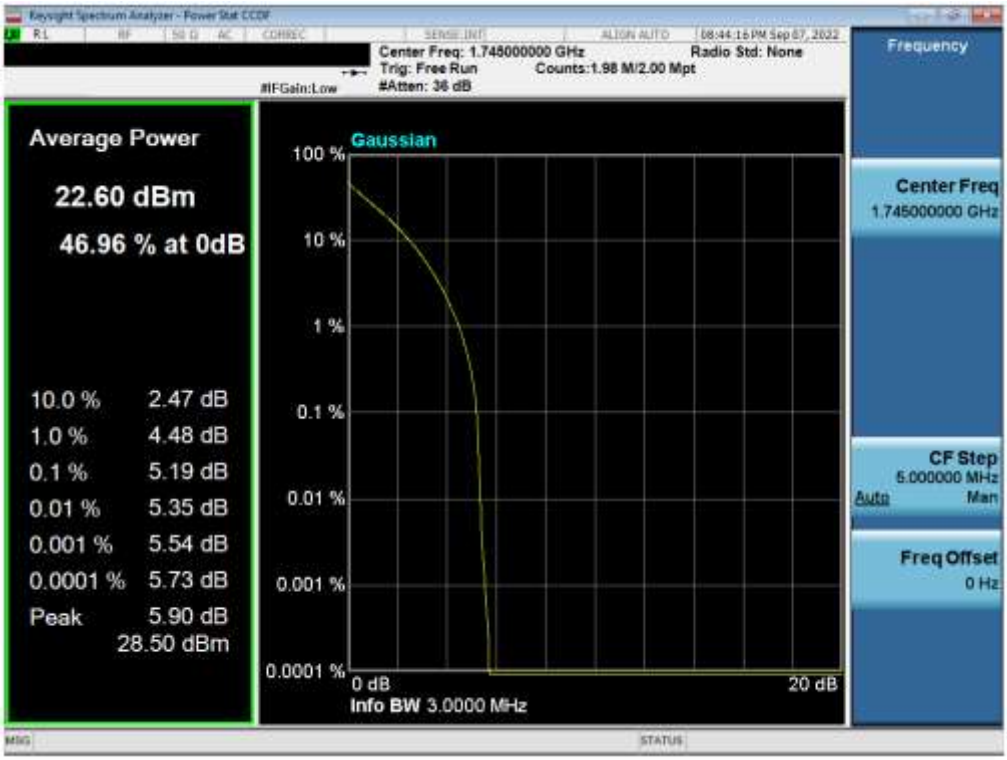
Plot 7-103. PAR Plot (LTE Band 66/4 - 10MHz 256-QAM - Full RB)



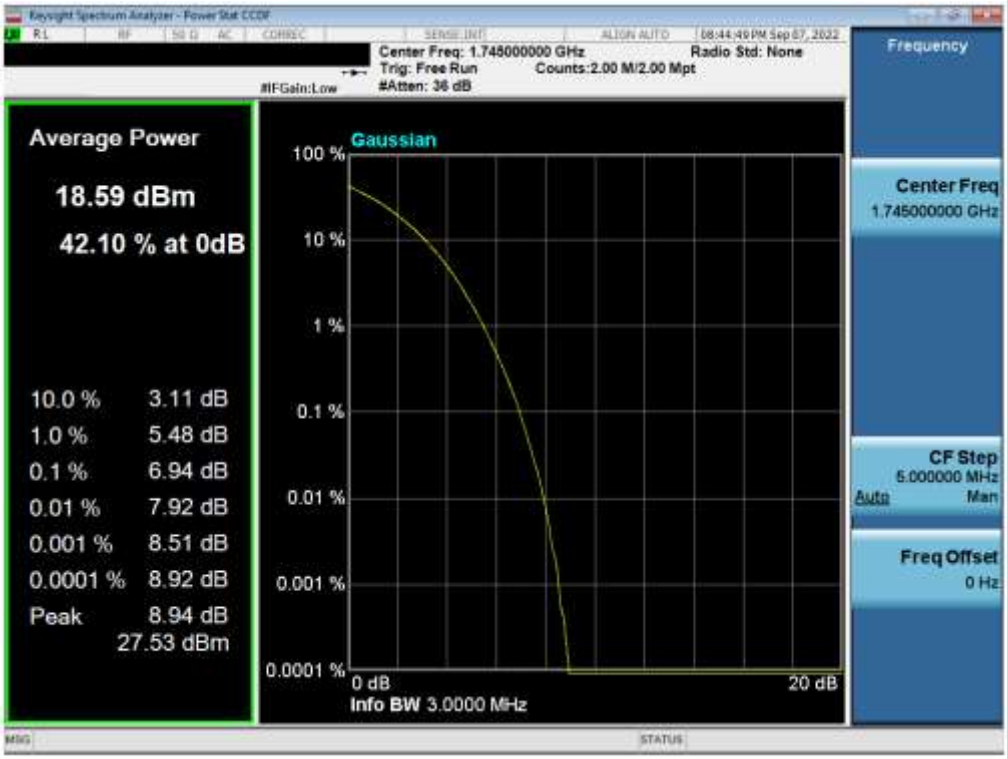
Plot 7-104. PAR Plot (LTE Band 66/4 - 5MHz QPSK - Full RB)



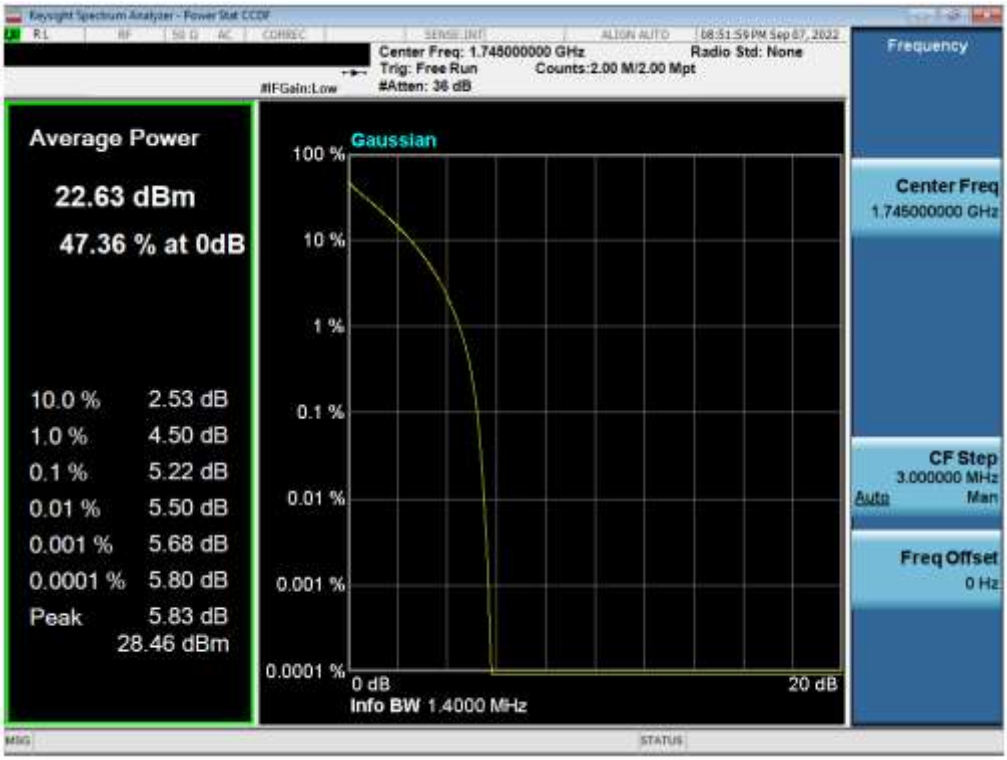
Plot 7-105. PAR Plot (LTE Band 66/4 - 5MHz 256-QAM - Full RB)



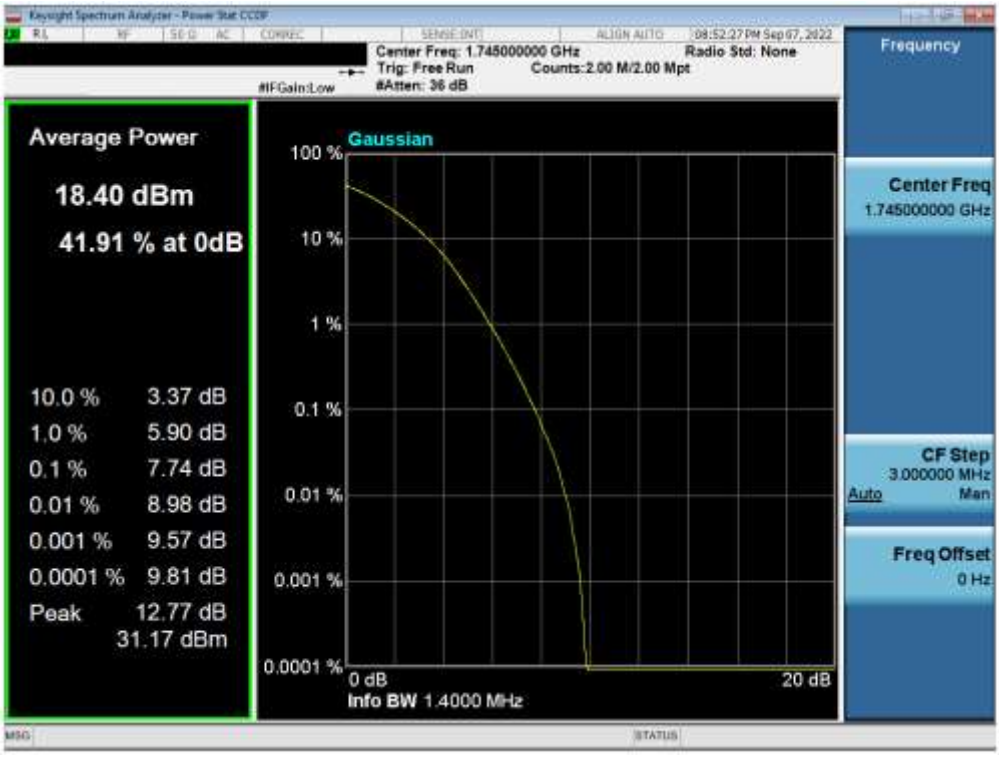
Plot 7-106. PAR Plot (LTE Band 66/4 - 3MHz QPSK - Full RB)



Plot 7-107. PAR Plot (LTE Band 66/4 - 3MHz 256-QAM - Full RB)



Plot 7-108. PAR Plot (LTE Band 66/4 - 1.4MHz QPSK - Full RB)



Plot 7-109. PAR Plot (LTE Band 66/4 - 1.4MHz 256-QAM - Full RB)

7.7 Radiated Power (ERP/EIRP)

Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI C63.26-2015 with the EUT transmitting into an integral antenna. Measurements are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

ANSI C63.26-2015 – Section 5.2.4.4

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Setup

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

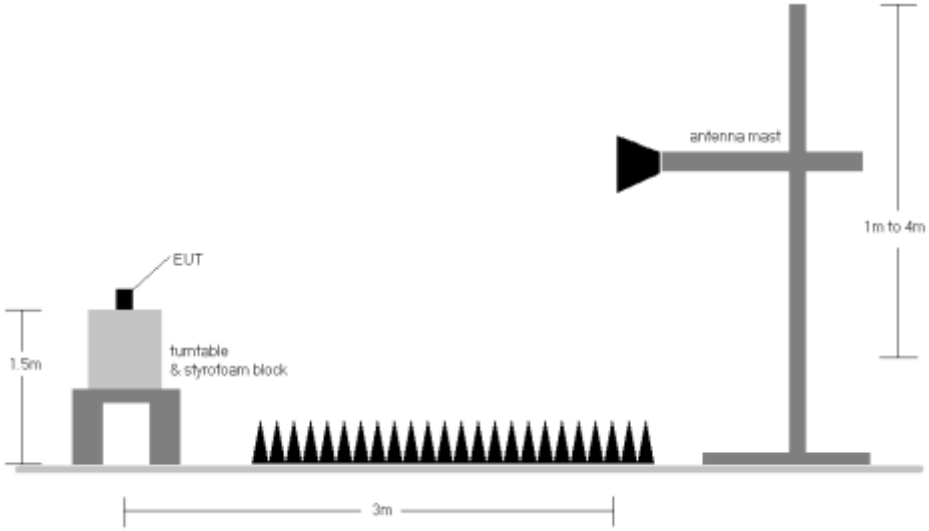


Figure 7-6. Radiated Test Setup <1GHz

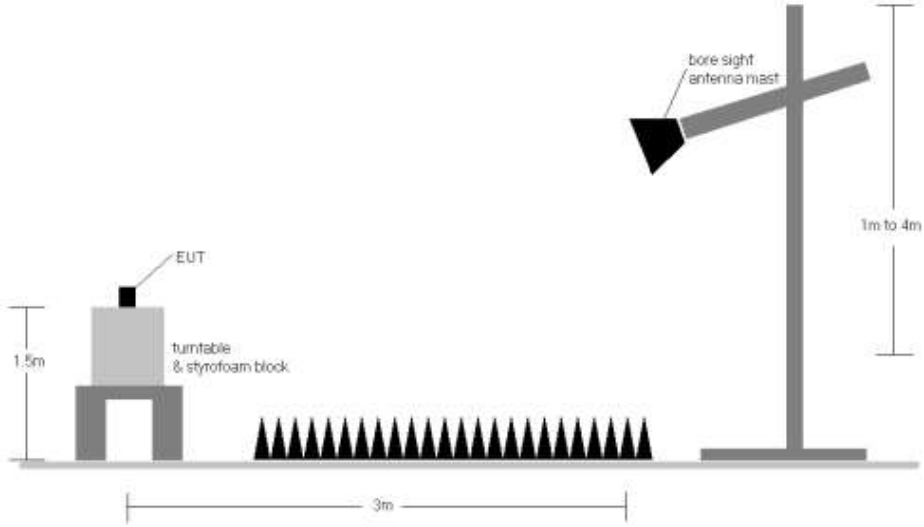


Figure 7-7. Radiated Test Setup >1GHz

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
10 MHz	QPSK	704.00	H	257	160	3.48	1 / 25	16.21	19.69	0.093	36.99	-17.30	17.54	0.057	34.77	-17.23
	QPSK	707.50	H	257	154	3.52	1 / 25	15.76	19.28	0.085	36.99	-17.71	17.13	0.052	34.77	-17.64
	QPSK	711.00	H	257	174	3.57	1 / 25	16.85	**20.42**	0.110	36.99	-16.57	**18.27**	0.067	34.77	-16.50
	16-QAM	711.00	H	257	174	3.57	1 / 25	16.28	19.85	0.097	36.99	-17.14	17.70	0.059	34.77	-17.07
5 MHz	QPSK	701.50	H	257	166	3.45	1 / 12	16.07	19.52	0.090	36.99	-17.47	17.37	0.055	34.77	-17.40
	QPSK	707.50	H	257	154	3.52	1 / 12	15.75	19.27	0.085	36.99	-17.71	17.12	0.052	34.77	-17.65
	QPSK	713.50	H	257	174	3.70	1 / 12	16.75	**20.45**	0.111	36.99	-16.54	**18.30**	0.068	34.77	-16.47
	16-QAM	713.50	H	257	174	3.70	1 / 24	16.11	19.81	0.096	36.99	-17.18	17.66	0.058	34.77	-17.11
3 MHz	QPSK	700.50	H	257	166	3.39	1 / 7	16.13	19.52	0.090	36.99	-17.47	17.37	0.055	34.77	-17.40
	QPSK	707.50	H	257	154	3.52	1 / 0	15.69	19.21	0.083	36.99	-17.78	17.06	0.051	34.77	-17.71
	QPSK	714.50	H	257	174	3.71	1 / 7	16.76	**20.47**	0.111	36.99	-16.52	**18.32**	0.068	34.77	-16.46
	16-QAM	714.50	H	257	174	3.71	1 / 0	16.17	19.88	0.097	36.99	-17.11	17.73	0.059	34.77	-17.05
1.4 MHz	QPSK	699.70	H	257	166	3.33	1 / 0	16.26	19.58	0.091	36.99	-17.41	17.43	0.055	34.77	-17.34
	QPSK	707.50	H	257	154	3.52	1 / 3	15.87	19.39	0.087	36.99	-17.59	17.24	0.053	34.77	-17.53
	QPSK	715.30	H	257	174	3.72	1 / 5	16.70	**20.42**	0.110	36.99	-16.57	**18.27**	0.067	34.77	-16.50
	16-QAM	715.30	H	257	174	3.72	1 / 5	16.09	19.81	0.096	36.99	-17.18	17.66	0.058	34.77	-17.11
10 MHz	Opposite Pol.	711.00	V	163	207	3.67	1 / 25	16.33	20.00	0.100	36.99	-16.99	17.85	0.061	34.77	-16.92
	WCP	711.00	H	257	278	3.57	1 / 49	13.61	17.58	0.057	36.99	-19.41	15.03	0.032	34.77	-19.74

Table 7-3. ERP Data (LTE Band 12)

Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
10 MHz	QPSK	782.00	H	237	272	6.09	1 / 0	16.06	**22.15**	0.164	36.99	-14.84	**20.00**	0.100	34.77	-14.77
	16-QAM	782.00	H	237	272	6.09	1 / 0	15.22	21.31	0.135	36.99	-15.68	19.16	0.082	34.77	-15.61
5 MHz	QPSK	779.50	H	237	272	5.97	1 / 24	16.31	**22.27**	0.169	36.99	-14.72	**20.12**	0.103	34.77	-14.65
	QPSK	782.00	H	237	272	6.09	1 / 0	15.97	22.06	0.161	36.99	-14.92	19.91	0.098	34.77	-14.86
	QPSK	784.50	H	237	272	6.17	1 / 12	15.90	22.07	0.161	36.99	-14.92	19.92	0.098	34.77	-14.85
	16-QAM	779.50	H	237	272	5.97	1 / 0	15.87	21.83	0.152	36.99	-15.16	19.68	0.093	34.77	-15.09
10 MHz	Opposite Pol.	782.00	V	146	233	5.99	1 / 0	14.99	20.98	0.125	36.99	-16.01	18.83	0.076	34.77	-15.94
	WCP	782.00	H	250	270	6.09	1 / 25	12.62	18.71	0.074	36.99	-18.28	16.56	0.045	34.77	-18.21

Table 7-4. ERP Data (LTE Band 13)

Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
20 MHz	QPSK	1720.00	H	114	197	9.47	1 / 0	12.06	21.53	0.142	30.00	-8.47
	QPSK	1745.00	H	127	202	9.48	1 / 99	12.78	**22.26**	0.168	30.00	-7.74
	QPSK	1770.00	H	172	173	9.39	1 / 99	12.13	21.52	0.142	30.00	-8.48
	16-QAM	1745.00	H	127	202	9.48	1 / 99	11.75	21.23	0.133	30.00	-8.77
15 MHz	QPSK	1717.50	H	114	197	9.49	1 / 0	12.14	21.64	0.146	30.00	-8.36
	QPSK	1745.00	H	127	202	9.48	1 / 37	12.86	**22.34**	0.171	30.00	-7.66
	QPSK	1772.50	H	172	173	9.36	1 / 37	12.24	21.60	0.145	30.00	-8.40
	16-QAM	1745.00	H	127	202	9.48	1 / 37	11.60	21.08	0.128	30.00	-8.92
10 MHz	QPSK	1715.00	H	114	197	9.52	1 / 49	12.12	21.64	0.146	30.00	-8.36
	QPSK	1745.00	H	127	202	9.48	1 / 25	13.02	**22.50**	0.178	30.00	-7.50
	QPSK	1775.00	H	172	173	9.34	1 / 25	12.37	21.70	0.148	30.00	-8.30
	16-QAM	1745.00	H	127	202	9.48	1 / 25	11.74	21.22	0.133	30.00	-8.78
5 MHz	QPSK	1712.50	H	114	197	9.54	1 / 24	12.09	21.63	0.146	30.00	-8.37
	QPSK	1745.00	H	127	202	9.48	1 / 24	12.87	**22.35**	0.172	30.00	-7.65
	QPSK	1777.50	H	172	173	9.31	1 / 0	12.36	21.68	0.147	30.00	-8.32
	16-QAM	1745.00	H	127	202	9.48	1 / 24	11.76	21.24	0.133	30.00	-8.76
3 MHz	QPSK	1711.50	H	114	197	9.55	1 / 7	12.21	21.76	0.150	30.00	-8.24
	QPSK	1745.00	H	127	202	9.48	1 / 7	12.99	**22.47**	0.177	30.00	-7.53
	QPSK	1778.50	H	172	173	9.30	1 / 7	12.39	21.70	0.148	30.00	-8.30
	16-QAM	1745.00	H	127	202	9.48	1 / 7	11.80	21.28	0.134	30.00	-8.72
1.4 MHz	QPSK	1710.70	H	114	197	9.56	1 / 0	12.06	21.62	0.145	30.00	-8.38
	QPSK	1745.00	H	127	202	9.48	1 / 0	12.95	**22.43**	0.175	30.00	-7.57
	QPSK	1779.30	H	172	173	9.29	1 / 3	12.29	21.58	0.144	30.00	-8.42
	16-QAM	1745.00	H	127	202	9.48	1 / 0	11.82	21.30	0.135	30.00	-8.70
20 MHz	Opposite Pol.	1745.00	V	115	307	9.03	1 / 50	11.33	20.36	0.109	30.00	-9.64
	WCP	1745.00	H	172	166	9.48	1 / 99	10.69	20.17	0.104	30.00	-9.83

Table 7-5. EIRP Data (LTE Band 66/4)

7.8 Radiated Spurious Emissions Measurements

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in ANSI C63.26-2015 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using hybrid (biconical/log) antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

ANSI C63.26-2015 – Section 5.5.4

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

Test Setup

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

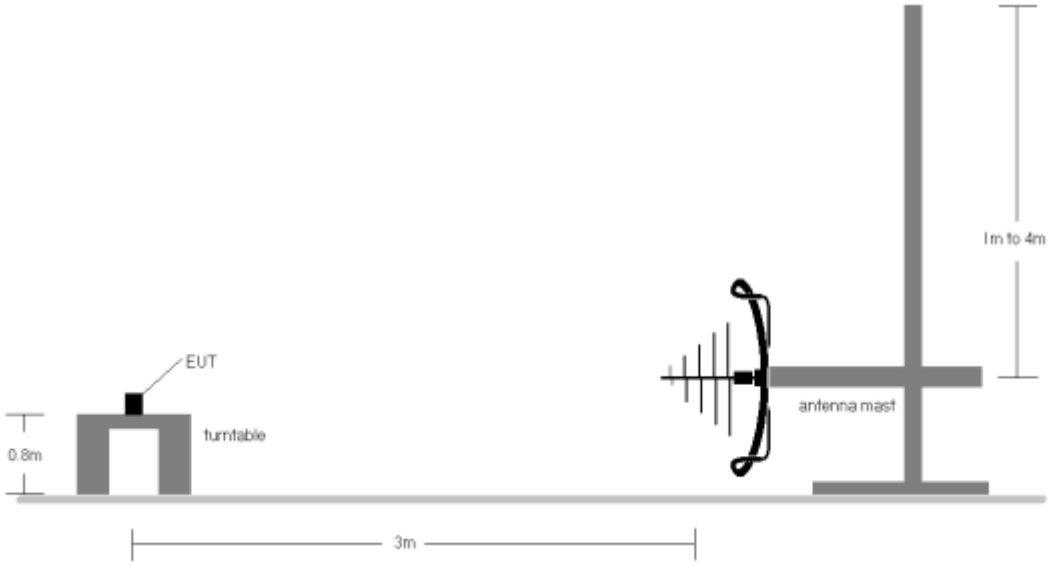


Figure 7-8. Test Instrument & Measurement Setup < 1GHz

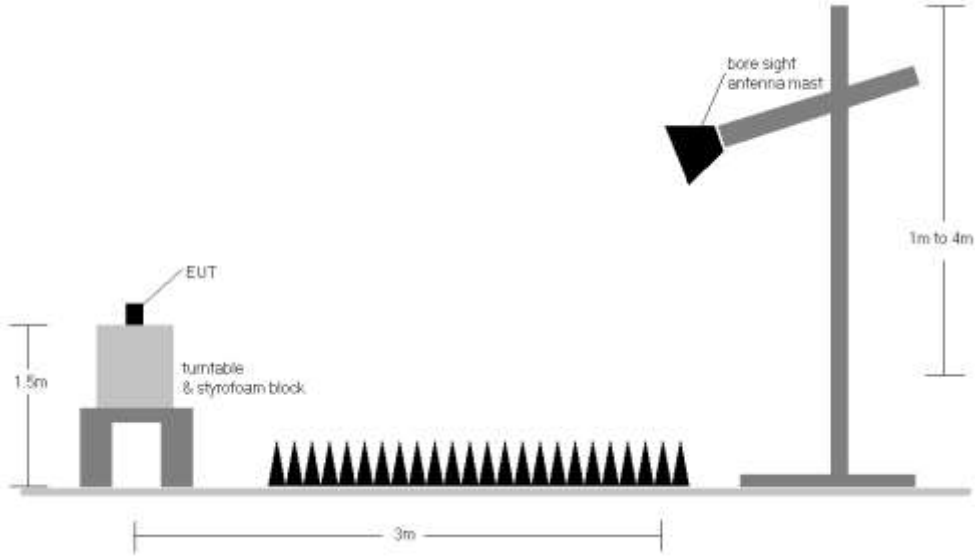


Figure 7-9. Test Instrument & Measurement Setup > 1GHz

Test Notes

1) Field strengths are calculated using the Measurement quantity conversions in ANSI C63.26-2015 Section 5.2.7:
   a) E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
   b) EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

2) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

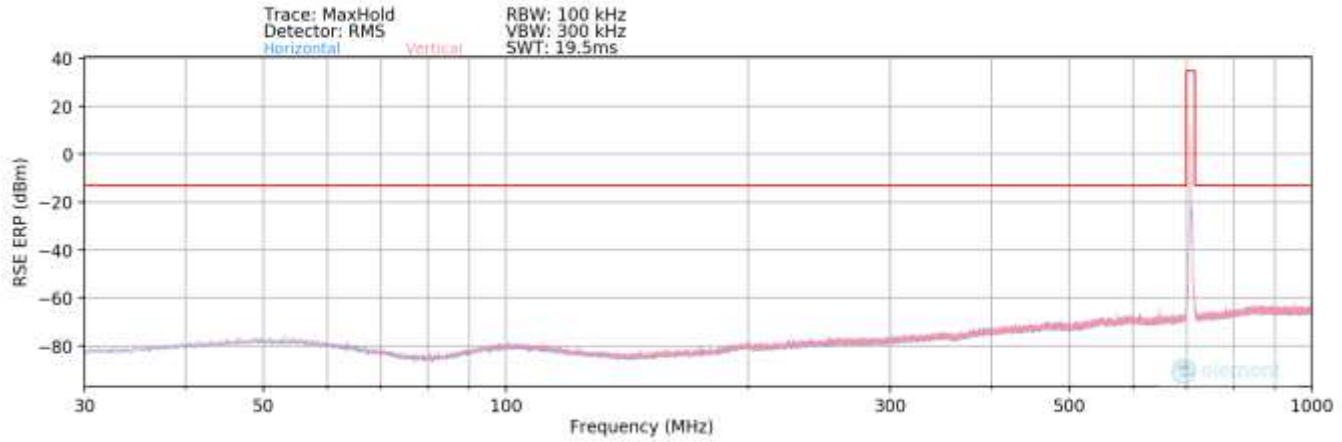
3) This unit was tested with its standard battery.

4) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

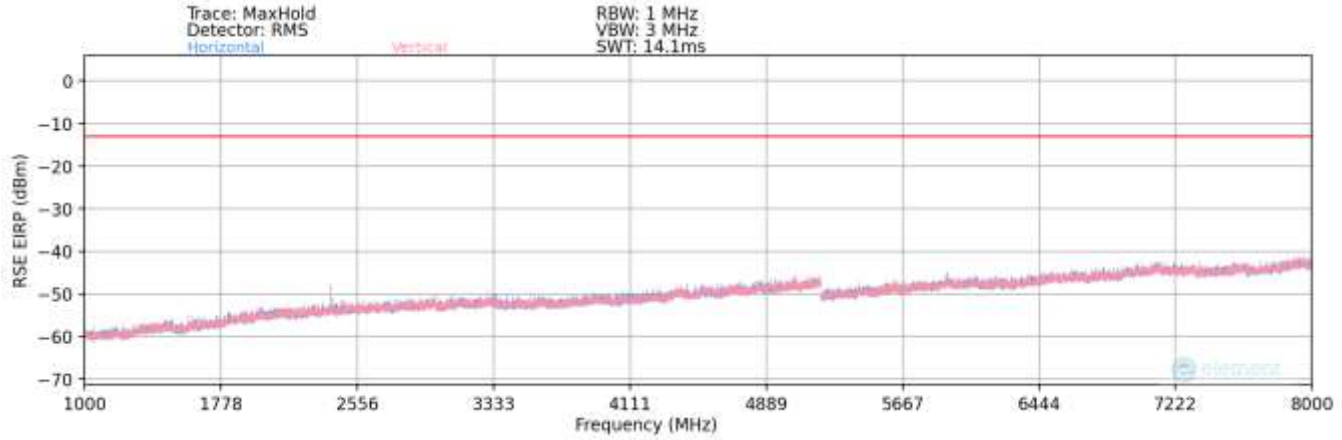
5) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

6) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

LTE Band 12



Plot 7-110. Radiated Spurious Plot (LTE Band 12)



Plot 7-111. Radiated Spurious Plot (LTE Band 12)

Mode:	Stand Alone
Channel:	23060
Frequency (MHz):	704.0
Detector / Trace Mode:	RMS / Average
RBW / VBW:	100kHz / 300kHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	ERP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
637.03	V	183	271	-64.91	-5.89	36.20	-61.21	-13.00	-48.21

Table 7-6. Radiated Spurious Data (LTE Band 12)

Bandwidth (MHz):	10
Frequency (MHz):	704
RB / Offset:	1 / 25

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1408.00	V	233	262	-67.07	-0.50	39.43	-55.83	-13.00	-42.83
2112.00	V	141	259	-76.10	4.03	34.93	-60.33	-13.00	-47.33
2816.00	V	-	-	-79.57	5.72	33.15	-62.11	-13.00	-49.11
3520.00	V	-	-	-80.08	7.12	34.04	-61.22	-13.00	-48.22
4224.00	V	-	-	-80.63	8.33	34.70	-60.56	-13.00	-47.56

Table 7-7. Radiated Spurious Data (LTE Band 12 – Low Channel)

Bandwidth (MHz):	10
Frequency (MHz):	707.5
RB / Offset:	1 / 25

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1415.00	V	162	257	-69.22	-0.54	37.24	-58.02	-13.00	-45.02
2122.50	V	215	311	-77.58	4.01	33.43	-61.82	-13.00	-48.82
2830.00	V	-	-	-79.34	5.88	33.54	-61.72	-13.00	-48.72
3537.50	V	-	-	-79.85	6.99	34.14	-61.12	-13.00	-48.12
4245.00	V	-	-	-80.87	8.43	34.56	-60.70	-13.00	-47.70

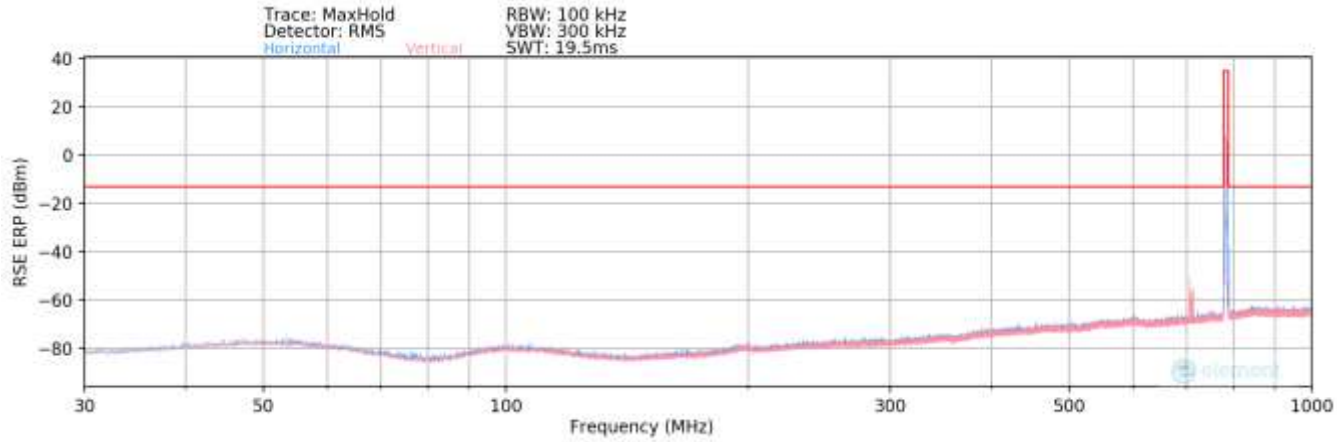
Table 7-8. Radiated Spurious Data (LTE Band 12 – Mid Channel)

Bandwidth (MHz):	10
Frequency (MHz):	711
RB / Offset:	1 / 25

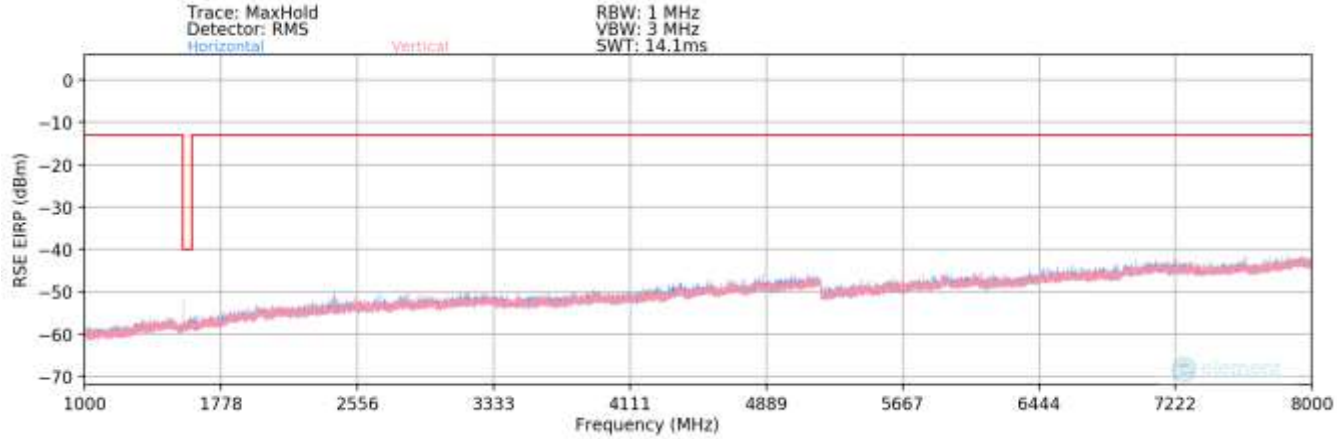
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1422.00	V	157	257	-69.23	-0.46	37.31	-57.95	-13.00	-44.95
2133.00	V	206	170	-77.42	3.93	33.51	-61.75	-13.00	-48.75
2844.00	V	-	-	-79.33	5.66	33.33	-61.93	-13.00	-48.93
3555.00	V	-	-	-79.95	7.07	34.12	-61.13	-13.00	-48.13
4266.00	V	-	-	-80.36	8.27	34.91	-60.35	-13.00	-47.35

Table 7-9. Radiated Spurious Data (LTE Band 12 – High Channel)

LTE Band 13



Plot 7-112. Radiated Spurious Plot (LTE Band 13)



Plot 7-113. Radiated Spurious Plot (LTE Band 13)

Mode:	Stand Alone
Channel:	23230.0
Frequency (MHz):	782.0
Detector / Trace Mode:	RMS / Average
RBW / VBW:	100kHz / 300kHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	ERP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
708.00	V	145	278	-64.82	-6.51	35.67	-61.74	-13.00	-48.74

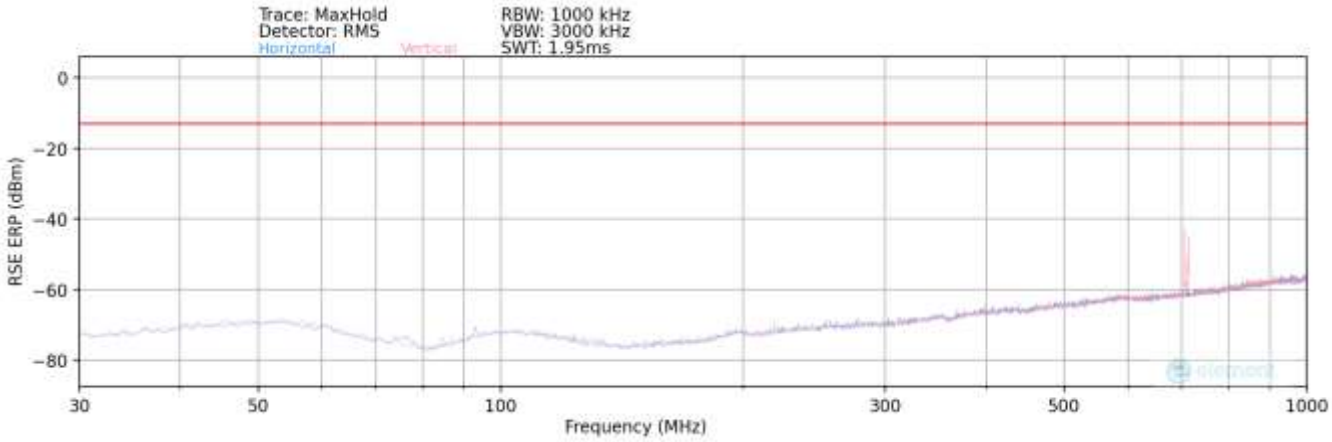
Table 7-10. Radiated Spurious Data (LTE Band 13)

Bandwidth (MHz):	10
Frequency (MHz):	782
RB / Offset:	1 / 25

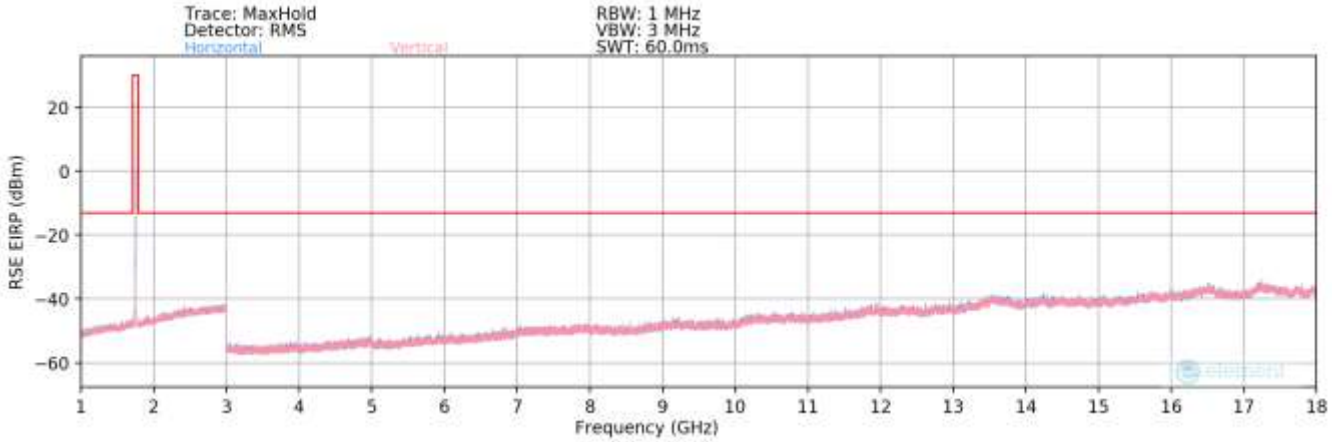
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1564.00	V	311	285	-73.98	-0.28	32.74	-62.51	-40.00	-22.51
2346.00	V	-	-	-76.52	4.26	34.74	-60.52	-13.00	-47.52
3128.00	V	-	-	-77.32	6.42	36.10	-59.15	-13.00	-46.15
3910.00	V	-	-	-78.04	8.19	37.15	-58.11	-13.00	-45.11

Table 7-11. Radiated Spurious Data (LTE Band 13 – Mid Channel)

LTE Band 66/4



Plot 7-114. Radiated Spurious Plot (LTE Band 66/4)



Plot 7-115. Radiated Spurious Plot (LTE Band 66/4)

Mode:	Stand Alone
Channel:	Mid
Frequency (MHz):	1745
Detector / Trace Mode:	RMS / Average
RBW / VBW:	100kHz / 300kHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	ERP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
714.16	V	-	-	-80.17	-6.53	20.30	-77.11	-13.00	-64.11

Table 7-12. Radiated Spurious Data (LTE Band 66/4)

Bandwidth (MHz):	20
Frequency (MHz):	1720
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3440.00	V	-	-	-79.59	5.49	32.90	-62.35	-13.00	-49.35
5160.00	V	-	-	-81.55	7.98	33.43	-61.83	-13.00	-48.83
6880.00	V	-	-	-81.97	11.68	36.71	-58.55	-13.00	-45.55

Table 7-13. Radiated Spurious Data (LTE Band 66/4 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	1745
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3490.00	V	-	-	-79.87	5.35	32.48	-62.78	-13.00	-49.78
5235.00	V	-	-	-81.25	7.92	33.67	-61.59	-13.00	-48.59
6980.00	V	-	-	-81.97	10.90	35.93	-59.33	-13.00	-46.33

Table 7-14. Radiated Spurious Data (LTE Band 66/4 – Mid Channel)

Bandwidth (MHz):	20
Frequency (MHz):	1770
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3540.00	V	-	-	-80.00	5.19	32.19	-63.07	-13.00	-50.07
5310.00	V	-	-	-81.71	8.26	33.55	-61.70	-13.00	-48.70
7080.00	V	-	-	-82.20	11.45	36.25	-59.01	-13.00	-46.01

Table 7-15. Radiated Spurious Data (LTE Band 66/4 – High Channel)

7.9 Frequency Stability / Temperature Variation

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

For Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI C63.26-2015 – Section 5.6

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

Test Notes

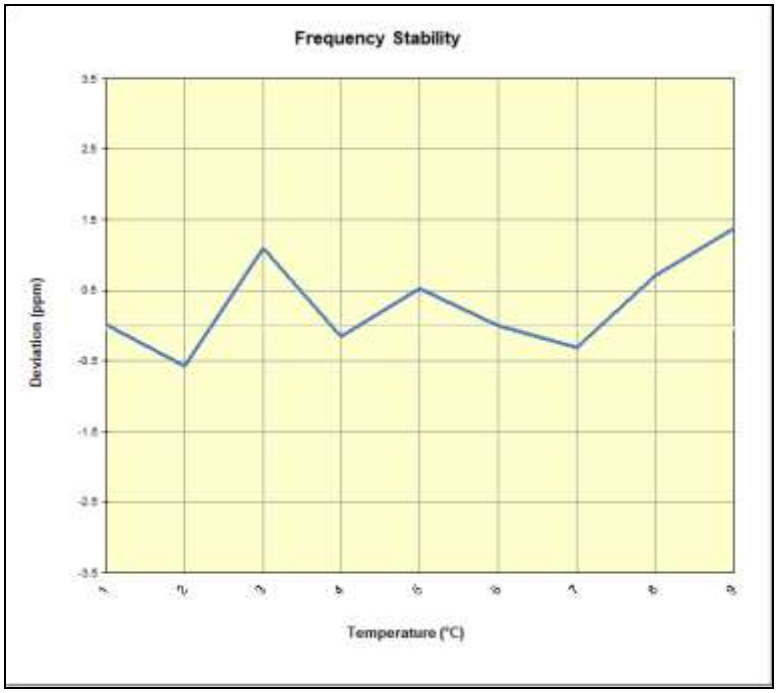
None

LTE Band 66/4

Operating Frequency (Hz):	1,745,000,000
Ref. Voltage (VDC):	4.34
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.34	- 30	1,745,087,114	21	0.0000012
		- 20	1,745,086,101	-992	-0.0000569
		- 10	1,745,089,014	1,921	0.0001101
		0	1,745,086,829	-265	-0.0000152
		+ 10	1,745,088,025	932	0.0000534
		+ 20 (Ref)	1,745,087,093	0	0.0000000
		+ 30	1,745,086,557	-536	-0.0000307
		+ 40	1,745,088,346	1,252	0.0000718
		+ 50	1,745,089,505	2,412	0.0001382
Battery Endpoint	3.71	+ 20	1,745,087,174	81	0.0000046

Table 7-16. LTE Band 66/4 Frequency Stability Data



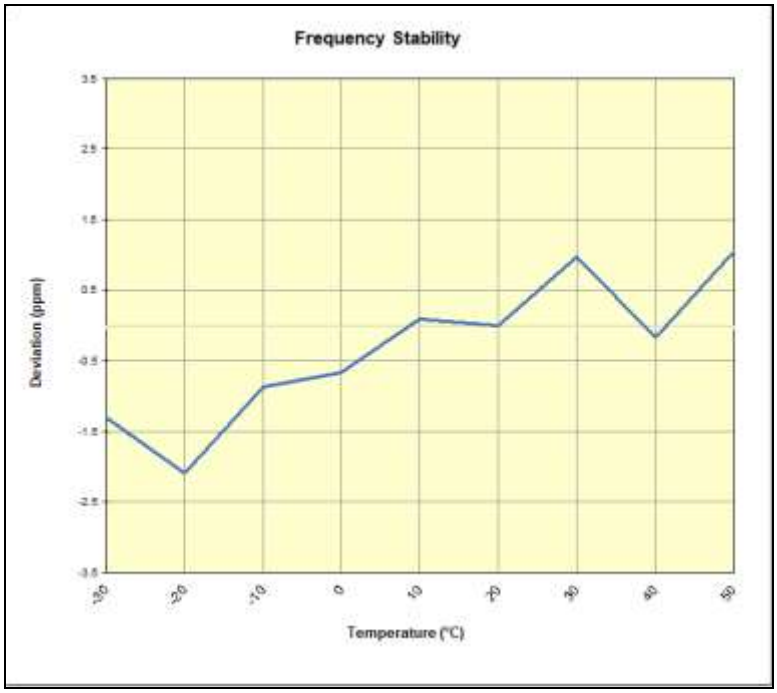
Plot 7-116. LTE Band 66/4 Frequency Stability Chart

LTE Band 12

Operating Frequency (Hz):	707,500,000
Ref. Voltage (VDC):	4.34
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.34	- 30	707,598,322	-925	-0.0001308
		- 20	707,597,771	-1,476	-0.0002086
		- 10	707,598,629	-618	-0.0000874
		0	707,598,780	-467	-0.0000660
		+ 10	707,599,316	69	0.0000098
		+ 20 (Ref)	707,599,247	0	0.0000000
		+ 30	707,599,933	686	0.0000970
		+ 40	707,599,129	-118	-0.0000166
		+ 50	707,599,994	747	0.0001056
Battery Endpoint	3.71	+ 20	707,600,249	1,002	0.0001416

Table 7-17. LTE Band 12 Frequency Stability Data



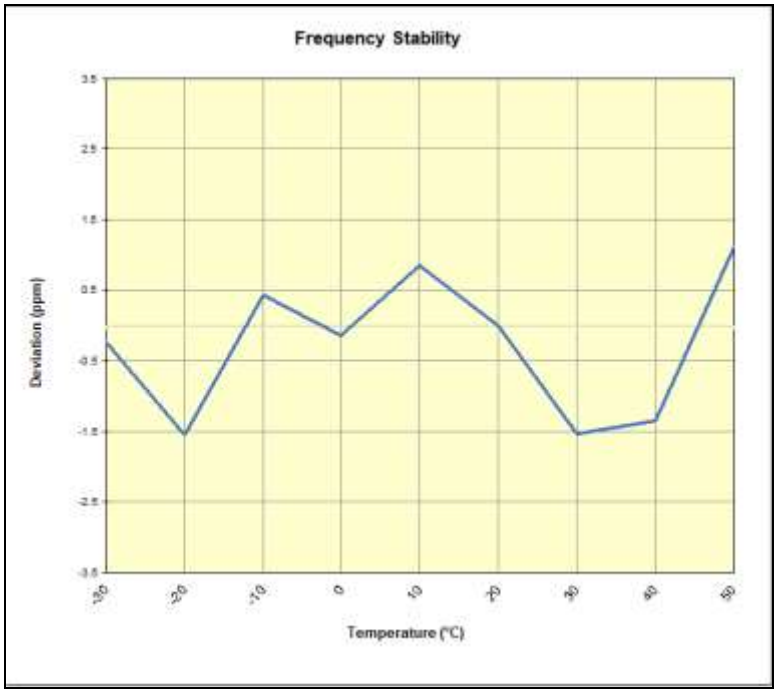
Plot 7-117. LTE Band 12 Frequency Stability Chart

LTE Band 13

Operating Frequency (Hz):	782,000,000
Ref. Voltage (VDC):	4.34
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.34	- 30	782,092,338	-185	-0.0000237
		- 20	782,091,313	-1,211	-0.0001548
		- 10	782,092,868	345	0.0000441
		0	782,092,414	-109	-0.0000140
		+ 10	782,093,190	666	0.0000852
		+ 20 (Ref)	782,092,523	0	0.0000000
		+ 30	782,091,329	-1,194	-0.0001527
		+ 40	782,091,469	-1,054	-0.0001348
		+ 50	782,093,390	867	0.0001108
Battery Endpoint	3.71	+ 20	782,092,477	-46	-0.0000059

Table 7-18. LTE Band 13 Frequency Stability Data



Plot 7-118. LTE Band 13 Frequency Stability Chart

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMS911JPN** complies with all the requirements of Part 27 of the FCC rules.