

DATA REFERENCE REPORT PART 96

Applicant Name:

Apple Inc.
One Apple Park Way
Cupertino, CA 95014
United States

Date of Testing:

5/30/2022 - 9/16/2022

Test Site/Location:

Element Washington DC LLC. Morgan Hill, CA, USA

Test Report Serial No.:

1C2205090029-09.BCG

FCC ID:

BCGA2437

APPLICANT:

Apple Inc.

Reference Model:

A2764

Variant Model:

A2437(A2766)

EUT Type:

Tablet Device

FCC Classification:

Citizens Band End User Devices (CBE)

FCC Rule Part:

96

Test Procedure(s):

ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01,
KDB 940660 D01 v02, WINNF-TS-0122 v1.0.0

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




FCC ID: BCGA2437	PART 96 DATA REFERENCE REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090029-09.BCG	Test Dates: 5/30/2022 - 9/16/2022	EUT Type: Tablet Device
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1.0 INTRODUCTION

1.1 Scope

Per manufacturer declaration, there are two tablet device models, A2764 and A2437(A2766), with high degree of similarity, reference model FCC ID: BCGA2764 and variant model **FCC ID: BCGA2437**. The reference model support mmWave operations, while the variant models have the mmWave components/antennas removed. Both models share the same material, form factor, circuit design, and components, including antennas and their locations. The reference and variant models use the same power tables and have same tune-up tolerances.


Per FCC approved Data Referencing Test Plan, testing was done fully on the reference model FCC ID: BCGA2764, while conducted and radiated spot-check verification has been performed on variant model **FCC ID: BCGA2437**. Spot-check measurements were conducted, all measurements were investigated and found to be within acceptable tolerance.

Equipment Class	Reference Model FCC ID	Reference Report	Report Title
CBE	BCGA2764	1C2205090028-10.BCG	RF Part 96 Test Report

Table 1-1. Reference Model Details

Spot-check verification are not applicable to this test report; therefore, all data for variant model **FCC ID: BCGA2437** can be fully referenced from the reference model.

Reference model FCC ID: BCGA2764 test report has been included in Appendix A

FCC ID: BCGA2437	 PART 96 DATA REFERENCE REPORT	Approved by: Technical Manager
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1.2 Element Washington DC LLC Test Location

These measurement tests were conducted at the Element facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at Element located in Morgan Hill, CA 95037, U.S.A.

- Element Washington DC LLC is a CBRS Alliance (OnGo) Approved Test Lab
- Element Washington DC LLC is a WinnForum Approved Test Lab
- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for CBRS Alliance Certification Test Plan and WinnForum Conformance and Performance Test Technical Standard.
- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 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 (22831) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Tablet Device FCC ID: BCGA2437**. 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 96.

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, 802.11a/ax WIFI 6E, Bluetooth (1x, EDR, LE1M, LE2M, HDR4, HDR8), NB UNII (1x, HDR4, HDR8), WPT

This device supports BT Beamforming

This device supports simultaneous transmission operations, which allows for multiple transmitters to transmit simultaneously on the same antenna. The table below shows all configurations possible.


Antenna	Simultaneous Tx Config	WiFi 2.4GHz	Bluetooth	NB UNII	WiFi 5GHz	WiFi 6GHz	LTE / FR1 NR
		802.11 b/g/n/ax	BDR, EDR, HDR4/8, LE1/2M	BDR, HDR4/8	802.11 a/n/ac/ax	802.11 a/ax	Ultra High Band
2a	Config 1	✓	✗	✗	✗	✗	✓
2a	Config 2	✗	✓	✗	✗	✗	✓
4a	Config 3	✓	✗	✓	✗	✗	✗
4a	Config 4	✗	✓	✗	✓	✗	✗

Table 2-1. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

Note:

Wi-Fi 2.4GHz and Bluetooth 2.4 GHz can transmit simultaneously on separate antennas. Specific 2.4 GHz Wi-Fi antenna that can only transmit simultaneously with 2.4 GHz Bluetooth antenna is listed in the SAR test report. For BT (2.4 GHz) in connected mode and Wi-Fi (2.4 GHz) – Wi-Fi max power will not exceed minimum of (13.5dBm, SAR max cap, Reg max cap) power. For BT (2.4 GHz) in disconnected mode and Wi-Fi (2.4 GHz) – BT will be using iPA only and Wi-Fi max power will not exceed minimum of (SAR max cap, Reg max cap) power.

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2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Band	Antenna Gain [dBi]			
	Antenna 3	Antenna 1	Antenna 4b	Antenna 2a
LTE Band 48	2.3	1.4	0.0	1.0


Table 2-2. Highest Antenna Gain

FCC ID: BCGA2437	 PART 96 DATA REFERENCE REPORT	Approved by: Technical Manager
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3.0 CONCLUSION


The spot-check data measured for variant model **FCC ID: BCGA2437** is in tolerance with reference model FCC ID: BCGA2764 per FCC Approved Data Referencing Test Plan.

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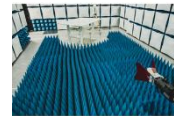
4.0 APPENDIX A: REFERENCE MODEL TEST REPORT

Attached is the test report (1C2205090028-10.BCG) from reference model FCC ID: BCGA2764, which includes referenced data results.

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MEASUREMENT REPORT FCC Part 96

Applicant Name:

Apple Inc.
One Apple Park Way
Cupertino, CA 95014
United States

Date of Testing:

5/30/2022-9/26/2022

Test Site/Location:

Element Washington DC LLC Morgan Hill, CA, USA

Test Report Serial No.:

1C2205090028-10.BCG

FCC ID:

BCGA2764

Applicant Name:

Apple Inc.

Application Type:

Certification

Model:

A2764

EUT Type:

Tablet Device

FCC Classification:

Citizens Band End User Devices (CBE)

FCC Rule Part:

96

Test Procedure(s):

ANSI C63.26-2015, ANSI/TIA-603-E-2016,
KDB 971168 D01 v03r01, KDB 940660 D01 v03,
WINNF-TS-0122 v1.0.2

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.

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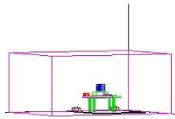
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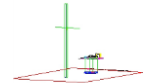
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PART 96 MEASUREMENT REPORT



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	PAR at 0.1% [dB]	EIRP		Emission Designator
						Max. Power [W]	Max. Power [dBm]	
LTE Band 48	5 MHz	QPSK	3552.5 - 3697.5	4.5326	4.45	0.158	22.00	4M53G7W
		16QAM	3552.5 - 3697.5	4.5258	5.47	0.129	21.11	4M53D7W
		64QAM	3552.5 - 3697.5	4.5304	6.28	0.105	20.22	4M53D7W
		256QAM	3552.5 - 3697.5	4.5301	7.53	0.054	17.29	4M53D7W
	10 MHz	QPSK	3555.0 - 3695.0	9.0050	4.40	0.158	22.00	9M00G7W
		16QAM	3555.0 - 3695.0	9.0217	5.27	0.132	21.19	9M02D7W
		64QAM	3555.0 - 3695.0	9.0216	6.20	0.107	20.28	9M02D7W
		256QAM	3555.0 - 3695.0	9.0389	6.58	0.054	17.33	9M04D7W
	15 MHz	QPSK	3557.5 - 3692.5	13.5154	5.02	0.158	22.00	13M5G7W
		16QAM	3557.5 - 3692.5	13.5036	6.00	0.132	21.19	13M5D7W
		64QAM	3557.5 - 3692.5	13.4662	6.42	0.104	20.15	13M5D7W
		256QAM	3557.5 - 3692.5	13.5067	6.59	0.055	17.40	13M5D7W
	20 MHz	QPSK	3560.0 - 3690.0	18.0143	4.92	0.158	22.00	18M0G7W
		16QAM	3560.0 - 3690.0	17.9854	5.82	0.142	21.52	18M0D7W
		64QAM	3560.0 - 3690.0	17.9586	6.39	0.110	20.41	18M0D7W
		256QAM	3560.0 - 3690.0	17.9930	6.57	0.057	17.53	18M0D7W
LTE ULCA Band 48	20 + 5 MHz	QPSK	3562.5 - 3687.5	23.3783	4.45	0.158	22.00	23M4G7W
		16QAM	3562.5 - 3687.5	23.2546	5.47	0.098	19.92	23M3D7W
		64QAM	3562.5 - 3687.5	23.3770	6.28	0.097	19.88	23M4D7W
		256QAM	3562.5 - 3687.5	23.3254	7.53	0.062	17.93	23M3D7W
	20 + 10 MHz	QPSK	3565.0 - 3685.0	28.0315	4.40	0.158	22.00	28M0G7W
		16QAM	3565.0 - 3685.0	28.0391	5.27	0.100	19.98	28M0D7W
		64QAM	3565.0 - 3685.0	27.9083	6.20	0.099	19.94	27M9D7W
		256QAM	3565.0 - 3685.0	28.0708	6.58	0.063	17.99	28M1D7W
	20 + 15 MHz	QPSK	3567.5 - 3682.5	32.8775	5.02	0.123	20.91	32M9G7W
		16QAM	3567.5 - 3682.5	32.8451	6.00	0.095	19.80	32M8D7W
		64QAM	3567.5 - 3682.5	32.8636	6.42	0.095	19.76	32M9D7W
		256QAM	3567.5 - 3682.5	32.9261	6.59	0.060	17.81	32M9D7W
	20 + 20 MHz	QPSK	3570.0 - 3680.0	37.7277	4.92	0.156	21.92	37M7G7W
		16QAM	3570.0 - 3680.0	37.7069	5.82	0.094	19.75	37M7D7W
		64QAM	3570.0 - 3680.0	37.6123	6.39	0.094	19.71	37M6D7W
		256QAM	3570.0 - 3680.0	37.7663	6.57	0.060	17.76	37M8D7W

EUT Overview

FCC ID: BCGA2764	 PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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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.


1.2 Element Washington DC LLC Test Location

These measurement tests were conducted at the Element Washington DC LLC facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at Element Washington DC LLC located in Morgan Hill, CA 95037, U.S.A.

- Element Washington DC LLC is a CBRS Alliance (OnGo) Approved Test Lab
- Element Washington DC LLC is a WinnForum Approved Test Lab
- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for CBRS Alliance Certification Test Plan and WinnForum Conformance and Performance Test Technical Standard.
- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 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 (22831) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Table Device FCC ID:BCGA2764**. The test data contained in this report pertains only to the emissions due to the EUT's LTE Band 48 operation in the CBRs band. Per FCC Part 96, this device is evaluated under Citizens Band End User Devices (CBE).

Test Device Serial No.: DLX2184009B1M9L1M, KRRF2YPXDHM, H4QHXRFX21, CC6D2QF1Q5, Y2M69VDCQJ

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1, FR2), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, 802.11a/ax WIFI 6E, Bluetooth (1x, EDR, LE1M, LE2M, HDR4, HDR8), NB UNII (1x, HDR4, HDR8), WPT

This device supports BT Beamforming

Measurements for LTE-Band48 and ULCA CA_48C were performed with NS10 for all antennas.

This device supports simultaneous transmission operations, which allows for multiple transmitters to transmit simultaneously on the same antenna. The table below shows all configurations possible.


Antenna	Simultaneous Tx Config	WiFi 2.4GHz	Bluetooth	NB UNII	WiFi 5GHz	WiFi 6GHz	LTE / FR1 NR
		802.11 b/g/n/ax	BDR, EDR, HDR4/8, LE1/2M	BDR, HDR4/8	802.11 a/n/ac/ax	802.11 a/ax	Ultra High Band
2a	Config 1	✓	✗	✗	✗	✗	✓
2a	Config 2	✗	✓	✗	✗	✗	✓
4a	Config 3	✓	✗	✓	✗	✗	✗
4a	Config 4	✗	✓	✗	✓	✗	✗

Table 2-1. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

Note:

Wi-Fi 2.4GHz and Bluetooth 2.4 GHz can transmit simultaneously on separate antennas. Specific 2.4 GHz Wi-Fi antenna that can only transmit simultaneously with 2.4 GHz Bluetooth antenna is listed in the SAR test report. For BT (2.4 GHz) in connected mode and Wi-Fi (2.4 GHz) – Wi-Fi max power will not exceed minimum of (13.5dBm, SAR max cap, Reg max cap) power. For BT (2.4 GHz) in disconnected mode and Wi-Fi (2.4 GHz) – BT will be using iPA only and Wi-Fi max power will not exceed minimum of (SAR max cap, Reg max cap) power.

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2.3 Antenna Description

The following antenna gains provided by manufacturer were used for testing.


Band	Antenna Gain [dBi]			
	Antenna 3	Antenna 1	Antenna 4b	Antenna 2a
LTE Band 48	2.3	1.4	0	1

Table 2-2. Highest Antenna Gain

2.4 Test Support Equipment

1	Apple MacBook Pro	Model:	A2141	S/N:	C02DV7VKMD6T
	w/AC/DC Adapter	Model:	A2166	S/N:	N/A
2	Apple USB-C Cable	Model:	Spartan	S/N:	000MKTR02U
3	USB-C Cable	Model:	A246	S/N:	N/A
	w/ AC Adapter	Model:	A2305	S/N:	N/A
4	Apple Pencil	Model:	N/A	S/N:	GQXGSXBJKM9
5	DC Power Supply	Model:	KPS3010D	S/N:	N/A

Table 2-3. Test Support Equipment

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.26 2015, TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz and above 18GHz were tested with the highest transmitting power and the worst case channel.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

All possible simultaneous transmission configurations have been investigated and the worst case config has been reported.

Description	Bluetooth	LTE
Antenna	2a	2a
Channel	79	55340
Operating Frequency (MHz)	2480	3560
Mode/Modulation	GFSK ePA	QPSK/1RB/20MHz


Table 2-4. Worst Case Simultaneous Transmission Configuration

2.6 Software and Firmware

The test was conducted with firmware version 20A8359 installed on the EUT.

2.7 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI C63.26-2015, TIA-603-E-2016) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure.....None

3.2 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 spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. 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

$$\text{EIRP}_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8; \text{ where } D \text{ is the measurement distance in meters.}$$

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

Per KDB 414788 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.


Radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015 and TIA-603-E-2016.

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4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. 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 (\pm dB)
Conducted Bench Top Measurements	1.77
Radiated Disturbance (<30MHz)	4.38
Radiated Disturbance (30MHz-1GHz)	4.75
Radiated Disturbance (1-18GHz)	5.20
Radiated Disturbance (>18GHz)	4.72

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5.0 TEST EQUIPMENT CALIBRATION DATA


Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	6/10/2022	Annual	6/10/2023	MY49430244
Agilent Technologies	N9020A	MXA Signal Analyzer	4/26/2022	Annual	4/26/2023	MY56470202
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	1/19/2022	Annual	1/19/2023	T058701-02
ETS-Lindgren	3142E	Biconilog Antenna (26-6000MHz)	10/21/2021	Annual	10/21/2022	208204
ETS-Lindgren	3117	Double Ridged Guide Horn Antenna (1-18GHz)	10/25/2021	Annual	10/25/2022	227597
ETS-Lindgren	SU-241	Table Top Temperature Chamber	10/6/2021	Annual	10/6/2022	92009574
Keysight Technology	N9040B	UXA Signal Analyzer	2/8/2022	Annual	2/8/2023	MY57212015
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz-6GHz)	1/6/2022	Annual	1/6/2023	102328
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	10/11/2021	Annual	10/11/2022	161616
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	11/4/2021	Annual	11/4/2022	151888
Rohde & Schwarz	ESW26	EMI Test Receiver	5/19/2022	Annual	5/19/2023	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	12/2/2021	Annual	12/2/2022	101570
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	3/4/2022	Annual	3/4/2023	101619
Rohde & Schwarz	FSVA3044	Signal Analyzer (up to 44 GHz)	5/12/2022	Annual	5/12/2023	101098
Rohde & Schwarz	HFH2-Z2	Loop Antenna	4/3/2022	Annual	4/3/2023	100546
Rohde & Schwarz	TC-TA18	Cross-Polarized Antenna 400MHz-18GHz	1/25/2022	Annual	1/25/2023	101063
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz-18GHz)	1/6/2022	Annual	1/6/2023	101639
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz-40GHz)	4/18/2022	Annual	4/18/2023	100050

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.

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6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7W

BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination of Any

QAM Modulation

Emission Designator = 8M45D7W

BW = 8.45 MHz

D = Amplitude/Angle Modulated


7 = Quantized/Digital Info

W = Combination of Any

Spurious Radiated Emission

Example: Spurious emission at 3700.40 MHz

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was -81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of -81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40 MHz. So 6.1 dB is added to the signal generator reading of -30.9 dBm yielding -24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm $- (-24.80) = 50.3$ dBc.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCGA2764
 FCC Classification: Citizens Band End User Devices (CBE)
 Mode(s): LTE/ULCA

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Occupied Bandwidth	2.1049	N/A	N/A	Section 7.2
	Conducted Band Edge / Spurious Emissions	2.1051, 96.41(e)(ii)	-13 dBm/MHz at frequencies within 0-B MHz of channel edge (where B is the bandwidth of the assigned channel) -25 dBm/MHz at frequencies greater than B MHz above and below channel edge -40 dBm/MHz at frequencies below 3530 MHz and above 3720 MHz	PASS	Sections 7.3, 7.4
	Transmitter Conducted Output Power	2.1046	N/A	N/A	See RF Exposure Report
	Peak-Average Ratio	96.41(g)	< 13 dB	PASS	Section 7.5
	Frequency Stability	2.1055	Fundamental emissions stay within authorized frequency block	PASS	Section 7.8
	End User Device Additional Requirements (CBSD Protocol)	96.47	End User Devices may operate only if they can positively receive and decode an authorization signal transmitted by a CBSD, including the frequencies and power limits for their operation. An End User Device must discontinue operations, change frequencies, or change its operational power level within 10 seconds of receiving instructions from its associated CBSD.	PASS	Section 7.9
	Equivalent Isotropic Radiated Power (EIRP)	96.41(b)	23 dBm/10MHz	PASS	Section 7.6
RADIATED	Radiated Spurious Emissions	2.1053, 96.41(e)	-40 dBm/MHz	PASS	Section 7.7

Table 7-1. Summary of Test Results


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Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3. All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4. All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized was Element Washington DC LLC EMC Software Tool 1.1.

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7.2 Occupied Bandwidth

\$2.1049

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. All ports were tested and only the worst case data were reported.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

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 $\geq 3 \times$ 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.

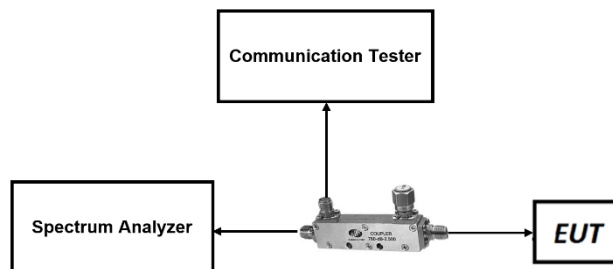



Figure 7-1. Test Instrument & Measurement Setup

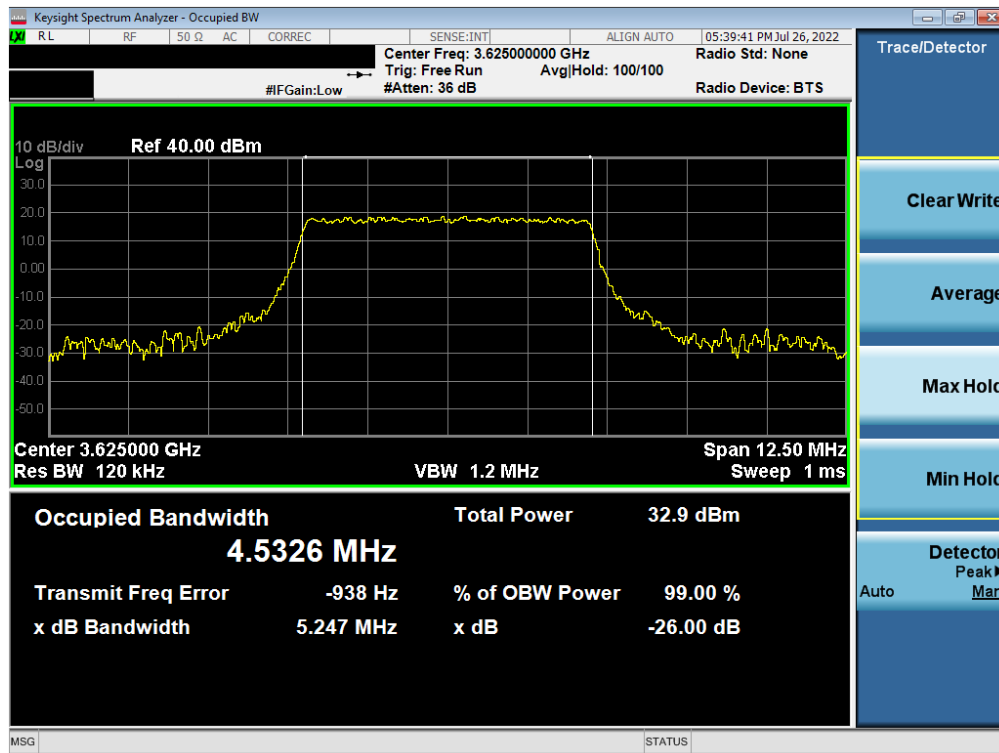
Test Notes

None.

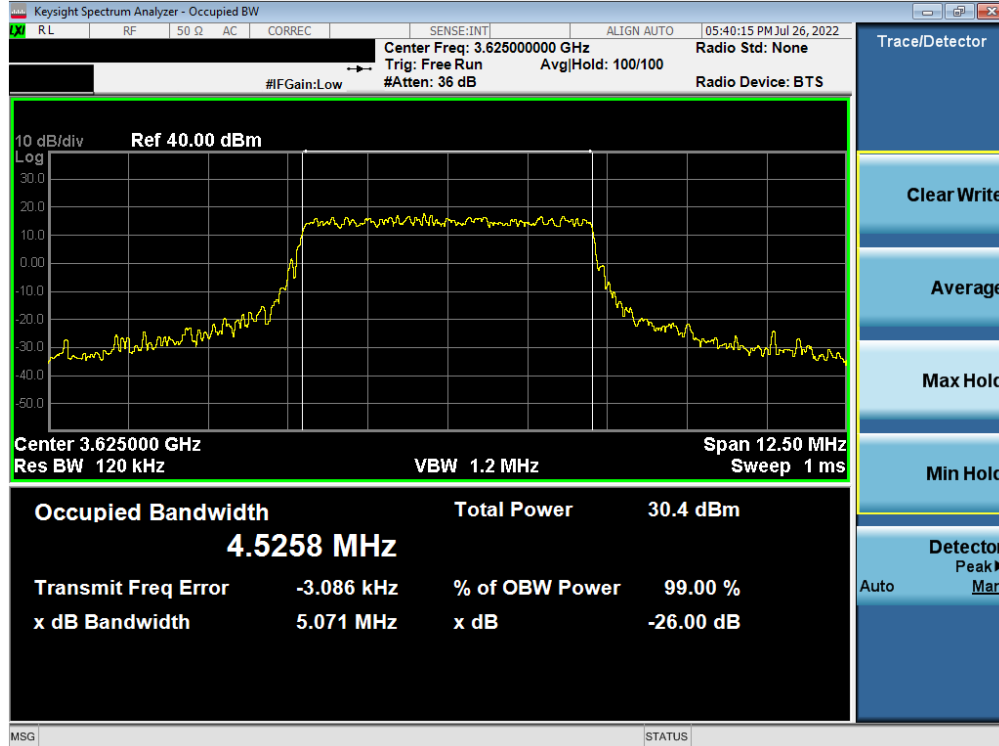
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LTE Band 48



Plot 7-1. Occupied Bandwidth Plot (LTE Band 48 - 5MHz QPSK - Full RB Configuration)

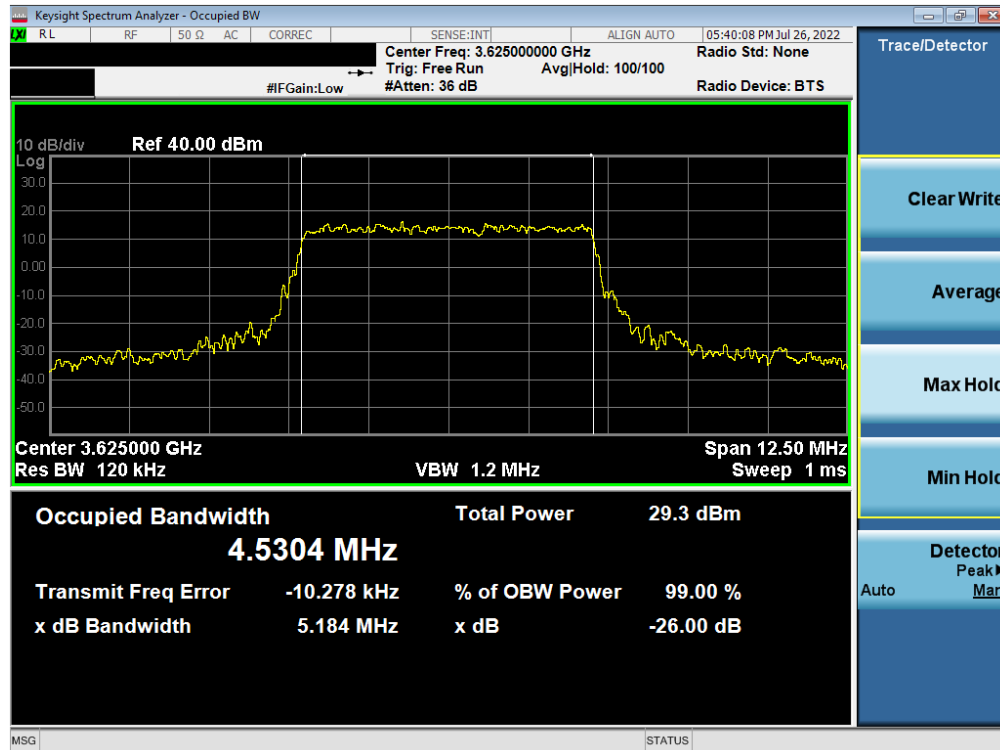


Plot 7-2. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 16-QAM - Full RB Configuration)

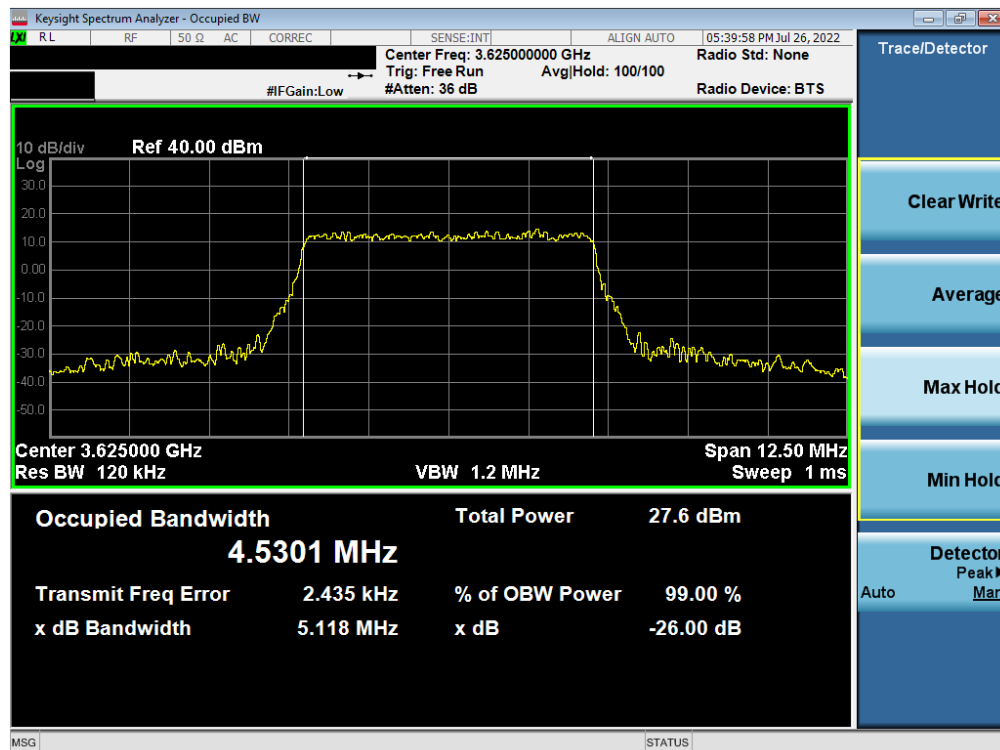
FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-3. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 64-QAM - Full RB Configuration)

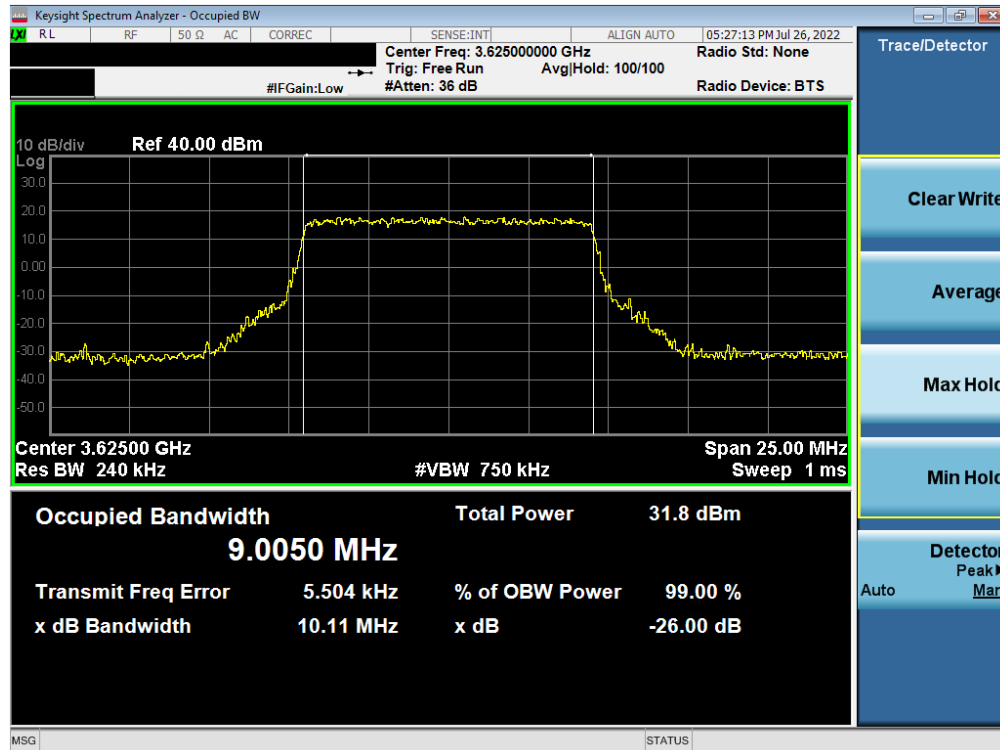


Plot 7-4. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 256-QAM - Full RB Configuration)

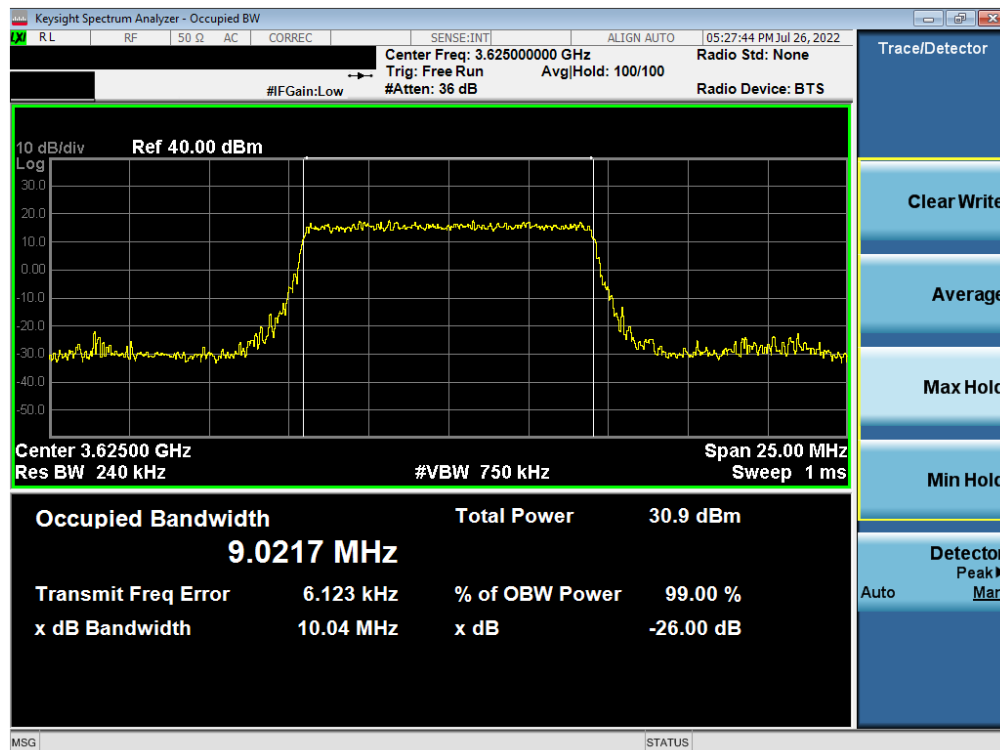
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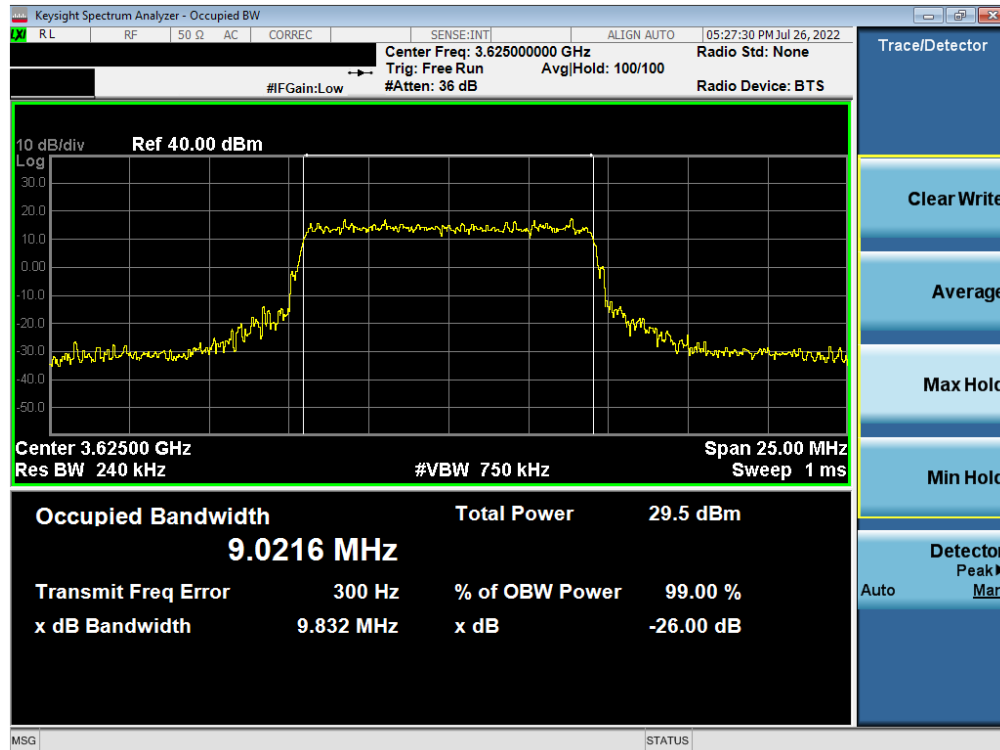
Plot 7-5. Occupied Bandwidth Plot (LTE Band 48 - 10MHz QPSK - Full RB Configuration)



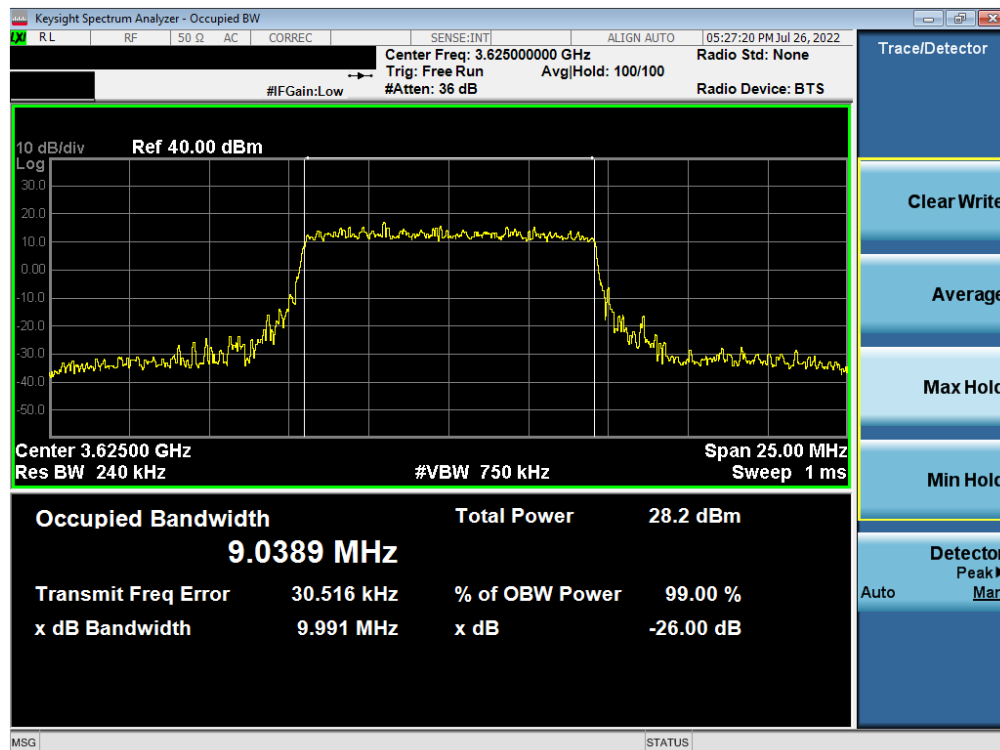
Plot 7-6. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 16-QAM - Full RB Configuration)

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Plot 7-7. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 64-QAM - Full RB Configuration)



Plot 7-8. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 256-QAM - Full RB Configuration)

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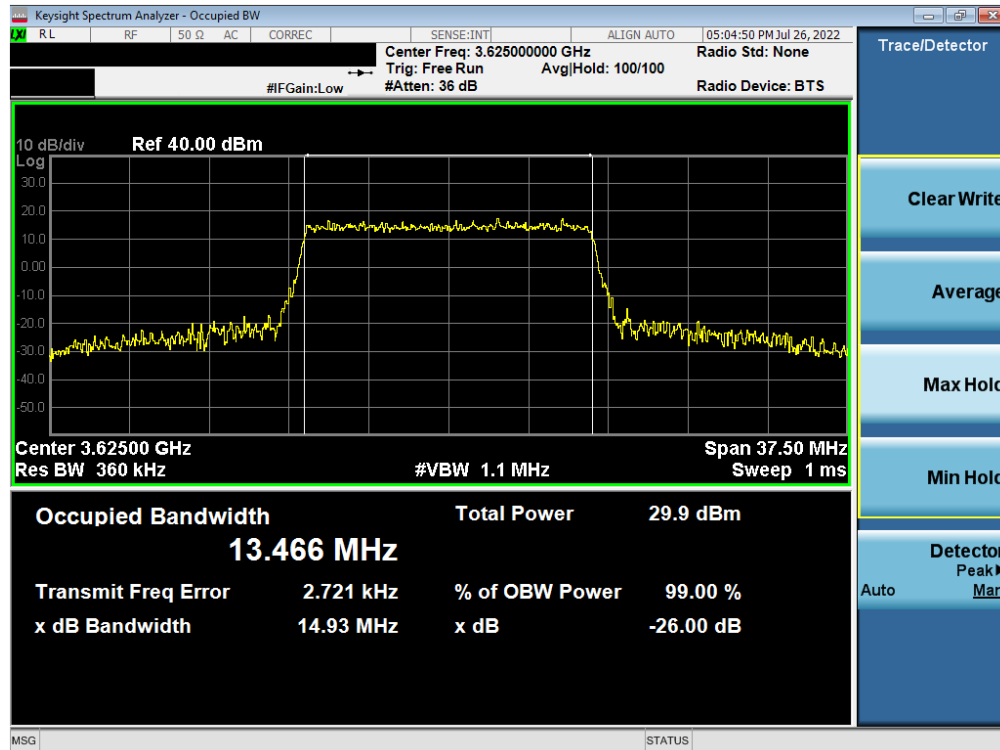
Plot 7-9. Occupied Bandwidth Plot (LTE Band 48 - 15MHz QPSK - Full RB Configuration)



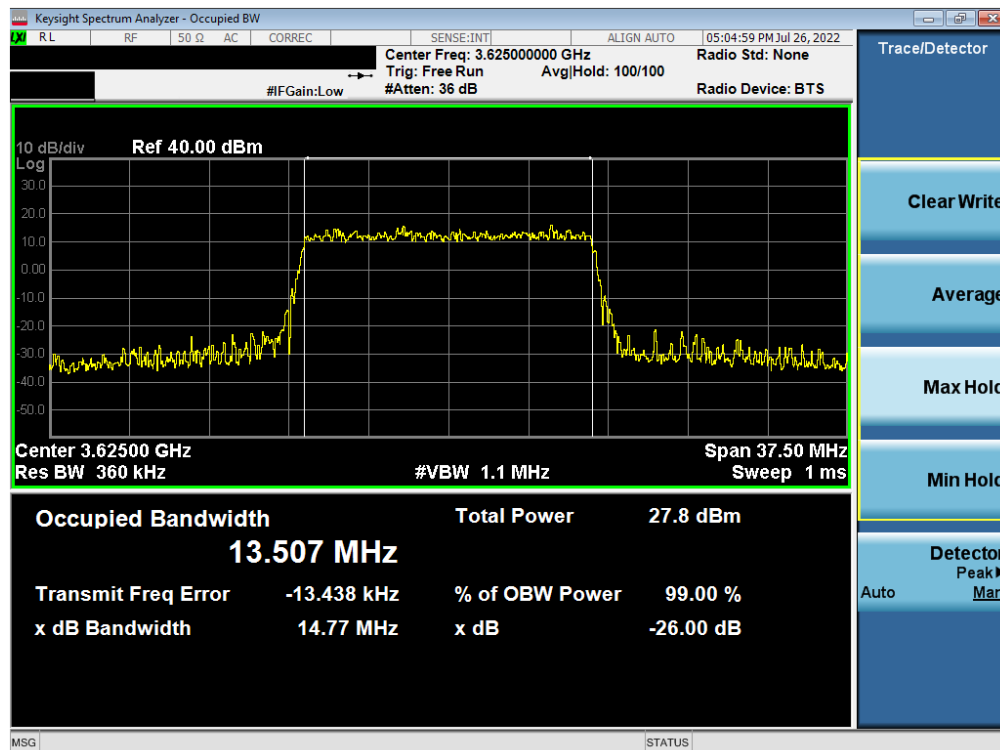
Plot 7-10. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 16-QAM - Full RB Configuration)

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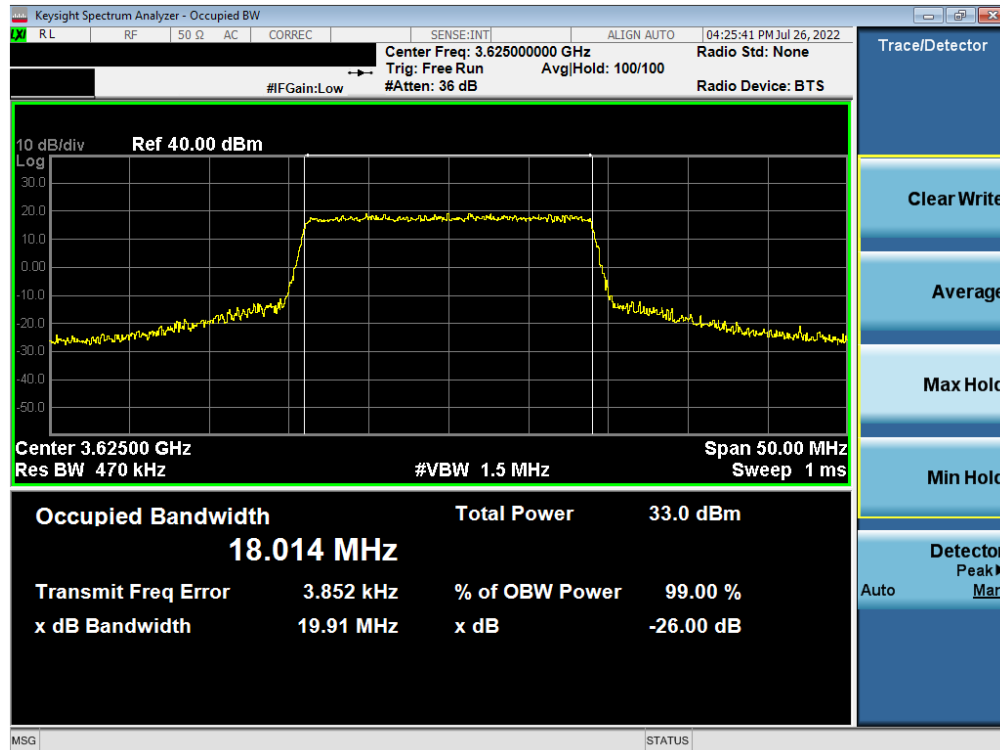
Plot 7-11. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 64-QAM - Full RB Configuration)



Plot 7-12. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 256-QAM - Full RB Configuration)

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Plot 7-13. Occupied Bandwidth Plot (LTE Band 48 - 20MHz QPSK - Full RB Configuration)

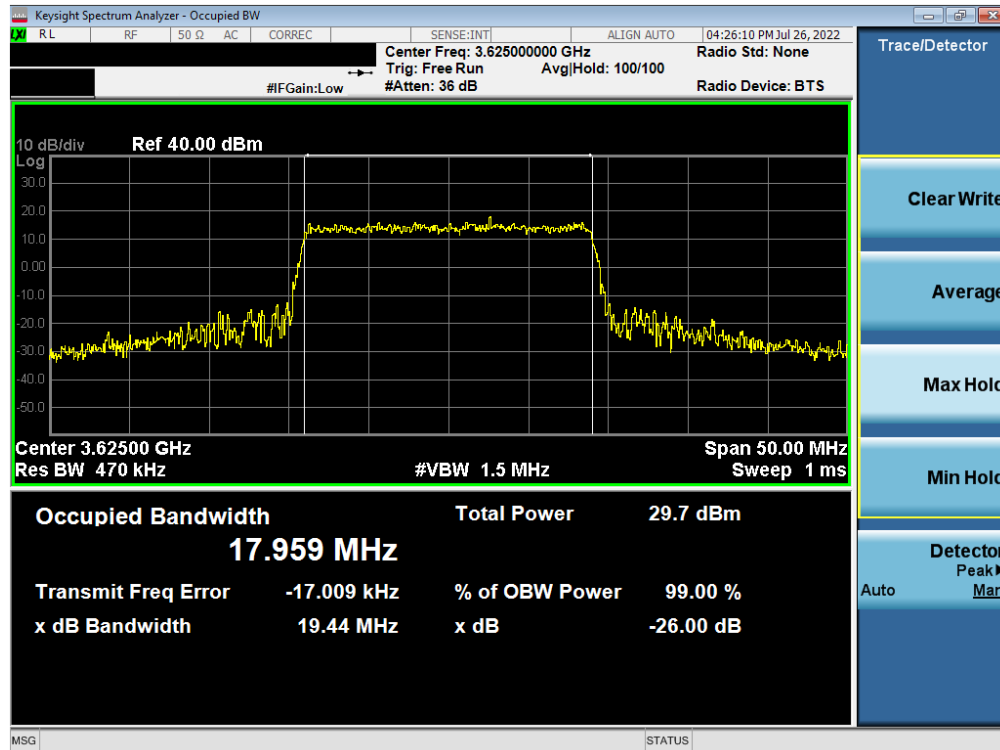


Plot 7-14. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 16-QAM - Full RB Configuration)

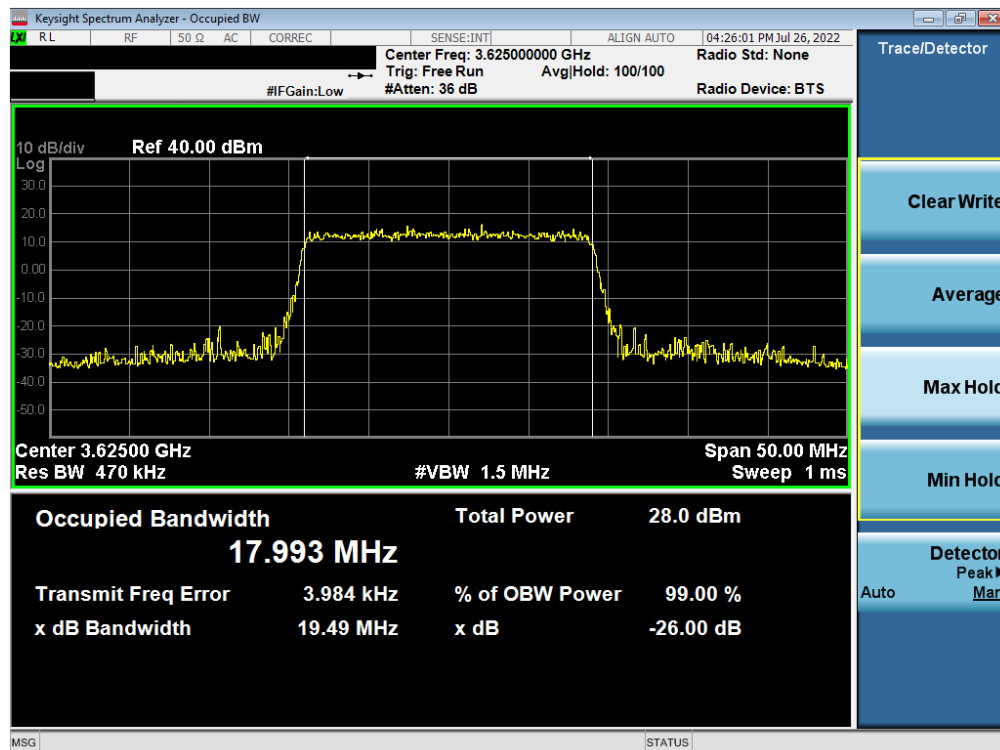
FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-15. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 64-QAM - Full RB Configuration)

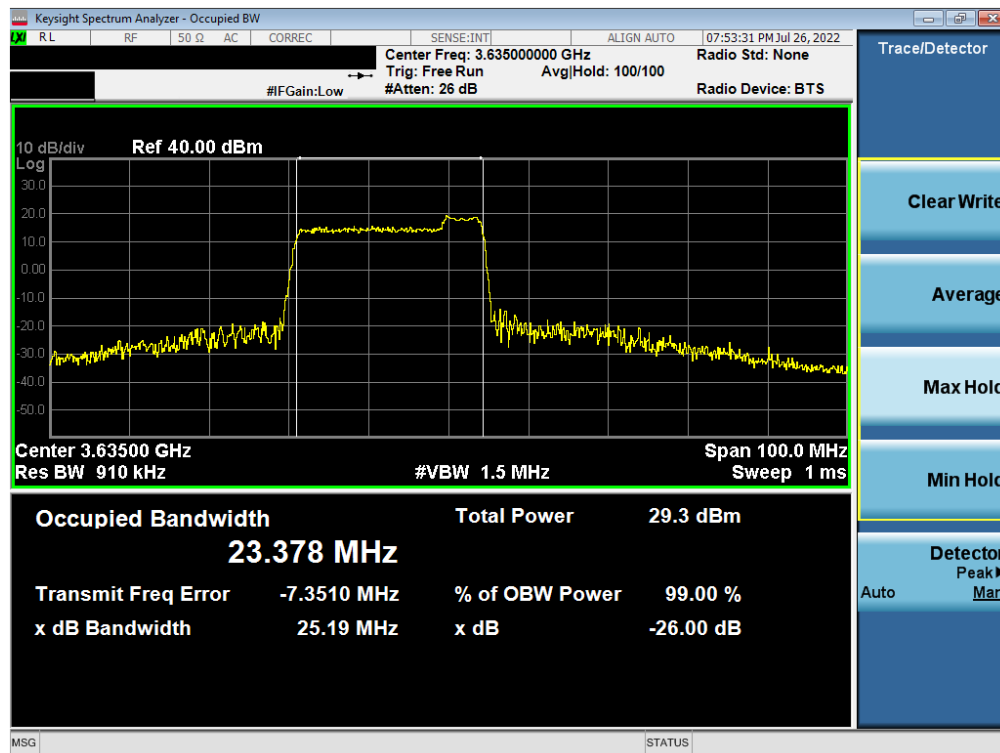


Plot 7-16. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 256-QAM - Full RB Configuration)

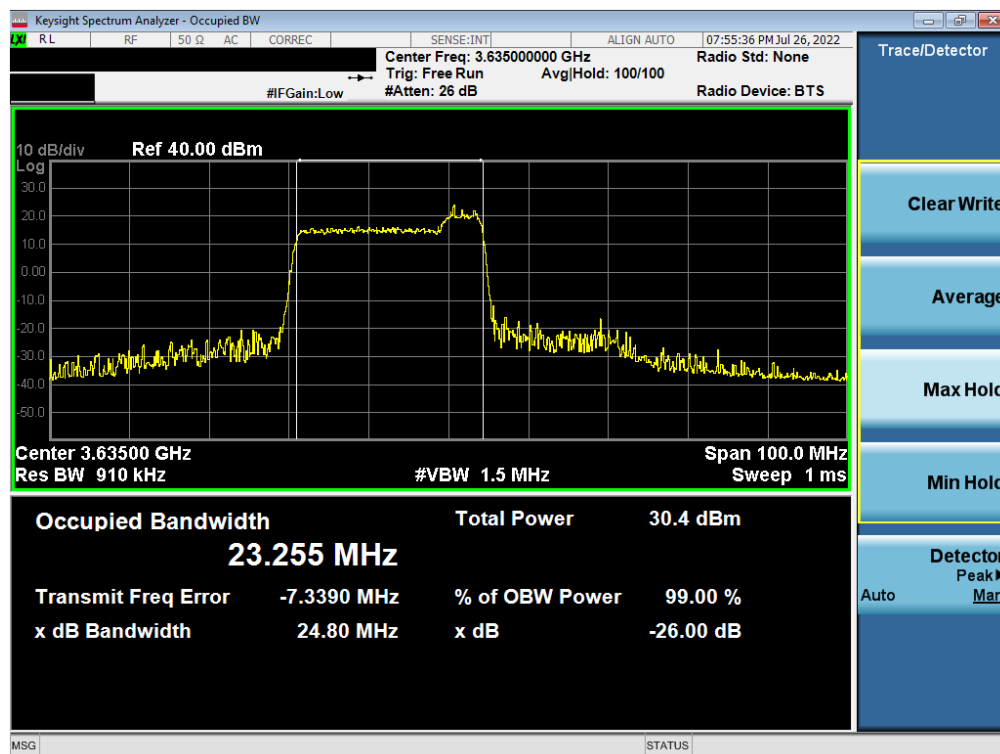
FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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ULCA LTE Band 48



Plot 7-17. Occupied Bandwidth Plot (ULCA Band 48 - 20+5MHz QPSK - Full RB Configuration)

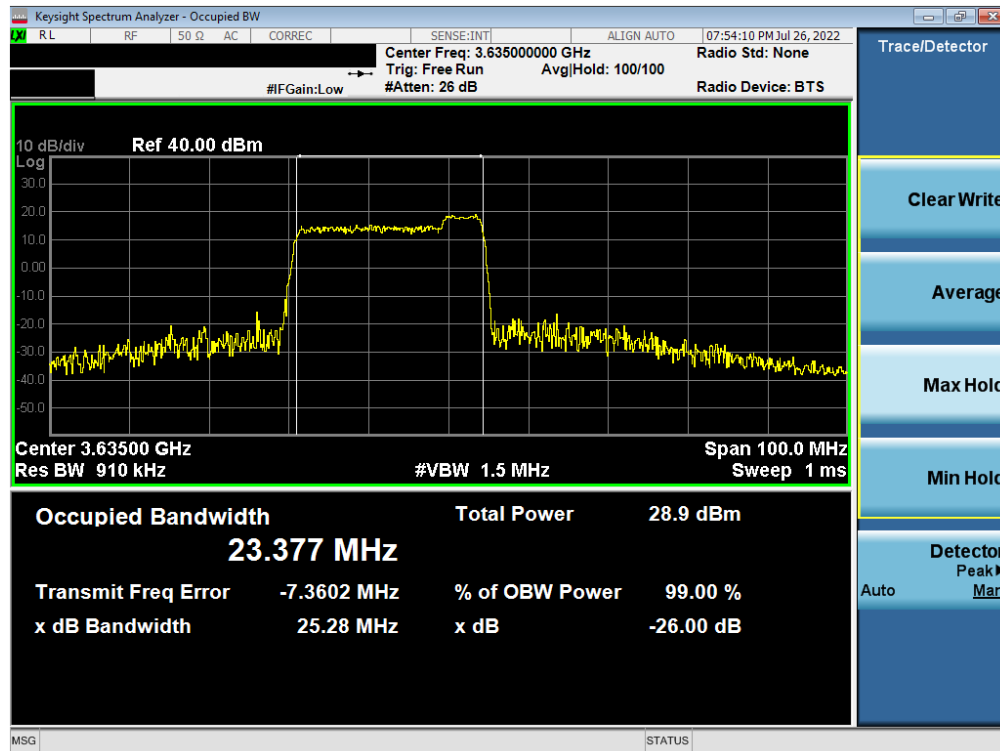


Plot 7-18. Occupied Bandwidth Plot (ULCA Band 48 - 20+5MHz 16-QAM - Full RB Configuration)

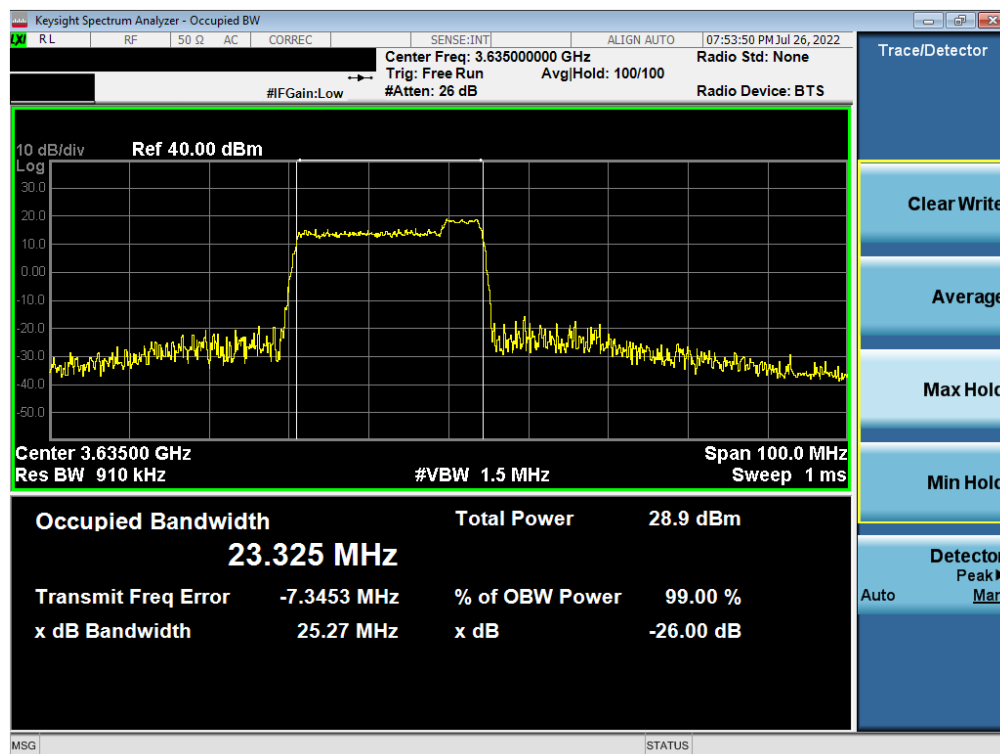
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Plot 7-19. Occupied Bandwidth Plot (ULCA Band 48 - 20+5MHz 64-QAM - Full RB Configuration)

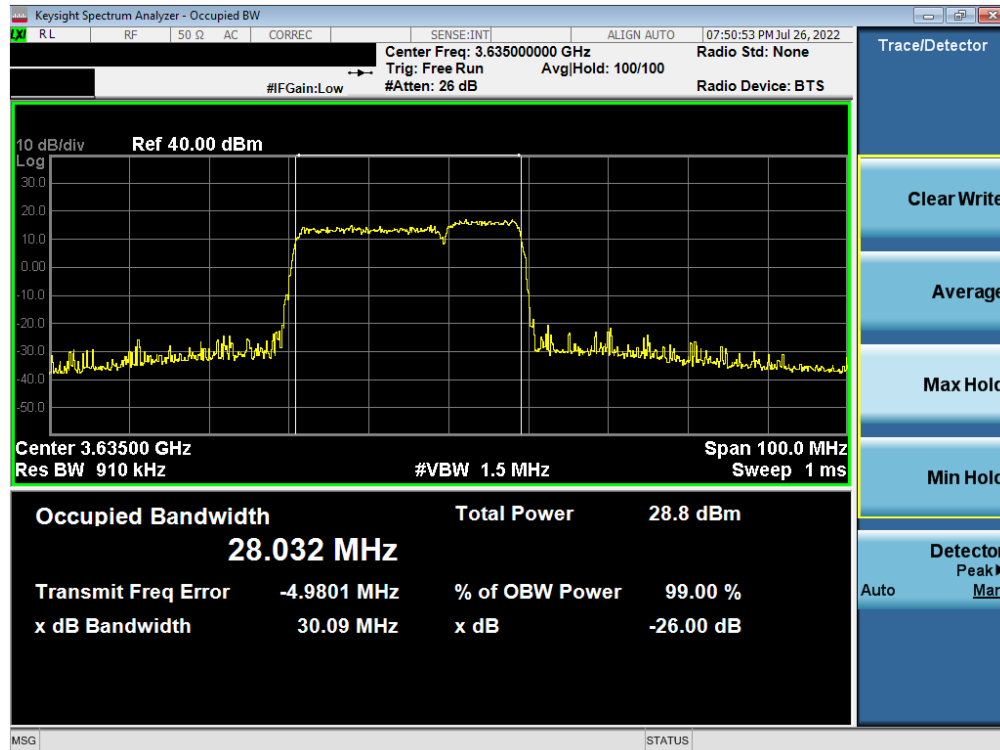


Plot 7-20. Occupied Bandwidth Plot (ULCA Band 48 - 20+5MHz 256-QAM - Full RB Configuration)

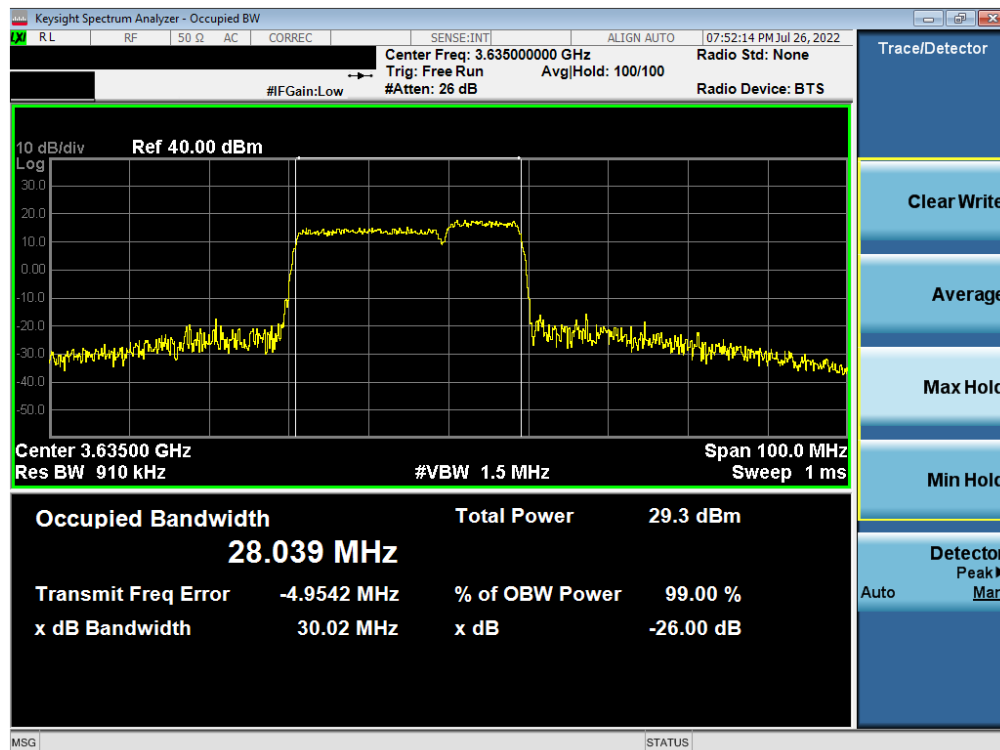
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Plot 7-21. Occupied Bandwidth Plot (ULCA Band 48 - 20+10MHz QPSK - Full RB Configuration)

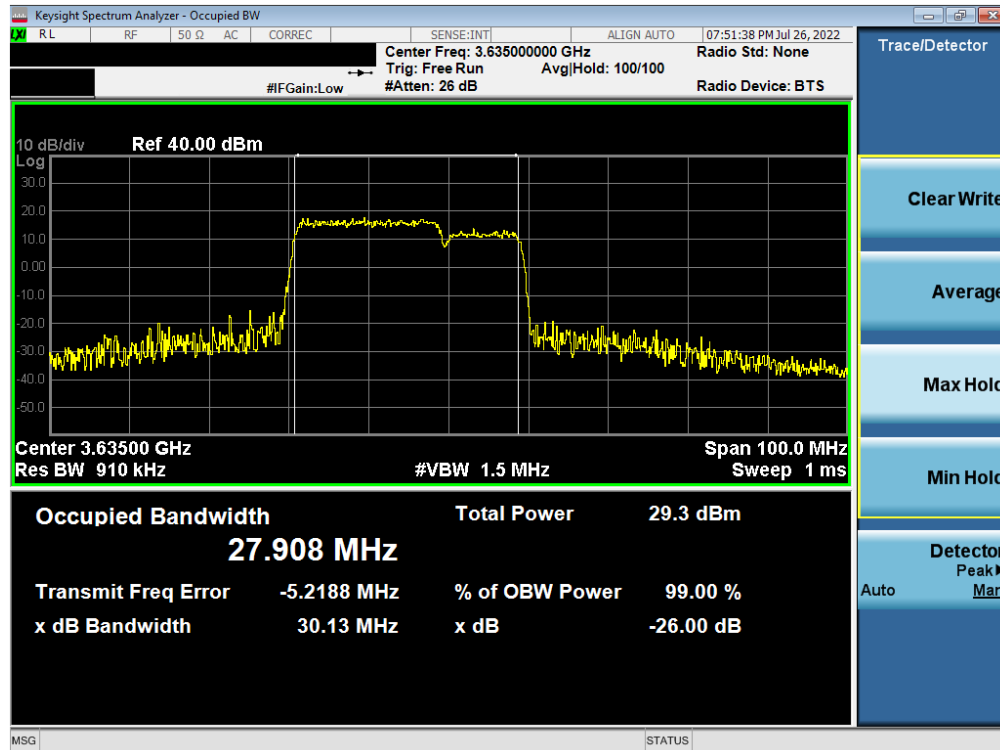


Plot 7-22. Occupied Bandwidth Plot (ULCA Band 48 - 20+10MHz 16-QAM - Full RB Configuration)

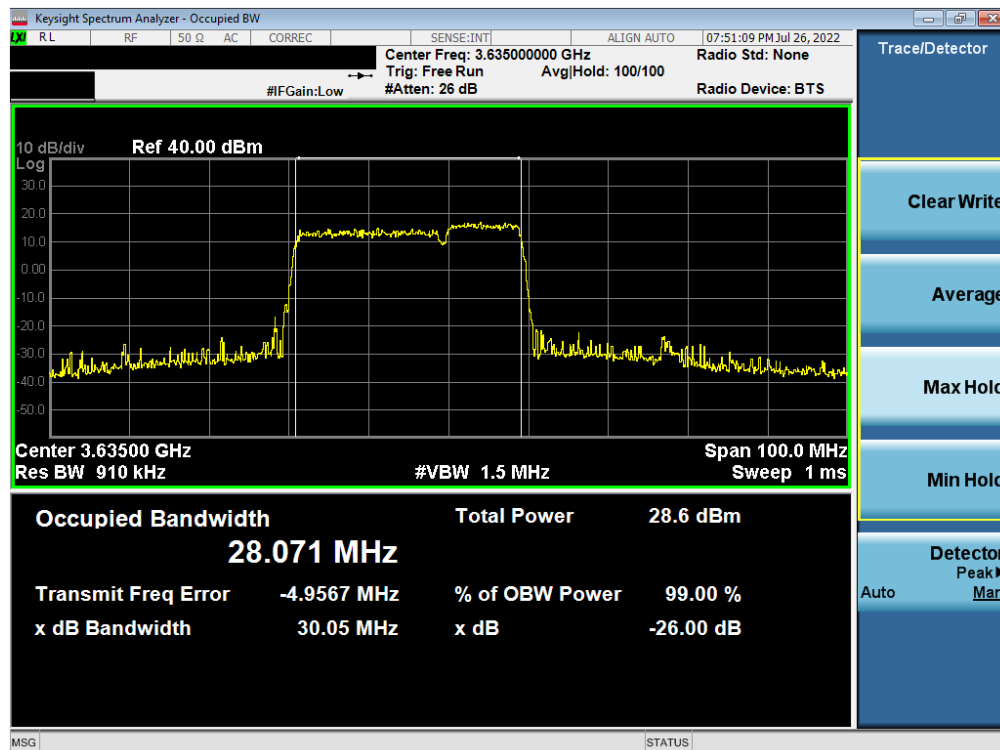
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Plot 7-23. Occupied Bandwidth Plot (ULCA Band 48 - 20+10MHz 64-QAM - Full RB Configuration)

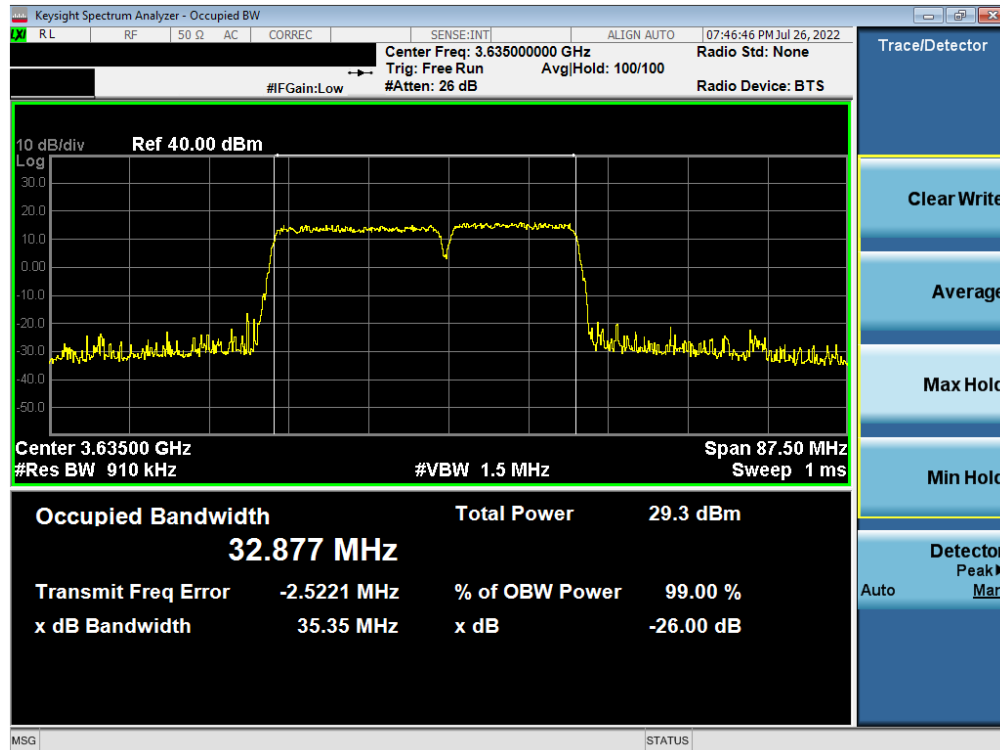


Plot 7-24. Occupied Bandwidth Plot (ULCA Band 48 - 20+10MHz 256-QAM - Full RB Configuration)

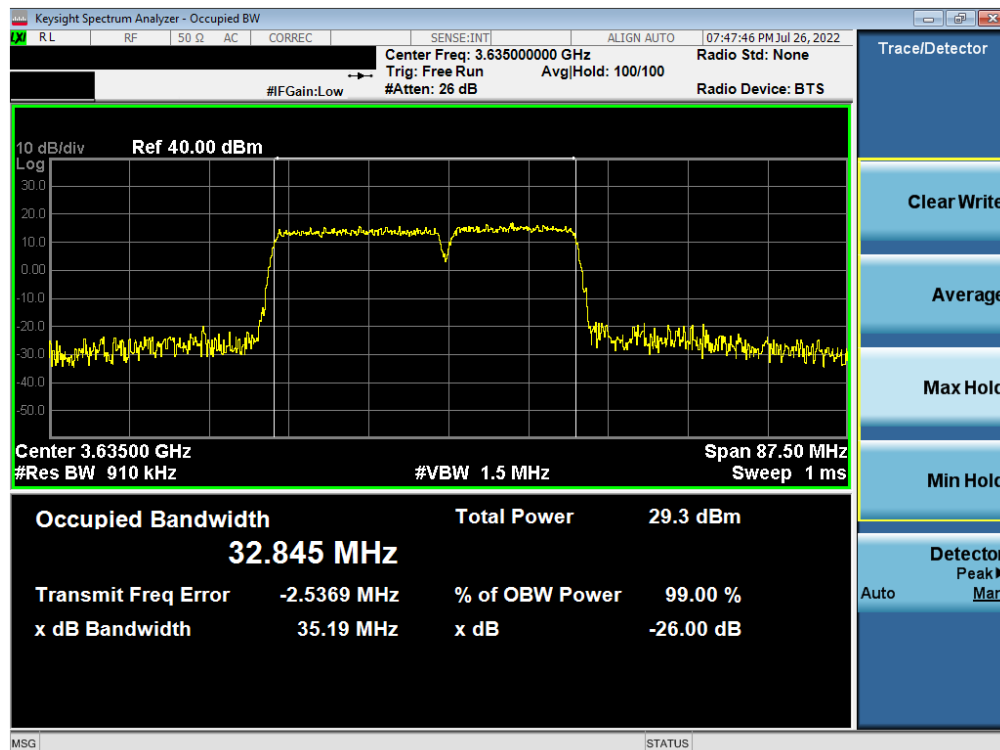
FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 26 of 89

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Plot 7-25. Occupied Bandwidth Plot (ULCA Band 48 - 20+15MHz QPSK - Full RB Configuration)

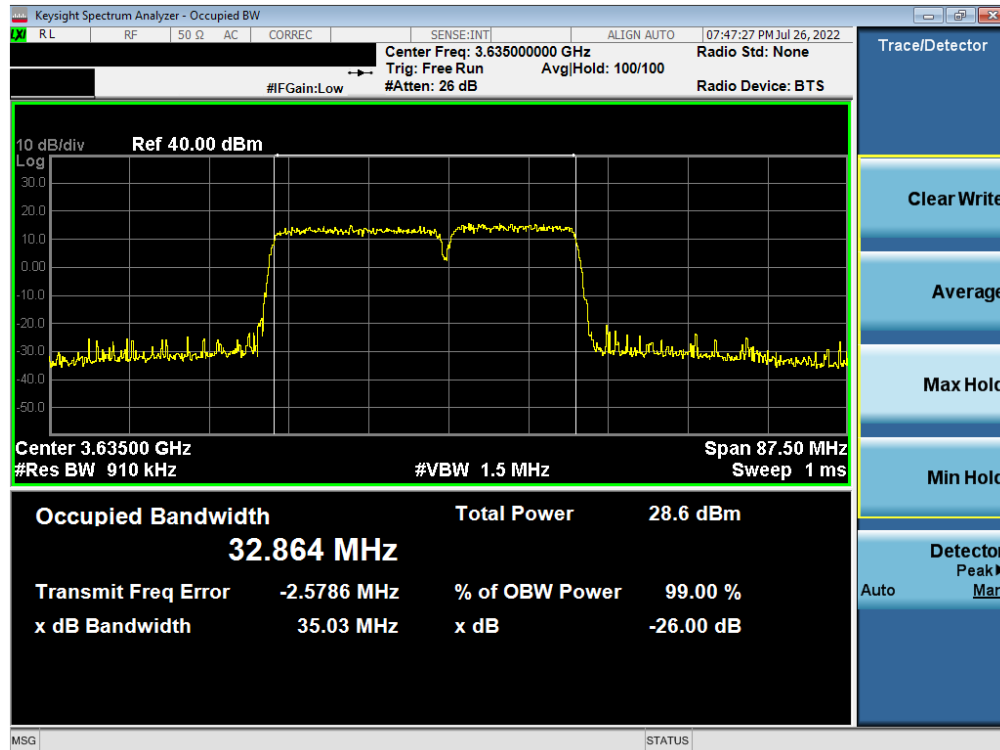


Plot 7-26. Occupied Bandwidth Plot (ULCA Band 48 - 20+15MHz 16-QAM - Full RB Configuration)

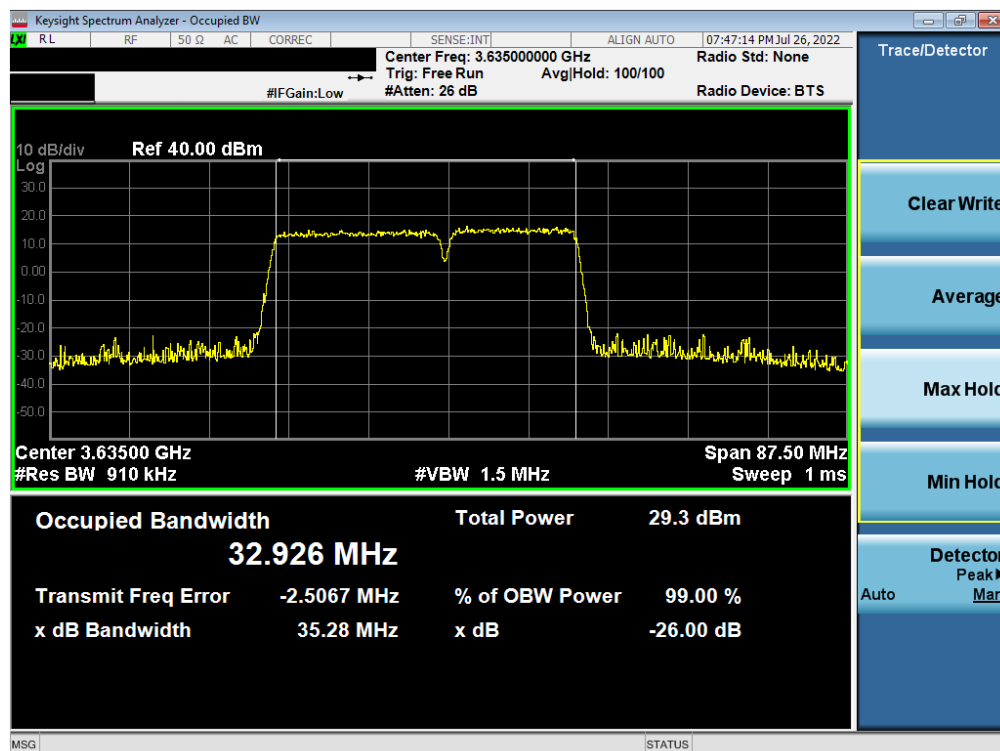
FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 27 of 89

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Plot 7-27. Occupied Bandwidth Plot (ULCA Band 48 - 20+15MHz 64-QAM - Full RB Configuration)

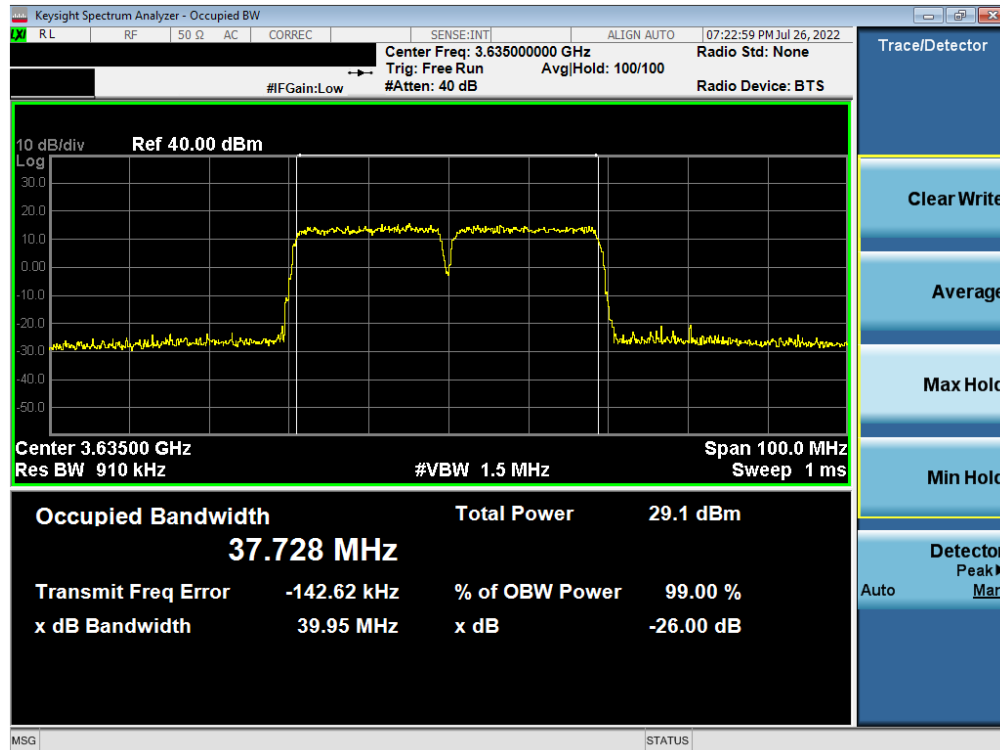


Plot 7-28. Occupied Bandwidth Plot (ULCA Band 48 - 20+15MHz 256-QAM - Full RB Configuration)

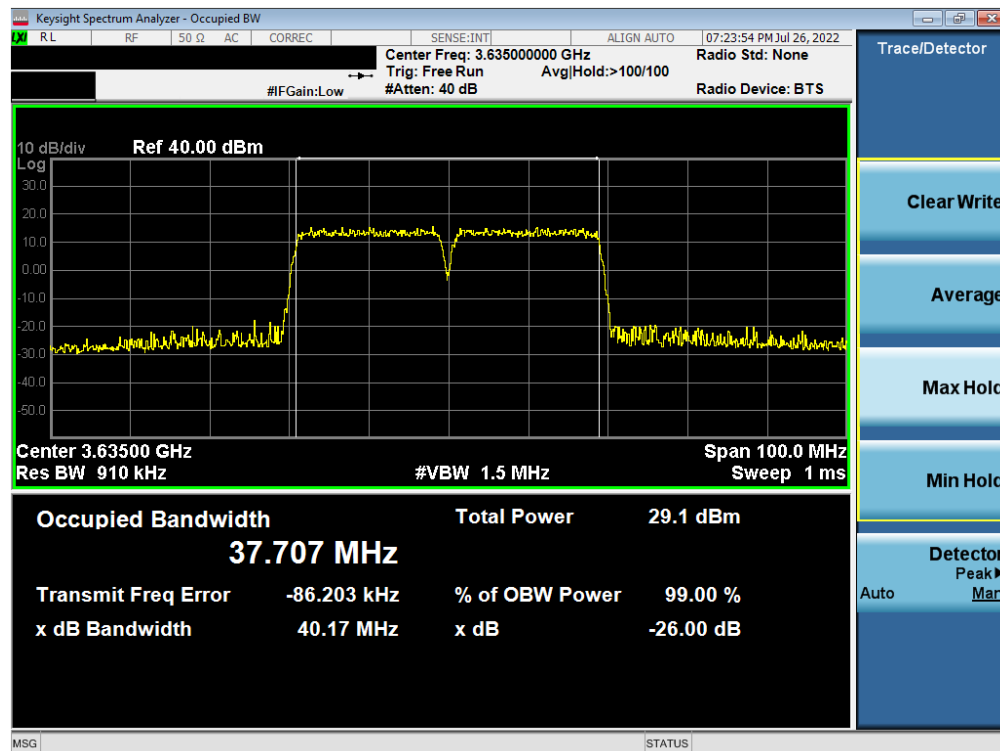
FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 28 of 89

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Plot 7-29. Occupied Bandwidth Plot (ULCA Band 48 - 20+20MHz QPSK - Full RB Configuration)

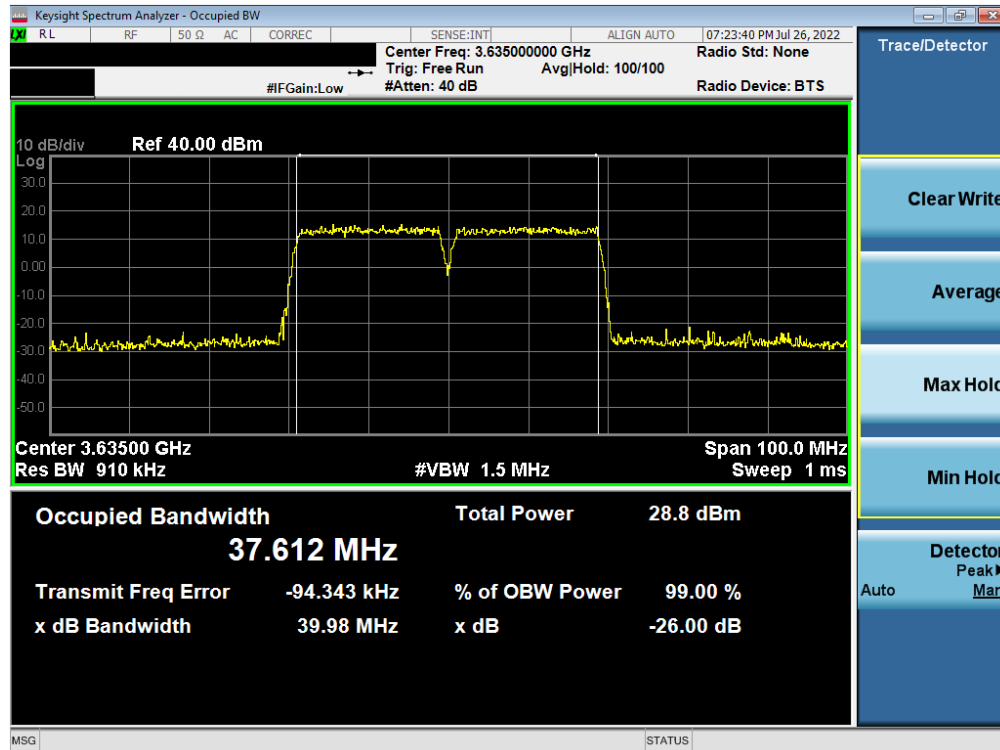


Plot 7-30. Occupied Bandwidth Plot (ULCA Band 48 - 20+20MHz 16-QAM - Full RB Configuration)

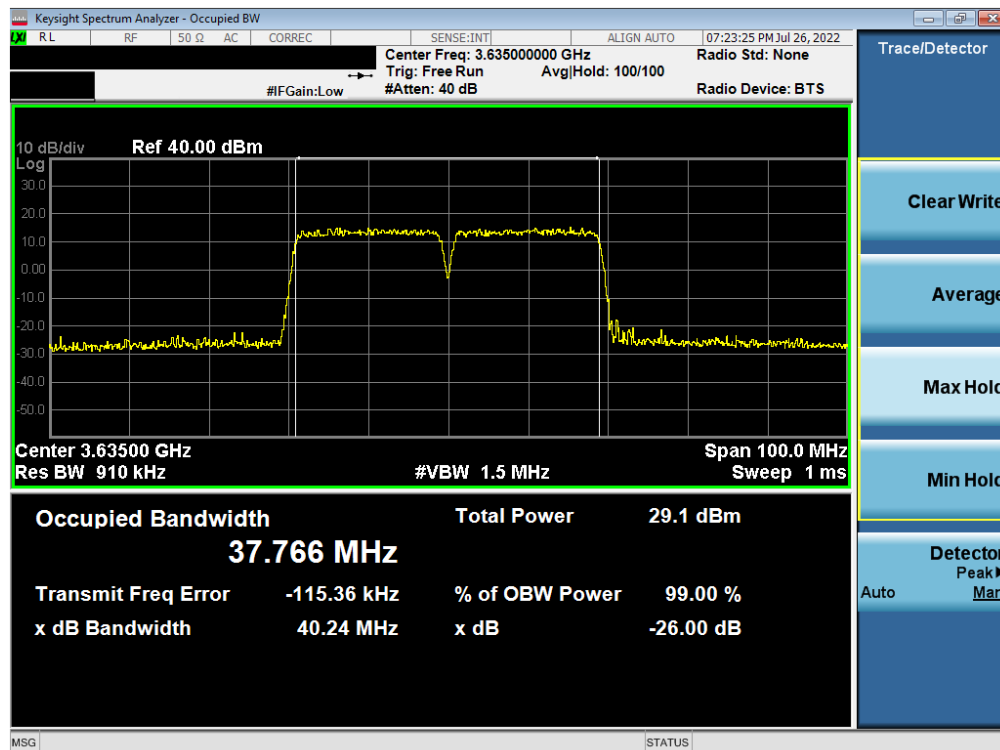
FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 29 of 89

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Plot 7-31. Occupied Bandwidth Plot (ULCA Band 48 - 20+20MHz 64-QAM - Full RB Configuration)



Plot 7-32. Occupied Bandwidth Plot (ULCA Band 48 - 20+20MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §96.41(e)

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 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. All ports were tested and only the worst case data were reported.

The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/Mhz.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = Average
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

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

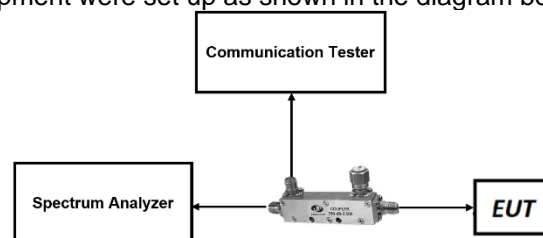




Figure 7-2. Test Instrument & Measurement Setup

FCC ID: BCGA2764	 PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Test Notes

1. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. However, 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. 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. Uplink carrier aggregation conducted spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. The worst case (highest) powers were found while operating with QPSK modulation with both carriers set to transmit using 1RB.
3. Uplink carrier aggregation inter-band emission was investigated and found to not be the worst case

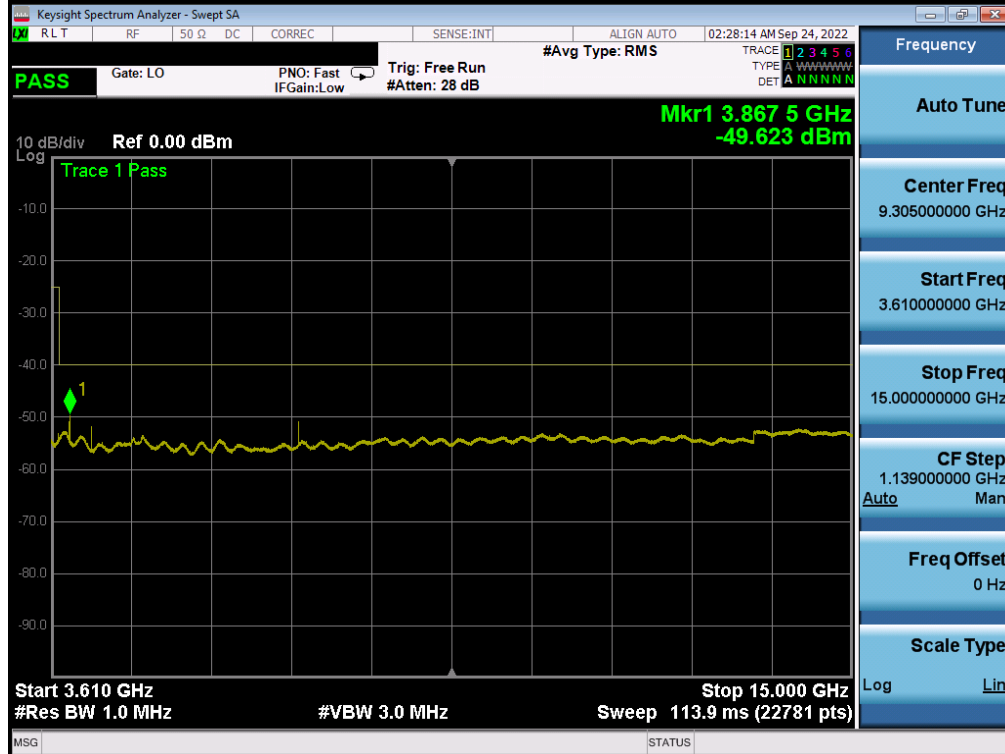
FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 32 of 89

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LTE Band 48



Plot 7-33. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

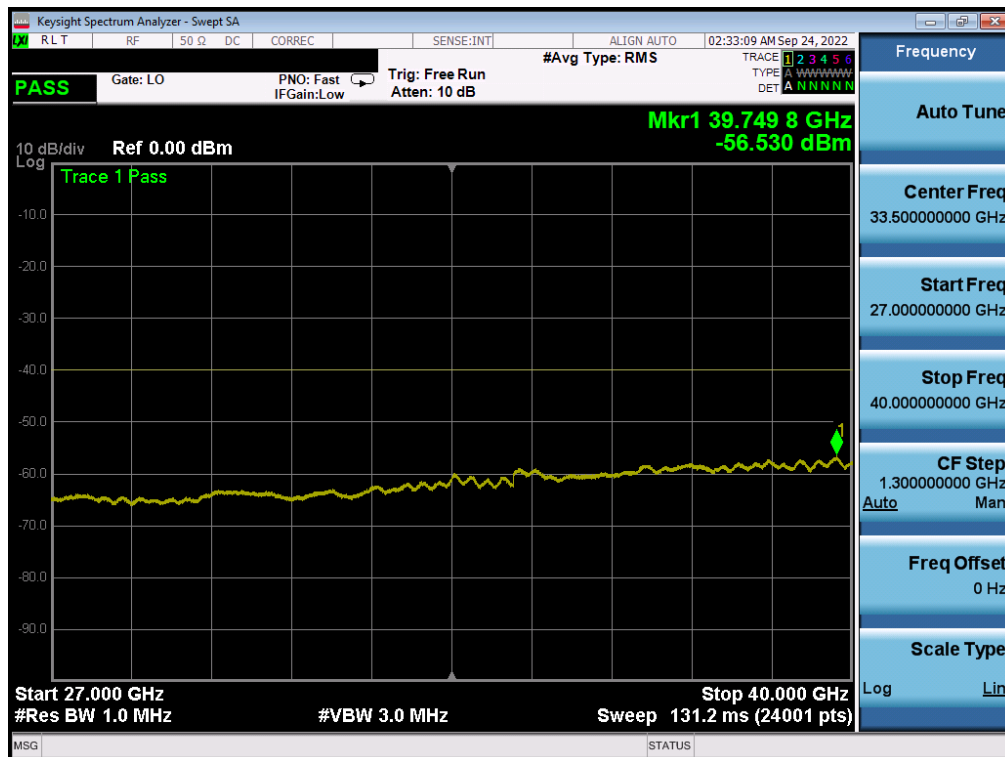


Plot 7-34. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 33 of 89	



Plot 7-35. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

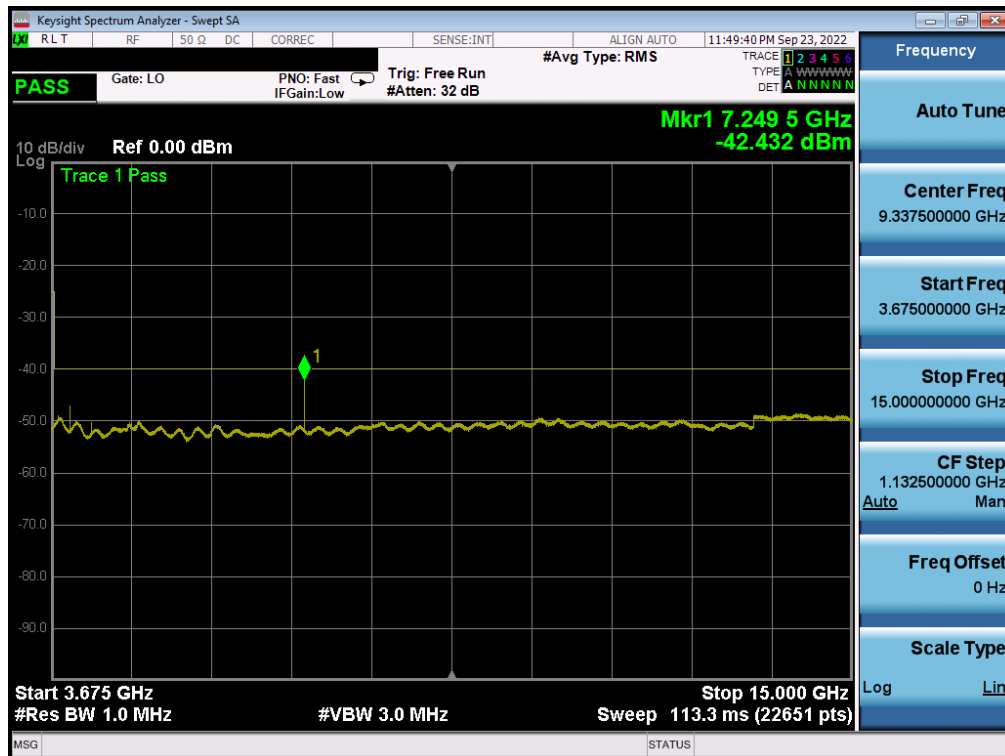


Plot 7-36. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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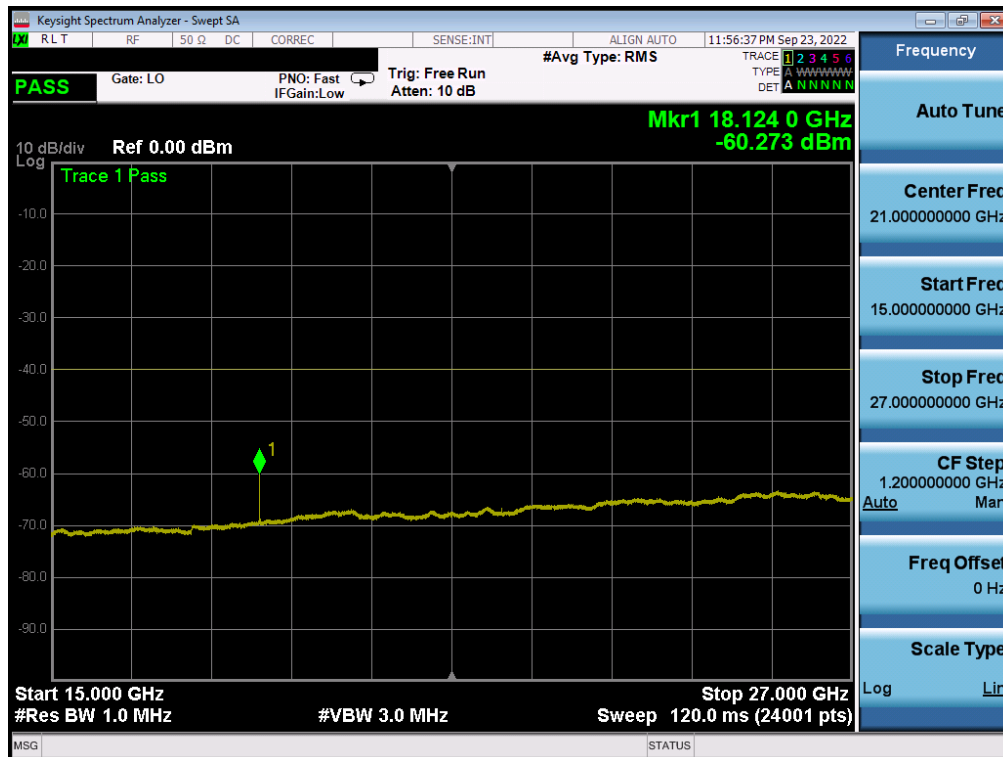


Plot 7-37. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

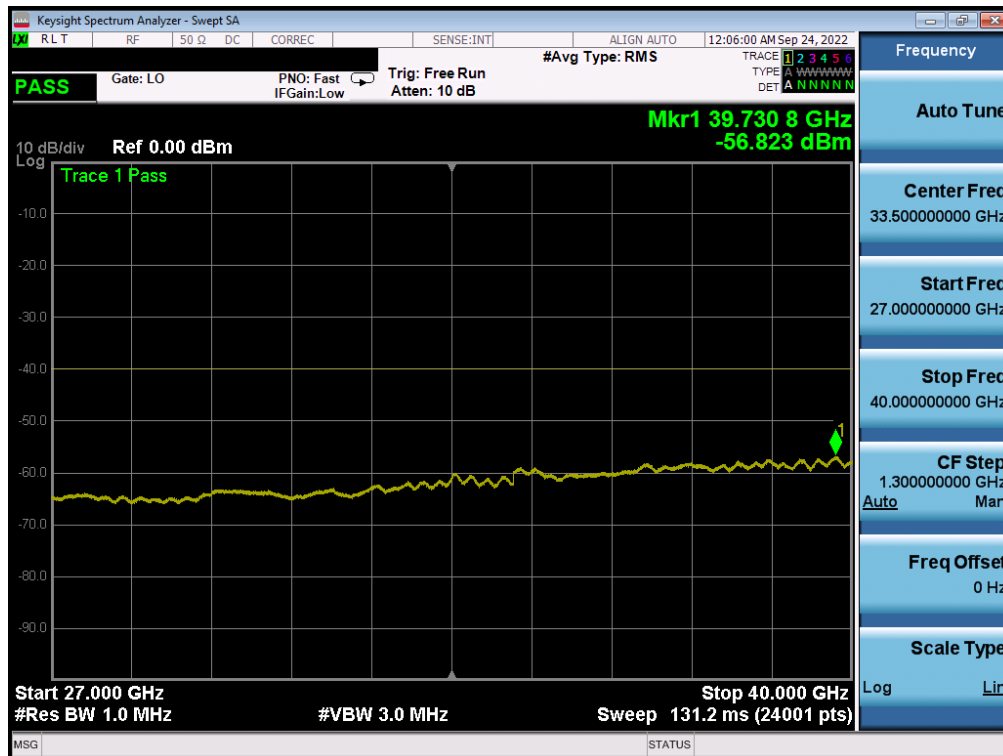


Plot 7-38. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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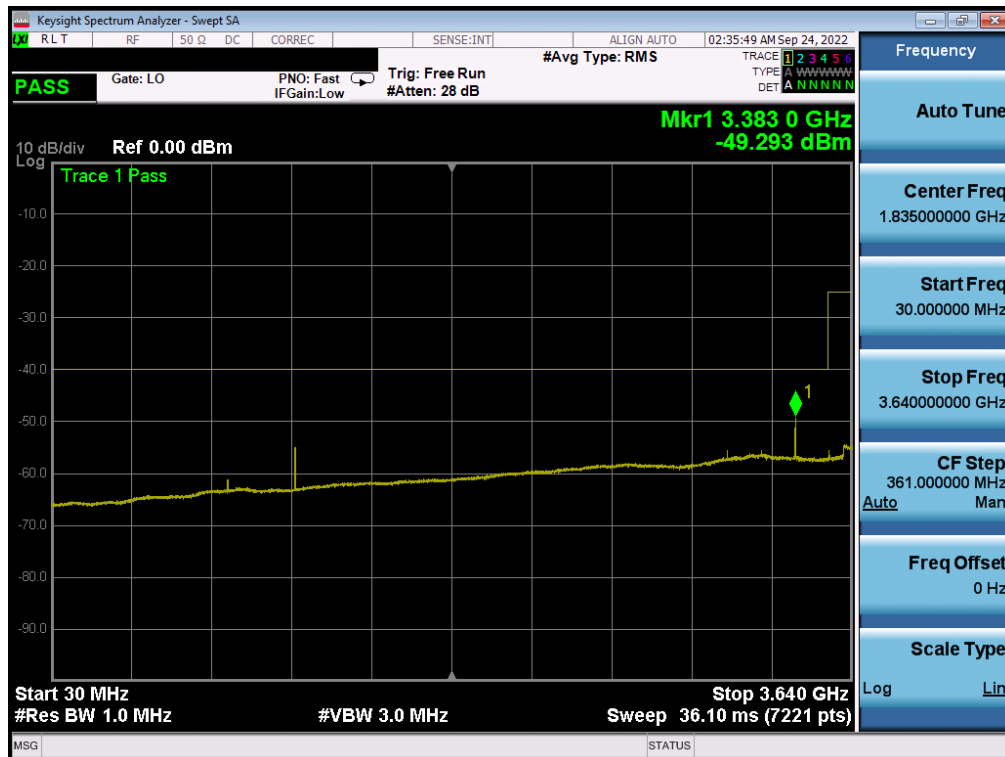


Plot 7-39. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

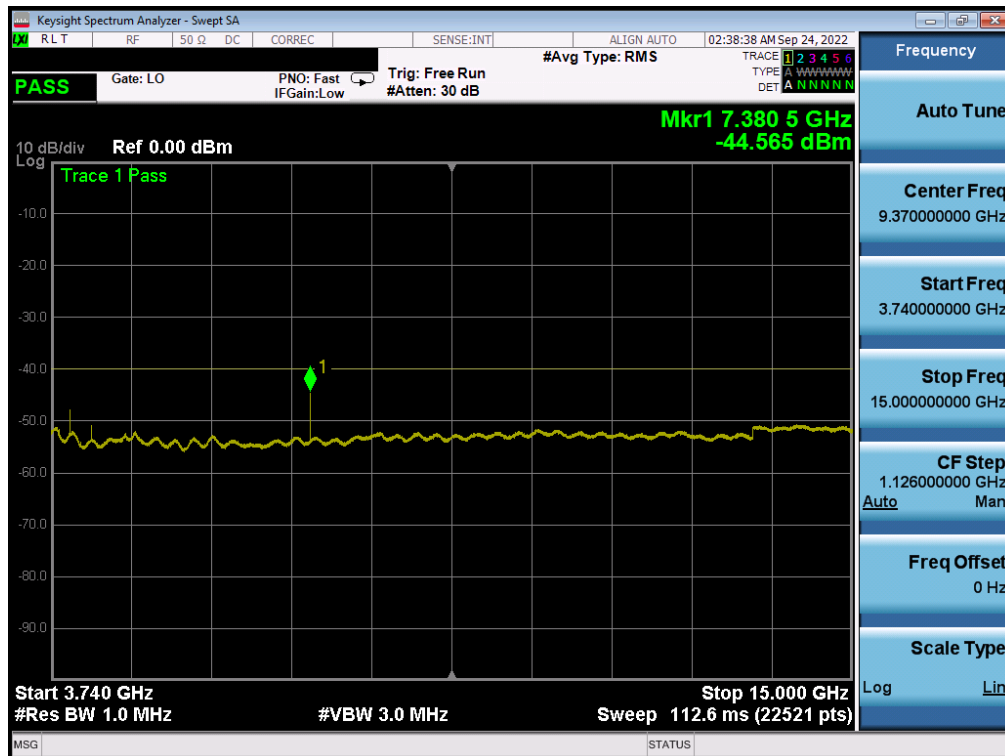


Plot 7-40. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 36 of 89



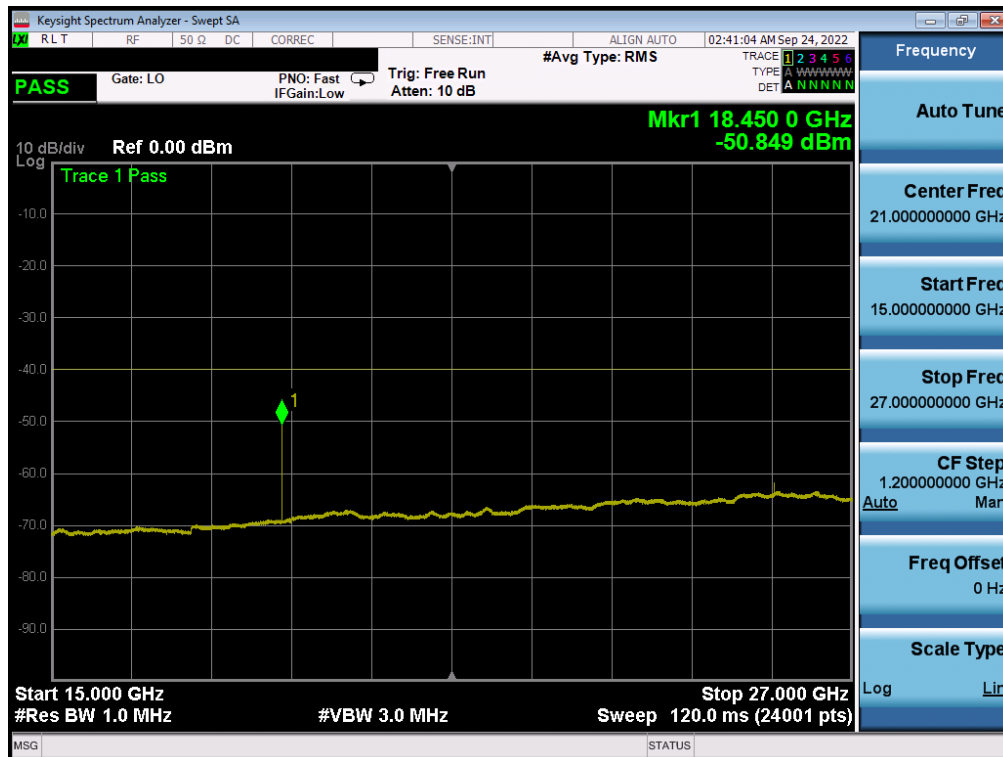
Plot 7-41. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)



Plot 7-42. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-43. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)



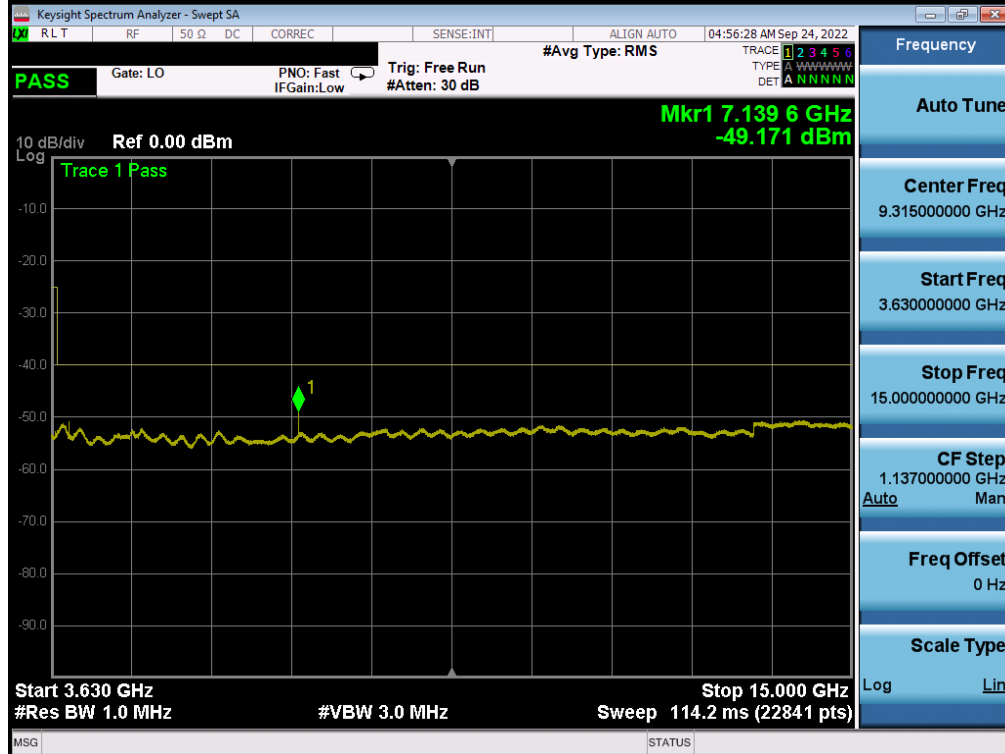
Plot 7-44. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 38 of 89


ULCA BAND 48

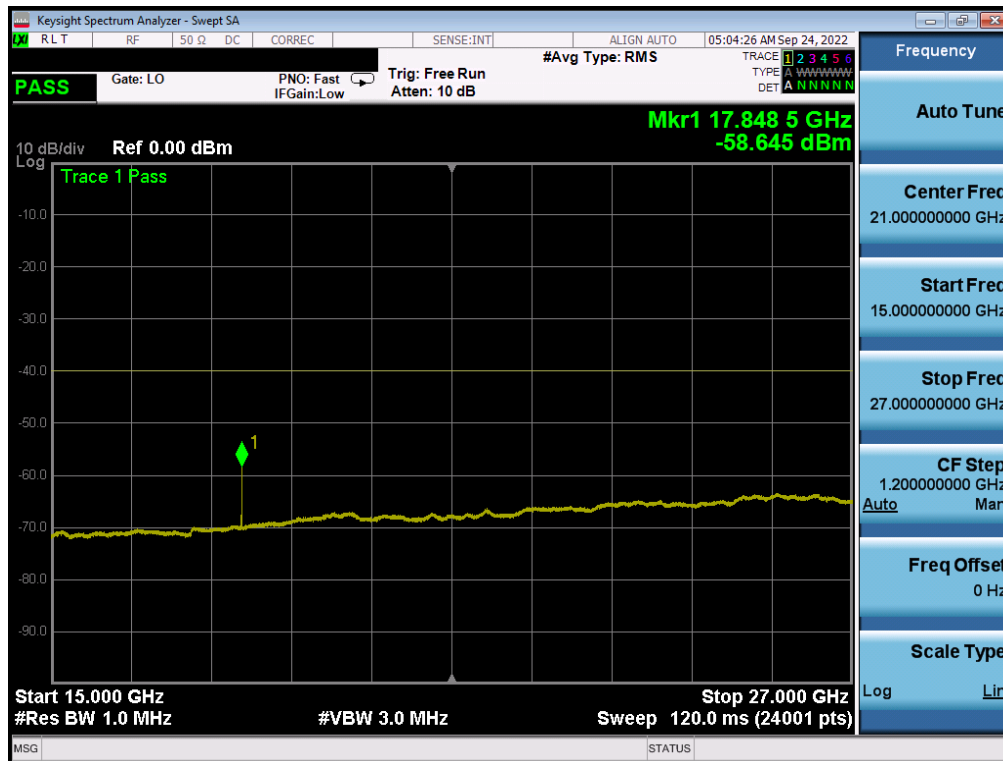


Plot 7-45. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - Low Channel)

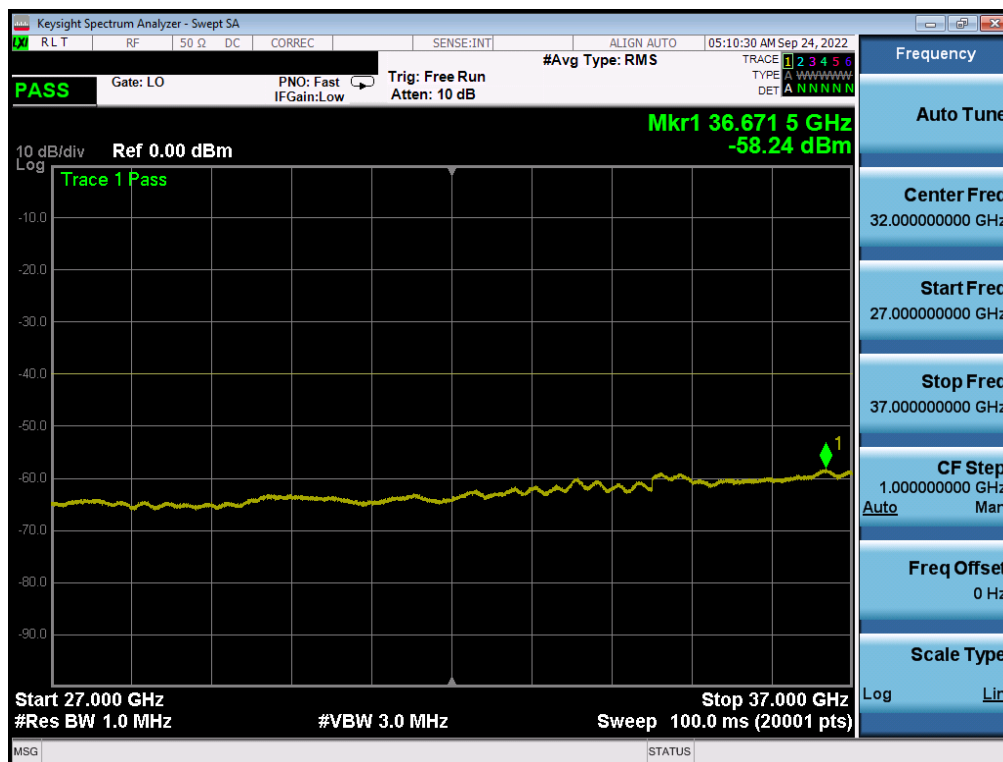


Plot 7-46. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - Low Channel)

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 39 of 89

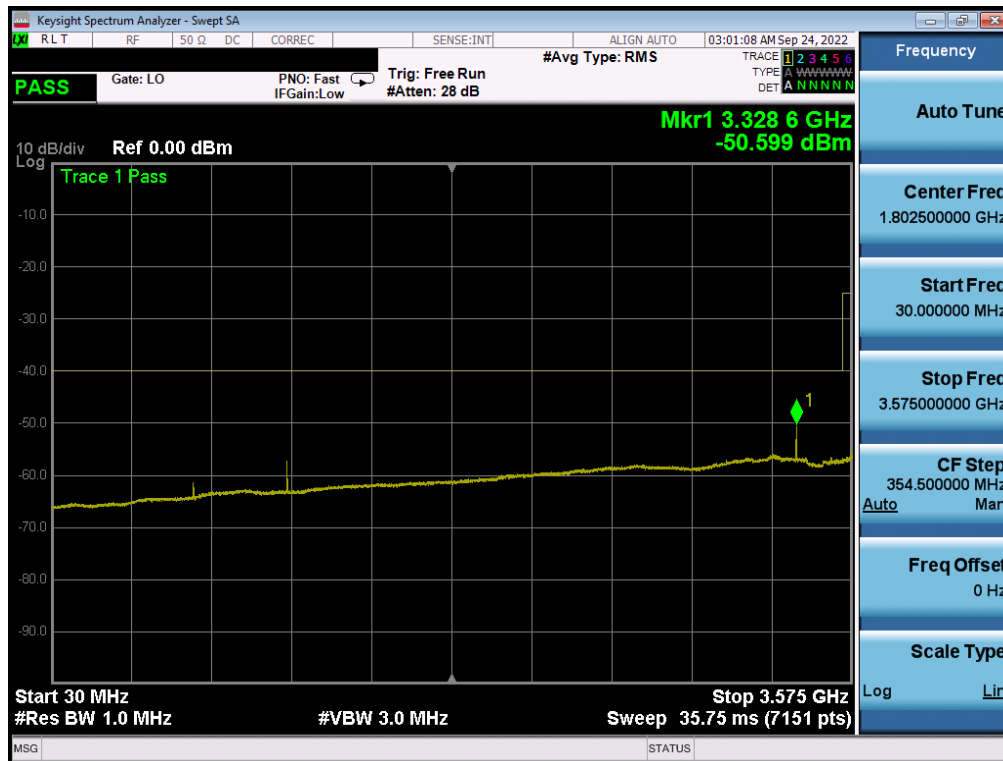


Plot 7-47. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - Low Channel)

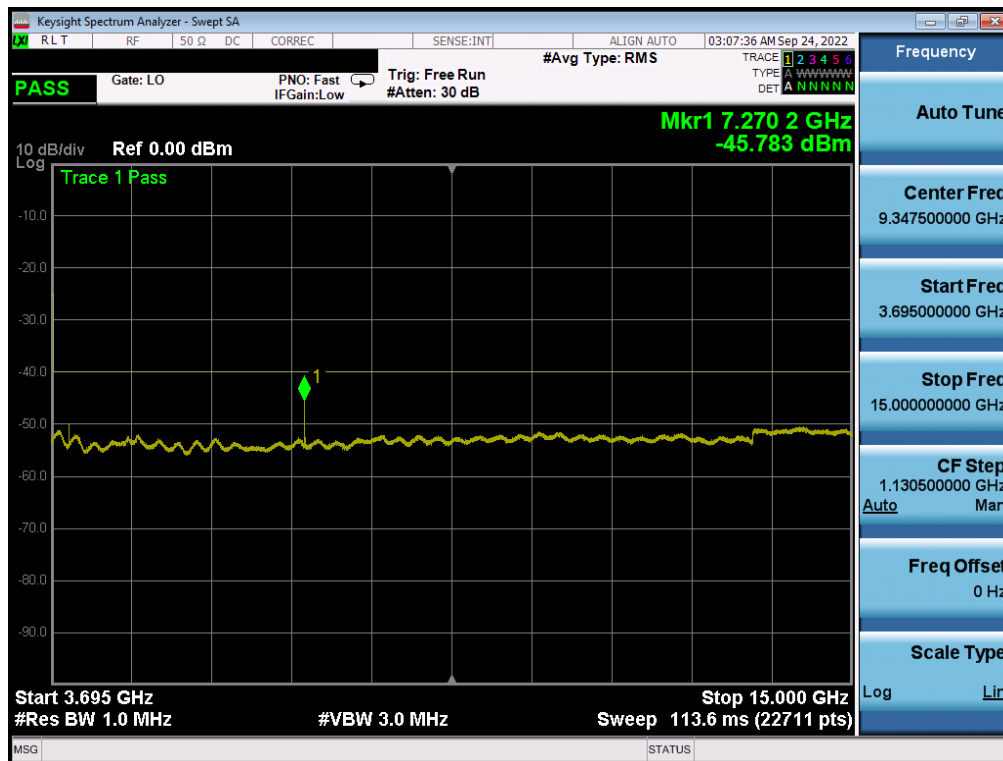


Plot 7-48. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - Low Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 40 of 89

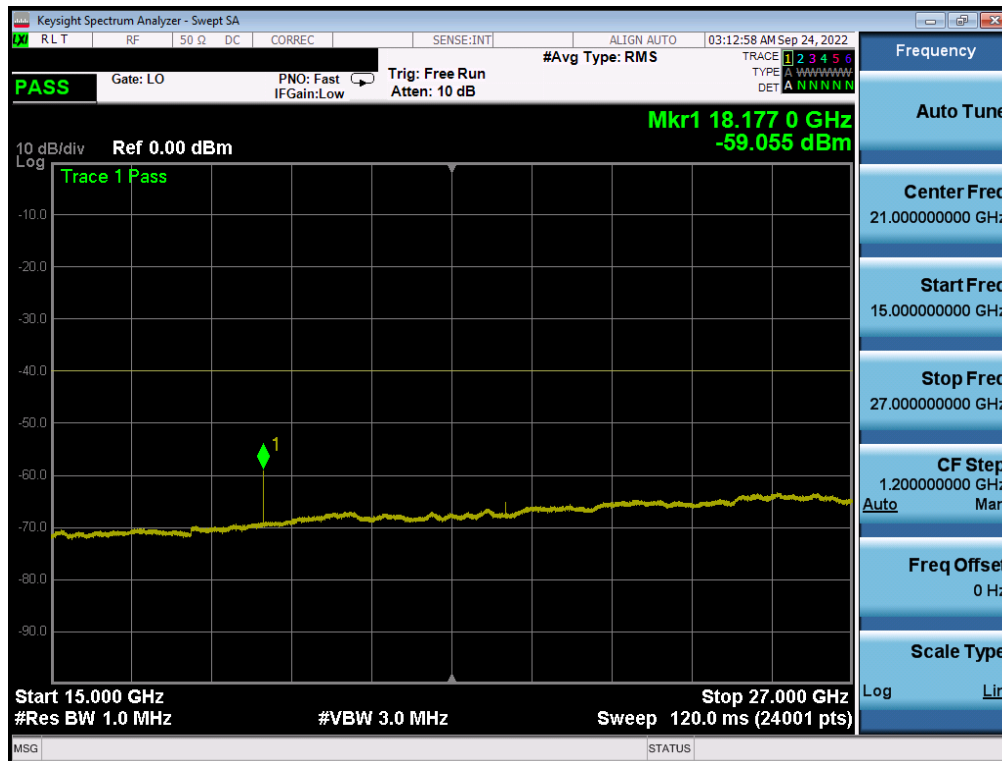


Plot 7-49. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - Mid Channel)

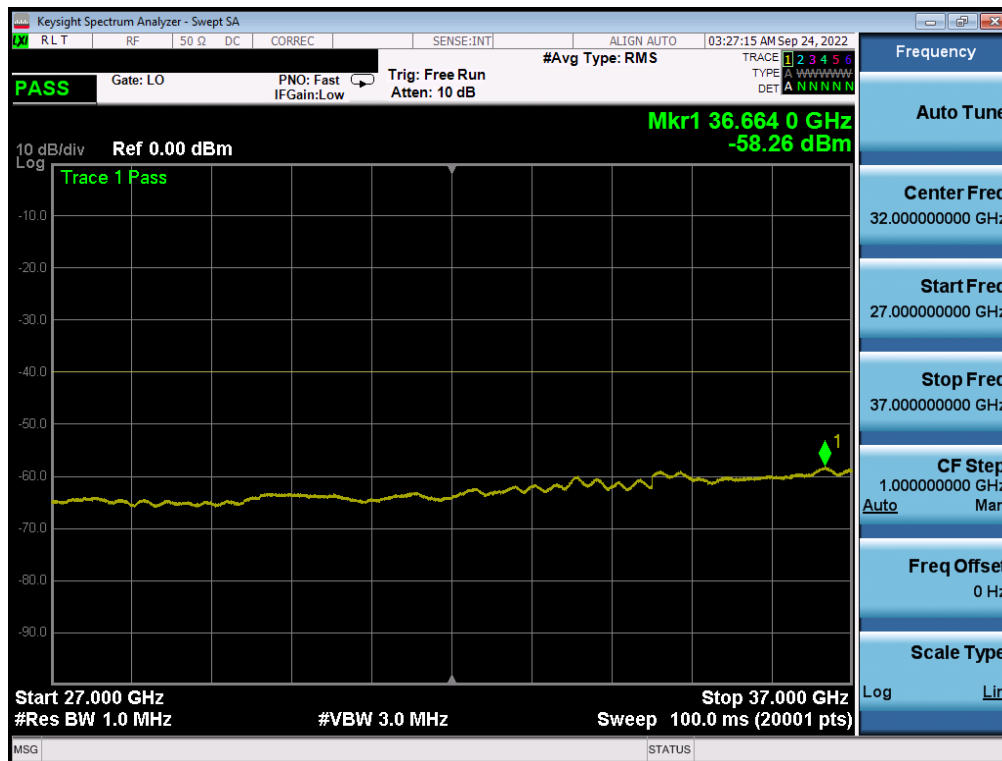


Plot 7-50. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - Mid Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-51. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - Mid Channel)

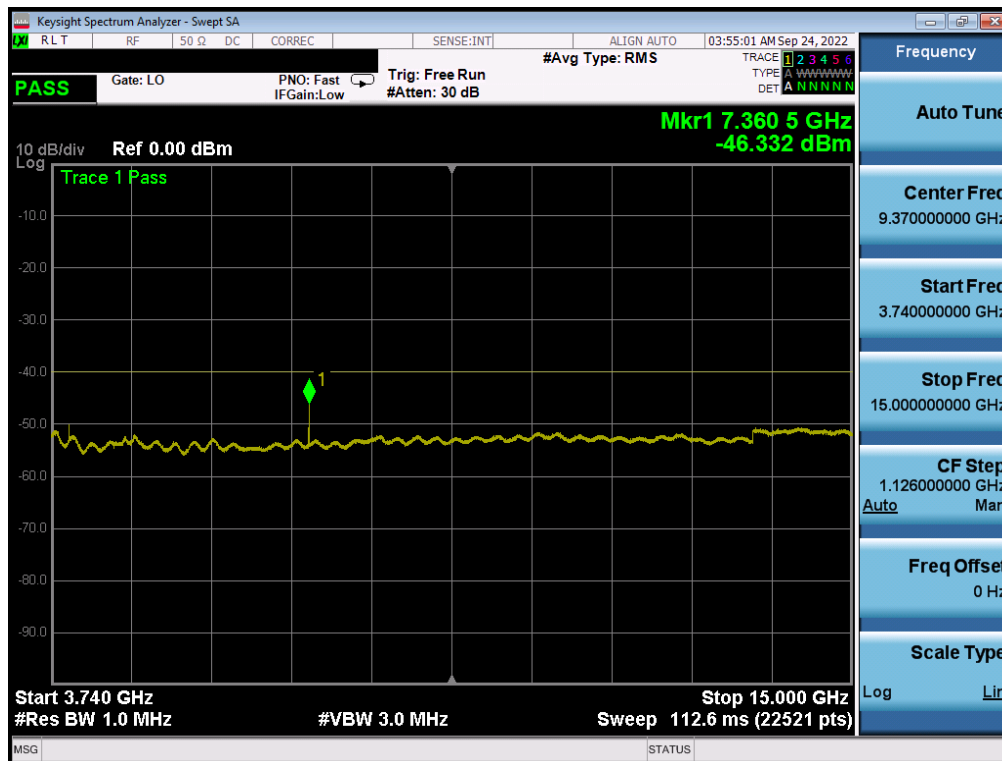


Plot 7-52. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - Mid Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 42 of 89

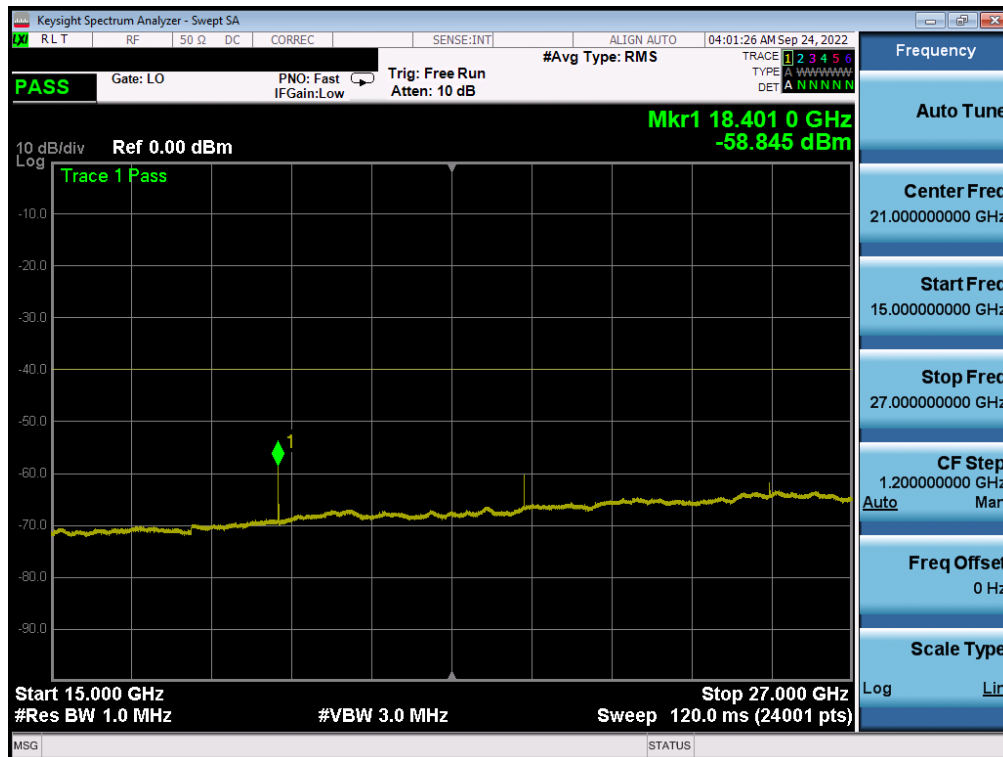


Plot 7-53. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - High Channel)

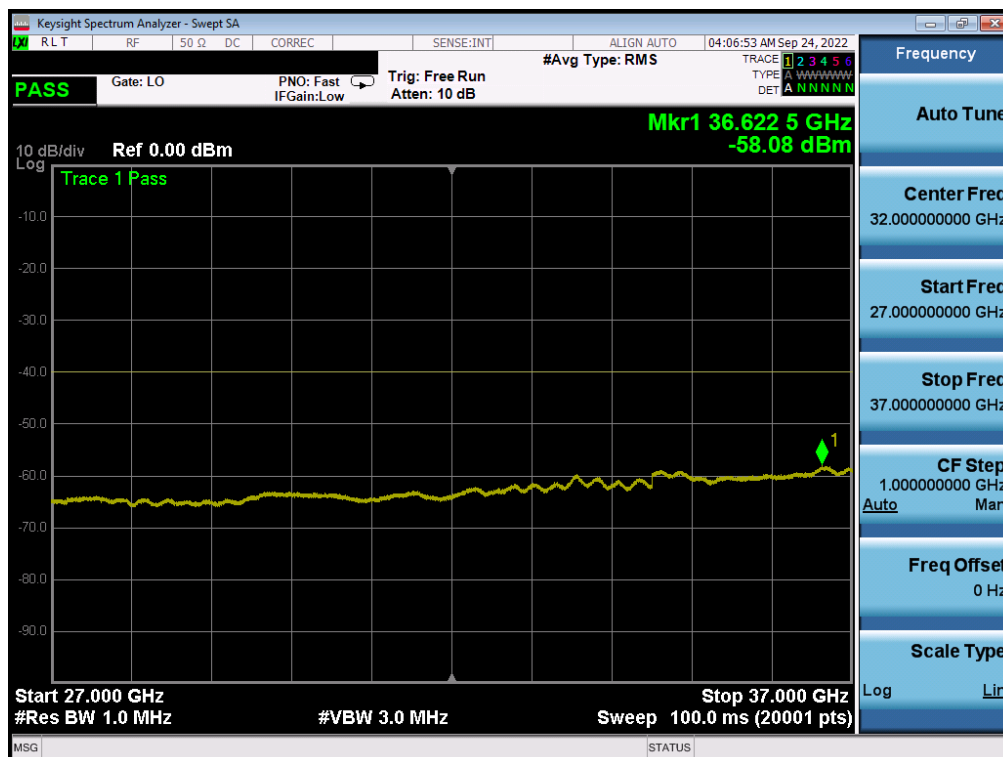


Plot 7-54. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - High Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-55. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - High Channel)



Plot 7-56. Conducted Spurious Plot (ULCA Band 48 - 20+20MHz QPSK - High Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §96.41(e)(ii)

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 and all ports were investigated and the worst case configuration results are reported in this section.

The conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0 to B MHz (where B is the bandwidth in MHz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B MHz below the lower CBSD-assigned channel edge. At all frequencies greater than B MHz above the upper CBSD assigned channel edge and less than B MHz below the lower CBSD-assigned channel edge, the conducted power of any end user device emission shall not exceed -25 dBm/MHz. The conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

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 \geq 1% of the emission bandwidth
4. VBW \geq 3 x RBW
5. Detector = RMS
6. Number of sweep points \geq 2 x Span/RBW
7. Trace mode = trace average
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.

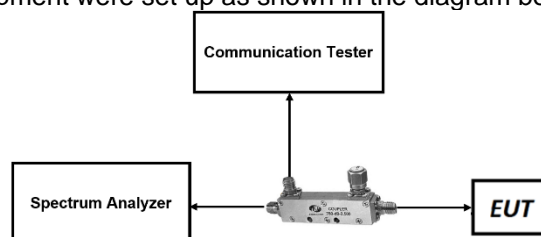



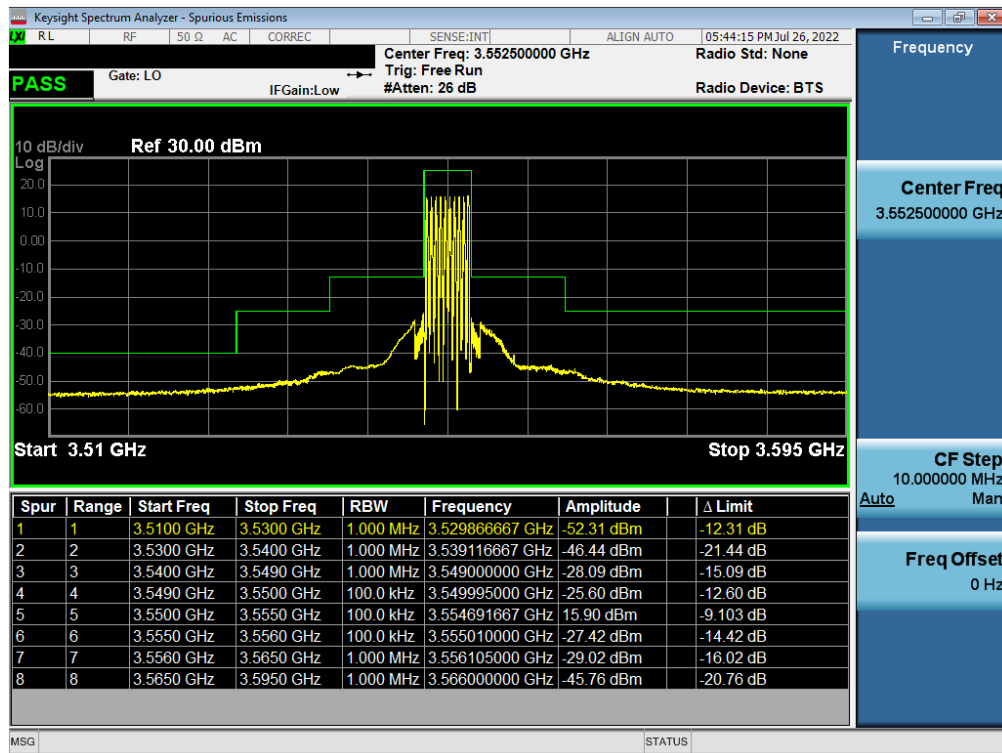
Figure 7-3. Test Instrument & Measurement Setup

Test Notes

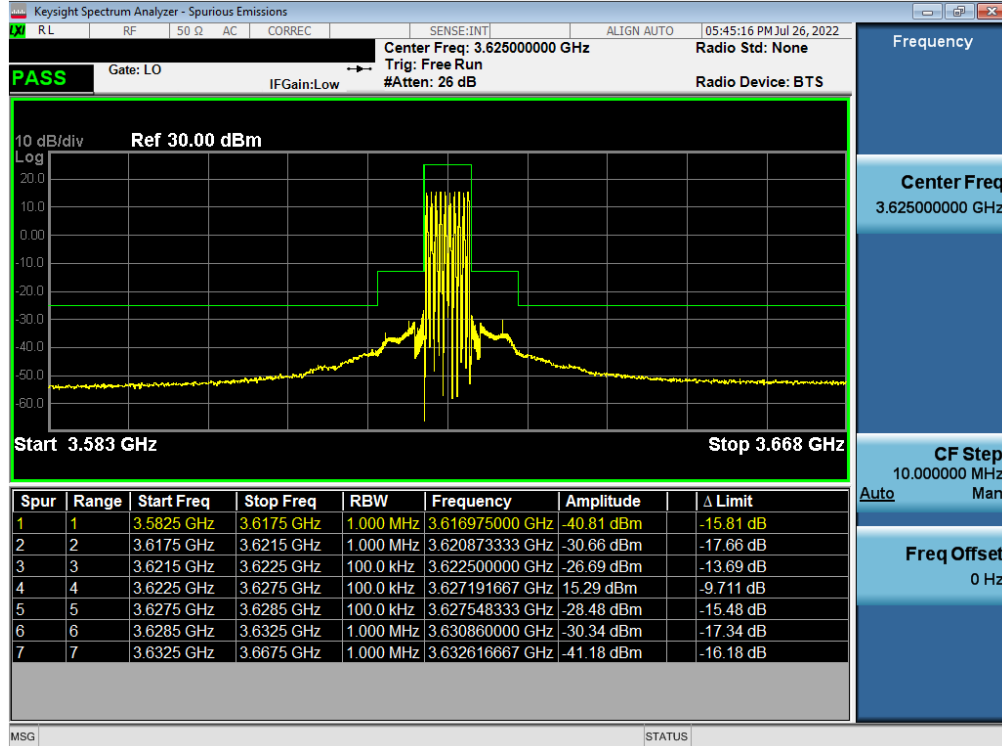
None

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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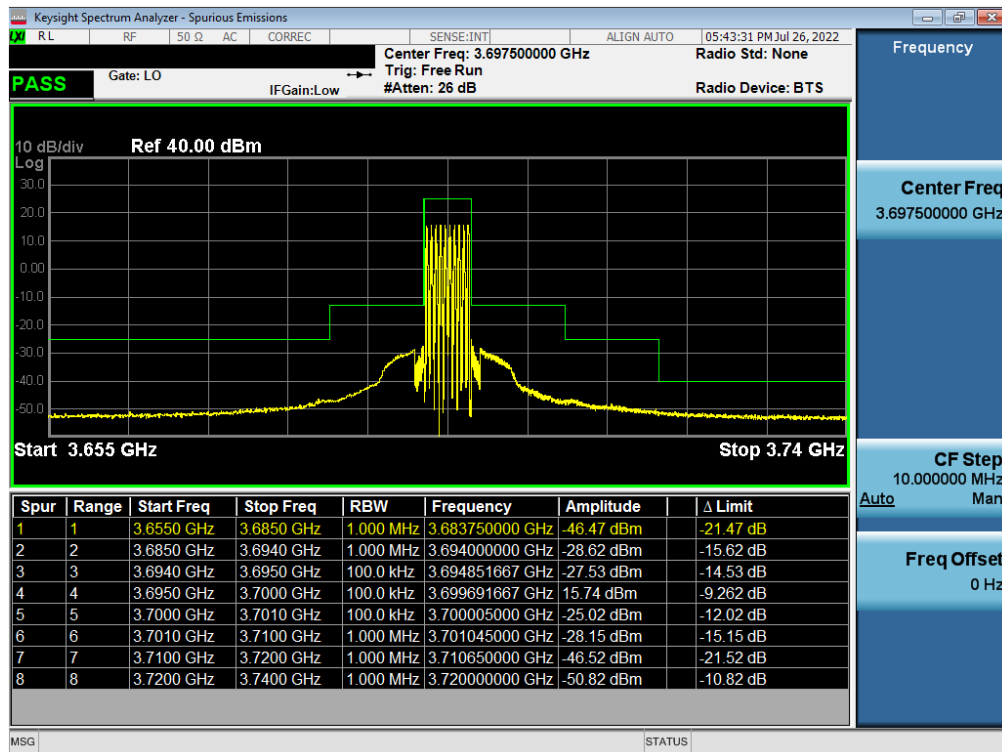


Plot 7-57. Channel Edge Plot (LTE Band 48 - 5MHz QPSK - Low Channel)

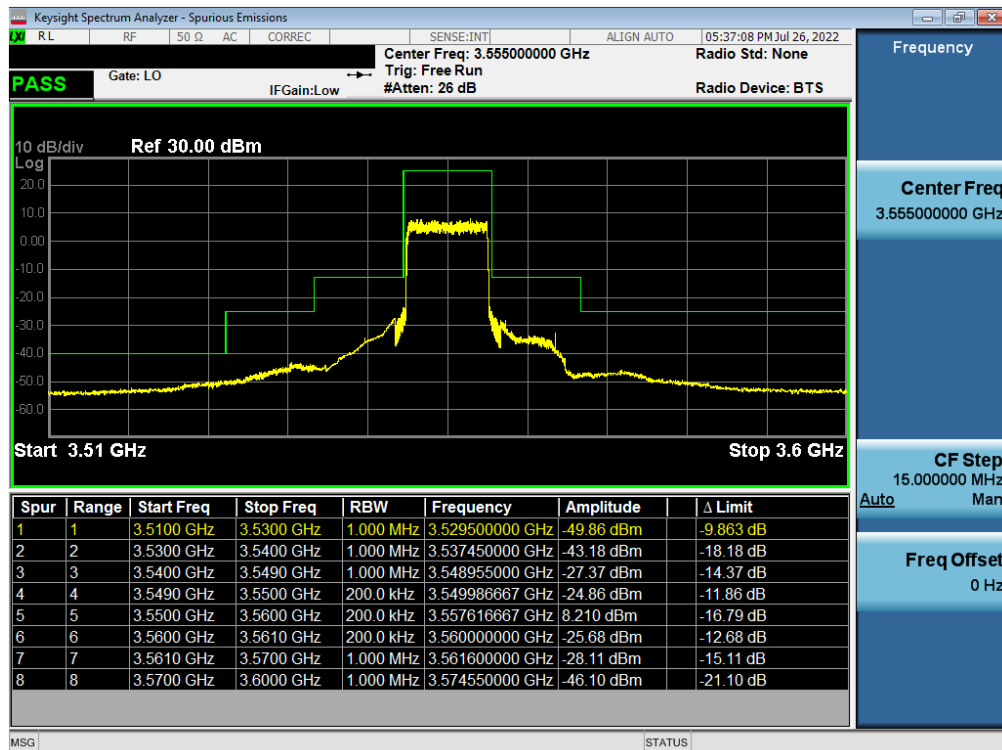


Plot 7-58. Channel Edge Plot (LTE Band 48 - 5MHz QPSK - Mid Channel)

FCC ID: BCGA2764	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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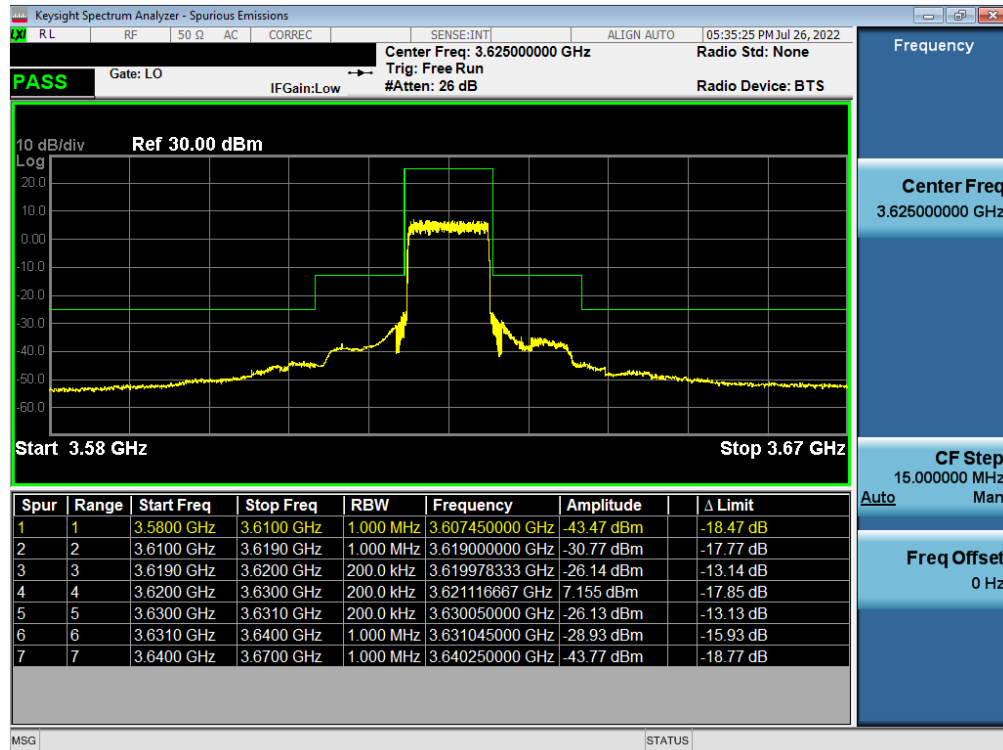


Plot 7-59. Channel Edge Plot (LTE Band 48 - 5MHz QPSK - High Channel)

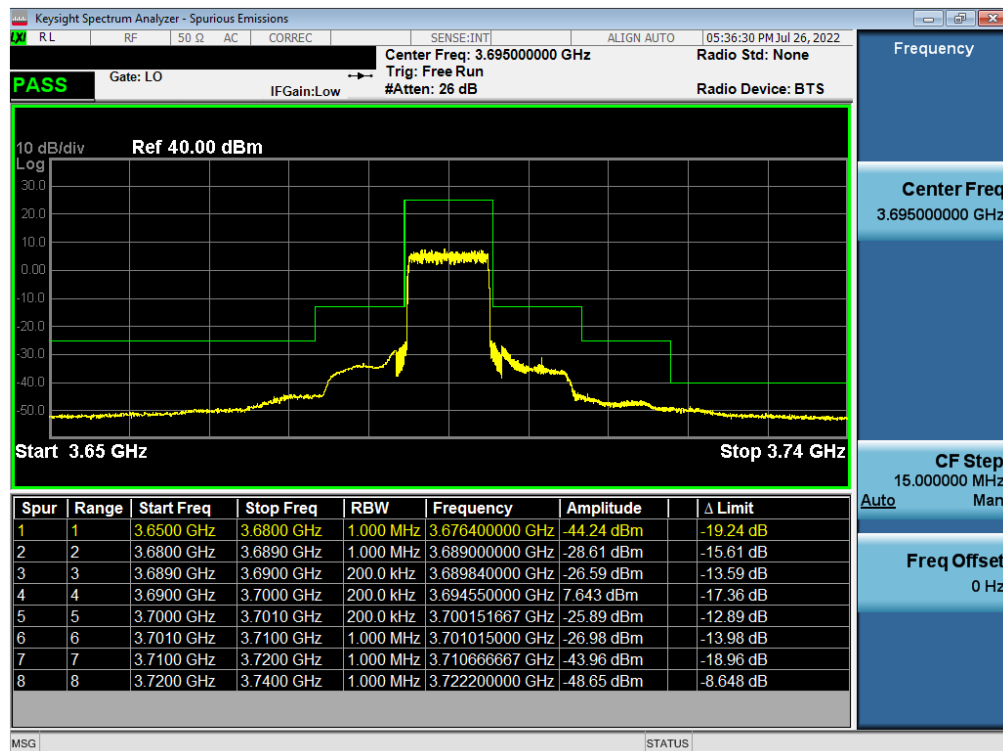


Plot 7-60. Channel Edge Plot (LTE Band 48 - 10MHz QPSK - Low Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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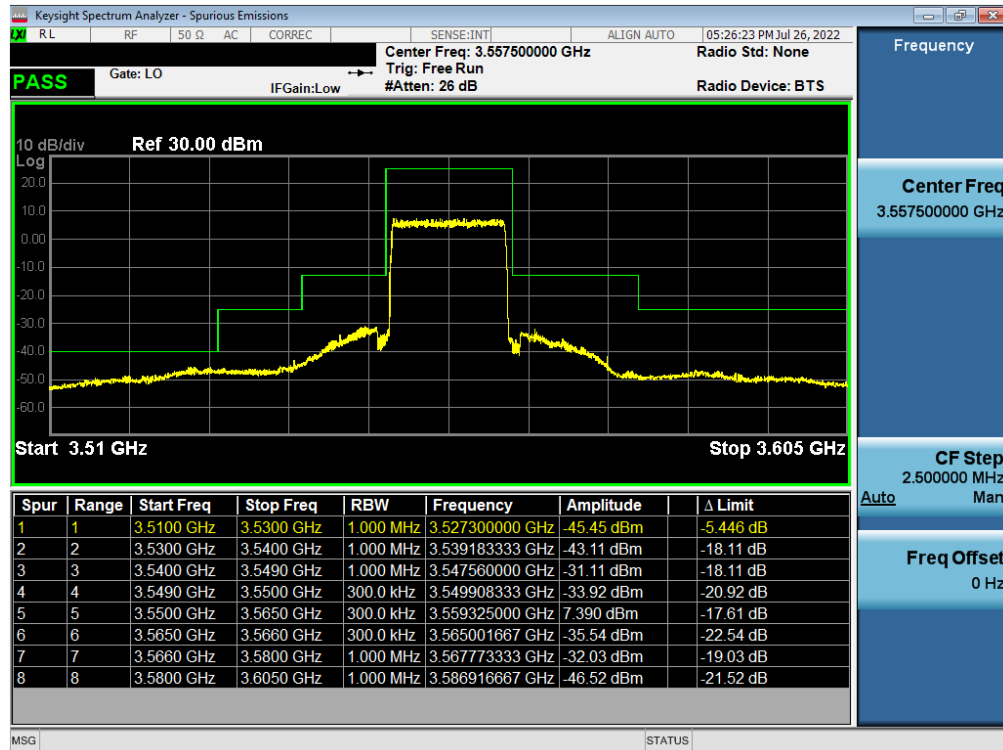


Plot 7-61. Channel Edge Plot (LTE Band 48 - 10MHz QPSK - Mid Channel)

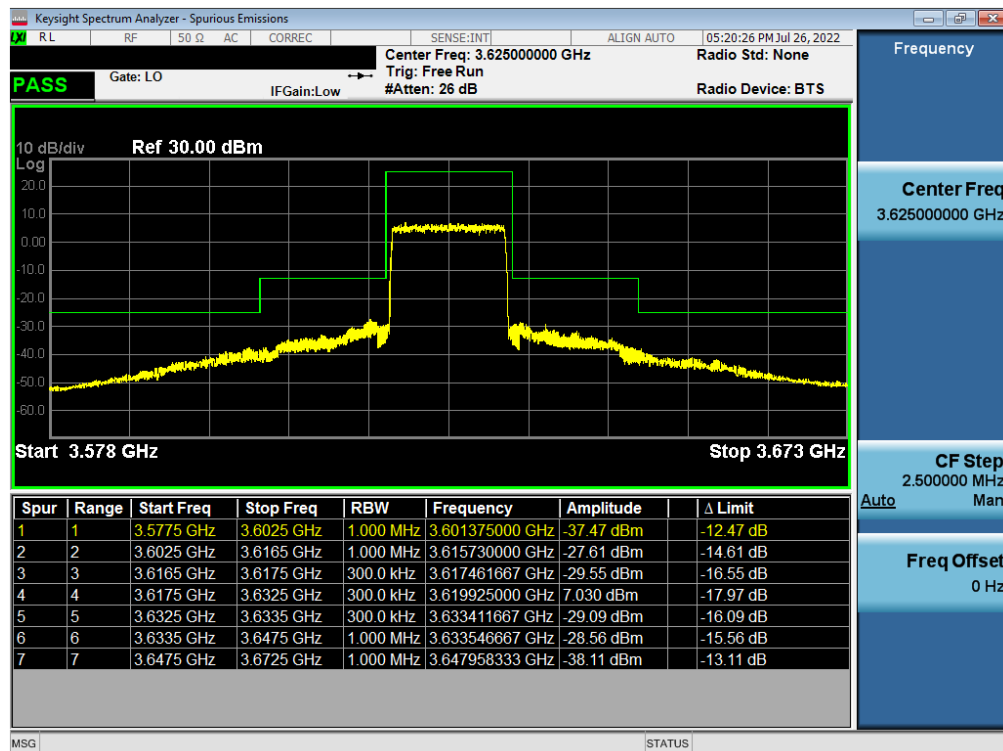


Plot 7-62. Channel Edge Plot (LTE Band 48 - 10MHz QPSK - High Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-63. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - Low Channel)

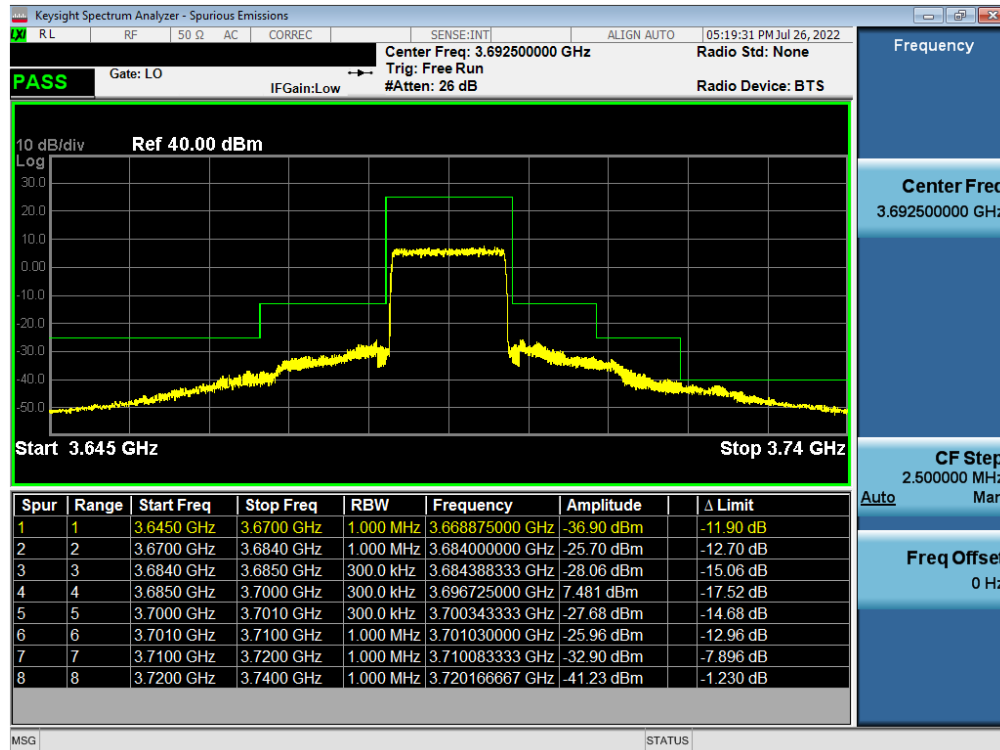


Plot 7-64. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - Mid Channel)

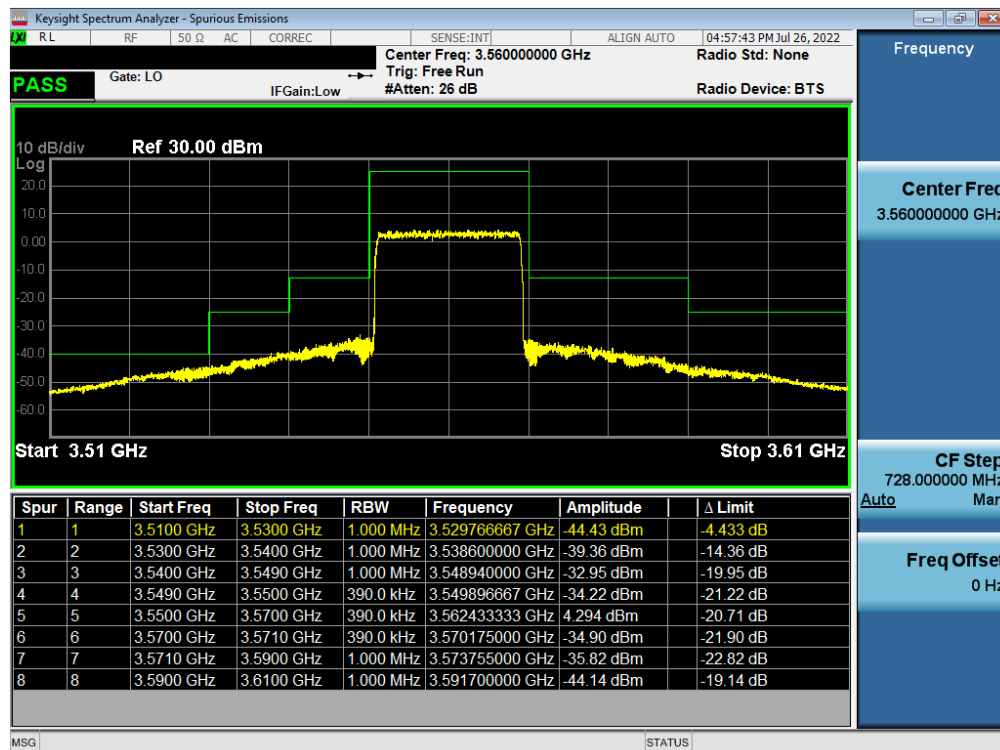
FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 49 of 89

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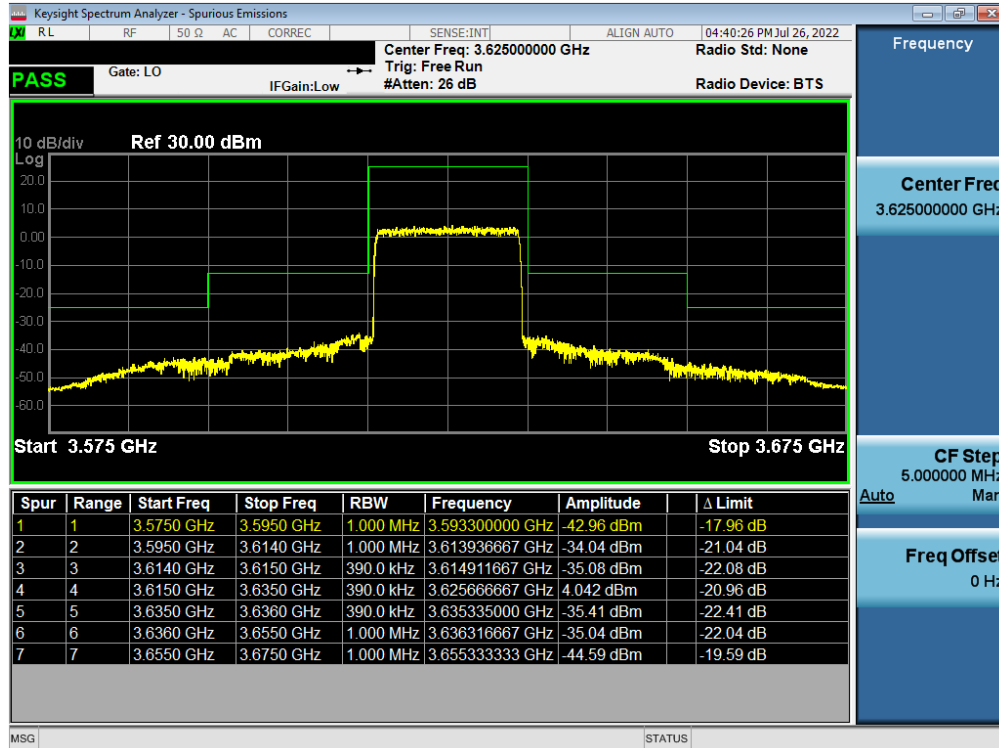


Plot 7-65. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - High Channel)

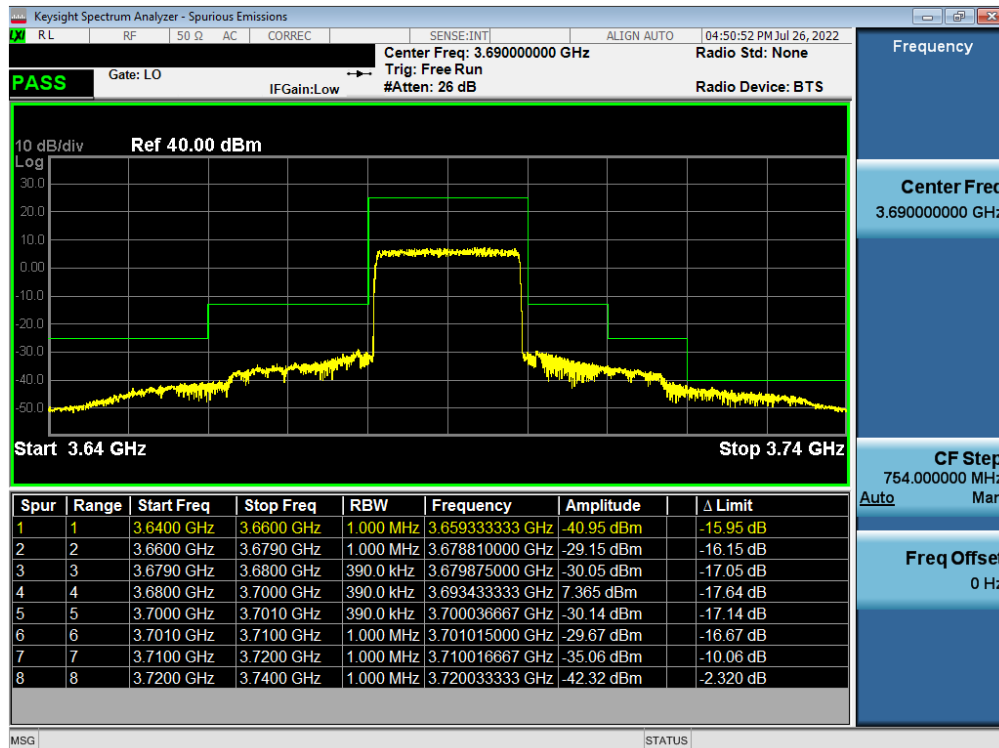


Plot 7-66. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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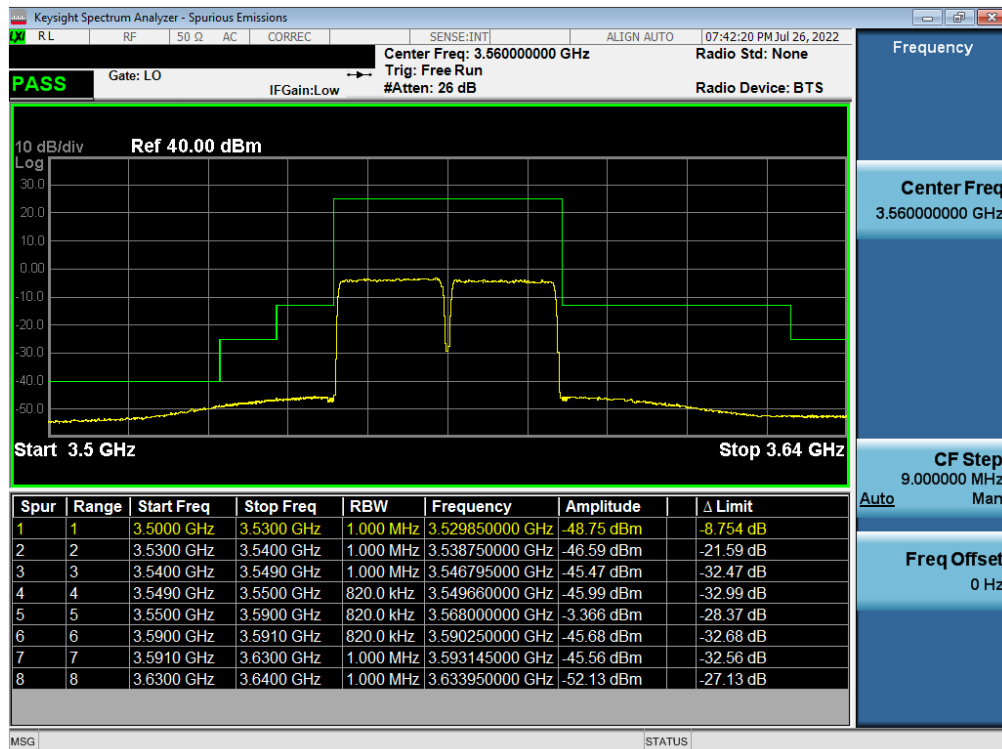
Plot 7-67. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)



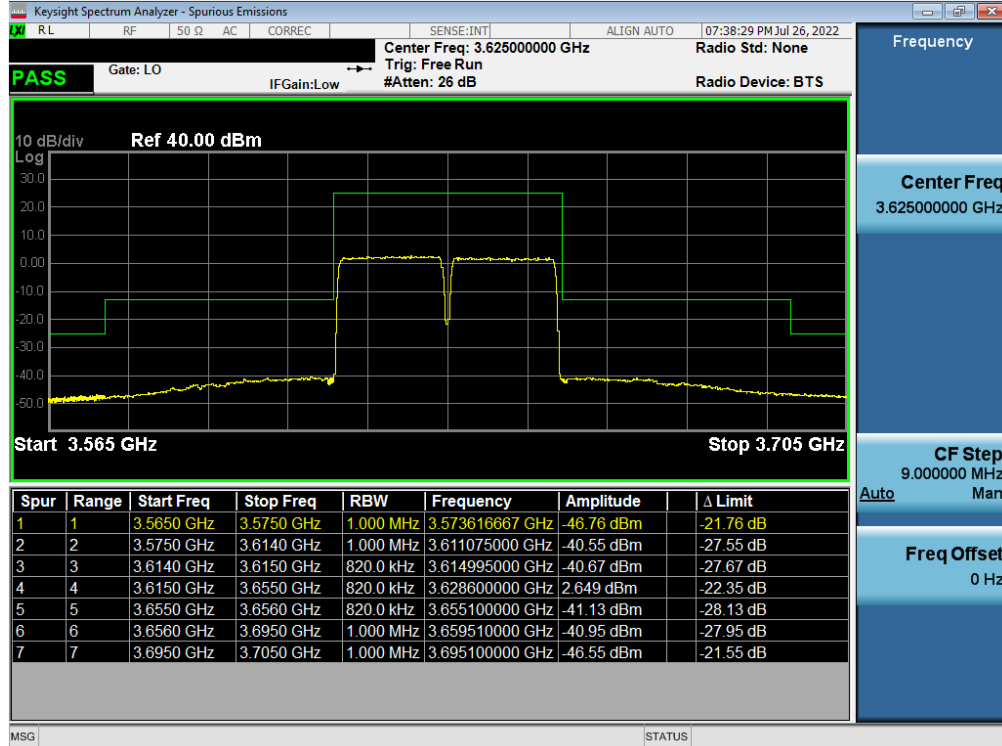
Plot 7-68. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - High Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 51 of 89

ULCA LTE Band 48



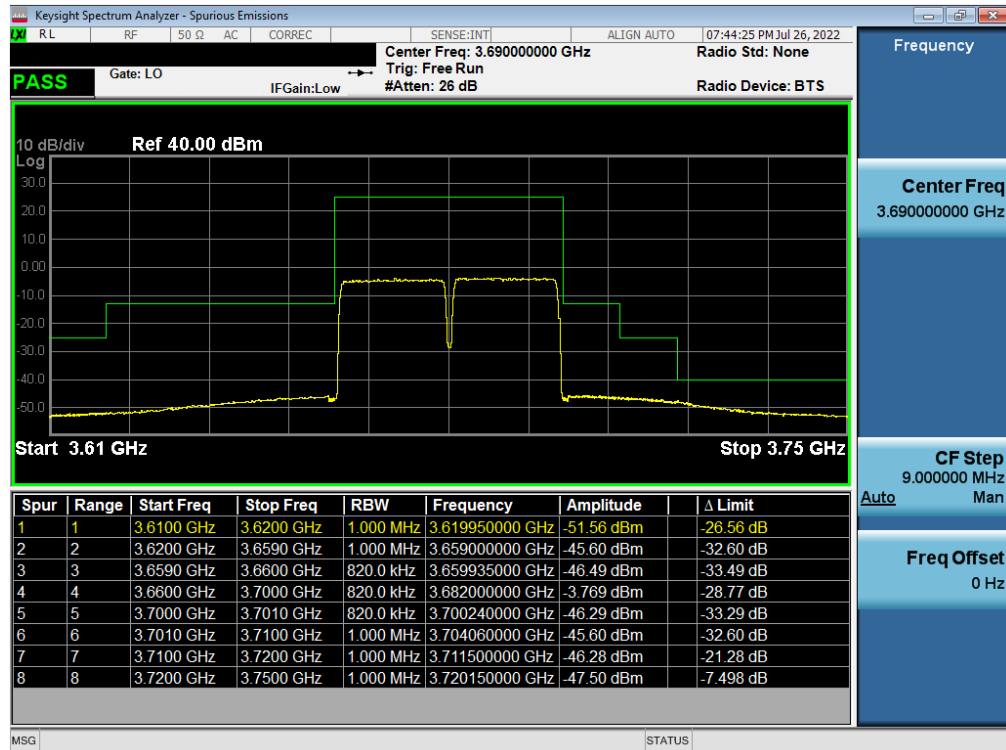
Plot 7-69. Channel Edge Plot (ULCA Band 48 – 20+20MHz QPSK - Low Channel)



Plot 7-70. Channel Edge Plot (ULCA Band 48 – 20+20MHz QPSK - Mid Channel)

FCC ID: BCGA2764	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device
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Plot 7-71. Channel Edge Plot (ULCA Band 48 – 20+20MHz QPSK - High Channel)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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7.5 Peak-Average Ratio

\$96.41(g):

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. All ports were tested and only the worst case data were reported.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.7.1

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW \geq 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.

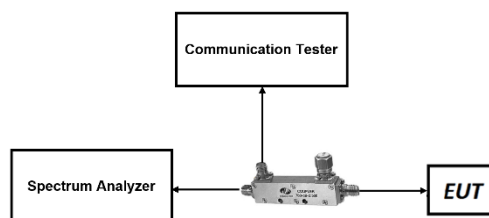



Figure 7-4. Test Instrument & Measurement Setup

Test Notes

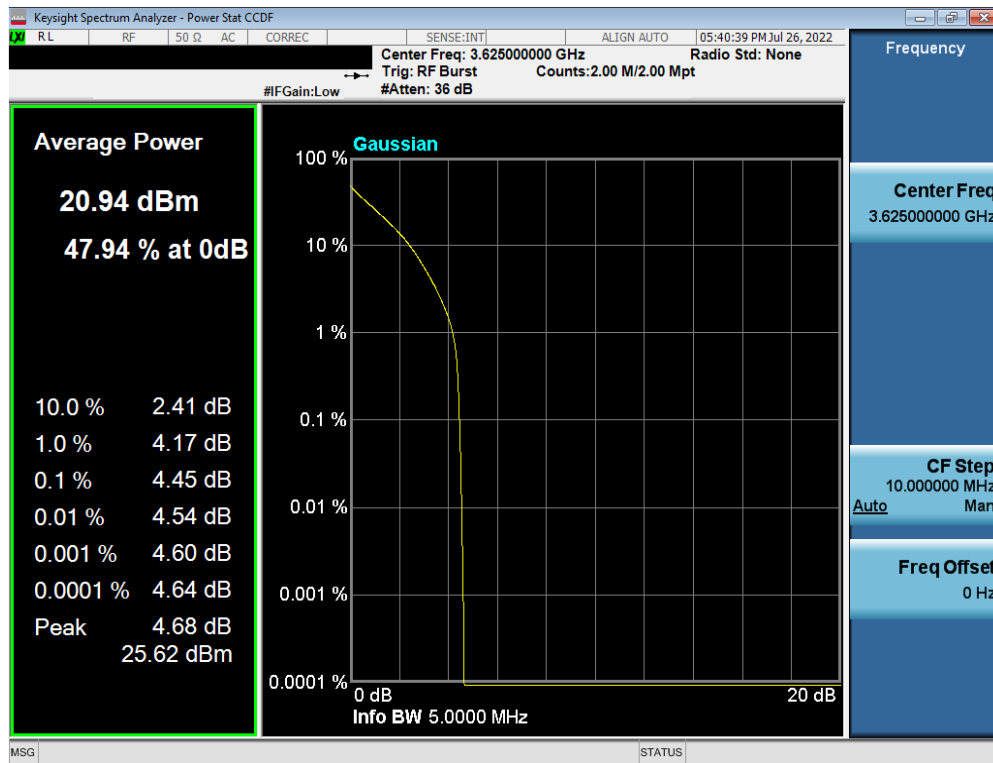
None.

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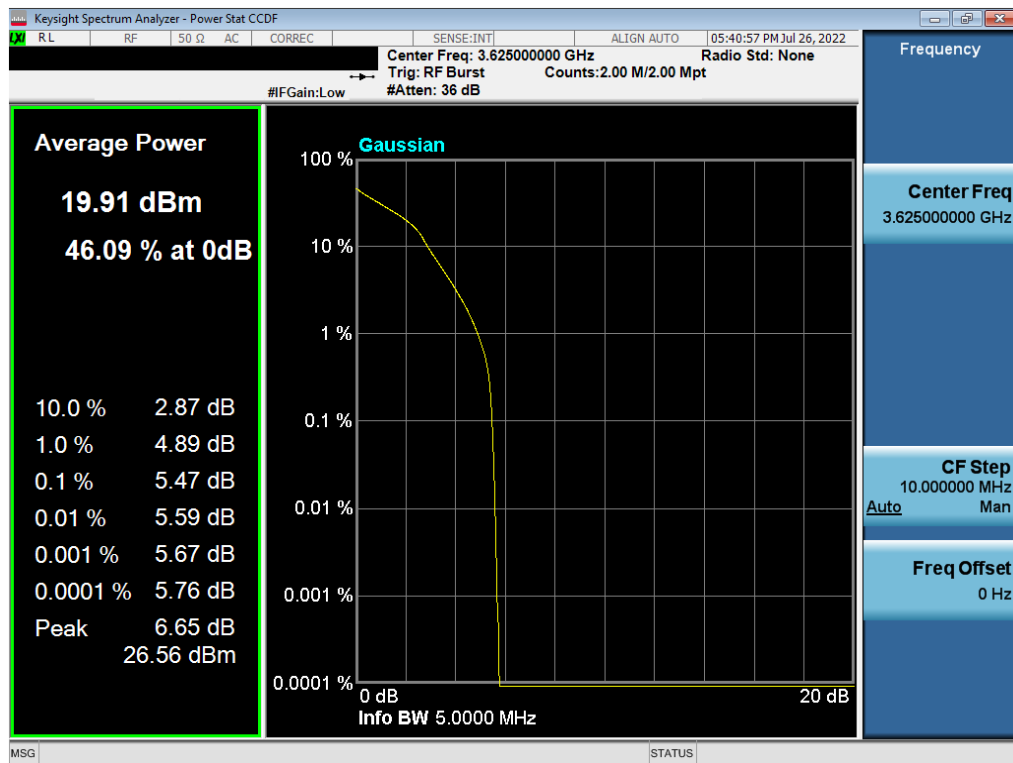
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LTE Band 48



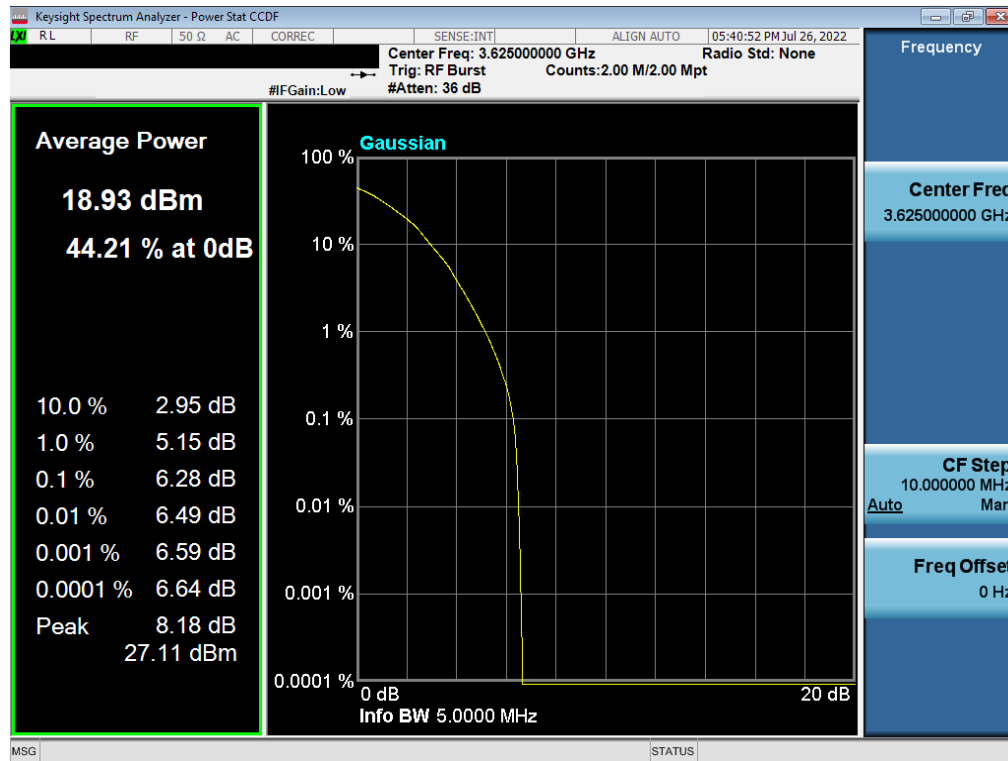
Plot 7-72. PAR Plot (LTE Band 48 - 5MHz QPSK - Full RB)



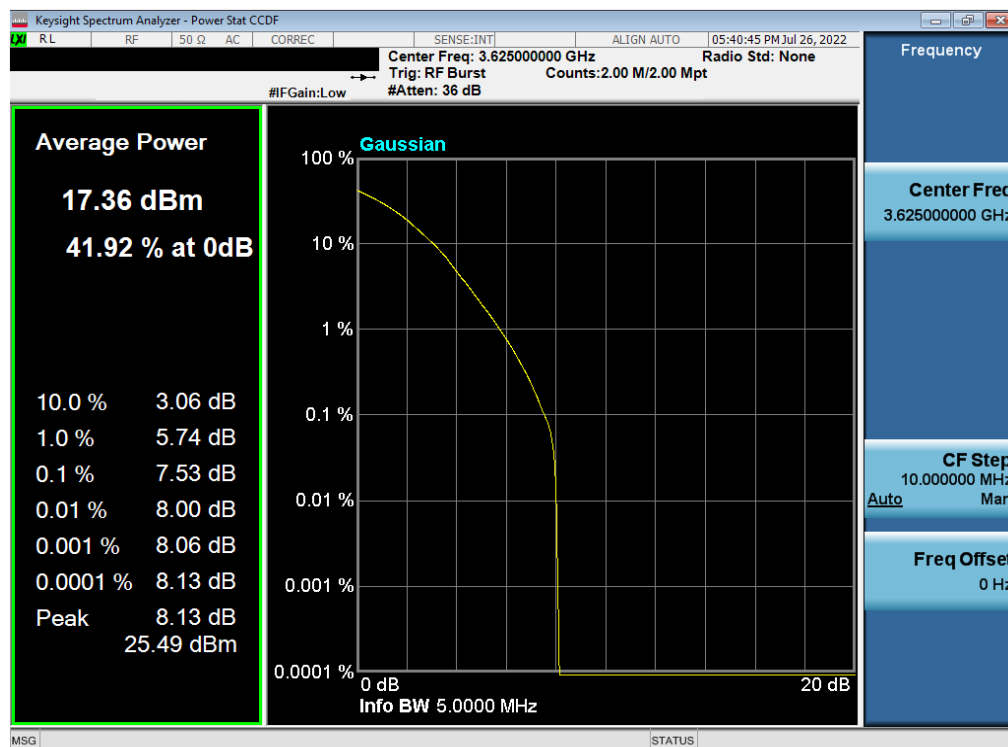
Plot 7-73. PAR Plot (LTE Band 48 - 5MHz 16-QAM - Full RB)

FCC ID: BCGA2764	 PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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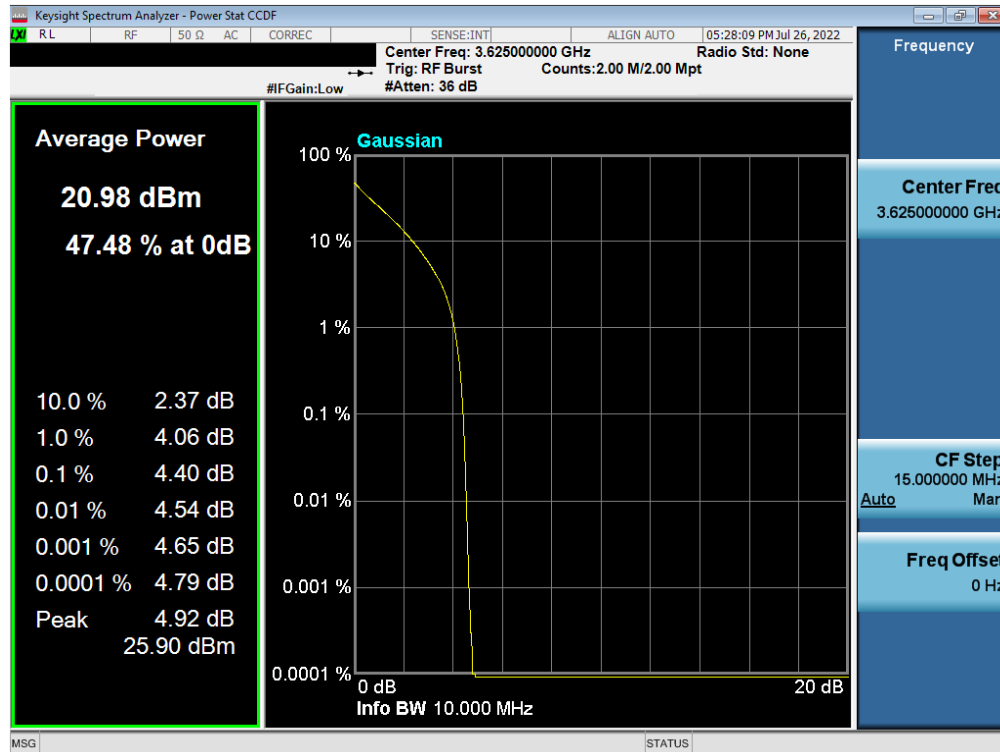


Plot 7-74. PAR Plot (LTE Band 48 - 5MHz 64-QAM - Full RB)

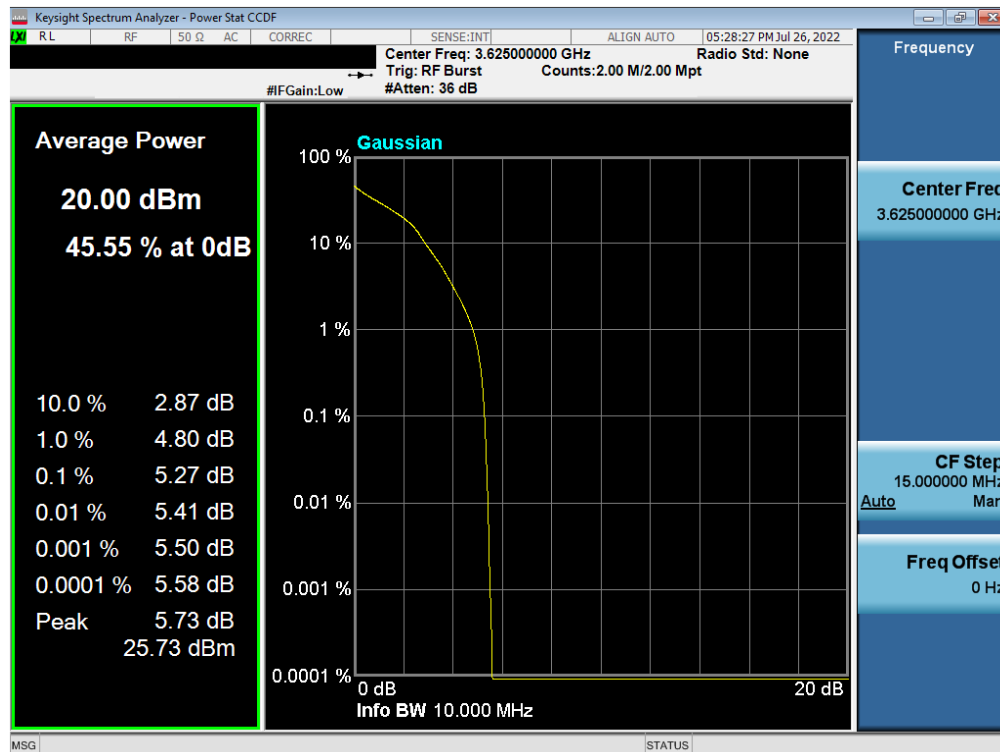


Plot 7-75. PAR Plot (LTE Band 48 - 5MHz 256-QAM - Full RB)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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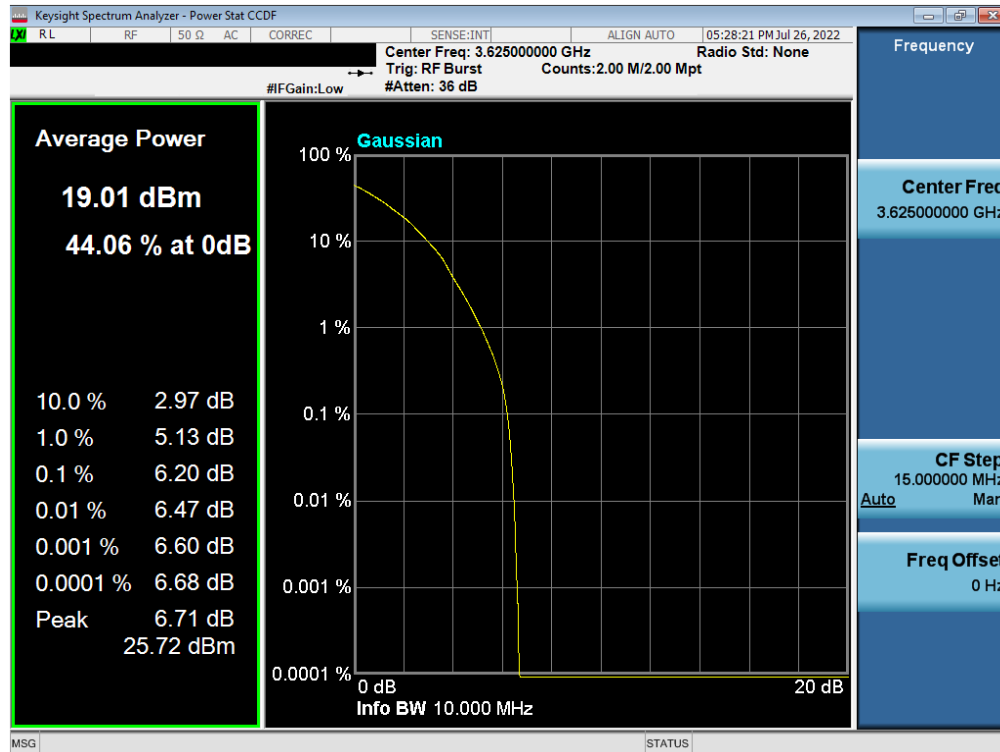
Plot 7-76. PAR Plot (LTE Band 48 - 10MHz QPSK - Full RB)



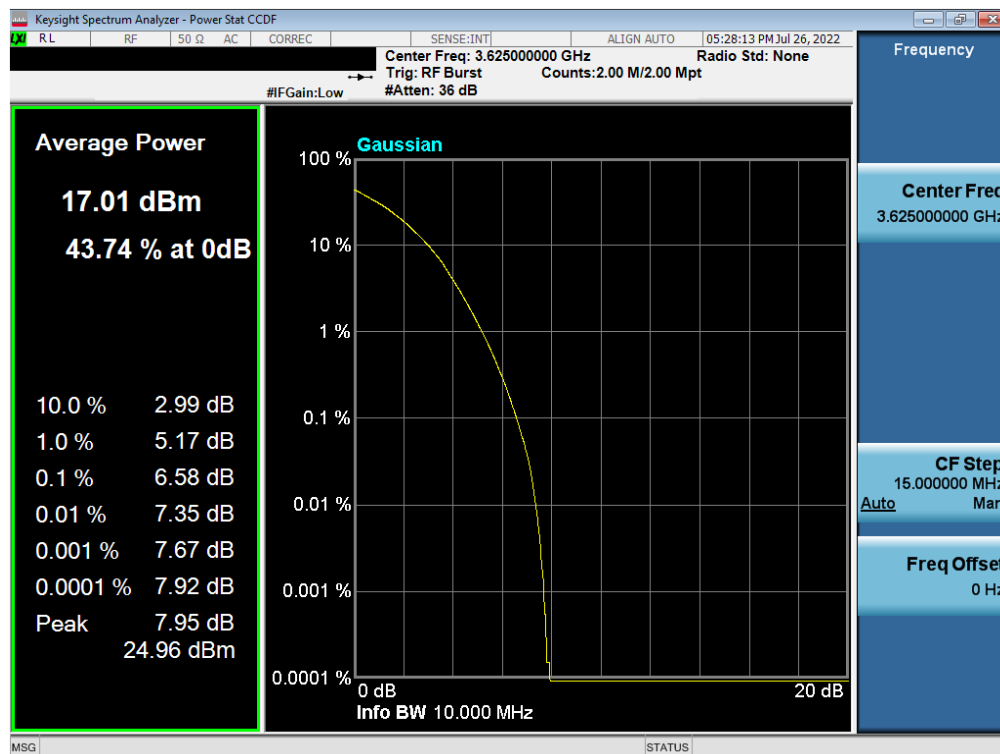
Plot 7-77. PAR Plot (LTE Band 48 - 10MHz 16-QAM - Full RB)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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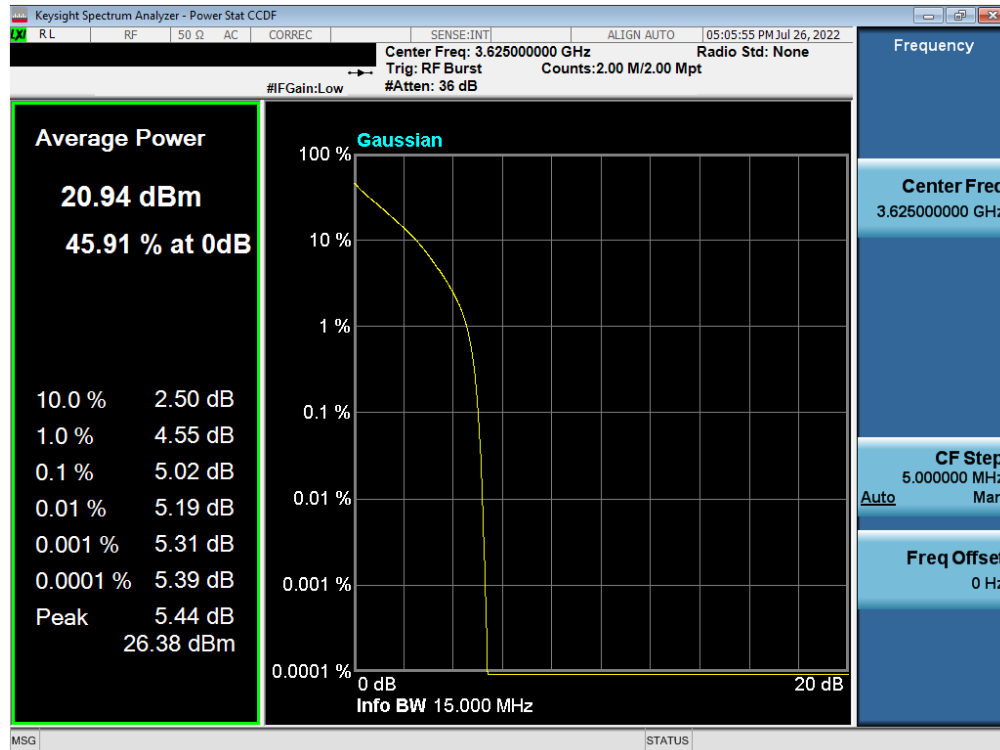
Plot 7-78. PAR Plot (LTE Band 48 - 10MHz 64-QAM - Full RB)



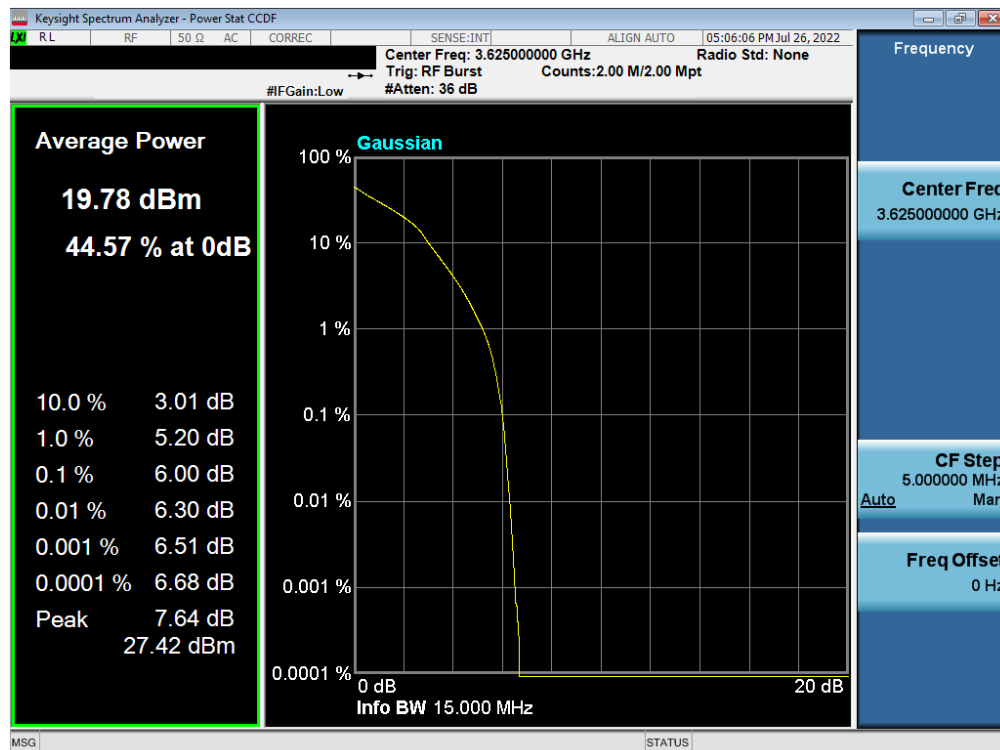
Plot 7-79. PAR Plot (LTE Band 48 - 10MHz 256-QAM - Full RB)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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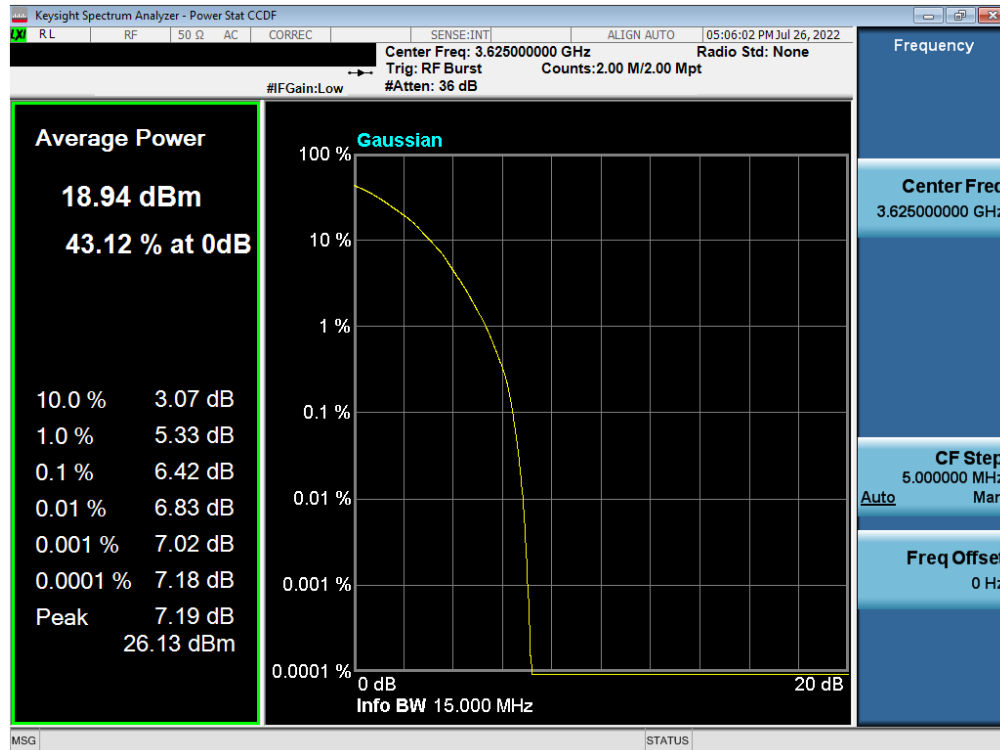
Plot 7-80. PAR Plot (LTE Band 48 - 15MHz QPSK - Full RB)



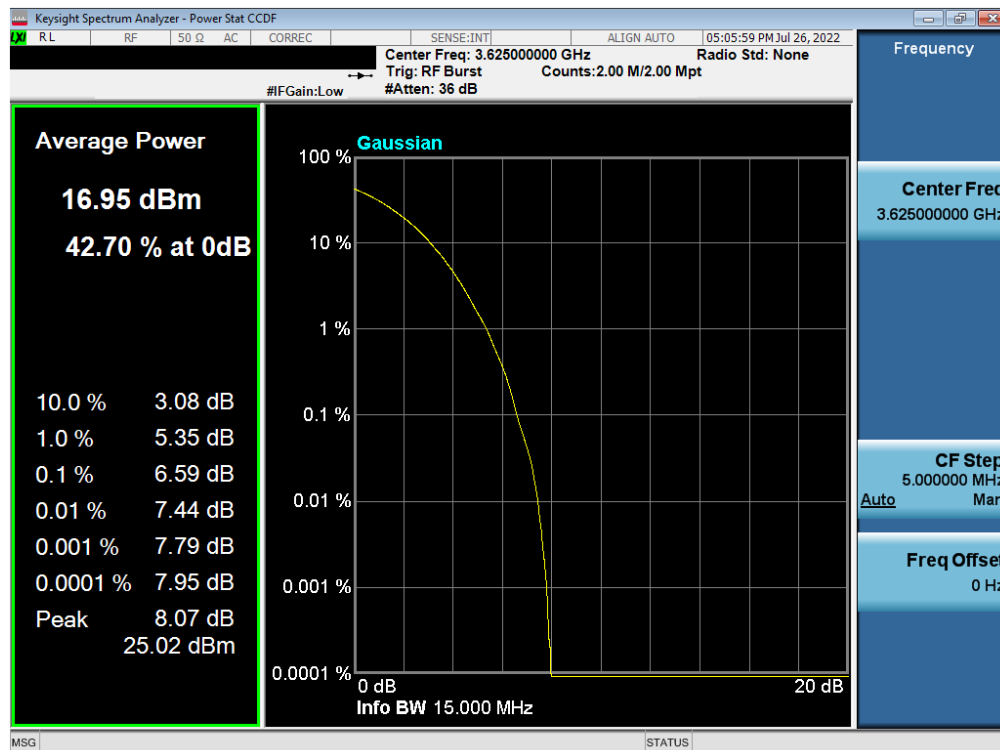
Plot 7-81. PAR Plot (LTE Band 48 - 15MHz 16-QAM - Full RB)

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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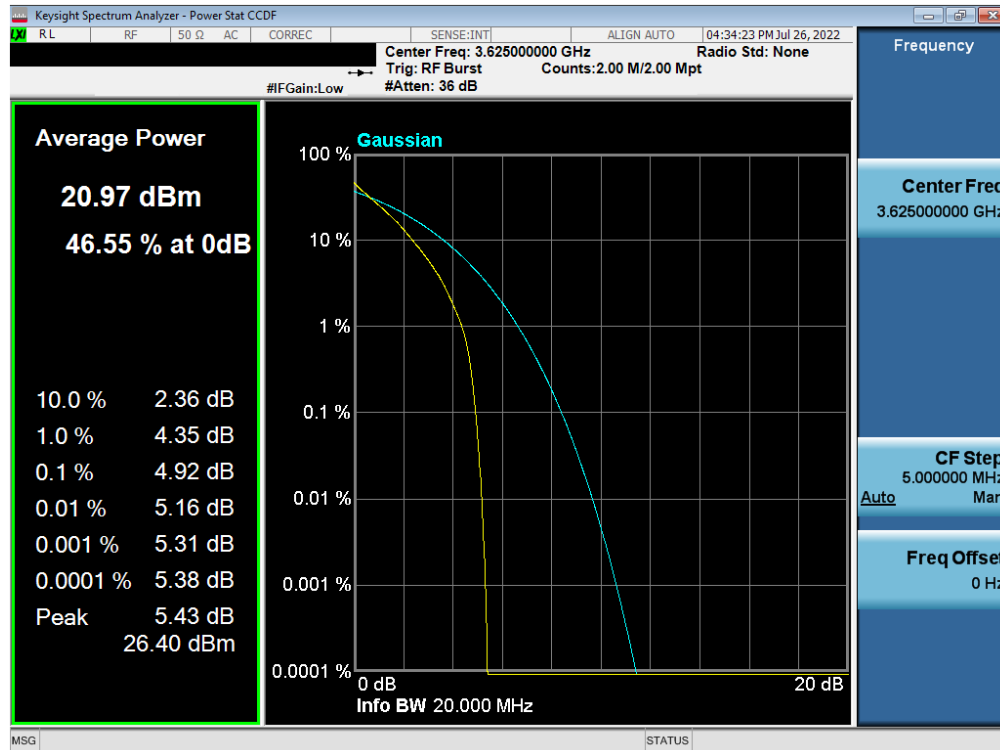
Plot 7-82. PAR Plot (LTE Band 48 - 15MHz 64-QAM - Full RB)



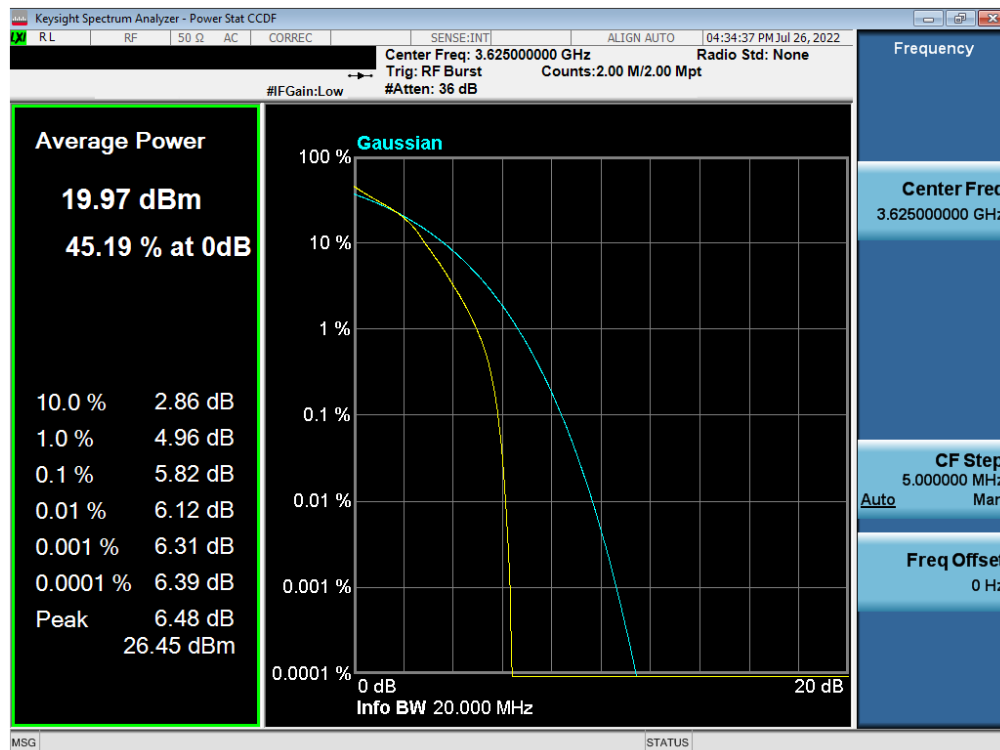
Plot 7-83. PAR Plot (LTE Band 48 - 15MHz 256-QAM - Full RB)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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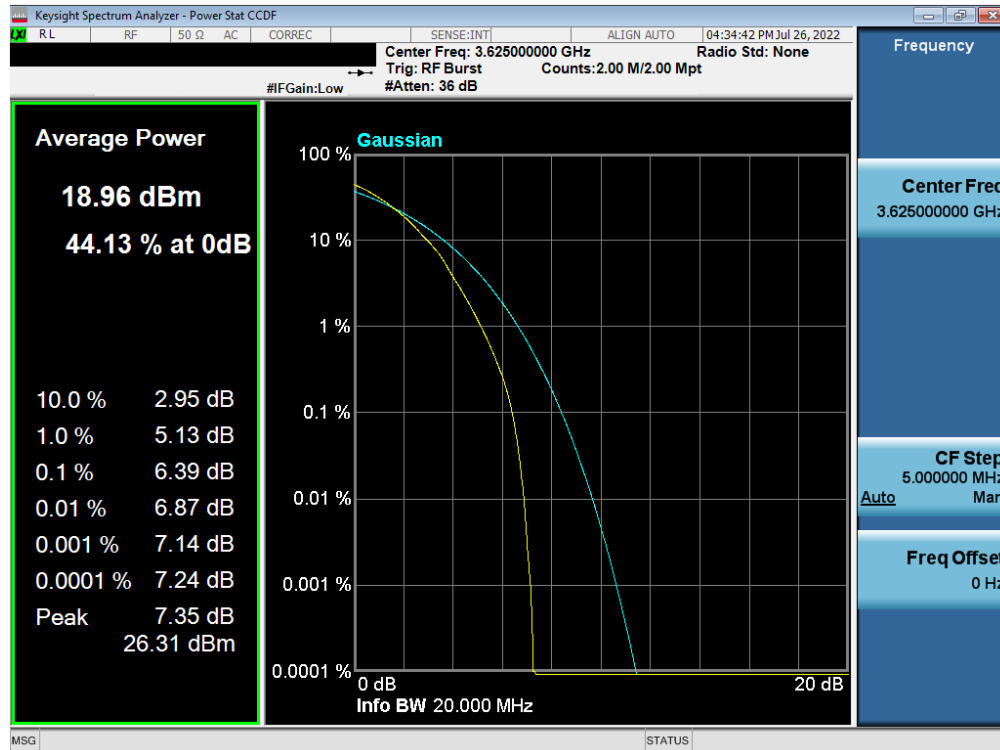
Plot 7-84. PAR Plot (LTE Band 48 - 20MHz QPSK - Full RB)



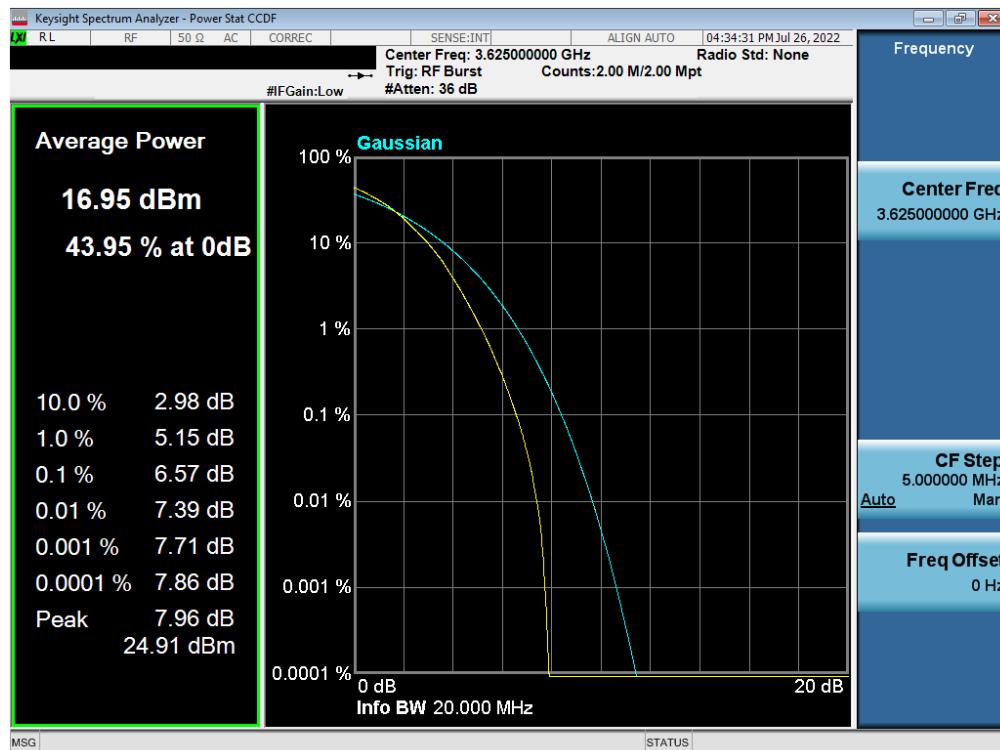
Plot 7-85. PAR Plot (LTE Band 48 - 20MHz 16-QAM - Full RB)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-86. PAR Plot (LTE Band 48 - 20MHz 64-QAM - Full RB)



Plot 7-87. PAR Plot (LTE Band 48 - 20MHz 256-QAM - Full RB)

FCC ID: BCGA2764	element	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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7.6 Radiated Power (EIRP)

§96.41(b)

Test Overview

Equivalent Isotropic Radiated Power (EIRP) measurements are calculated by adding highest antenna gain to maximum measured conducted output power. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI C63.26-2015

Test Settings

The relevant equation for determining the EIRP from the conducted RF output power measured is:

$$\text{EIRP} = \text{PMeas} - \text{LC} + \text{GT}$$

Where:

EIRP = Equivalent Isotropic Radiated Power (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBi (EIRP)

Test Setup

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

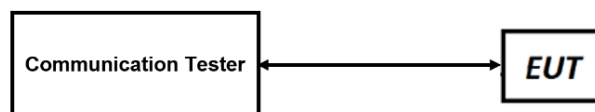




Figure 7-5. EIRP Measurement Setup

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Test Notes

- 1) The worst case emissions are reported with the modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
- 2) This unit was tested with its standard battery.
- 3) The Level (dBm) readings in the table were taken with a correction table loaded into the base station simulator. The correction table was used to account for the signal attenuation in the connecting cable between the transmitter and antenna.
- 4) The worst case EIRP shown in this section is found with LTE operating only using 1RB. As such, the EIRP/10MHz and full channel EIRP values will be identical since 1RB is fully contained within all available channel bandwidths for LTE Band 48 (i.e. 5, 10, 15, 20MHz).
- 5) Uplink carrier aggregation for LTE B48 is only supported in this EUT while operating in Power Class 3.
- 6) For ULCA, conducted power measurements were evaluated for the two contiguous channels 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.

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Antenna 3 – EIRP

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
5 MHz	QPSK	3552.5	2.30	1 / 12	19.70	22.00	0.158	23.00	-1.00
		3625.0	2.30	1 / 12	19.28	21.58	0.144	23.00	-1.42
		3697.5	2.30	1 / 12	19.31	21.61	0.145	23.00	-1.39
	16-QAM	3552.5	2.30	1 / 24	18.81	21.11	0.129	23.00	-1.89
	64-QAM	3697.5	2.30	1 / 12	17.92	20.22	0.105	23.00	-2.78
	256-QAM	3552.5	2.30	1 / 12	14.99	17.29	0.054	23.00	-5.71
10 MHz	QPSK	3555.0	2.30	1 / 25	19.70	22.00	0.158	23.00	-1.00
		3625.0	2.30	1 / 25	19.36	21.66	0.147	23.00	-1.34
		3695.0	2.30	1 / 25	19.41	21.71	0.148	23.00	-1.29
	16-QAM	3695.0	2.30	1 / 0	18.89	21.19	0.132	23.00	-1.81
	64-QAM	3555.0	2.30	1 / 25	17.98	20.28	0.107	23.00	-2.72
	256-QAM	3555.0	2.30	1 / 0	15.03	17.33	0.054	23.00	-5.67
15 MHz	QPSK	3557.5	2.30	1 / 36	19.70	22.00	0.158	23.00	-1.00
		3625.0	2.30	1 / 36	19.37	21.67	0.147	23.00	-1.33
		3692.5	2.30	1 / 36	19.43	21.73	0.149	23.00	-1.27
	16-QAM	3692.5	2.30	1 / 36	18.89	21.19	0.132	23.00	-1.81
	64-QAM	3692.5	2.30	1 / 36	17.85	20.15	0.104	23.00	-2.85
	256-QAM	3557.5	2.30	1 / 74	15.10	17.40	0.055	23.00	-5.60
20 MHz	QPSK	3560.0	2.30	1 / 50	19.70	22.00	0.158	23.00	-1.00
		3625.0	2.30	1 / 50	19.57	21.87	0.154	23.00	-1.13
		3690.0	2.30	1 / 50	19.43	21.73	0.149	23.00	-1.27
	16-QAM	3625.0	2.30	1 / 50	19.22	21.52	0.142	23.00	-1.48
	64-QAM	3625.0	2.30	1 / 50	18.11	20.41	0.110	23.00	-2.59
	256-QAM	3560.0	2.30	1 / 0	15.23	17.53	0.057	23.00	-5.47

Table 7-2. EIRP Data (LTE Band 48)

Power State	Band	Bandwidth (PCC + SCC)	PCC				SCC				ULCA Conducted Power [dBm]	Ant. Gain [dBi]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]		
			Modulation	UL Channel	UL Frequency [MHz]	UL # RB	UL RB Offset	Modulation	UL Channel	UL Frequency [MHz]							UL # RB	UL RB Offset
Max	LTE B48	20MHz + 5MHz	QPSK	55340	3560.0	1	99	QPSK	55457	3571.7	1	0	19.58	2.30	21.88	0.154	23.00	-1.12
				55990	3625.0	1	99		56107	3636.7	1	0	19.70	2.30	22.00	0.158	23.00	-1.00
				56640	3690.0	1	0		56757	3701.7	1	24	19.65	2.30	21.95	0.157	23.00	-1.05
			16-QAM	55990	3625	100	0	16-QAM	56107	3636.7	25	0	17.85	2.30	20.15	0.104	23.00	-2.85
				55990	3625	100	0		56107	3636.7	25	0	17.01	2.30	19.31	0.085	23.00	-3.69
				64-QAM	55990	3625	100		0	64-QAM	56107	3636.7	25	0	16.95	2.30	19.25	0.084
			256-QAM	55990	3625	100	0	256-QAM	56107	3636.7	25	0	15.15	2.30	17.45	0.056	23.00	-5.55
Max	LTE B48	20MHz + 10MHz	QPSK	55340	3560.0	1	99	QPSK	55484	3574.4	1	0	19.68	2.30	21.98	0.158	23.00	-1.02
				55990	3625.0	1	99		56134	3639.4	1	0	19.64	2.30	21.94	0.156	23.00	-1.06
				56640	3690.0	1	0		56784	3704.4	1	49	19.56	2.30	21.86	0.153	23.00	-1.14
			16-QAM	55340	3560	100	0	16-QAM	55484	3574.4	50	0	17.88	2.30	20.18	0.104	23.00	-2.82
				55340	3560	100	0		55484	3574.4	50	0	16.93	2.30	19.23	0.084	23.00	-3.77
				64-QAM	55340	3560	100		0	64-QAM	55484	3574.4	50	0	16.82	2.30	19.12	0.082
			256-QAM	55340	3560	100	0	256-QAM	55484	3574.4	50	0	15.08	2.30	17.38	0.055	23.00	-5.62
Max	LTE B48	20MHz + 15MHz	QPSK	55340	3560.0	1	99	QPSK	55511	3577.1	1	0	19.55	2.30	21.85	0.153	23.00	-1.15
				55990	3625.0	1	99		56161	3642.1	1	0	19.51	2.30	21.81	0.152	23.00	-1.19
				56640	3690.0	1	0		56811	3707.1	1	74	19.43	2.30	21.73	0.149	23.00	-1.27
			16-QAM	55340	3560	100	0	16-QAM	55511	3577.1	75	0	17.75	2.30	20.05	0.101	23.00	-2.95
				55340	3560	100	0		55511	3577.1	75	0	16.80	2.30	19.10	0.081	23.00	-3.90
				64-QAM	55340	3560	100		0	64-QAM	55511	3577.1	75	0	16.76	2.30	19.06	0.081
			256-QAM	55340	3560	100	0	256-QAM	55511	3577.1	75	0	14.95	2.30	17.25	0.053	23.00	-5.75
Max	LTE B48	20MHz + 20MHz	QPSK	55340	3560.0	1	99	QPSK	55538	3579.8	1	0	19.50	2.30	21.80	0.151	23.00	-1.20
				55990	3625.0	1	99		56188	3644.8	1	0	19.62	2.30	21.92	0.156	23.00	-1.08
				56640	3690.0	1	0		56442	3670.2	1	99	19.57	2.30	21.87	0.154	23.00	-1.13
			16-QAM	55990	3625	100	0	16-QAM	56188	3644.8	100	0	17.77	2.30	20.07	0.102	23.00	-2.93
				55990	3625	100	0		56188	3644.8	100	0	16.93	2.30	19.23	0.084	23.00	-3.77
				55990	3625	100	0		56188	3644.8	100	0	16.88	2.30	19.18	0.083	23.00	-3.82
			256-QAM	55990	3625	100	0	256-QAM	56188	3644.8	100	0	15.07	2.30	17.37	0.055	23.00	-5.63

Table 7-3. EIRP Data (ULCA Band 48)

FCC ID: BCGA2764		PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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Antenna 1 – EIRP

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
5 MHz	QPSK	3552.5	1.40	1 / 12	20.60	22.00	0.158	23.00	-1.00
		3625.0	1.40	1 / 12	20.25	21.65	0.146	23.00	-1.35
		3697.5	1.40	1 / 12	20.02	21.42	0.139	23.00	-1.58
	16-QAM	3552.5	1.40	1 / 12	19.51	20.91	0.123	23.00	-2.09
	64-QAM	3625.0	1.40	1 / 12	18.37	19.77	0.095	23.00	-3.23
	256-QAM	3552.5	1.40	1 / 12	15.67	17.07	0.051	23.00	-5.93
10 MHz	QPSK	3555.0	1.40	1 / 25	20.60	22.00	0.158	23.00	-1.00
		3625.0	1.40	1 / 0	20.25	21.65	0.146	23.00	-1.35
		3695.0	1.40	1 / 25	20.20	21.60	0.145	23.00	-1.40
	16-QAM	3555.0	1.40	1 / 0	19.63	21.03	0.127	23.00	-1.97
	64-QAM	3625.0	1.40	1 / 25	18.80	20.20	0.105	23.00	-2.80
	256-QAM	3555.0	1.40	1 / 25	15.81	17.21	0.053	23.00	-5.79
15 MHz	QPSK	3557.5	1.40	1 / 36	20.60	22.00	0.158	23.00	-1.00
		3625.0	1.40	1 / 36	20.45	21.85	0.153	23.00	-1.15
		3692.5	1.40	1 / 36	20.21	21.61	0.145	23.00	-1.39
	16-QAM	3557.5	1.40	1 / 36	19.55	20.95	0.124	23.00	-2.05
	64-QAM	3625.0	1.40	1 / 74	18.73	20.13	0.103	23.00	-2.87
	256-QAM	3557.5	1.40	1 / 36	15.70	17.10	0.051	23.00	-5.90
20 MHz	QPSK	3560.0	1.40	1 / 50	20.60	22.00	0.158	23.00	-1.00
		3625.0	1.40	1 / 0	20.48	21.88	0.154	23.00	-1.12
		3690.0	1.40	1 / 50	20.35	21.75	0.150	23.00	-1.25
	16-QAM	3560.0	1.40	1 / 50	19.81	21.21	0.132	23.00	-1.79
	64-QAM	3560.0	1.40	1 / 50	19.34	20.74	0.119	23.00	-2.26
	256-QAM	3560.0	1.40	1 / 0	15.70	17.10	0.051	23.00	-5.90

Table 7-4. EIRP Data (LTE Band 48)

Power State	Band	Bandwidth (PCC + SCC)	PCC				SCC				ULCA Conducted Power [dBm]	Ant. Gain [dBi]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
			Modulation	UL Channel	UL Frequency [MHz]	UL # RB	UL RB Offset	Modulation	UL Channel	UL Frequency [MHz]	UL # RB	UL RB Offset				
Max	LTE B48	20MHz + 5MHz	QPSK	55340	3560.0	1	99	QPSK	55457	3571.7	1	0	20.55	1.40	21.95	-1.05
				55990	3625.0	1	99		56107	3636.7	1	0	20.60	1.40	22.00	-1.00
				56640	3690.0	1	0		56757	3701.7	1	99	20.48	1.40	21.88	-1.12
			16-QAM	55990	3625	100	0	QPSK	56107	3636.7	100	0	18.65	1.40	20.05	-2.95
				55990	3625	100	0		56107	3636.7	100	0	17.63	1.40	19.03	-3.97
				55990	3625	100	0		56107	3636.7	100	0	17.72	1.40	19.12	-3.88
Max	LTE B48	20MHz + 10MHz	QPSK	55340	3560.0	1	99	QPSK	55484	3574.4	1	0	20.36	1.40	21.76	-1.24
				55990	3625.0	1	99		56134	3639.4	1	0	20.41	1.40	21.81	-1.19
				56640	3690.0	1	0		56784	3704.4	1	99	20.29	1.40	21.69	-1.31
			16-QAM	55990	3625	100	0	QPSK	56134	3639.4	100	0	18.46	1.40	19.86	-3.14
				55990	3625	100	0		56134	3639.4	100	0	17.44	1.40	18.84	-4.16
				55990	3625	100	0		56134	3639.4	100	0	17.53	1.40	18.93	-4.07
Max	LTE B48	20MHz + 15MHz	QPSK	55340	3560.0	1	99	QPSK	56134	3639.4	100	0	15.56	1.40	16.96	-6.04
				55990	3625	100	0		56134	3639.4	100	0	20.52	1.40	21.92	-1.08
				55990	3625	1	99		56161	3642.1	1	0	20.60	1.40	22.00	-1.00
			16-QAM	55990	3625	100	0	QPSK	56811	3707.1	1	99	20.55	1.40	21.95	-1.05
				55990	3625	100	0		56161	3642.1	100	0	18.72	1.40	20.12	-2.88
				55990	3625	100	0		56161	3642.1	100	0	17.70	1.40	19.10	-3.90
Max	LTE B48	20MHz + 20MHz	QPSK	55340	3560.0	1	99	QPSK	56161	3642.1	100	0	17.79	1.40	19.19	-3.81
				55990	3625	100	0		56161	3642.1	100	0	15.82	1.40	17.22	-5.78
				55990	3625	100	0		56161	3642.1	100	0	20.43	1.40	21.83	-1.17
			16-QAM	55990	3625	100	0	QPSK	56188	3644.8	100	0	20.48	1.40	21.88	-1.12
				55990	3625	100	0		56442	3670.2	1	99	20.36	1.40	21.76	-1.24
				55990	3625	100	0		56188	3644.8	100	0	18.53	1.40	19.93	-3.07

Table 7-5. EIRP Data (ULCA Band 48)

FCC ID: BCGA2764	 PART 96 MEASUREMENT REPORT			Approved by: Technical Manager
Test Report S/N: 1C2205090028-10.BCG	Test Dates: 5/30/2022-9/26/2022	EUT Type: Tablet Device	Page 66 of 89	

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Antenna 4b – EIRP

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
5 MHz	QPSK	3552.5	0.00	1 / 12	21.76	21.76	0.150	23.00	-1.24
		3625.0	0.00	1 / 12	21.89	21.89	0.155	23.00	-1.11
		3697.5	0.00	1 / 0	22.00	22.00	0.158	23.00	-1.00
	16-QAM	3552.5	0.00	1 / 0	21.12	21.12	0.129	23.00	-1.88
	64-QAM	3697.5	0.00	1 / 24	19.94	19.94	0.099	23.00	-3.06
	256-QAM	3625.0	0.00	1 / 24	17.06	17.06	0.051	23.00	-5.94
10 MHz	QPSK	3555.0	0.00	1 / 49	21.83	21.83	0.152	23.00	-1.17
		3625.0	0.00	1 / 49	22.00	22.00	0.158	23.00	-1.00
		3695.0	0.00	1 / 0	21.56	21.56	0.143	23.00	-1.44
	16-QAM	3625.0	0.00	1 / 49	21.12	21.12	0.129	23.00	-1.88
	64-QAM	3555.0	0.00	1 / 49	20.13	20.13	0.103	23.00	-2.87
	256-QAM	3625.0	0.00	1 / 0	16.97	16.97	0.050	23.00	-6.03
15 MHz	QPSK	3557.5	0.00	1 / 37	21.86	21.86	0.153	23.00	-1.14
		3625.0	0.00	1 / 37	21.89	21.89	0.155	23.00	-1.11
		3692.5	0.00	1 / 37	22.00	22.00	0.158	23.00	-1.00
	16-QAM	3692.5	0.00	1 / 74	21.09	21.09	0.129	23.00	-1.91
	64-QAM	3625.0	0.00	1 / 37	20.14	20.14	0.103	23.00	-2.86
	256-QAM	3557.5	0.00	1 / 0	17.27	17.27	0.053	23.00	-5.73
20 MHz	QPSK	3560.0	0.00	1 / 99	21.62	21.62	0.145	23.00	-1.38
		3625.0	0.00	1 / 99	22.00	22.00	0.158	23.00	-1.00
		3690.0	0.00	1 / 0	21.80	21.80	0.151	23.00	-1.20
	16-QAM	3560.0	0.00	1 / 99	21.01	21.01	0.126	23.00	-1.99
	64-QAM	3560.0	0.00	1 / 99	20.05	20.05	0.101	23.00	-2.95
	256-QAM	3690.0	0.00	1 / 0	16.84	16.84	0.048	23.00	-6.16

Table 7-6. EIRP Data (LTE Band 48)

Power State	Band	Bandwidth (PCC + SCC)	PCC				SCC				ULCA Conducted Power [dBm]	Ant. Gain [dBi]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]			
			Modulation	UL Channel	UL Frequency [MHz]	UL # RB	UL RB Offset	Modulation	UL Channel	UL Frequency [MHz]							UL # RB	UL RB Offset	
Max	LTE B48	20MHz + 5MHz	QPSK	55340	3560.0	1	99	QPSK	55457	3571.7	1	0	21.85	0.00	21.85	0.153	23.00	-1.15	
				55990	3625.0	1	99		56107	3636.7	1	0	21.93	0.00	21.93	0.156	23.00	-1.07	
				56640	3690.0	1	0		56757	3701.7	1	24	21.76	0.00	21.76	0.150	23.00	-1.24	
			QPSK	55990	3625	100	0	QPSK	56107	3636.7	25	0	20.75	0.00	20.75	0.119	23.00	-2.25	
				16-QAM	55990	3625	100	0	16-QAM	56107	3636.7	25	0	19.82	0.00	19.82	0.086	23.00	-3.18
				64-QAM	55990	3625	100	0	64-QAM	56107	3636.7	25	0	19.78	0.00	19.78	0.095	23.00	-3.22
				256-QAM	55990	3625	100	0	256-QAM	56107	3636.7	25	0	17.83	0.00	17.83	0.061	23.00	-5.17
Max	LTE B48	20MHz + 10MHz	QPSK	55340	3560.0	1	99	QPSK	55484	3574.4	1	0	22.00	0.00	22.00	0.158	23.00	-1.00	
				55990	3625.0	1	99		56134	3639.4	1	0	21.96	0.00	21.96	0.157	23.00	-1.04	
				56640	3690.0	1	0		56784	3704.4	1	49	21.92	0.00	21.92	0.156	23.00	-1.08	
			QPSK	55340	3560	100	0	QPSK	55484	3574.4	50	0	20.91	0.00	20.91	0.123	23.00	-2.09	
				16-QAM	55340	3560	100	0	16-QAM	55484	3574.4	50	0	19.98	0.00	19.98	0.100	23.00	-3.02
				64-QAM	55340	3560	100	0	64-QAM	55484	3574.4	50	0	19.94	0.00	19.94	0.099	23.00	-3.06
				256-QAM	55340	3560	100	0	256-QAM	55484	3574.4	50	0	17.99	0.00	17.99	0.063	23.00	-5.01
Max	LTE B48	20MHz + 15MHz	QPSK	55340	3560.0	1	99	QPSK	55511	3577.1	1	0	21.76	0.00	21.76	0.150	23.00	-1.24	
				55990	3625.0	1	99		56161	3642.1	1	0	21.82	0.00	21.82	0.152	23.00	-1.18	
				56640	3690.0	1	0		56811	3707.1	1	74	21.68	0.00	21.68	0.147	23.00	-1.32	
			QPSK	55990	3625	100	0	QPSK	56161	3642.1	75	0	20.67	0.00	20.67	0.117	23.00	-2.33	
				16-QAM	55990	3625	100	0	16-QAM	56161	3642.1	75	0	19.74	0.00	19.74	0.084	23.00	-3.26
				64-QAM	55990	3625	100	0	64-QAM	56161	3642.1	75	0	19.70	0.00	19.70	0.093	23.00	-3.30
				256-QAM	55990	3625	100	0	256-QAM	56161	3642.1	75	0	17.75	0.00	17.75	0.060	23.00	-5.25
Max	LTE B48	20MHz + 20MHz	QPSK	55340	3560.0	1	99	QPSK	55538	3579.8	1	0	21.78	0.00	21.78	0.151	23.00	-1.22	
				55990	3625.0	1	99		56188	3644.8	1	0	21.86	0.00	21.86	0.153	23.00	-1.14	
				56640	3690.0	1	0		56442	3670.2	1	99	21.69	0.00	21.69	0.148	23.00	-1.31	
			QPSK	55990	3625	100	0	QPSK	56188	3644.8	100	0	20.68	0.00	20.68	0.117	23.00	-2.32	
				16-QAM	55990	3625	100	0	16-QAM	56188	3644.8	100	0	19.75	0.00	19.75	0.084	23.00	-3.25
				64-QAM	55990	3625	100	0	64-QAM	56188	3644.8	100	0	19.71	0.00	19.71	0.094	23.00	-3.29
				256-QAM	55990	3625	100	0	256-QAM	56188	3644.8	100	0	17.76	0.00	17.76	0.060	23.00	-5.24

Table 7-7. EIRP Data (ULCA Band 48)

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Antenna 2a – EIRP

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
5 MHz	QPSK	3552.5	1.00	1 / 0	20.71	21.71	0.148	23.00	-1.29
		3625.0	1.00	1 / 12	21.00	22.00	0.158	23.00	-1.00
		3697.5	1.00	1 / 0	20.57	21.57	0.144	23.00	-1.43
	16-QAM	3625.0	1.00	1 / 12	20.12	21.12	0.129	23.00	-1.88
	64-QAM	3625.0	1.00	1 / 24	19.15	20.15	0.104	23.00	-2.85
	256-QAM	3625.0	1.00	1 / 24	16.18	17.18	0.052	23.00	-5.82
10 MHz	QPSK	3555.0	1.00	1 / 25	21.00	22.00	0.158	23.00	-1.00
		3625.0	1.00	1 / 25	20.94	21.94	0.156	23.00	-1.06
		3695.0	1.00	1 / 0	20.87	21.87	0.154	23.00	-1.13
	16-QAM	3625.0	1.00	1 / 49	19.74	20.74	0.119	23.00	-2.26
	64-QAM	3555.0	1.00	1 / 25	19.01	20.01	0.100	23.00	-2.99
	256-QAM	3695.0	1.00	1 / 0	15.81	16.81	0.048	23.00	-6.19
15 MHz	QPSK	3557.5	1.00	1 / 0	20.86	21.86	0.153	23.00	-1.14
		3625.0	1.00	1 / 74	20.88	21.88	0.154	23.00	-1.12
		3692.5	1.00	1 / 37	21.00	22.00	0.158	23.00	-1.00
	16-QAM	3557.5	1.00	1 / 74	19.96	20.96	0.125	23.00	-2.04
	64-QAM	3692.5	1.00	1 / 74	18.97	19.97	0.099	23.00	-3.03
	256-QAM	3625.0	1.00	1 / 74	15.60	16.60	0.046	23.00	-6.40
20 MHz	QPSK	3560.0	1.00	1 / 50	21.00	22.00	0.158	23.00	-1.00
		3625.0	1.00	1 / 99	21.00	22.00	0.158	23.00	-1.00
		3690.0	1.00	1 / 50	20.60	21.60	0.145	23.00	-1.40
	16-QAM	3690.0	1.00	1 / 0	19.90	20.90	0.123	23.00	-2.10
	64-QAM	3690.0	1.00	1 / 50	19.03	20.03	0.101	23.00	-2.97
	256-QAM	3560.0	1.00	1 / 50	15.86	16.86	0.049	23.00	-6.14

Table 7-8. EIRP Data (LTE Band 48)

Power State	Band	Bandwidth (PCC + SCC)	PCC				SCC				ULCA Conducted Power [dBm]	Ant. Gain [dBi]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
			Modulation	UL Channel	UL Frequency [MHz]	UL # RB	UL RB Offset	Modulation	UL Channel	UL Frequency [MHz]	UL # RB	UL RB Offset				
Max	LTE B48	20MHz + 5MHz	QPSK	55340	3560.0	1	99	QPSK	55457	3571.7	1	0	20.95	1.00	21.95	-1.05
				55990	3625.0	1	99		56107	3636.7	1	0	21.00	1.00	22.00	-1.00
				56640	3690.0	1	0		56757	3701.7	1	24	20.86	1.00	21.86	-1.14
			QPSK	55990	3625	100	0	QPSK	56107	3636.7	25	0	19.85	1.00	20.85	-2.15
			16-QAM	55990	3625	100	0	16-QAM	56107	3636.7	25	0	18.92	1.00	19.92	-3.08
			64-QAM	55990	3625	100	0	64-QAM	56107	3636.7	25	0	18.88	1.00	19.88	-3.12
Max	LTE B48	20MHz + 10MHz	256-QAM	55990	3625	100	0	256-QAM	56107	3636.7	25	0	16.93	1.00	17.93	-5.07
			QPSK	55340	3560.0	1	99	QPSK	55484	3574.4	1	0	20.83	1.00	21.83	-1.17
				55990	3625.0	1	99		56134	3639.4	1	0	20.88	1.00	21.88	-1.12
				56640	3690.0	1	0		56784	3704.4	1	49	20.74	1.00	21.74	-1.26
			QPSK	55990	3625	100	0	QPSK	56134	3639.4	50	0	19.73	1.00	20.73	-2.27
			16-QAM	55990	3625	100	0	16-QAM	56134	3639.4	50	0	18.80	1.00	19.80	-3.20
Max	LTE B48	20MHz + 15MHz	64-QAM	55990	3625	100	0	64-QAM	56134	3639.4	50	0	18.76	1.00	19.76	-3.24
			256-QAM	55990	3625	100	0	256-QAM	56134	3639.4	50	0	16.81	1.00	17.81	-5.19
			QPSK	55340	3560.0	1	99	QPSK	55511	3577.1	1	0	20.84	1.00	21.84	-1.16
				55990	3625.0	1	99		56161	3642.1	1	0	20.89	1.00	21.89	-1.11
				56640	3690.0	1	0		56811	3707.1	1	74	20.65	1.00	21.65	-1.35
			QPSK	55990	3625	100	0	QPSK	56161	3642.1	75	0	19.64	1.00	20.64	-2.36
Max	LTE B48	20MHz + 20MHz	16-QAM	55990	3625	100	0	16-QAM	56161	3642.1	75	0	18.71	1.00	19.71	-3.29
			64-QAM	55990	3625	100	0	64-QAM	56161	3642.1	75	0	18.67	1.00	19.67	-3.33
			256-QAM	55990	3625	100	0	256-QAM	56161	3642.1	75	0	16.72	1.00	17.72	-5.28
			QPSK	55340	3560.0	1	99	QPSK	55538	3579.8	1	0	20.69	1.00	21.69	-1.31
				55990	3625.0	1	99		56188	3644.8	1	0	20.74	1.00	21.74	-1.26
				56640	3690.0	1	0		56442	3670.2	1	99	20.50	1.00	21.50	-1.50
Max	LTE B48	20MHz + 20MHz	QPSK	55990	3625	100	0	QPSK	56188	3644.8	100	0	19.49	1.00	20.49	-2.51
			16-QAM	55990	3625	100	0	16-QAM	56188	3644.8	100	0	19.56	1.00	19.56	-3.44
			64-QAM	55990	3625	100	0	64-QAM	56188	3644.8	100	0	18.52	1.00	19.52	-3.48
			256-QAM	55990	3625	100	0	256-QAM	56188	3644.8	100	0	16.57	1.00	17.57	-5.43

Table 7-9. EIRP Data (ULCA Band 48)

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7.7 Radiated Spurious Emissions

§2.1053 §96.41(e)

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized broadband hybrid antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed while the EUT is operating at maximum power and at the appropriate frequencies.

Test Procedures Used


KDB 971168 D01 v03r01 – Section 5.8

ANSI C63.26-2015

TIA-603-E-2016 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW $\geq 3 \times$ RBW
3. Span = 1.5 times the OBW
4. No. of sweep points $\geq 2 \times$ span / RBW
5. Detector = RMS
6. Trace mode = Max Hold (In cases where the level is within 2dB of the limit, the final measurement is taken using triggering/gating and trace averaging.)
7. The trace was allowed to stabilize

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Test Setup

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

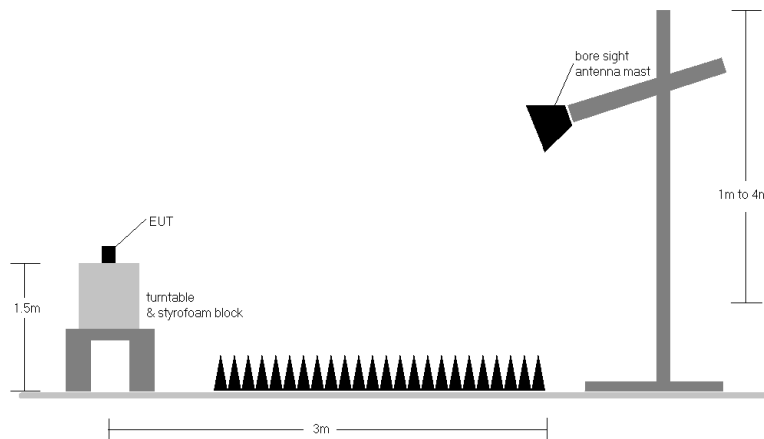



Figure 7-6. Test Instrument & Measurement Setup

Test Notes

- Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$; where D is the measurement distance in meters.
- 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. 1RB config was found and reported as a worst case RB size.
- This unit was tested with its standard battery.
- The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 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.
- The "-" shown in the following RSE tables are used to denote a noise floor measurement.
- 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.
- For LTE Band 48 pre-scans 1-18GHz, the RBW is set to 1MHz and VBW to 30kHz. For final measurements above 1GHz, the RBW is set to 1MHz and VBW to 3MHz when measuring with an RMS detector and max hold trace.
- Uplink carrier aggregation intra-band radiated spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. The worst case (highest) emissions were found while operating with QPSK modulation with both carriers set to transmit using 1RB

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7.7.1 Antenna 3 Radiated Spurious Emissions Measurements

LTE Band 48

Bandwidth (MHz):	20
Frequency (MHz):	3560.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7120.0	H	-	-	-79.81	10.75	37.94	-57.32	-40.00	-17.32
10680.0	H	-	-	-81.50	15.79	41.29	-53.97	-40.00	-13.97
14240.0	H	-	-	-80.20	18.48	45.28	-49.98	-40.00	-9.98
17800.0	H	-	-	-82.48	23.53	48.05	-47.21	-40.00	-7.21

Table 7-10. Radiated Spurious Data (LTE Band 48 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3625.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7250.0	H	-	-	-79.92	11.59	38.67	-56.58	-40.00	-16.58
10875.0	H	-	-	-81.06	15.46	41.40	-53.86	-40.00	-13.86
14500.0	H	-	-	-80.48	20.16	46.68	-48.57	-40.00	-8.57

Table 7-11. Radiated Spurious Data (LTE Band 48 – Mid Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3690.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7380.0	H	-	-	-79.65	10.90	38.25	-57.01	-40.00	-17.01
11070.0	H	-	-	-81.45	15.98	41.53	-53.73	-40.00	-13.73
14760.0	H	-	-	-81.46	20.78	46.32	-48.93	-40.00	-8.93

Table 7-12. Radiated Spurious Data (LTE Band 48 – High Channel)

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ULCA Band 48

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3560.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3579.8
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK

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/MHz]	Limit [dBm/MHz]	Margin [dB]
7120.0	H	-	-	-80.29	11.60	38.31	-56.94	-40.00	-16.94
10680.0	H	-	-	-81.63	15.45	40.82	-54.44	-40.00	-14.44
14240.0	H	-	-	-82.33	18.82	43.49	-51.77	-40.00	-11.77

Table 7-13. Radiated Spurious Data (ULCA Band 48– Low Channel)

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3625.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3644.8
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK


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/MHz]	Limit [dBm/MHz]	Margin [dB]
7250.0	H	-	-	-79.93	12.15	39.22	-56.03	-40.00	-16.03
10875.0	H	-	-	-81.67	15.94	41.27	-53.99	-40.00	-13.99
14500.0	H	-	-	-82.04	19.07	44.03	-51.23	-40.00	-11.23

Table 7-14. Radiated Spurious Data (ULCA Band 48– Mid Channel)

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3690.0
PCC RB / Offset:	1 / 0
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3670.2
SCC RB / Offset:	1 / 99
Modulation Signal:	QPSK

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/MHz]	Limit [dBm/MHz]	Margin [dB]
7380.0	H	-	-	-80.43	12.81	39.38	-55.88	-40.00	-15.88
11070.0	H	-	-	-81.87	16.56	41.69	-53.57	-40.00	-13.57
14760.0	H	-	-	-82.08	19.19	44.11	-51.14	-40.00	-11.14

Table 7-15. Radiated Spurious Data (ULCA Band 48– High Channel)

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Antenna 1 Radiated Spurious Emissions Measurements

LTE Band 48

Bandwidth (MHz):	20
Frequency (MHz):	3560.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7120.0	V	259	4	-73.33	10.75	44.42	-50.84	-40.00	-10.84
10680.0	V	-	-	-81.20	15.79	41.59	-53.67	-40.00	-13.67
14240.0	V	-	-	-80.08	18.48	45.40	-49.86	-40.00	-9.86
17800.0	V	-	-	-82.54	23.53	47.99	-47.27	-40.00	-7.27

Table 7-16. Radiated Spurious Data (LTE Band 48 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3625.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7250.0	V	260	12	-74.16	11.59	44.43	-50.82	-40.00	-10.82
10875.0	V	-	-	-81.17	15.46	41.29	-53.97	-40.00	-13.97
14500.0	V	240	145	-80.17	20.16	46.99	-48.26	-40.00	-8.26

Table 7-17. Radiated Spurious Data (LTE Band 48 – Mid Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3690.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7380.0	V	256	8	-75.48	10.90	42.42	-52.84	-40.00	-12.84
11070.0	V	253	317	-80.89	15.98	42.09	-53.17	-40.00	-13.17
14760.0	V	-	-	-81.31	20.78	46.47	-48.78	-40.00	-8.78

Table 7-18. Radiated Spurious Data (LTE Band 48 – High Channel)

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ULCA Band 48

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3560.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3579.8
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK

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/MHz]	Limit [dBm/MHz]	Margin [dB]
7120.0	H	-	-	-79.82	11.60	38.78	-56.47	-40.00	-16.47
10680.0	H	-	-	-81.84	15.45	40.61	-54.65	-40.00	-14.65
14240.0	H	-	-	-81.94	18.82	43.88	-51.38	-40.00	-11.38

Table 7-19. Radiated Spurious Data (ULCA Band 48– Low Channel)

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3625.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3644.8
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK


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/MHz]	Limit [dBm/MHz]	Margin [dB]
7250.0	H	-	-	-79.83	12.15	39.32	-55.93	-40.00	-15.93
10875.0	H	-	-	-81.81	15.94	41.13	-54.13	-40.00	-14.13
14500.0	H	-	-	-83.84	19.07	42.23	-53.03	-40.00	-13.03

Table 7-20. Radiated Spurious Data (ULCA Band 48– Mid Channel)

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3690.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3670.2
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK

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/MHz]	Limit [dBm/MHz]	Margin [dB]
7380.0	H	-	-	-79.90	12.81	39.91	-55.35	-40.00	-15.35
11070.0	H	-	-	-81.71	16.56	41.85	-53.41	-40.00	-13.41
14760.0	H	-	-	-81.82	19.19	44.37	-50.88	-40.00	-10.88

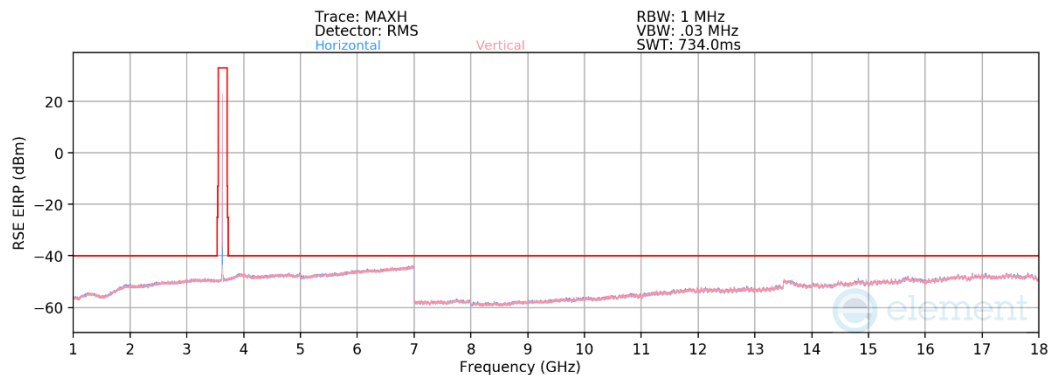
Table 7-21. Radiated Spurious Data (ULCA Band 48– High Channel)

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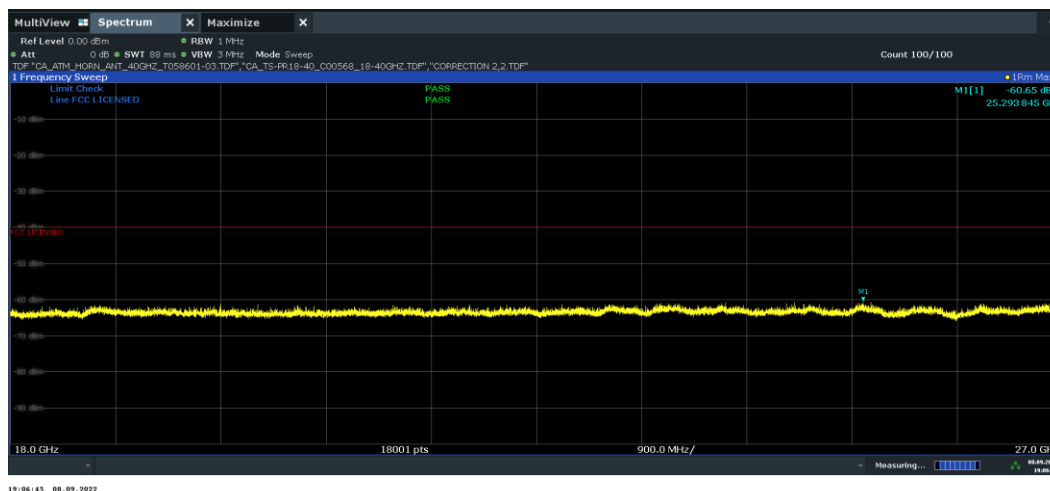
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7.7.3 Antenna 4b Radiated Spurious Emissions Measurements

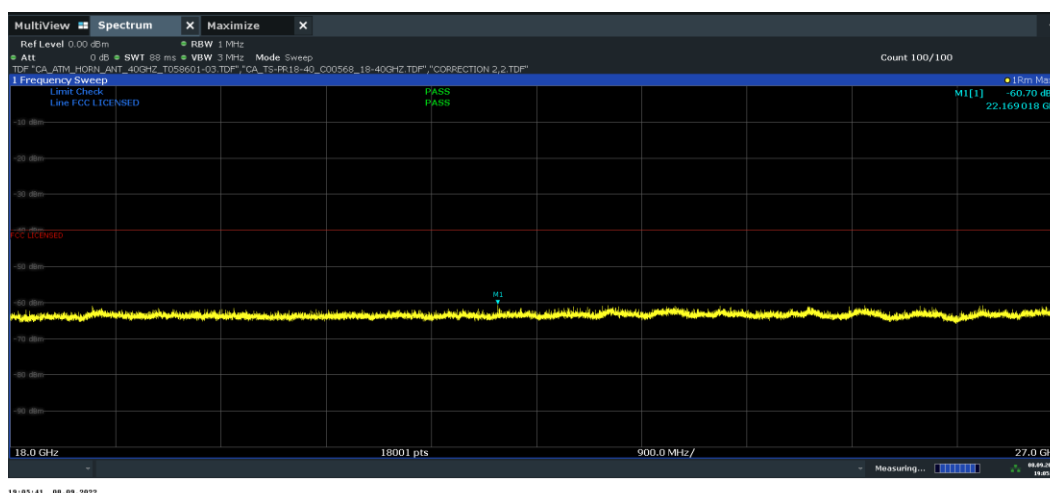
LTE Band 48



Plot 7-88. Radiated Spurious Plot 1 – 18GHz (LTE Band 48)



Plot 7-89. Radiated Spurious Plot 18 – 40GHz (LTE Band 48 – Ant. Pol H)



Plot 7-90. Radiated Spurious Plot 18 – 40GHz (LTE Band 48 – Ant. Pol V)

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Bandwidth (MHz):	20
Frequency (MHz):	3560.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7120.0	H	-	-	-79.70	10.75	38.05	-57.21	-40.00	-17.21
10680.0	H	-	-	-83.36	15.79	39.43	-55.83	-40.00	-15.83
14240.0	H	-	-	-83.82	18.48	41.66	-53.60	-40.00	-13.60

Table 7-22. Radiated Spurious Data (LTE Band 48 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3625.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7250.0	H	-	-	-79.81	11.59	38.78	-56.47	-40.00	-16.47
10875.0	H	-	-	-83.24	15.46	39.22	-56.04	-40.00	-16.04
14500.0	H	-	-	-84.25	20.16	42.91	-52.34	-40.00	-12.34

Table 7-23. Radiated Spurious Data (LTE Band 48 – Mid Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3690.0
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 50

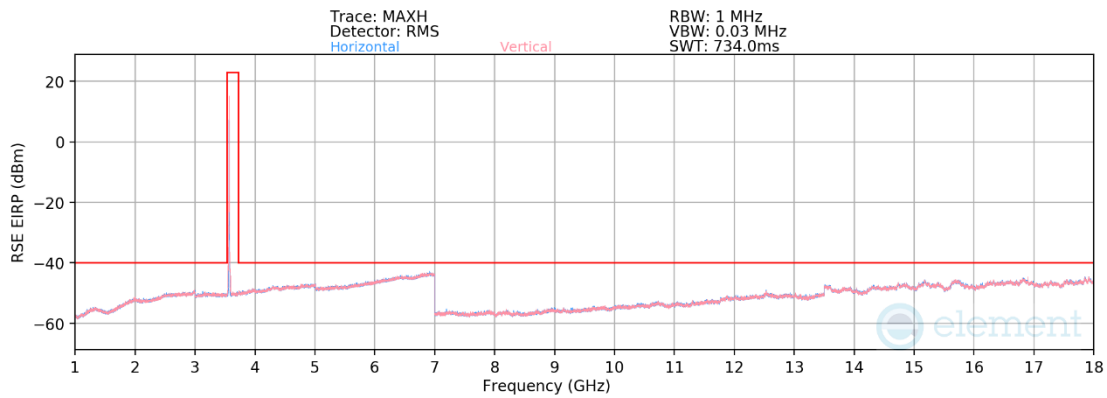
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
7380.0	H	-	-	-79.98	10.90	37.92	-57.34	-40.00	-17.34
11070.0	H	-	-	-83.61	15.98	39.37	-55.89	-40.00	-15.89
14760.0	H	-	-	-85.03	20.78	42.75	-52.50	-40.00	-12.50

Table 7-24. Radiated Spurious Data (LTE Band 48 – High Channel)

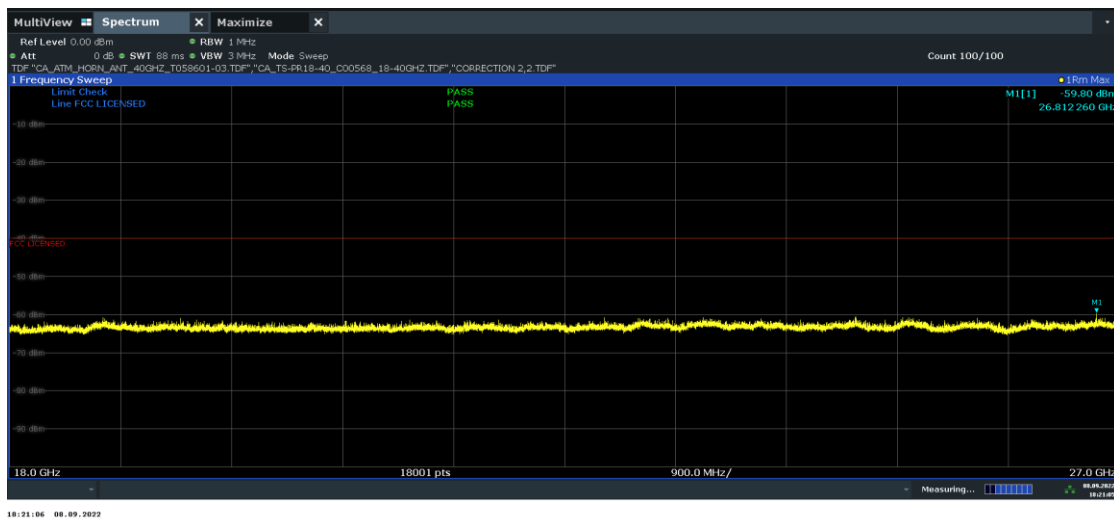
FCC ID: BCGA2764	 PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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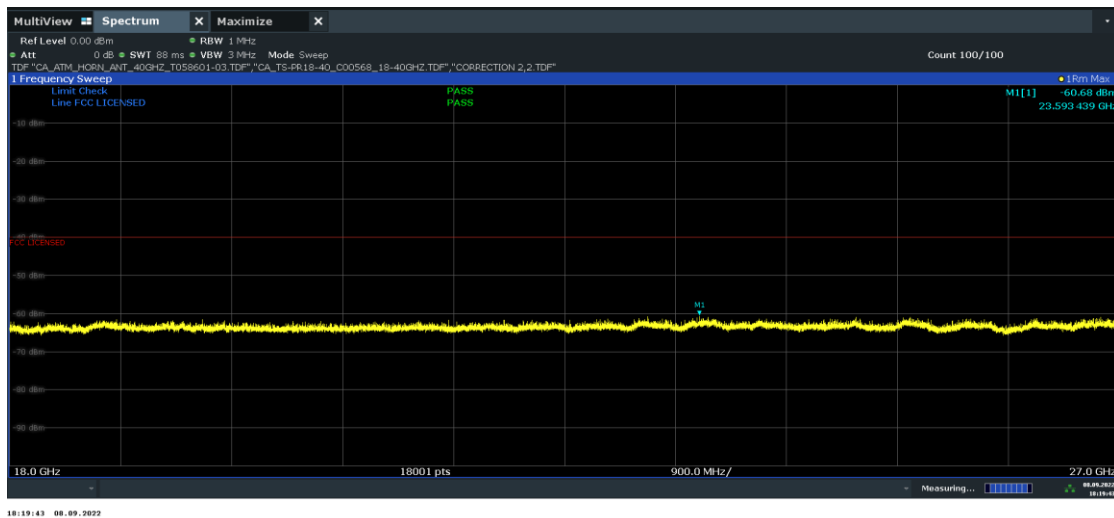
ULCA Band 48




Plot 7-91. Radiated Spurious Plot 1 – 18GHz (ULCA Band 48)



Plot 7-92. Radiated Spurious Plot 18 – 40GHz (ULCA Band 48, Ant. Pol H)



Plot 7-93. Radiated Spurious Plot 18 – 40GHz (ULCA Band 48, Ant. Pol V)

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PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3560.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3579.8
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK

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/MHz]	Limit [dBm/MHz]	Margin [dB]
7120.0	H	-	-	-80.40	11.60	38.20	-57.05	-40.00	-17.05
10680.0	H	-	-	-81.88	15.45	40.57	-54.69	-40.00	-14.69
14240.0	H	-	-	-82.09	18.82	43.73	-51.53	-40.00	-11.53

Table 7-25. Radiated Spurious Data (ULCA Band 48– Low Channel)

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3625.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3644.8
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK


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/MHz]	Limit [dBm/MHz]	Margin [dB]
7250.0	H	-	-	-79.98	12.15	39.17	-56.08	-40.00	-16.08
10875.0	H	-	-	-81.58	15.94	41.36	-53.90	-40.00	-13.90
14500.0	H	-	-	-81.98	19.07	44.09	-51.17	-40.00	-11.17

Table 7-26. Radiated Spurious Data (ULCA Band 48– Mid Channel)

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3690.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3670.2
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK

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/MHz]	Limit [dBm/MHz]	Margin [dB]
7380.0	H	-	-	-79.95	12.81	39.86	-55.40	-40.00	-15.40
11070.0	H	-	-	-81.48	16.56	42.08	-53.18	-40.00	-13.18
14760.0	H	-	-	-82.12	19.19	44.07	-51.18	-40.00	-11.18

Table 7-27. Radiated Spurious Data (ULCA Band 48– High Channel)

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7.7.4 Antenna 2a Radiated Spurious Emissions Measurements

LTE Band 48

Bandwidth (MHz):	20
Frequency (MHz):	3690.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7380.0	H	-	-	-79.98	10.90	37.92	-57.34	-40.00	-17.34
11070.0	H	-	-	-83.61	15.98	39.37	-55.89	-40.00	-15.89
14760.0	H	-	-	-85.03	20.78	42.75	-52.50	-40.00	-12.50

Table 7-28. Radiated Spurious Data (LTE Band 48 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3560.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7120.0	H	-	-	-80.17	10.75	37.58	-57.68	-40.00	-17.68
10680.0	H	-	-	-82.10	15.79	40.69	-54.57	-40.00	-14.57
14240.0	H	-	-	-80.79	18.48	44.69	-50.57	-40.00	-10.57
17800.0	H	-	-	-83.88	23.53	46.65	-48.61	-40.00	-8.61

Table 7-29. Radiated Spurious Data (LTE Band 48 – Mid Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3625.0
Modulation Signal:	QPSK
RB Config (Size / 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/MHz]	Limit [dBm/MHz]	Margin [dB]
7250.0	H	-	-	-80.78	11.59	37.81	-57.44	-40.00	-17.44
10875.0	H	-	-	-81.77	15.46	40.69	-54.57	-40.00	-14.57
14500.0	H	-	-	-81.53	20.16	45.63	-49.62	-40.00	-9.62

Table 7-30. Radiated Spurious Data (LTE Band 48 – High Channel)

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ULCA Band 48

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3560.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3579.8
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK

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/MHz]	Limit [dBm/MHz]	Margin [dB]
7120.0	H	-	-	-80.39	11.60	38.21	-57.04	-40.00	-17.04
10680.0	H	-	-	-81.65	15.45	40.80	-54.46	-40.00	-14.46
14240.0	H	-	-	-82.07	18.82	43.75	-51.51	-40.00	-11.51

Table 7-31. Radiated Spurious Data (ULCA Band 48– Low Channel)

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3625.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3644.8
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK


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/MHz]	Limit [dBm/MHz]	Margin [dB]
7250.0	H	-	-	-79.97	12.15	39.18	-56.07	-40.00	-16.07
10875.0	H	-	-	-81.70	15.94	41.24	-54.02	-40.00	-14.02
14500.0	H	-	-	-82.08	19.07	43.99	-51.27	-40.00	-11.27

Table 7-32. Radiated Spurious Data (ULCA Band 48– Mid Channel)

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3690.0
PCC RB / Offset:	1 / 99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3670.2
SCC RB / Offset:	1 / 0
Modulation Signal:	QPSK

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/MHz]	Limit [dBm/MHz]	Margin [dB]
7380.0	H	-	-	-80.02	12.81	39.79	-55.47	-40.00	-15.47
11070.0	H	-	-	-81.52	16.56	42.04	-53.22	-40.00	-13.22
14760.0	H	-	-	-81.92	19.19	44.27	-50.98	-40.00	-10.98

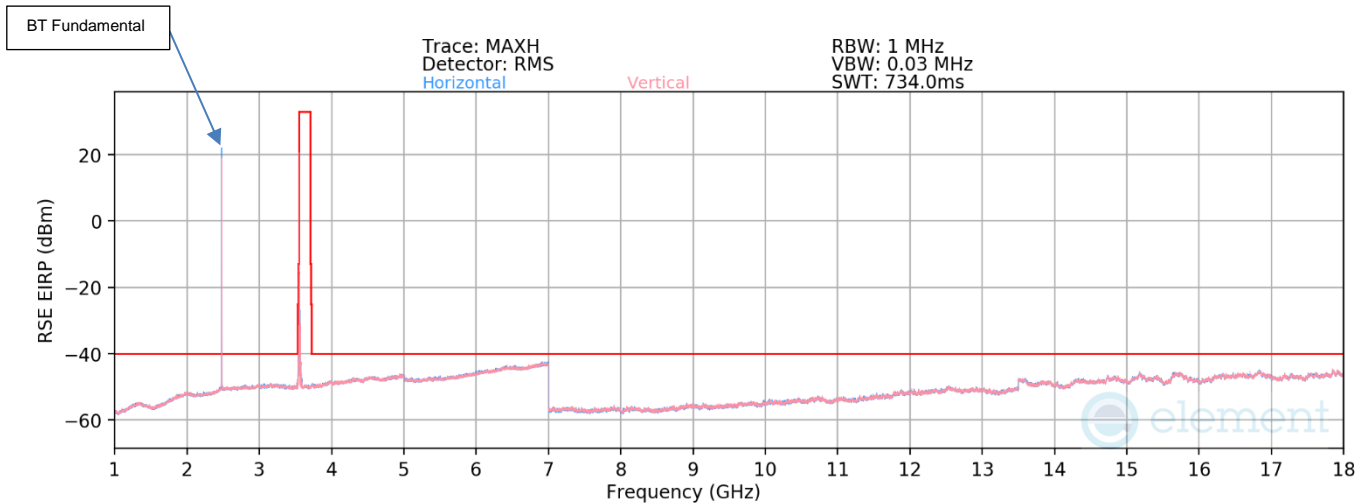
Table 7-33. Radiated Spurious Data (ULCA Band 48– High Channel)

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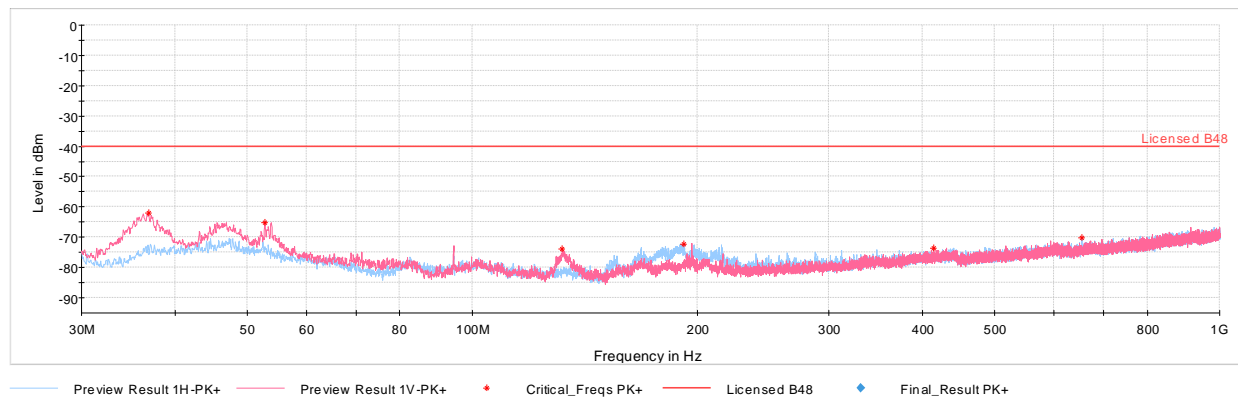
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7.7.5 Simultaneous Transmission

Description	Bluetooth	LTE
Antenna	2a	2a
Channel	79	55340
Operating Frequency (MHz)	2480	3560
Mode/Modulation	GFSK ePA	QPSK/1RB/20MHz



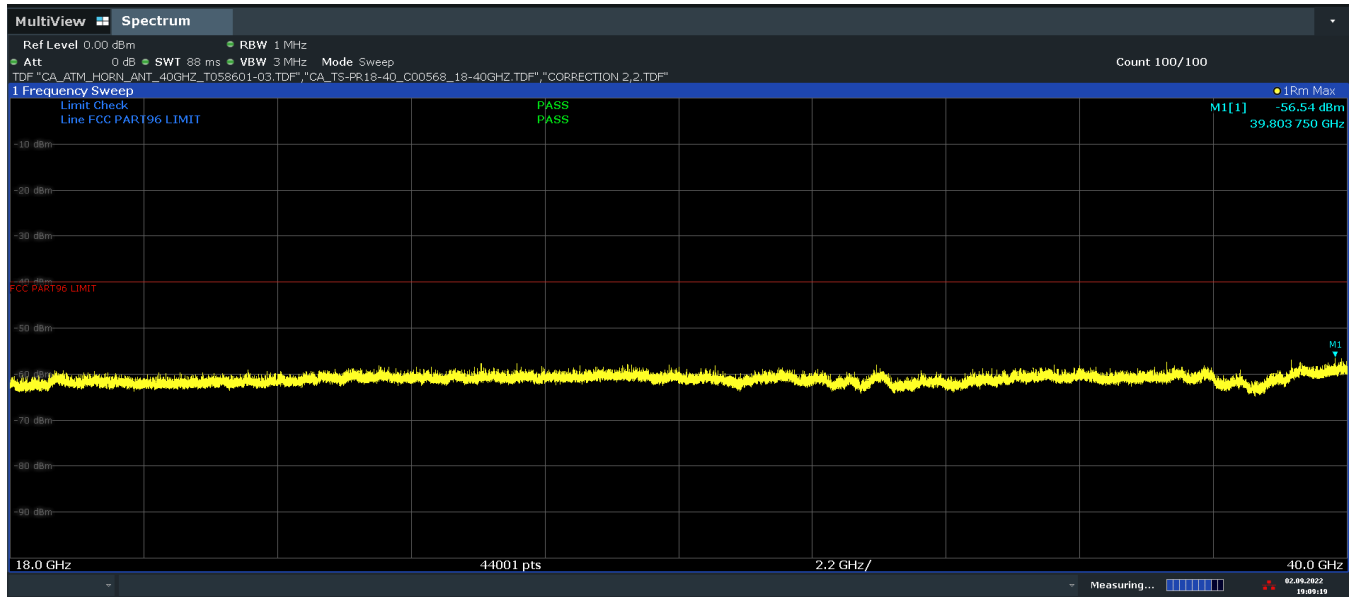
Plot 7-94. Radiated Spurious Emissions – Simultaneous Transmission 1GHz-18GHz



Plot 7-95. Radiated Spurious Emissions – Simultaneous Transmission 30MHz - 1GHz

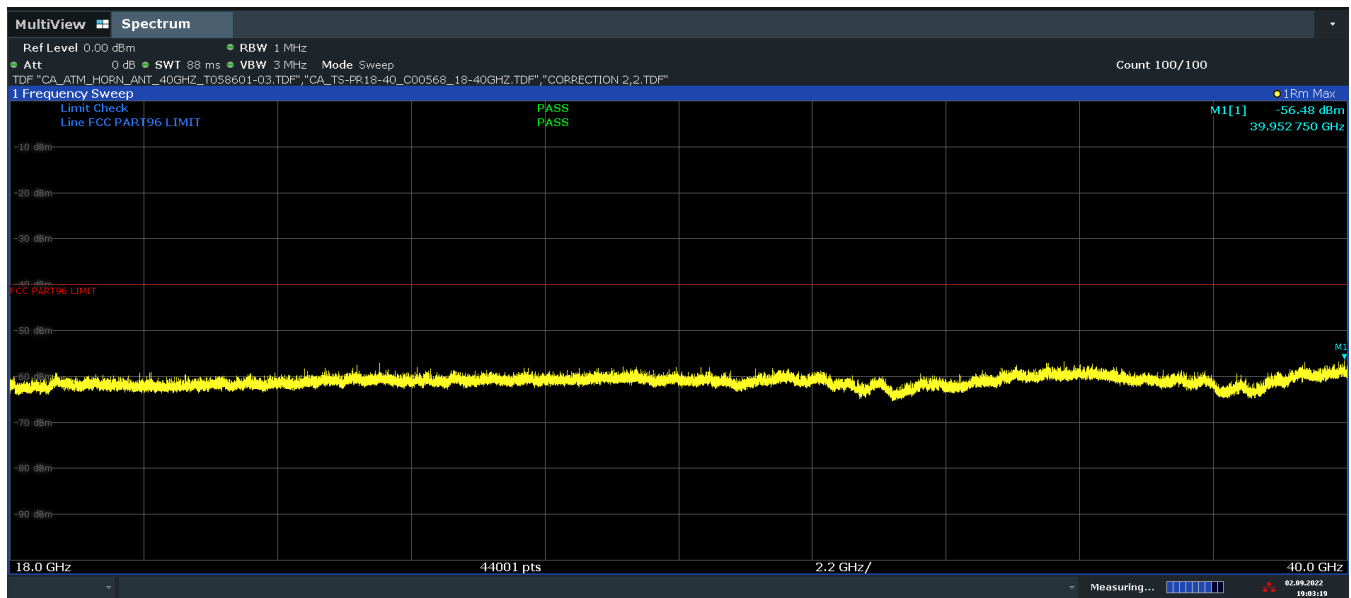
FCC ID: BCGA2764	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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19:09:19 02.09.2022

Plot 7-96. Radiated Spurious Emissions – Simultaneous Transmission 18GHz - 40GHz Pol. H



19:03:19 02.09.2022

Plot 7-97. Radiated Spurious Emissions – Simultaneous Transmission 18GHz - 40GHz Pol. V

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Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dBm]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
7102.00	H	-	-	-82.51	11.21	35.7	-59.52	-40.00	-19.52
10653.00	H	-	-	-85.53	15.66	37.1	-58.10	-40.00	-18.10
14204.00	H	258	171	-82.00	18.22	43.2	-52.01	-40.00	-12.01
17755.00	H	-	-	-86.19	22.22	43.0	-52.20	-40.00	-12.20
1409.00*	H	-	-	-78.86	7.55	35.7	-59.54	-40.00	-19.54
4622.00*	H	-	-	-82.10	19.17	44.1	-51.16	-40.00	-11.16

Table 7-34. LTE Harmonics and Intermodulations (*) Emissions Measurements in Simultaneous Transmission Mode

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4960.00	Peak	H	-	-	-71.92	18.35	53.43	73.98	-20.55
7440.00	Peak	H	-	-	-72.03	12.07	47.04	73.98	-26.94
12400.00	Peak	H	-	-	-75.22	18.11	49.89	73.98	-24.09

Table 7-35. Bluetooth Harmonics Emissions Measurements in Simultaneous Transmission Mode

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7.8 Frequency Stability / Temperature Variation

\$2.1055

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015 and TIA-603-E-2016. 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 96, 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

TIA-603-E-2016

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

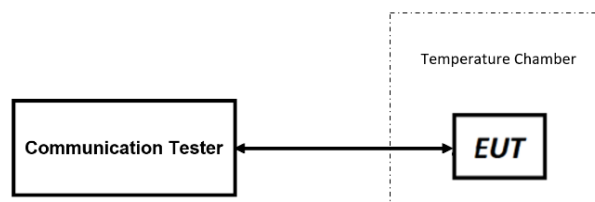



Figure 7-7. Test Instrument & Measurement Setup

Test Notes

All ports were tested and only the worst case data were reported.

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Frequency Stability / Temperature Variation

LTE Band 48							
			Low Channel Frequency (Hz):		3,560,000,000		
			High Channel Frequency (Hz):		3,690,000,000		
			Ref. Voltage (VDC):		3.8		
Voltage (%)	Power (VDC)	Temp (°C)	Low Freq. (Hz)	High Freq. (Hz)	Low Freq. Dev. (Hz)	High Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	3,560,000,238	3,560,000,235	118	129	0.000003624
		- 20	3,560,000,227	3,560,000,228	107	122	0.000003427
		- 10	3,560,000,214	3,560,000,207	94	101	0.000002837
		0	3,560,000,251	3,560,000,210	131	104	0.000003680
		+ 10	3,560,000,248	3,560,000,234	128	128	0.000003596
		+ 20 (Ref)	3,560,000,120	3,560,000,106	0	0	0.000000000
		+ 30	3,560,000,250	3,560,000,202	130	96	0.000003652
		+ 40	3,560,000,240	3,560,000,211	120	105	0.000003371
		+ 50	3,560,000,210	3,560,000,200	90	94	0.000002640
Battery Endpoint	3.23	+ 20	3,560,000,235	3,560,000,209	115	103	0.000003230

Table 7-36. LTE Band 48 Frequency Stability Data

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7.9 End User Device Additional Requirement (CBSD Protocol)

\$96.47

Test Overview and Limit

End user device additional requirements (CBSD Protocol) are tested per the test procedures listed below. During testing, the EUT is connected to a certified CBSD (Ruckus FCC ID: S9GQ910US00) as a companion device to show compliance with Part 96.47.

End User Devices may operate only if they can positively receive and decode an authorization signal transmitted by a CBSD, including the frequencies and power limits for their operation.

An End User Device must discontinue operations, change frequencies, or change its operational power level within 10 seconds of receiving instructions from its associated CBSD.

Test Procedure Used

KDB 940660 D01 v03

WINNF-TS-0122 v1.0.2


Test Setup/Method

The EUT was connected via an RF cable to a certified CBSD and spectrum analyzer. The following procedure is performed by applying WINNF-TS-0122 CBRS CBSD Test Specification.

1. Run#1:
 - a. Setup WINNF.PT.C.HBT.1 with 3685MHz – 3695MHz.
 - b. Enable AP service from Ruckus Cloud management.
 - c. Check EUT Tx frequency.
 - d. Disable AP service from Ruckus Cloud management and check EUT stop transmission within 10s.
2. Run#2:
 - a. Setup WINNF.PT.C.HBT.1 with 3615MHz – 3635MHz.
 - b. Enable AP service from Ruckus Cloud management.
 - c. Check EUT Tx frequency.
 - d. Disable AP service from Ruckus Cloud management and check EUT stop transmission within 10s.

Test Notes

The EUT is an End User Device.

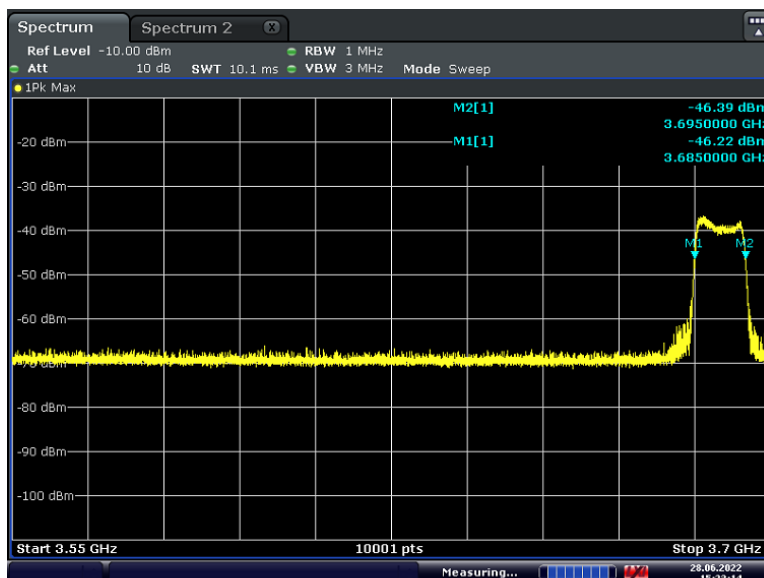
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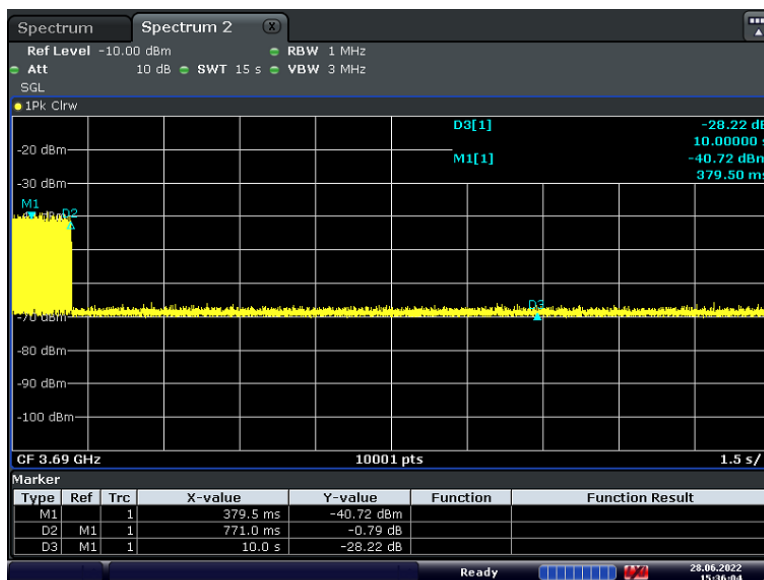
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Run#1:

- Tx Frequency Set: 3685 – 3695MHz
- MaxEIRP Set: 10dBm/MHz



Plot 7-98. Run#1 End User Device Frequency of Operations




Plot 7-99. Run#1 End User Device Discontinues Operations within 10s

Note:

Marker 1: CBSD sends instructions to discontinue LTE operations.

Marker 2: EUT discontinues operation.

Marker 3: 10 seconds elapsed time from CBSD sending instructions to EUT.

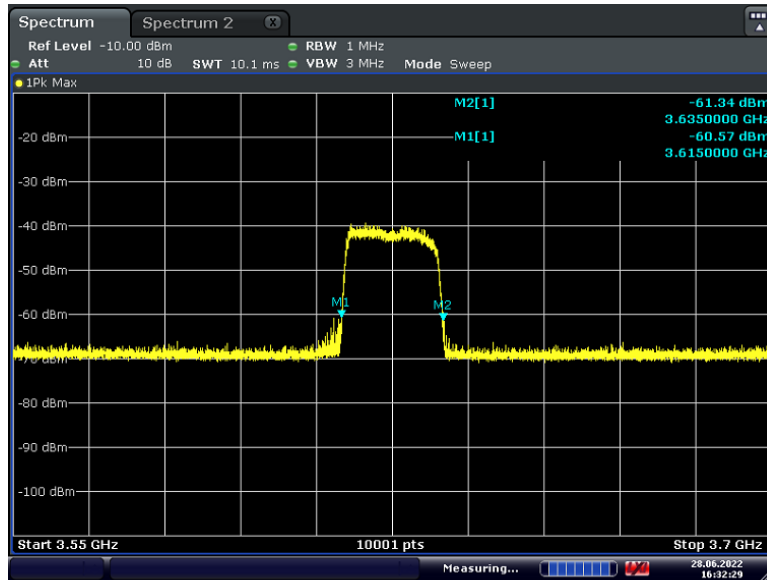
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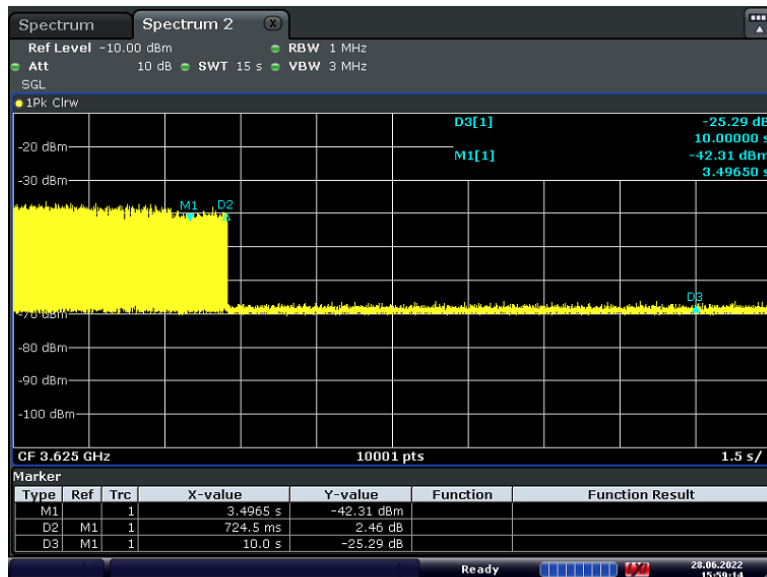
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Run#2:

- Tx Frequency Set: 3615 – 3635MHz
- MaxEIRP Set: 10dBm/MHz



Plot 7-100. Run#2 End User Device Frequency of Operations




Plot 7-101. Run#2 End User Device Discontinues Operations within 10s

Note:

Marker 1: CBSD sends instructions to discontinue LTE operations.


Marker 2: EUT discontinues operation.

Marker 3: 10 seconds elapsed time from CBSD sending instructions to EUT.

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the Apple **Tablet Devices FCC ID: BCGA2764** complies with all of the End User Device requirements of Part 96 of the FCC Rules for LTE operation only.

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