

DATA REFERENCE REPORT PART 96

Applicant Name:

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

Date of Testing:

12/15/2020 - 03/04/2021

Test Site/Location:

PCTEST Lab. Morgan Hill, CA, USA

Test Report Serial No.:

1C2101020003-09.BCG

FCC ID:

BCGA2459

Applicant Name:

Apple Inc.

Reference Model:

A2301

Variant Model:

A2459, A2460

EUT Type:

Tablet Device

FCC Classification:

PCS Licensed Transmitter (PCB)

FCC Rule Part:

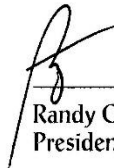
96

Test Procedure(s):

ANSI C63.26-2015, TIA-603-E-2016, KDB 971168 D01 v03r01, KDB 940660 D01 v02, 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.




Randy Ortanez
President



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1.0 INTRODUCTION

1.1 Scope

Per manufacturer declaration, there are two tablet device models, A2301 and A2459(A2460), with high degree of similarity, reference model FCC ID: BCGA2301 and variant model **FCC ID: BCGA2459**. The reference model supports mmWave operations, while the variant model has 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: BCGA2301, while radiated spot-check verification has been performed on variant model **FCC ID: BCGA2459**. Additionally, due to Antenna 4a location being close to the depopulated mmWave components, full radiated testing has been done for all supported technologies on Antenna 4a. 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	BCGA2301	1C2101020002-08.BCG	RF Part 96 Test Report

Table 1-1. Reference Model Details


Reference model FCC ID: BCGA2301 test report has been included in Appendix A

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST. 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

- PCTEST 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.
- PCTEST 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).
- PCTEST 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:BCGA2459**. 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.

Test Device Serial No.: H1931W7GTV, TM6JQGGX3H

2.2 Device Capabilities

This device contains the following capabilities:

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

This device supports BT Beamforming


LTE Band 48 supports NS10 for Antenna 3, Antenna 1, Antenna 4a, and Antenna 2a.

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	WLAN	Bluetooth	GSM / WCDMA	LTE / FR1 NR			UNII
		802.11 b/g/n/ax	BDR, EDR, HDR4/8, LE1/2M	Mid Band	Mid Band	High Band	Ultra High Band	802.11 a/n/ac/ax
2a	Config 1	✓	✗	✗	✗	✗	✓	✗
2a	Config 2	✗	✓	✗	✗	✗	✓	✗
4a	Config 3	✓	✗	✗	✗	✗	✓	✗
4a	Config 4	✗	✓	✗	✗	✗	✓	✗
4b	Config 5	✗	✗	✓	✗	✗	✗	✓
4b	Config 6	✗	✗	✗	✓	✗	✗	✓
4b	Config 7	✗	✗	✗	✗	✓	✗	✓

Table 2-1. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

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2.3 Antenna Description

Following antenna gains provided by manufacturer were used for the testing.


Band	Antenna Gain (dBi)			
	Antenna 3	Antenna 1	Antenna 4a	Antenna 2a
LTE Band 48	-1.0	-2.6	2.7	2.4

Table 2-2. Highest Antenna Gain

2.4 Test Support Equipment

1	Apple MacBook Pro w/AC/DC Adapter	Model: A2141 Model: A2166	S/N: C02DV7VKMD6T S/N: N/A
2	Apple USB-C Cable	Model: Chimp	S/N: 420A57
3	USB-C Cable w/ AC Adapter	Model: A146 Model: A2305	S/N: N/A S/N: N/A
4	Apple Pencil	Model: N/A	S/N: GQXYGSXBJKM9
5	DC Power Supply	Model: KPS3010D	S/N: N/A

Table 2-3. Test Support Equipment

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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 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.

Per FCC Approved Data Referencing Test Plan, Antenna 4a radiated testing and spot-check measurements have been conducted and reported. Spot-check Test Plan can be referred to below Table 2-4.

Technology	Test Case	FCC ID: BCGA2459	
		Mode	Channel
GSM, WCDMA, LTE, FR1 Single Carrier & IntraBand ULCA	Radiated Spurious Emissions	Antenna 3 LTE Band 5, 2, 7 Max BW, 1RB, QPSK	M

Table 2-4. FCC Approved Spot-Check Test Plan


Output powers were measured and confirmed to be consistent between Reference and Variant models prior to testing.

2.6 Software and Firmware

The test was conducted with firmware version 18E20700y 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.

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:

$$E_{[\text{dB}\mu\text{V}/\text{m}]} = \text{Measured amplitude level}_{[\text{dBm}]} + 107 + \text{Cable Loss}_{[\text{dB}]} + \text{Antenna Factor}_{[\text{dB}/\text{m}]}$$

And


$$\text{EIRP}_{[\text{dBm}]} = E_{[\text{dB}\mu\text{V}/\text{m}]} + 20\log D - 104.8;$$

Where D is the measurement distance in meters.

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

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)
Radiated Disturbance (<30MHz)	4.06
Radiated Disturbance (30MHz-1GHz)	4.30
Radiated Disturbance (1-18GHz)	4.78
Radiated Disturbance (>18GHz)	4.79

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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	PXA Signal Analyzer (3Hz - 26.5 GHz)	7/24/2020	Annual	7/24/2021	MY55330128
Keysight Technology	N9040B	UXA Signal Analyzer	12/19/2020	Annual	12/19/2021	MY57212015
Keysight Technology	E7515B	UXM 5G Wireless Test Platform	11/14/2020	Annual	11/14/2021	MY60192562
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	8/11/2020	Annual	8/11/2021	T058701-01
ESPEC	SU-241	Tabletop Temperature Chamber	9/28/2020	Annual	9/28/2021	92009574
ETS-Lindgren	3142E	BiConiLog Antenna (30MHz - 6GHz)	9/15/2020	Annual	9/15/2021	208204
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	4/21/2020	Annual	4/21/2021	205956
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	7/15/2020	Annual	7/15/2021	102356
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	12/3/2020	Annual	12/3/2021	101648
Rohde & Schwarz	ESW26	EMI Test Receiver	6/8/2020	Annual	6/8/2021	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	8/6/2020	Annual	8/6/2021	101668
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	10/13/2020	Annual	10/13/2021	161616
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	4/16/2020	Annual	4/16/2021	166869
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	4/23/2020	Annual	4/23/2021	100052
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Antenna (400MHz-18GHz)	10/2/2020	Annual	10/2/2021	101063
Rohde & Schwarz	HFH2-Z2	Loop Antenna	3/12/2020	Annual	3/12/2021	100546

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.


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6.0 SAMPLE CALCULATIONS

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 (ANTENNA 4A)

7.1 Summary


Company Name: Apple Inc.
 FCC ID: BCGA2459
 FCC Classification: Citizens Band End User Devices (CBE)
 Mode(s): LTE/ULCA

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1053 96.41(e)	Undesirable Emissions	-40 dBm/MHz	RADIATED	PASS	Section 7.7

Table 7-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) Below 1GHz and Above 18GHz Radiated Spurious Emissions have been investigated and no significant emissions were found.

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7.2 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.

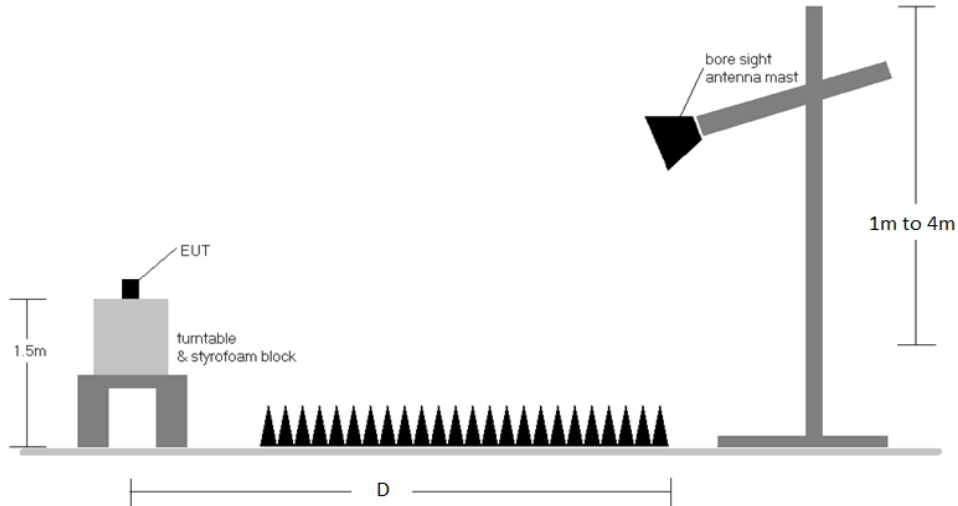


Figure 7-1. Test Instrument & Measurement Setup

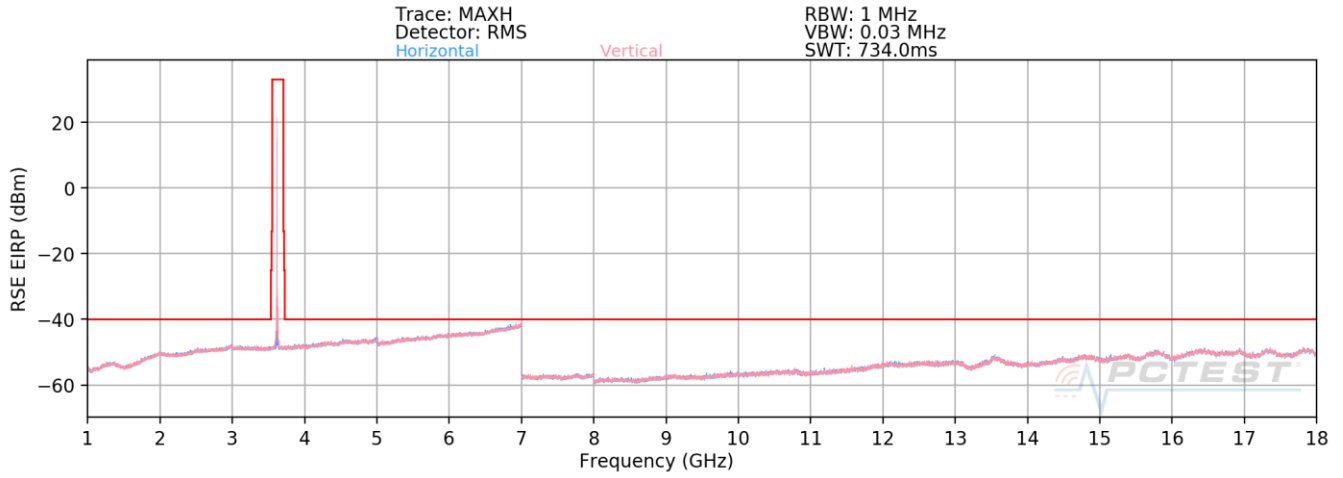
Test Notes

- 1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - a. $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - b. $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$; where D is the measurement distance in meters.
- 2) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below. 1RB config was found and reported as a worst case RB size.
- 3) This unit was tested with its standard battery.
- 4) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 5) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
- 6) The "-" shown in the following RSE tables are used to denote a noise floor measurement.
- 7) 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.
- 8) 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.
- 9) 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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Antenna 4a Radiated Spurious Emissions Measurements

LTE Band 48



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

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Bandwidth (MHz):	20
Frequency (MHz):	3560.0
Modulation Signal:	QPSK
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7120.0	H	120	8	-71.04	8.91	44.87	-50.39	-40.00	-10.39
10680.0	H	-	-	-75.66	14.48	45.82	-49.43	-40.00	-9.43
14240.0	H	-	-	-75.48	18.27	49.79	-45.47	-40.00	-5.47

Table 7-2. Radiated Spurious Data (Band 48 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3625.0
Modulation Signal:	QPSK
RB / Offset:	1 / 50


Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7250.0	H	-	-	-72.46	8.68	43.22	-52.04	-40.00	-12.04
10875.0	H	-	-	-76.53	15.18	45.65	-49.61	-40.00	-9.61
14500.0	H	-	-	-75.33	19.52	51.19	-44.07	-40.00	-4.07

Table 7-3. Radiated Spurious Data (Band 48 – Mid Channel)

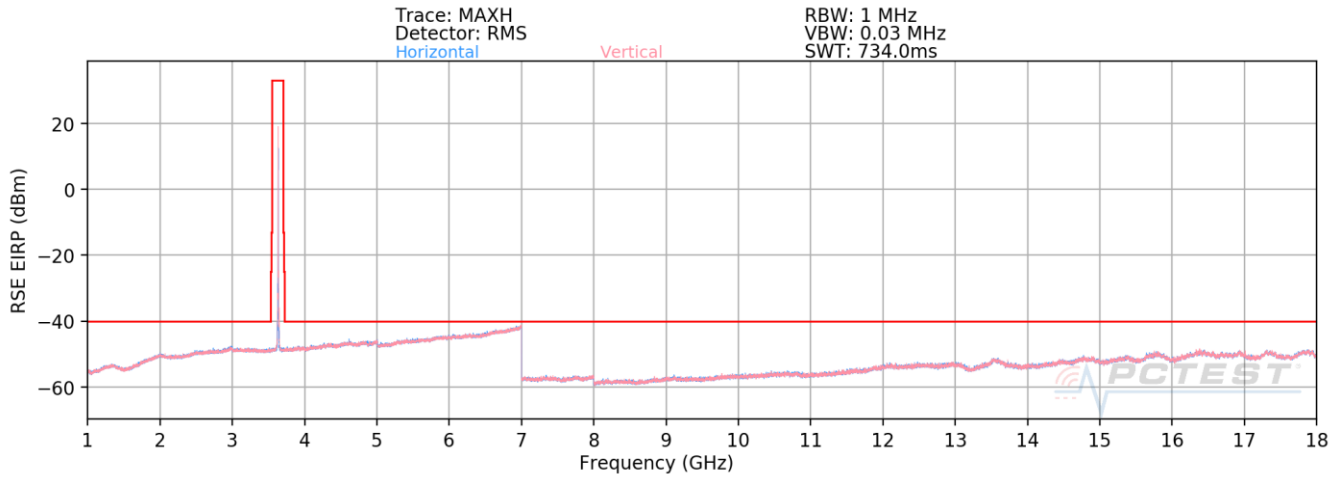
Bandwidth (MHz):	20
Frequency (MHz):	3690.0
Modulation Signal:	QPSK
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7380.00	V	182	110	-71.95	9.26	44.31	-50.95	-40.00	-10.95
11070.00	H	-	-	-76.17	15.28	46.11	-49.15	-40.00	-9.15
14760.00	H	-	-	-76.12	19.84	50.72	-44.54	-40.00	-4.54

Table 7-4. Radiated Spurious Data (Band 48 – High Channel)

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ULCA - LTE Band 48



Plot 7-2. Radiated Spurious Plot 1 - 18GHz (ULCA Band 48)

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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

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7140.0	H	118	238	-70.24	8.91	45.67	-49.59	-40.00	-9.59
10710.0	H	-	-	-76.37	14.48	45.11	-50.14	-40.00	-10.14
14280.0	H	-	-	-75.21	18.27	50.06	-45.20	-40.00	-5.20

Table 7-5. 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


Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7270.0	H	108	228	-70.90	8.68	44.78	-50.48	-40.00	-10.48
10905.0	H	-	-	-76.25	15.18	45.93	-49.33	-40.00	-9.33
14540.0	H	-	-	-75.36	19.52	51.16	-44.10	-40.00	-4.10

Table 7-6. 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


Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7400.0	H	293	81	-72.30	9.26	43.96	-51.30	-40.00	-11.30
11100.0	H	-	-	-76.25	15.28	46.03	-49.23	-40.00	-9.23
14800.0	H	-	-	-76.06	19.84	50.78	-44.48	-40.00	-4.48

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

FCC ID: BCGA2459	 PART 96 DATA REFERENCE REPORT		Approved by: Quality Manager
Test Report S/N: 1C2101020003-09.BCG	Test Dates: 12/15/2020 - 03/04/2021	EUT Type: Tablet Device	Page 17 of 19


8.0 CONCLUSION

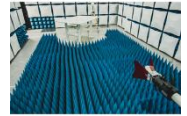
Antenna 4a radiated testing has been fully conducted for variant model **FCC ID: BCGA2459** and results were found in compliance with all of the End User Device requirements of Part 96 of the FCC Rules for LTE operation only.

FCC ID: BCGA2459	 PART 96 DATA REFERENCE REPORT		Approved by: Quality Manager
Test Report S/N: 1C2101020003-09.BCG	Test Dates: 12/15/2020 - 03/04/2021	EUT Type: Tablet Device	Page 18 of 19

9.0 APPENDIX A: REFERENCE MODEL TEST REPORT

Attached is the test report (1C2101020002-08.BCG) from reference model FCC ID: BCGA2301, which includes referenced data results.

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Test Report S/N: 1C2101020003-09.BCG	Test Dates: 12/15/2020 - 03/04/2021	EUT Type: Tablet Device
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MEASUREMENT REPORT

Part 96 LTE

Applicant Name:

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

Date of Testing:

12/15/2020-03/04/2021

Test Site/Location:

PCTEST Morgan Hill, CA, USA

Test Report Serial No.:

1C2101020002-08.BCG

FCC ID:	BCGA2301
APPLICANT:	Apple Inc.

Application Type:

Certification

Model:

A2301

EUT Type:

Tablet Device

FCC Classification:

Citizens Band End User Devices (CBE)

FCC Rule Part(s):


96

Test Procedure(s):

ANSI C63.26-2015, TIA-603-E-2016, KDB 971168 D01 v03r01,
KDB 940660 D01 v02, 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.



Randy Ortanez
President

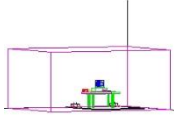


FCC ID: BCGA2301	 MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device
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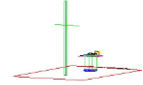
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MEASUREMENT REPORT

FCC Part 96



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	EIRP		Emission Designator
					Max. Power [W]	Max. Power [dBm]	
LTE Band 48	20 MHz	QPSK	3560.0 - 3690.0	17.9870	0.158	22.00	18M0G7W
		16QAM	3560.0 - 3690.0	18.0040	0.157	21.96	18M0D7W
		64QAM	3560.0 - 3690.0	17.9720	0.147	21.68	18M0D7W
		256QAM	3560.0 - 3690.0	17.9970	0.142	21.66	18M0D7W
	15 MHz	QPSK	3557.5 - 3692.5	13.4720	0.158	22.00	13M5G7W
		16QAM	3557.5 - 3692.5	13.5190	0.150	21.76	13M5D7W
		64QAM	3557.5 - 3692.5	13.5050	0.150	21.76	13M5D7W
		256QAM	3557.5 - 3692.5	13.5260	0.140	21.52	13M5D7W
	10 MHz	QPSK	3555.0 - 3695.0	8.9718	0.158	22.00	8M9G7W
		16QAM	3555.0 - 3695.0	9.0293	0.153	21.84	9M03D7W
		64QAM	3555.0 - 3695.0	9.0148	0.147	21.67	9M01D7W
		256QAM	3555.0 - 3695.0	9.0337	0.141	21.50	9M03D7W
	5 MHz	QPSK	3552.5 - 3697.5	4.4985	0.158	22.00	4M50G7W
		16QAM	3552.5 - 3697.5	4.5226	0.151	21.79	4M52D7W
		64QAM	3552.5 - 3697.5	4.5325	0.150	21.77	4M53D7W
		256QAM	3552.5 - 3697.5	4.5029	0.140	21.51	4M50D7W
LTE ULCA Band 48	20+20 MHz	QPSK	3570.0 - 3680.0	37.5500	0.158	22.00	37M5G7W
		16QAM	3570.0 - 3680.0	37.6020	0.136	21.34	37M6D7W
		64QAM	3570.0 - 3680.0	37.5920	0.134	21.26	37M6D7W
		256QAM	3570.0 - 3680.0	37.5790	0.136	21.35	37M6D7W
	20+15 MHz	QPSK	3567.5 - 3682.5	32.7130	0.158	22.00	32M7G7W
		16QAM	3567.5 - 3682.5	32.7260	0.129	21.12	32M7D7W
		64QAM	3567.5 - 3682.5	32.6410	0.130	21.15	32M6D7W
		256QAM	3567.5 - 3682.5	32.8000	0.126	21.00	32M8D7W
	20+10 MHz	QPSK	3565.0 - 3685.0	27.8790	0.158	22.00	27M9G7W
		16QAM	3565.0 - 3685.0	27.8280	0.134	21.27	27M8D7W
		64QAM	3565.0 - 3685.0	27.7540	0.135	21.31	27M8D7W
		256QAM	3565.0 - 3685.0	27.8220	0.133	21.24	27M8D7W
	20+5 MHz	QPSK	3562.5 - 3687.5	23.0940	0.158	22.00	23M1G7W
		16QAM	3562.5 - 3687.5	23.1090	0.136	21.34	23M1D7W
		64QAM	3562.5 - 3687.5	23.0740	0.135	21.31	23M1D7W
		256QAM	3562.5 - 3687.5	23.0330	0.133	21.25	23M0D7W

EUT Overview

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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 PCTEST Test Location

These measurement tests were conducted at the PCTEST 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 PCTEST located in Morgan Hill, CA 95037, U.S.A.

- PCTEST is a CBRS Alliance (OnGo) Approved Test Lab
- PCTEST is a WinnForum Approved Test Lab
- PCTEST 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.
- PCTEST 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.
- PCTEST 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).
- PCTEST facility is a registered (22831) test laboratory with the site description on file with ISED.

FCC ID: BCGA2301	 Proud to be part of  element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Tablet Device FCC ID: BCGA2301**. 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.: NQ73CFK6VJ, LGXMHP6X6Y, DLX0384008YQ4FC1D, L17WN3G6DQ

2.2 Device Capabilities

This device contains the following capabilities:

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

This device supports BT Beamforming.

LTE Band 48 supports NS10 for Antenna 3, Antenna 1, Antenna 4a, and Antenna 2a.

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	WLAN	Bluetooth	GSM / WCDMA	LTE / FR1 NR			UNII
		802.11 b/g/n/ax	BDR, EDR, HDR4/8, LE1/2M	Mid Band	Mid Band	High Band	Ultra High Band	802.11 a/n/ac/ax
2a	Config 1	✓	✗	✗	✗	✗	✓	✗
2a	Config 2	✗	✓	✗	✗	✗	✓	✗
4a	Config 3	✓	✗	✗	✗	✗	✓	✗
4a	Config 4	✗	✓	✗	✗	✗	✓	✗
4b	Config 5	✗	✗	✓	✗	✗	✗	✓
4b	Config 6	✗	✗	✗	✓	✗	✗	✓
4b	Config 7	✗	✗	✗	✗	✓	✗	✓

Table 2-1. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

Note:

All the above simultaneous transmission configurations have been tested and the worst case configuration was found to be config 6 and reported in UNII 802.11ax (OFDMA) and FCC part 27a test reports.

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2.3 Antenna Description

Following antenna gains provided by manufacturer were used for the testing.

Band	Antenna Gain (dBi)			
	Antenna 3	Antenna 1	Antenna 4a	Antenna 2a
LTE Band 48	-1.0	-2.6	2.7	2.4

Table 2-2. Highest Antenna Gain

2.4 Test Support Equipment

1	Apple MacBook	Model: A2141	S/N: C02DV7VKMD6T
	w/AC/DC Adapter	Model: A2166	S/N: N/A
2	Apple USB-C Cable	Model: Chimp	S/N: 420A57
3	USB-C Cable	Model: A146	S/N: N/A
	w/ AC/DC Adapter	Model: A2305	S/N: N/A
4	Apple Pencil	Model: N/A	S/N: GQXYGSXBJKM9
5	DC Power Supply	Model: KPS3010D	S/N: N/A
6	LTE Access Point	Model: Q710	S/N: 991929000125
7	Dell Laptop (Local SAS - WINNForum Test Harness)	Model: A2217	S/N: C39Z600ANXM2

Table 2-3. Test Support Equipment List

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.

2.6 Software and Firmware

The test was conducted with firmware version 18E20700y 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.

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

$$\text{EIRP}_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8;$$

Where D is the measurement distance in meters.

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

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 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	1.65
Radiated Disturbance (<30MHz)	4.06
Radiated Disturbance (30MHz-1GHz)	4.30
Radiated Disturbance (1GHz-18GHz)	4.78
Radiated Disturbance (>18GHz)	4.79

FCC ID: BCGA2301	 PCTEST Proud to be part of  element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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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	3/4/2020	Annual	3/4/2021	MY49430244
Keysight Technology	N9040B	UXA Signal Analyzer	12/19/2020	Annual	12/19/2021	MY57212015
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	8/11/2020	Annual	8/11/2021	T058701-01
ESPEC	SU-241	Tabletop Temperature Chamber	9/28/2020	Annual	9/28/2021	92009574
ETS-Lindgren	3142E	BiConiLog Antenna (30MHz - 6GHz)	9/15/2020	Annual	9/15/2021	208204
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	4/21/2020	Annual	4/21/2021	205956
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	7/15/2020	Annual	7/15/2021	102356
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	12/3/2020	Annual	12/3/2021	101648
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	3/2/2020	Annual	3/2/2021	101619
Rohde & Schwarz	ESW26	EMI Test Receiver	6/8/2020	Annual	6/8/2021	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	8/6/2020	Annual	8/6/2021	101668
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	10/13/2020	Annual	10/13/2021	161616
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	9/24/2020	Annual	9/24/2021	151888
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	4/23/2020	Annual	4/23/2021	100052
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Antenna (400MHz-18GHz)	10/2/2020	Annual	10/2/2021	101063
Rohde & Schwarz	HFH2-Z2	Loop Antenna	3/12/2020	Annual	3/12/2021	100546

Table 5-1. Test Equipment List

Notes:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7W

LTE BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination of Any

QAM Modulation

Emission Designator = 8M45D7W

LTE BW = 8.45 MHz

D = Amplitude/Angle Modulated

7 = Quantized/Digital Info

W = Combination of Any

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (7250 MHz)

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

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7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCGA2301
 FCC Classification: Citizens Band End User Devices (CBE)
 Mode(s): LTE/ULCA

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	N/A	Section 7.2
2.1051 96.41(e)(ii)	Out of Band Emissions	-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	Section 7.3, 7.4
2.1046	Transmitter Conducted Output Power	N/A		N/A	See RF Exposure Report
2.1046	Additional Maximum Power Reduction (A-MPR)	N/A		N/A	Section 7.5
96.41(b)	Equivalent Isotropic Radiated Power (EIRP)	23 dBm/10MHz		PASS	Section 7.6
2.1053 96.41(e)	Undesirable Emissions	-40 dBm/MHz	RADIATED	PASS	Section 7.7
2.1055	Frequency Stability	Fundamental emissions stay within authorized frequency block over the temperature and voltage range as tested	CONDUCTED	PASS	Section 7.8
96.47	End User Device Additional Requirements (CBSD Protocol)	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

Table 7-1. Summary of Test Results

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device		Page 11 of 77

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) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST “LTE Automation,” Version 5.3.

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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 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

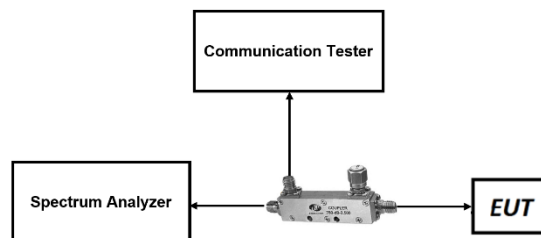


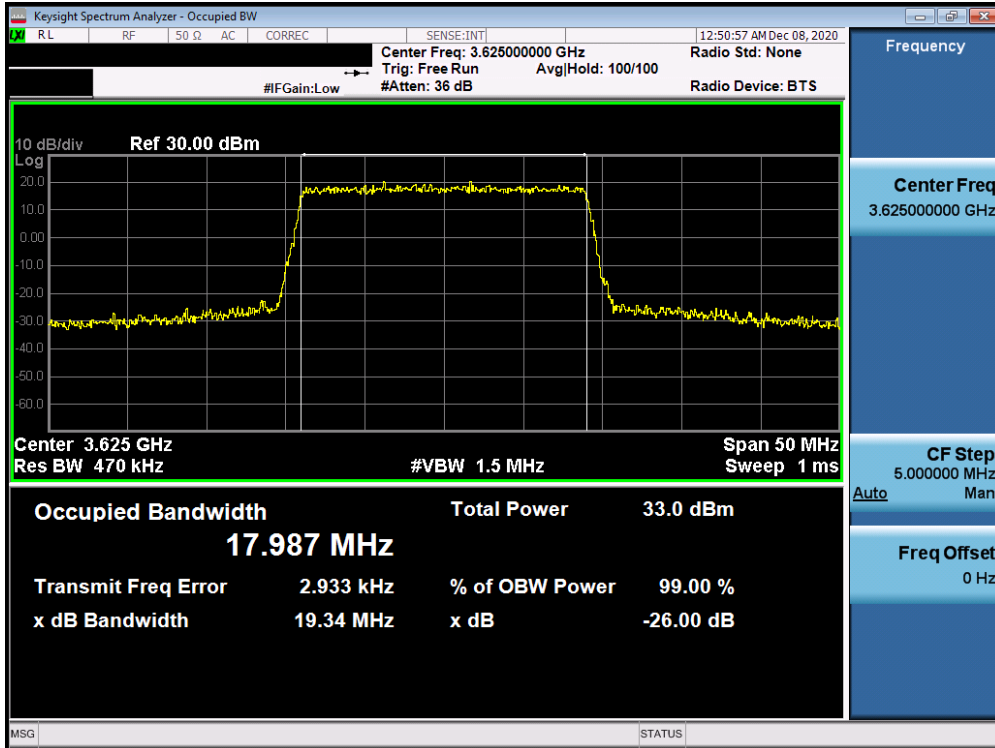
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

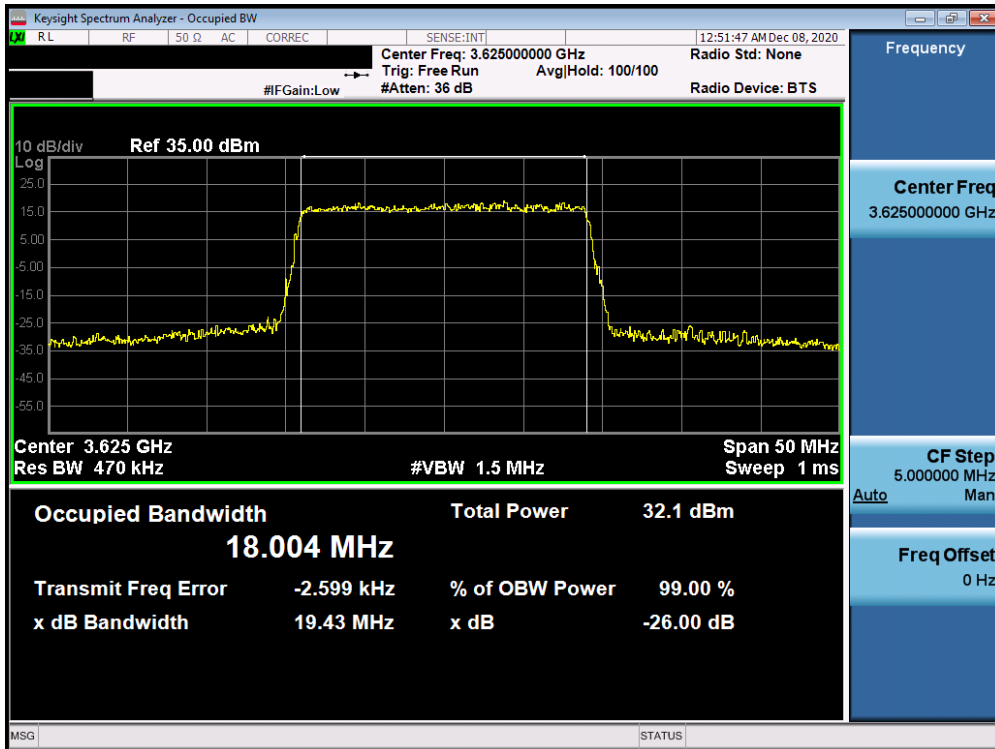
None.

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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LTE Band 48

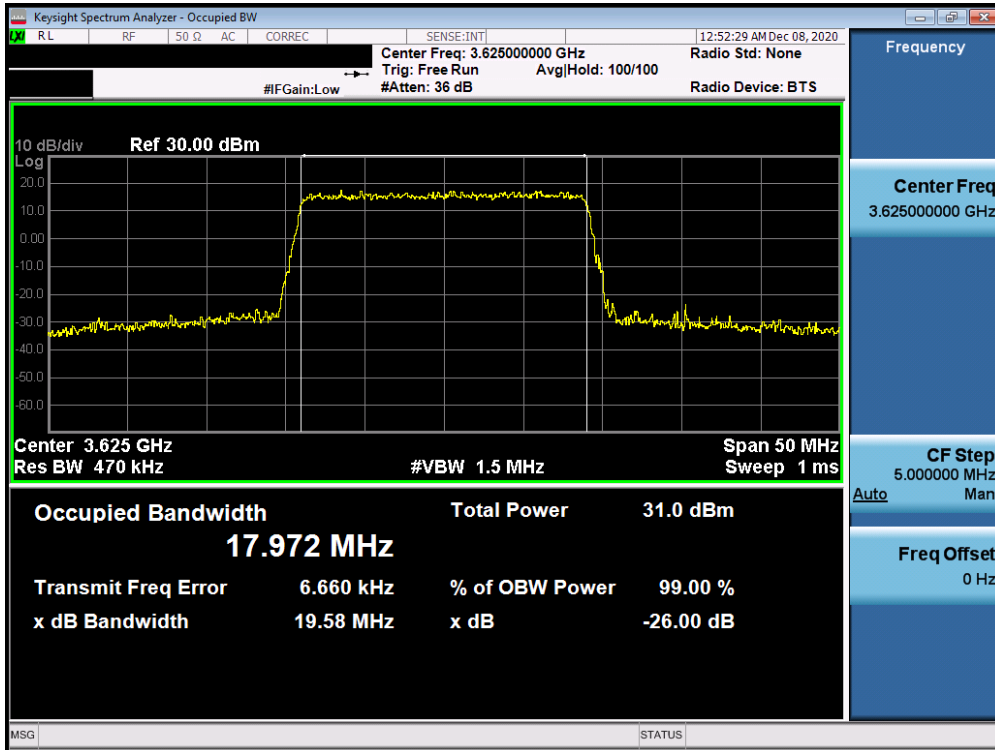


Plot 7-1. Occupied Bandwidth Plot (LTE Band 48 - 20MHz QPSK - Full RB Configuration)

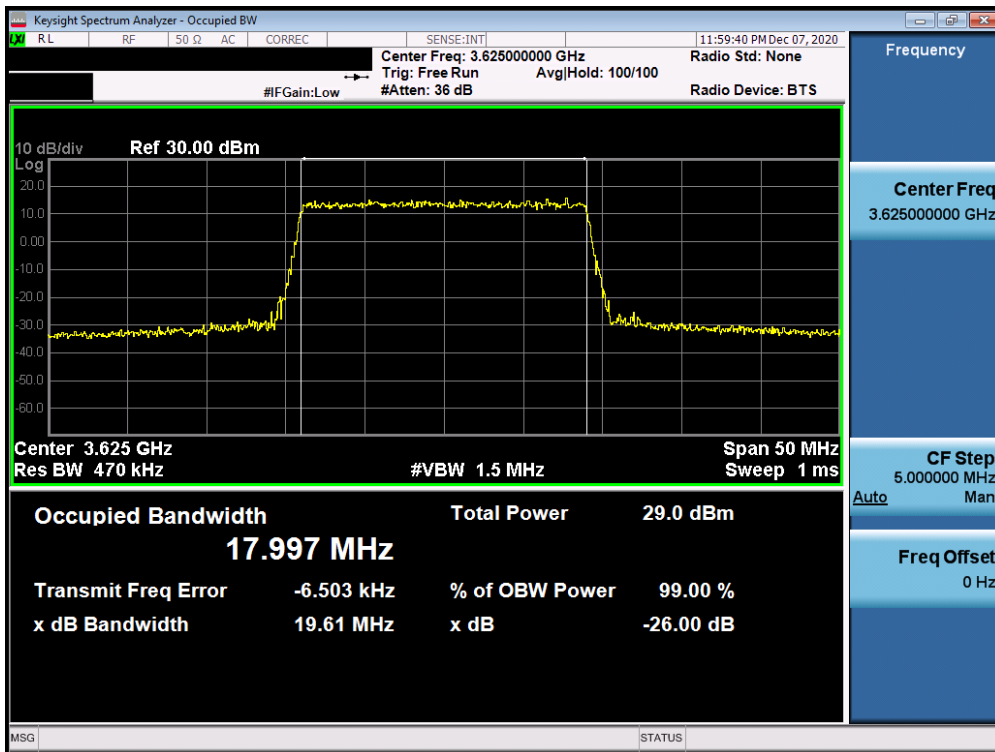


Plot 7-2. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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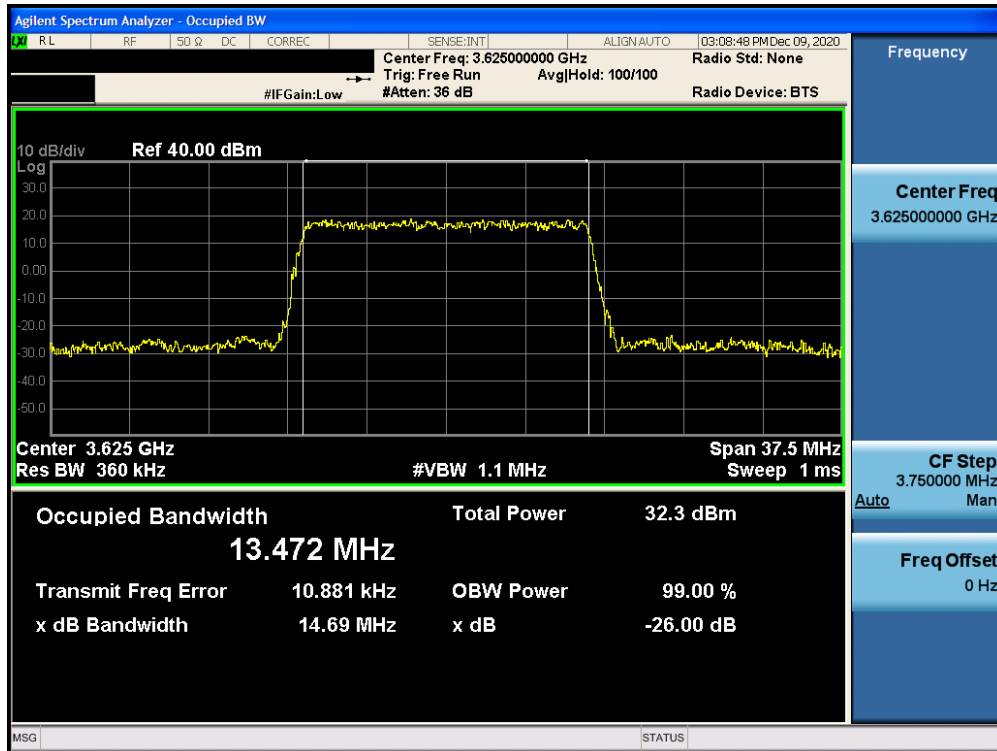


Plot 7-3. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 64-QAM - Full RB Configuration)

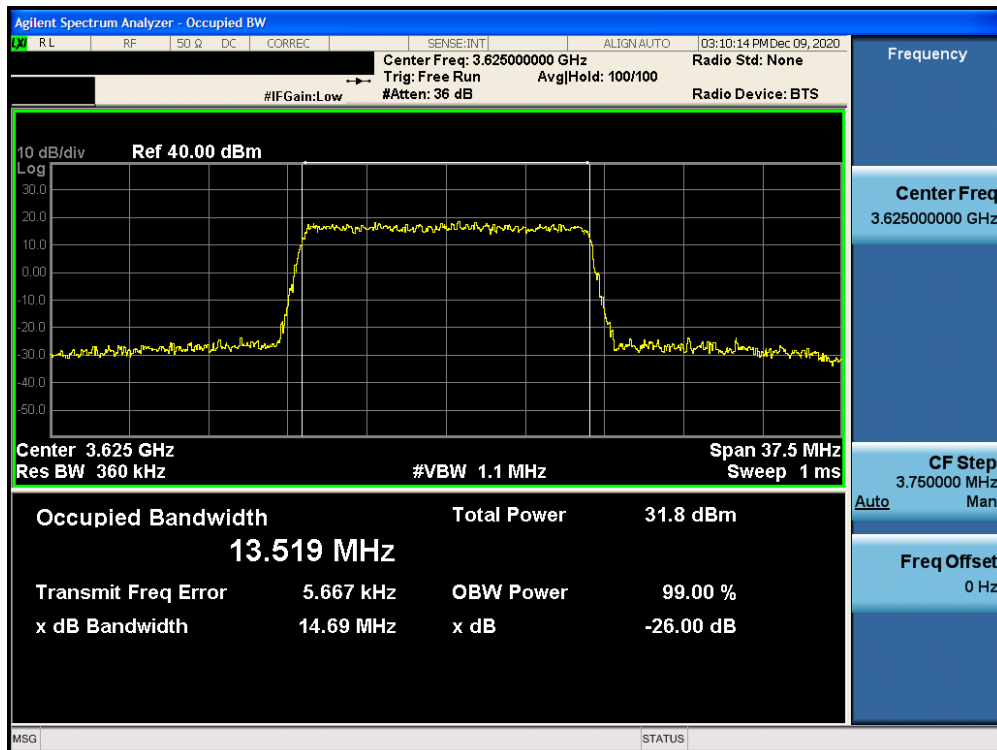


Plot 7-4. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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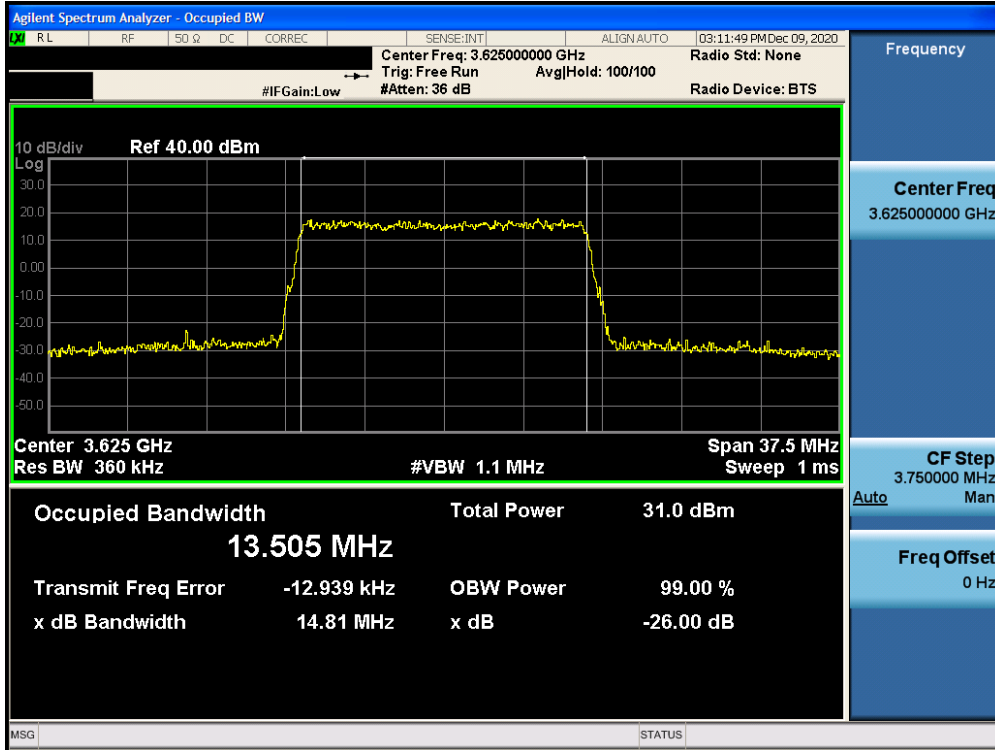


Plot 7-5. Occupied Bandwidth Plot (LTE Band 48 - 15MHz QPSK - Full RB Configuration)

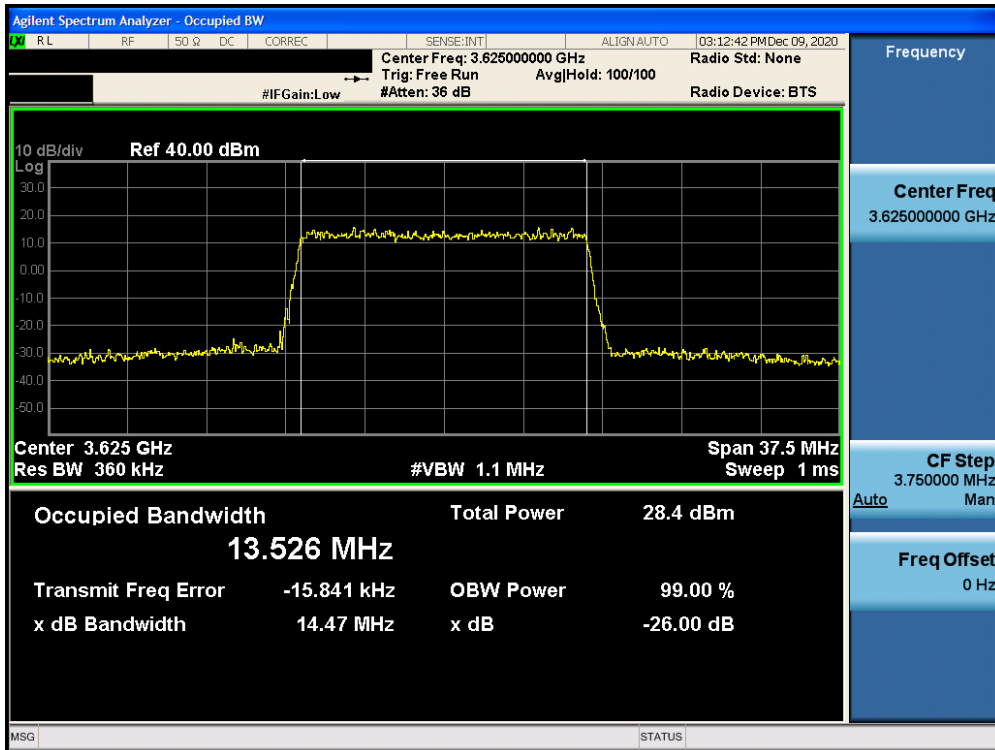


Plot 7-6. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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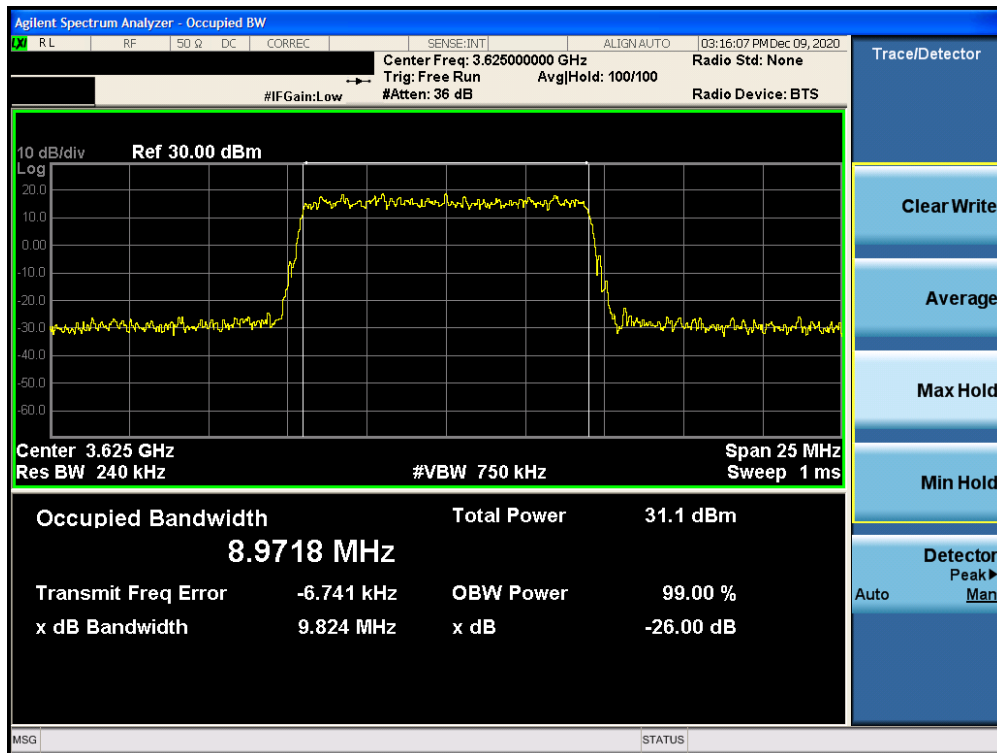


Plot 7-7. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 64-QAM - Full RB Configuration)

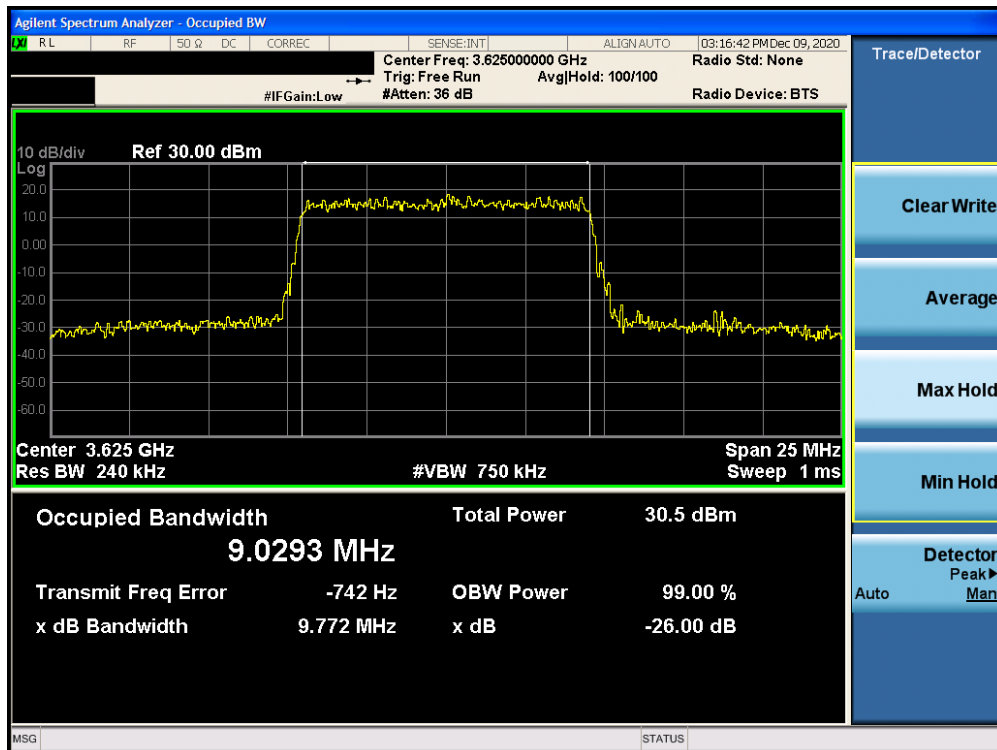


Plot 7-8. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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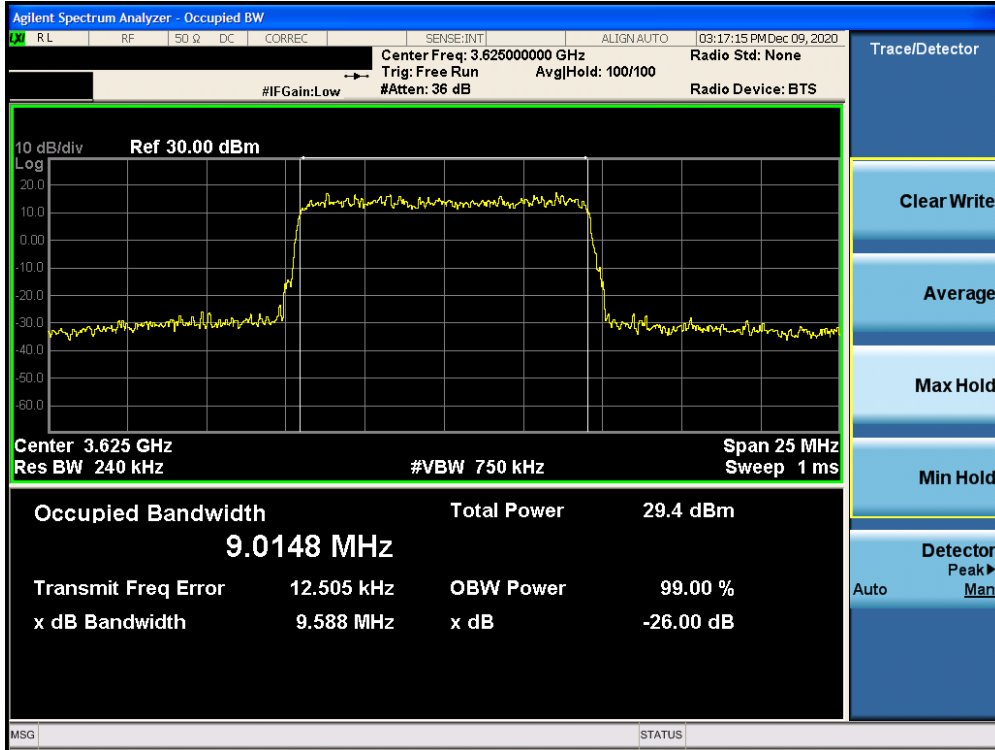


Plot 7-9. Occupied Bandwidth Plot (LTE Band 48 - 10MHz QPSK - Full RB Configuration)

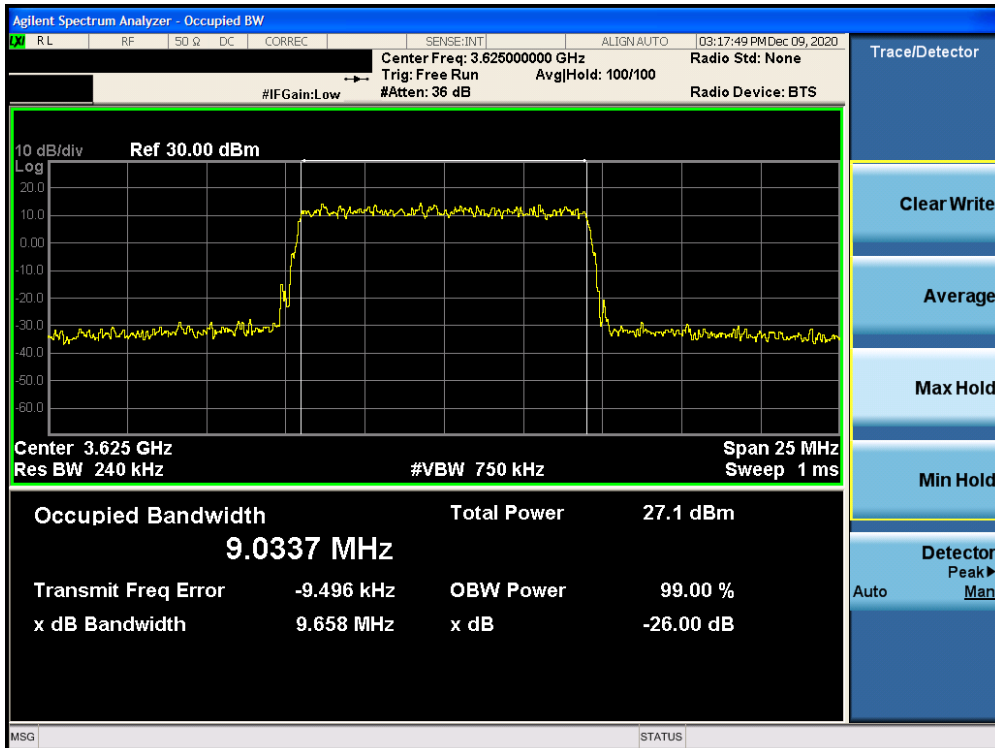


Plot 7-10. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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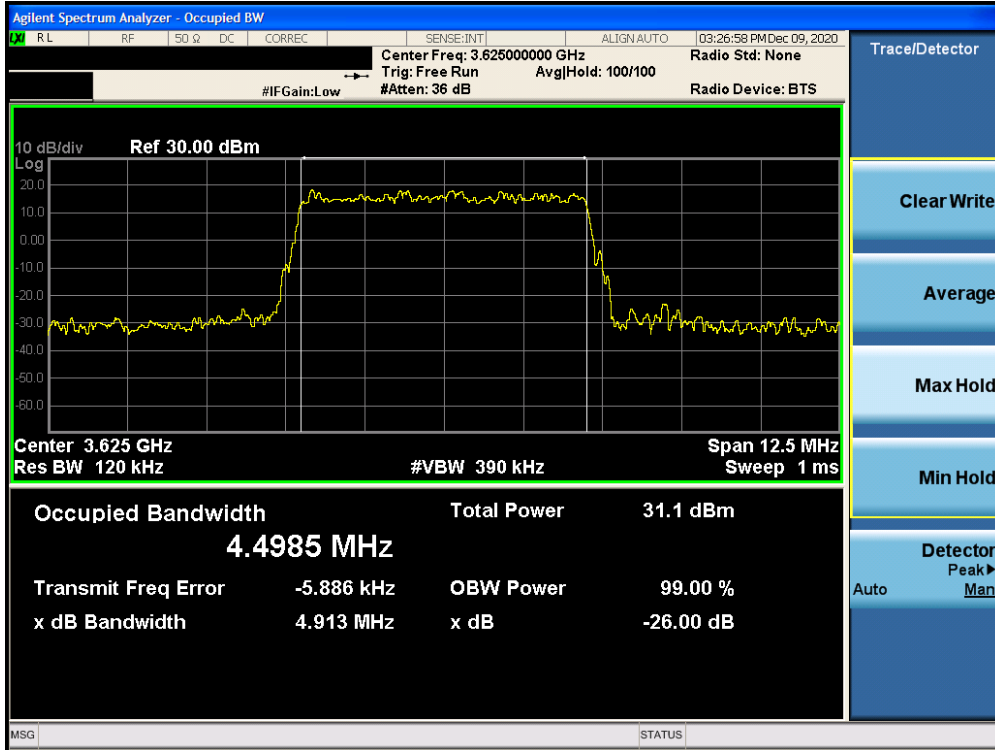


Plot 7-11. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 64-QAM - Full RB Configuration)

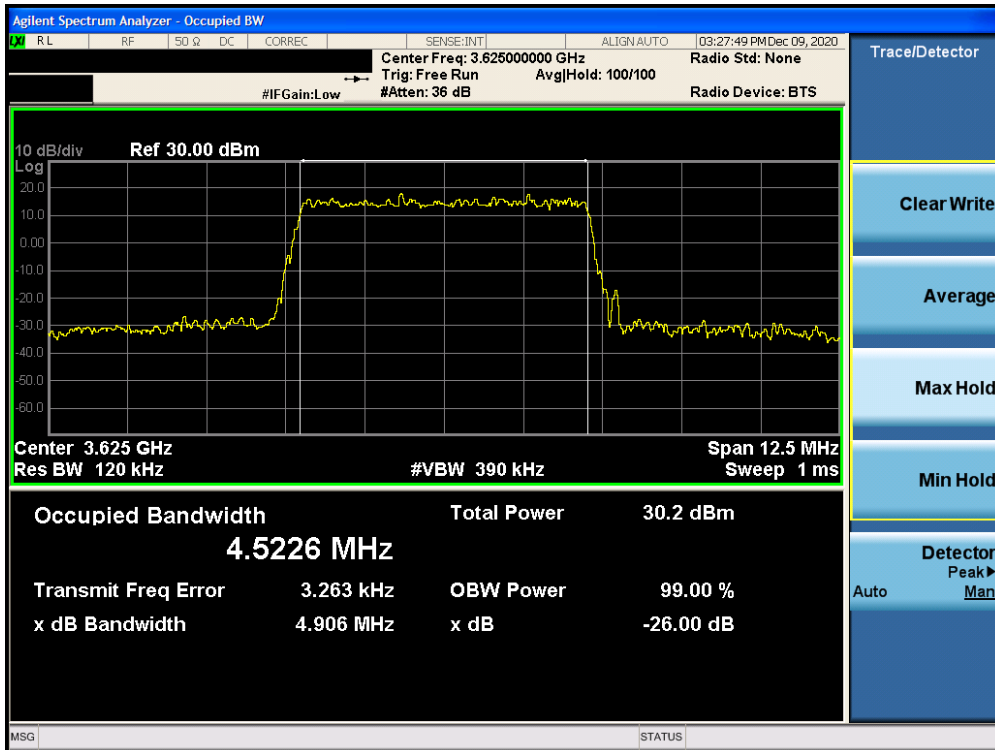


Plot 7-12. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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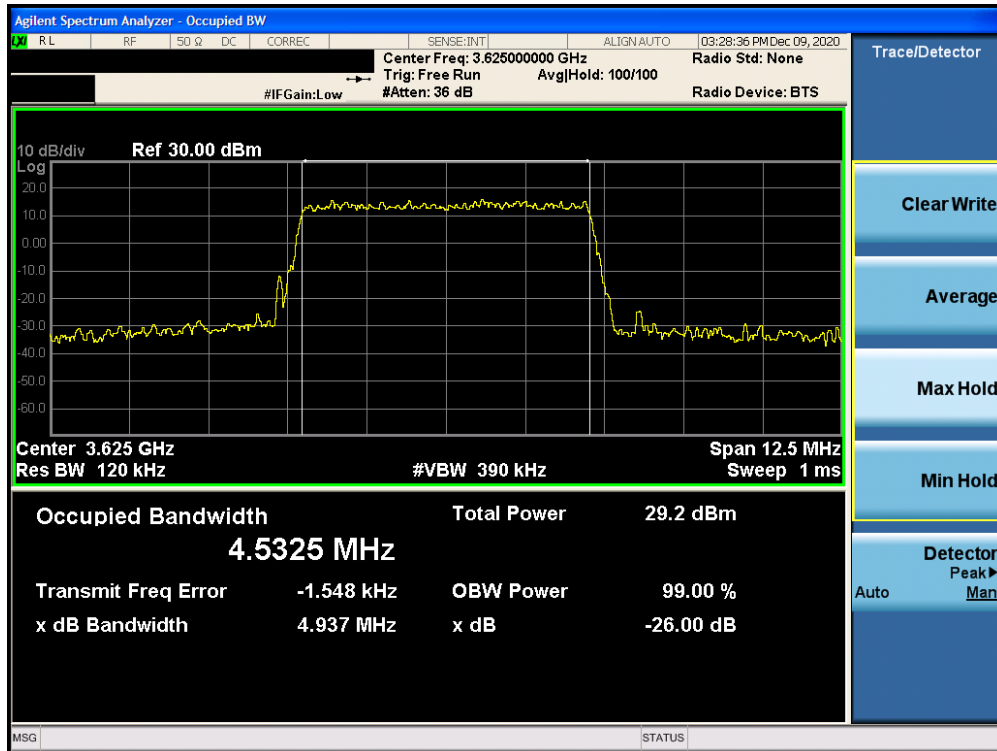


Plot 7-13. Occupied Bandwidth Plot (LTE Band 48 - 5MHz QPSK - Full RB Configuration)

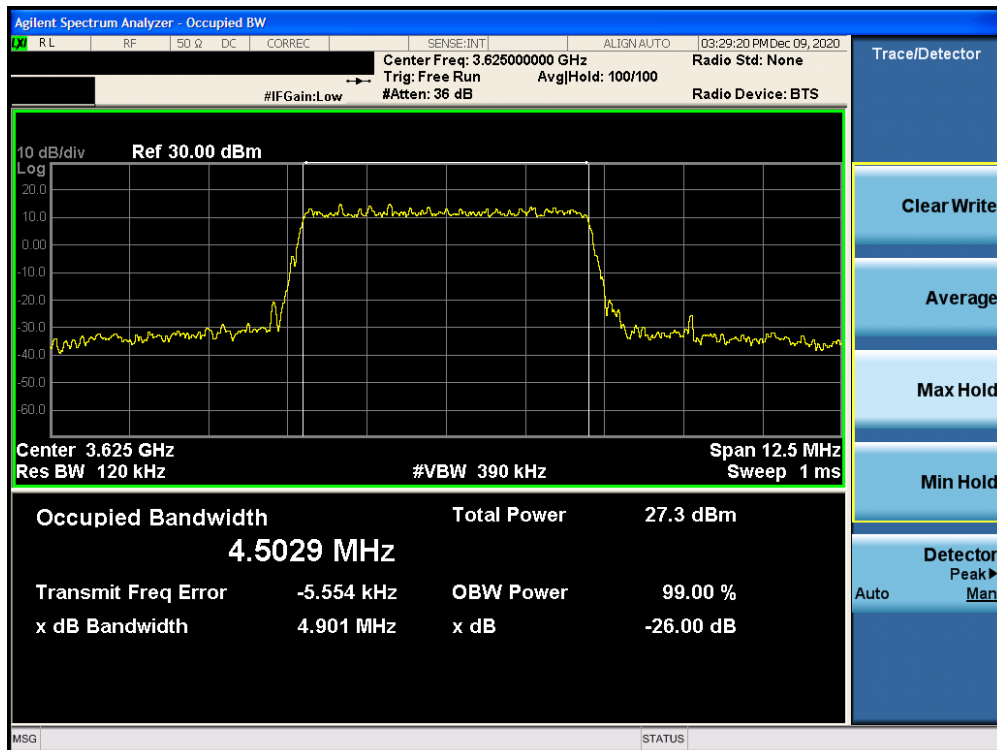


Plot 7-14. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 20 of 77



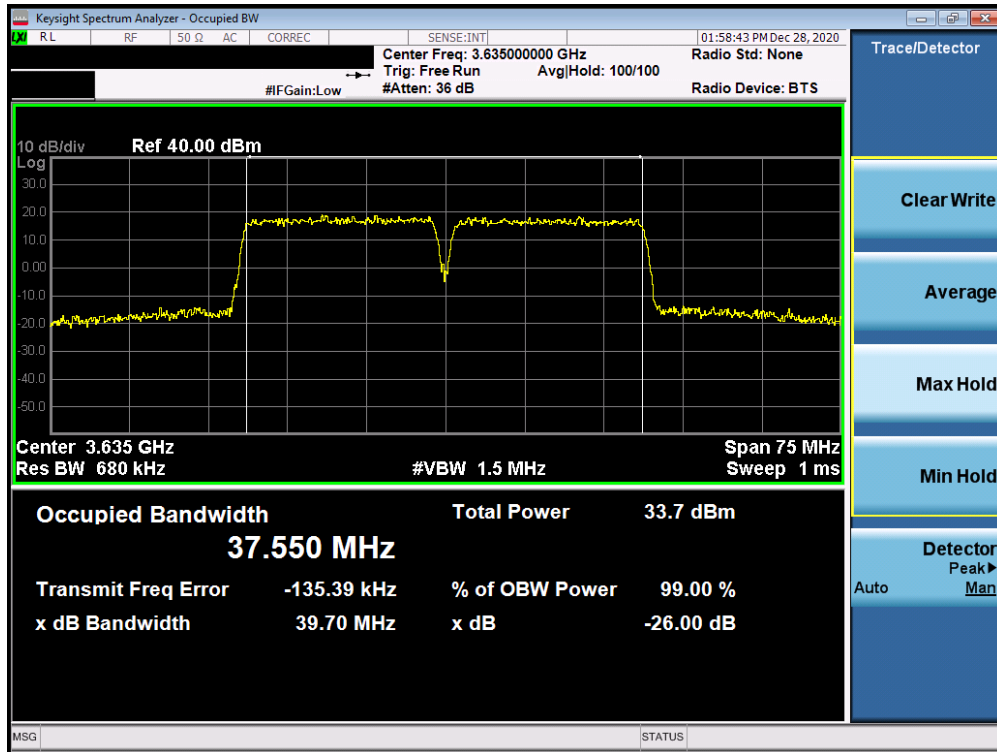
Plot 7-15. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 64-QAM - Full RB Configuration)



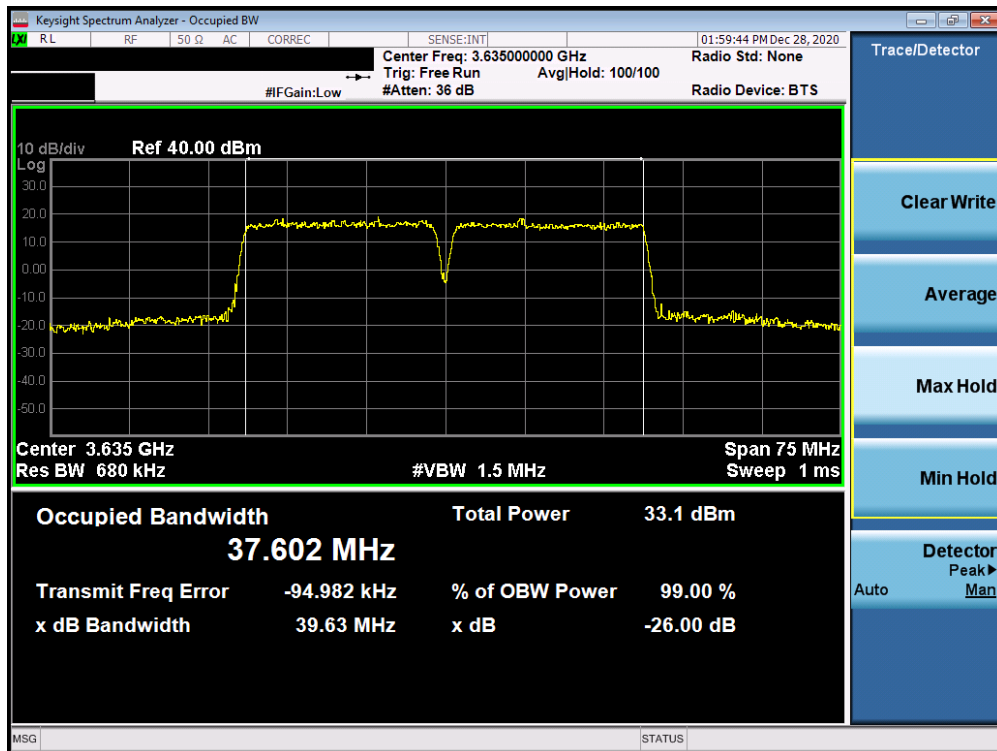
Plot 7-16. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 21 of 77

ULCA - LTE Band 48



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

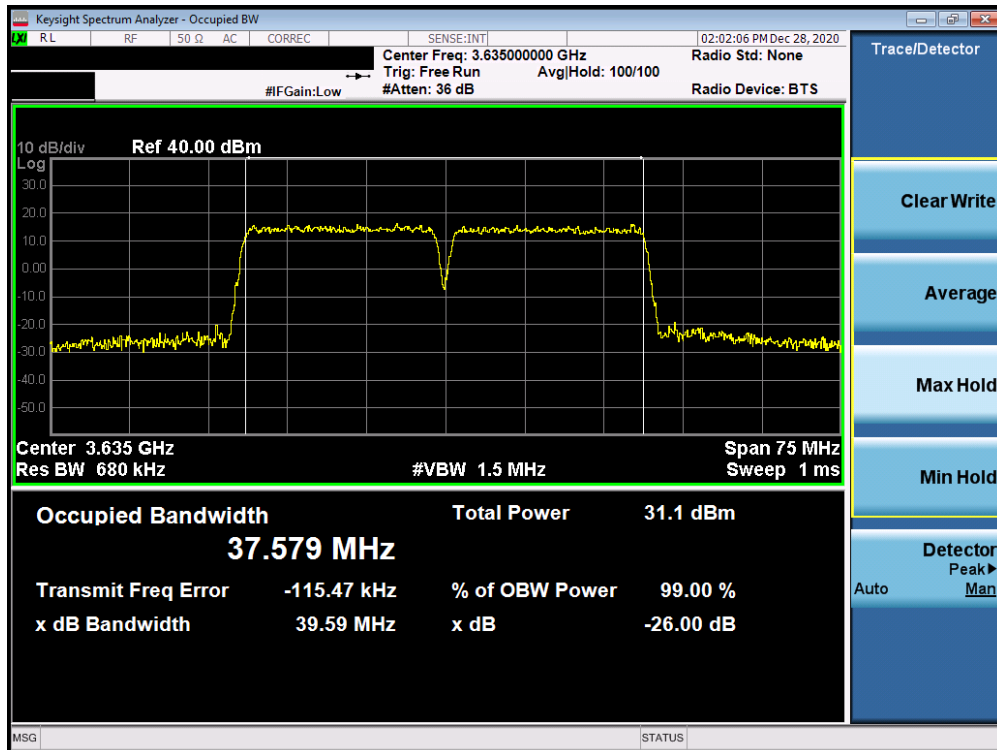


Plot 7-18. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+20MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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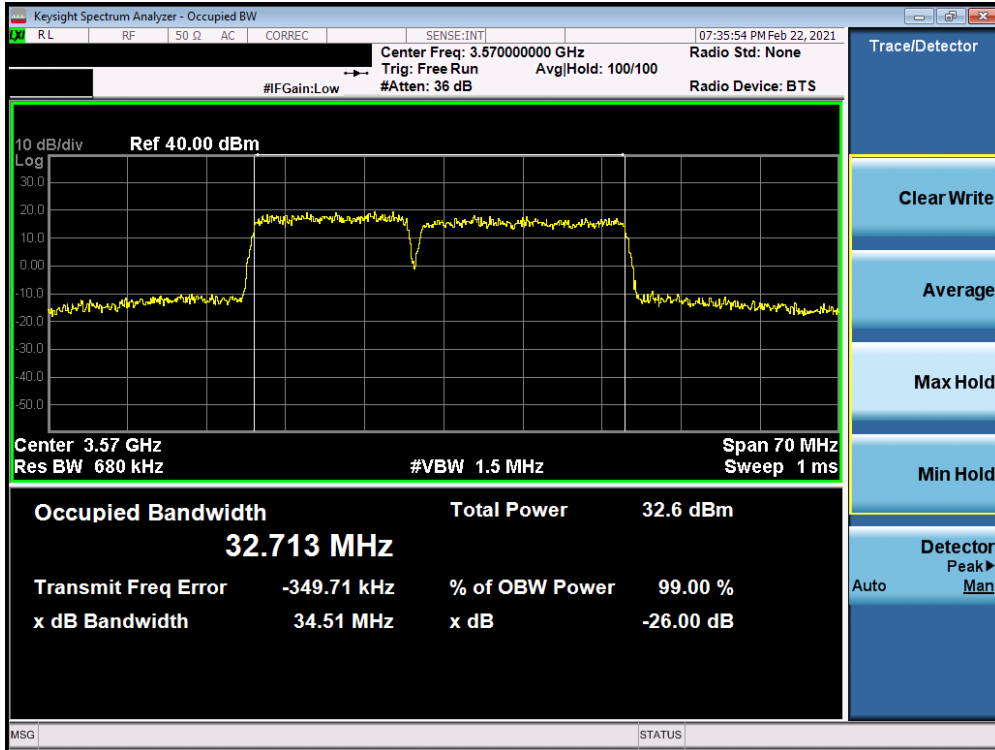


Plot 7-19. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+20MHz 64-QAM - Full RB Configuration)

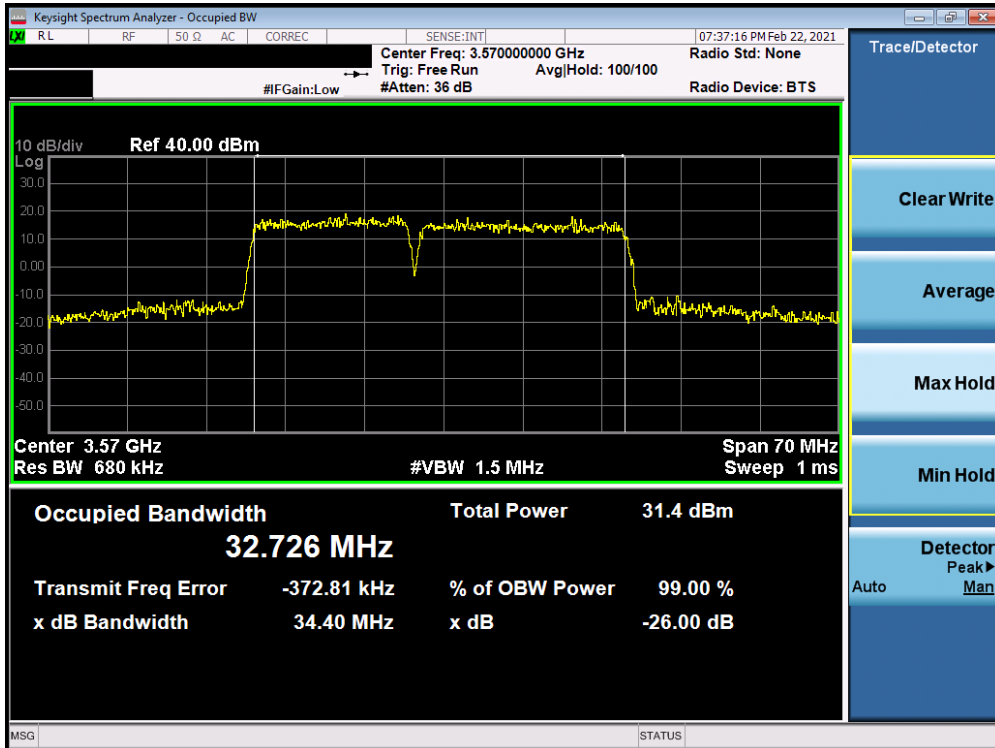


Plot 7-20. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+20MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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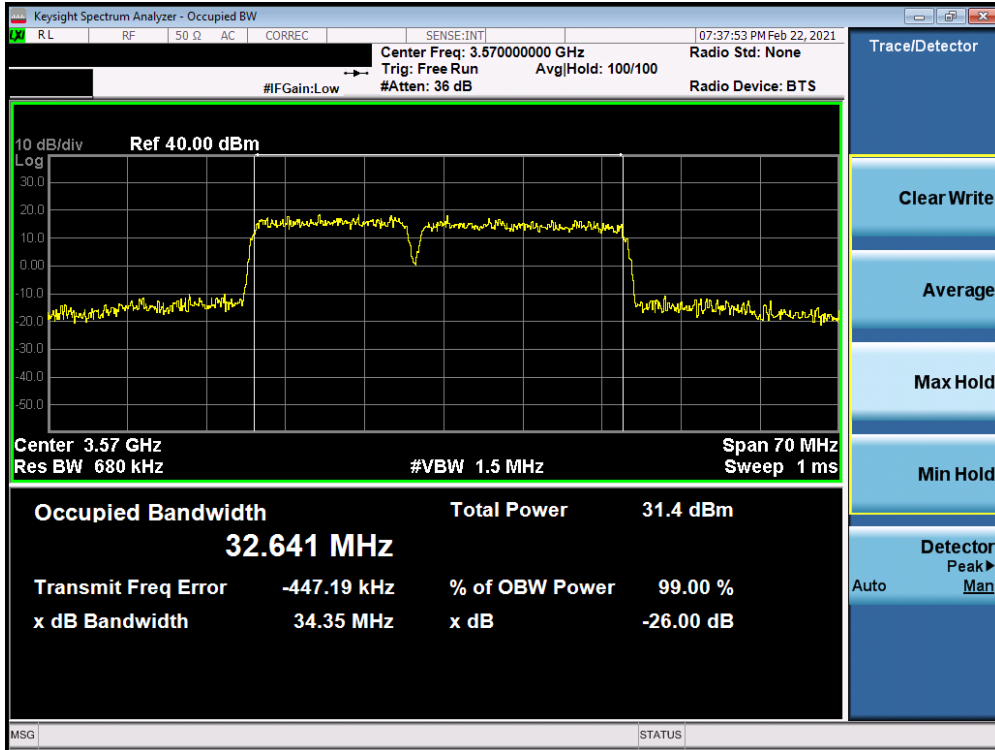


Plot 7-21. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+15MHz QPSK - Full RB Configuration)

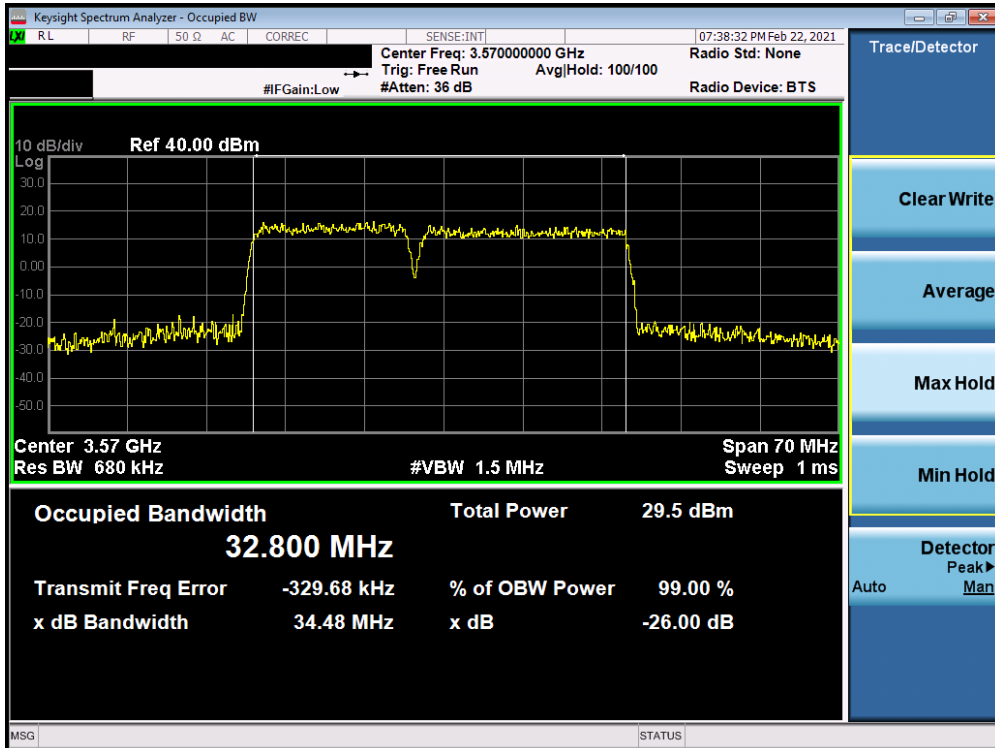


Plot 7-22. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+15MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	 MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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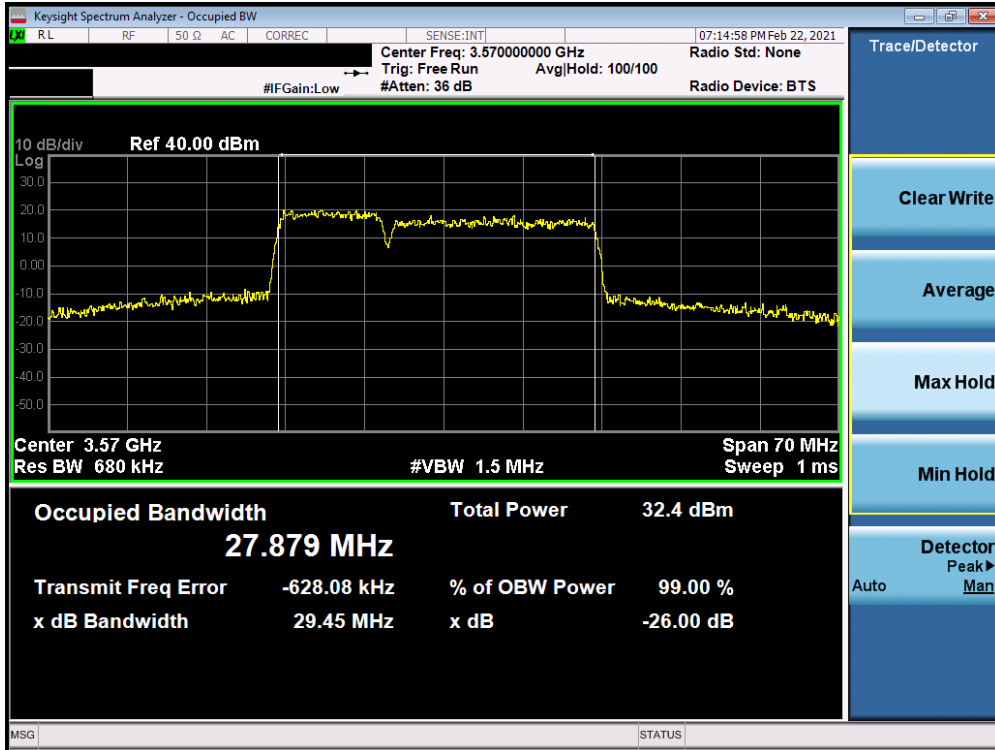


Plot 7-23. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+15MHz 64-QAM - Full RB Configuration)

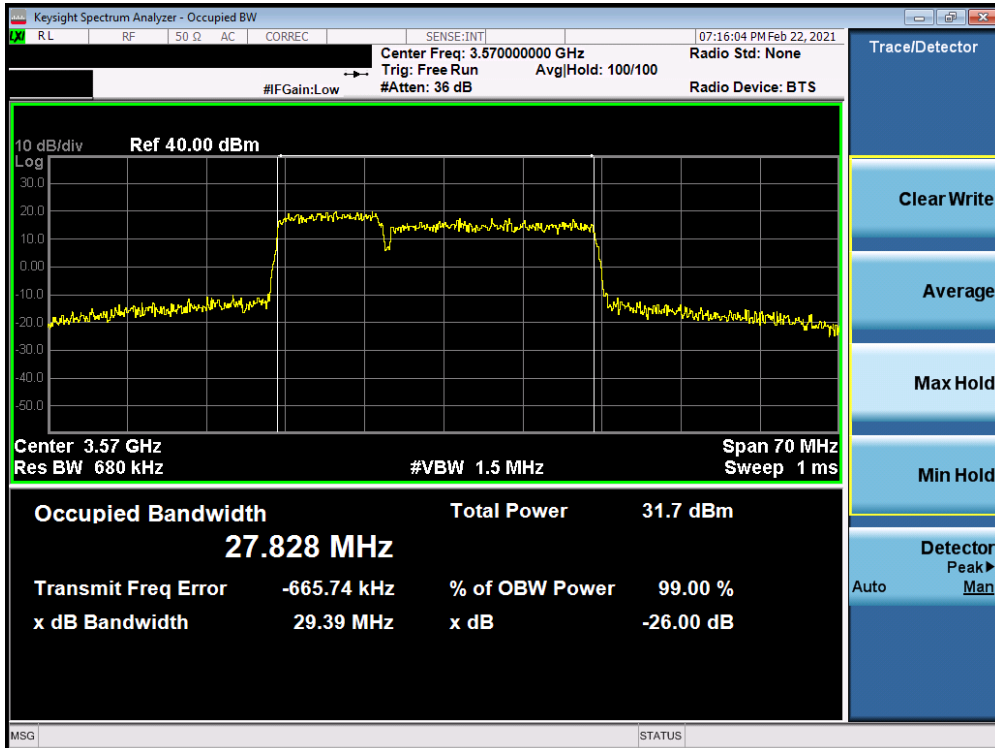


Plot 7-24. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+15MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-25. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+10MHz QPSK - Full RB Configuration)

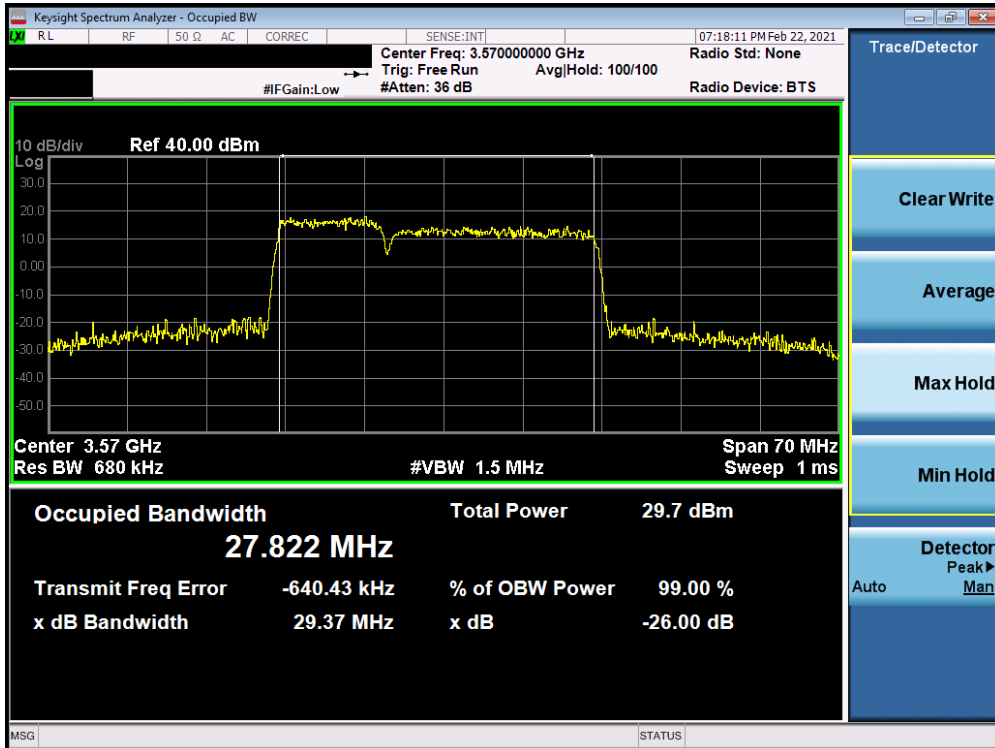


Plot 7-26. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+10MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-27. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+10MHz 64-QAM - Full RB Configuration)

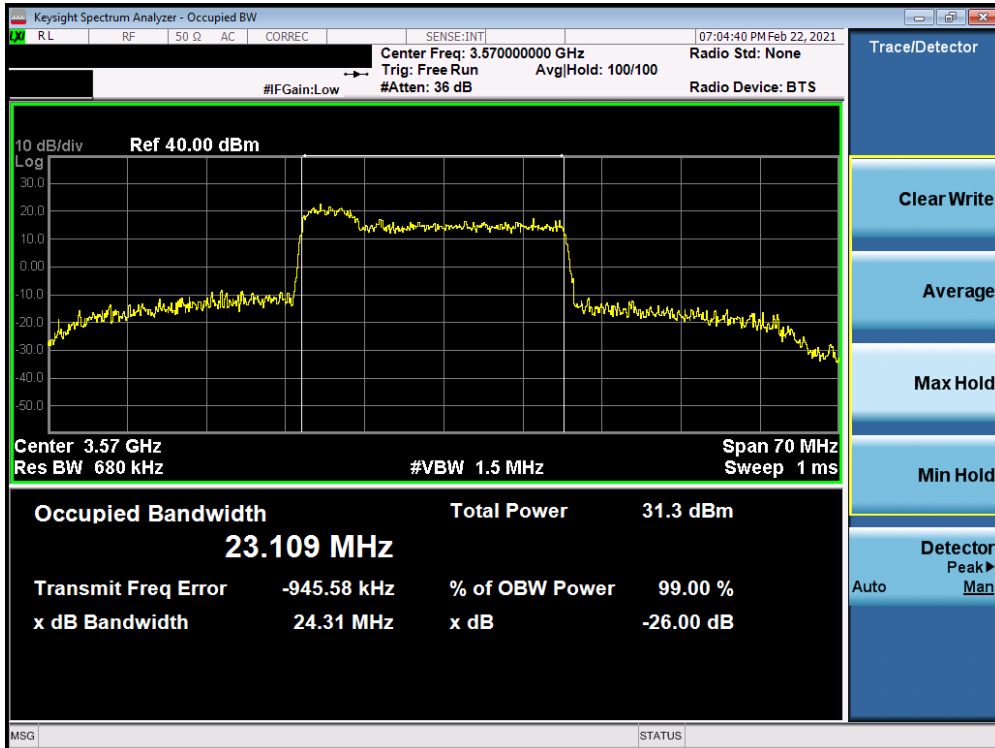


Plot 7-28. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+10MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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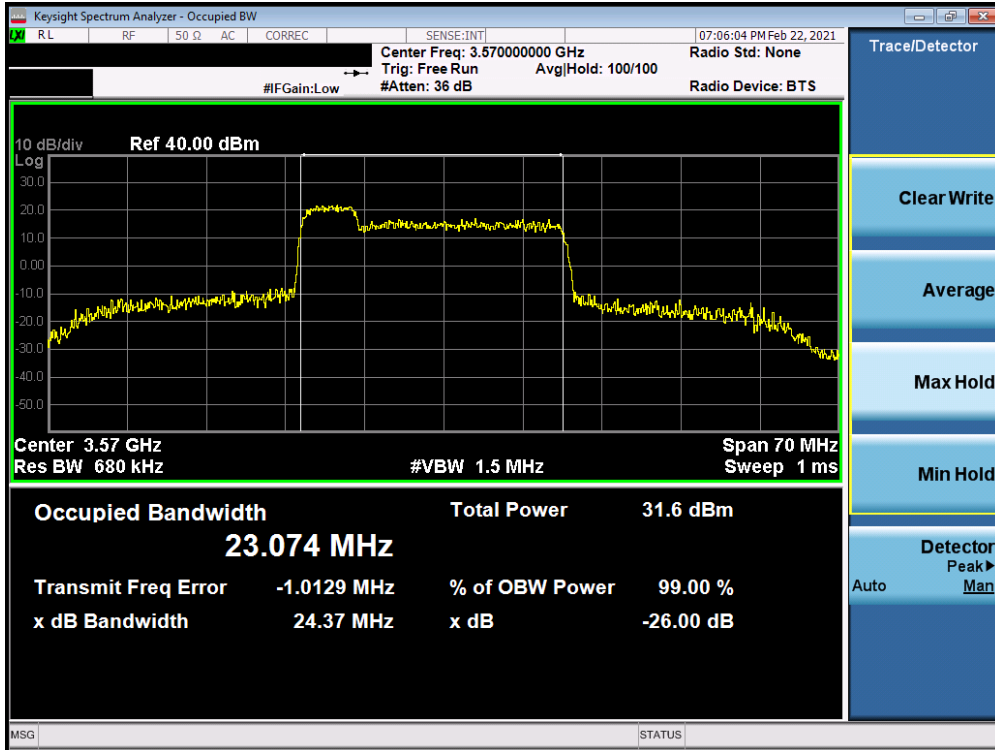


Plot 7-29. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+5MHz QPSK - Full RB Configuration)

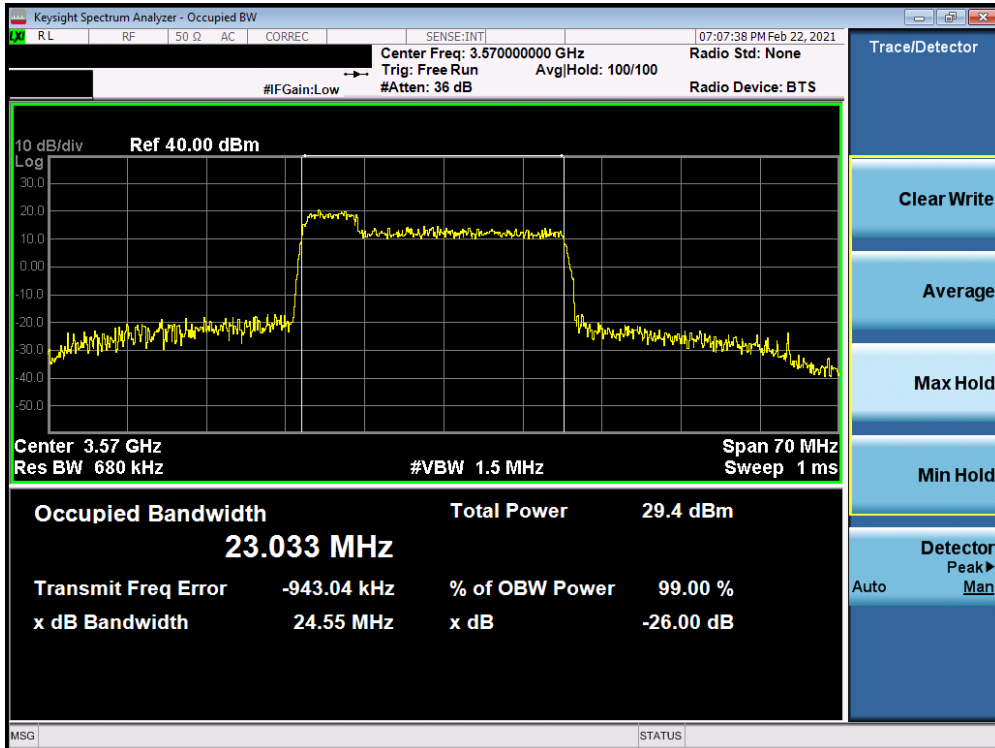


Plot 7-30. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+5MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-31. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+5MHz 64-QAM - Full RB Configuration)



Plot 7-32. Occupied Bandwidth Plot (ULCA LTE Band 48 – 20+5MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality 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 = Max Hold
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.

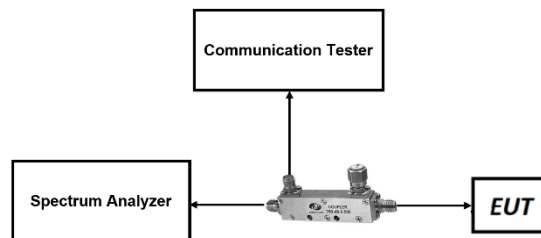


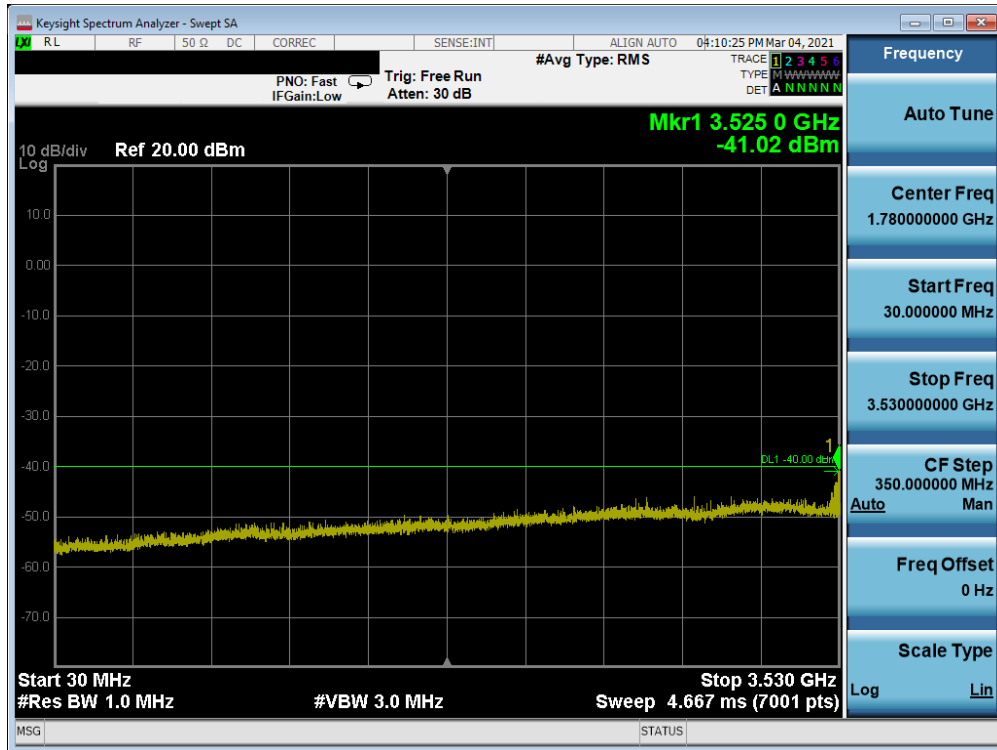
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

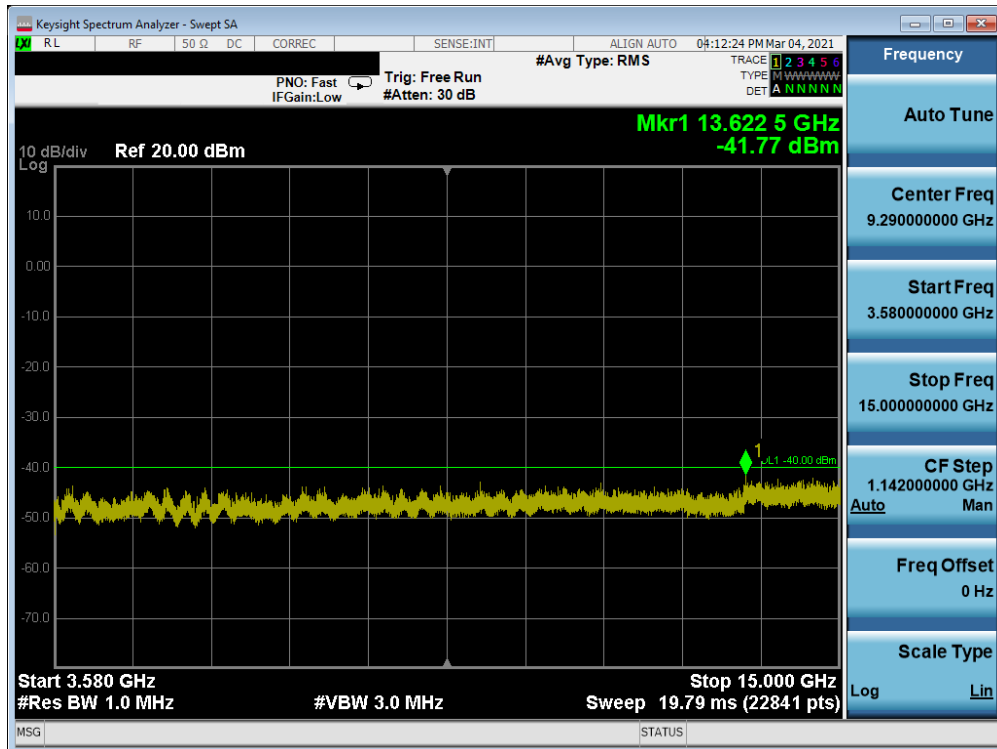
1. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the 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: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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LTE Band 48

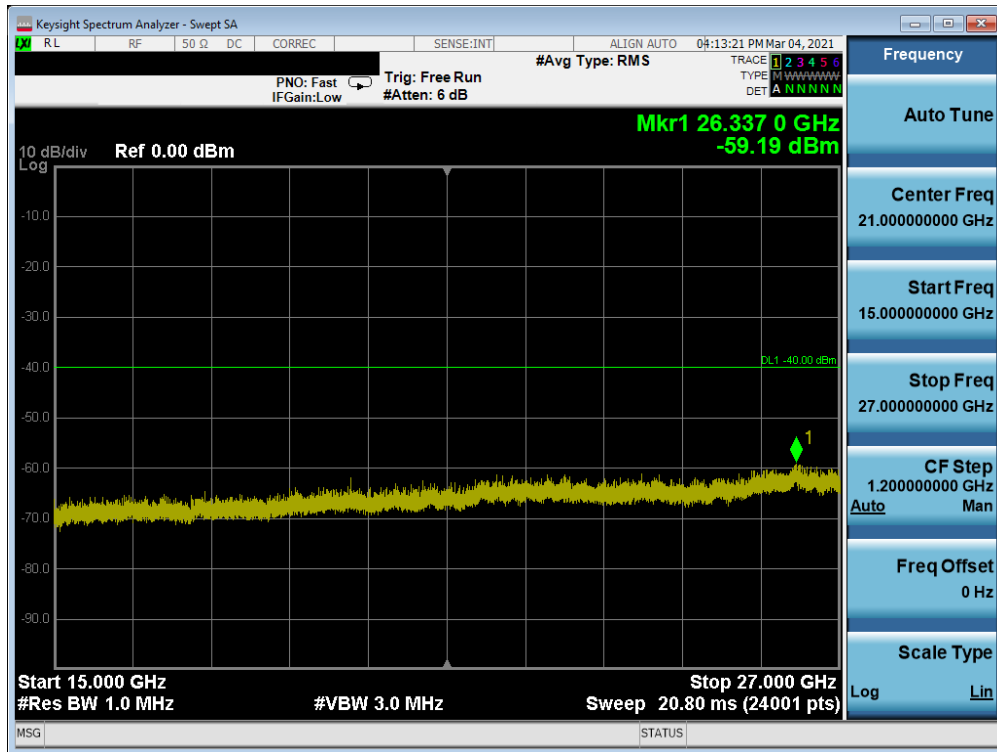


Plot 7-33. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

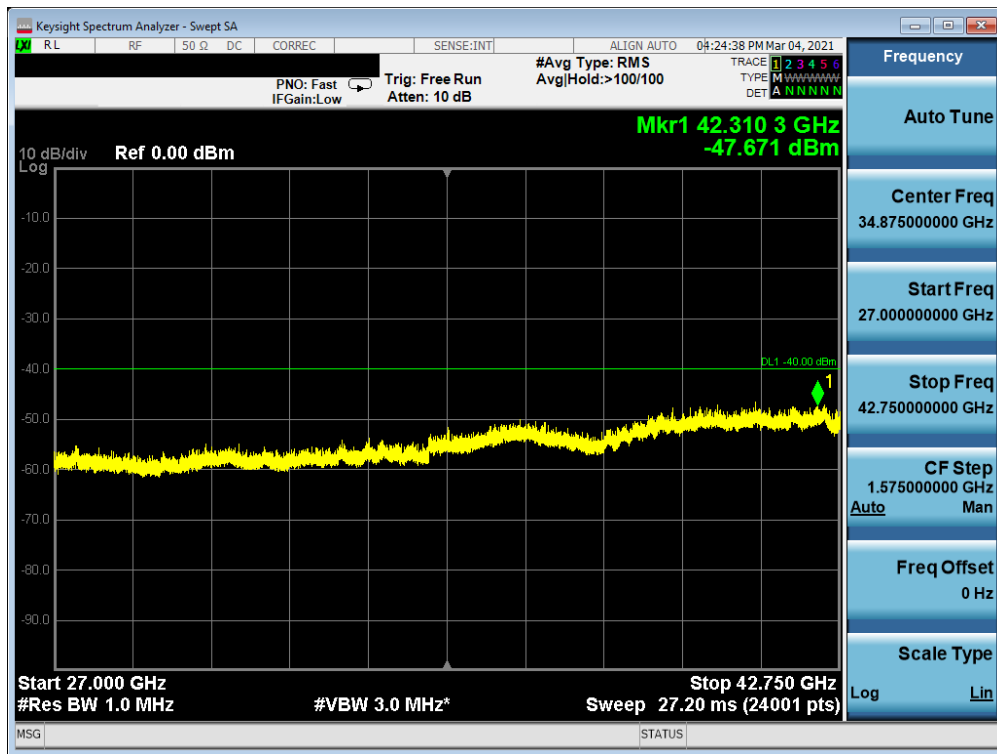


Plot 7-34. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 31 of 77

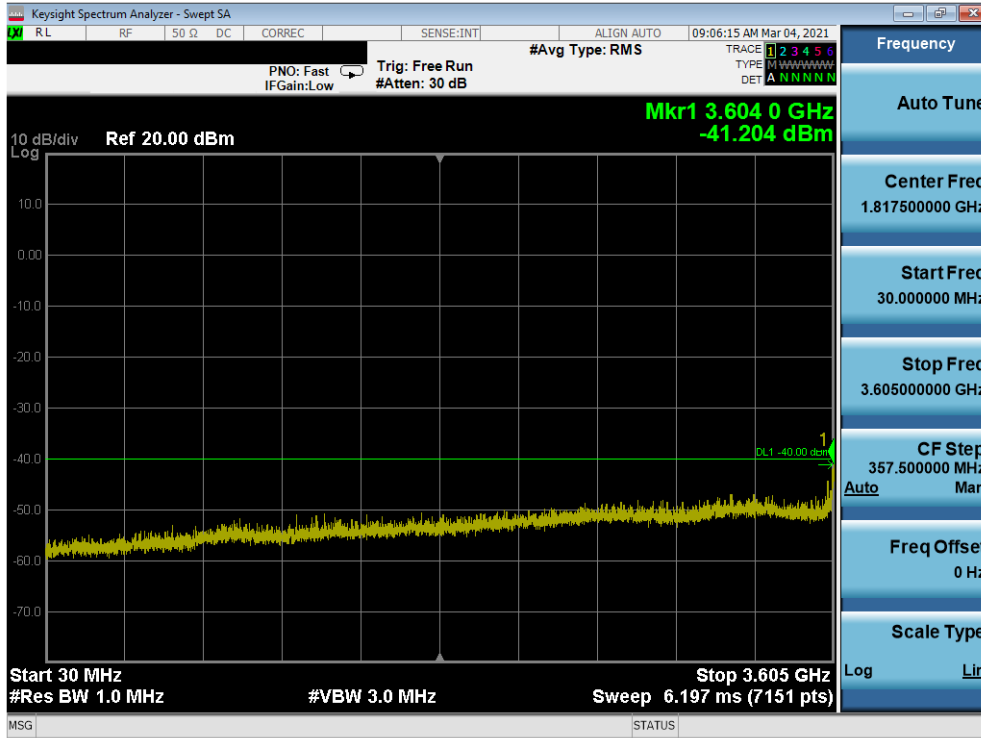


Plot 7-35. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

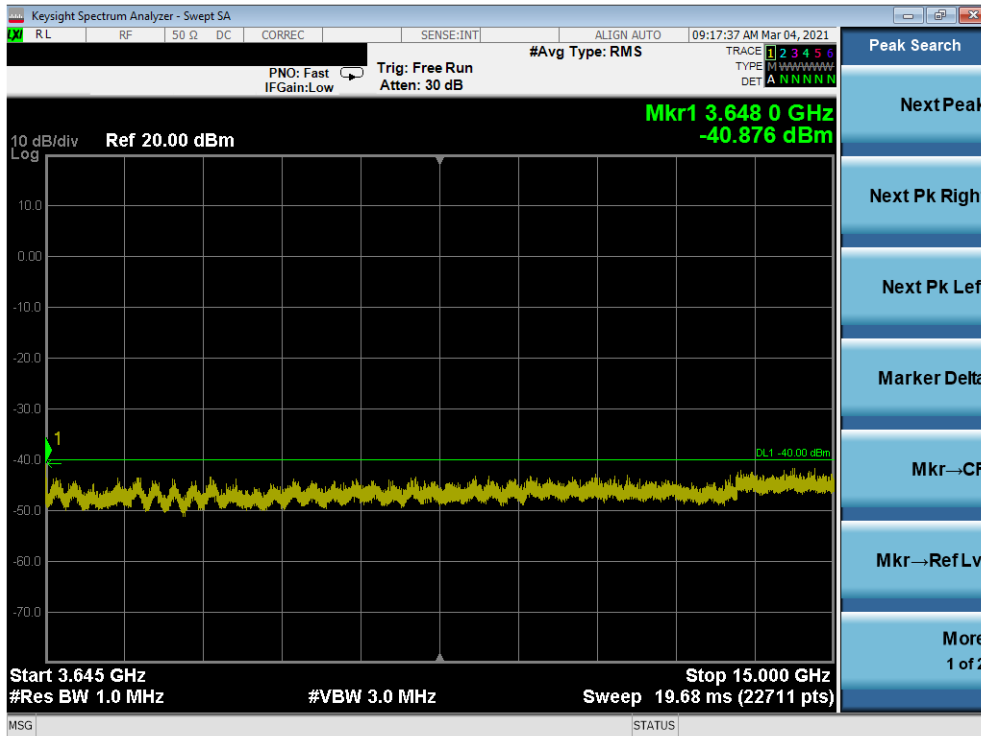


Plot 7-36. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 32 of 77

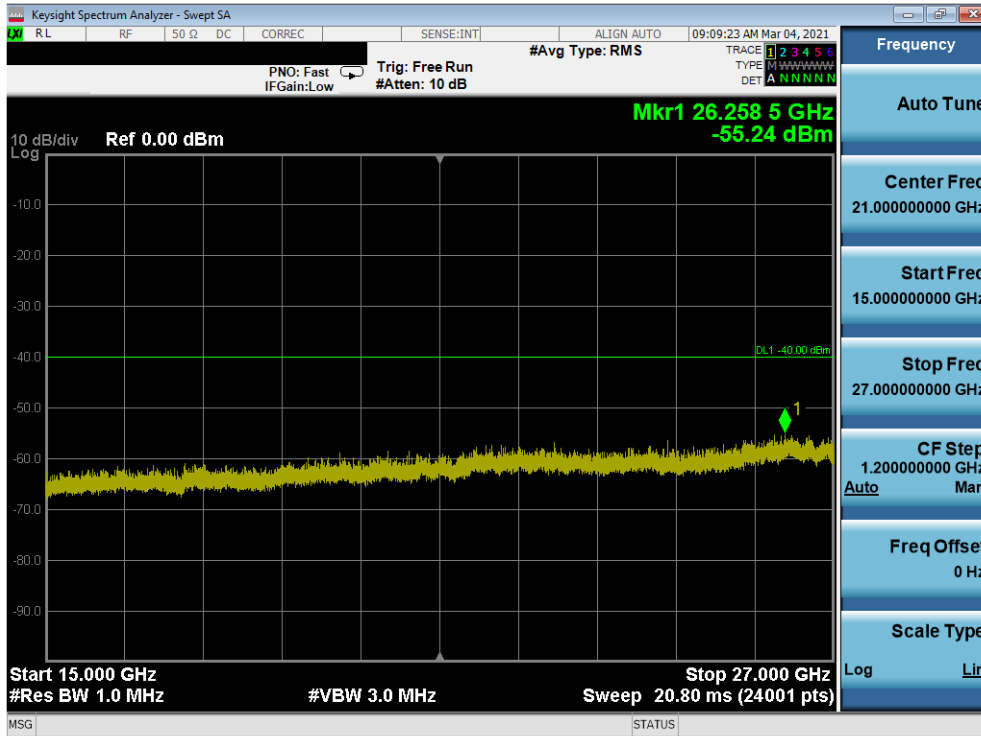


Plot 7-37. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

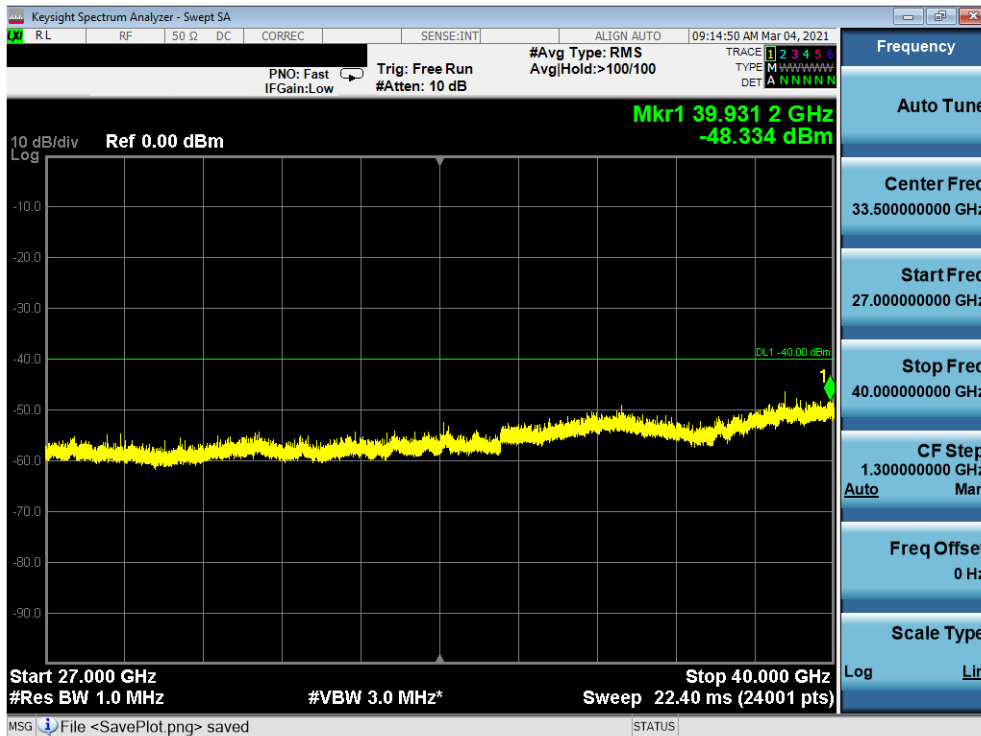


Plot 7-38. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 33 of 77

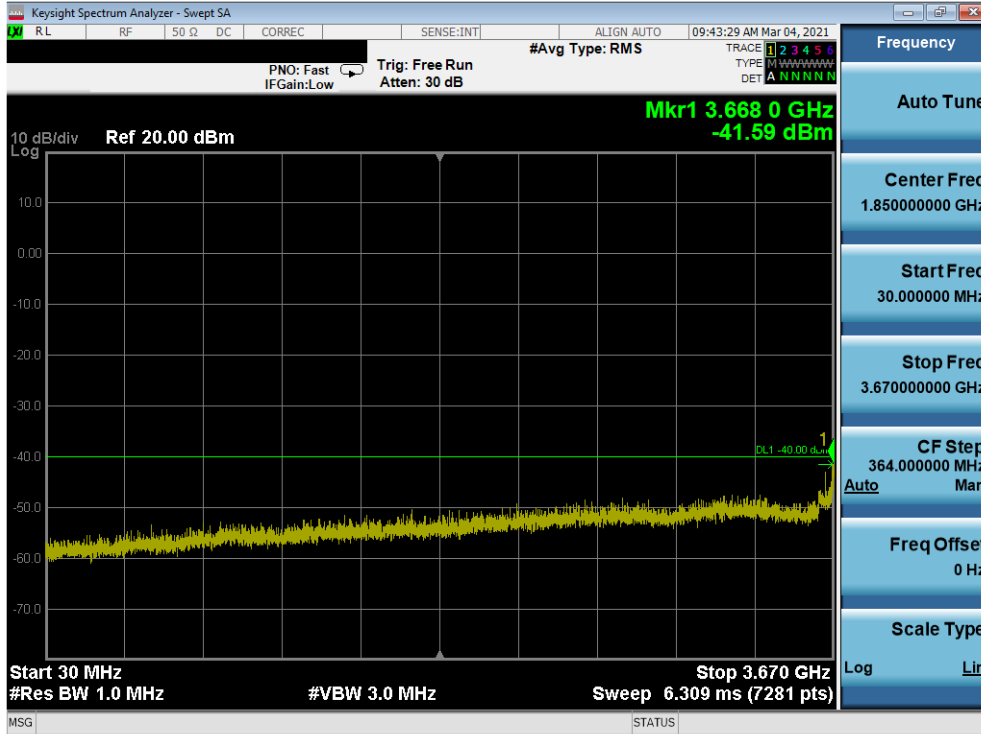


Plot 7-39. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

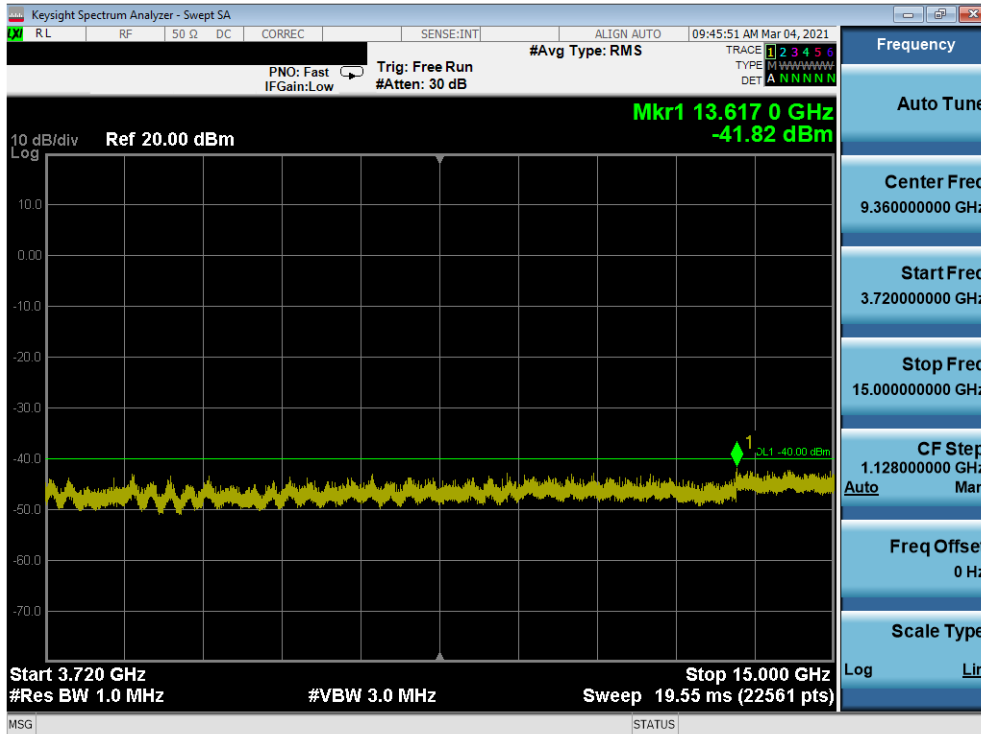


Plot 7-40. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 34 of 77

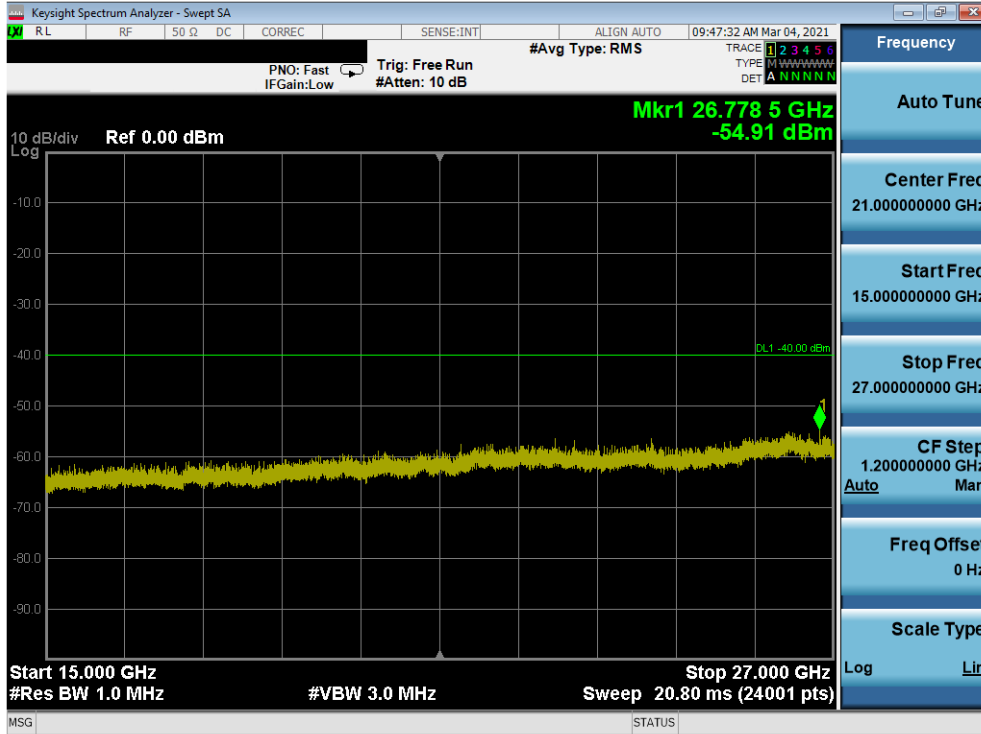


Plot 7-41. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

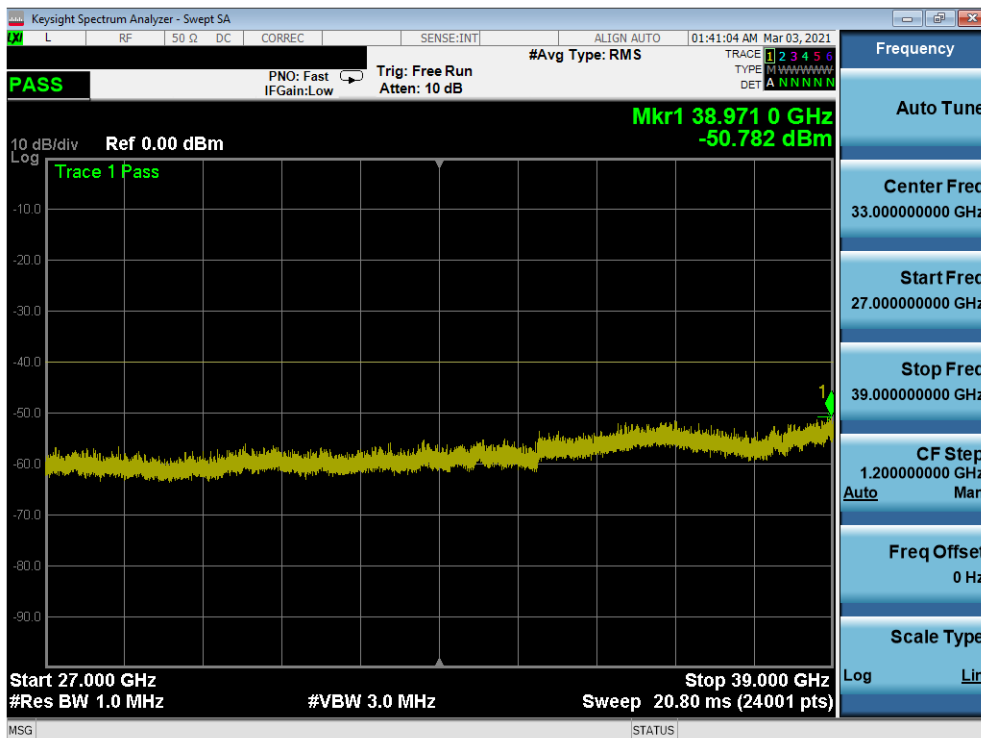


Plot 7-42. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 35 of 77



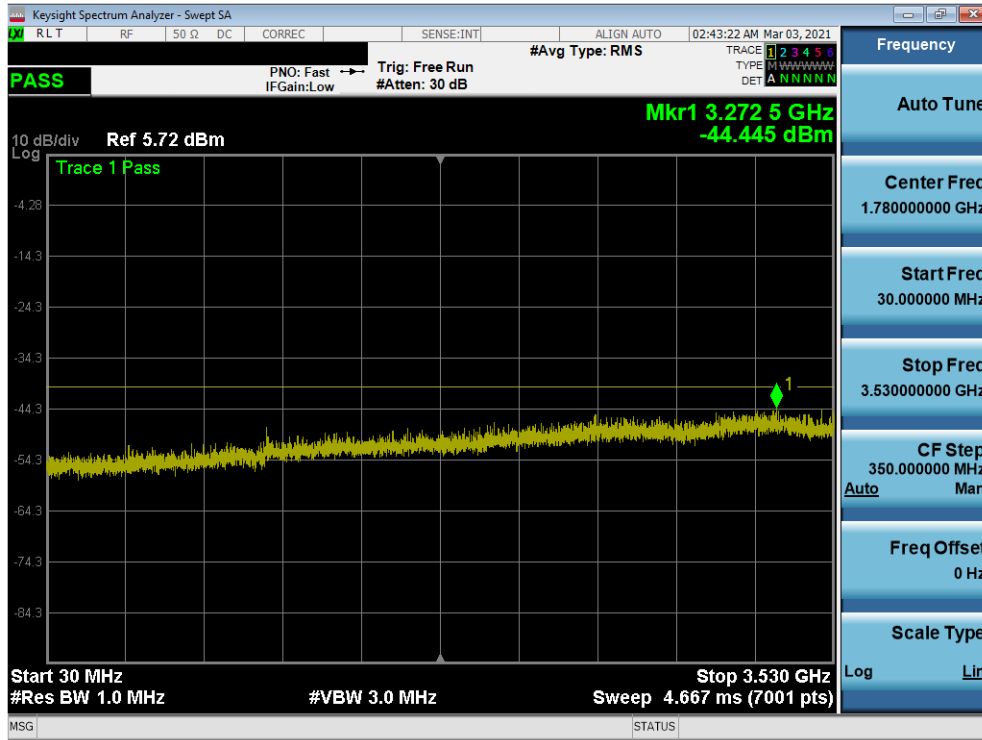
Plot 7-43. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



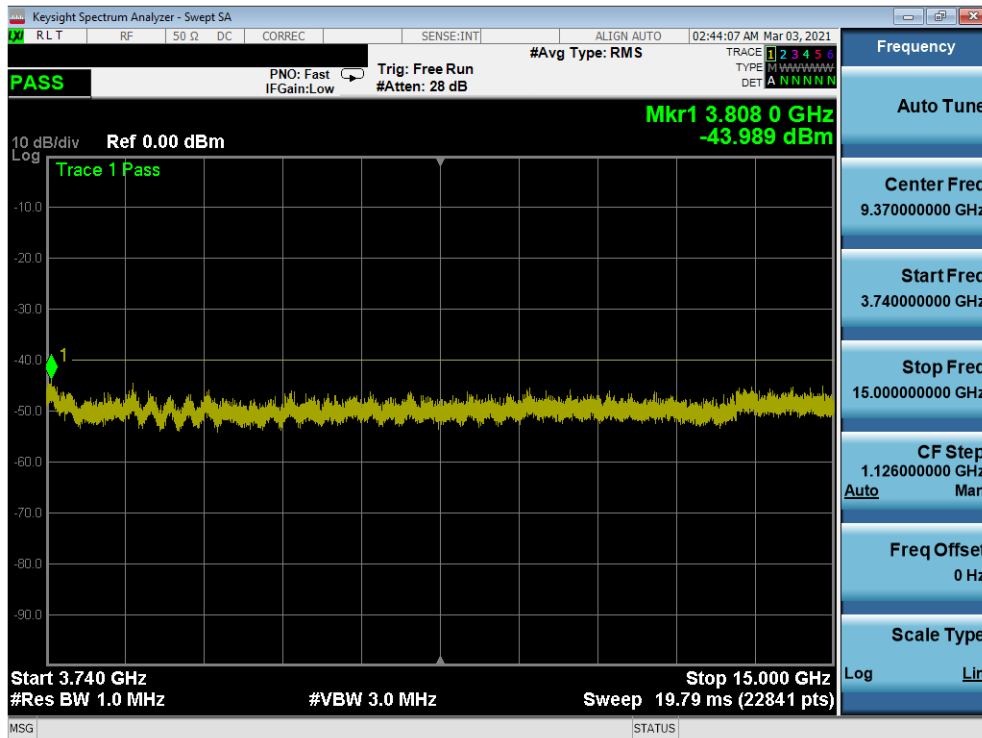
Plot 7-44. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 36 of 77

ULCA - LTE Band 48

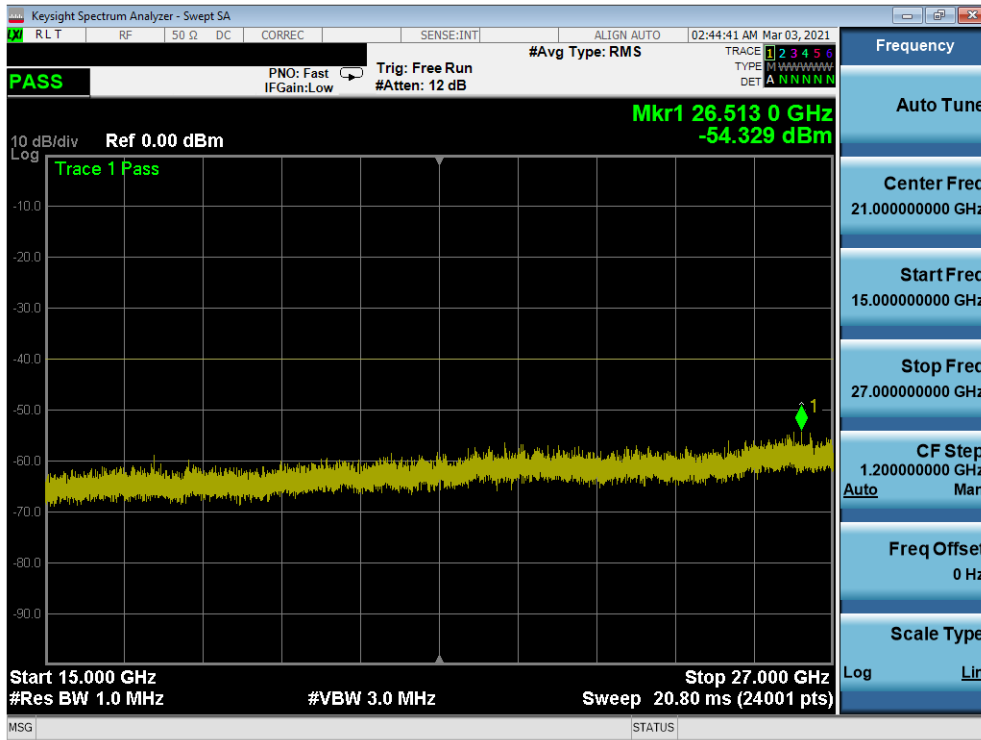


Plot 7-45. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

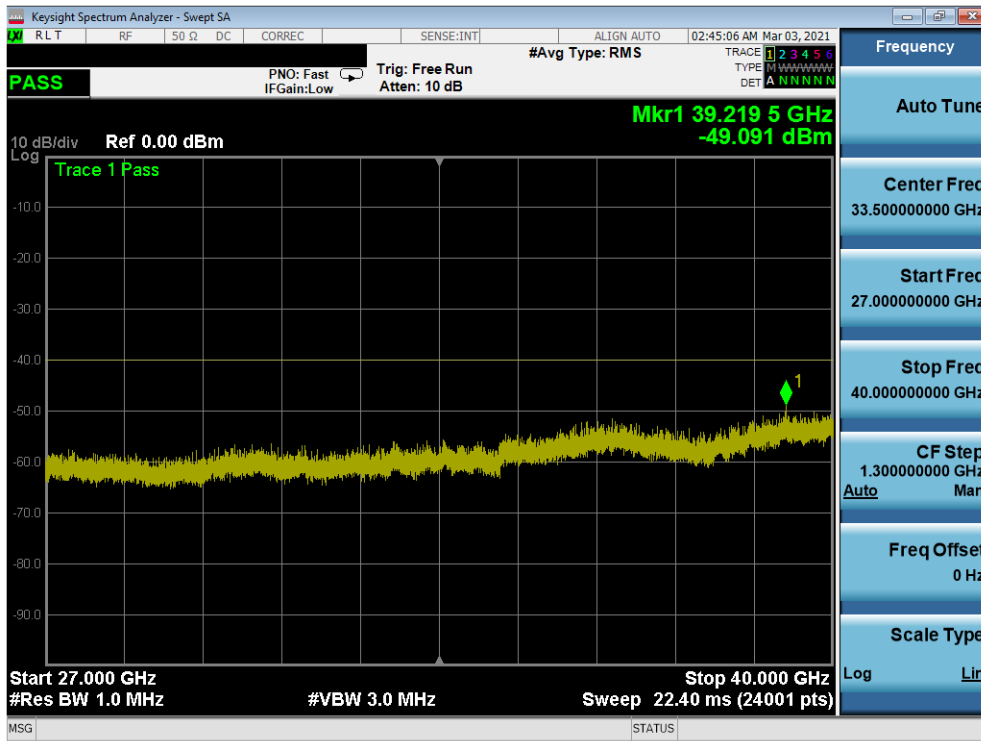


Plot 7-46. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 37 of 77

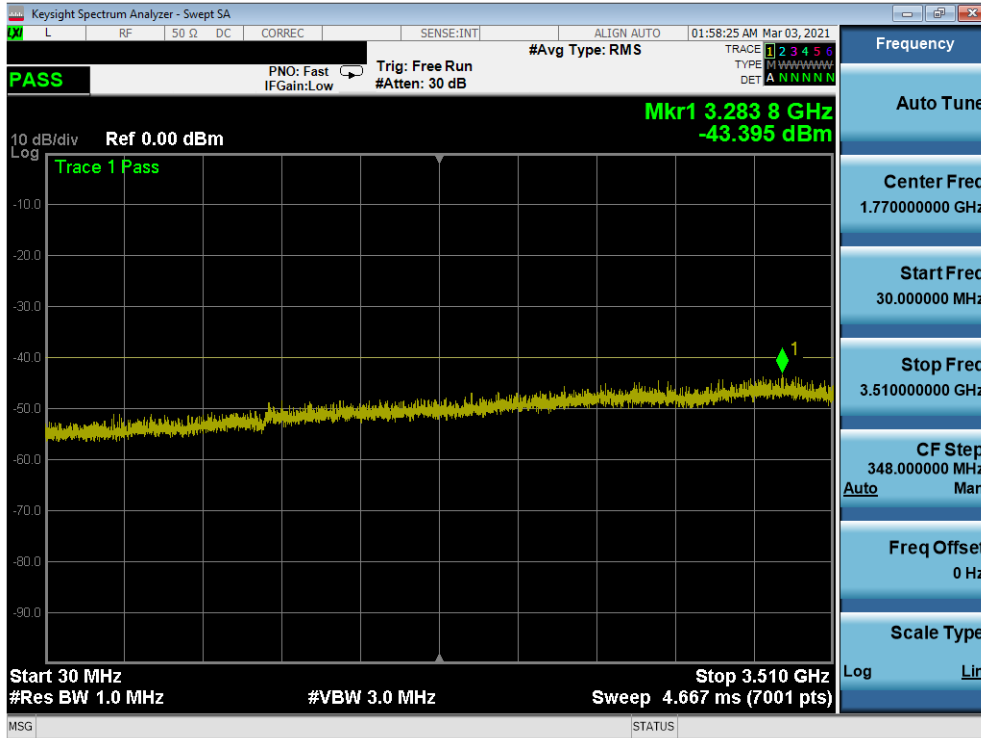


Plot 7-47. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

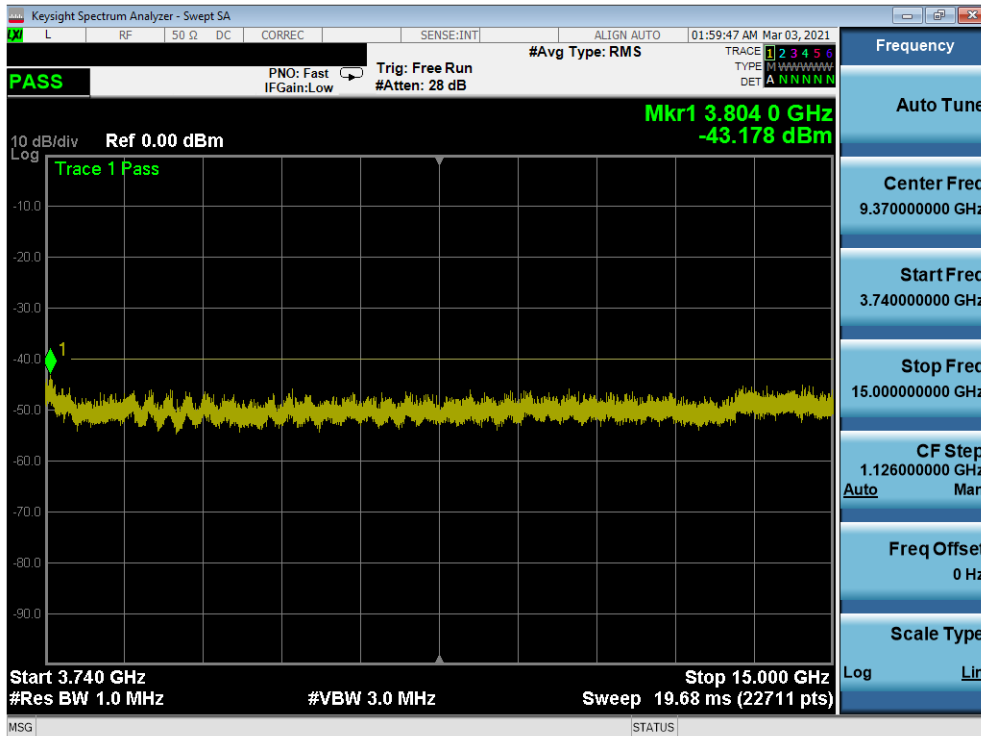


Plot 7-48. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 38 of 77

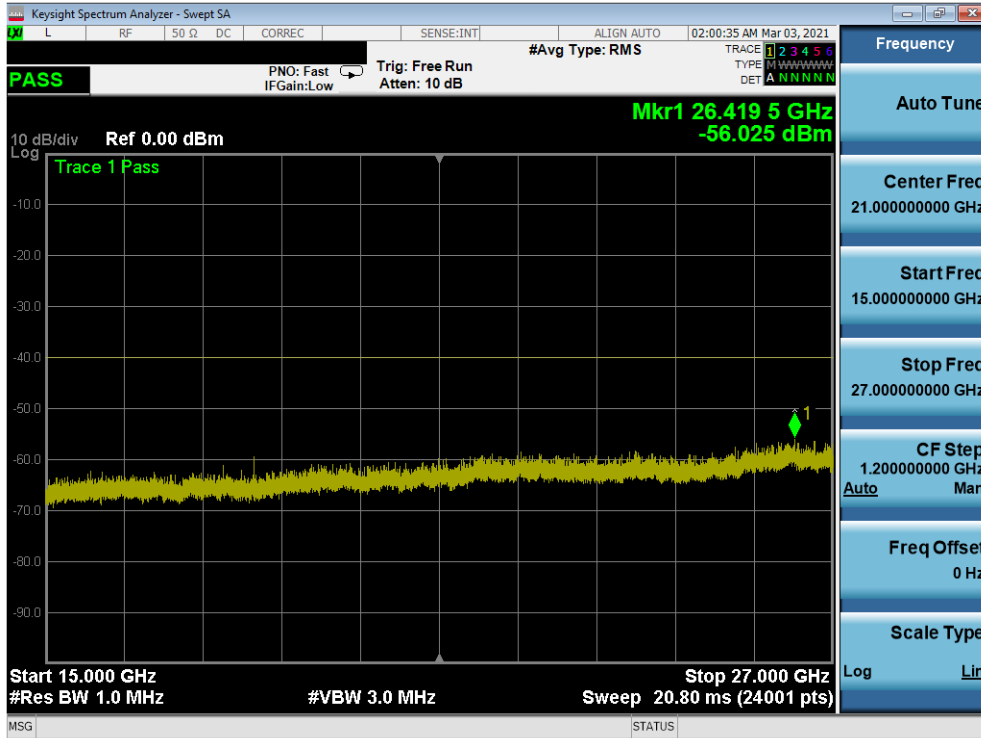


Plot 7-49. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

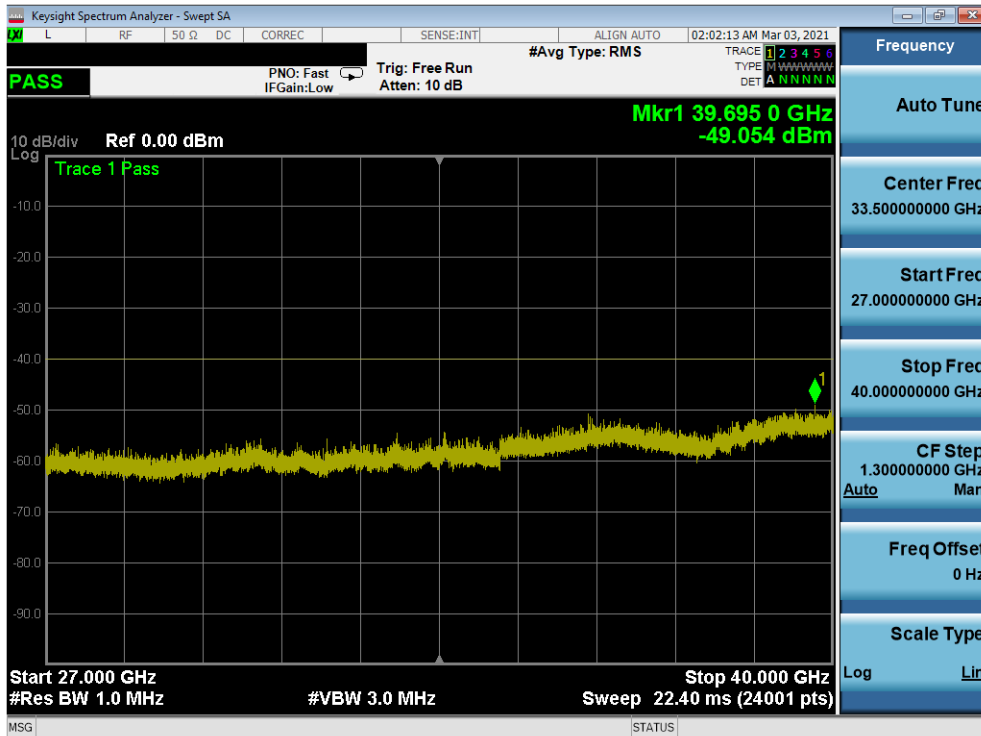


Plot 7-50. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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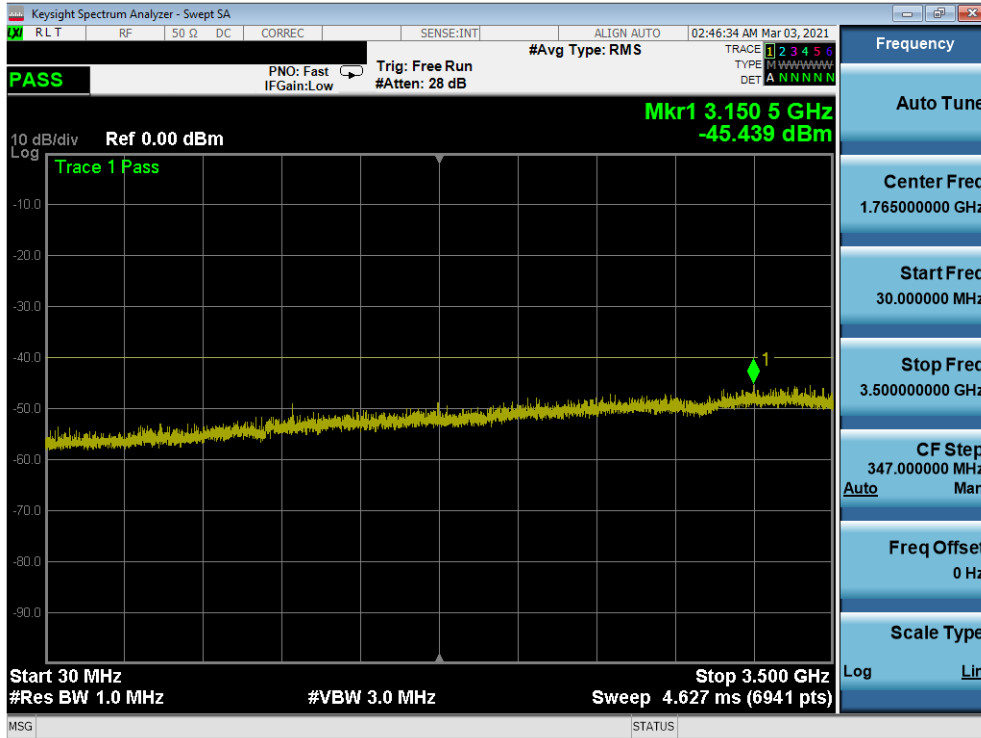


Plot 7-51. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

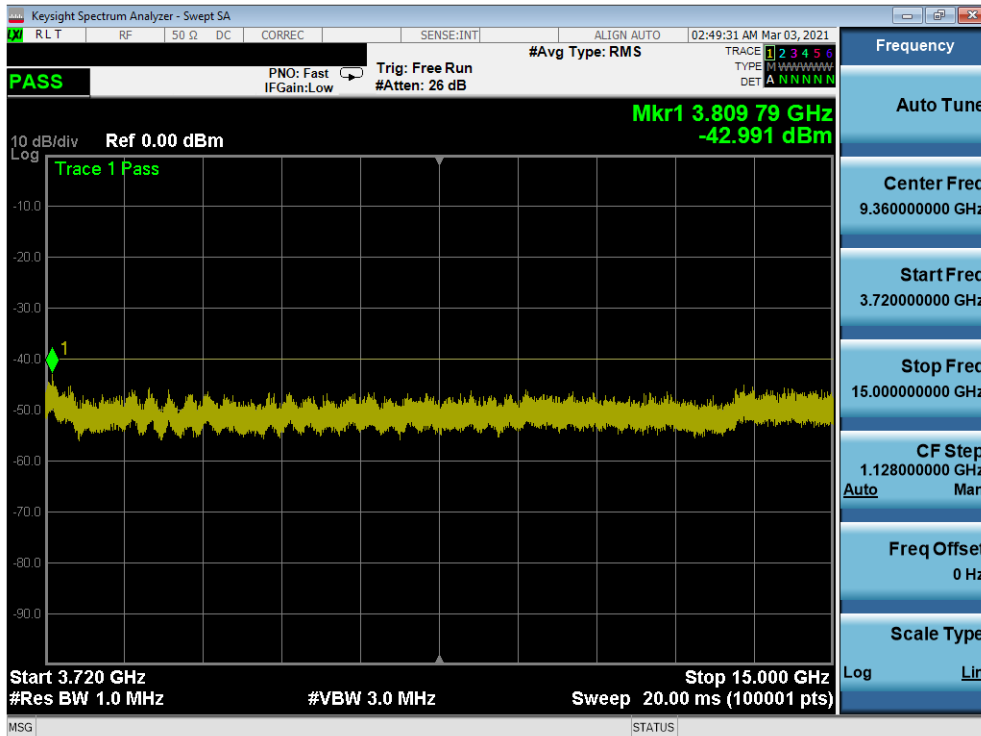


Plot 7-52. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 40 of 77

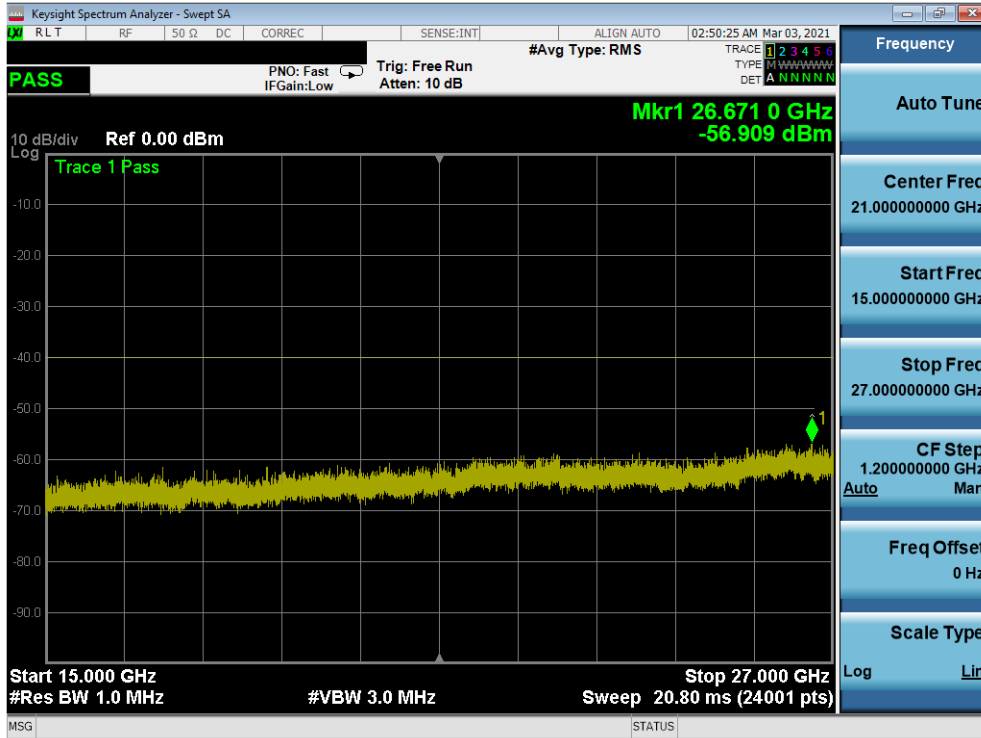


Plot 7-53. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

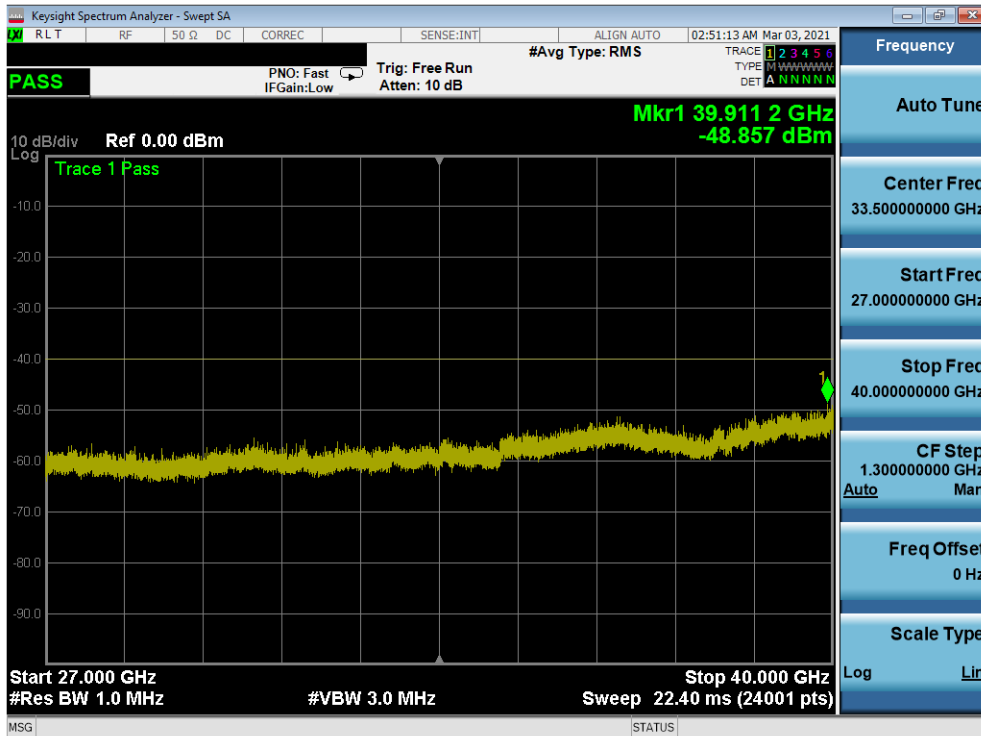


Plot 7-54. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 41 of 77



Plot 7-55. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-56. Conducted Spurious Plot (ULCA LTE Band 48 – 20+20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 42 of 77

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.

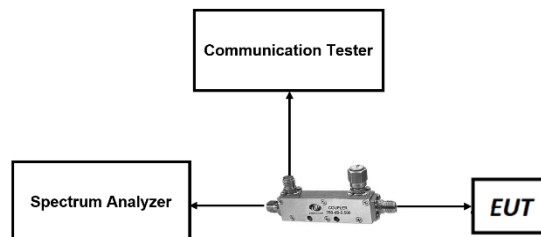


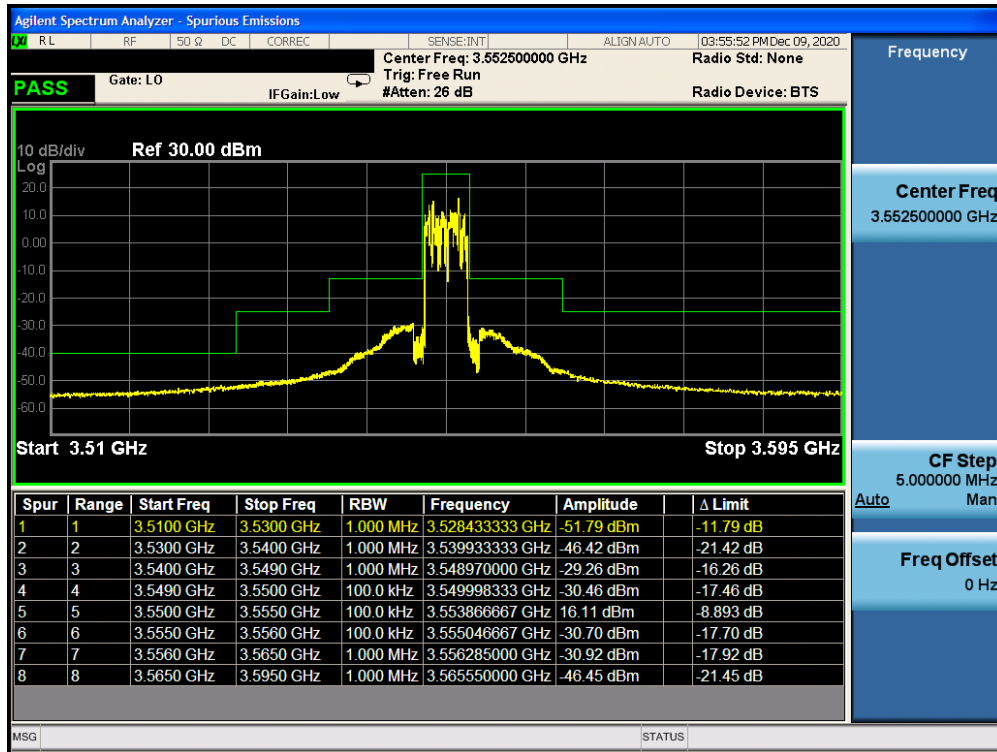
Figure 7-3. Test Instrument & Measurement Setup

Test Notes

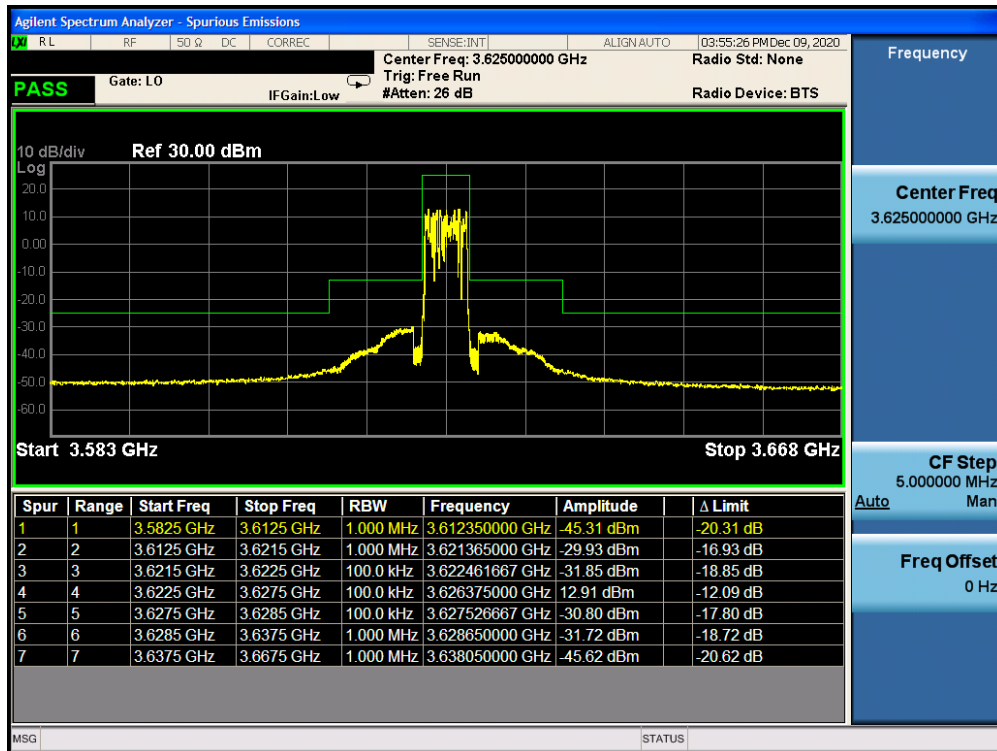
None.

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 43 of 77	

LTE Band 48

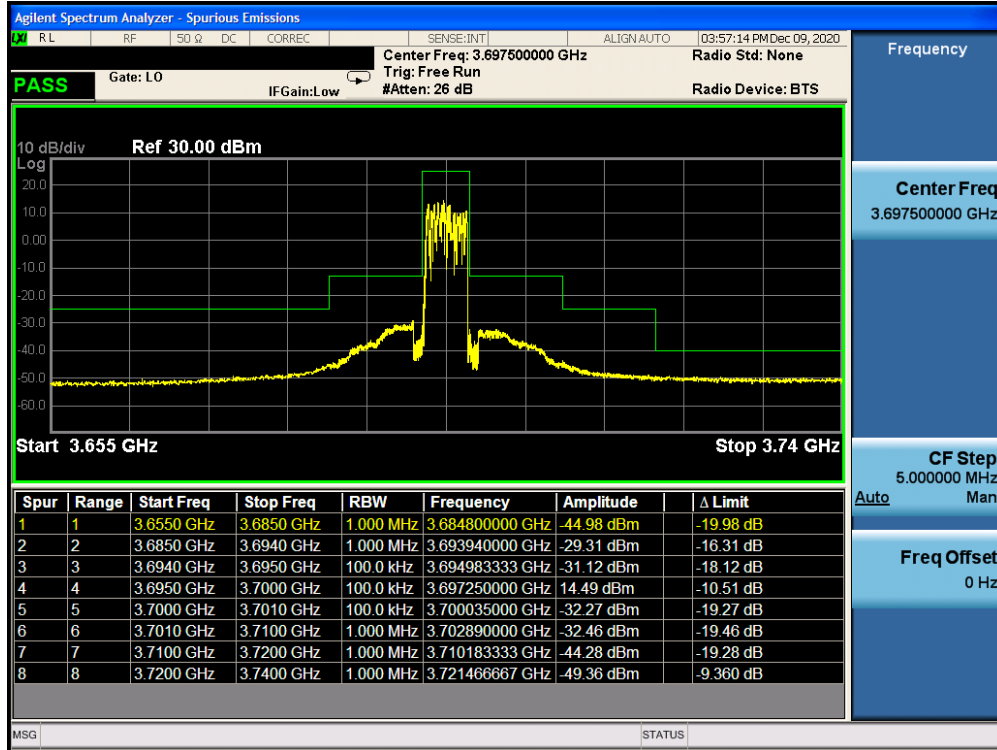


Plot 7-57. Lower ACP Plot (LTE Band 48 - 5MHz QPSK)

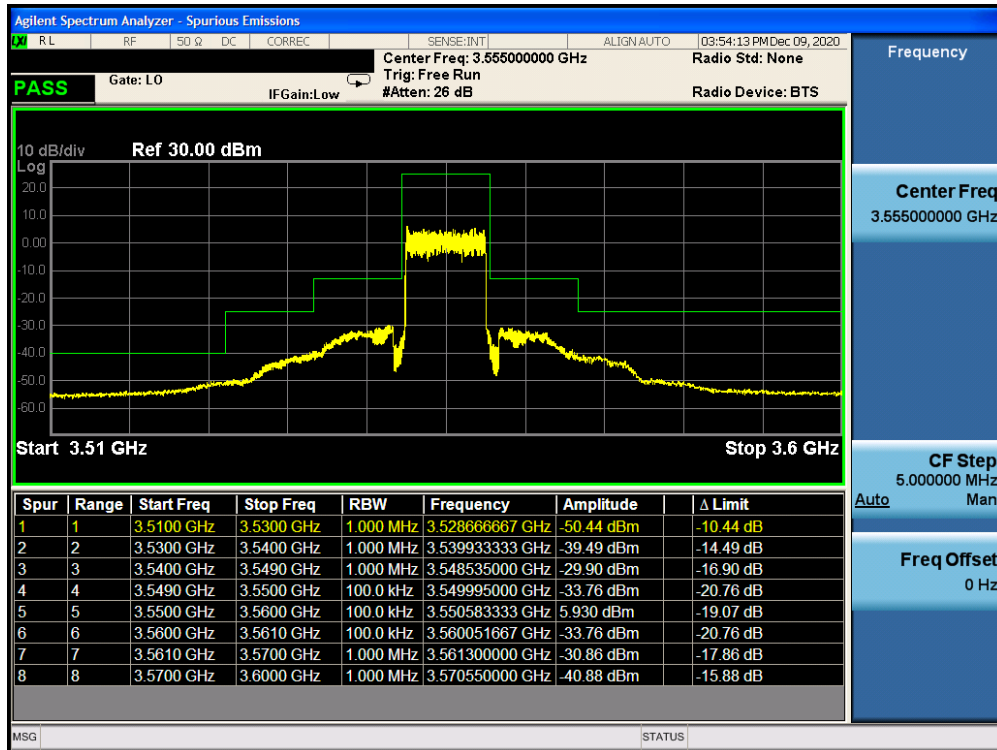


Plot 7-58. Mid ACP Plot (LTE Band 48 - 5MHz QPSK)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 44 of 77

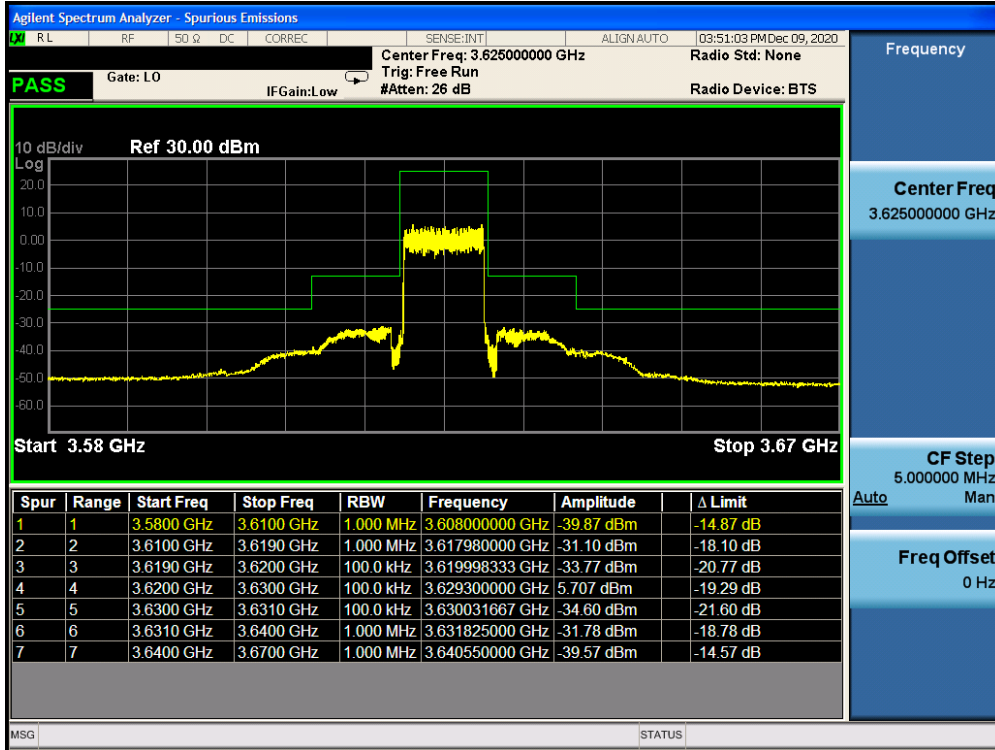


Plot 7-59. Upper ACP Plot (LTE Band 48 - 5MHz QPSK)

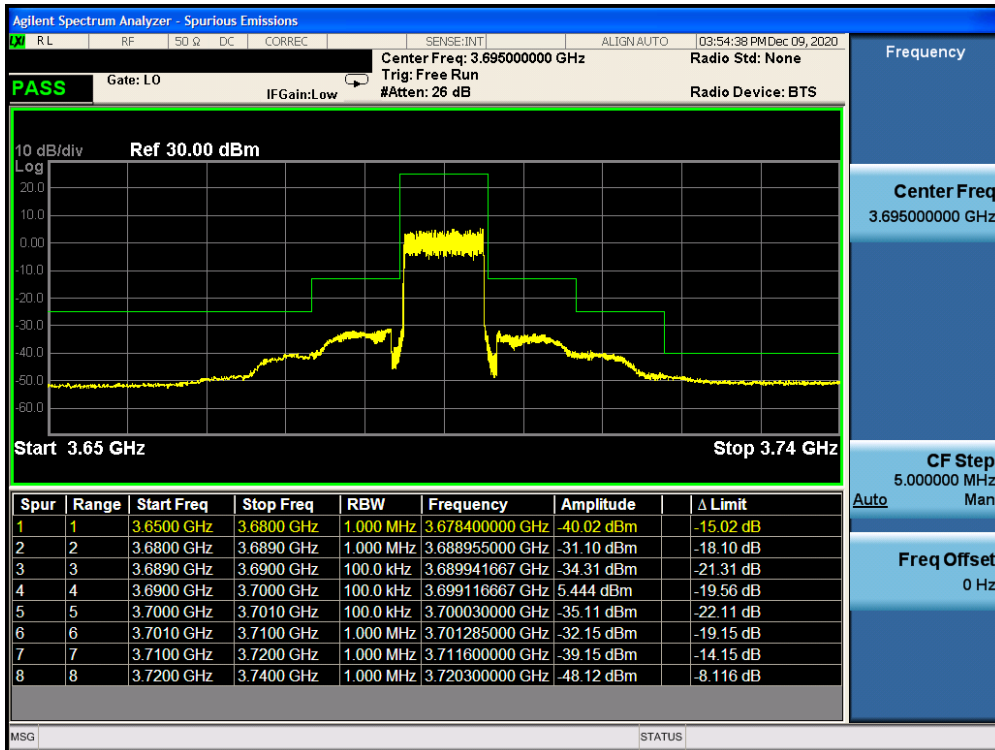


Plot 7-60. Lower ACP Plot (LTE Band 48 - 10MHz QPSK)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 45 of 77

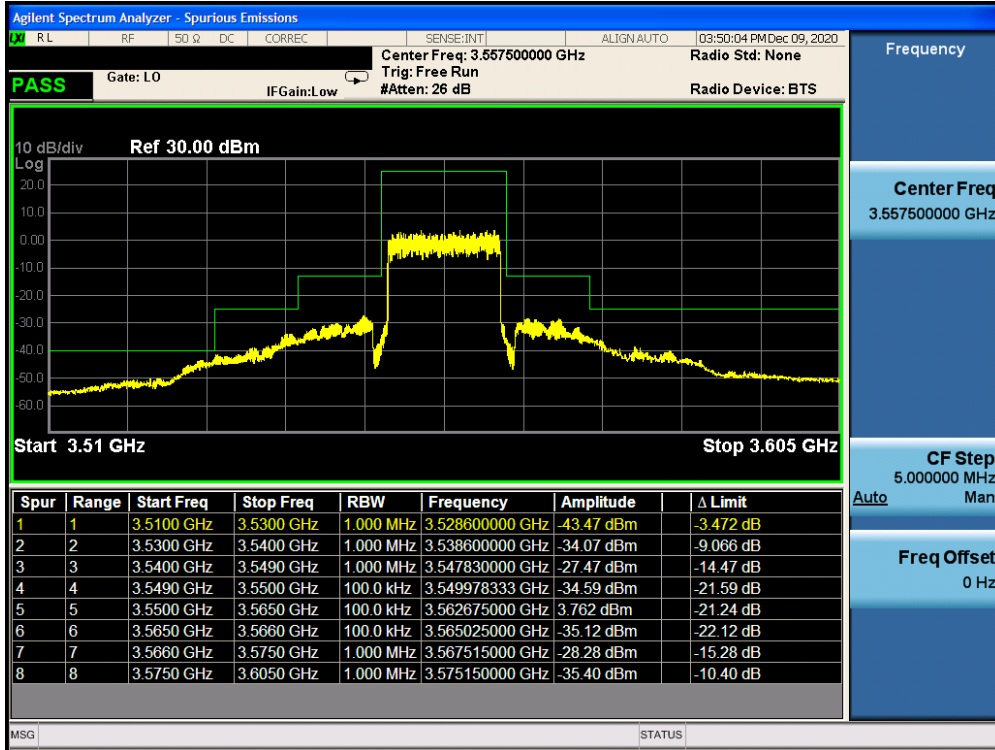


Plot 7-61. Mid ACP Plot (LTE Band 48 - 10MHz QPSK)

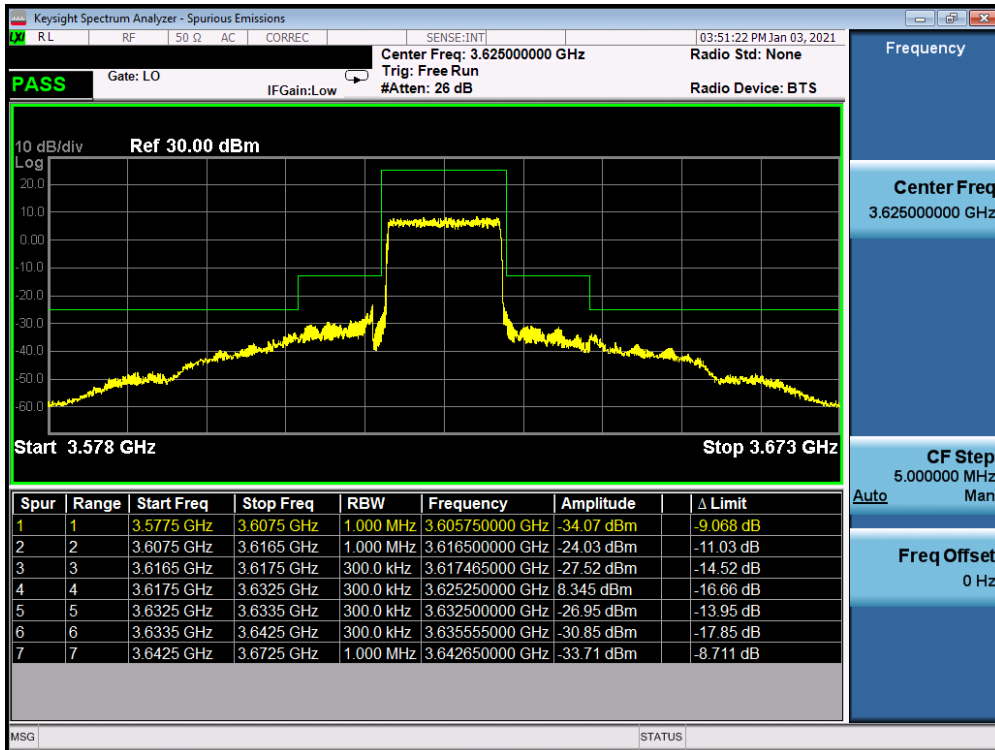


Plot 7-62. Upper ACP Plot (LTE Band 48 - 10MHz QPSK)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 46 of 77

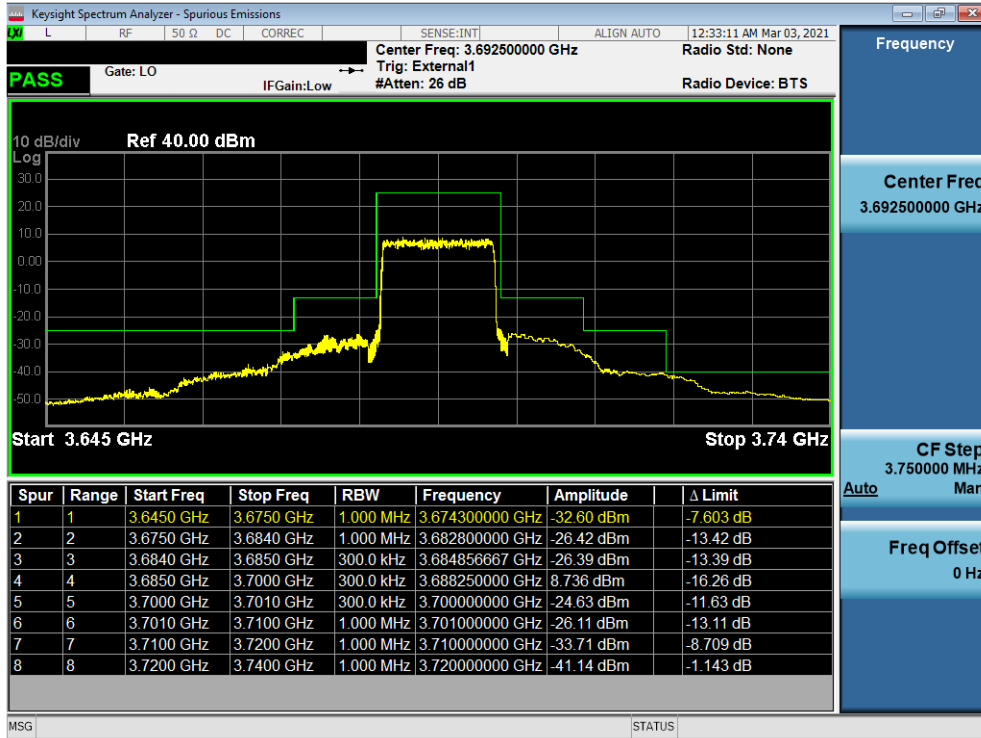


Plot 7-63. Lower ACP Plot (LTE Band 48 - 15MHz QPSK)

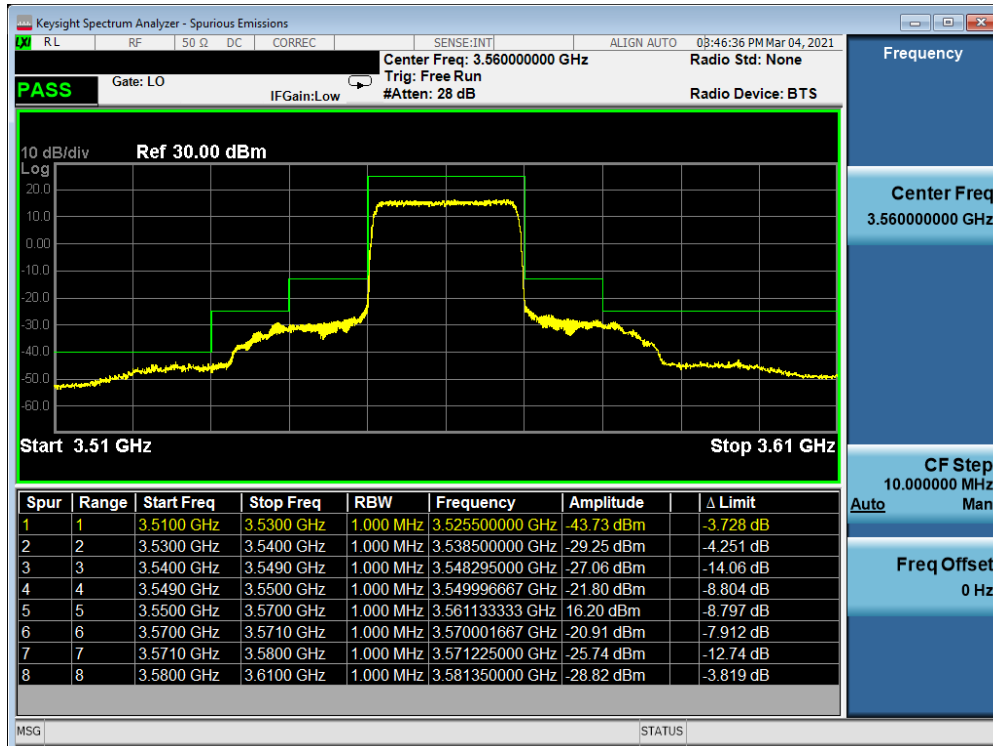


Plot 7-64. Mid ACP Plot (LTE Band 48 - 15MHz QPSK)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 47 of 77

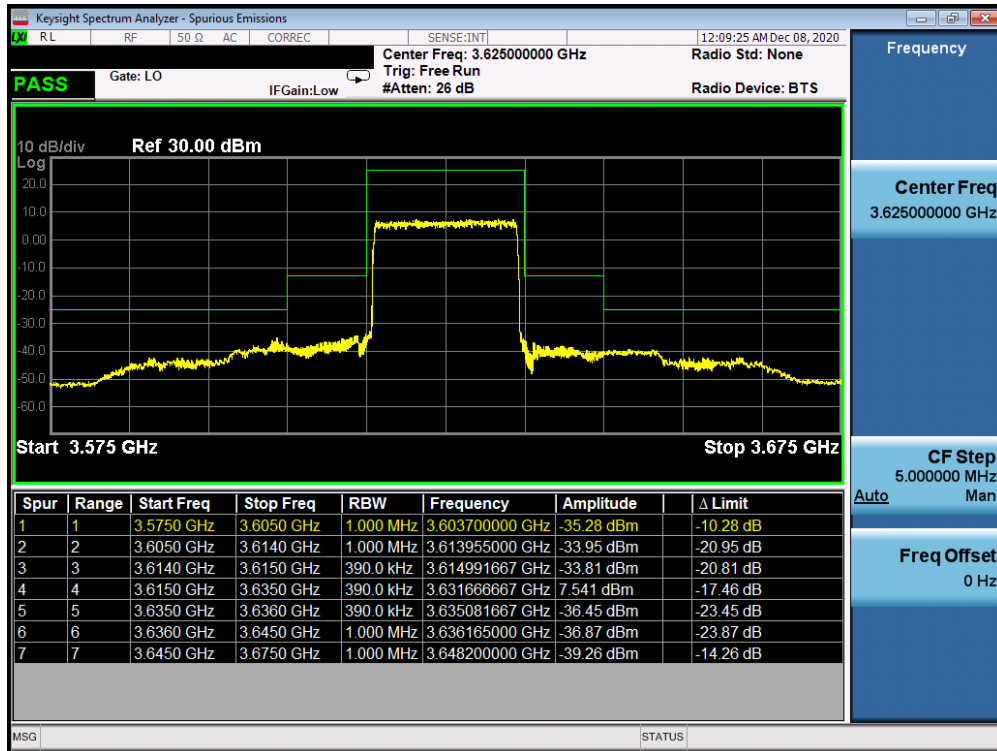


Plot 7-65. Upper ACP Plot (LTE Band 48 - 15MHz QPSK)

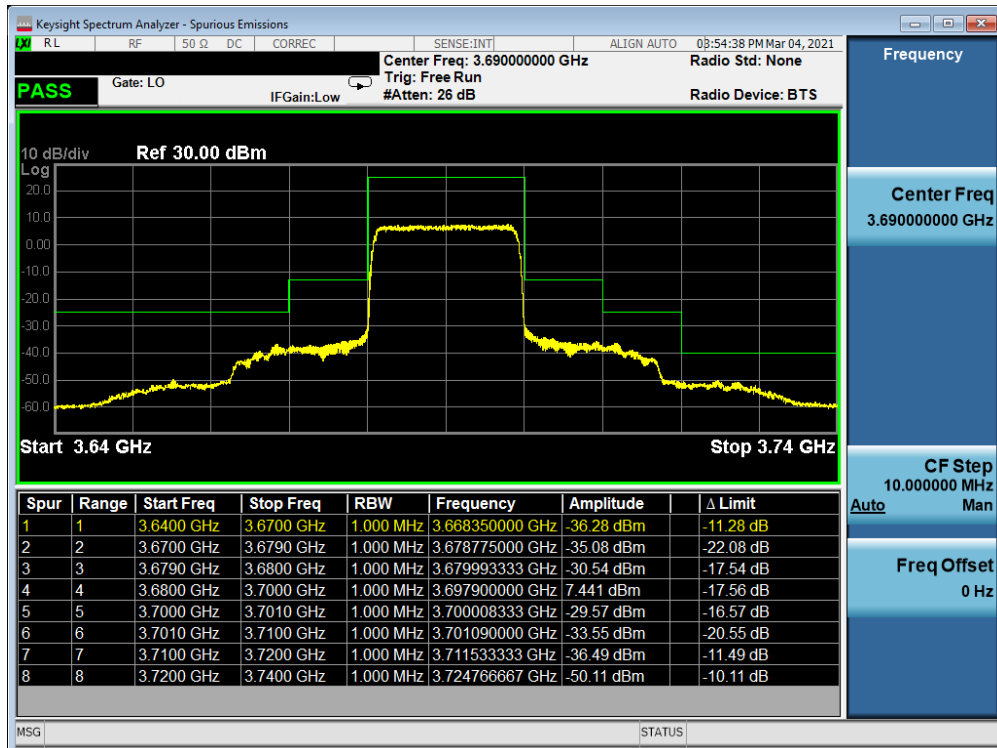


Plot 7-66. Lower ACP Plot (LTE Band 48 - 20MHz QPSK)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 48 of 77



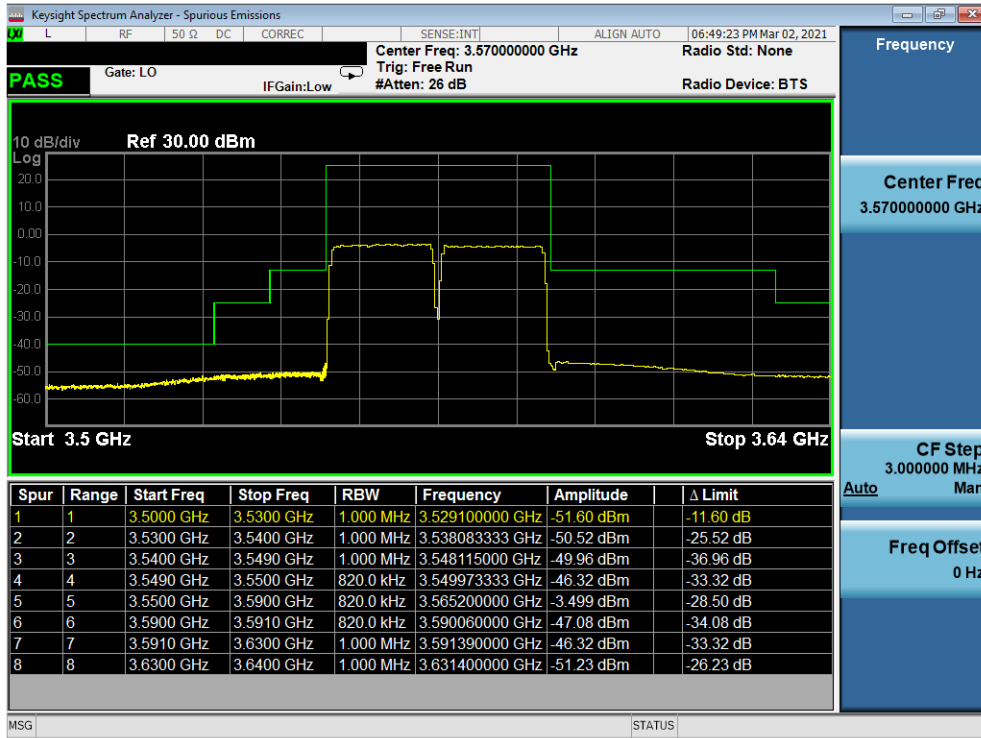
Plot 7-67. Mid ACP Plot (LTE Band 48 - 20MHz QPSK)



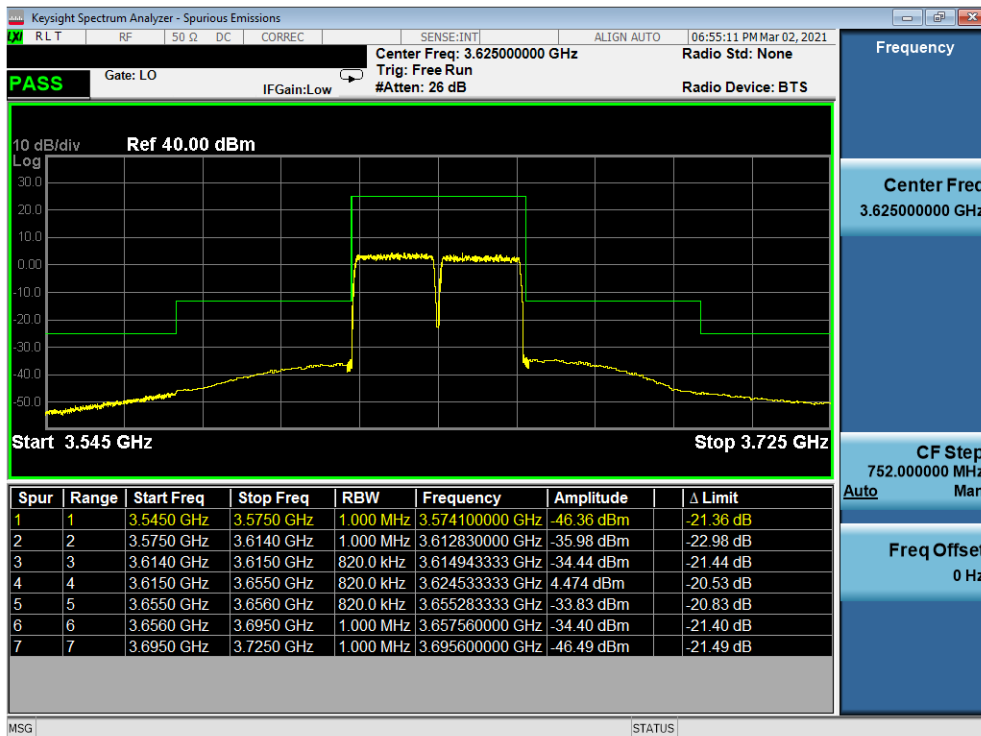
Plot 7-68. Upper ACP Plot (LTE Band 48 - 20MHz QPSK)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 49 of 77

ULCA - LTE Band 48

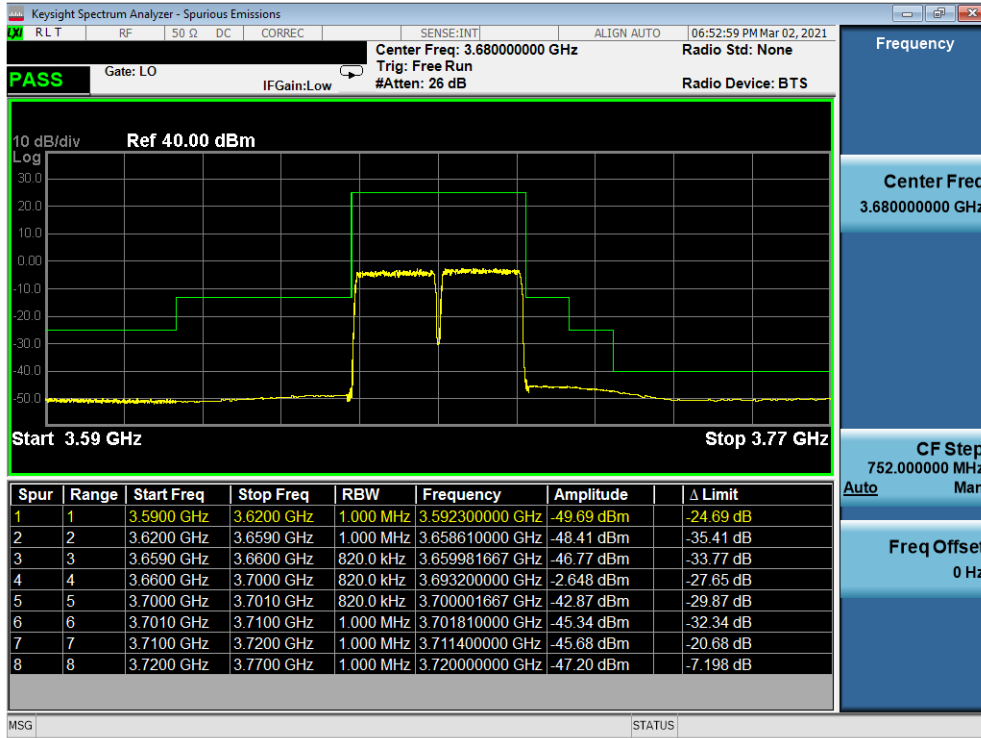


Plot 7-69. Lower ACP Plot (ULCA LTE Band 48 – 20+20MHz QPSK)



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

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 50 of 77



Plot 7-71. Upper ACP Plot (ULCA LTE Band 48 – 20+20MHz QPSK)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 51 of 77

7.5 Additional Maximum Power Reduction (A-MPR) §2.1046

Test Overview

A-MPR is implemented in this device per the A-MPR specification in 3GPP TS 36.101. The conducted powers are shown herein to cover the different A-MPR levels specified in the standard. Conducted power measurements are performed to measure the average output power of the EUT. The averaging is to be performed only over duration of active transmissions at maximum output power level. The average measurements do not include averaging over periods when the transmitter is quiescent or when operating at reduced power level. All ports were tested and only the worst case data were reported.

Test Procedure Used

KDB 971168 D01 v03

Test Setup

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

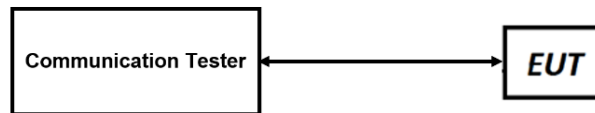


Figure 7-4. Conducted Power Measurement Setup

Test Notes

1. A-MPR was only applied for test purposes to the 2CC case since the 1CC case was compliant for all testing at max power.
2. A-MPR was verified to comply with the "CA_NS_10" specification in the 3GPP TS 36.101 standard by setting the MCC to a U.S. code and the MNC to a U.S. carrier supporting LTE B48 operation.

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Test Case	NS	MCC	MNC	Channel BW [MHz]	PCC Channel Frequency [MHz]	SCC Channel Frequency [MHz]	Modulation	PCC RB Size	PCC RB Offset	SCC RB Size	SCC RB Offset	MPR [dB]	Maximum Target Output Power [dBm]	A-MPR [dB]	A-MPR Measured Power [dBm]
1	01	310	910	20 + 20	3560	3579.8	QPSK	100	0	100	0	0	23.00	≤11	14.71
							16-QAM	100	0	100	0	≤1	22.00		14.73
							64-QAM	100	0	100	0	≤2	21.00		14.73
							256-QAM	100	0	100	0	≤3	20.00		14.70
2				20 + 20	3560	3579.8	QPSK	1	99	1	0	0	23.00	21.01	
							16-QAM	1	99	1	0	≤1	22.00	20.87	
							64-QAM	1	99	1	0	≤2	21.00	21.03	
							256-QAM	1	99	1	0	≤3	20.00	20.86	
3				20 + 20	3605.1	3624.9	QPSK	100	0	100	0	0	23.00	21.29	
							16-QAM	100	0	100	0	≤1	22.00	21.27	
							64-QAM	100	0	100	0	≤2	21.00	21.35	
							256-QAM	100	0	100	0	≤3	20.00	20.79	
4				20 + 20	3605.1	3624.9	QPSK	1	99	1	0	0	23.00	22.78	
							16-QAM	1	99	1	0	≤1	22.00	22.75	
							64-QAM	1	99	1	0	≤2	21.00	22.72	
							256-QAM	1	99	1	0	≤3	20.00	20.99	
5	20 + 20	3667.1	3689.9	QPSK	100	0	100	0	0	23.00	14.79				
				16-QAM	100	0	100	0	≤1	22.00	14.86				
				64-QAM	100	0	100	0	≤2	21.00	14.84				
				256-QAM	100	0	100	0	≤3	20.00	14.82				
6	20 + 20	3667.1	3689.9	QPSK	1	0	1	99	0	23.00	21.11				
				16-QAM	1	0	1	99	≤1	22.00	21.32				
				64-QAM	1	0	1	99	≤2	21.00	21.17				
				256-QAM	1	0	1	99	≤3	20.00	21.06				

Table 7-2. A-MPR Conducted Power Measurements

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device		Page 53 of 77

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.

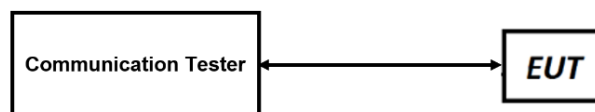


Figure 7-5. EIRP Measurement Setup

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality 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: BCGA2301	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Antenna 3

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]
20 MHz	QPSK	3560.0	-1.00	1 / 50	23.00	22.00	0.158	23.00	-1.00
		3625.0	-1.00	1 / 99	22.87	21.87	0.154	23.00	-1.13
		3690.0	-1.00	1 / 50	22.79	21.79	0.151	23.00	-1.21
	16-QAM	3690.0	-1.00	1 / 50	22.96	21.96	0.157	23.00	-1.04
	64-QAM	3625.0	-1.00	1 / 50	22.64	21.64	0.146	23.00	-1.36
256-QAM	3690.0	-1.00	1 / 50	21.61	20.61	0.115	23.00	-2.39	
15 MHz	QPSK	3557.5	-1.00	1 / 74	22.94	21.94	0.156	23.00	-1.06
		3625.0	-1.00	1 / 37	22.98	21.98	0.158	23.00	-1.02
		3692.5	-1.00	1 / 74	23.00	22.00	0.158	23.00	-1.00
	16-QAM	3692.5	-1.00	1 / 37	22.76	21.76	0.150	23.00	-1.24
	64-QAM	3692.5	-1.00	1 / 0	22.76	21.76	0.150	23.00	-1.24
256-QAM	3557.5	-1.00	1 / 74	21.56	20.56	0.114	23.00	-2.44	
10 MHz	QPSK	3555.0	-1.00	1 / 25	23.00	22.00	0.158	23.00	-1.00
		3625.0	-1.00	1 / 49	22.97	21.97	0.157	23.00	-1.03
		3695.0	-1.00	1 / 25	22.87	21.87	0.154	23.00	-1.13
	16-QAM	3695.0	-1.00	1 / 49	22.73	21.73	0.149	23.00	-1.27
	64-QAM	3695.0	-1.00	1 / 25	22.67	21.67	0.147	23.00	-1.33
256-QAM	3695.0	-1.00	1 / 49	21.46	20.46	0.111	23.00	-2.54	
5 MHz	QPSK	3552.5	-1.00	1 / 24	22.86	21.86	0.153	23.00	-1.14
		3625.0	-1.00	1 / 12	22.94	21.94	0.156	23.00	-1.06
		3697.5	-1.00	1 / 12	23.00	22.00	0.158	23.00	-1.00
	16-QAM	3697.5	-1.00	1 / 24	22.79	21.79	0.151	23.00	-1.21
	64-QAM	3697.5	-1.00	1 / 0	22.77	21.77	0.150	23.00	-1.23
256-QAM	3552.5	-1.00	1 / 12	21.48	20.48	0.112	23.00	-2.52	

Table 7-3. EIRP Data (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 + 20MHz	QPSK	55340	3560.0	1	99	QPSK	55338	3579.8	1	0	22.87	-1.00	21.87	0.154	23.00	-1.13
				55990	3625.0	1	99		56188	3644.8	1	0	22.69	-1.00	21.69	0.148	23.00	-1.31
				56640	3690.0	1	0		56442	3670.2	1	99	23.00	-1.00	22.00	0.158	23.00	-1.00
			QPSK	55990	3625.0	100	0	QPSK	56188	3644.8	100	0	22.34	-1.00	21.34	0.136	23.00	-1.66
			16-QAM	55990	3625.0	100	0	16-QAM	56188	3644.8	100	0	22.34	-1.00	21.34	0.136	23.00	-1.66
			64-QAM	55990	3625.0	100	0	64-QAM	56188	3644.8	100	0	22.26	-1.00	21.26	0.134	23.00	-1.74
			256-QAM	55990	3625.0	100	0	256-QAM	56188	3644.8	100	0	22.35	-1.00	21.35	0.136	23.00	-1.65
Max	LTE B48	20MHz + 15MHz	QPSK	55340	3560.0	1	99	QPSK	55511	3577.1	1	0	22.95	-1.00	21.95	0.157	23.00	-1.05
				55990	3625.0	1	99		56161	3642.1	1	0	23.00	-1.00	22.00	0.158	23.00	-1.00
				56640	3690.0	1	0		56811	3707.1	1	99	22.81	-1.00	21.81	0.152	23.00	-1.19
			QPSK	55990	3625.0	100	0	QPSK	56161	3642.1	100	0	22.00	-1.00	21.00	0.126	23.00	-2.00
			16-QAM	55990	3625.0	100	0	16-QAM	56161	3642.1	100	0	22.12	-1.00	21.12	0.129	23.00	-1.88
			64-QAM	55990	3625.0	100	0	64-QAM	56161	3642.1	100	0	22.15	-1.00	21.15	0.130	23.00	-1.85
			256-QAM	55990	3625.0	100	0	256-QAM	56161	3642.1	100	0	22.00	-1.00	21.00	0.126	23.00	-2.00
Max	LTE B48	20MHz + 10MHz	QPSK	55340	3560.0	1	99	QPSK	55484	3574.4	1	0	23.00	-1.00	22.00	0.158	23.00	-1.00
				55990	3625.0	1	99		56134	3639.4	1	0	22.93	-1.00	21.93	0.156	23.00	-1.07
				56640	3690.0	1	0		56784	3704.4	1	99	22.97	-1.00	21.97	0.157	23.00	-1.03
			QPSK	55990	3625.0	100	0	QPSK	56134	3639.4	100	0	22.17	-1.00	21.17	0.131	23.00	-1.83
			16-QAM	55990	3625.0	100	0	16-QAM	56134	3639.4	100	0	22.27	-1.00	21.27	0.134	23.00	-1.73
			64-QAM	55990	3625.0	100	0	64-QAM	56134	3639.4	100	0	22.31	-1.00	21.31	0.135	23.00	-1.69
			256-QAM	55990	3625.0	100	0	256-QAM	56134	3639.4	100	0	22.24	-1.00	21.24	0.133	23.00	-1.76
Max	LTE B48	20MHz + 5MHz	QPSK	55340	3560.0	1	99	QPSK	55457	3571.7	1	0	22.83	-1.00	21.83	0.152	23.00	-1.17
				55990	3625.0	1	99		56107	3636.7	1	0	23.00	-1.00	22.00	0.158	23.00	-1.00
				56640	3690.0	1	0		56757	3701.7	1	99	22.94	-1.00	21.94	0.156	23.00	-1.06
			QPSK	55990	3625.0	100	0	QPSK	56107	3636.7	100	0	22.23	-1.00	21.23	0.133	23.00	-1.77
			16-QAM	55990	3625.0	100	0	16-QAM	56107	3636.7	100	0	22.34	-1.00	21.34	0.136	23.00	-1.66
			64-QAM	55990	3625.0	100	0	64-QAM	56107	3636.7	100	0	22.31	-1.00	21.31	0.135	23.00	-1.69
			256-QAM	55990	3625.0	100	0	256-QAM	56107	3636.7	100	0	22.25	-1.00	21.25	0.133	23.00	-1.75

Table 7-4. EIRP Data (ULCA LTE B48)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 56 of 77

Antenna 1

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]
20 MHz	QPSK	3560.0	-2.60	1 / 50	19.70	17.10	0.051	23.00	-5.90
		3625.0	-2.60	1 / 99	19.68	17.08	0.051	23.00	-5.92
		3690.0	-2.60	1 / 50	19.59	16.99	0.050	23.00	-6.01
	16-QAM	3690.0	-2.60	1 / 50	19.36	16.76	0.047	23.00	-6.24
	256-QAM	3690.0	-2.60	1 / 50	19.30	16.70	0.047	23.00	-6.30
15 MHz	QPSK	3557.5	-2.60	1 / 74	19.70	17.10	0.051	23.00	-5.90
		3625.0	-2.60	1 / 37	19.64	17.04	0.051	23.00	-5.96
		3692.5	-2.60	1 / 74	19.67	17.07	0.051	23.00	-5.93
	16-QAM	3625.0	-2.60	1 / 37	19.54	16.94	0.049	23.00	-6.06
	256-QAM	3557.5	-2.60	1 / 74	19.41	16.81	0.048	23.00	-6.19
10 MHz	QPSK	3555.0	-2.60	1 / 25	19.67	17.07	0.051	23.00	-5.93
		3625.0	-2.60	1 / 49	19.70	17.10	0.051	23.00	-5.90
		3695.0	-2.60	1 / 0	19.66	17.06	0.051	23.00	-5.94
	16-QAM	3625.0	-2.60	1 / 25	19.39	16.79	0.048	23.00	-6.21
	256-QAM	3625.0	-2.60	1 / 49	19.38	16.78	0.048	23.00	-6.22
5 MHz	QPSK	3552.5	-2.60	1 / 12	19.68	17.08	0.051	23.00	-5.92
		3625.0	-2.60	1 / 24	19.70	17.10	0.051	23.00	-5.90
		3697.5	-2.60	1 / 0	19.65	17.05	0.051	23.00	-5.95
	16-QAM	3552.5	-2.60	1 / 12	19.49	16.89	0.049	23.00	-6.11
	256-QAM	3625.0	-2.60	1 / 24	19.34	16.74	0.047	23.00	-6.26
256-QAM	3552.5	-2.60	1 / 12	17.71	15.11	0.032	23.00	-7.89	

Table 7-5. EIRP Data (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	Frequency [MHz]	UL # RB	UL RB Offset	Modulation	UL Channel	Frequency [MHz]							UL # RB	UL RB Offset
Max	LTE B48	20MHz + 20MHz	QPSK	55340	3560.0	1	99	QPSK	55338	3579.8	1	0	21.57	-2.60	18.97	0.079	23.00	-4.03
				55990	3625.0	1	99		56188	3644.8	1	0	21.43	-2.60	18.83	0.076	23.00	-4.17
				56640	3690.0	1	0		56442	3670.2	1	99	21.70	-2.60	19.10	0.081	23.00	-3.90
			16-QAM	55990	3625.0	100	0	56188	3644.8	100	0	21.32	-2.60	18.72	0.074	23.00	-4.28	
				55990	3625.0	100	0	64-QAM	56188	3644.8	100	0	21.10	-2.60	18.50	0.071	23.00	-4.50
				55990	3625.0	100	0	64-QAM	56188	3644.8	100	0	21.13	-2.60	18.53	0.071	23.00	-4.47
				256-QAM	55990	3625.0	100	0	256-QAM	56188	3644.8	100	0	19.11	-2.60	16.51	0.045	23.00
Max	LTE B48	20MHz + 15MHz	QPSK	55340	3560.0	1	99	QPSK	55511	3577.1	1	0	21.65	-2.60	19.05	0.080	23.00	-3.95
				55990	3625.0	1	99		56161	3642.1	1	0	21.45	-2.60	18.85	0.077	23.00	-4.15
				56640	3690.0	1	0		56811	3707.1	1	99	21.70	-2.60	19.10	0.081	23.00	-3.90
			16-QAM	55990	3625.0	100	0	56161	3642.1	100	0	20.70	-2.60	18.10	0.065	23.00	-4.90	
				55990	3625.0	100	0	16-QAM	56161	3642.1	100	0	20.71	-2.60	18.11	0.065	23.00	-4.89
				55990	3625.0	100	0	64-QAM	56161	3642.1	100	0	20.65	-2.60	18.05	0.064	23.00	-4.95
				256-QAM	55990	3625.0	100	0	256-QAM	56161	3642.1	100	0	18.98	-2.60	16.38	0.043	23.00
Max	LTE B48	20MHz + 10MHz	QPSK	55340	3560.0	1	99	QPSK	55484	3574.4	1	0	21.70	-2.60	19.10	0.081	23.00	-3.90
				55990	3625.0	1	99		56134	3639.4	1	0	21.57	-2.60	18.97	0.079	23.00	-4.03
				56640	3690.0	1	0		56784	3704.4	1	99	21.62	-2.60	19.02	0.080	23.00	-3.98
			16-QAM	55990	3625.0	100	0	56134	3639.4	100	0	21.20	-2.60	18.60	0.072	23.00	-4.40	
				55990	3625.0	100	0	16-QAM	56134	3639.4	100	0	20.93	-2.60	18.33	0.068	23.00	-4.67
				55990	3625.0	100	0	64-QAM	56134	3639.4	100	0	20.94	-2.60	18.34	0.068	23.00	-4.66
				256-QAM	55990	3625.0	100	0	256-QAM	56134	3639.4	100	0	19.46	-2.60	16.86	0.049	23.00
Max	LTE B48	20MHz + 5MHz	QPSK	55340	3560.0	1	99	QPSK	55457	3571.7	1	0	21.57	-2.60	18.97	0.079	23.00	-4.03
				55990	3625.0	1	99		56107	3636.7	1	0	21.70	-2.60	19.10	0.081	23.00	-3.90
				56640	3690.0	1	0		56757	3701.7	1	99	21.49	-2.60	18.89	0.077	23.00	-4.11
			16-QAM	55990	3625.0	100	0	56107	3636.7	100	0	21.16	-2.60	18.56	0.072	23.00	-4.44	
				55990	3625.0	100	0	16-QAM	56107	3636.7	100	0	20.98	-2.60	18.38	0.069	23.00	-4.62
				55990	3625.0	100	0	64-QAM	56107	3636.7	100	0	20.94	-2.60	18.34	0.068	23.00	-4.66
				256-QAM	55990	3625.0	100	0	256-QAM	56107	3636.7	100	0	19.07	-2.60	16.47	0.044	23.00

Table 7-6. EIRP Data (ULCA LTE B48)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 57 of 77

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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]
20 MHz	QPSK	3560.0	2.70	1 / 50	19.30	22.00	0.158	23.00	-1.00
		3625.0	2.70	1 / 99	19.27	21.97	0.157	23.00	-1.03
		3690.0	2.70	1 / 50	19.21	21.91	0.155	23.00	-1.09
	16-QAM	3625.0	2.70	1 / 0	18.94	21.64	0.146	23.00	-1.36
	64-QAM	3560.0	2.70	1 / 99	18.67	21.37	0.137	23.00	-1.63
15 MHz	QPSK	3557.5	2.70	1 / 0	19.26	21.96	0.157	23.00	-1.04
		3625.0	2.70	1 / 37	19.30	22.00	0.158	23.00	-1.00
		3692.5	2.70	1 / 37	19.23	21.93	0.156	23.00	-1.07
	16-QAM	3557.5	2.70	1 / 74	18.98	21.68	0.147	23.00	-1.32
	64-QAM	3557.5	2.70	1 / 0	18.63	21.33	0.136	23.00	-1.67
10 MHz	QPSK	3555.0	2.70	1 / 0	19.28	21.98	0.158	23.00	-1.02
		3625.0	2.70	1 / 25	19.24	21.94	0.156	23.00	-1.06
		3695.0	2.70	1 / 49	19.17	21.87	0.154	23.00	-1.13
	16-QAM	3555.0	2.70	1 / 25	18.97	21.67	0.147	23.00	-1.33
	64-QAM	3555.0	2.70	1 / 49	18.67	21.37	0.137	23.00	-1.63
5 MHz	QPSK	3552.5	2.70	1 / 0	19.30	22.00	0.158	23.00	-1.00
		3625.0	2.70	1 / 12	19.26	21.96	0.157	23.00	-1.04
		3697.5	2.70	1 / 24	19.21	21.91	0.155	23.00	-1.09
	16-QAM	3552.5	2.70	1 / 24	18.94	21.64	0.146	23.00	-1.36
	64-QAM	3552.5	2.70	1 / 0	18.57	21.27	0.134	23.00	-1.73
5 MHz	QPSK	3625.0	2.70	1 / 24	18.45	21.15	0.130	23.00	-1.85

Table 7-7. EIRP Data (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	Frequency [MHz]	UL # RB	UL RB Offset	Modulation	UL Channel	Frequency [MHz]	UL # RB	UL RB Offset						
Max	LTE B48	20MHz + 20MHz	QPSK	55340	3560.0	1	99	QPSK	55338	3579.8	1	0	19.24	2.70	21.94	0.156	23.00	-1.06
				55990	3625.0	1	99		56188	3644.8	1	0	19.18	2.70	21.88	0.154	23.00	-1.12
			QPSK	56640	3690.0	1	0	56442	3670.2	1	99	19.30	2.70	22.00	0.159	23.00	-1.00	
				55990	3625.0	100	0	56188	3644.8	100	0	17.88	2.70	20.58	0.114	23.00	-2.42	
			16-QAM	55990	3625.0	100	0	16-QAM	56188	3644.8	100	0	17.69	2.70	20.39	0.109	23.00	-2.61
				55990	3625.0	100	0	64-QAM	56188	3644.8	100	0	17.77	2.70	20.47	0.111	23.00	-2.53
			256-QAM	55990	3625.0	100	0	256-QAM	56188	3644.8	100	0	17.80	2.70	20.50	0.112	23.00	-2.50

Table 7-8. EIRP Data (ULCA LTE B48)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 58 of 77	

Antenna 2a

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]
20 MHz	QPSK	3560.0	2.40	1 / 50	19.60	22.00	0.158	23.00	-1.00
		3625.0	2.40	1 / 99	19.57	21.97	0.157	23.00	-1.03
		3690.0	2.40	1 / 0	19.55	21.95	0.157	23.00	-1.05
	16-QAM	3625.0	2.40	1 / 50	19.32	21.72	0.149	23.00	-1.28
	64-QAM	3560.0	2.40	1 / 0	19.28	21.68	0.147	23.00	-1.32
256-QAM	3560.0	2.40	1 / 0	19.26	21.66	0.147	23.00	-1.34	
15 MHz	QPSK	3557.5	2.40	1 / 37	19.57	21.97	0.157	23.00	-1.03
		3625.0	2.40	1 / 74	19.60	22.00	0.158	23.00	-1.00
		3692.5	2.40	1 / 0	19.54	21.94	0.156	23.00	-1.06
	16-QAM	3692.5	2.40	1 / 37	19.21	21.61	0.145	23.00	-1.39
	64-QAM	3557.5	2.40	1 / 37	19.15	21.55	0.143	23.00	-1.45
		3625.0	2.40	1 / 0	19.12	21.52	0.142	23.00	-1.48
10 MHz	QPSK	3555.0	2.40	1 / 0	19.49	21.89	0.155	23.00	-1.11
		3625.0	2.40	1 / 25	19.53	21.93	0.156	23.00	-1.07
		3695.0	2.40	1 / 25	19.60	22.00	0.158	23.00	-1.00
	16-QAM	3555.0	2.40	1 / 0	19.44	21.84	0.153	23.00	-1.16
	64-QAM	3695.0	2.40	1 / 25	19.18	21.58	0.144	23.00	-1.42
256-QAM	3555.0	2.40	1 / 25	19.10	21.50	0.141	23.00	-1.50	
5 MHz	QPSK	3552.5	2.40	1 / 12	19.60	22.00	0.158	23.00	-1.00
		3625.0	2.40	1 / 24	19.51	21.91	0.155	23.00	-1.09
		3697.5	2.40	1 / 0	19.44	21.84	0.153	23.00	-1.16
	16-QAM	3552.5	2.40	1 / 0	19.26	21.66	0.147	23.00	-1.34
	64-QAM	3552.5	2.40	1 / 24	19.22	21.62	0.145	23.00	-1.38
256-QAM	3697.5	2.40	1 / 0	19.11	21.51	0.142	23.00	-1.49	

Table 7-9. EIRP Data (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 + 20MHz	QPSK	55340	3560.0	1	99	QPSK	55338	3579.8	1	0	19.55	2.40	21.95	0.157	23.00	-1.05
				55990	3625.0	1	99		56188	3644.8	1	0	19.59	2.40	21.99	0.158	23.00	-1.01
			16-QAM	56640	3690.0	1	0	56442	3670.2	1	99	19.50	2.40	21.90	0.155	23.00	-1.10	
				55990	3625.0	100	0	56188	3644.8	100	0	18.59	2.40	20.99	0.126	23.00	-2.01	
				55990	3625.0	100	0	64-QAM	56188	3644.8	100	0	18.60	2.40	21.00	0.126	23.00	-2.00
				55990	3625.0	100	0	64-QAM	56188	3644.8	100	0	18.55	2.40	20.95	0.124	23.00	-2.05
256-QAM	55990	3625.0	100	0	256-QAM	56188	3644.8	100	0	18.53	2.40	20.93	0.124	23.00	-2.07			
Max	LTE B48	20MHz + 15MHz	QPSK	55340	3560.0	1	99	QPSK	55511	3577.1	1	0	19.60	2.40	22.00	0.158	23.00	-1.00
				55990	3625.0	1	99		56161	3642.1	1	0	19.53	2.40	21.93	0.156	23.00	-1.07
			16-QAM	56640	3690.0	1	0	56811	3707.1	1	99	19.55	2.40	21.95	0.157	23.00	-1.05	
				55990	3625.0	100	0	56161	3642.1	100	0	18.60	2.40	21.00	0.126	23.00	-2.00	
				55990	3625.0	100	0	16-QAM	56161	3642.1	100	0	18.58	2.40	20.98	0.125	23.00	-2.02
				55990	3625.0	100	0	64-QAM	56161	3642.1	100	0	18.60	2.40	21.00	0.126	23.00	-2.00
256-QAM	55990	3625.0	100	0	256-QAM	56161	3642.1	100	0	18.42	2.40	20.82	0.121	23.00	-2.18			
Max	LTE B48	20MHz + 10MHz	QPSK	55340	3560.0	1	99	QPSK	55484	3574.4	1	0	19.58	2.40	21.98	0.158	23.00	-1.02
				55990	3625.0	1	99		56134	3639.4	1	0	19.60	2.40	22.00	0.158	23.00	-1.00
			16-QAM	56640	3690.0	1	0	56784	3704.4	1	99	19.57	2.40	21.97	0.157	23.00	-1.03	
				55990	3625.0	100	0	56134	3639.4	100	0	18.32	2.40	20.72	0.118	23.00	-2.28	
				55990	3625.0	100	0	16-QAM	56134	3639.4	100	0	18.35	2.40	20.75	0.119	23.00	-2.25
				55990	3625.0	100	0	64-QAM	56134	3639.4	100	0	18.40	2.40	20.80	0.120	23.00	-2.20
256-QAM	55990	3625.0	100	0	256-QAM	56134	3639.4	100	0	18.42	2.40	20.82	0.121	23.00	-2.18			
Max	LTE B48	20MHz + 5MHz	QPSK	55340	3560.0	1	99	QPSK	55457	3571.7	1	0	19.60	2.40	22.00	0.158	23.00	-1.00
				55990	3625.0	1	99		56107	3636.7	1	0	19.51	2.40	21.91	0.155	23.00	-1.09
			16-QAM	56640	3690.0	1	0	56757	3701.7	1	99	19.48	2.40	21.88	0.154	23.00	-1.12	
				55990	3625.0	100	0	56107	3636.7	100	0	18.29	2.40	20.69	0.117	23.00	-2.31	
				55990	3625.0	100	0	16-QAM	56107	3636.7	100	0	18.28	2.40	20.68	0.117	23.00	-2.32
				55990	3625.0	100	0	64-QAM	56107	3636.7	100	0	18.35	2.40	20.75	0.119	23.00	-2.25
256-QAM	55990	3625.0	100	0	256-QAM	56107	3636.7	100	0	18.42	2.40	20.82	0.121	23.00	-2.18			

Table 7-10. EIRP Data (ULCA LTE B48)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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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 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points \geq 2 x 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.

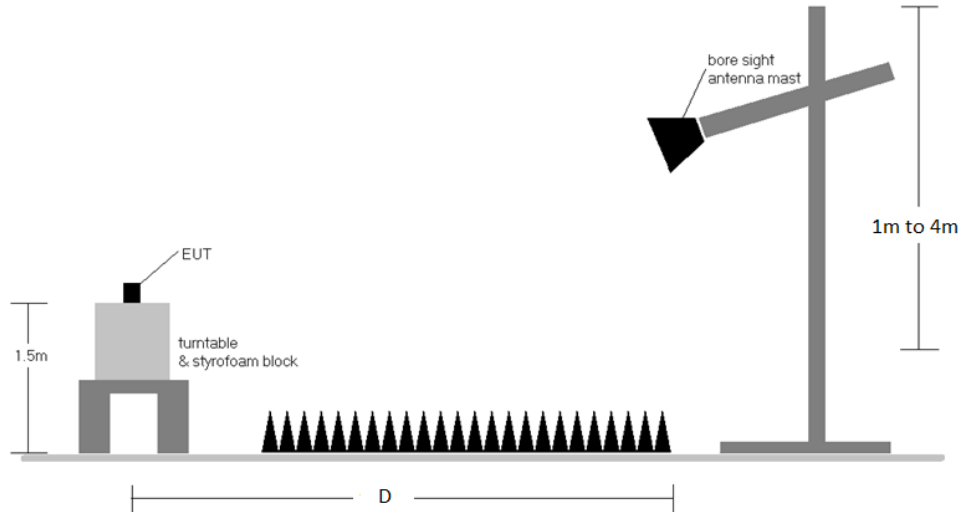


Figure 7-6. Test Instrument & Measurement Setup

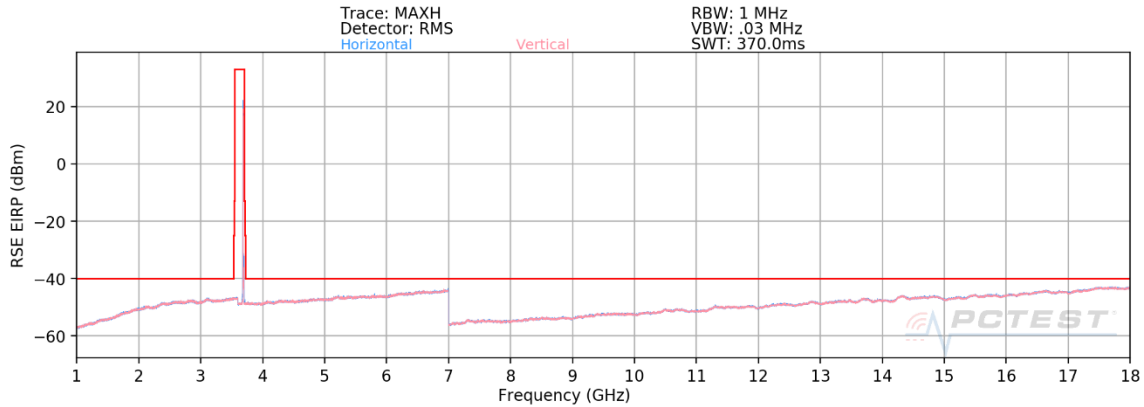
Test Notes

- 1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - a. $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - b. $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$; where D is the measurement distance in meters.
- 2) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below. 1RB config was found and reported as a worst case RB size.
- 3) This unit was tested with its standard battery.
- 4) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 5) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
- 6) The "-" shown in the following RSE tables are used to denote a noise floor measurement.
- 7) 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.
- 8) 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.
- 9) 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.

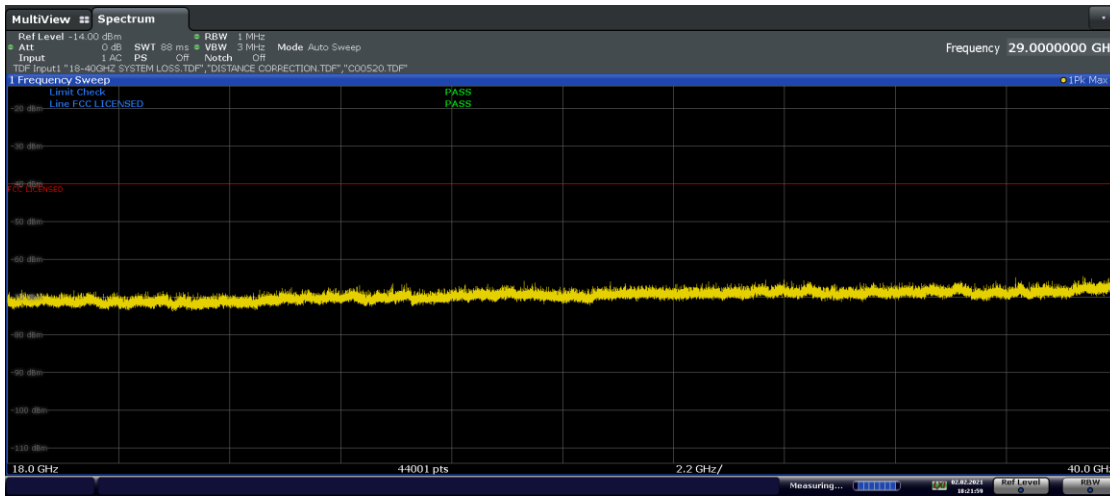
FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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7.7.1 Antenna 3 Radiated Spurious Emissions Measurements

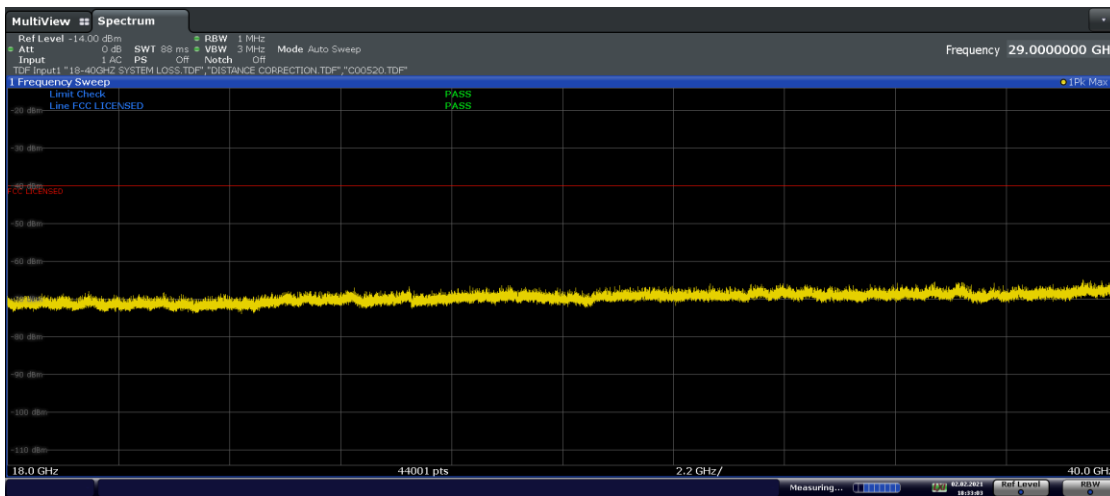
LTE Band 48



Plot 7-72. Radiated Spurious Plot 1 - 18GHz (Band 48)



Plot 7-73. Radiated Spurious Plot 18 - 40GHz (Band 48 - Ant. Pol H)



Plot 7-74. Radiated Spurious Plot 18 - 40GHz (Band 48 - Ant. Pol V)

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Bandwidth (MHz):	20
Frequency (MHz):	3560
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]	Limit [dBm]	Margin [dB]
7120.0	V	-	-	-72.63	10.69	45.06	-50.20	-40.00	-10.20
10680.0	V	-	-	-75.12	15.75	47.63	-47.63	-40.00	-7.63
14240.0	V	-	-	-76.39	20.22	50.83	-44.43	-40.00	-4.43

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

Bandwidth (MHz):	20
Frequency (MHz):	3625
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]	Limit [dBm]	Margin [dB]
7250.0	V	-	-	-72.48	10.60	45.12	-50.14	-40.00	-10.14
10875.0	V	-	-	-75.26	15.53	47.27	-47.99	-40.00	-7.99
14500.0	V	-	-	-76.73	20.13	50.40	-44.86	-40.00	-4.86

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

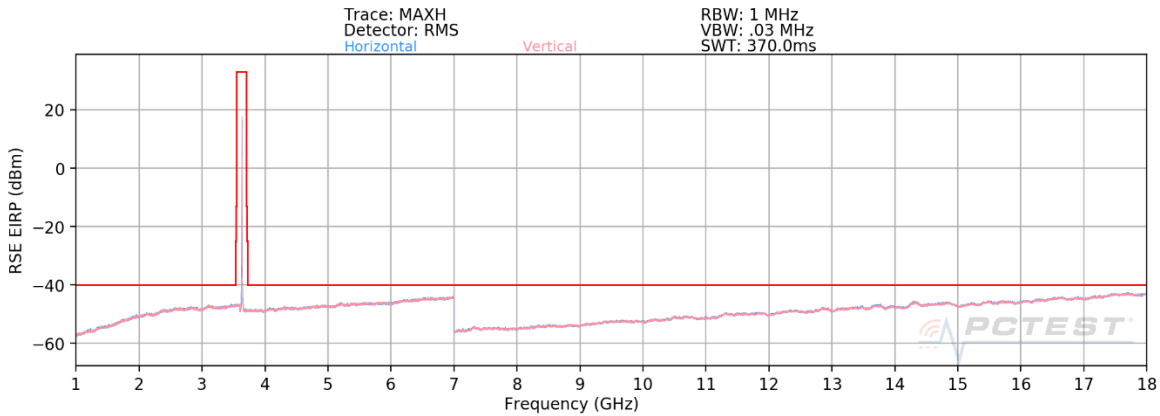
Bandwidth (MHz):	20
Frequency (MHz):	3690
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 50

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]	Limit [dBm]	Margin [dB]
7380.00	V	-	-	-72.30	10.84	45.54	-49.71	-40.00	-9.71
11070.00	V	-	-	-75.12	15.80	47.68	-47.57	-40.00	-7.57
14760.00	V	-	-	-76.45	20.43	50.98	-44.27	-40.00	-4.27

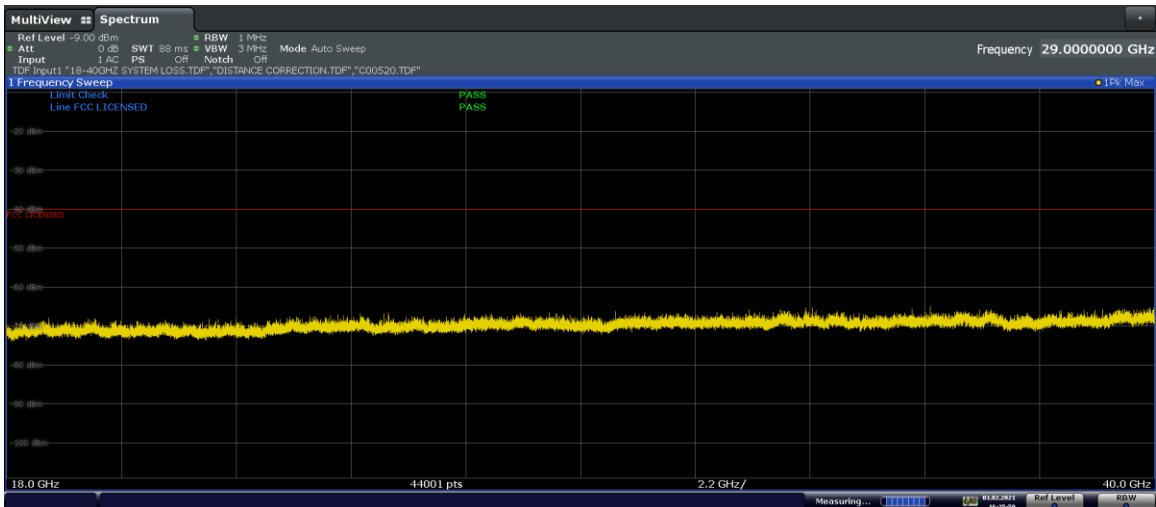
Table 7-13. Radiated Spurious Data (Band 48 – High Channel)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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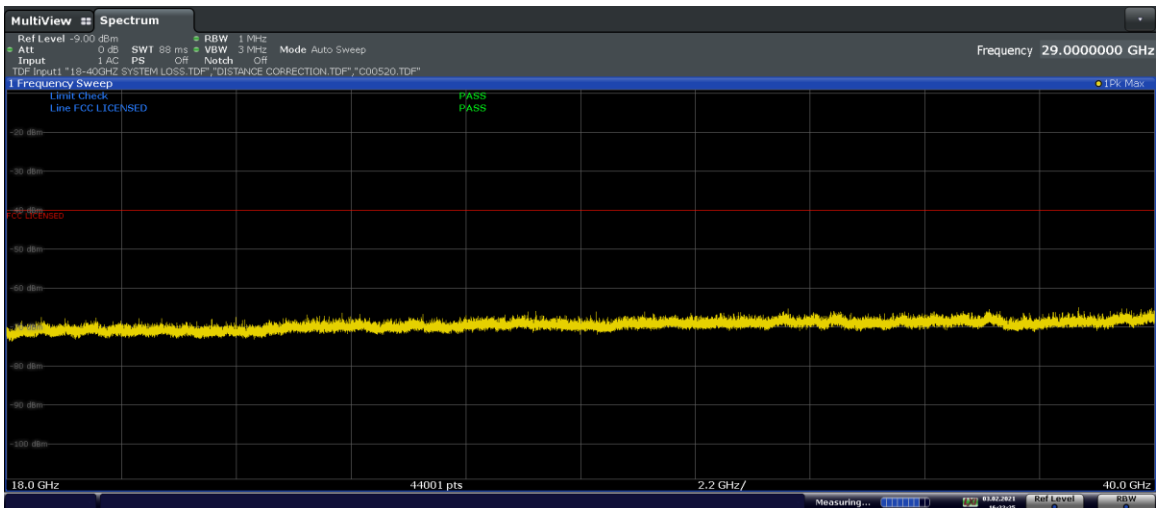
ULCA - LTE Band 48



Plot 7-75. Radiated Spurious Plot 1 - 18GHz (ULCA Band 48)



Plot 7-76. Radiated Spurious Plot 18 - 40GHz (ULCA Band 48 – Ant. Pol H)



Plot 7-77. Radiated Spurious Plot 18 - 40GHz (ULCA Band 48 – Ant. Pol V)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3560
PCC RB (Size / Offset):	1/99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3579.8
SCC RB (Size / Offset):	1/0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7120.0	H	-	-	-72.49	10.69	45.20	-50.06	-40.00	-10.06
10680.0	H	-	-	-75.37	15.75	47.38	-47.88	-40.00	-7.88
14240.0	H	-	-	-76.03	20.22	51.19	-44.07	-40.00	-4.07

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

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3625
PCC RB (Size / Offset):	1/99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3644.8
SCC RB (Size / Offset):	1/0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7250.0	H	-	-	-72.52	10.60	45.08	-50.18	-40.00	-10.18
10875.0	H	-	-	-75.88	15.53	46.65	-48.61	-40.00	-8.61
14500.0	H	-	-	-76.28	20.13	50.85	-44.41	-40.00	-4.41

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

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3690
PCC RB (Size / Offset):	1/0
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3670.2
SCC RB (Size / Offset):	1/99

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7380.00	H	-	-	-72.15	10.84	45.69	-49.56	-40.00	-9.56
11070.00	H	-	-	-75.44	15.80	47.36	-47.89	-40.00	-7.89
14760.00	H	-	-	-76.36	20.43	51.07	-44.18	-40.00	-4.18

Table 7-16. Radiated Spurious Data (ULCA Band 48 – High Channel)

FCC ID: BCGA2301	 PCTEST [®] Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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7.7.2 Antenna 1 Radiated Spurious Emissions Measurements

LTE Band 48

Bandwidth (MHz):	20
Frequency (MHz):	3560
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]	Limit [dBm]	Margin [dB]
7120.0	H	-	-	-72.29	10.69	45.40	-49.86	-40.00	-9.86
10680.0	H	-	-	-75.13	15.75	47.62	-47.64	-40.00	-7.64
14240.0	H	-	-	-76.81	20.22	50.41	-44.85	-40.00	-4.85

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

Bandwidth (MHz):	20
Frequency (MHz):	3625
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]	Limit [dBm]	Margin [dB]
7250.0	H	-	-	-72.47	10.60	45.13	-50.13	-40.00	-10.13
10875.0	H	-	-	-74.95	15.53	47.58	-47.68	-40.00	-7.68
14500.0	H	-	-	-76.06	20.13	51.07	-44.19	-40.00	-4.19

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

Bandwidth (MHz):	20
Frequency (MHz):	3690
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]	Limit [dBm]	Margin [dB]
7380.00	H	-	-	-72.59	10.84	45.25	-50.00	-40.00	-10.00
11070.00	H	-	-	-75.61	15.80	47.19	-48.06	-40.00	-8.06
14760.00	H	-	-	-76.27	20.43	51.16	-44.09	-40.00	-4.09

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

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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ULCA LTE Band 48

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3560
PCC RB (Size / Offset):	1/99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3579.8
SCC RB (Size / Offset):	1/0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7120.0	H	-	-	-72.64	10.69	45.05	-50.21	-40.00	-10.21
10680.0	H	-	-	-75.71	15.75	47.04	-48.22	-40.00	-8.22
14240.0	H	-	-	-75.97	20.22	51.25	-44.01	-40.00	-4.01

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

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3625
PCC RB (Size / Offset):	1/99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3644.8
SCC RB (Size / Offset):	1/0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7250.0	H	-	-	-72.56	10.60	45.04	-50.22	-40.00	-10.22
10875.0	H	-	-	-75.29	15.53	47.24	-48.02	-40.00	-8.02
14500.0	H	-	-	-76.13	20.13	51.00	-44.26	-40.00	-4.26

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

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3690
PCC RB (Size / Offset):	1/0
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3670.2
SCC RB (Size / Offset):	1/99

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7380.00	H	-	-	-72.16	10.84	45.68	-49.57	-40.00	-9.57
11070.00	H	-	-	-75.48	15.80	47.32	-47.93	-40.00	-7.93
14760.00	H	-	-	-76.04	20.43	51.39	-43.86	-40.00	-3.86

Table 7-22. Radiated Spurious Data (ULCA Band 48 – High Channel)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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7.7.3 Antenna 4a Radiated Spurious Emissions Measurements

LTE Band 48

Bandwidth (MHz):	20
Frequency (MHz):	3560
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]	Limit [dBm]	Margin [dB]
7120.0	H	-	-	-72.46	10.69	45.23	-50.03	-40.00	-10.03
10680.0	H	-	-	-75.43	15.75	47.32	-47.94	-40.00	-7.94
14240.0	H	-	-	-76.33	20.22	50.89	-44.37	-40.00	-4.37

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

Bandwidth (MHz):	20
Frequency (MHz):	3625
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]	Limit [dBm]	Margin [dB]
7250.0	H	-	-	-72.77	10.60	44.83	-50.43	-40.00	-10.43
10875.0	H	-	-	-75.59	15.53	46.94	-48.32	-40.00	-8.32
14500.0	H	-	-	-76.16	20.13	50.97	-44.29	-40.00	-4.29

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

Bandwidth (MHz):	20
Frequency (MHz):	3690
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]	Limit [dBm]	Margin [dB]
7380.00	H	-	-	-72.48	10.84	45.36	-49.89	-40.00	-9.89
11070.00	H	-	-	-75.06	15.80	47.74	-47.51	-40.00	-7.51
14760.00	H	-	-	-76.27	20.43	51.16	-44.09	-40.00	-4.09

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

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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ULCA LTE Band 48

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3560
PCC RB (Size / Offset):	1/99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3579.8
SCC RB (Size / Offset):	1/0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7120.0	V	-	-	-72.27	10.69	45.42	-49.84	-40.00	-9.84
10680.0	V	-	-	-74.88	15.75	47.87	-47.39	-40.00	-7.39
14240.0	V	-	-	-75.72	20.22	51.50	-43.76	-40.00	-3.76

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

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3625
PCC RB (Size / Offset):	1/99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3644.8
SCC RB (Size / Offset):	1/0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7250.0	V	-	-	-72.33	10.60	45.27	-49.99	-40.00	-9.99
10875.0	V	-	-	-75.46	15.53	47.07	-48.19	-40.00	-8.19
14500.0	V	-	-	-75.94	20.13	51.19	-44.07	-40.00	-4.07

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

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3690
PCC RB (Size / Offset):	1/0
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3670.2
SCC RB (Size / Offset):	1/99

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7380.00	V	-	-	-72.19	10.84	45.65	-49.60	-40.00	-9.60
11070.00	V	-	-	-74.96	15.80	47.84	-47.41	-40.00	-7.41
14760.00	V	-	-	-76.09	20.43	51.34	-43.91	-40.00	-3.91

Table 7-28. Radiated Spurious Data (ULCA Band 48 – High Channel)

FCC ID: BCGA2301	 PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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7.7.4 Antenna 2a Radiated Spurious Emissions Measurements

LTE Band 48

Bandwidth (MHz):	20
Frequency (MHz):	3560
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]	Limit [dBm]	Margin [dB]
7120.0	H	-	-	-72.64	10.69	45.05	-50.21	-40.00	-10.21
10680.0	H	-	-	-74.93	15.75	47.82	-47.44	-40.00	-7.44
14240.0	H	-	-	-75.87	20.22	51.35	-43.91	-40.00	-3.91

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

Bandwidth (MHz):	20
Frequency (MHz):	3625
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]	Limit [dBm]	Margin [dB]
7250.0	H	-	-	-72.72	10.60	44.88	-50.38	-40.00	-10.38
10875.0	H	-	-	-74.87	15.53	47.66	-47.60	-40.00	-7.60
14500.0	H	-	-	-75.66	20.13	51.47	-43.79	-40.00	-3.79

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

Bandwidth (MHz):	20
Frequency (MHz):	3690
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]	Limit [dBm]	Margin [dB]
7380.00	H	-	-	-72.54	10.84	45.30	-49.95	-40.00	-9.95
11070.00	H	-	-	-74.82	15.80	47.98	-47.27	-40.00	-7.27
14760.00	H	-	-	-76.11	20.43	51.32	-43.93	-40.00	-3.93

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

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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ULCA LTE Band 48

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3560
PCC RB (Size / Offset):	1/99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3579.8
SCC RB (Size / Offset):	1/0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7120.0	V	-	-	-72.24	10.69	45.45	-49.81	-40.00	-9.81
10680.0	V	-	-	-75.61	15.75	47.14	-48.12	-40.00	-8.12
14240.0	V	-	-	-75.94	20.22	51.28	-43.98	-40.00	-3.98

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

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3625
PCC RB (Size / Offset):	1/99
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3644.8
SCC RB (Size / Offset):	1/0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7250.0	V	-	-	-72.65	10.60	44.95	-50.31	-40.00	-10.31
10875.0	V	-	-	-75.26	15.53	47.27	-47.99	-40.00	-7.99
14500.0	V	-	-	-75.88	20.13	51.25	-44.01	-40.00	-4.01

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

PCC Bandwidth (MHz):	20
PCC Frequency (MHz):	3690
PCC RB (Size / Offset):	1/0
SCC Bandwidth (MHz):	20
SCC Frequency (MHz):	3670.2
SCC RB (Size / Offset):	1/99

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7380.00	V	-	-	-72.10	10.84	45.74	-49.51	-40.00	-9.51
11070.00	V	-	-	-75.27	15.80	47.53	-47.72	-40.00	-7.72
14760.00	V	-	-	-76.14	20.43	51.29	-43.96	-40.00	-3.96

Table 7-34. Radiated Spurious Data (ULCA Band 48 – High Channel)

FCC ID: BCGA2301	 PCTEST [®] Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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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, 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

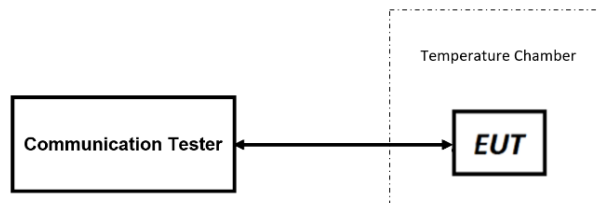


Figure 7-7. Test Instrument & Measurement Setup

Test Notes

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

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LTE Band 48 Frequency Stability Measurements

LTE Band 48							
		Low Ch. Frequency (Hz):		3,560,000,000			
		High Ch. Frequency (Hz):		3,690,000,000			
		Ref. Voltage (VDC):		3.80			
Voltage (%)	Power (VDC)	Temp (°C)	Low Ch. Frequency (Hz)	High Ch. Frequency (Hz)	Low Ch. Frequency Dev. (Hz)	High Ch. Frequency Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	3,560,000,009	3,690,000,005	16	4	0.0000004
		- 20	3,560,000,003	3,690,000,006	10	5	0.0000003
		- 10	3,560,000,008	3,689,999,998	15	-3	0.0000004
		0	3,560,000,005	3,690,000,007	12	6	0.0000003
		+ 10	3,560,000,006	3,689,999,999	13	-2	0.0000004
		+ 20 (Reference)	3,559,999,993	3,690,000,001	0	0	0.0000000
		+ 30	3,560,000,002	3,690,000,007	9	6	0.0000003
		+ 40	3,560,000,007	3,690,000,003	14	2	0.0000004
		+ 50	3,560,000,006	3,690,000,004	13	3	0.0000004
Battery Endpoint	3.23	+ 20	3,560,000,003	3,689,999,996	10	-5	0.0000003

Table 7-35. Frequency Stability Data (LTE Band 48)

Note:

The lowest and highest channel of this band have been tested and is determined to remain operating in-band over the temperature and voltage range as tested.

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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 v02, 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 3570MHz – 3590MHz.
 - 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 3550MHz – 3560MHz.
 - 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.

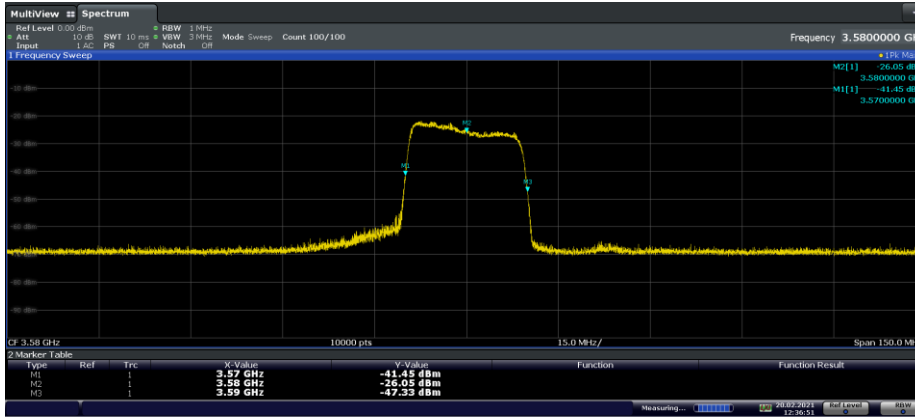
Test Notes

The EUT is an End User Device.

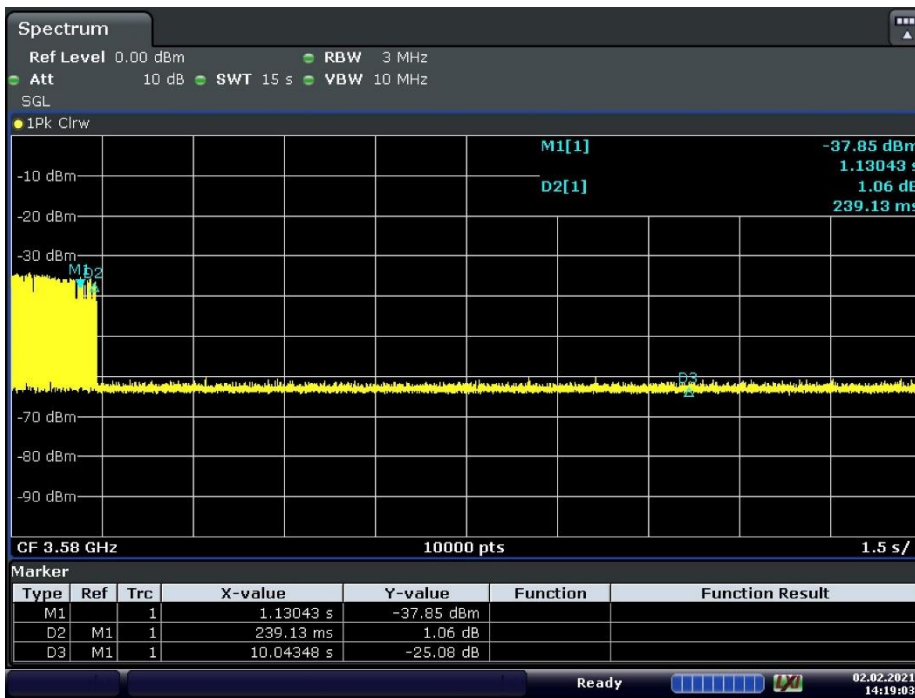
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Run#1:

- Tx Frequency Set: 3570 – 3590MHz
- MaxEIRP Set: 23dBm/MHz



Plot 7-78. Run#1 End User Device Frequency of Operations



Date: 2.FEB.2021 14:19:04

Plot 7-79. Run#1 End User Device Discontinues Operations within 10s

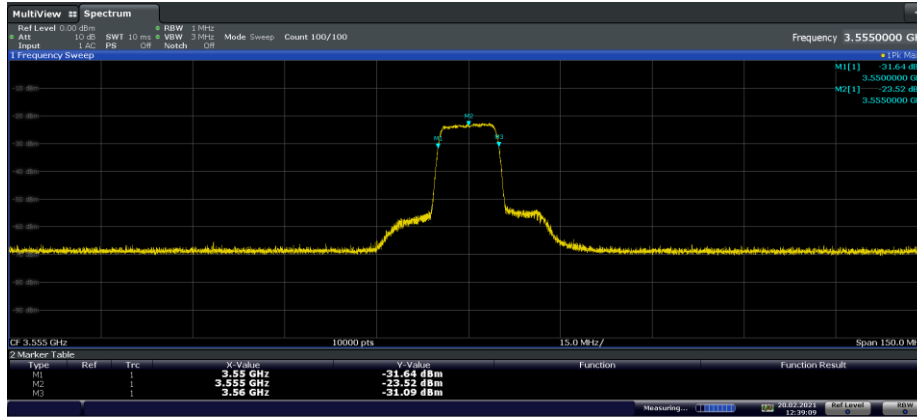
Note:

- 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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Run#2:

- Tx Frequency Set: 3550 – 3560MHz
- MaxEIRP Set: 23dBm/MHz



Plot 7-80. Run#2 End User Device Frequency of Operations



Date: 2.FEB.2021 14:23:45

Plot 7-81. 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 Device FCC ID: BCGA2301** complies with all of the End User Device requirements of Part 96 of the FCC Rules for LTE operation only.

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Test Report S/N: 1C2101020002-08.BCG	Test Dates: 12/15/2020-03/04/2021		EUT Type: Tablet Device