



MEASUREMENT REPORT

FCC Part 90

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.:

1C2101020002-07.BCG

FCC ID:

BCGA2301

APPLICANT:

Apple Inc.

Application Type:

Certification

Model:

A2301

EUT Type:

Tablet Device

FCC Classification:

PCS Licensed Transmitter (PCB)

FCC Rule Part:


§2.1049, §90(S), §90(R)

Test Procedure(s):

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

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.

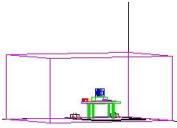

Randy Ortanez
President

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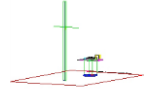
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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	Measurement	Max. Power [W]	Max. Power [dBm]	Emission Designator
LTE Band 26	10 MHz	QPSK	819.0	8.9625	Conducted	0.372	25.70	8M96G7W
		16QAM	819.0	8.9841	Conducted	0.250	23.98	8M98D7W
		64QAM	819.0	8.9597	Conducted	0.239	23.78	8M96D7W
		256QAM	819.0	8.9491	Conducted	0.125	20.96	8M95D7W
	5 MHz	QPSK	816.5 - 821.5	4.4953	Conducted	0.372	25.70	4M50G7W
		16QAM	816.5 - 821.5	4.4850	Conducted	0.305	24.84	4M49D7W
		64QAM	816.5 - 821.5	4.4934	Conducted	0.261	24.17	4M49D7W
		256QAM	816.5 - 821.5	4.4947	Conducted	0.118	20.73	4M49D7W
	3 MHz	QPSK	815.5 - 822.5	2.6941	Conducted	0.370	25.68	2M69G7W
		16QAM	815.5 - 822.5	2.6973	Conducted	0.316	24.99	2M70D7W
		64QAM	815.5 - 822.5	2.6956	Conducted	0.259	24.14	2M70D7W
		256QAM	815.5 - 822.5	2.6898	Conducted	0.129	21.12	2M69D7W
	1.4 MHz	QPSK	814.7 - 823.3	1.0832	Conducted	0.372	25.70	1M08G7W
		16QAM	814.7 - 823.3	1.0862	Conducted	0.306	24.86	1M09D7W
		64QAM	814.7 - 823.3	1.0787	Conducted	0.242	23.84	1M08D7W
		256QAM	814.7 - 823.3	1.0826	Conducted	0.124	20.93	1M08D7W
LTE Band 14	10 MHz	QPSK	793.0	9.0042	ERP	0.111	20.45	9M00G7W
		16QAM	793.0	9.0184	ERP	0.095	19.79	9M02D7W
		64QAM	793.0	9.0015	ERP	0.073	18.62	9M00D7W
		256QAM	793.0	8.9989	ERP	0.037	15.71	9M00D7W
	5 MHz	QPSK	790.5 - 795.5	4.5469	ERP	0.111	20.45	4M55G7W
		16QAM	790.5 - 795.5	4.5264	ERP	0.094	19.71	4M53D7W
		64QAM	790.5 - 795.5	4.5370	ERP	0.073	18.64	4M54D7W
		256QAM	790.5 - 795.5	4.5292	ERP	0.038	15.82	4M53D7W

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 and the Innovation, Science and Economic Development Canada.

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 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: BCGA2301**. 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 Parts 90(S) & 90(R).

Test Device Serial No.: NQ73CFK6VJ, LGXMHP6X6Y, DLX0384008YQ4FC1D

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 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
LTE Band 14	-3.1	-2.2
LTE Band 26	-1.9	-3.2

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

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 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 Evaluation Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI C63.26-2015 and 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

\$2.1053, \$90.635, \$90(S)

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 C63.26-2015 and TIA-603-E-2016.

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4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (\pm dB)
Conducted Bench Top Measurements	1.65
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
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 List

Notes:

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

16QAM 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 (1564 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum 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: PCS Licensed Transmitter (PCB)
Mode(s): LTE
Band: Band 26 / Band 14

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 90(S).691(a) 90(R).543(a)	Conducted Band Edge / Spurious Emissions	On all frequencies between 769-775 MHz and 799-805 MHz, attenuation by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations. On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, attenuation by at least $43 + 10 \log(P)$ dB.(Band 14) > $43 + 10 \log_{10}(P[\text{Watts}])$ for all out-of-band emissions except > $50 + 10 \log_{10}(P[\text{Watts}])$ at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge (Band 26)		PASS	Sections 7.3, 7.4
2.1046 90.635	Conducted Power	< 100 Watts		PASS	Section 7.5
90.542(a)(7)	Effective Radiated Power (Band 14)	< 3 Watts max. ERP		PASS	Section 7.6
2.1053 90(S).691(a) 90(R).543(e)	Radiated Spurious Emissions	> $43 + 10 \log_{10}(P[\text{Watts}])$ for all out-of-band emissions except > $50 + 10 \log_{10}(P[\text{Watts}])$ at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge	RADIATED	PASS	Section 7.7
2.1055 90.213	Frequency Stability	< 2.5 ppm	CONDUCTED	PASS	Section 7.8

Table 7-1. Summary of Test Results

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Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
- 4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "2G/3G Automation," Version 4.2.
- 5) All ports were investigated and for some test cases only the worst case data was reported.

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

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

Test Setup

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

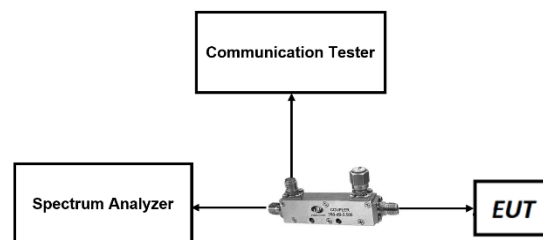


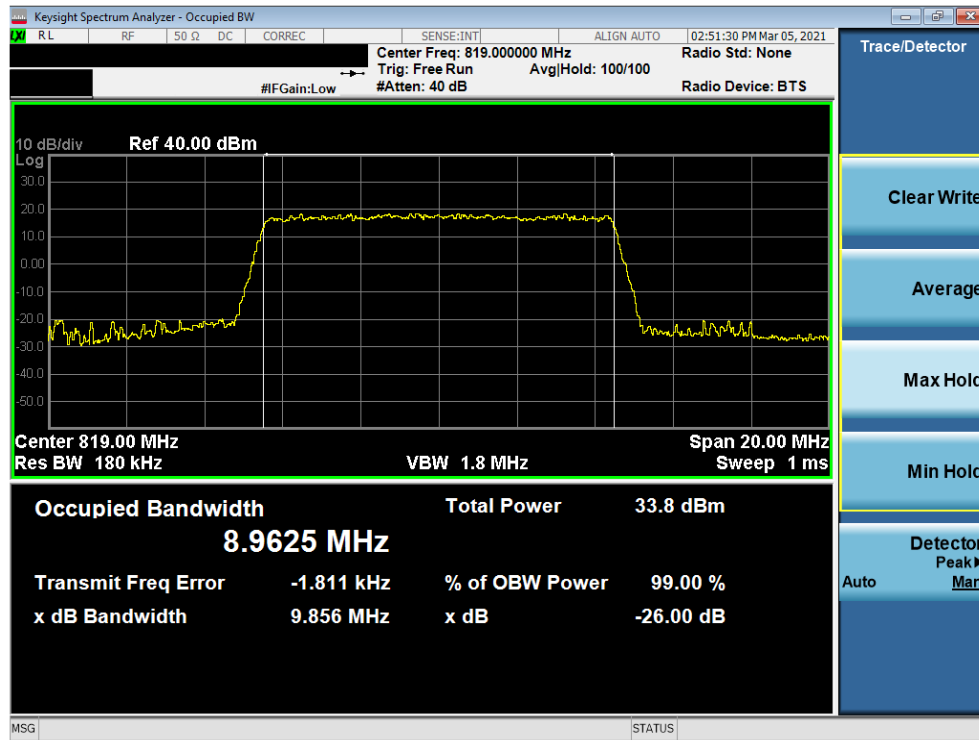
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

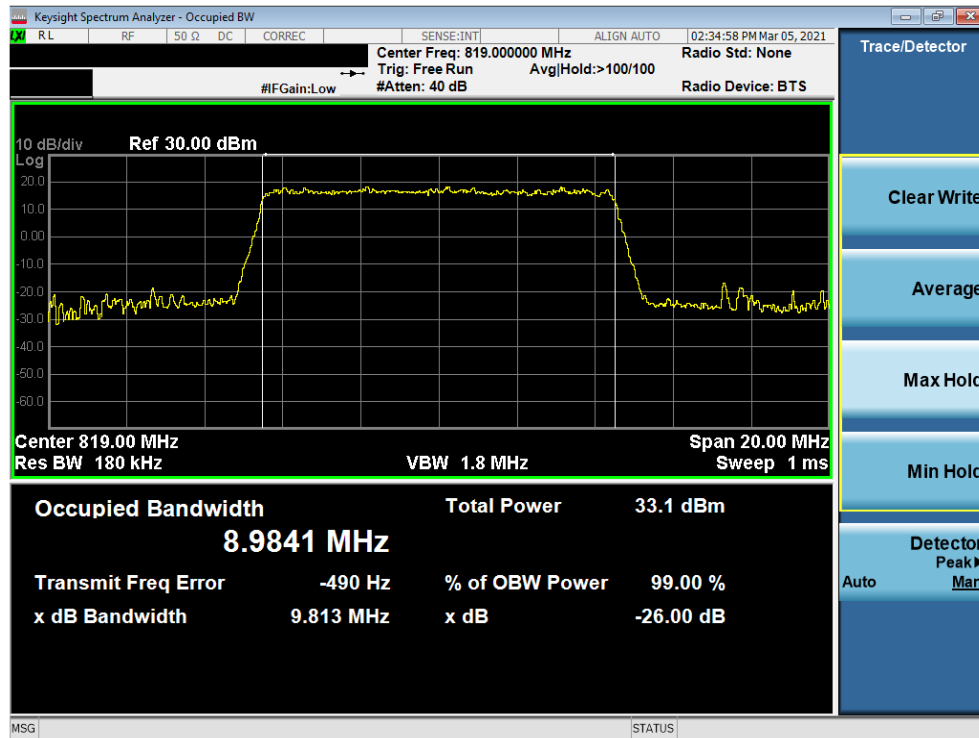
None

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LTE Band 26

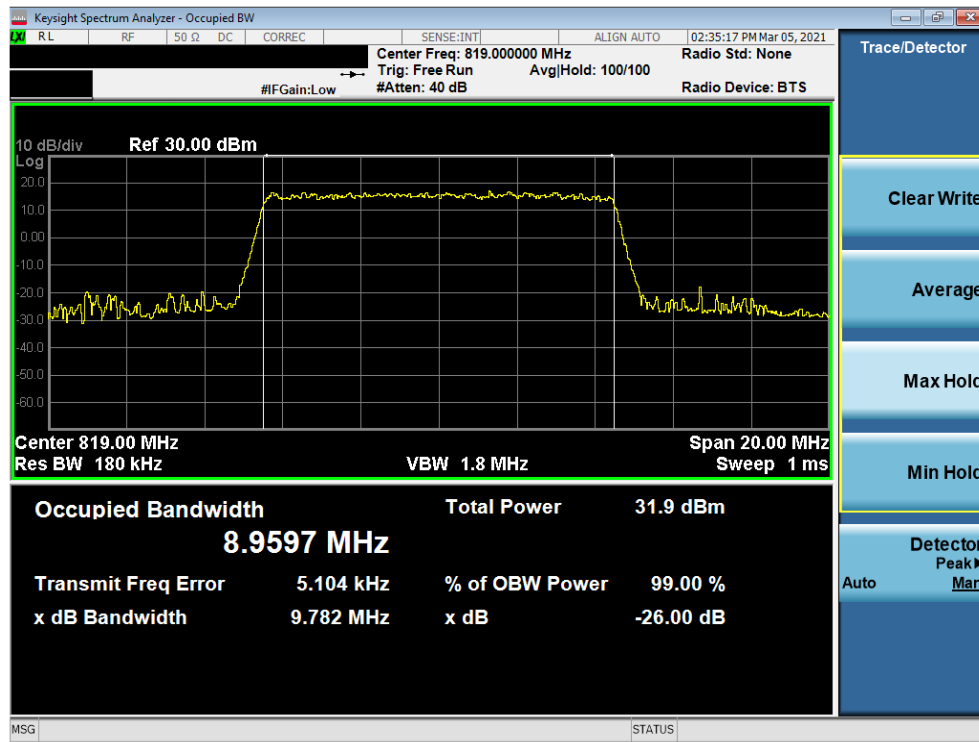


Plot 7-1. Occupied Bandwidth Plot (LTE Band 26 - 10MHz QPSK - Full RB Configuration)

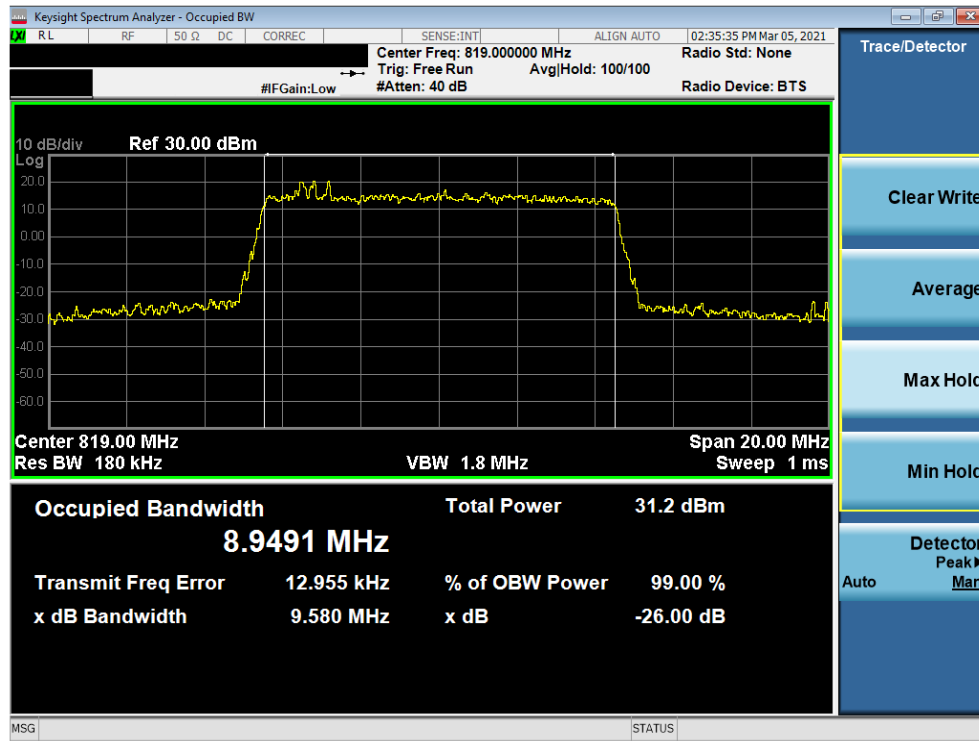


Plot 7-2. Occupied Bandwidth Plot (LTE Band 26 - 10MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 14 of 58

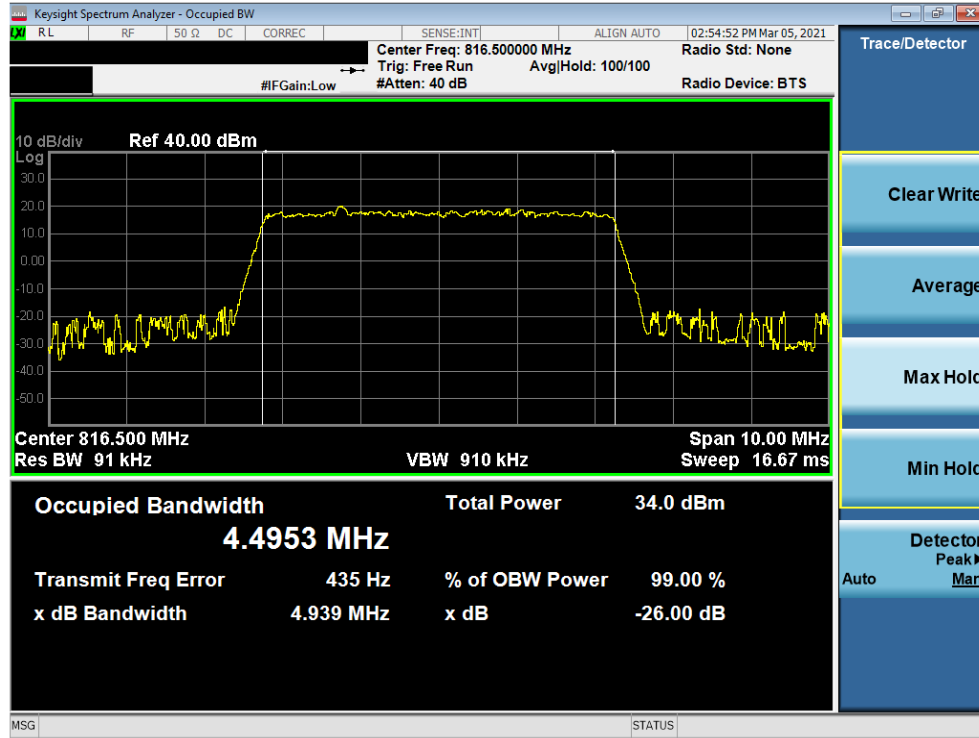


Plot 7-3. Occupied Bandwidth Plot (LTE Band 26 - 10MHz 64-QAM - Full RB Configuration)

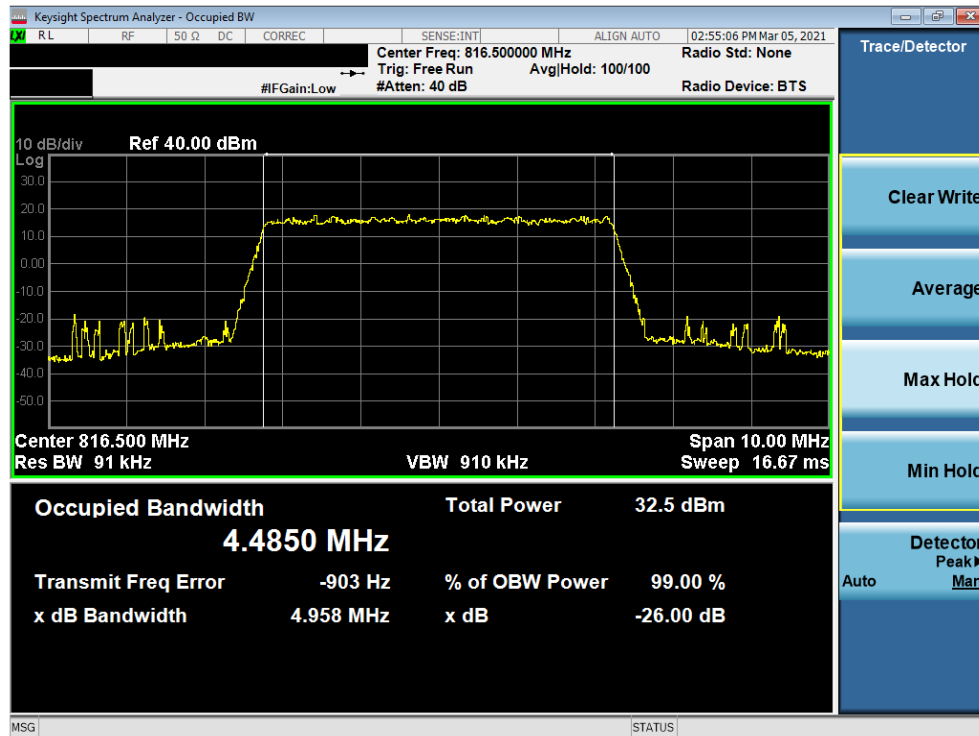


Plot 7-4. Occupied Bandwidth Plot (LTE Band 26 - 10MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 15 of 58

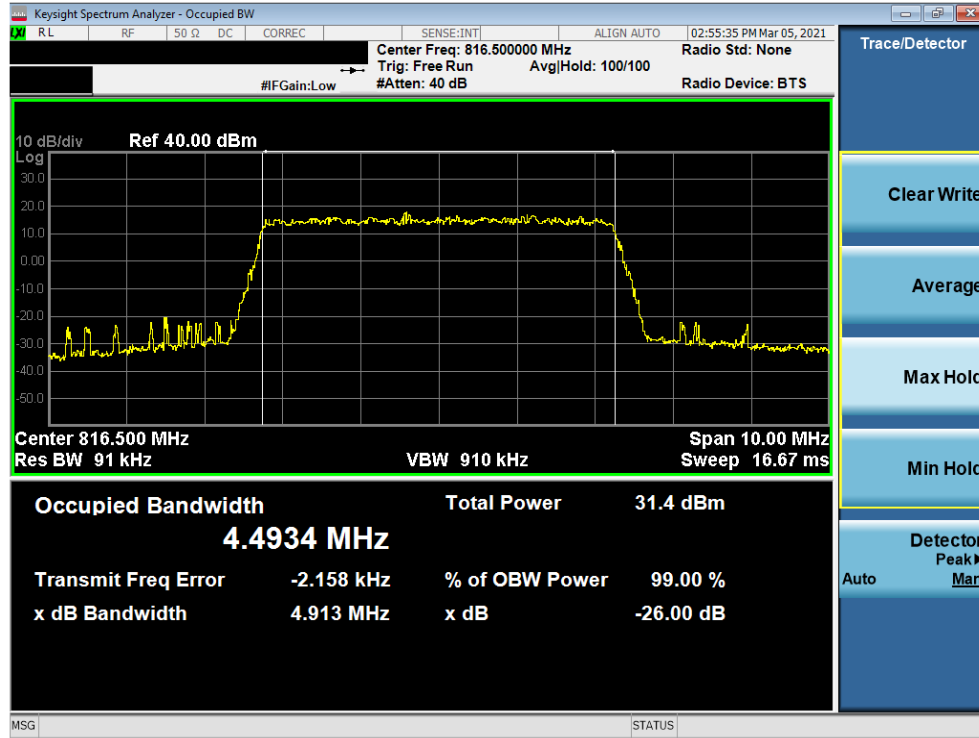


Plot 7-5. Occupied Bandwidth Plot (LTE Band 26 - 5MHz QPSK - Full RB Configuration)

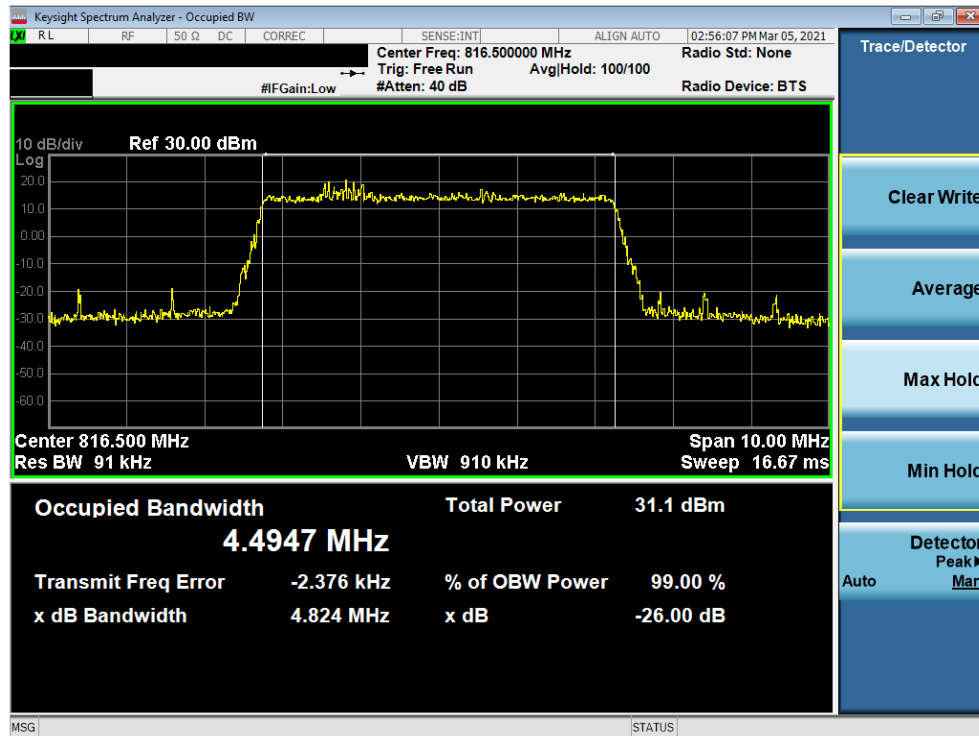


Plot 7-6. Occupied Bandwidth Plot (LTE Band 26 - 5MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 16 of 58

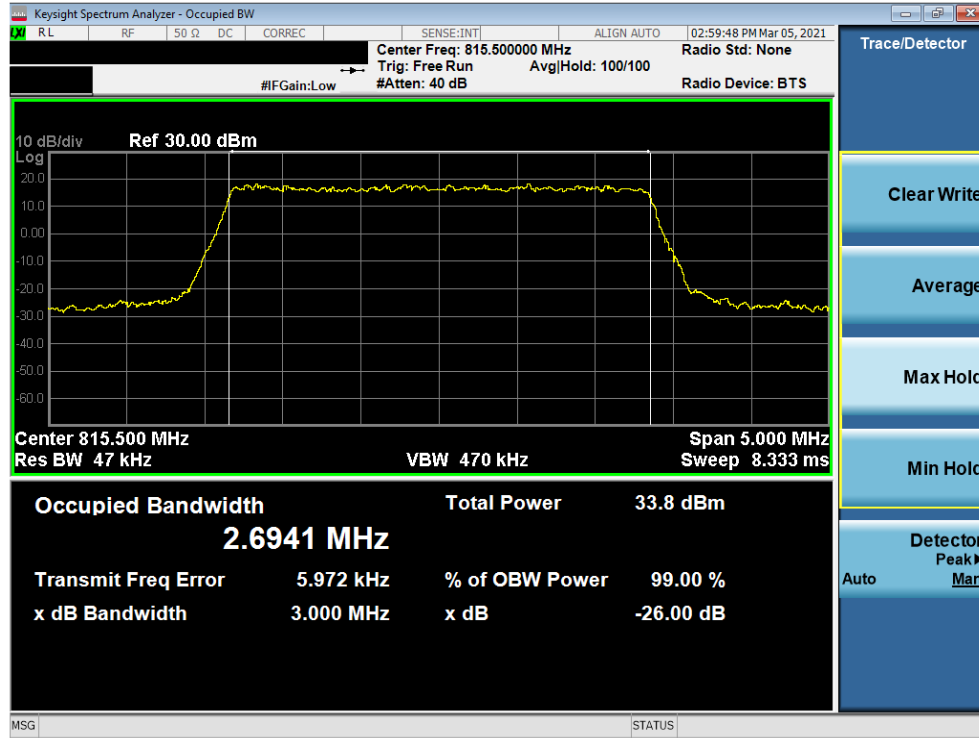


Plot 7-7. Occupied Bandwidth Plot (LTE Band 26 - 5MHz 64-QAM - Full RB Configuration)

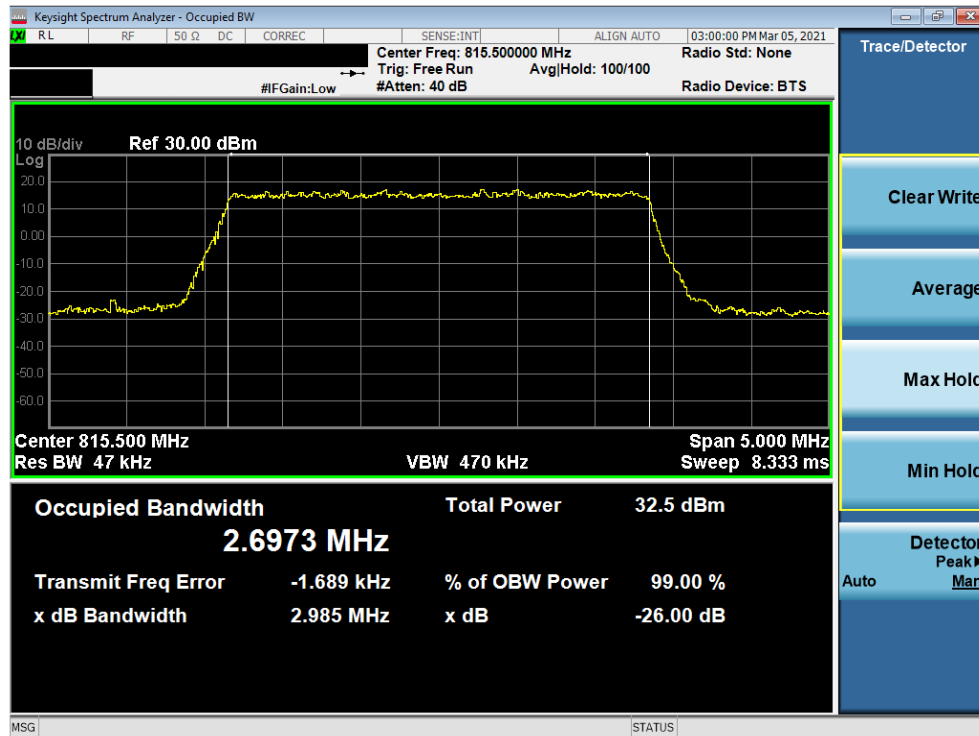


Plot 7-8. Occupied Bandwidth Plot (LTE Band 26 - 5MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 17 of 58

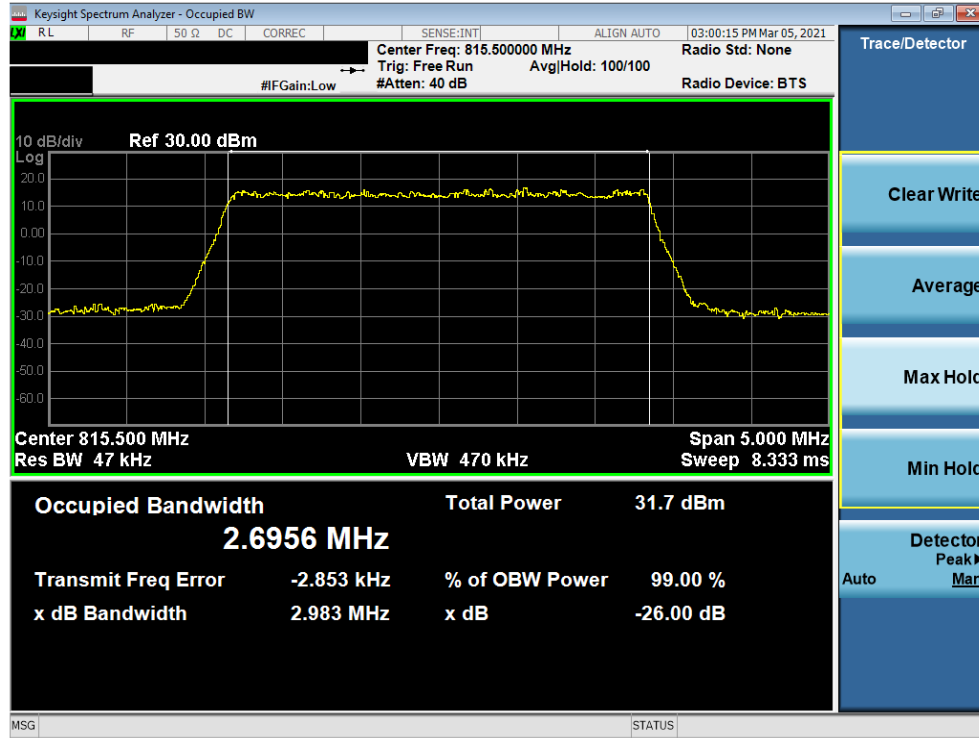


Plot 7-9. Occupied Bandwidth Plot (LTE Band 26 - 3MHz QPSK - Full RB Configuration)

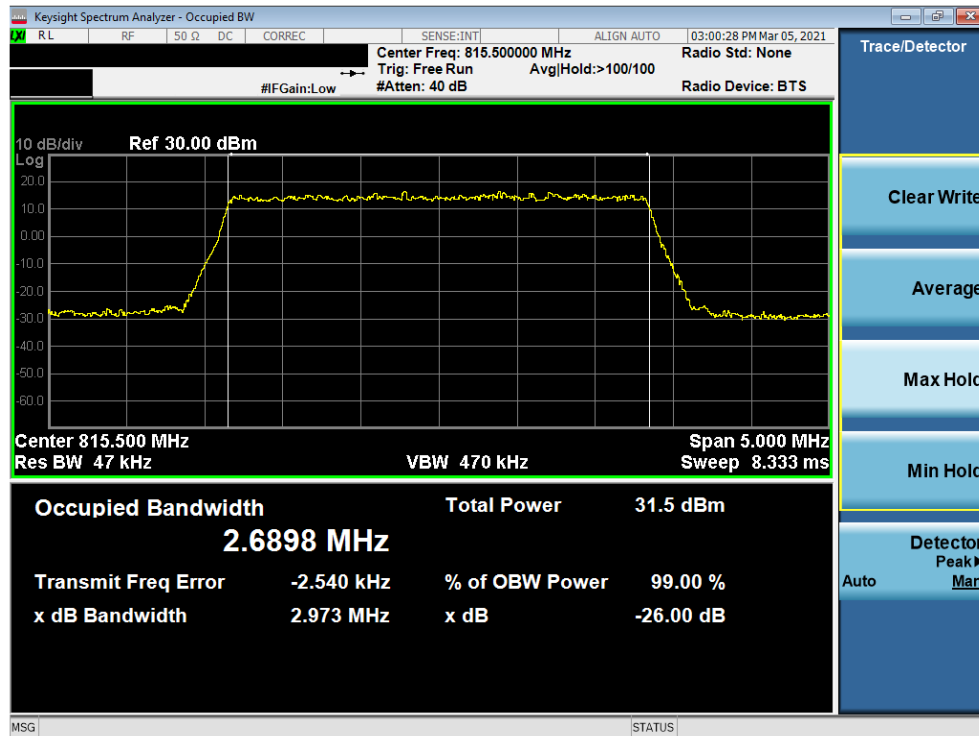


Plot 7-10. Occupied Bandwidth Plot (LTE Band 26 - 3MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 18 of 58

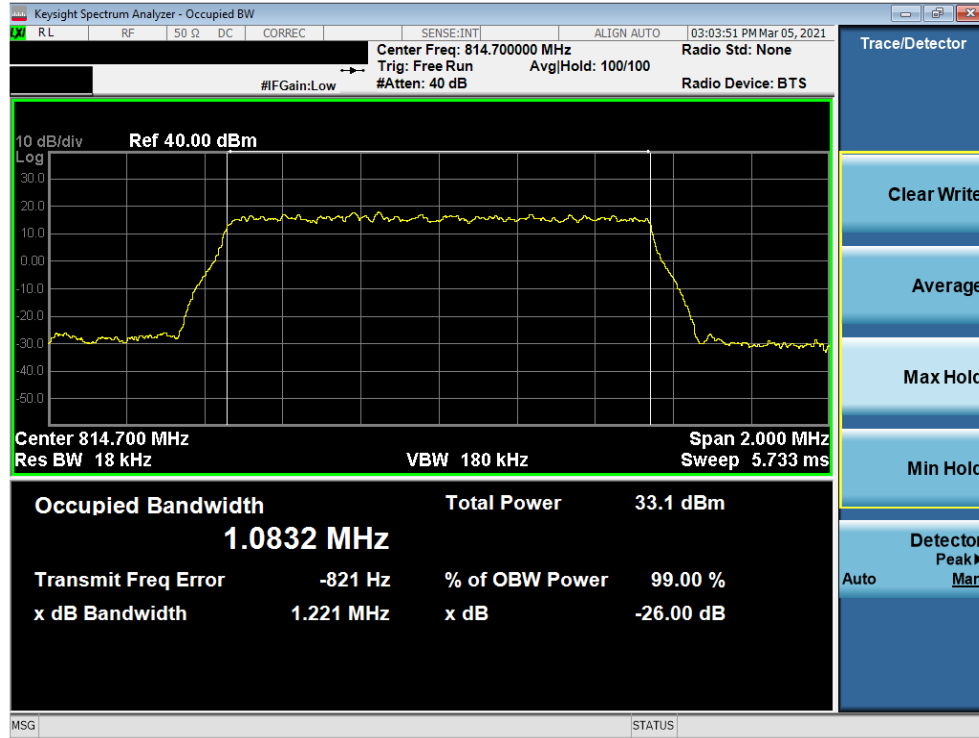


Plot 7-11. Occupied Bandwidth Plot (LTE Band 26 - 3MHz 64-QAM - Full RB Configuration)

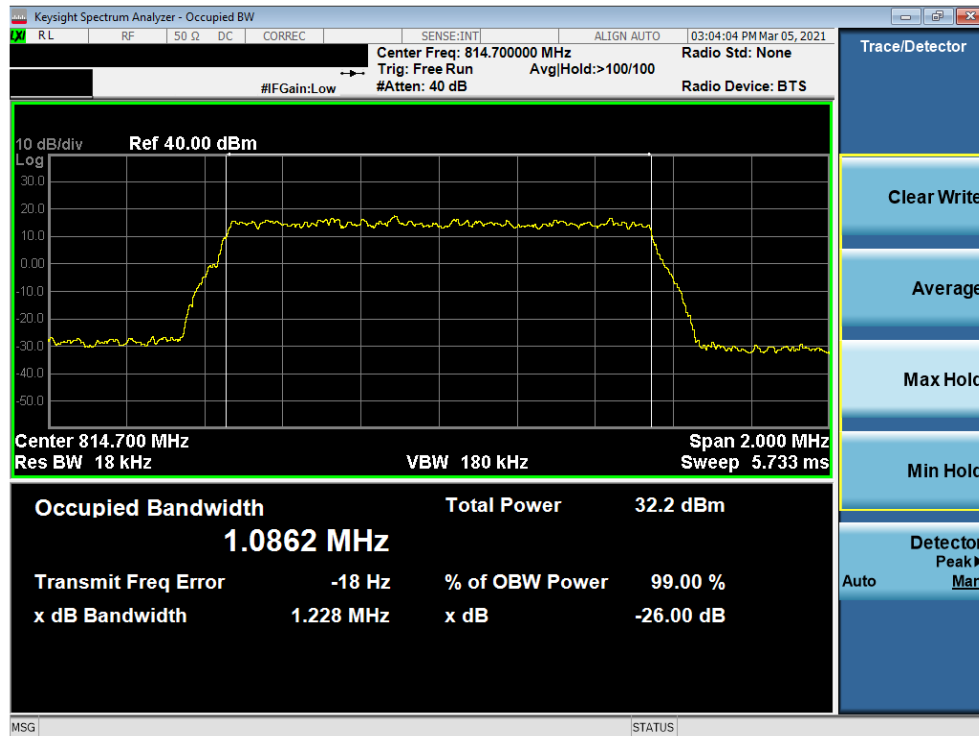


Plot 7-12. Occupied Bandwidth Plot (LTE Band 26 - 3MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 19 of 58

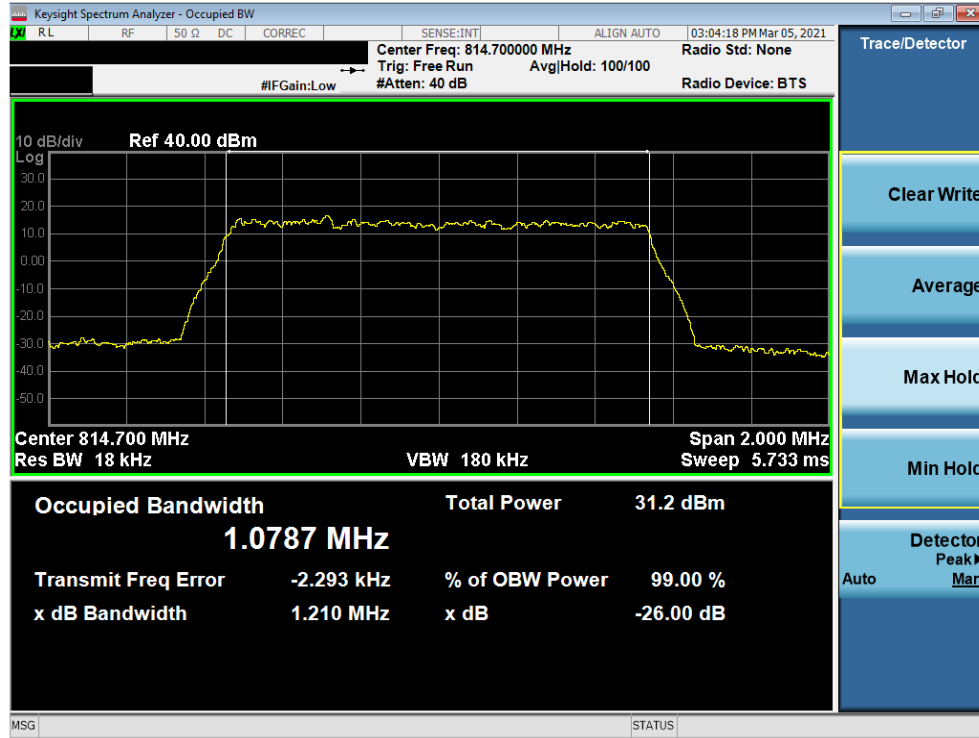


Plot 7-13. Occupied Bandwidth Plot (LTE Band 26 - 1.4MHz QPSK - Full RB Configuration)

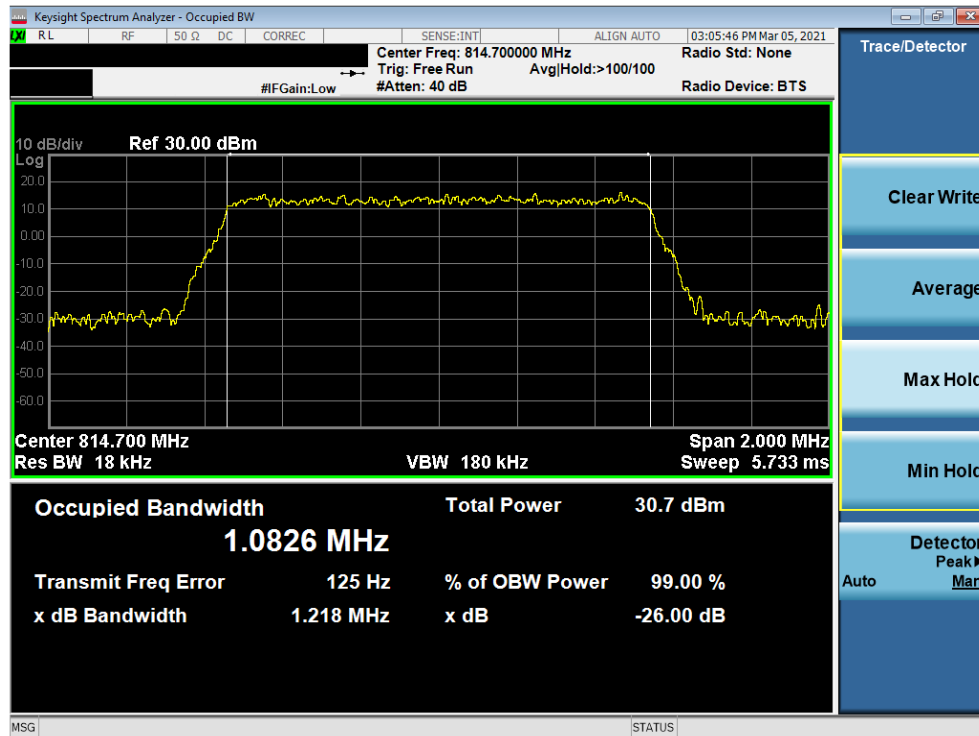


Plot 7-14. Occupied Bandwidth Plot (LTE Band 26 - 1.4MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 20 of 58



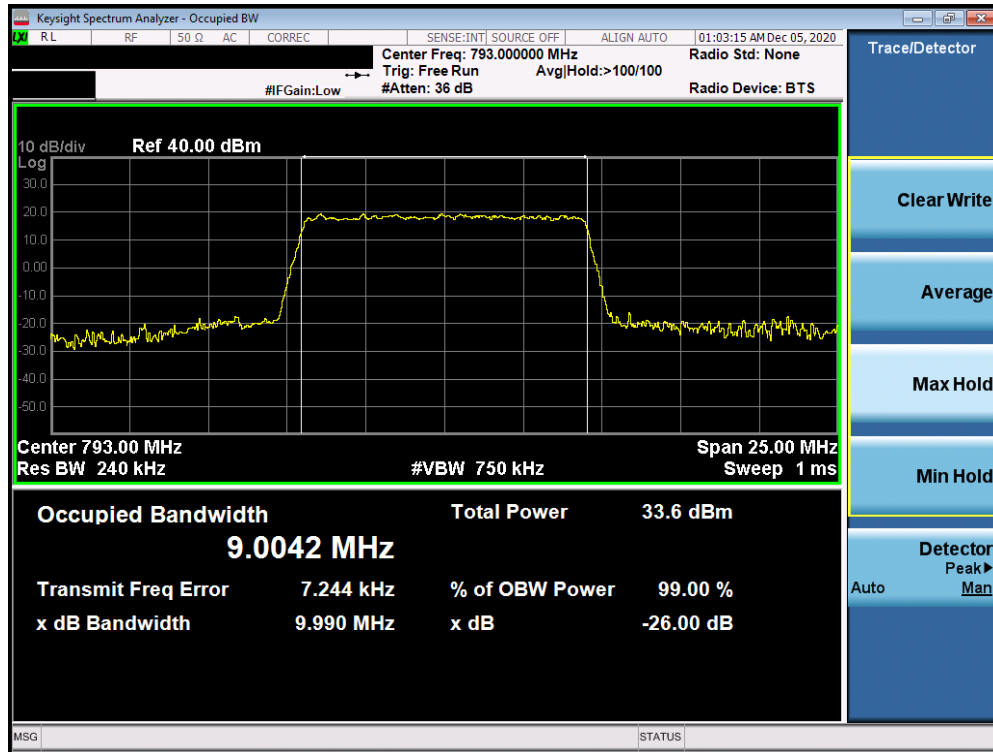
Plot 7-15. Occupied Bandwidth Plot (LTE Band 26 - 1.4MHz 64-QAM - Full RB Configuration)



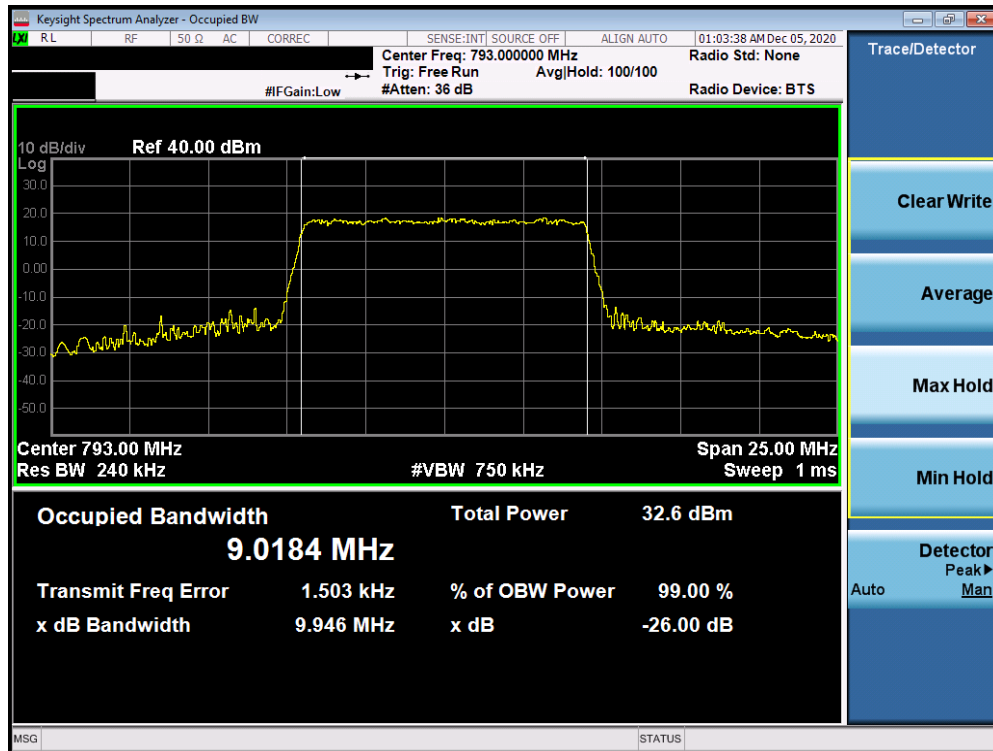
Plot 7-16. Occupied Bandwidth Plot (LTE Band 26 - 1.4MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 21 of 58

LTE Band 14

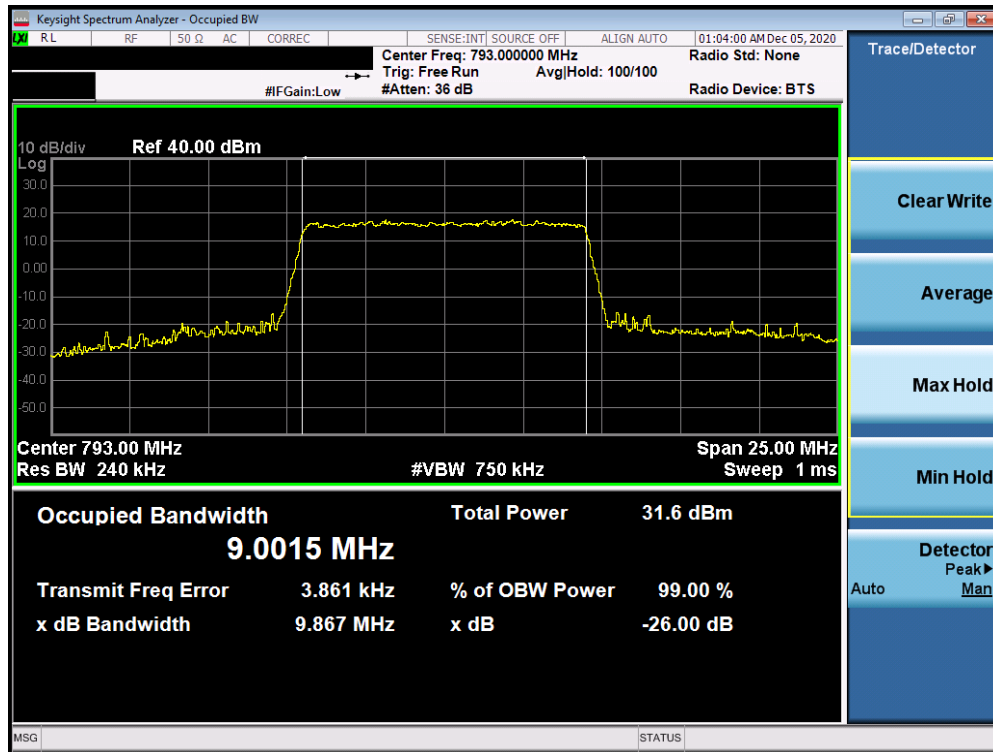


Plot 7-17. Occupied Bandwidth Plot (Band 14 - 10MHz QPSK - Full RB Configuration)

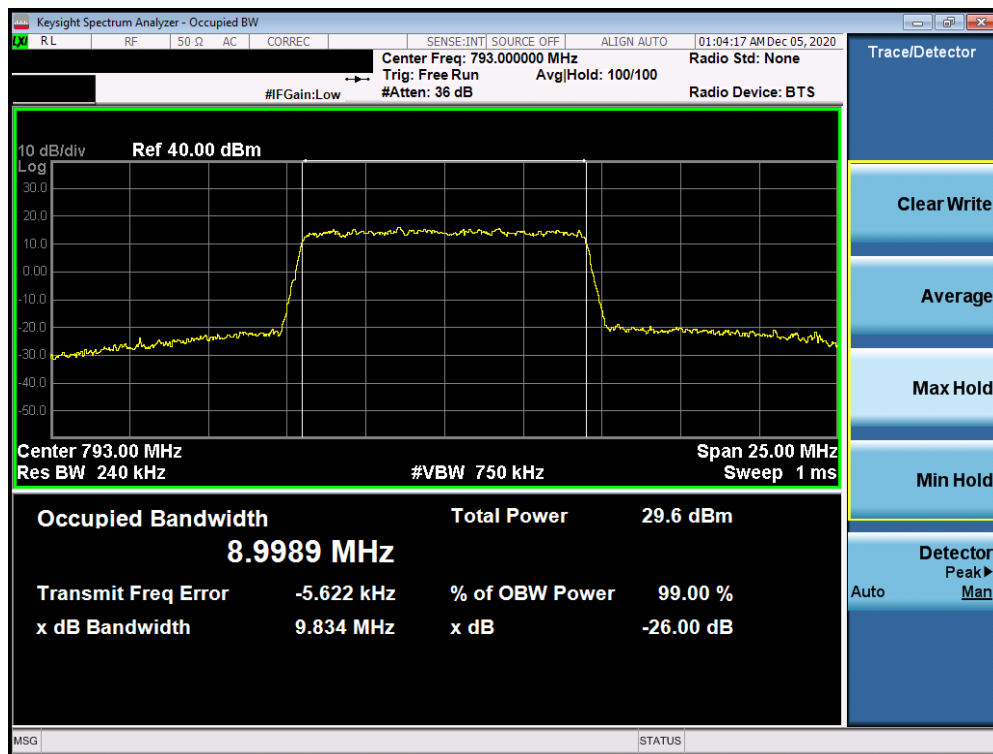


Plot 7-18. Occupied Bandwidth Plot (Band 14 - 10MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 22 of 58

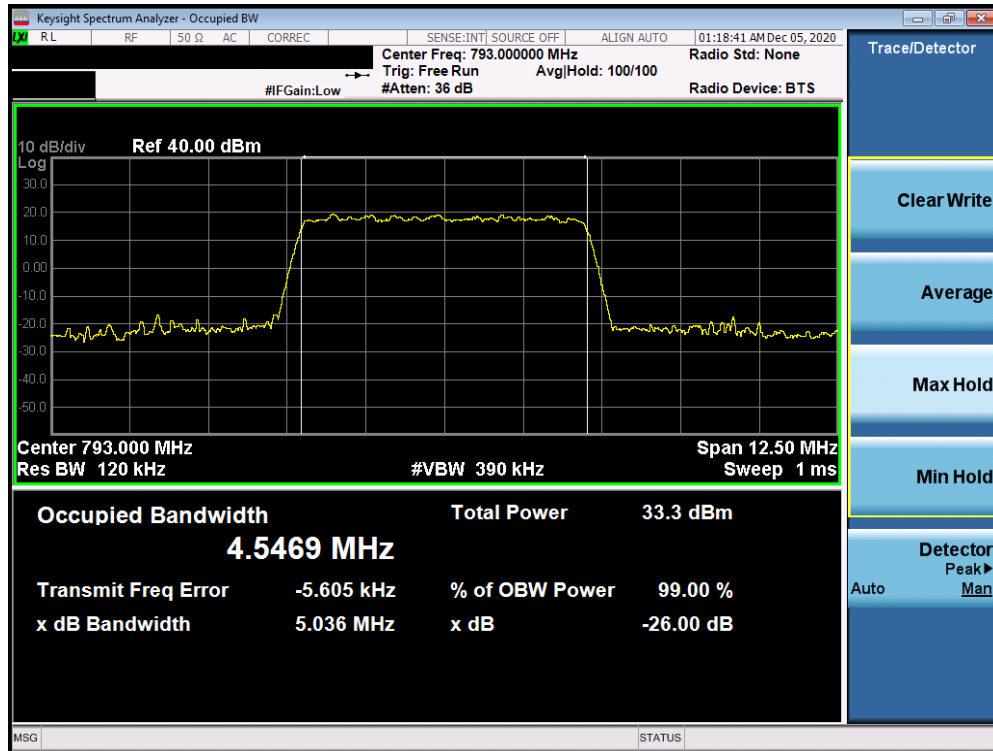


Plot 7-19. Occupied Bandwidth Plot (Band 14 - 10MHz 64-QAM - Full RB Configuration)

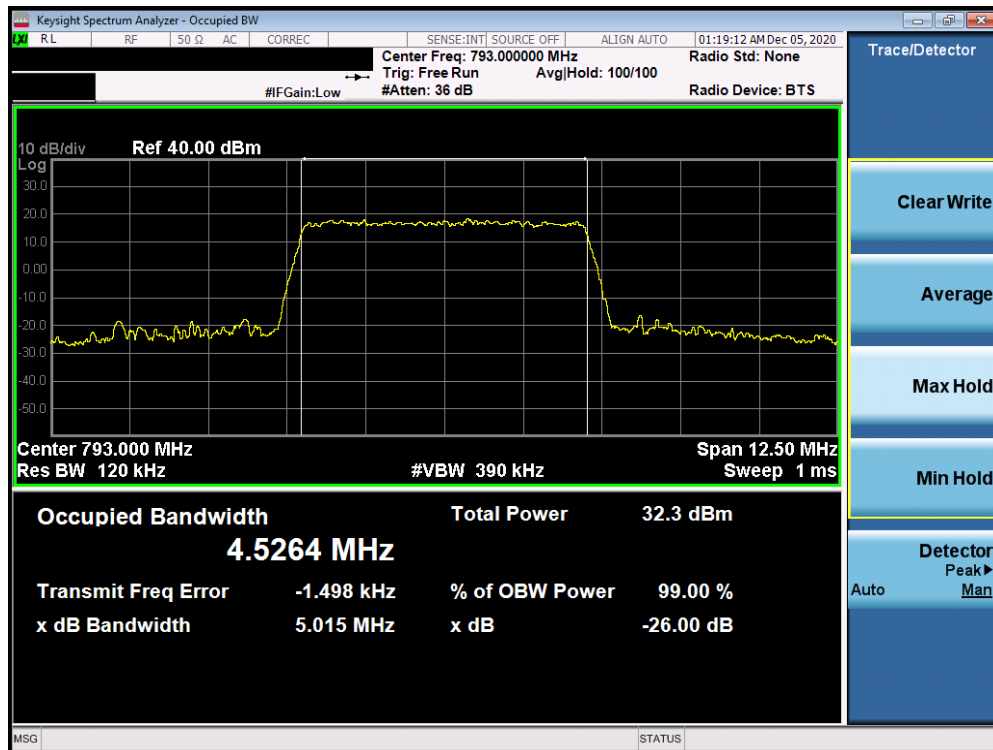


Plot 7-20. Occupied Bandwidth Plot (Band 14 - 10MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 23 of 58

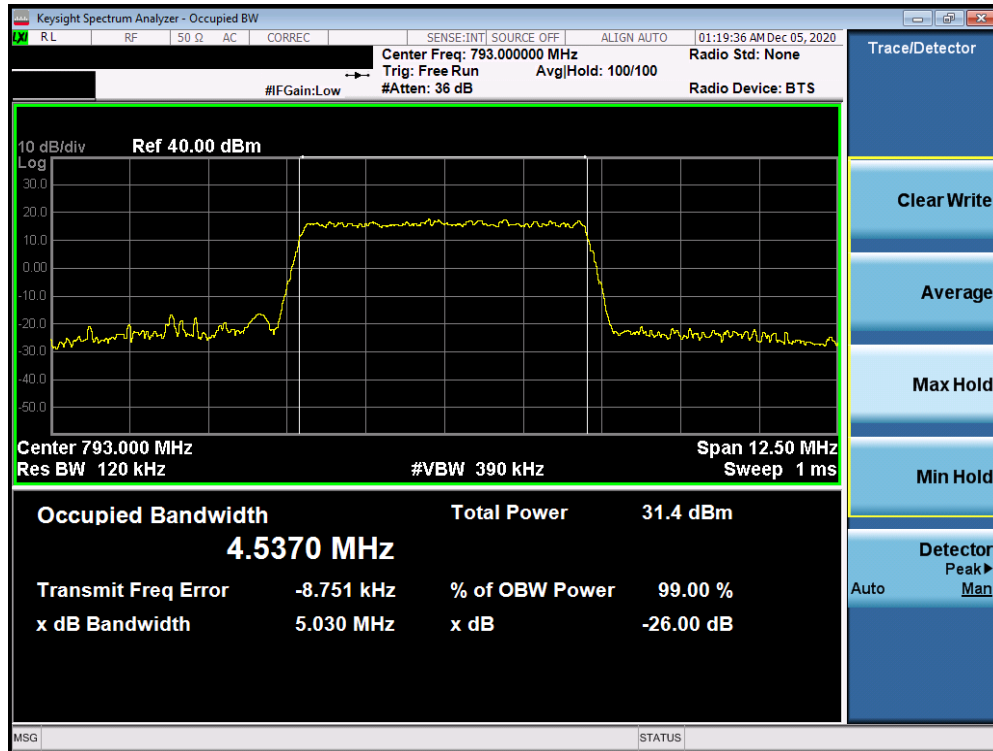


Plot 7-21. Occupied Bandwidth Plot (Band 14 - 5MHz QPSK - Full RB Configuration)

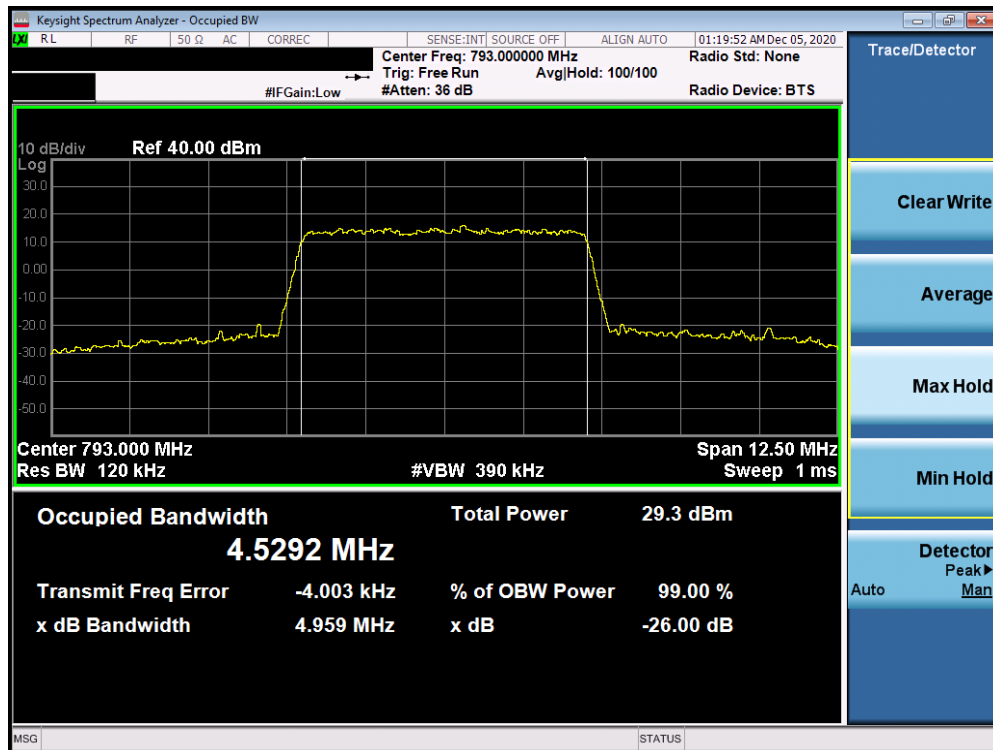


Plot 7-22. Occupied Bandwidth Plot (Band 14 - 5MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 24 of 58



Plot 7-23. Occupied Bandwidth Plot (Band 14 - 5MHz 64-QAM - Full RB Configuration)



Plot 7-24. Occupied Bandwidth Plot (Band 14 - 5MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 25 of 58

7.3 Spurious and Harmonic Emissions at Antenna Terminal §2.1051 §90(S).691(a) §90(R).543(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 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 minimum permissible attenuation level of any spurious emission is $43 + 10 \log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts.

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 10GHz (separated into at least two plots per channel)
2. RBW \geq 100kHz
3. VBW \geq 3 x RBW
4. Detector = RMS
5. Trace mode = trace average
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

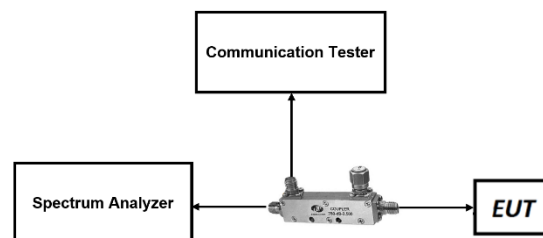


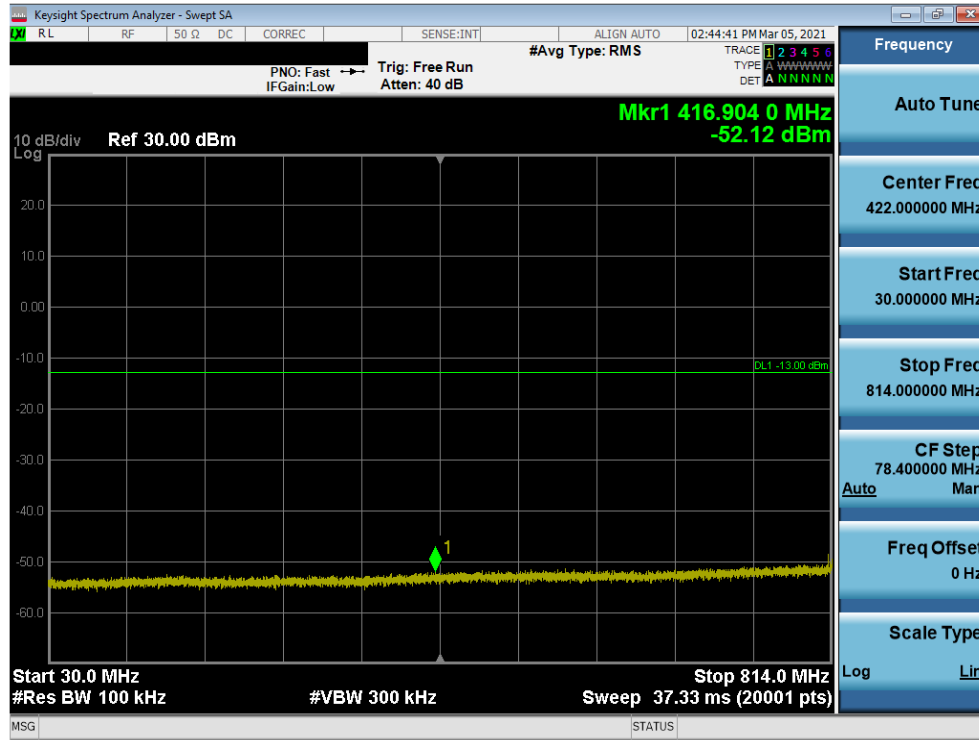
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

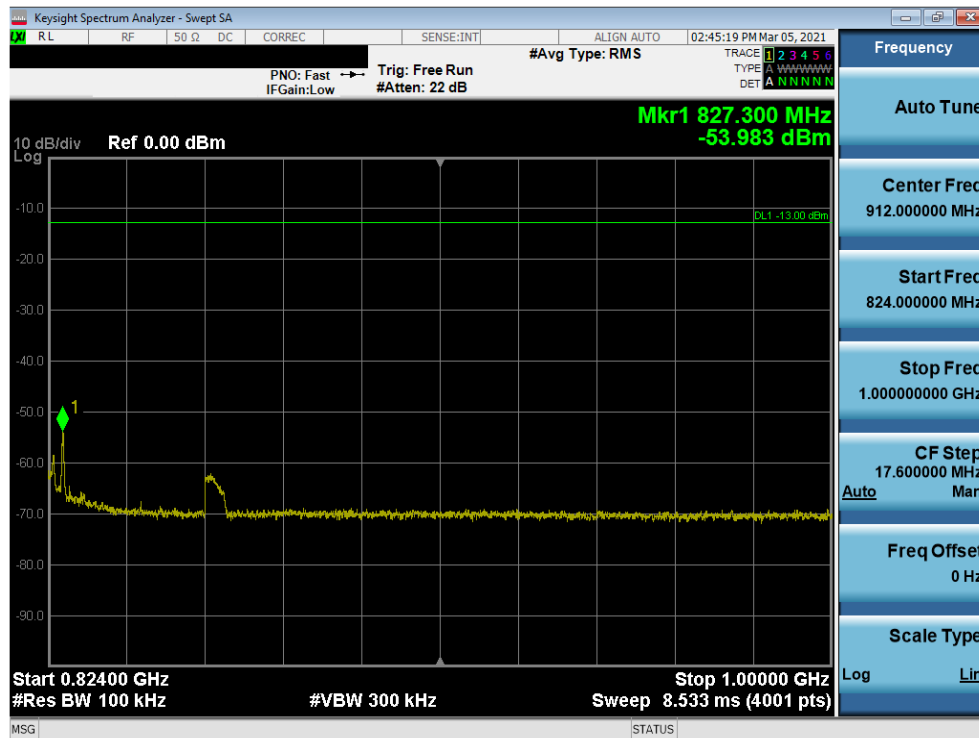
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for Part 90. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission 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.

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device		Page 26 of 58

LTE Band 26

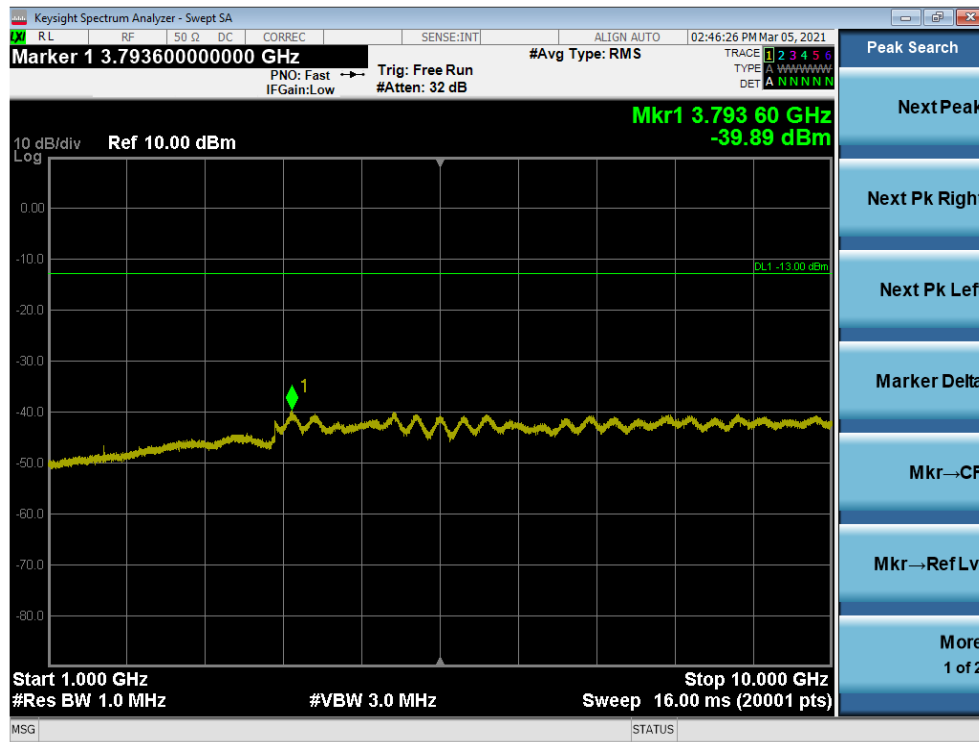


Plot 7-25. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

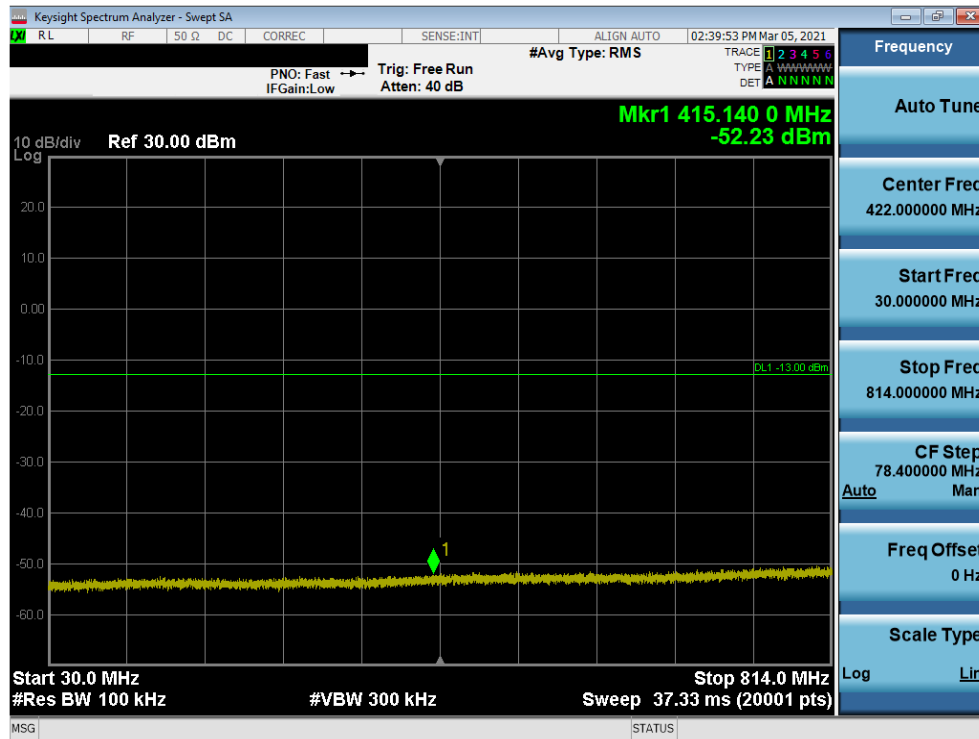


Plot 7-26. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 27 of 58

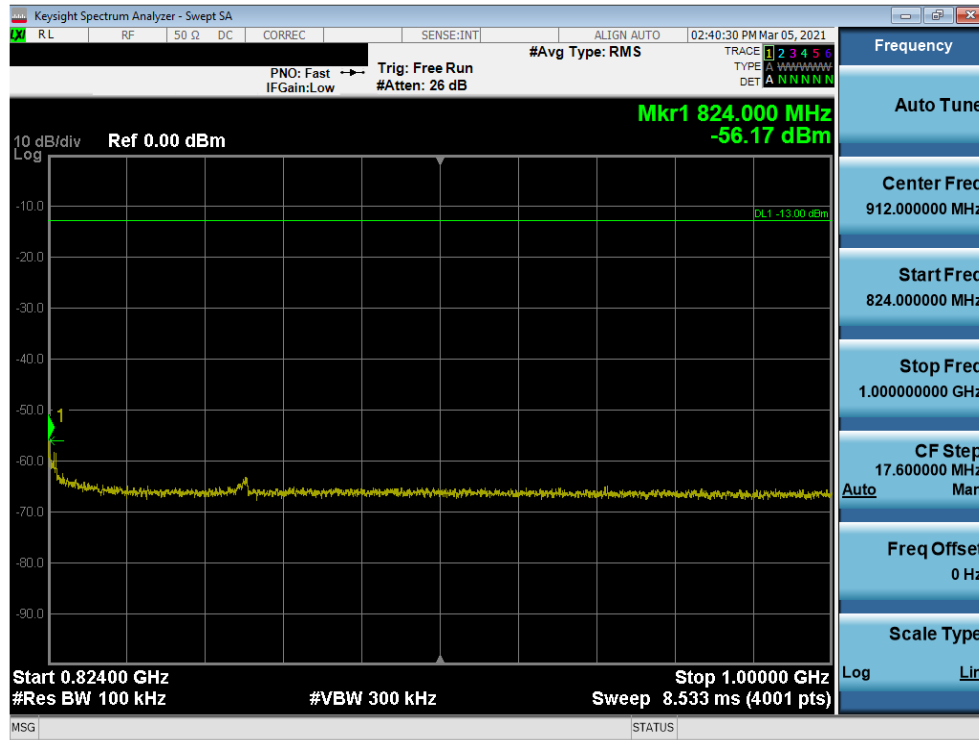


Plot 7-27. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

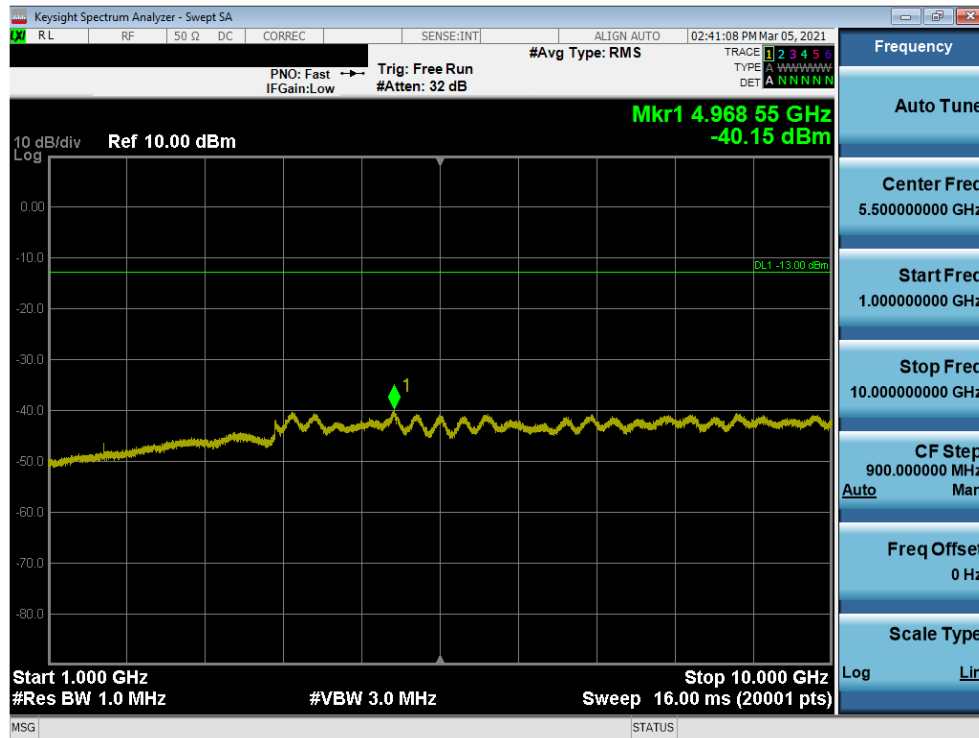


Plot 7-28. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 28 of 58



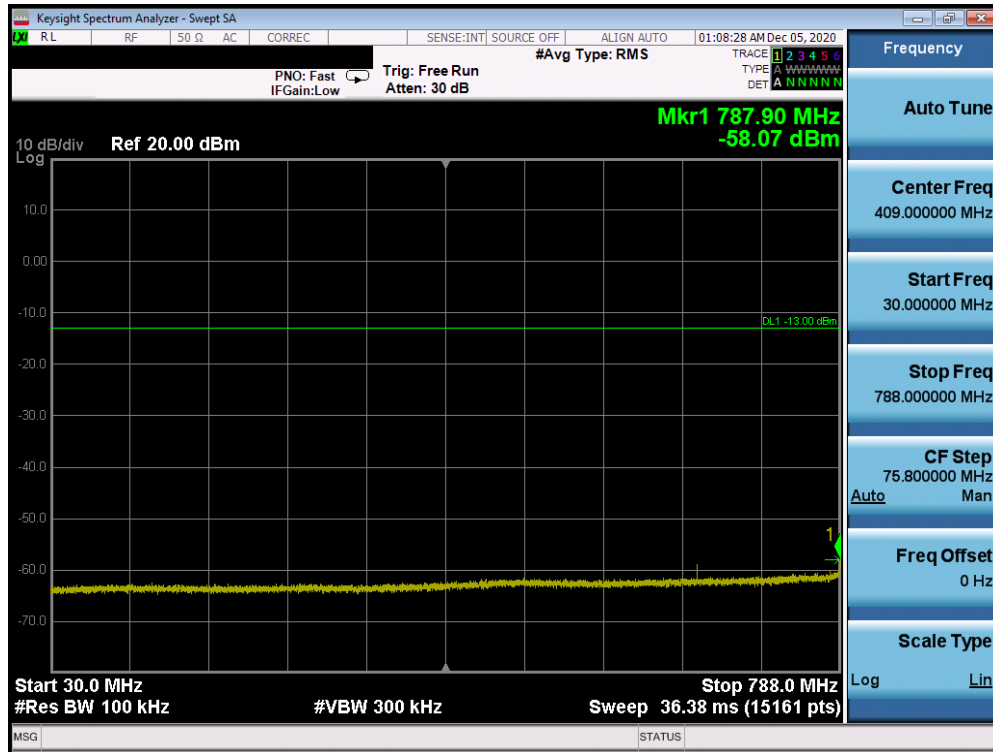
Plot 7-29. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



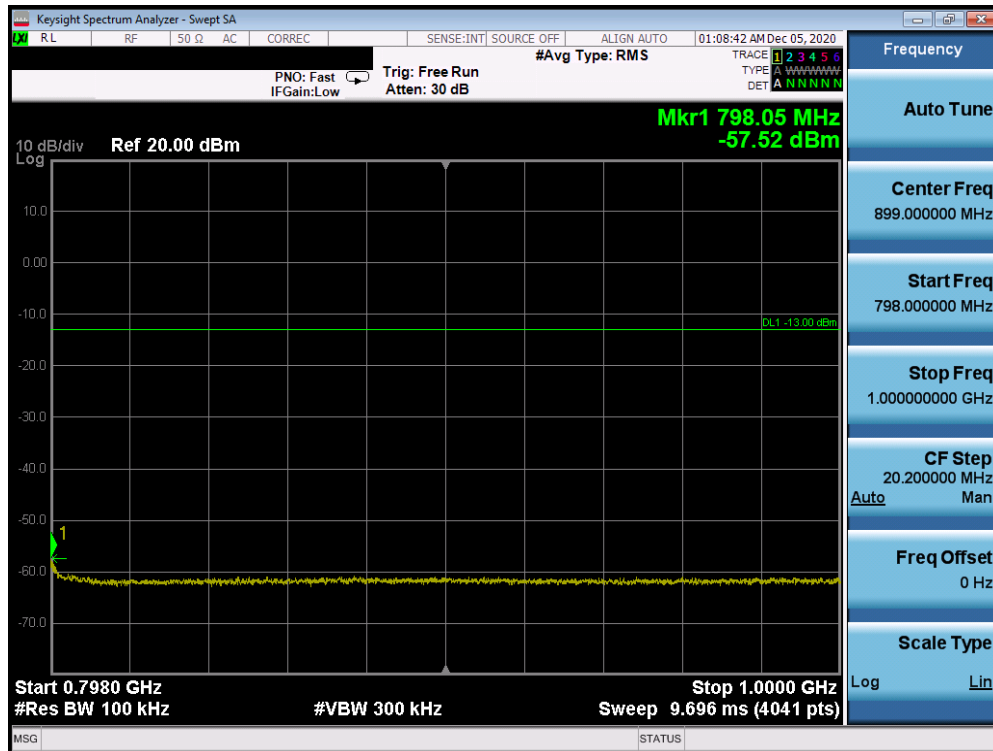
Plot 7-30. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 29 of 58

LTE Band 14

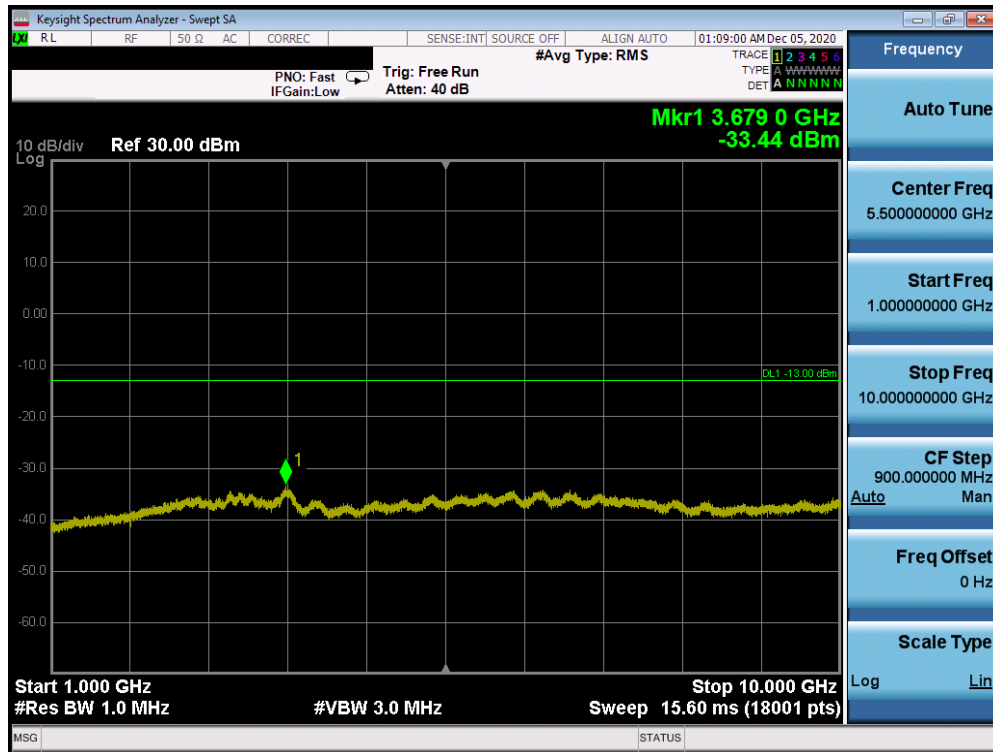


Plot 7-31. Conducted Spurious Plot (Band 14 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



Plot 7-32. Conducted Spurious Plot (Band 14 - 10MHz 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: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 30 of 58



Plot 7-33. Conducted Spurious Plot (Band 14 - 10MHz 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: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 31 of 58

7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §90(S).691(a) §90(R).543(e)

Test Overview

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

For LTE B26 operation under Part 90.691, the minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by greater than 37.5 kHz is $43 + 10\log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts. The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by up to and including 37.5 kHz is $50 + 10\log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Span was set large enough so as to capture all out of band emissions near the band edge
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Detector = RMS
5. Trace mode = trace average
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

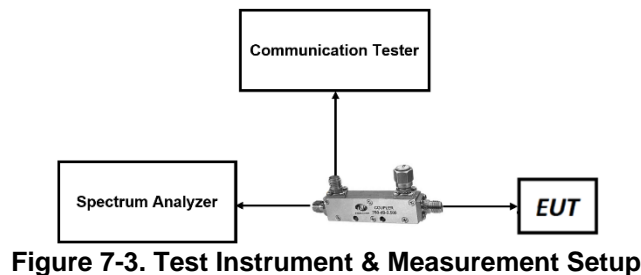


Figure 7-3. Test Instrument & Measurement Setup

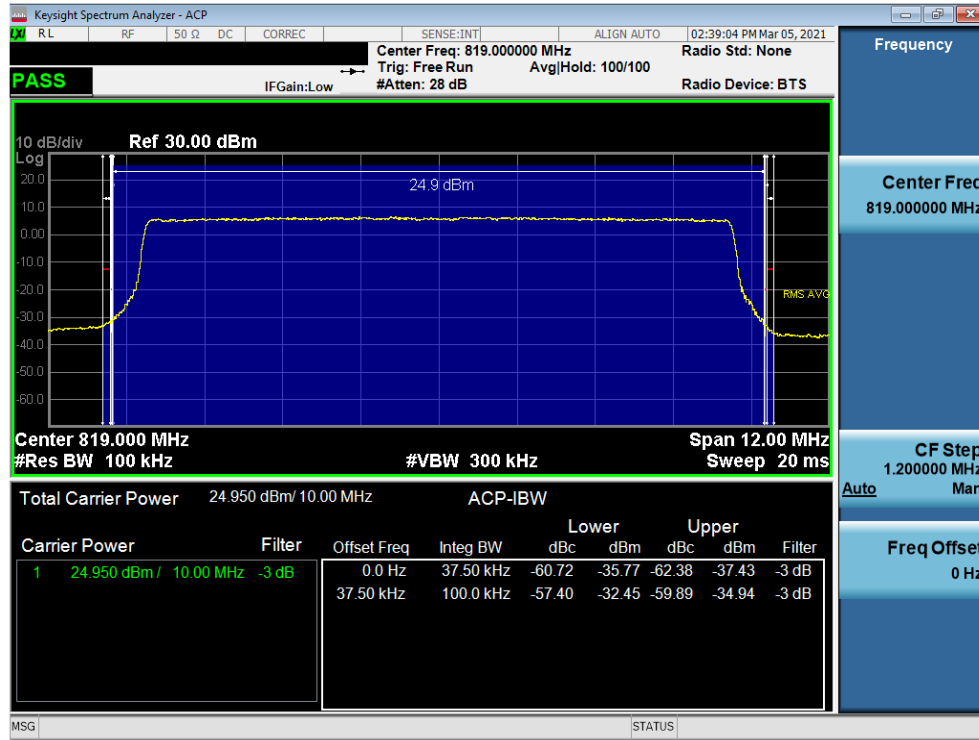
FCC ID: BCGA2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 32 of 58

Test Notes

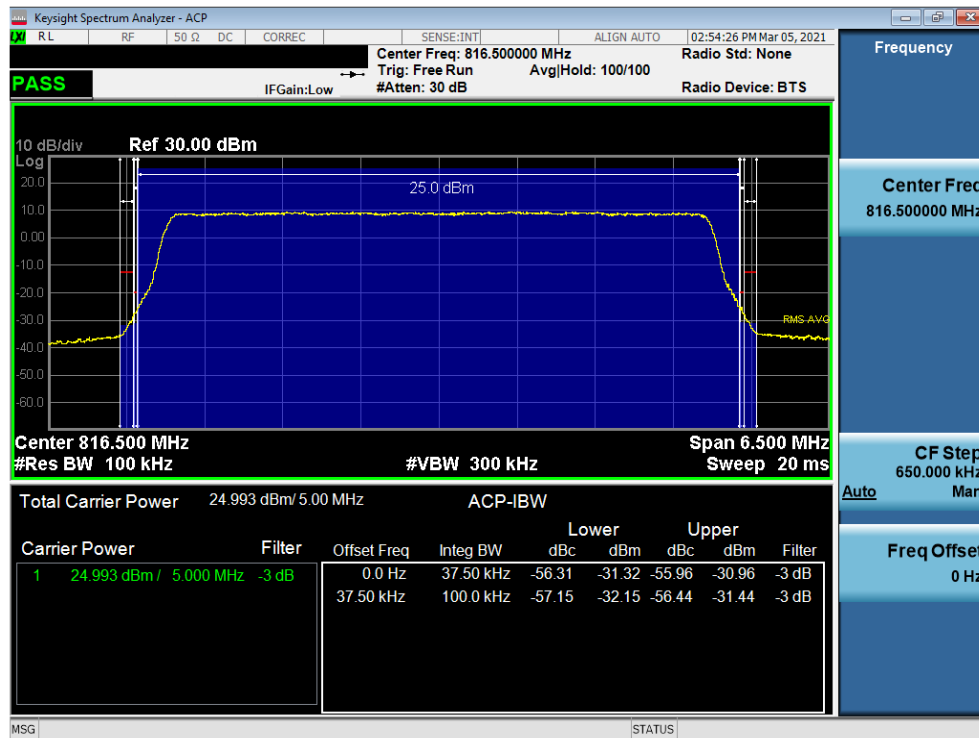
1. For channel edge emission, the signal analyzer's "ACP" measurement capability is used.
2. Per Part 90, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center.
3. For LTE Band 14 operation under Part 90.543, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.
4. Additionally, for LTE Band 14 operation, on all frequencies between 769-775 MHz and 799-805 MHz, the power of any emission shall be attenuated by a factor not less than $65 + 10\log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

FCC ID: BCGA2301	 <small>Proud to be part of element</small>	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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LTE Band 26

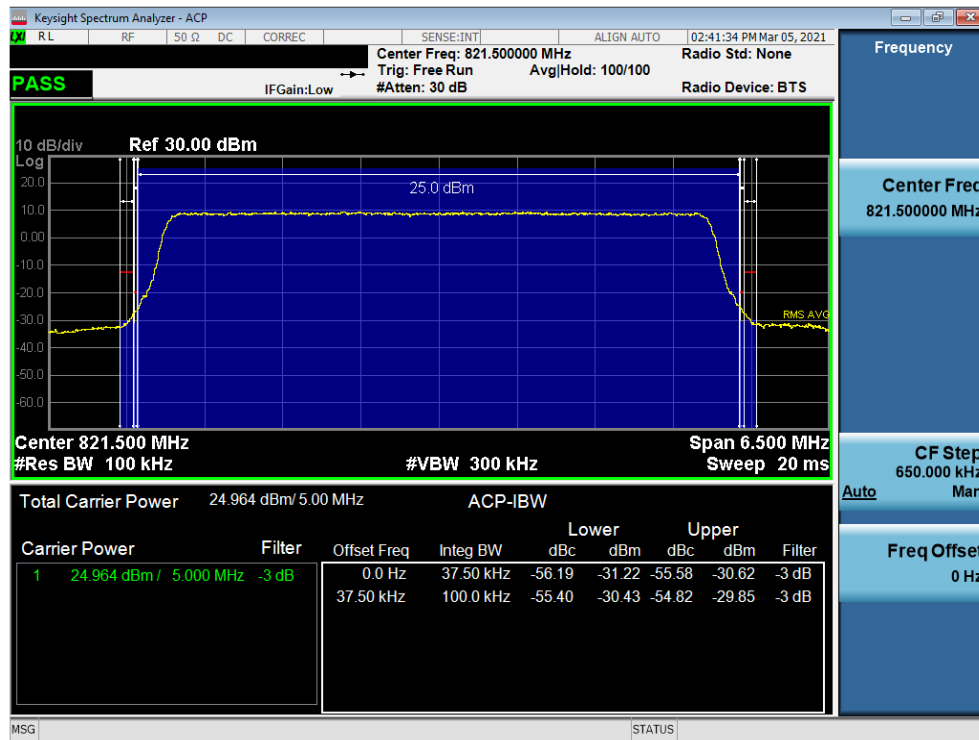


Plot 7-34. Channel Edge Plot (LTE Band 26 - 10MHz QPSK - Mid Channel)

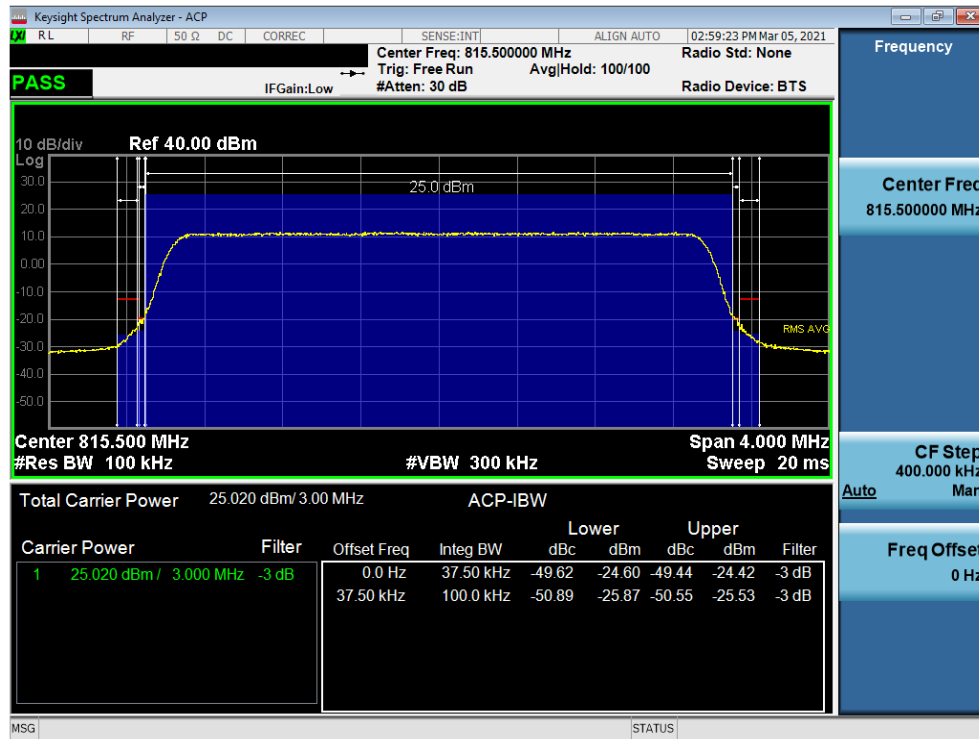


Plot 7-35. Channel Edge Plot (LTE Band 26 - 5MHz QPSK - Low Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 34 of 58

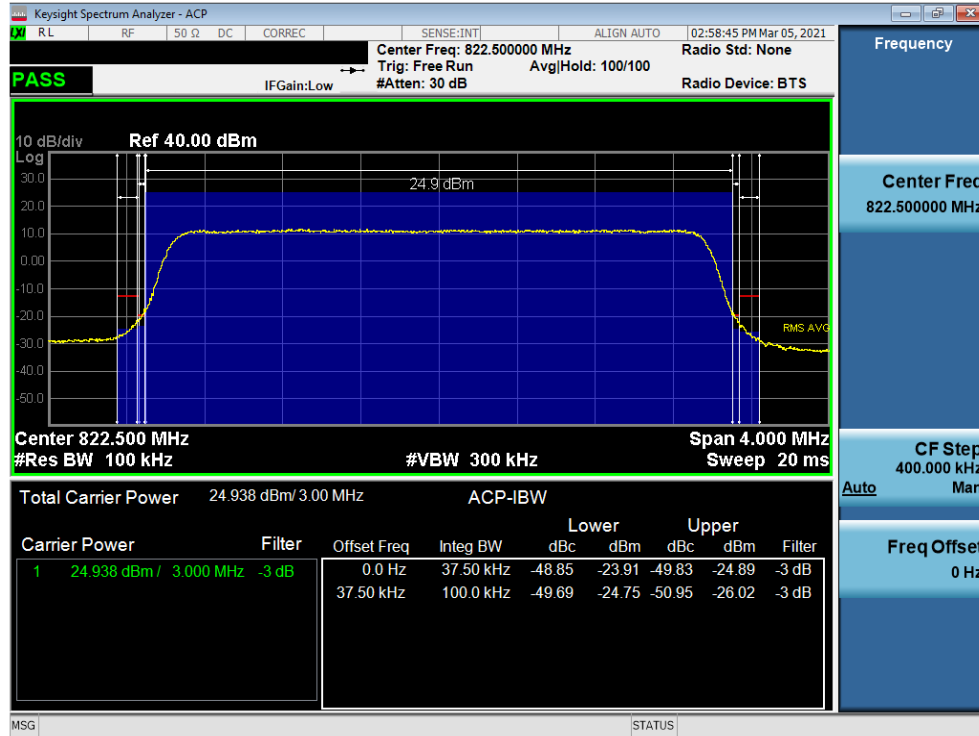


Plot 7-36. Channel Edge Plot (LTE Band 26 - 5MHz QPSK - High Channel)

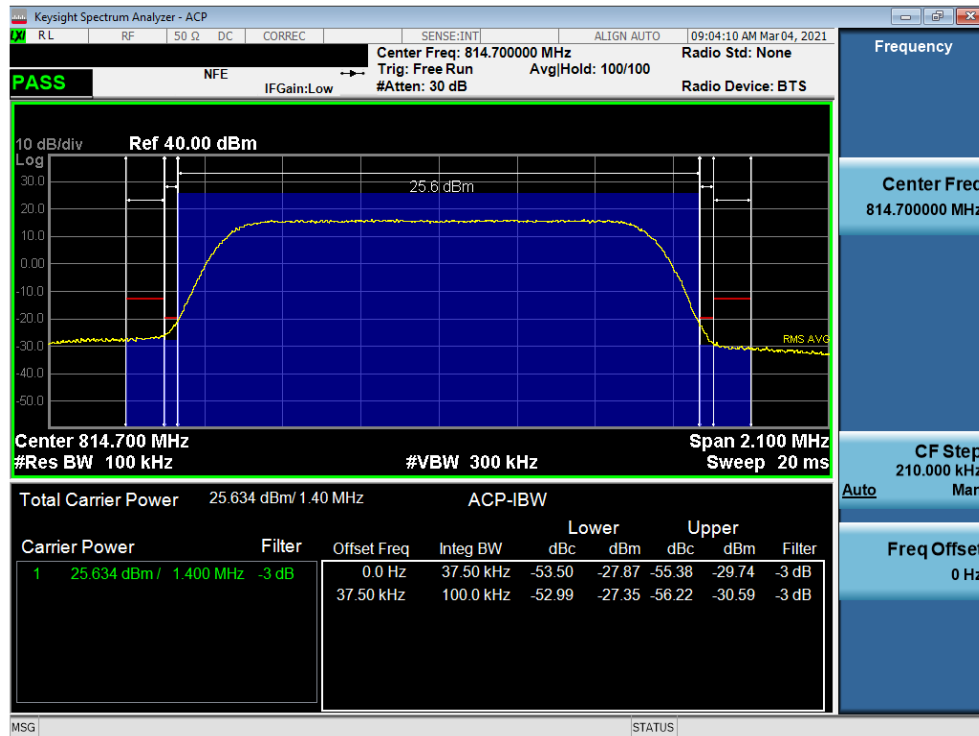


Plot 7-37. Channel Edge Plot (LTE Band 26 - 3MHz QPSK - Low Channel)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 35 of 58

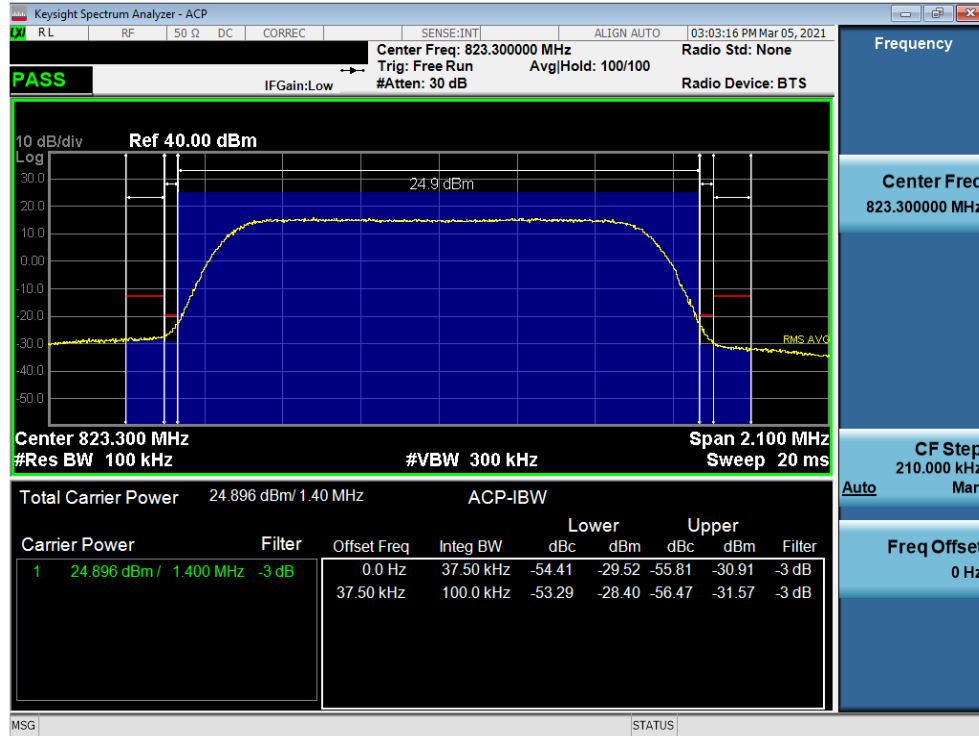


Plot 7-38. Channel Edge Plot (LTE Band 26 - 3MHz QPSK - High Channel)



Plot 7-39. Channel Edge Plot (LTE Band 26 - 1.4MHz QPSK - Low Channel)

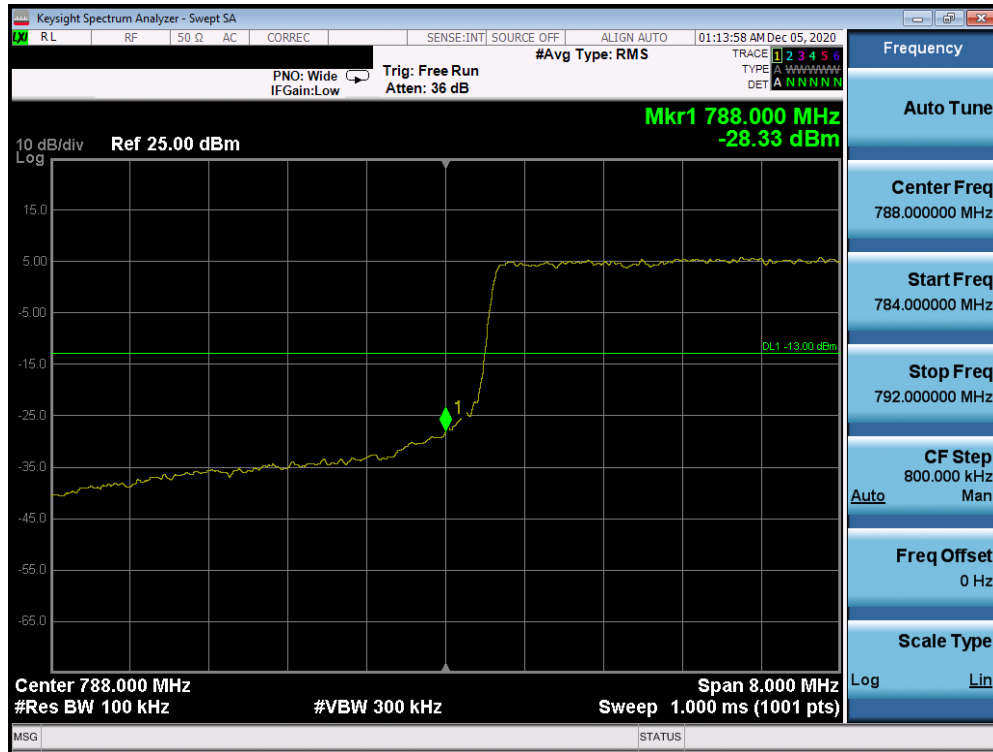
FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 36 of 58



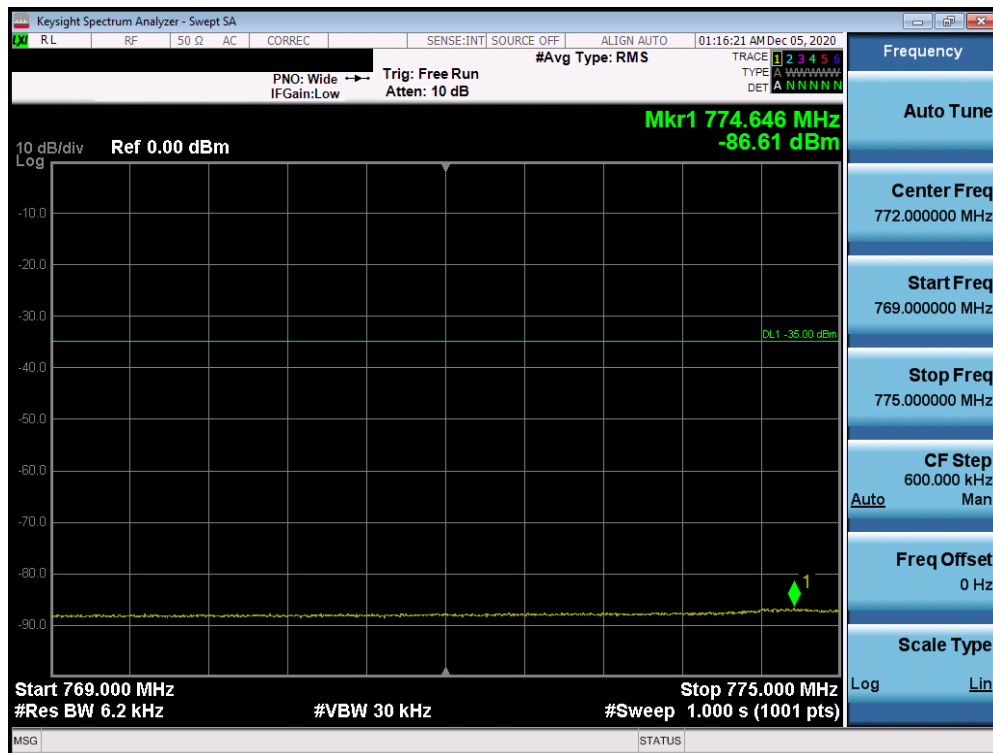
Plot 7-40. Channel Edge Plot (LTE Band 26 - 1.4MHz QPSK - High Channel)

FCC ID: BCGA2301	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 37 of 58

LTE Band 14



Plot 7-41. Lower Band Edge Plot (LTE Band 14 - 10MHz QPSK)

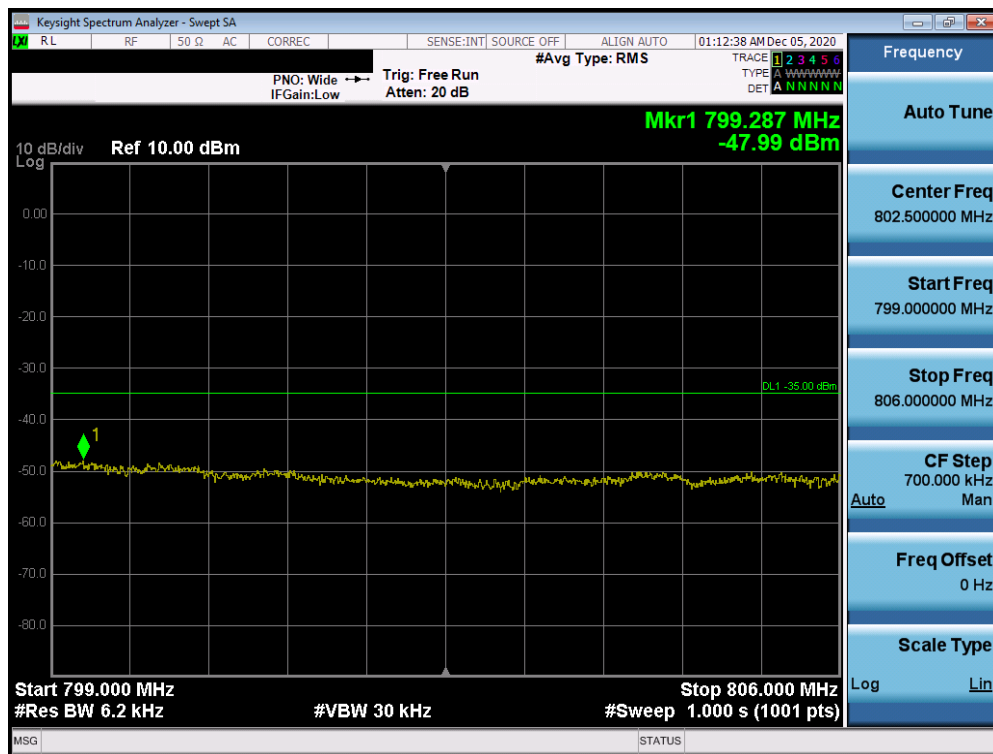


Plot 7-42. Lower Emission Mask Plot (LTE Band 14 - 10MHz QPSK)

FCC ID: BCGA2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-07.BCG	Test Dates: 12/15/2020-03/04/2021	EUT Type: Tablet Device	Page 38 of 58

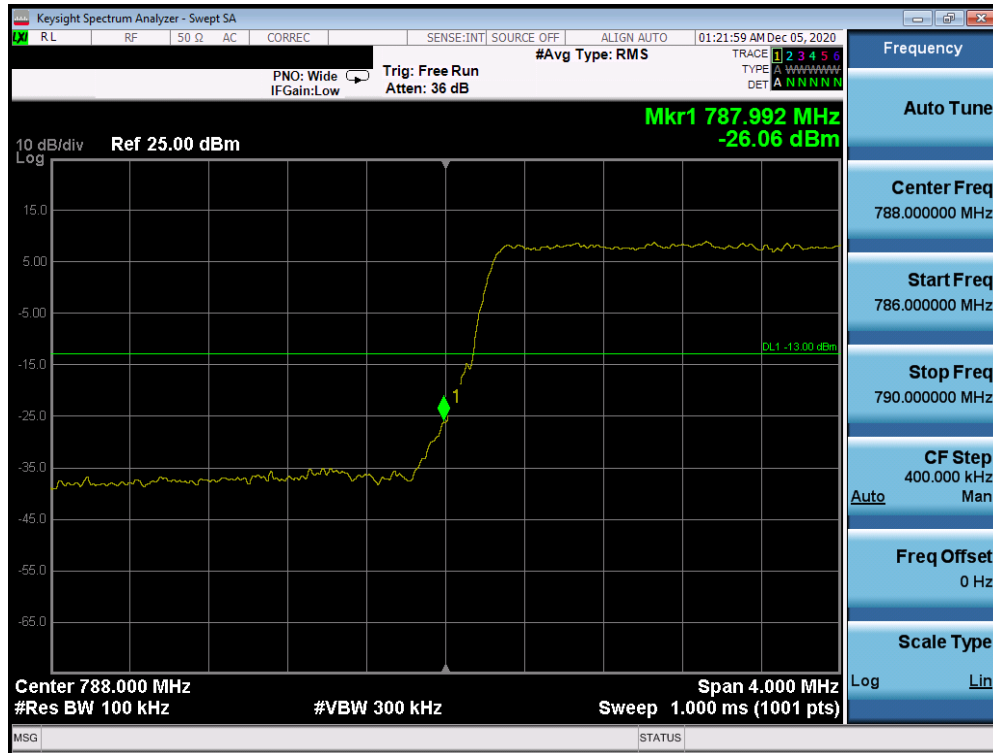


Plot 7-43. Upper Band Edge Plot (LTE Band 14 - 10MHz QPSK)

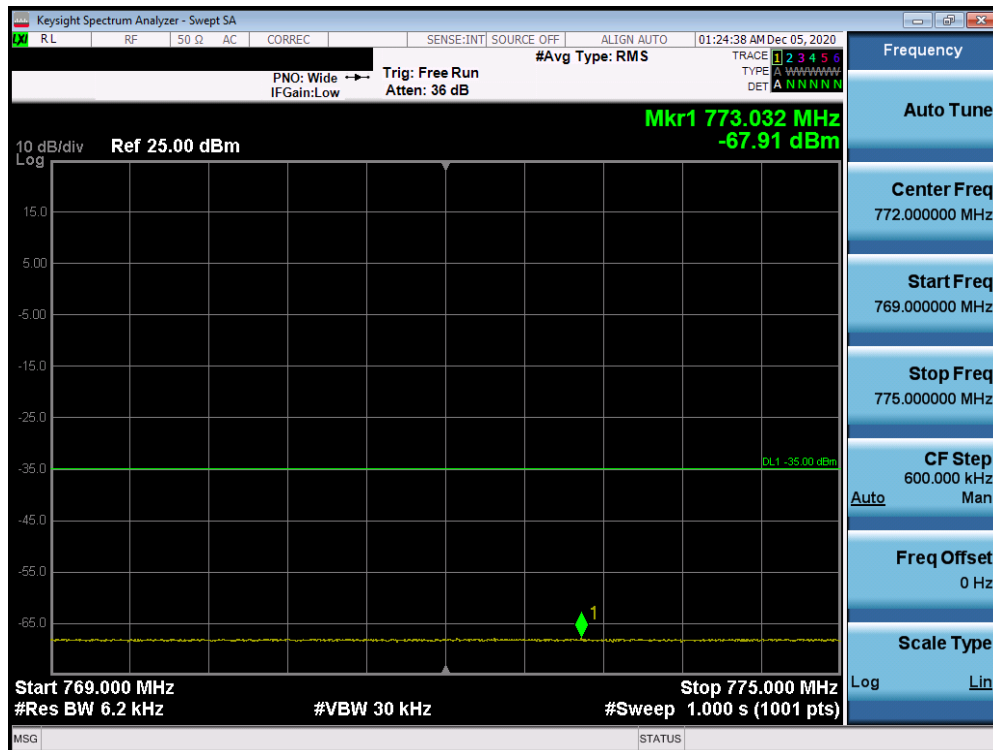


Plot 7-44. Upper Emission Mask Plot (LTE Band 14 - 10MHz QPSK)

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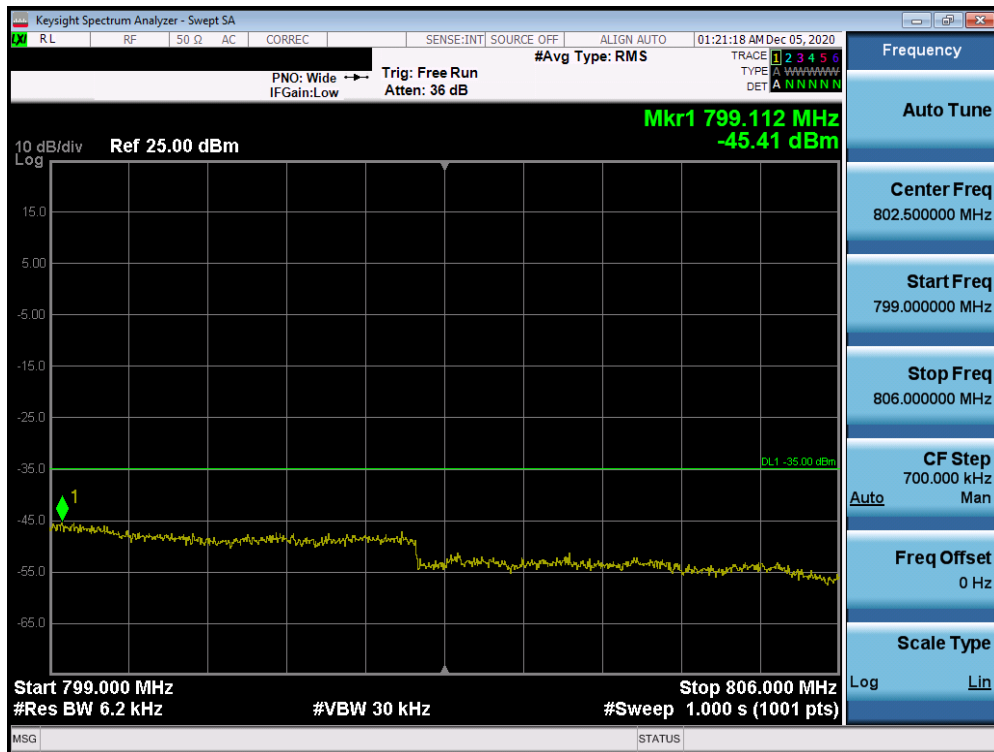
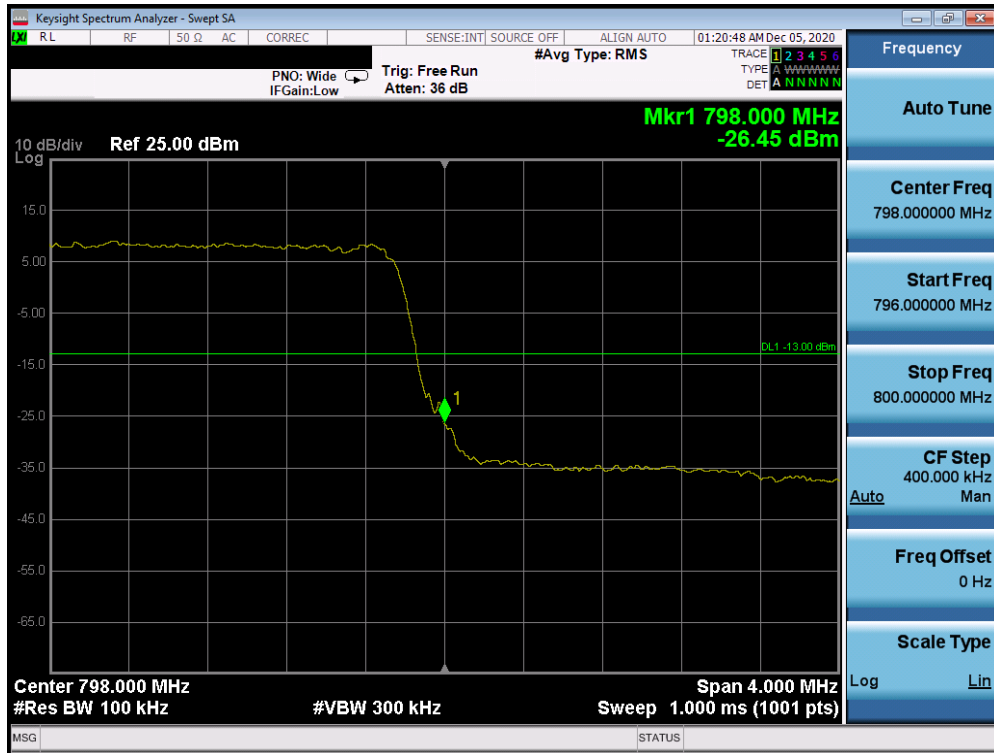


Plot 7-45. Lower Band Edge Plot (LTE Band 14 - 5MHz QPSK)



Plot 7-46. Lower Emission Mask Plot (LTE Band 14 - 5MHz QPSK)

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

\$2.1046 \$90.635

Test Overview

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.

Test Procedures Used

KDB 971168 D01 v03r01

Test Setup

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

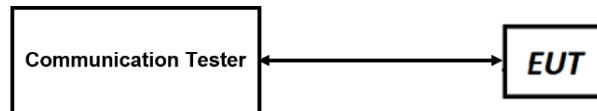


Figure 7-4. Conducted Power Measurement Setup

Test Notes

1. The EUT was tested in all possible test configurations. The worst case emissions are reported with the EUT modulations and channel bandwidth configurations shown in the tables below.
2. This unit was tested with its standard battery.

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Antenna 3

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Conducted Power [Watts]	Conducted Power Limit [dBm]	Margin [dB]
10 MHz	QPSK	26740	819.0	1 / 0	25.70	0.372	50.00	-24.30
	16-QAM	26740	819.0	1 / 0	23.98	0.250	50.00	-26.02
	64-QAM	26740	819.0	1 / 0	23.78	0.239	50.00	-26.22
	256-QAM	26740	819.0	1 / 25	20.96	0.125	50.00	-29.04
5 MHz	QPSK	26715	816.5	1 / 0	25.70	0.372	50.00	-24.30
		26765	821.5	1 / 12	25.63	0.366	50.00	-24.37
	16-QAM	26715	816.5	1 / 0	24.84	0.305	50.00	-25.16
	64-QAM	26715	816.5	1 / 0	24.17	0.261	50.00	-25.83
	256-QAM	26715	816.5	1 / 0	20.73	0.118	50.00	-29.27
3 MHz	QPSK	26705	815.5	1 / 0	25.68	0.370	50.00	-24.32
		26775	822.5	1 / 0	25.56	0.360	50.00	-24.44
	16-QAM	26705	815.5	1 / 0	24.99	0.316	50.00	-25.01
	64-QAM	26705	815.5	1 / 0	24.14	0.259	50.00	-25.86
	256-QAM	26705	815.5	1 / 0	21.12	0.129	50.00	-28.88
1.4 MHz	QPSK	26697	814.7	1 / 0	25.67	0.369	50.00	-24.33
		26783	823.3	1 / 5	25.70	0.372	50.00	-24.30
	16-QAM	26697	814.7	1 / 0	24.86	0.306	50.00	-25.14
	64-QAM	26783	823.3	1 / 5	23.84	0.242	50.00	-26.16
	256-QAM	26697	814.7	1 / 3	20.93	0.124	50.00	-29.07

Table 7-2. LTE Band 26 Conducted Power Output Data

Antenna 1

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Conducted Power [Watts]	Conducted Power Limit [dBm]	Margin [dB]
10 MHz	QPSK	26740	819.0	1 / 0	23.90	0.245	50.00	-26.10
	16-QAM	26740	819.0	1 / 0	22.82	0.191	50.00	-27.18
	64-QAM	26740	819.0	1 / 25	21.98	0.158	50.00	-28.02
	256-QAM	26740	819.0	1 / 0	18.81	0.076	50.00	-31.19
5 MHz	QPSK	26715	816.5	1 / 0	23.90	0.245	50.00	-26.10
		26765	821.5	1 / 24	23.82	0.241	50.00	-26.18
	16-QAM	26715	816.5	1 / 0	23.27	0.212	50.00	-26.73
	64-QAM	26765	821.5	1 / 12	21.85	0.153	50.00	-28.15
	256-QAM	26765	821.5	1 / 0	18.91	0.078	50.00	-31.09
3 MHz	QPSK	26705	815.5	1 / 0	23.85	0.243	50.00	-26.15
		26775	822.5	1 / 0	23.89	0.245	50.00	-26.11
	16-QAM	26775	822.5	1 / 0	23.10	0.204	50.00	-26.90
	64-QAM	26775	822.5	1 / 0	21.49	0.141	50.00	-28.51
	256-QAM	26775	822.5	1 / 0	18.98	0.079	50.00	-31.02
1.4 MHz	QPSK	26697	814.7	1 / 3	23.90	0.245	50.00	-26.10
		26783	823.3	1 / 0	23.76	0.238	50.00	-26.24
	16-QAM	26697	814.7	1 / 3	23.06	0.202	50.00	-26.94
	64-QAM	26783	823.3	1 / 0	21.56	0.143	50.00	-28.44
	256-QAM	26697	814.7	1 / 0	18.69	0.074	50.00	-31.31

Table 7-3. LTE Band 26 Conducted Power Output Data

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7.6 Radiated Power (ERP)

§90.542(a)(7)

Test Overview

Effective Radiated Power (ERP) 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
 TIA-603-E-2016 – Section 2.2.17

Test Settings

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

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

Where:

ERP = effective or equivalent radiated power, respectively (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 dBd (ERP)

Test Setup

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

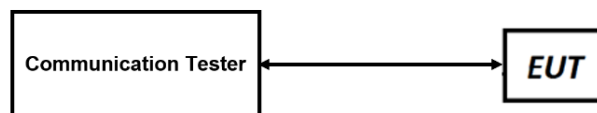


Figure 7-5. ERP Measurement Setup

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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 Ant. Gains (GT) are listed in dBi.

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Antenna 3 - ERP

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
10 MHz	QPSK	793.0	-3.10	1 / 0	25.70	20.45	0.111	38.45	-18.00
	16-QAM	793.0	-3.10	1 / 0	25.04	19.79	0.095	38.45	-18.66
	64-QAM	793.0	-3.10	1 / 25	23.87	18.62	0.073	38.45	-19.83
	256-QAM	793.0	-3.10	1 / 0	20.96	15.71	0.037	38.45	-22.74
5 MHz	QPSK	790.5	-3.10	1 / 0	25.64	20.39	0.109	38.45	-18.06
		793.0	-3.10	1 / 12	25.57	20.32	0.108	38.45	-18.13
		795.5	-3.10	1 / 0	25.70	20.45	0.111	38.45	-18.00
	16-QAM	793.0	-3.10	1 / 0	24.96	19.71	0.094	38.45	-18.74
	64-QAM	795.5	-3.10	1 / 0	23.89	18.64	0.073	38.45	-19.81
	256-QAM	793.0	-3.10	1 / 12	21.07	15.82	0.038	38.45	-22.63

Table 7-4. ERP Data (Band 14)

Antenna 1 - ERP

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
10 MHz	QPSK	793.0	-2.20	1 / 0	23.90	19.55	0.090	38.45	-18.90
	16-QAM	793.0	-2.20	1 / 25	22.94	18.59	0.072	38.45	-19.86
	64-QAM	793.0	-2.20	1 / 0	22.31	17.96	0.063	38.45	-20.49
	256-QAM	793.0	-2.20	1 / 0	19.47	15.12	0.033	38.45	-23.33
5 MHz	QPSK	790.5	-2.20	1 / 0	23.90	19.55	0.090	38.45	-18.90
		793.0	-2.20	1 / 0	23.85	19.50	0.089	38.45	-18.95
		795.5	-2.20	1 / 0	23.79	19.44	0.088	38.45	-19.01
	16-QAM	790.5	-2.20	1 / 24	23.06	18.71	0.074	38.45	-19.74
	64-QAM	790.5	-2.20	1 / 0	22.49	18.14	0.065	38.45	-20.31
	256-QAM	795.5	-2.20	1 / 24	20.11	15.76	0.038	38.45	-22.69

Table 7-5. ERP Data (Band 14)

FCC ID: BCGA2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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7.7 Radiated Spurious Emissions

§2.1053 §90(S).691(a) §90(R).543(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 = Average (Max Hold for pulsed emissions)
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.

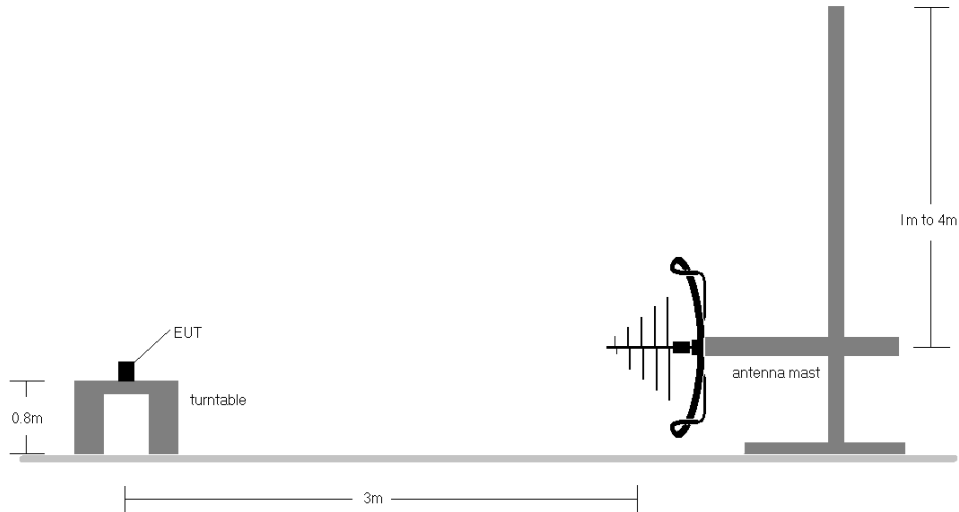


Figure 7-6. Test Instrument & Measurement Setup < 1GHz

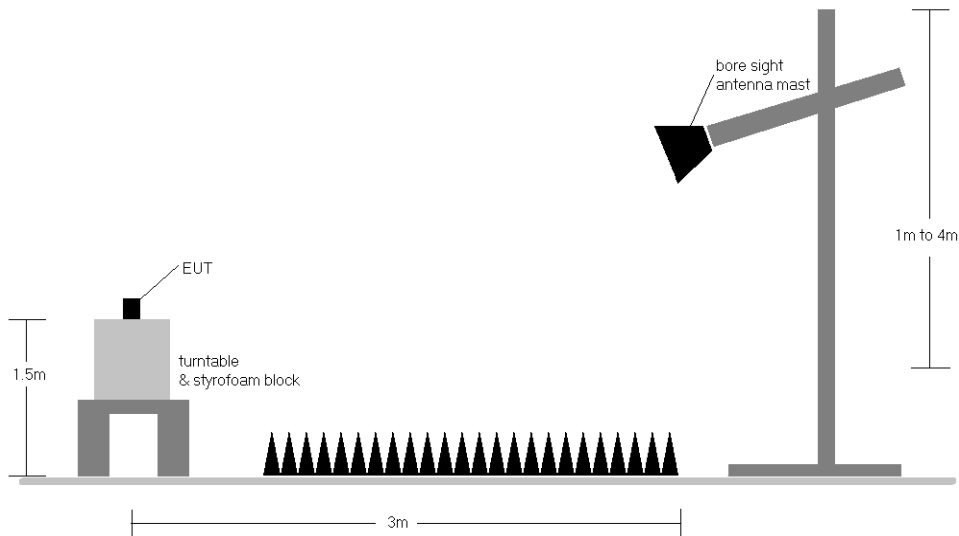


Figure 7-7. Test Instrument & Measurement Setup >1 GHz

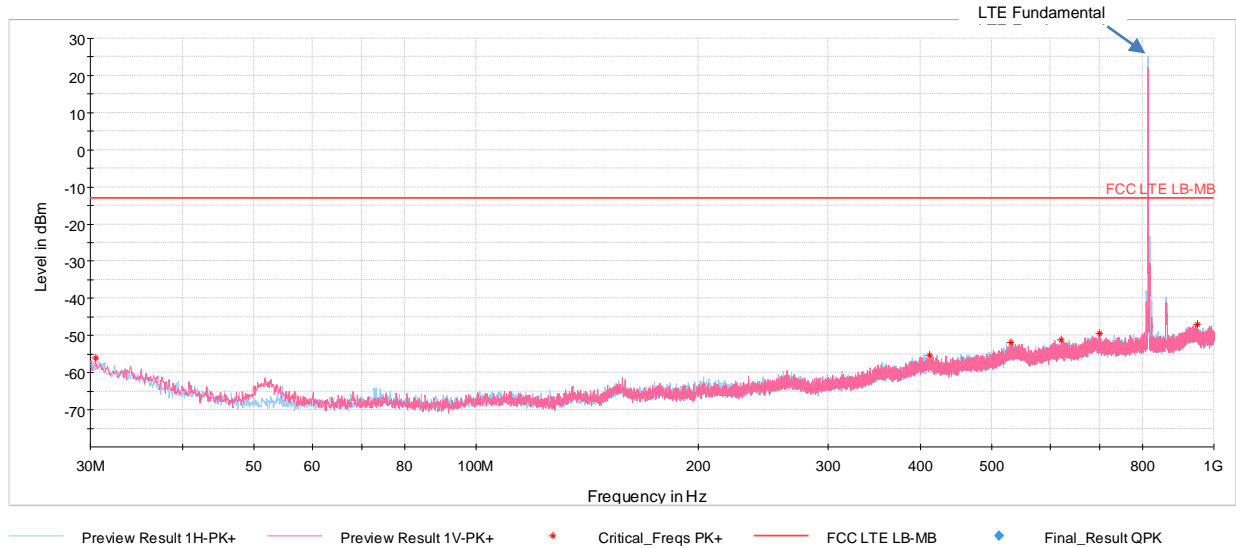
Test Notes

- Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$; where D is the measurement distance in meters.
- For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.
- This unit was tested with its standard battery.
- The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.
- The "-" shown in the following RSE tables are used to denote a noise floor measurement.

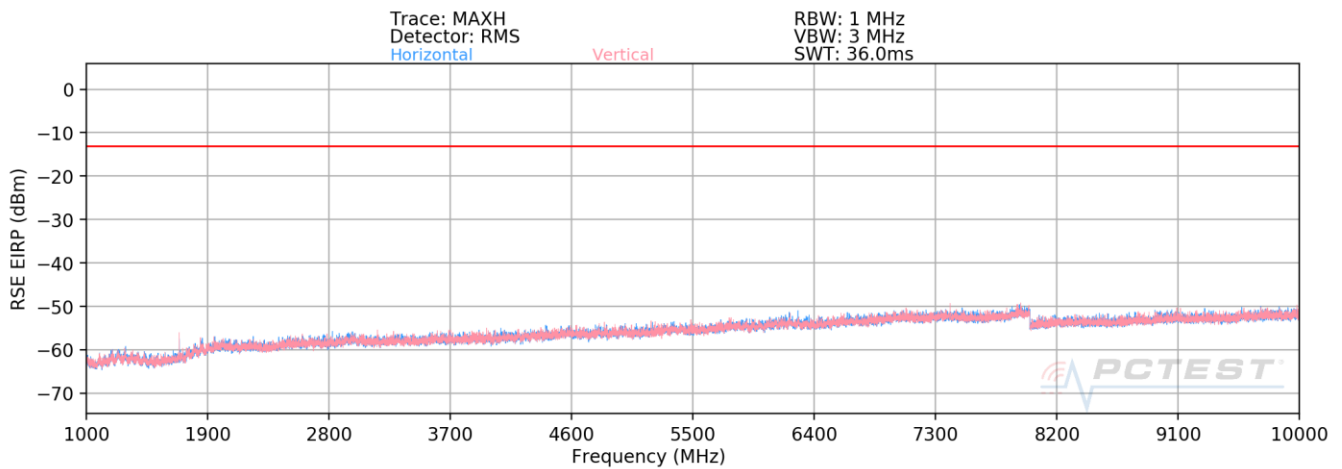
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7.7.1 Antenna 3 Radiated Spurious Emissions Measurements

LTE Band 26



Plot 7-49. Radiated Spurious Emissions Below 1GHz (Band 26)



Plot 7-50. Radiated Spurious Emissions Above 1GHz (Band 26)

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Bandwidth (MHz):	5
Frequency (MHz):	816.5
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1633.0	H	120	193	-72.22	-3.87	30.91	-64.35	-13.00	-51.35
2449.5	H	357	129	-75.55	0.18	31.63	-63.63	-13.00	-50.63
3266.0	V	-	-	-76.96	2.13	32.17	-63.09	-13.00	-50.09
4082.5	V	-	-	-77.54	3.08	32.54	-62.72	-13.00	-49.72
4899.0	V	-	-	-78.03	4.90	33.87	-61.38	-13.00	-48.38

Table 7-6. Radiated Spurious Data (LTE Band 26 – Low Channel)

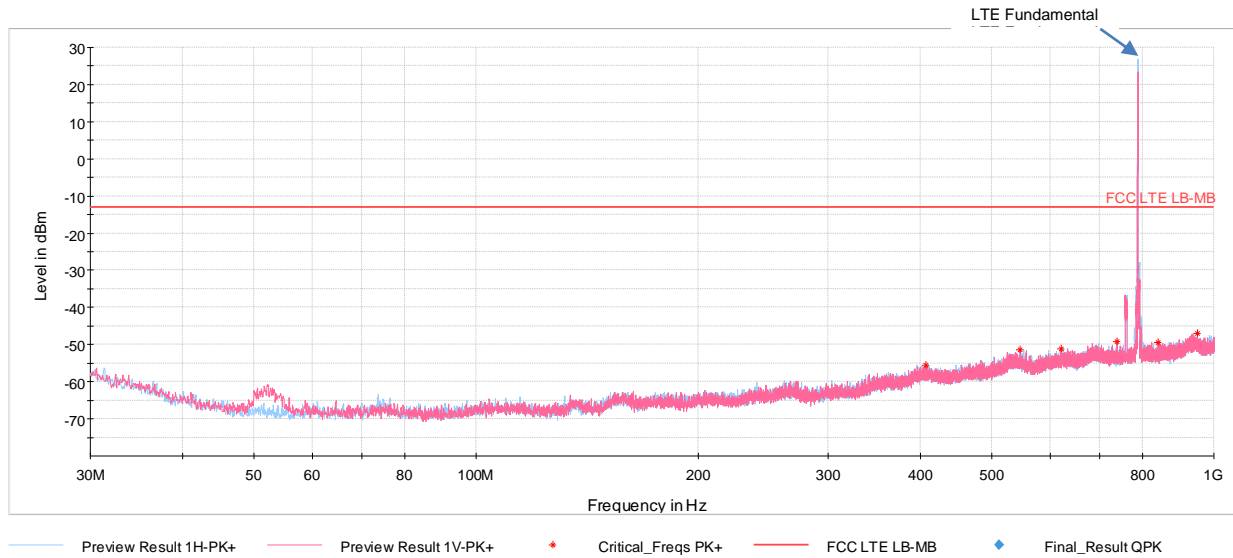
Bandwidth (MHz):	5
Frequency (MHz):	821.5
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1643.0	H	250	53	-69.73	-3.67	33.60	-61.66	-13.00	-48.66
2464.5	H	366	60	-75.58	0.68	32.10	-63.16	-13.00	-50.16
3286.0	H	-	-	-77.13	1.87	31.74	-63.51	-13.00	-50.51
4107.5	H	-	-	-77.49	3.09	32.60	-62.66	-13.00	-49.66
4929.0	H	-	-	-78.07	4.63	33.56	-61.69	-13.00	-48.69

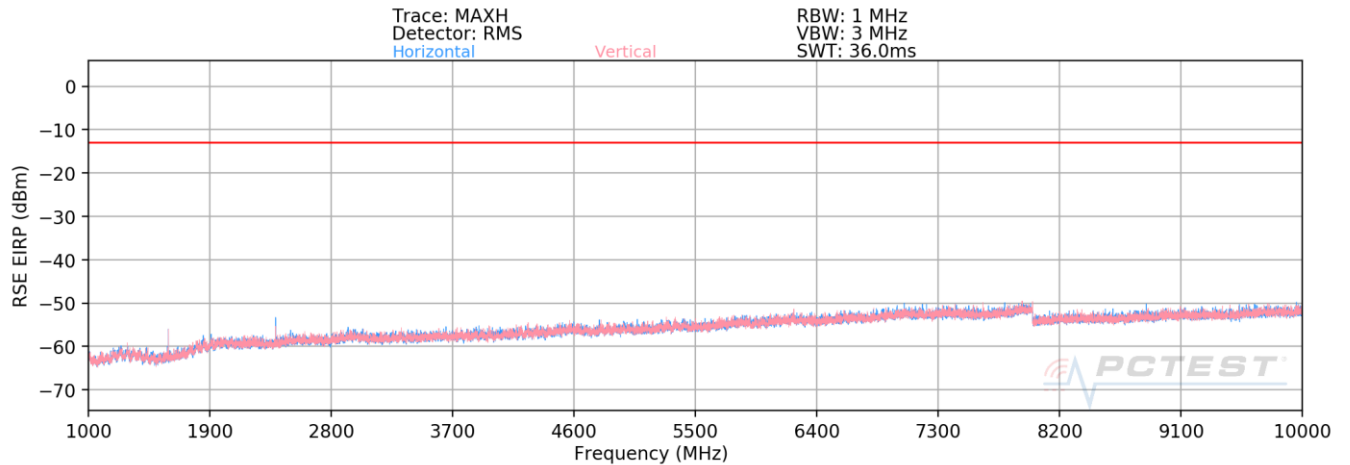
Table 7-7. Radiated Spurious Data (LTE Band 26 – High Channel)

FCC ID: BCGA2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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LTE Band 14



Plot 7-51. Radiated Spurious Emissions Below 1GHz (Band 14)



Plot 7-52. Radiated Spurious Emissions Above 1GHz (Band 14)

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Bandwidth (MHz):	5
Frequency (MHz):	790.5
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1581.0	H	205	140	-69.54	-1.05	36.41	-58.85	-40.00	-18.85
2371.5	H	-	-	-76.34	2.93	33.59	-61.66	-13.00	-48.66
3162.0	H	-	-	-77.31	4.31	34.00	-61.26	-13.00	-48.26
3952.5	H	-	-	-77.87	5.11	34.24	-61.02	-13.00	-48.02

Table 7-8. Radiated Spurious Data (LTE Band 14 – Low Channel)

Bandwidth (MHz):	5
Frequency (MHz):	793.0
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1586.0	V	249	186	-67.81	-1.02	38.17	-57.09	-40.00	-17.09
2379.0	V	-	-	-76.63	3.00	33.37	-61.88	-13.00	-48.88
3172.0	V	-	-	-77.19	4.39	34.20	-61.06	-13.00	-48.06
3965.0	V	-	-	-77.64	5.09	34.45	-60.81	-13.00	-47.81

Table 7-9. Radiated Spurious Data (LTE Band 14 – Mid Channel)

Bandwidth (MHz):	5
Frequency (MHz):	795.5
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1591.0	V	268	207	-74.49	-1.03	31.48	-63.78	-40.00	-23.78
2386.5	V	358	223	-76.65	3.05	33.40	-61.86	-13.00	-48.86
3182.0	V	-	-	-78.26	4.40	33.14	-62.12	-13.00	-49.12
3977.5	V	-	-	-79.55	5.25	32.70	-62.56	-13.00	-49.56
4773.0	V	-	-	-79.38	5.94	33.56	-61.70	-13.00	-48.70

Table 7-10. Radiated Spurious Data (LTE Band 14 – High Channel)

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

LTE Band 26

Bandwidth (MHz):	5
Frequency (MHz):	816.5
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1633.0	V	142	182	-72.86	-0.80	33.34	-61.92	-13.00	-48.92
2449.5	V	236	183	-73.97	3.46	36.49	-58.77	-13.00	-45.77
3266.0	V	-	-	-77.97	4.12	33.15	-62.11	-13.00	-49.11
4082.5	V	-	-	-78.56	4.84	33.28	-61.98	-13.00	-48.98
4899.0	V	-	-	-79.96	6.74	33.78	-61.48	-13.00	-48.48

Table 7-11. Radiated Spurious Data (LTE Band 26 – Low Channel)

Bandwidth (MHz):	5
Frequency (MHz):	821.5
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1643.0	H	110	206	-74.94	-0.75	31.31	-63.95	-13.00	-50.95
2464.5	H	232	143	-67.96	3.28	42.32	-52.93	-13.00	-39.93
3286.0	H	-	-	-77.99	4.03	33.04	-62.22	-13.00	-49.22
4107.5	H	-	-	-78.56	4.76	33.20	-62.06	-13.00	-49.06
4929.0	H	-	-	-79.76	6.71	33.95	-61.30	-13.00	-48.30

Table 7-12. Radiated Spurious Data (LTE Band 26 – High Channel)

FCC ID: BCGA2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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LTE Band 14

Bandwidth (MHz):	5
Frequency (MHz):	790.5
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1581.0	H	207	216	-76.21	-1.05	29.74	-65.52	-40.00	-25.52
2371.5	H	191	133	-72.10	2.93	37.83	-57.42	-13.00	-44.42
3162.0	H	-	-	-78.05	4.31	33.26	-62.00	-13.00	-49.00
3952.5	H	-	-	-79.44	5.11	32.67	-62.59	-13.00	-49.59
4743.0	H	-	-	-79.51	6.09	33.58	-61.67	-13.00	-48.67

Table 7-13. Radiated Spurious Data (LTE Band 14 – Low Channel)

Bandwidth (MHz):	5
Frequency (MHz):	793.0
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1586.0	V	371	223	-76.51	-1.02	29.47	-65.79	-40.00	-25.79
2379.0	V	187	137	-75.97	3.00	34.03	-61.22	-13.00	-48.22
3172.0	V	-	-	-78.17	4.39	33.22	-62.04	-13.00	-49.04
3965.0	V	-	-	-79.61	5.09	32.48	-62.78	-13.00	-49.78
4758.0	V	-	-	-79.31	6.13	33.82	-61.43	-13.00	-48.43

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

Bandwidth (MHz):	5
Frequency (MHz):	795.5
Modulation Signal:	QPSK

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1591.0	V	199	142	-69.61	-1.03	36.36	-58.90	-40.00	-18.90
2386.5	V	-	-	-76.80	3.05	33.25	-62.01	-13.00	-49.01
3182.0	V	-	-	-77.31	4.40	34.09	-61.17	-13.00	-48.17
3977.5	V	-	-	-77.93	5.25	34.32	-60.94	-13.00	-47.94

Table 7-15. Radiated Spurious Data (LTE Band 14 – High Channel)

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7.8 Frequency Stability / Temperature Variation

§2.1055 §90.213

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015 and TIA-603-E-2016. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

For Band 26, the frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency. For Band 14 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

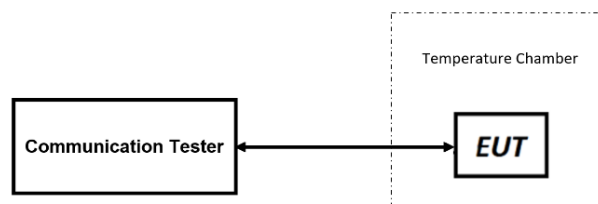


Figure 7-8. Test Instrument & Measurement Setup

Test Notes

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

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Frequency Stability / Temperature Variation

\$2.1055, \$90.213

LTE Band 26					
		Operating Frequency (Hz):		819,000,000	
		Ref. Voltage (VDC):		3.80	
		Deviation Limit:		± 0.00025% or 2.5 ppm	
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	819,000,009	9	0.0000011
		- 20	819,000,003	3	0.0000004
		- 10	819,000,008	8	0.0000010
		0	819,000,005	5	0.0000006
		+ 10	819,000,006	6	0.0000007
		+ 20	819,000,001	1	0.0000001
		+ 30	819,000,002	2	0.0000002
		+ 40	819,000,007	7	0.0000009
		+ 50	819,000,006	6	0.0000007
Battery Endpoint	3.23	+ 20	819,000,003	3	0.0000004

Table 7-16. Frequency Stability Data (LTE Band 26 – 10MHz QPSK – Full RB Configuration)

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Frequency Stability / Temperature Variation

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LTE Band 14

Low Ch. Frequency (Hz):	790,500,000
High Ch. Frequency (Hz):	795,500,000
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	790,500,008	795,500,010	-5	-6	-0.0000008
		- 20	790,499,994	795,500,008	-19	-8	-0.0000010
		- 10	790,500,005	795,499,993	-8	-23	-0.0000029
		0	790,500,003	795,500,006	-10	-10	-0.0000013
		+ 10	790,500,007	795,500,008	-6	-8	-0.0000010
		+ 20 (Ref)	790,500,013	795,500,016	0	0	0.0000000
		+ 30	790,500,007	795,500,009	-6	-7	-0.0000009
		+ 40	790,499,994	795,500,010	-19	-6	-0.0000008
		+ 50	790,500,008	795,500,009	-5	-7	-0.0000009
Battery Endpoint	3.23	+ 20	790,500,006	795,499,992	-7	-24	-0.0000030

Table 7-17. Frequency Stability Data (LTE Band 14 – 10MHz QPSK – Full RB Configuration)

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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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 the requirements of Part 90 of the FCC rules.

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