

DATA REFERENCE REPORT

FCC PART 15.247 / ISSED RSS-247 Bluetooth (HDR)

Applicant Name:

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

Date of Testing:

12/15/2020 - 03/03/2021

Test Site/Location:

PCTEST Lab. Morgan Hill, CA, USA

Test Report Serial No.:

1C2101020003-12.BCG

FCC ID:	BCGA2459
IC:	579C-A2459
APPLICANT:	Apple Inc.

Reference Model/HVIN:	A2301
Variant Model/HVIN:	A2459, A2460
EUT Type:	Tablet Device
Frequency Range:	2404 – 2476MHz
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
ISSED Specification:	RSS-247 Issue 2
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01 v05r02

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 ANSI C63.10-2013 and KDB 558074 D01 v05r02. 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: BCGA2459 IC: 579C-A2459	 PCTEST Proud to be part of  element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
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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 / IC: 579C-A2301 and variant model **FCC ID: BCGA2459 / IC: 579C-A2459**. 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/ISED approved Data Referencing Test Plan, testing was done fully on the reference model FCC ID: BCGA2301 / IC: 579C-A2301, while radiated spot-check verification has been performed on variant model **FCC ID: BCGA2459 / IC: 579C-A2459**. 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 & IC	Reference Report	Report Title
DTS	BCGA2301 579C- A2301	1C2101020002-11.BCG	RF Bluetooth HDR Test Report

Table 1-1. Reference Model Details

Reference model FCC ID: BCGA2301 / IC: 579C-A2301 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

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: BCGA2459 / IC: 579C-A2459**.

Test Device Serial No.: DLX0497003G0J801S, DLX0496001Z0J7X1N, QJ59J42G1X, Q5H7X9XL5W

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

Ch.	Frequency (MHz)
1	2404
:	:
38	2441
:	:
73	2476

Table 2-1. Bluetooth HDR Frequency / Channel Operations

Measured Duty Cycles				
HDR Mode		Duty Cycle [%]		
		Antenna 4a	Antenna 2a	TxBF
HDR4	ePA	100.0	100.0	100.0
	iPA	100.0	100.0	100.0
HDR8	ePA	100.0	100.0	100.0
	iPA	100.0	100.0	100.0

Table 2-2. Measured Duty Cycles

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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 2-3. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

This device is capable of operating in hopping and non-hopping mode. The EUT can hop between 73 different channels in the 2400 – 2483.5MHz band.

2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Frequency [GHz]	Antenna Gain (dBi)	
	Antenna 4a	Antenna 2a
2.4	1.5	2.5

Table 2-4. Highest Antenna Gain

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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 2-5. Test Support Equipment List

2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013 and KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions. See Sections 3.2 for radiated emissions test setups.

There are two vendors of the WiFi/Bluetooth radio modules, variant 1 and variant 2. Both radio modules have the same mechanical outline, same on-board antenna matching circuit, identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances. The worst case configuration was found between the two variants. The EUT was also investigated with and without charger.

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/ISED Approved Data Referencing Test Plan, Antenna 4a radiated testing and spot-check measurements have been conducted and reported. Bluetooth (BDR, EDR, LE, HDR) Spot-check Test Plan can be referred to below Table 2-3.

Technology	Test Case	FCC ID: BCGA2459 IC: 579C-A2459	
		Mode	Channel
BT (BDR, EDR, LE, HDR)	Radiated Spurious Emissions	Max Power Only ePA: HDR4	M

Table 2-6. FCC/ISED Approved Data Referencing Test Plan

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

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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/or 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 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure.....None

3.2 Radiated 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. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

Per KDB 414788, 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 rotated about its vertical axis 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.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

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3.3 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antenna(s) of the EUT are **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

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5.0 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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6.0 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
Anritsu	ML2496A	Power Meter	4/9/2020	Annual	4/9/2021	2002005
Anritsu	MA2411B	Pulse Power Sensor	3/10/2020	Annual	3/10/2021	1911105
Anritsu	MA2411B	Pulse Power Sensor	3/10/2020	Annual	3/10/2021	1911106
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	8/11/2020	Annual	8/11/2021	T058701-01
COM-POWER	LIN-120A	LISN	3/4/2020	Annual	3/4/2021	241297
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	3/4/2020	Annual	3/4/2021	102325
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	ESW26	EMI Test Receiver	6/1/2020	Annual	6/1/2021	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	8/7/2020	Annual	8/7/2021	101668
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	4/3/2020	Annual	4/3/2021	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
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	12/3/2020	Annual	12/3/2021	101648
Rohde & Schwarz	ENV216	Two-Line V-Network (LISN)	12/7/2020	Annual	12/7/2021	101364

Table 6-1. Test Equipment List

Note:

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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7.0 TEST RESULTS (SPOT-CHECK DATA)

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCGA2459
 IC: 579C-A2459
 FCC Classification: Digital Transmission System (DTS)
 Number of Channels: 73

Technology	Test Configurations					Reference Model		Variant Model		Delta	
	Test Description	Data Rate [Mbps]	Power Scheme	Channel	Measurement Frequency [MHz]	FCC ID: BCGA2301 IC: 579C-A2301		FCC ID: BCGA245959 IC: 579C-A245959			
						Peak [dBµV/m]	Average [dBµV/m]	Peak [dBµV/m]	Average [dBµV/m]	Peak [dB]	Average [dB]
Bluetooth HDR	Radiated Spurious Emissions	4.0	ePA	38	4882MHz	45.15	33.79	45.87	34.39	0.72	0.60

Table 7-1. Worst Case Spot-check Results

Spot-checks were conducted, all measurements were investigated and found to be within acceptable tolerance in accordance with FCC/ISED Approved Data Referencing Test Plan.

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7.2 Radiated Spurious Emissions

§15.205 §15.209 §15.247(d); RSS-Gen [8.9]

Bluetooth Mode:	HDR4
Power Scheme	ePA
Distance of Measurements:	3 Meters
Operating Frequency:	2441MHz
Channel:	38

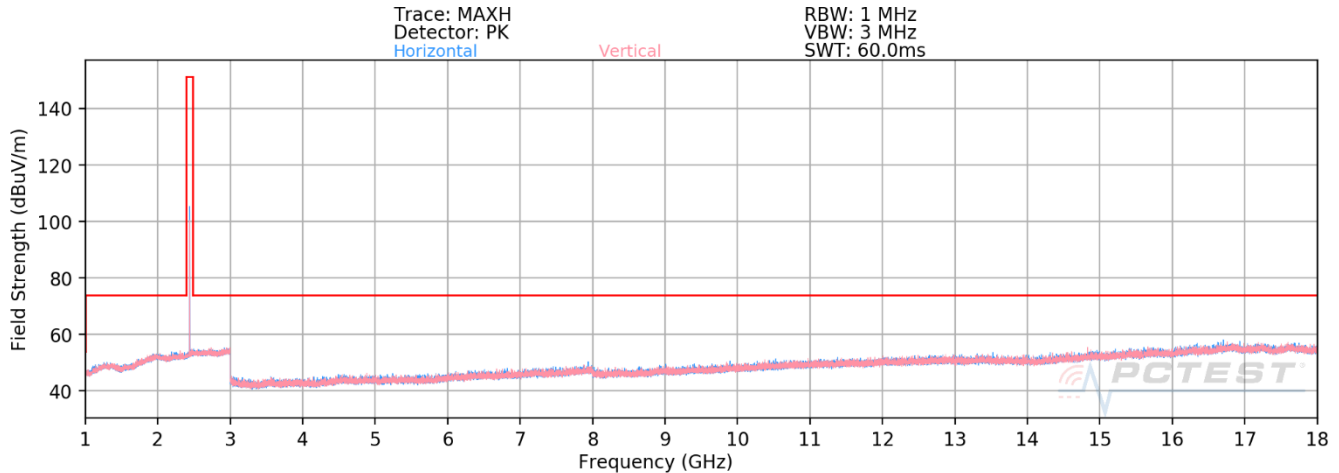


Table 7-2. Radiated Measurements TxBF

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
4882.00	Avg	H	-	-	-78.68	6.07	34.39	53.98	-19.59
4882.00	Peak	H	-	-	-67.20	6.07	45.87	73.98	-28.11
7323.00	Avg	H	-	-	-79.38	8.60	36.22	53.98	-17.76
7323.00	Peak	H	-	-	-68.46	8.60	47.14	73.98	-26.84
12205.00	Avg	H	-	-	-81.79	15.25	40.46	53.98	-13.52
12205.00	Peak	H	-	-	-71.09	15.25	51.16	73.98	-22.82

Plot 7-1. Radiated Spurious Emissions Above 1GHz TxBF (4Mbps, HDR4, ePA – Ch. 38)

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8.0 TEST RESULTS (ANTENNA 4A)

8.1 Summary

Company Name: Apple Inc.
FCC ID: BCGA2459
IC: 579C-A2459
FCC Classification: Digital Transmission System (DTS)
Number of Channels: 73

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.205 15.209	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])	RADIATED	PASS	Sections 8.2

Table 8-1. Summary of Test Results

Notes:

1. All modes of operation were investigated. The test results shown in the following sections represent the worst case emissions.
2. The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3. For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.3.1.
4. Radiated test results in following sections has been conducted on Antenna 4a, per FCC/ISED Approved Data Referencing Test Plan.
5. Below 1GHz and Above 18GHz Radiated Spurious Emissions have been investigated and no significant emissions were found.

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8.2 Radiated Spurious Emissions – Above 1GHz

§15.205 §15.209 §15.247(d); RSS-Gen [8.9]

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 7 of RSS-Gen (8.10) must not exceed the limits shown in Table 8-2 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [$\mu\text{V/m}$]	Measured Distance [Meters]
Above 960.0 MHz	500	3

Table 8-2. Radiated Limits

Test Procedures Used

ANSI C63.10-2013 – Section 6.6.4.3

KDB 558074 D01 v05r02 – Section 8.6, 8.7

Test Settings

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be $\geq 2 \times \text{span/RBW}$)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. 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.

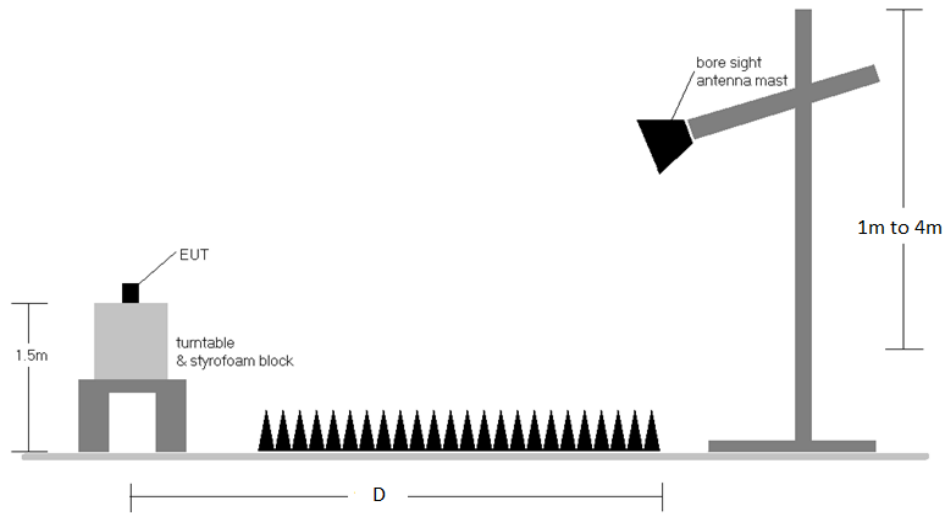


Figure 8-1. Radiated Test Setup >1GHz

Test Notes

1. The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of KDB 558074 D01 v05r02 were not used to evaluate this device for compliance to radiated limits. All radiated spurious emissions levels were measured in a radiated test setup.
2. All emissions lying in restricted bands specified in §15.205 and Section 8.10 of RSS-Gen are below the limit shown in Table 8-2.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested with its standard battery.
5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas.
6. D is the measurement test distance and emissions 1-18GHz were measured at a 3 meters test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
8. All supported modulation, antenna (including TxBF mode) and power schemes have been tested on the unit and only worst case configuration is reported.

FCC ID: BCGA2459 IC: 579C-A2459	 PCTEST Proud to be part of 	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 17 of 34

Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level $_{[dB_{\mu V/m}]} = \text{Analyzer Level}_{[dBm]} + 107 + \text{AFCL}_{[dB/m]}$
- $\text{AFCL}_{[dB/m]} = \text{Antenna Factor}_{[dB/m]} + \text{Cable Loss}_{[dB]} - \text{Preamplifier Gain}_{[dB]}$
- $\text{Margin}_{[dB]} = \text{Field Strength Level}_{[dB_{\mu V/m}]} - \text{Limit}_{[dB_{\mu V/m}]}$

Radiated Band Edge Measurement Offset

- The amplitude offset shown in the radiated restricted band edge plots in Section 7.8 was calculated using the formula:

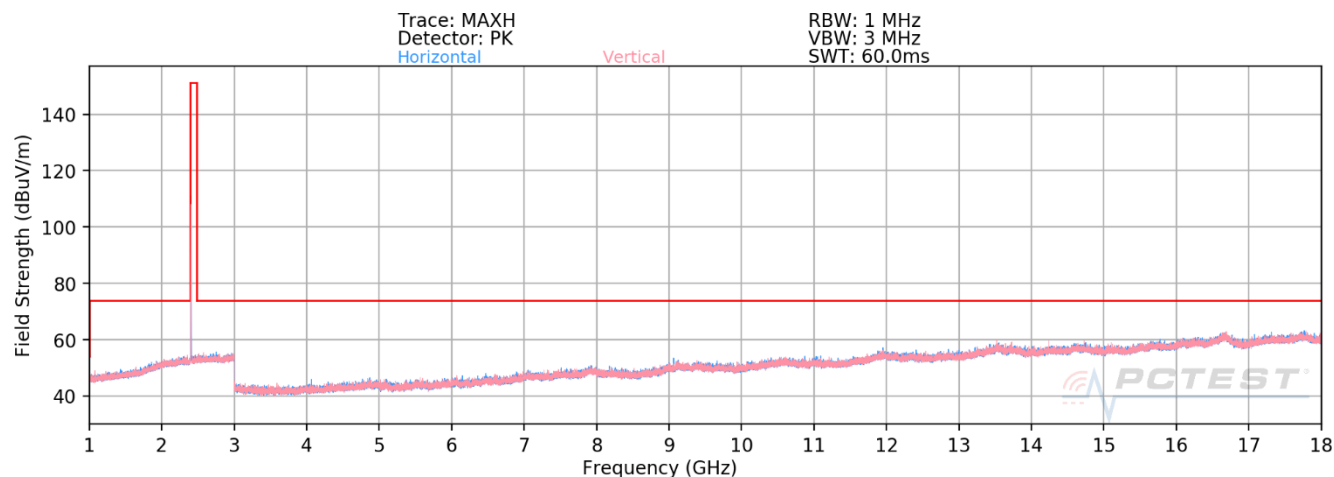
$$\text{Offset (dB)} = (\text{Antenna Factor} + \text{Cable Loss} + \text{Attenuator}) - \text{Preamplifier Gain}$$

FCC ID: BCGA2459 IC: 579C-A2459	 PCTEST Proud to be part of 	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 18 of 34

Radiated Spurious Emission Measurements (1 – 18GHz)

§15.205 §15.209 §15.247(d); RSS-Gen [8.9]

Antenna 4a



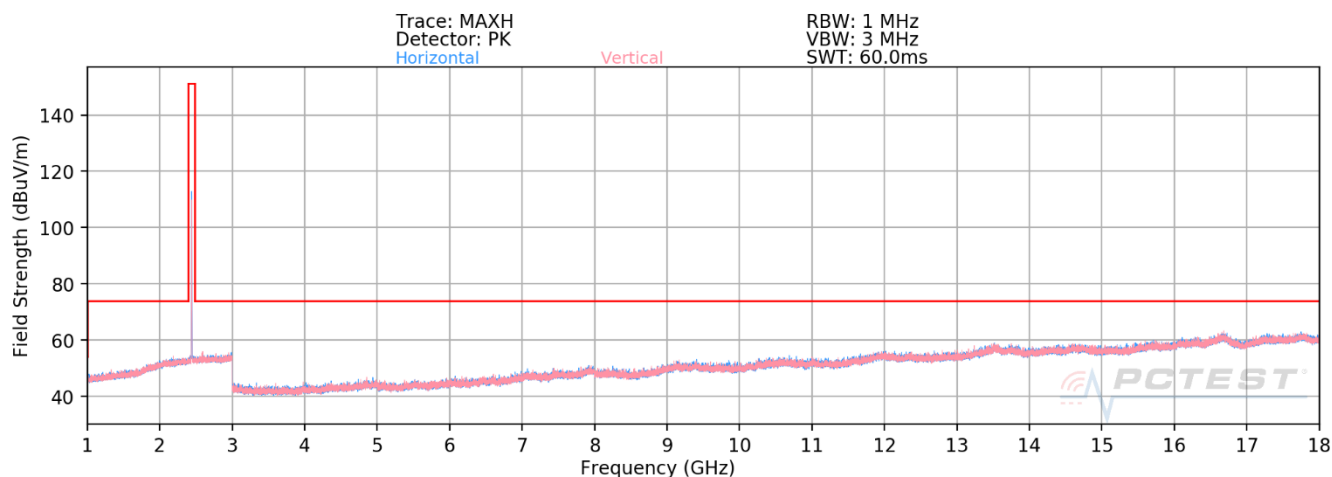
Plot 8-1. Radiated Spurious Emissions Above 1GHz Antenna 4a (4Mbps, HDR4, ePA – Ch. 1)

Bluetooth Mode:	HDR4
Power Scheme	ePA
Distance of Measurements:	3 Meters
Operating Frequency:	2404MHz
Channel:	01

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
4808.00	Avg	V	285	196	-79.56	9.16	36.60	53.98	-17.38
4808.00	Peak	V	285	196	-69.41	9.16	46.75	73.98	-27.23
12020.00	Avg	V	-	-	-84.57	21.17	43.60	53.98	-10.38
12020.00	Peak	V	-	-	-73.06	21.17	55.11	73.98	-18.87

Table 8-3. Radiated Measurements Antenna 4a

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device		Page 19 of 34



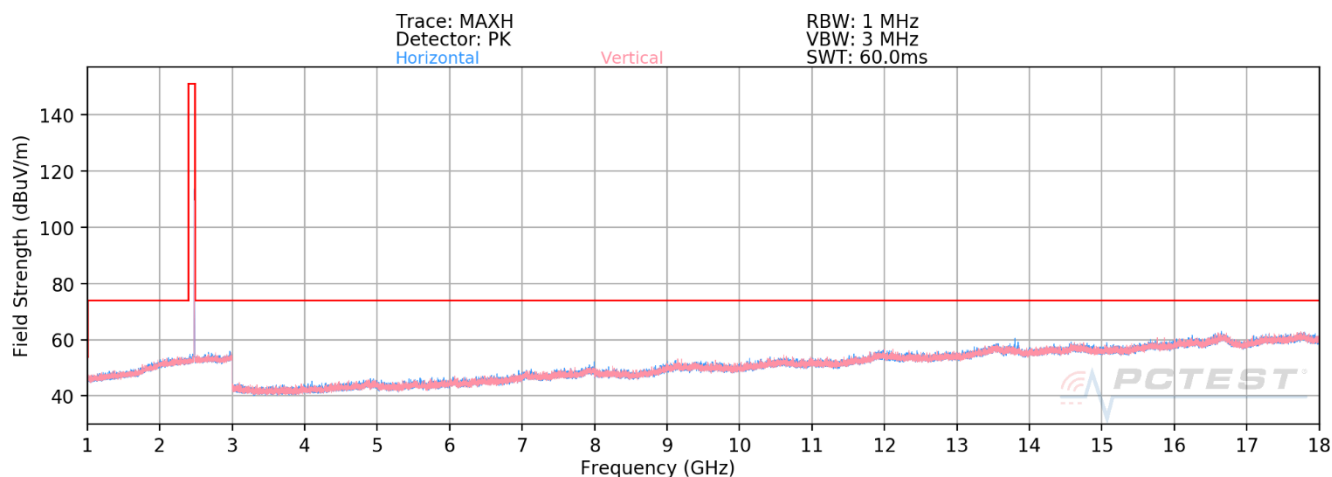
Plot 8-2. Radiated Spurious Emissions Above 1GHz Antenna 4a (4Mbps, HDR4, ePA – Ch. 38)

Bluetooth Mode: HDR4
Power Scheme: ePA
Distance of Measurements: 3 Meters
Operating Frequency: 2441MHz
Channel: 38

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
4882.00	Avg	V	-	-	-82.26	9.49	34.23	53.98	-19.75
4882.00	Peak	V	-	-	-70.78	9.49	45.71	73.98	-28.27
7323.00	Avg	V	-	-	-84.10	13.93	36.83	53.98	-17.15
7323.00	Peak	V	-	-	-72.61	13.93	48.32	73.98	-25.66
12205.00	Avg	V	-	-	-84.90	21.40	43.50	53.98	-10.47
12205.00	Peak	V	-	-	-73.01	21.40	55.39	73.98	-18.58

Table 8-4. Radiated Measurements Antenna 4a

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 20 of 34



Plot 8-3. Radiated Spurious Emissions Above 1GHz Antenna 4a (4Mbps, HDR4, ePA – Ch. 73)

Bluetooth Mode: HDR4
Power Scheme: ePA
Distance of Measurements: 3 Meters
Operating Frequency: 2476MHz
Channel: 73

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
4956.00	Avg	V	-	-	-82.08	9.40	34.32	53.98	-19.66
4956.00	Peak	V	-	-	-70.53	9.40	45.87	73.98	-28.11
7434.00	Avg	V	-	-	-84.34	14.66	37.32	53.98	-16.66
7434.00	Peak	V	-	-	-72.48	14.66	49.18	73.98	-24.80
12390.00	Avg	V	-	-	-85.76	21.75	42.99	53.98	-10.99
12390.00	Peak	V	-	-	-73.32	21.75	55.43	73.98	-18.55

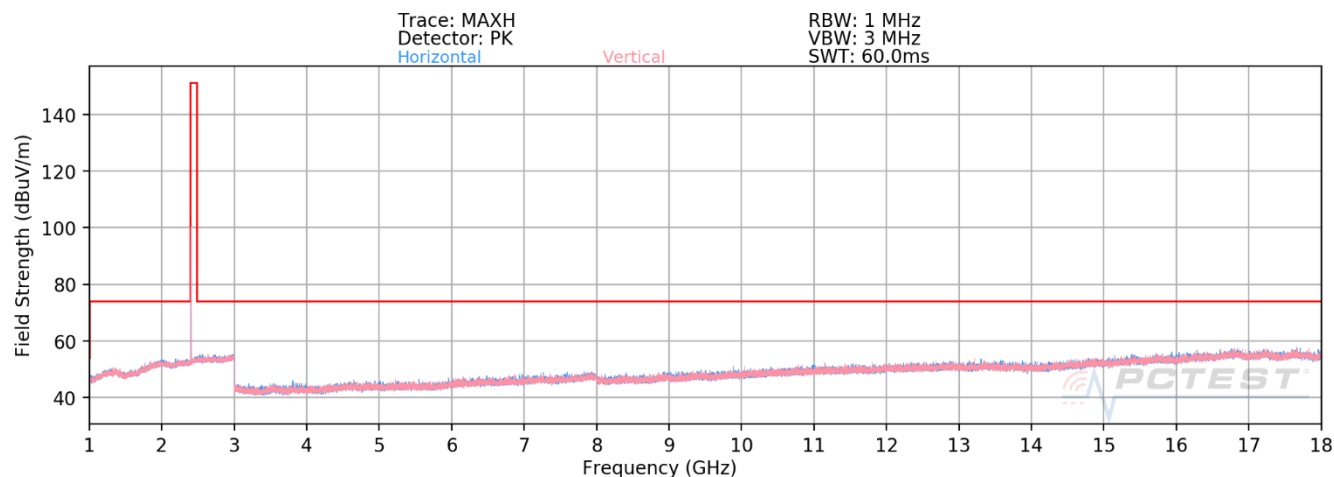
Table 8-5. Radiated Measurements Antenna 4a

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 21 of 34

Radiated Spurious Emission Measurements (Above 1GHz)

§15.205 §15.209 §15.247(d); RSS-Gen [8.9]

TxBF



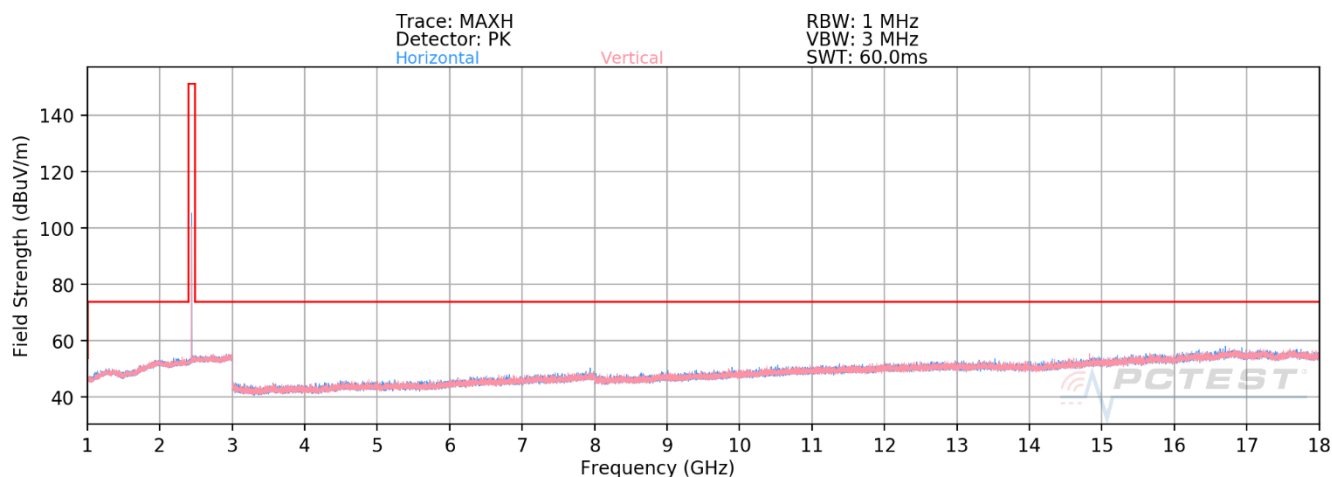
Plot 8-4. Radiated Spurious Emissions Above 1GHz TxBF (4Mbps, HDR4, ePA – Ch. 1)

Bluetooth Mode:	HDR4
Power Scheme	ePA
Distance of Measurements:	3 Meters
Operating Frequency:	2404MHz
Channel:	01

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
4808.00	Avg	H	-	-	-78.22	5.84	34.62	53.98	-19.36
4808.00	Peak	H	-	-	-67.61	5.84	45.23	73.98	-28.75
12020.00	Avg	H	-	-	-82.27	15.57	40.30	53.98	-13.68
12020.00	Peak	H	-	-	-70.24	15.57	52.33	73.98	-21.65

Table 8-6. Radiated Measurements TxBF

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device		Page 22 of 34



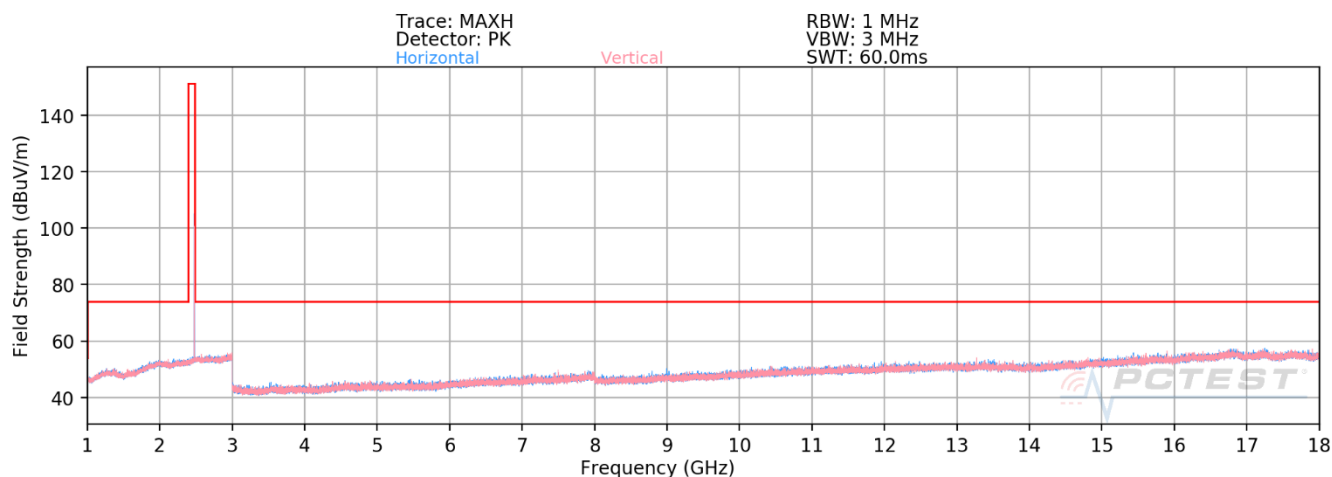
Plot 8-5. Radiated Spurious Emissions Above 1GHz TxBF (4Mbps, HDR4, ePA – Ch. 38)

Bluetooth Mode: HDR4
Power Scheme: ePA
Distance of Measurements: 3 Meters
Operating Frequency: 2441MHz
Channel: 38

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
4882.00	Avg	H	-	-	-78.68	6.07	34.39	53.98	-19.59
4882.00	Peak	H	-	-	-67.20	6.07	45.87	73.98	-28.11
7323.00	Avg	H	-	-	-79.38	8.60	36.22	53.98	-17.76
7323.00	Peak	H	-	-	-68.46	8.60	47.14	73.98	-26.84
12205.00	Avg	H	-	-	-81.79	15.25	40.46	53.98	-13.52
12205.00	Peak	H	-	-	-71.09	15.25	51.16	73.98	-22.82

Table 8-7. Radiated Measurements TxBF

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 23 of 34



Plot 8-6. Radiated Spurious Emissions Above 1GHz TxBF (4Mbps, HDR4, ePA – Ch. 73)

Bluetooth Mode: HDR4
Power Scheme: ePA
Distance of Measurements: 3 Meters
Operating Frequency: 2476MHz
Channel: 73

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
4956.00	Avg	H	-	-	-78.69	5.92	34.23	53.98	-19.75
4956.00	Peak	H	-	-	-67.12	5.92	45.80	73.98	-28.18
7434.00	Avg	H	-	-	-79.39	8.96	36.57	53.98	-17.41
7434.00	Peak	H	-	-	-68.11	8.96	47.85	73.98	-26.13
12390.00	Avg	H	-	-	-82.50	15.96	40.46	53.98	-13.52
12390.00	Peak	H	-	-	-71.29	15.96	51.67	73.98	-22.31

Table 8-8. Radiated Measurements TxBF

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 24 of 34

8.2.1 Radiated Restricted Band Edge Measurements

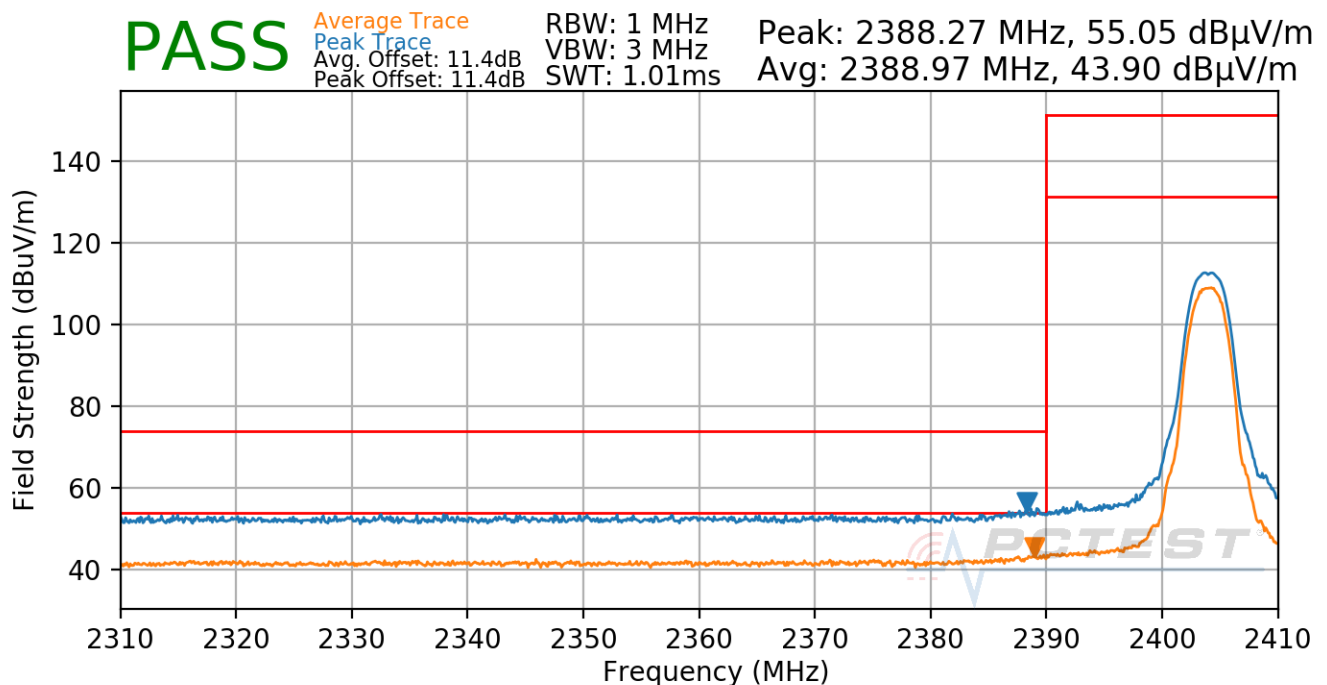
§15.205 §15.209; RSS-Gen [8.9]

Antenna 4a

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Bluetooth Mode:	HDR4-Antenna 4a
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 8-7. Radiated Restricted Lower Band Edge Measurement Antenna 4a (Average & Peak)

FCC ID: BCGA2459 IC: 579C-A2459	 PCTEST Proud to be part of 	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 25 of 34

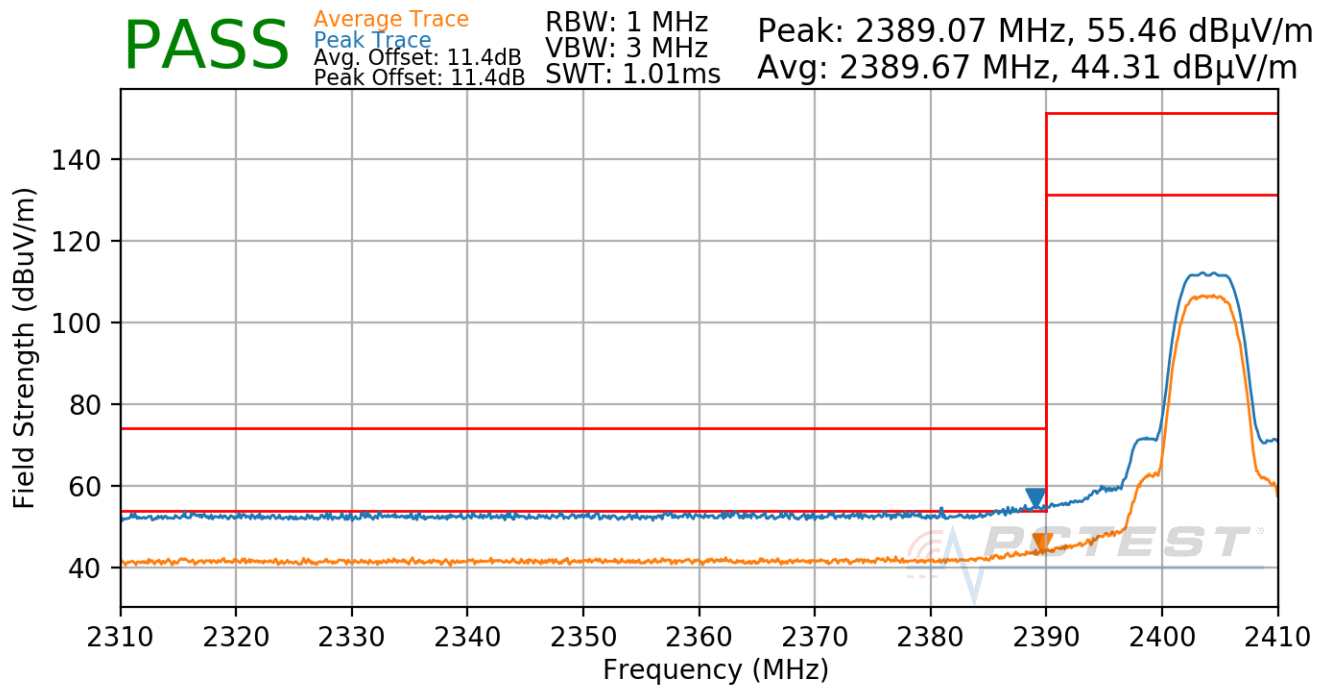
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Bluetooth Mode:	HDR8-Antenna 4a
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 8-8. Radiated Restricted Lower Band Edge Measurement Antenna 4a (Average & Peak)

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 26 of 34

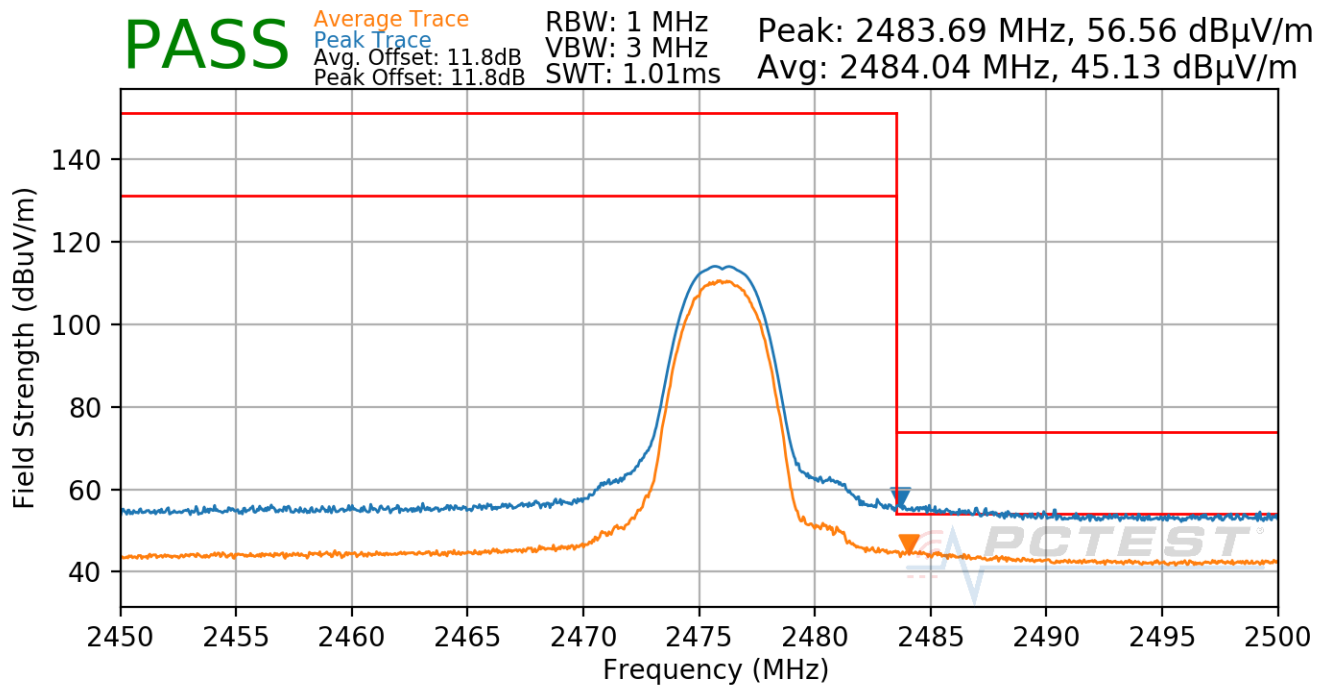
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Bluetooth Mode:	HDR4-Antenna 4a
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 8-9. Radiated Restricted Upper Band Edge Measurement Antenna 4a (Average & Peak)

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 27 of 34

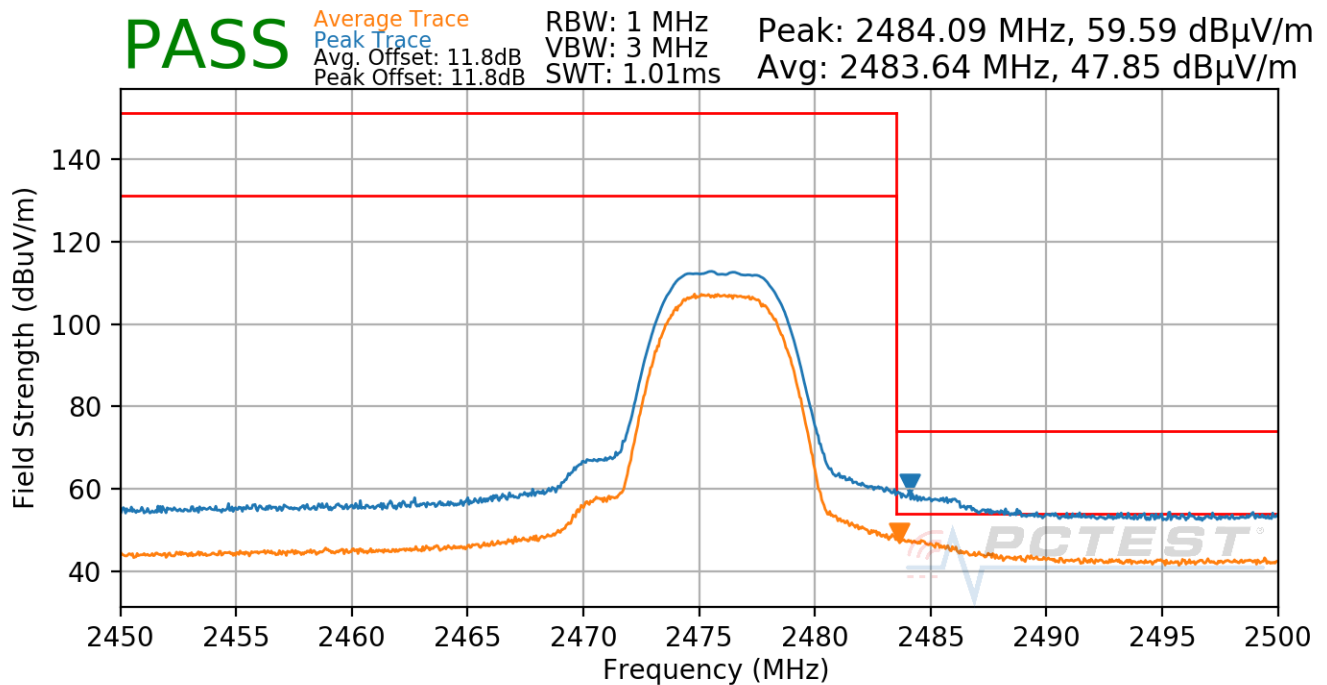
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Bluetooth Mode:	HDR8-Antenna 4a
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 8-10. Radiated Restricted Upper Band Edge Measurement Antenna 4a (Average & Peak)

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 28 of 34

Radiated Restricted Band Edge Measurements

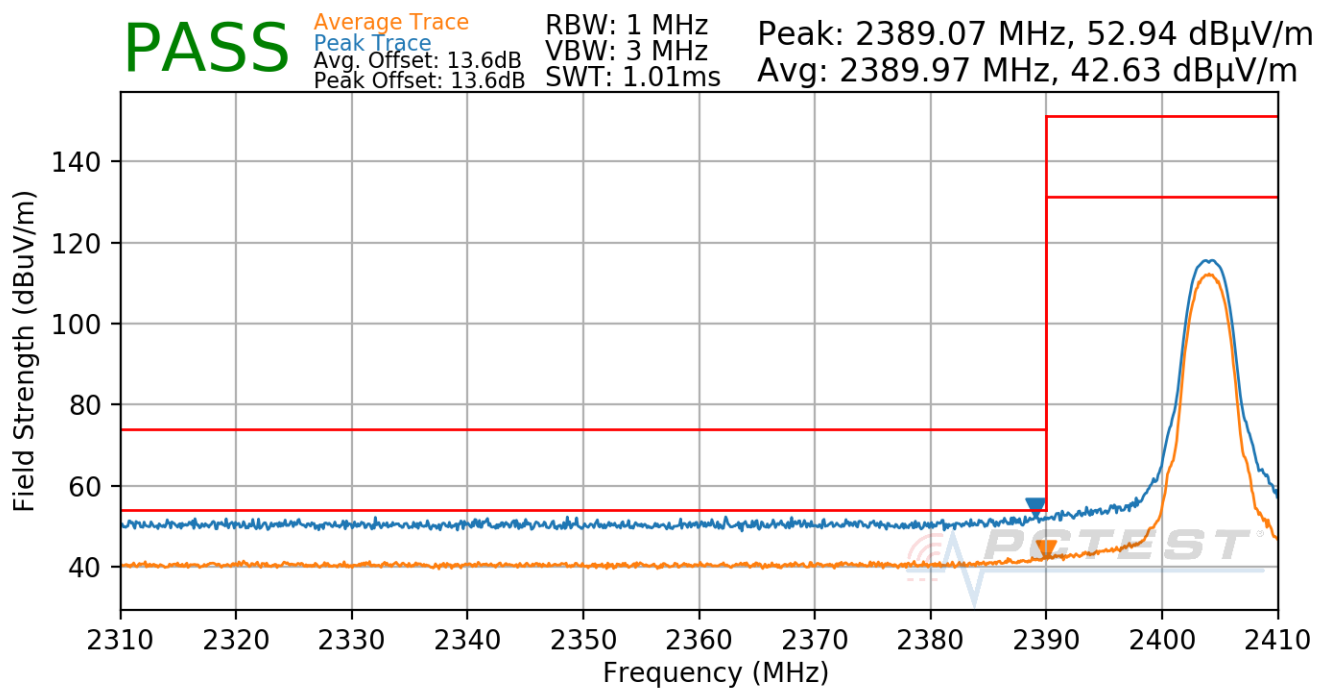
§15.205 §15.209; RSS-Gen [8.9]

TxBF

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Bluetooth Mode:	HDR4-TxBF
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 8-11. Radiated Restricted Lower Band Edge Measurement TxBF (Average & Peak)

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 29 of 34

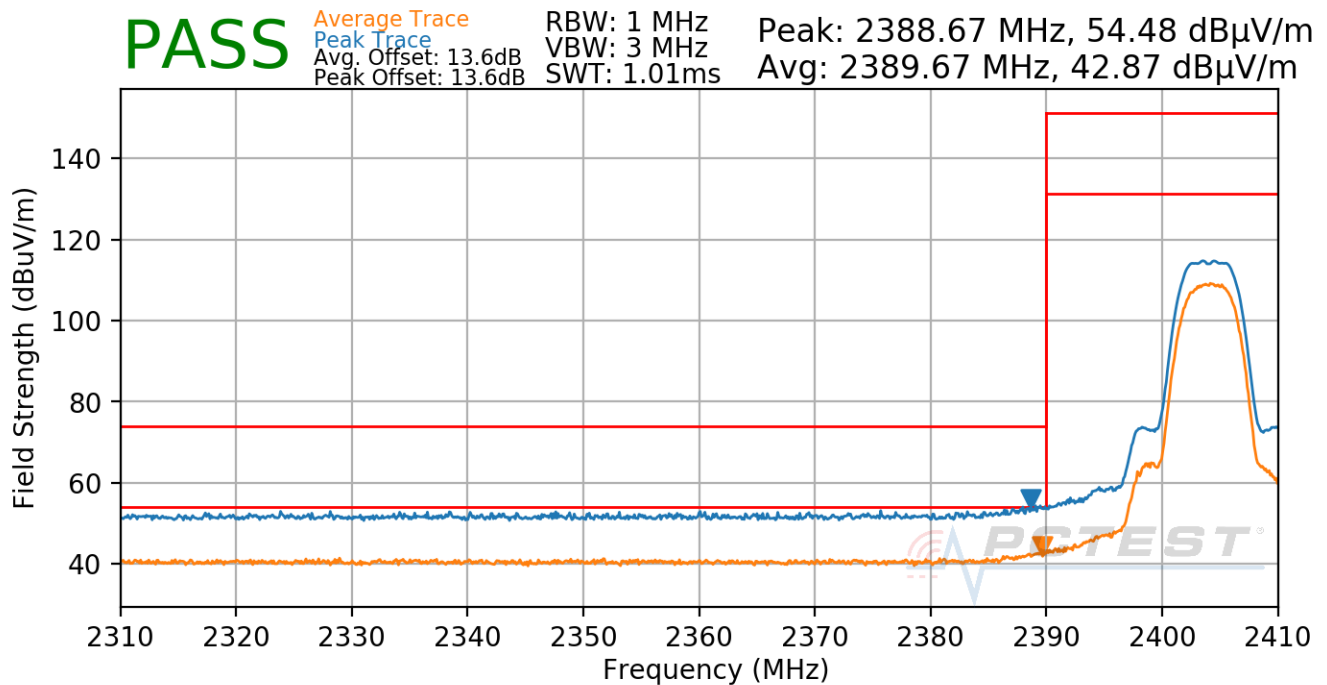
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Bluetooth Mode:	HDR8-TxBF
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 8-12. Radiated Restricted Lower Band Edge Measurement TxBF (Average & Peak)

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 30 of 34

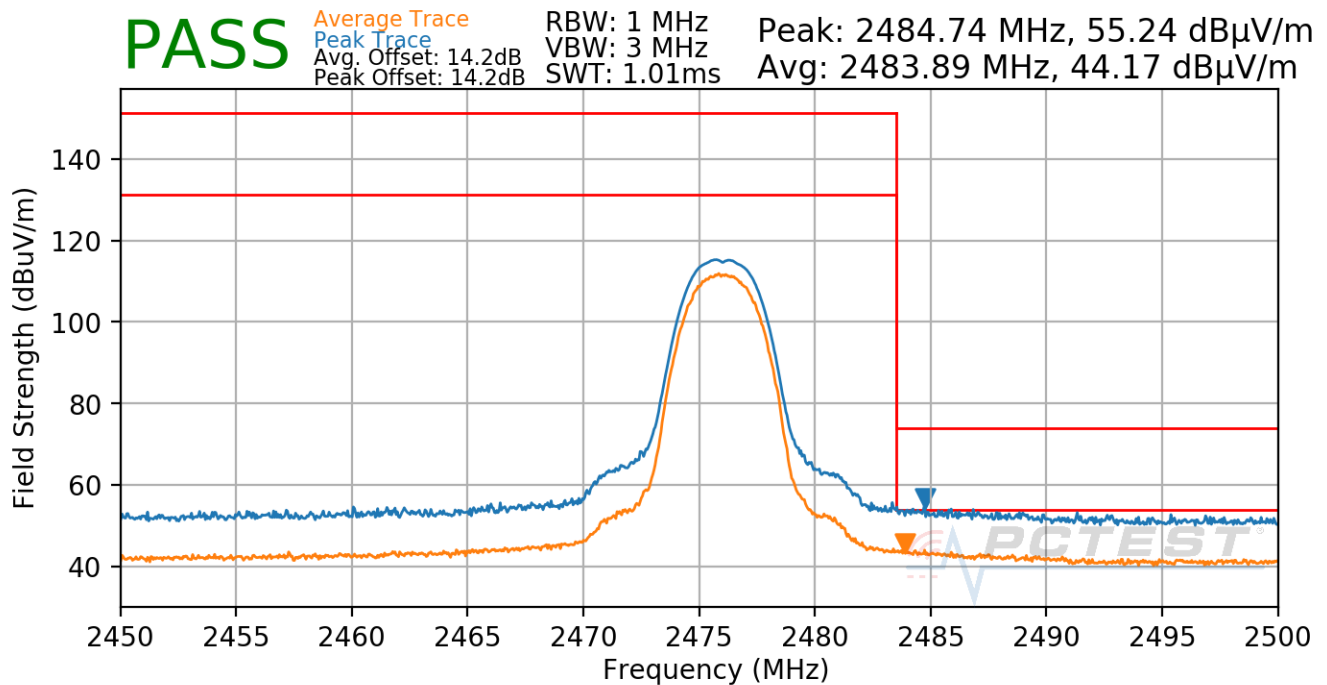
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Bluetooth Mode:	HDR4-TxBF
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 8-13. Radiated Restricted Upper Band Edge Measurement TxBF (Average & Peak)

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 31 of 34

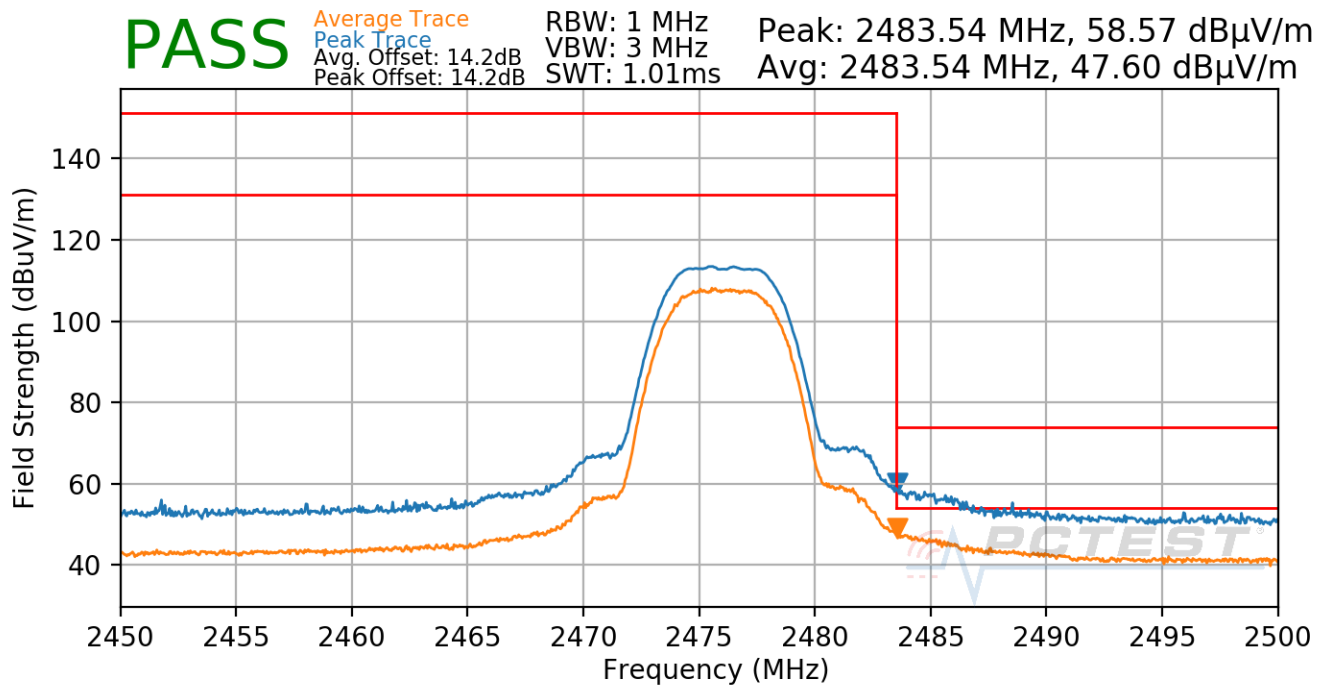
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Bluetooth Mode:	HDR8-TxBF
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 8-14. Radiated Restricted Upper Band Edge Measurement TxBF (Average & Peak)

FCC ID: BCGA2459 IC: 579C-A2459	PCTEST Proud to be part of element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device	Page 32 of 34

9.0 CONCLUSION

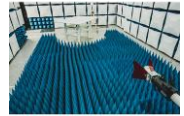
The spot-check data measured for variant model **FCC ID: BCGA2459 / IC: 579C-A2459** is in tolerance with reference model FCC ID: BCGA2301 / IC: 579C-A2301 per FCC/ISED Approved Data Referencing Test Plan. Additionally, Antenna 4a radiated testing has been fully conducted and results were found in compliance with Part 15 Subpart C (15.247) of the FCC Rules and RSS-247 of the Innovation, Science and Economic Development Canada Rules.

FCC ID: BCGA2459 IC: 579C-A2459	 DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device

10.0 APPENDIX A: REFERENCE MODEL TEST REPORT

Attached is the test report (1C2101020002-11.BCG) from reference model FCC ID: BCGA2301 / IC: 579C-A2301, which includes referenced data results.

FCC ID: BCGA2459 IC: 579C-A2459	 DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020003-12.BCG	Test Dates: 12/15/2020 - 03/03/2021	EUT Type: Tablet Device



MEASUREMENT REPORT

FCC PART 15.247 / ISCED RSS-247 Bluetooth (HDR)

Applicant Name:

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

Date of Testing:

12/15/2020-2/25/2021

Test Site/Location:

PCTEST Lab. Morgan Hill, CA, USA

Test Report Serial No.:

1C2101020002-11.BCG

FCC ID:

BCGA2301

IC:

579C-A2301

APPLICANT:

Apple Inc.

Application Type:

Certification

Model/HVIN:

A2301

EUT Type:

Tablet Device

Max. RF Output Power:

46.345 mW (16.66 dBm) Peak Conducted

Frequency Range:

2404 – 2476MHz

FCC Classification:

Digital Transmission System (DTS)

FCC Rule Part(s):

Part 15 Subpart C (15.247)

ISED Specification:

RSS-247 Issue 2

Test Procedure(s):

ANSI C63.10-2013, KDB 558074 D01 v05r02

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 ANSI C63.10-2013 and KDB 558074 D01 v05r02. 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 IC: 579C-A2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 1 of 101

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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 ISSED Standards (RSS).
- PCTEST facility is a registered (22831) test laboratory with the site description on file with ISSED.

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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, IC: 579C-A2301**. The data found in this test report was taken with the EUT operating in Bluetooth HDR mode. While in HDR mode, the Bluetooth transmitter hops pseudo-randomly between 73 channels.

Test Device Serial No.: LGXMHP6X6Y, JDP7MWF160, NQ73CFK6VJ, N9TXL9P7K6

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

Ch.	Frequency (MHz)
1	2404
:	:
38	2441
:	:
73	2476

Table 2-1. Bluetooth HDR Frequency / Channel Operations

Measured Duty Cycles				
HDR Mode		Duty Cycle [%]		
		Antenna 4a	Antenna 2a	TxBF
HDR4	ePA	100.0	100.0	100.0
	iPA	100.0	100.0	100.0
HDR8	ePA	100.0	100.0	100.0
	iPA	100.0	100.0	100.0

Table 2-2. Measured Duty Cycles

This device is capable of operating in hopping and non-hopping mode. The EUT can hop between 73 different channels in the 2400 – 2483.5MHz band.

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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, LE 1M/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 2-3. 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 OFDMA and FCC part 27b test reports.

2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Frequency [GHz]	Antenna Gain (dBi)	
	Antenna 4a	Antenna 2a
2.4	1.5	2.5

Table 2-4. 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 2-5. Test Support Equipment List

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2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013 and KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2, 7.3, 7.4, 7.5, and 7.6 for antenna port conducted emissions test setups.

There are two vendors of the WiFi/Bluetooth radio modules, variant 1 and variant 2. Both radio modules have the same mechanical outline, same on-board antenna matching circuit, identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances. The worst case configuration was found between the two variants. The EUT was also investigated with and without charger.

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.

For AC line conducted and radiated test below 1GHz, following configuration were investigated and the worst case was reported.

- EUT powered by AC/DC adaptor via USB-C cable with wire charger
- EUT powered by host PC via USB-C cable with wire charger

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/or 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 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure.....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 7m x 3.66m x 2.7m shielded enclosure. The shielded enclosure is manufactured by AP Americas. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an EPCOS 2X60A Power Line Filter (100dB Attenuation, 14kHz-18GHz) and the two EPCOS 2X48A filters (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that the cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.10. Automated test software was used to perform the AC line conducted emissions testing. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 10.50.40.

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3.3 Radiated 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. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

Per KDB 414788, 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 rotated about its vertical axis 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.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

3.4 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antenna(s) of the EUT are **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

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5.0 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
Line Conducted Disturbance	2.75
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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6.0 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
Anritsu	ML2496A	Power Meter	4/9/2020	Annual	4/9/2021	2002005
Anritsu	MA2411B	Pulse Power Sensor	3/10/2020	Annual	3/10/2021	1911105
Anritsu	MA2411B	Pulse Power Sensor	3/10/2020	Annual	3/10/2021	1911106
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	8/11/2020	Annual	8/11/2021	T058701-01
COM-POWER	LIN-120A	LISN	3/4/2020	Annual	3/4/2021	241297
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	ESW26	EMI Test Receiver	6/1/2020	Annual	6/1/2021	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	8/7/2020	Annual	8/7/2021	101668
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	4/3/2020	Annual	4/3/2021	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
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	12/3/2020	Annual	12/3/2021	101648
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	3/4/2020	Annual	3/4/2021	102325
Rohde & Schwarz	ENV216	Two-Line V-Network (LISN)	12/7/2020	Annual	12/7/2021	101364

Table 6-1. Test Equipment List

Note:

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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7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
FCC ID: BCGA2301
IC: 579C-A2301
FCC Classification: Digital Transmission System (DTS)
Number of Channels: 73

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	> 500kHz	CONDUCTED	PASS	Section 7.2
2.1049	RSS-Gen [6.7]	Occupied Bandwidth	N/A		N/A	Section 7.2
15.247(b)(3)	RSS-247 [5.4(d)]	Transmitter Output Power	< 1 Watt		PASS	Sections 7.3
15.247(e)	RSS-247 [5.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz Band		PASS	Section 7.4
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	≥ 20dBc		PASS	Sections 7.5, 7.6
15.205 15.209	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])	RADIATED	PASS	Sections 7.7, 7.7.1, 7.8
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen[8.8])	AC LINE CONDUCTED	PASS	Section 7.10

Table 7-1. Summary of Test Results

Notes:

1. All modes of operation were investigated. The test results shown in the following sections represent the worst case emissions.
2. The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer 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 and attenuators.
4. For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST “Chamber Automation,” Version 1.3.1.

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7.2 Bandwidth Measurement – Bluetooth (HDR)

§2.1049; §15.247(a.2); RSS-247 [5.2]; RSS-Gen [6.7]

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the transmitter antenna terminal of the EUT while the EUT is operating at maximum power and at the appropriate frequencies. All modes of operation were investigated and the worst case configuration results are reported in this section.

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.

The minimum permissible 6dB bandwidth is 500 kHz.

Test Procedure Used

ANSI C63.10-2013 – Section 11.8.2 Option 2

KDB 558074 D01 v05r02 – Section 8.2

RSS-Gen [6.7]

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 99% occupied bandwidth and the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to $X = 6$. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 100kHz
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

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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

All supported modulation, antennas (including TxBF mode) and power schemes have been tested on the unit and only the worst case configuration is reported.

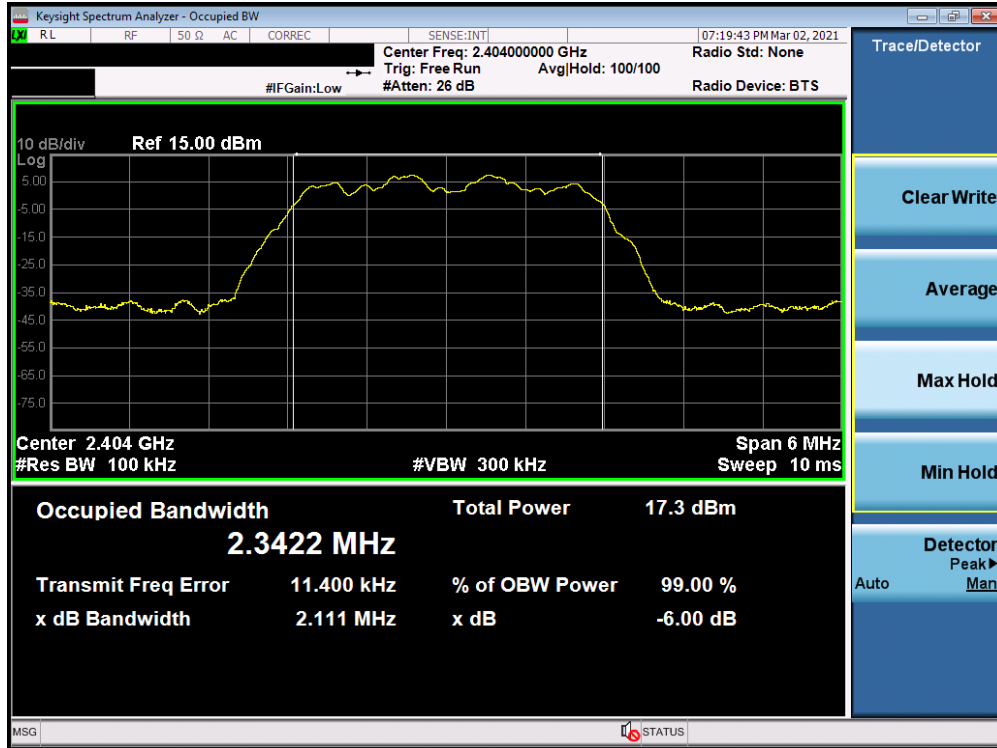
FCC ID: BCGA2301 IC: 579C-A2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Antenna 4a

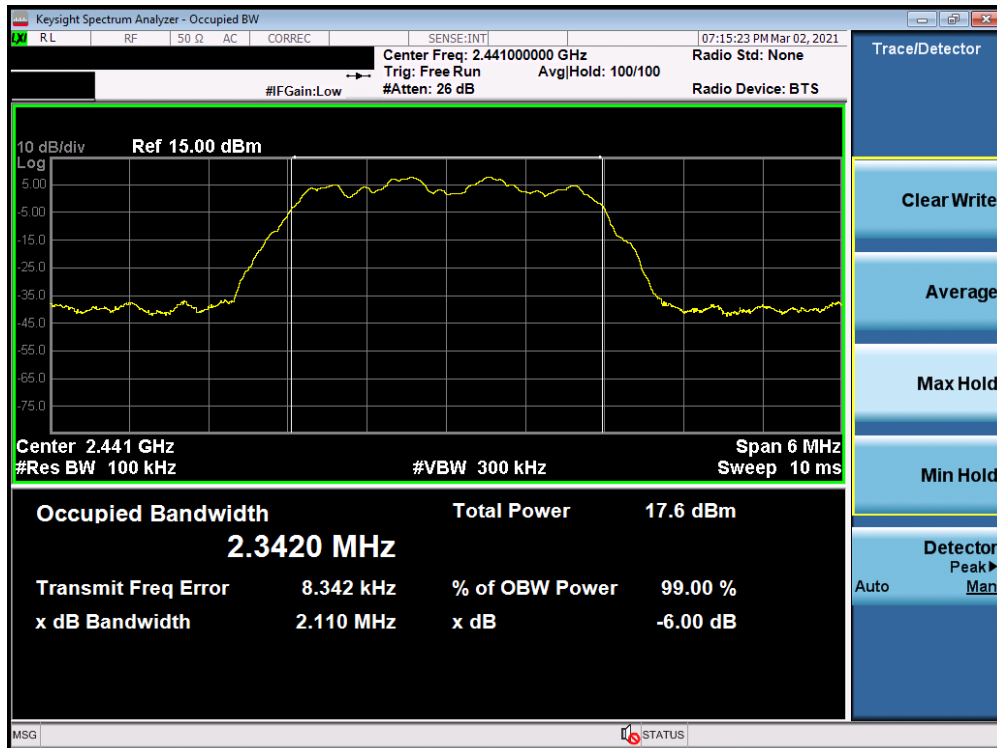
Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	99% Occupied Bandwidth [kHz]	6dB Bandwidth [kHz]	Minimum 6dB Bandwidth [kHz]	Pass / Fail
2404	4.0	ePA	1	2342.2	2111.0	500	Pass
2441	4.0	ePA	38	2342.0	2110.0	500	Pass
2476	4.0	ePA	73	2343.0	2114.0	500	Pass
2404	8.0	ePA	1	4704.7	4113.0	500	Pass
2441	8.0	ePA	38	4700.8	4117.0	500	Pass
2476	8.0	ePA	73	4693.8	4129.0	500	Pass

Table 7-2. 6dB BW & 99% OBW Measurements Antenna 4a

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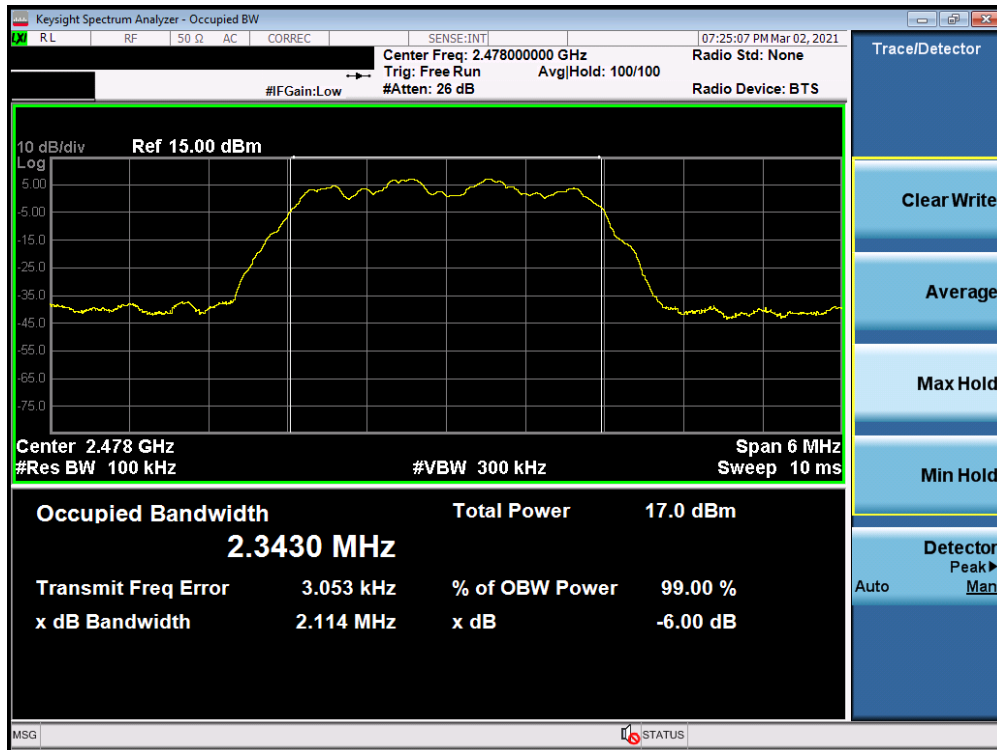


Plot 7-1. 6dB BW & 99% OBW Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 1)

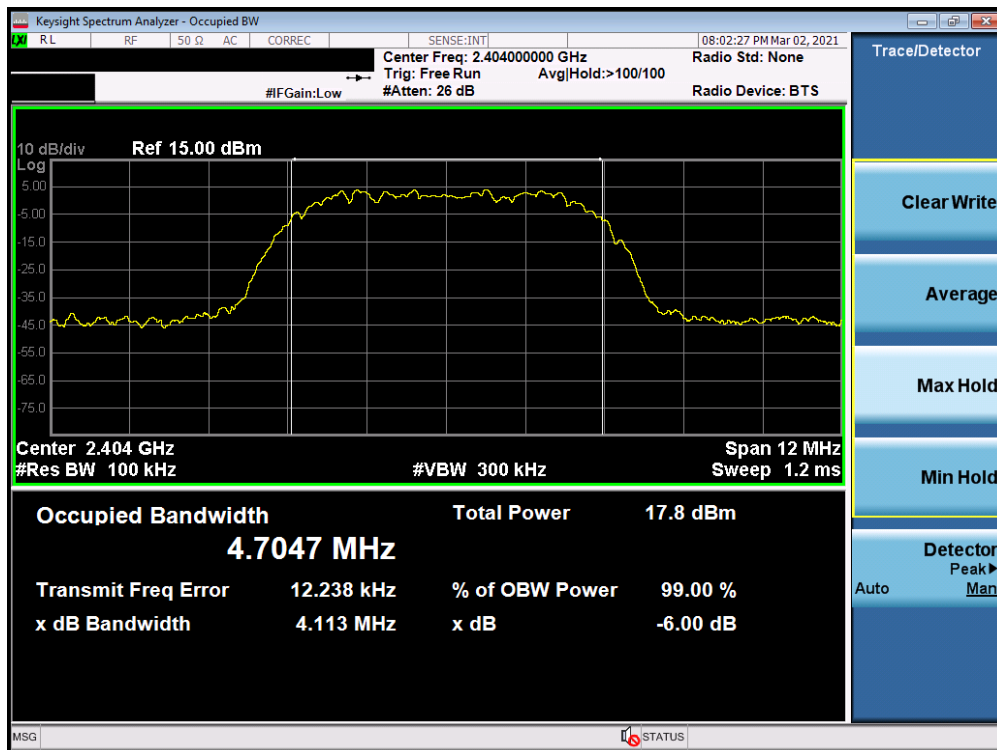


Plot 7-2. 6dB BW & 99% OBW Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 38)

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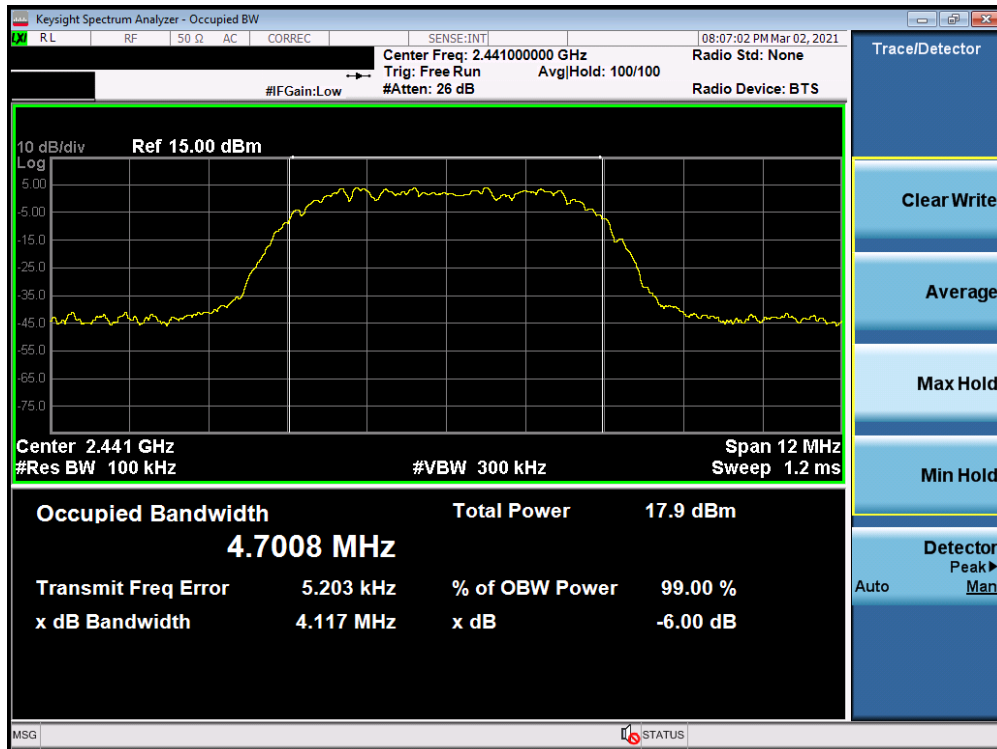


Plot 7-3. 6dB BW & 99% OBW Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 73)

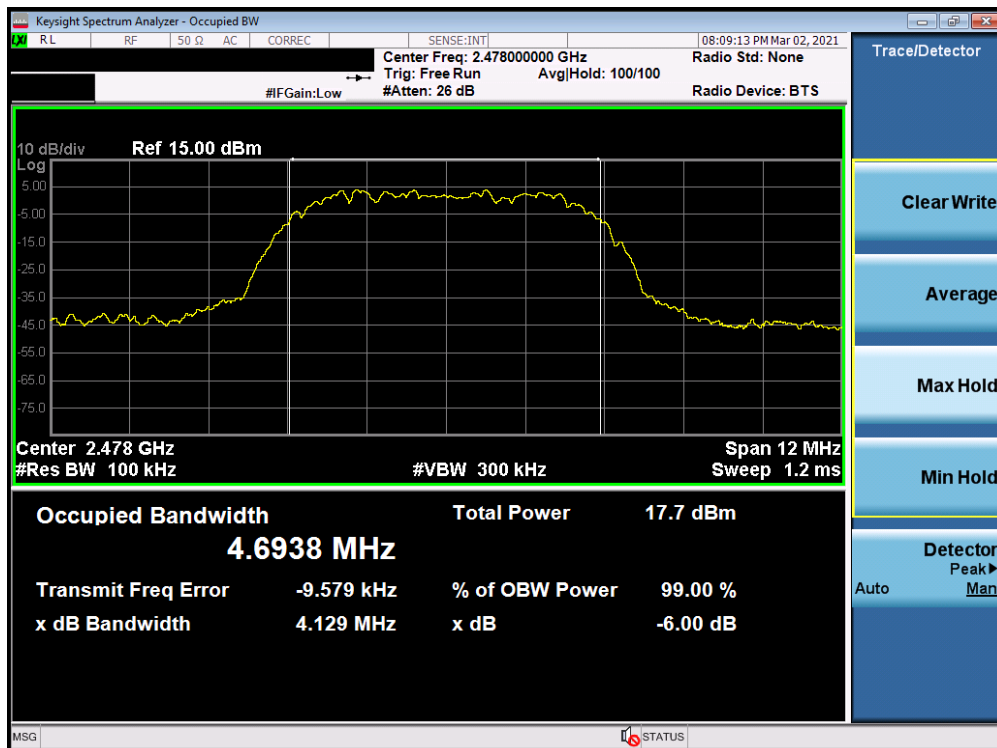


Plot 7-4. 6dB BW & 99% OBW Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-5. 6dB BW & 99% OBW Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 38)



Plot 7-6. 6dB BW & 99% OBW Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 73)

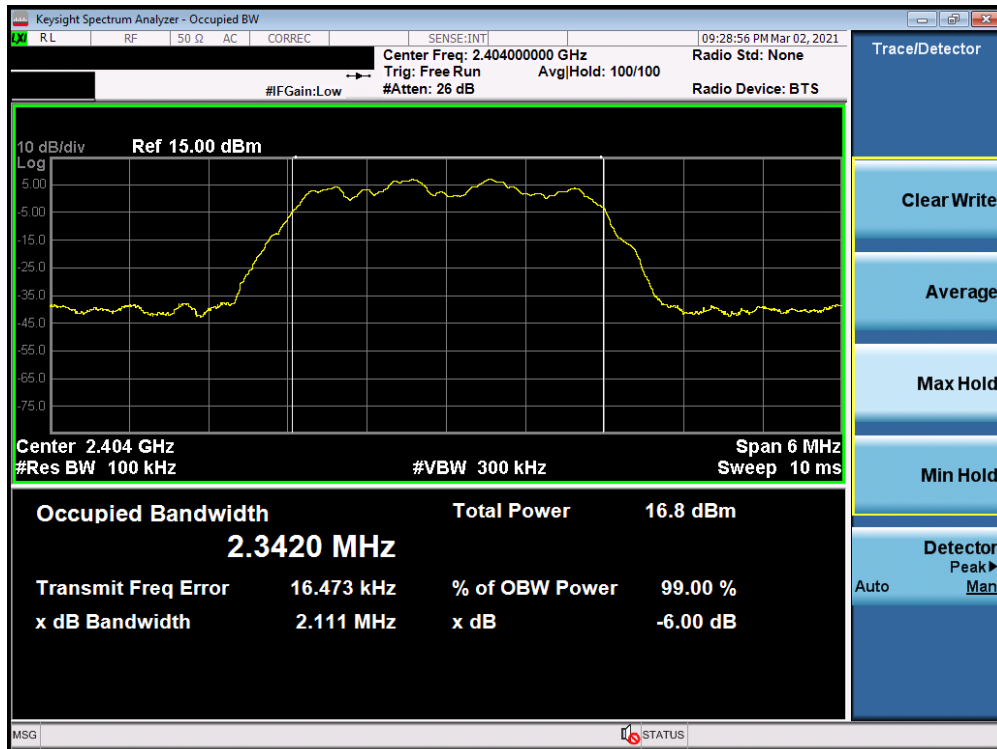
FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 18 of 101

Antenna 2a

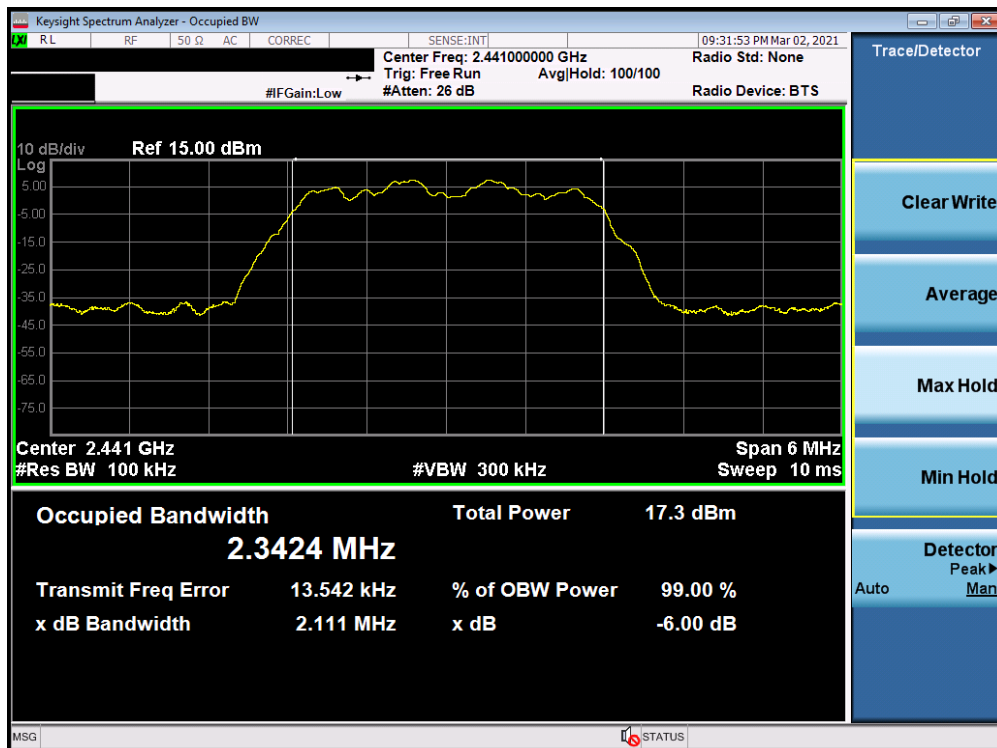
Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	99% Occupied Bandwidth [kHz]	6dB Bandwidth [kHz]	Minimum 6dB Bandwidth [kHz]	Pass / Fail
2404	4.0	ePA	1	2342.0	2111.0	500	Pass
2441	4.0	ePA	38	2342.4	2111.0	500	Pass
2476	4.0	ePA	73	2342.4	2114.0	500	Pass
2404	8.0	ePA	1	4701.9	4114.0	500	Pass
2441	8.0	ePA	38	4697.8	4121.0	500	Pass
2476	8.0	ePA	73	4691.1	4141.0	500	Pass

Table 7-3. 6dB BW & 99% OBW Measurements Antenna 2a

FCC ID: BCGA2301 IC: 579C-A2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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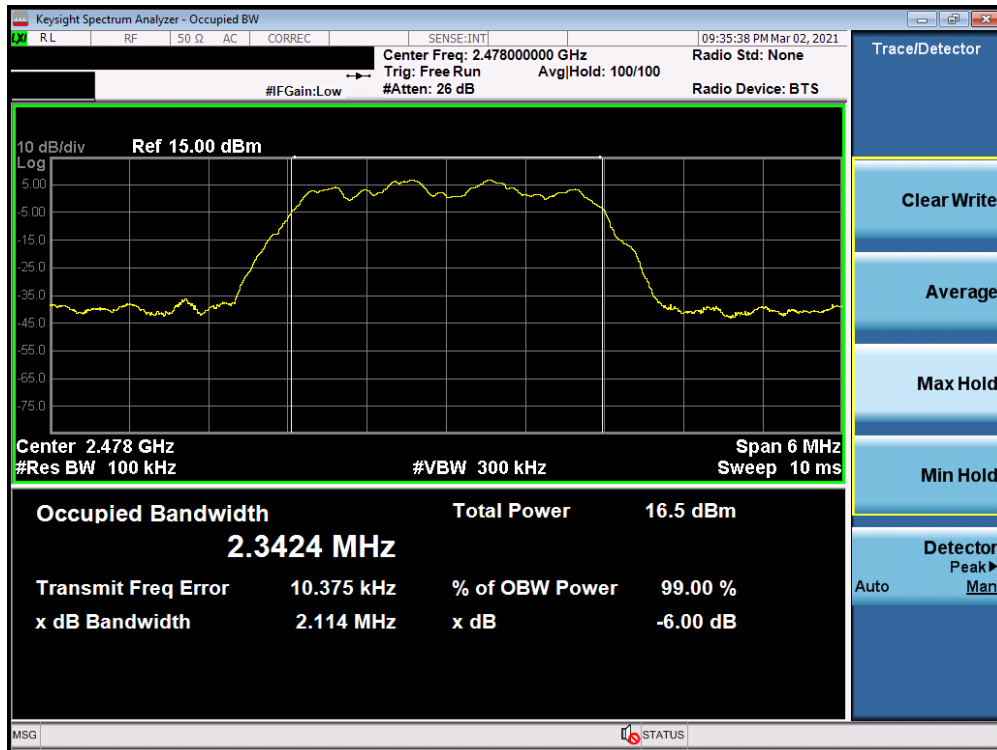


Plot 7-7. 6dB BW & 99% OBW Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 1)

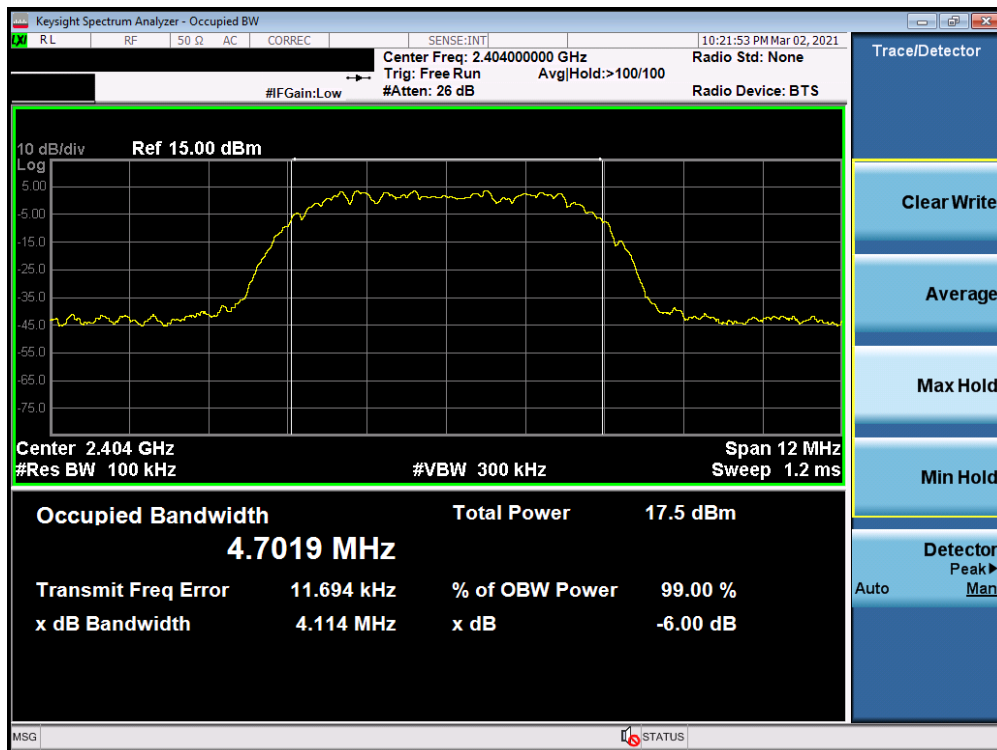


Plot 7-8. 6dB BW & 99% OBW Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 38)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 20 of 101

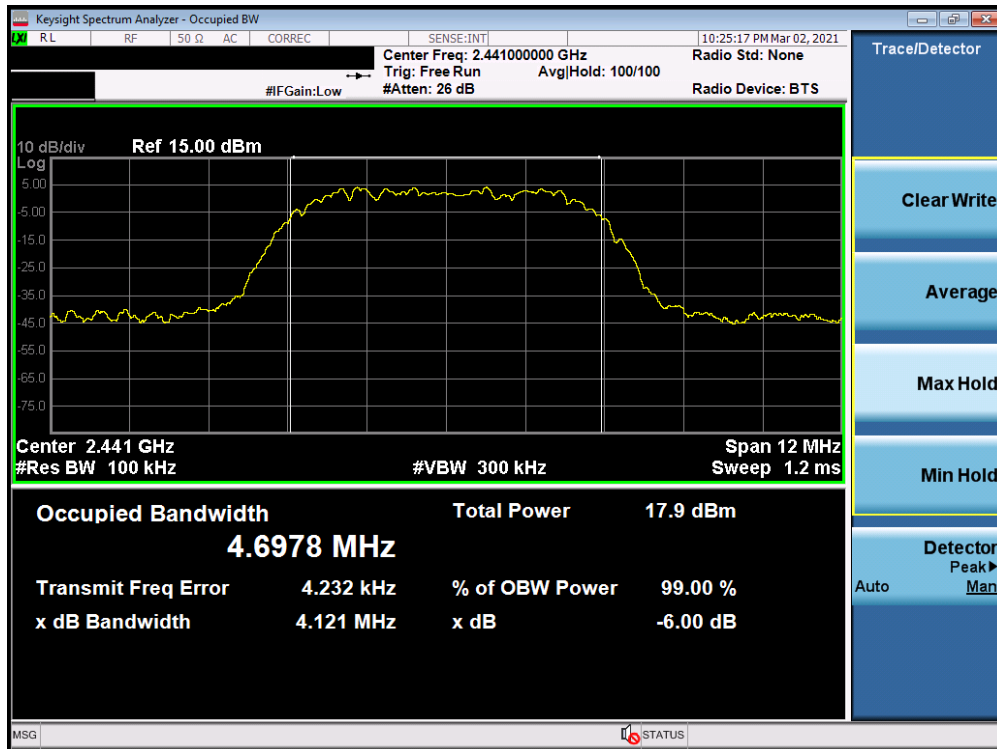


Plot 7-9. 6dB BW & 99% OBW Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 73)

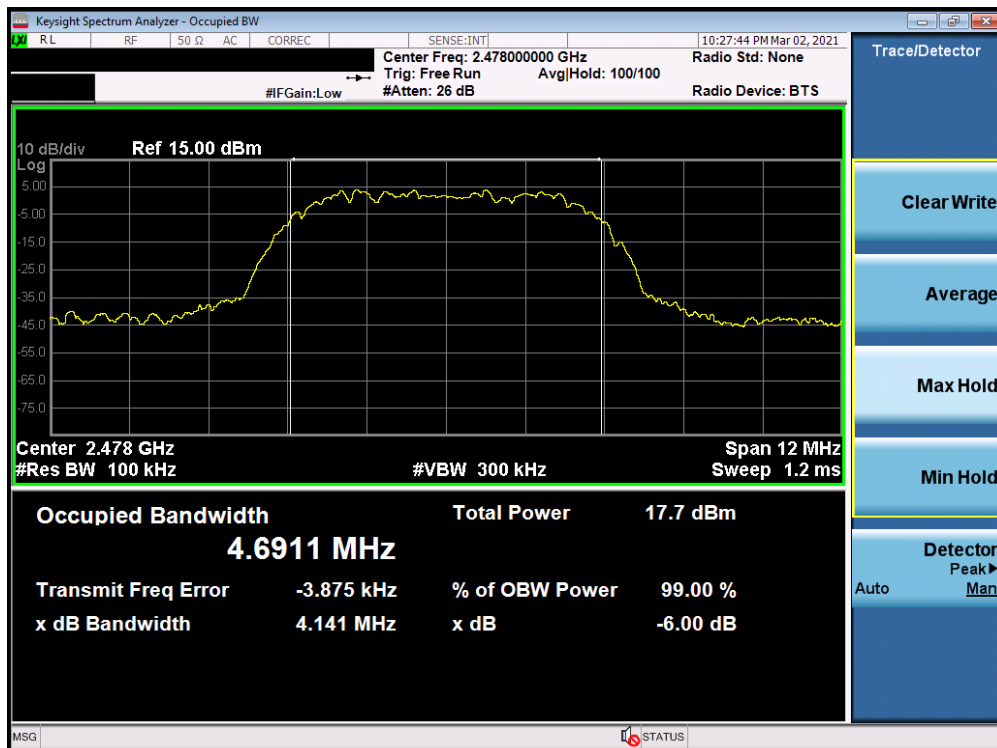


Plot 7-10. 6dB BW & 99% OBW Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 21 of 101



Plot 7-11. 6dB BW & 99% OBW Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 38)



Plot 7-12. 6dB BW & 99% OBW Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 73)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 22 of 101

7.3 Output Power Measurement – Bluetooth (HDR)

§15.247(b.3); RSS-247 [5.4(d)]

Test Overview and Limits

The transmitter antenna terminal of the EUT is connected to the input of a spectrum analyzer. Measurements are made while the EUT is operating at maximum power and at the appropriate frequencies.

The maximum peak conducted output power of digital modulation systems operating in the 2400-2483.5 MHz band is 1 Watt.

The conducted output power limit on paragraph above is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W.

Test Procedure Used

ANSI C63.10-2013 – Section 11.9.1.3
ANSI C63.10-2013 – Section 11.9.2.3.2
KDB 558074 D01 v05r02 – Section 8.3.1.3, 8.3.2.3
ANSI C63.10-2013 – Section 14.2 Measure-and-Sum Technique
KDB 662911 D01 v02r01 – Section E)1) Measure-and-Sum Technique

Test Settings

Method PKPM1 (Peak Power Measurement)

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

Method AVGPM-G (Average Power Measurement)

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

Test Setup

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



Figure 7-2. Test Instrument & Measurement Setup for Peak and Average Power Measurement

Test Notes

None

FCC ID: BCGA2301 IC: 579C-A2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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7.3.1 Peak Output Power Measurement – Bluetooth (HDR)

Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Peak Conducted Power		Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
				[dBm]	[mW]						
2404	4.0	ePA	1	12.87	19.364	30.00	-17.13	1.50	14.37	36.02	-21.65
2441	4.0	ePA	38	12.89	19.454	30.00	-17.11	1.50	14.39	36.02	-21.63
2476	4.0	ePA	73	12.81	19.099	30.00	-17.19	1.50	14.31	36.02	-21.71
2404	4.0	iPA	1	6.87	4.864	30.00	-23.13	1.50	8.37	36.02	-27.65
2441	4.0	iPA	38	6.49	4.457	30.00	-23.51	1.50	7.99	36.02	-28.03
2476	4.0	iPA	73	6.88	4.875	30.00	-23.12	1.50	8.38	36.02	-27.64
2404	8.0	ePA	1	13.98	25.003	30.00	-16.02	1.50	15.48	36.02	-20.54
2441	8.0	ePA	38	13.61	22.961	30.00	-16.39	1.50	15.11	36.02	-20.91
2476	8.0	ePA	73	13.68	23.335	30.00	-16.32	1.50	15.18	36.02	-20.84
2404	8.0	iPA	1	7.95	6.237	30.00	-22.05	1.50	9.45	36.02	-26.57
2441	8.0	iPA	38	7.60	5.754	30.00	-22.40	1.50	9.10	36.02	-26.92
2476	8.0	iPA	73	7.86	6.109	30.00	-22.14	1.50	9.36	36.02	-26.66

Table 7-4. Peak Conducted Output Power Measurements Antenna 4a (Bluetooth HDR)

Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Peak Conducted Power		Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
				[dBm]	[mW]						
2404	4.0	ePA	1	12.32	17.061	30.00	-17.68	2.50	14.82	36.02	-21.20
2441	4.0	ePA	38	12.55	17.989	30.00	-17.45	2.50	15.05	36.02	-20.97
2476	4.0	ePA	73	12.29	16.943	30.00	-17.71	2.50	14.79	36.02	-21.23
2404	4.0	iPA	1	5.44	3.499	30.00	-24.56	2.50	7.94	36.02	-28.08
2441	4.0	iPA	38	5.20	3.311	30.00	-24.80	2.50	7.70	36.02	-28.32
2476	4.0	iPA	73	5.46	3.516	30.00	-24.54	2.50	7.96	36.02	-28.06
2404	8.0	ePA	1	13.51	22.439	30.00	-16.49	2.50	16.01	36.02	-20.01
2441	8.0	ePA	38	13.18	20.797	30.00	-16.82	2.50	15.68	36.02	-20.34
2476	8.0	ePA	73	13.20	20.893	30.00	-16.80	2.50	15.70	36.02	-20.32
2404	8.0	iPA	1	6.25	4.217	30.00	-23.75	2.50	8.75	36.02	-27.27
2441	8.0	iPA	38	6.00	3.981	30.00	-24.00	2.50	8.50	36.02	-27.52
2476	8.0	iPA	73	6.28	4.246	30.00	-23.72	2.50	8.78	36.02	-27.24

Table 7-5. Peak Conducted Output Power Measurements Antenna 2a (Bluetooth HDR)

Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Peak Conducted Power						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
				Antenna 4a		Antenna 2a		Summed							
				[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]						
2404	4.0	ePA	1	13.10	20.417	12.36	17.219	15.76	37.670	30.00	-14.24	5.02	20.78	36.02	-15.24
2441	4.0	ePA	38	13.37	21.727	12.26	16.827	15.86	38.548	30.00	-14.14	5.02	20.88	36.02	-15.14
2476	4.0	ePA	73	13.19	20.845	12.38	17.298	15.81	38.107	30.00	-14.19	5.02	20.83	36.02	-15.19
2404	4.0	iPA	1	6.47	4.436	5.20	3.311	8.89	7.745	30.00	-21.11	5.02	13.91	36.02	-22.11
2441	4.0	iPA	38	6.22	4.188	5.19	3.304	8.75	7.499	30.00	-21.25	5.02	13.77	36.02	-22.25
2476	4.0	iPA	73	6.23	4.198	5.28	3.373	8.79	7.568	30.00	-21.21	5.02	13.81	36.02	-22.21
2404	8.0	ePA	1	13.75	23.714	13.54	22.594	16.66	46.345	30.00	-13.34	5.02	21.68	36.02	-14.34
2441	8.0	ePA	38	13.69	23.388	12.93	19.634	16.34	43.053	30.00	-13.66	5.02	21.36	36.02	-14.66
2476	8.0	ePA	73	13.73	23.605	12.95	19.724	16.37	43.351	30.00	-13.63	5.02	21.39	36.02	-14.63
2404	8.0	iPA	1	7.16	5.200	6.07	4.046	9.66	9.247	30.00	-20.34	5.02	14.68	36.02	-21.34
2441	8.0	iPA	38	7.04	5.058	5.97	3.954	9.55	9.016	30.00	-20.45	5.02	14.57	36.02	-21.45
2476	8.0	iPA	73	7.06	5.082	6.09	4.064	9.61	9.141	30.00	-20.39	5.02	14.63	36.02	-21.39

Table 7-6. Peak Conducted Output Power Measurements TxBF (Bluetooth HDR)

FCC ID: BCGA2301 IC: 579C-A2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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7.3.2 Average Output Power Measurement – Bluetooth (HDR)

Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Average Conducted Power		Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
				[dBm]	[mW]						
2404	4.0	ePA	1	9.93	9.840	30.00	-20.07	1.50	11.43	36.02	-24.59
2441	4.0	ePA	38	9.92	9.817	30.00	-20.08	1.50	11.42	36.02	-24.60
2476	4.0	ePA	73	9.79	9.528	30.00	-20.21	1.50	11.29	36.02	-24.73
2404	4.0	iPA	1	3.96	2.489	30.00	-26.04	1.50	5.46	36.02	-30.56
2441	4.0	iPA	38	3.58	2.280	30.00	-26.42	1.50	5.08	36.02	-30.94
2476	4.0	iPA	73	3.90	2.455	30.00	-26.10	1.50	5.40	36.02	-30.62
2404	8.0	ePA	1	9.72	9.376	30.00	-20.28	1.50	11.22	36.02	-24.80
2441	8.0	ePA	38	9.53	8.974	30.00	-20.47	1.50	11.03	36.02	-24.99
2476	8.0	ePA	73	9.56	9.036	30.00	-20.44	1.50	11.06	36.02	-24.96
2404	8.0	iPA	1	3.98	2.500	30.00	-26.02	1.50	5.48	36.02	-30.54
2441	8.0	iPA	38	3.61	2.296	30.00	-26.39	1.50	5.11	36.02	-30.91
2476	8.0	iPA	73	3.92	2.466	30.00	-26.08	1.50	5.42	36.02	-30.60

Table 7-7. Average Conducted Output Power Measurements Antenna 4a (Bluetooth HDR)

Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Average Conducted Power		Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
				[dBm]	[mW]						
2404	4.0	ePA	1	9.62	9.162	30.00	-20.38	2.50	12.12	36.02	-23.90
2441	4.0	ePA	38	9.87	9.705	30.00	-20.13	2.50	12.37	36.02	-23.65
2476	4.0	ePA	73	9.63	9.183	30.00	-20.37	2.50	12.13	36.02	-23.89
2404	4.0	iPA	1	2.83	1.919	30.00	-27.17	2.50	5.33	36.02	-30.69
2441	4.0	iPA	38	2.58	1.811	30.00	-27.42	2.50	5.08	36.02	-30.94
2476	4.0	iPA	73	2.87	1.936	30.00	-27.13	2.50	5.37	36.02	-30.65
2404	8.0	ePA	1	10.00	10.000	30.00	-20.00	2.50	12.50	36.02	-23.52
2441	8.0	ePA	38	9.71	9.354	30.00	-20.29	2.50	12.21	36.02	-23.81
2476	8.0	ePA	73	9.68	9.290	30.00	-20.32	2.50	12.18	36.02	-23.84
2404	8.0	iPA	1	2.87	1.936	30.00	-27.13	2.50	5.37	36.02	-30.65
2441	8.0	iPA	38	2.62	1.828	30.00	-27.38	2.50	5.12	36.02	-30.90
2476	8.0	iPA	73	2.92	1.959	30.00	-27.08	2.50	5.42	36.02	-30.60

Table 7-8. Average Conducted Output Power Measurements Antenna 2a (Bluetooth HDR)

Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Average Conducted Power						Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
				Antenna 4a		Antenna 2a		Summed							
				[dBm]	[mW]	[dBm]	[mW]	[dBm]	[mW]						
2404	4.0	ePA	1	10.00	10.000	9.69	9.311	12.86	19.320	30.00	-17.14	5.02	17.88	36.02	-18.14
2441	4.0	ePA	38	10.00	10.000	9.50	8.913	12.77	18.923	30.00	-17.23	5.02	17.79	36.02	-18.23
2476	4.0	ePA	73	10.00	10.000	9.68	9.290	12.85	19.275	30.00	-17.15	5.02	17.87	36.02	-18.15
2404	4.0	iPA	1	3.86	2.432	2.58	1.811	6.28	4.246	30.00	-23.72	5.02	11.30	36.02	-24.72
2441	4.0	iPA	38	3.62	2.301	2.52	1.786	6.12	4.093	30.00	-23.88	5.02	11.14	36.02	-24.88
2476	4.0	iPA	73	3.64	2.312	2.67	1.849	6.19	4.159	30.00	-23.81	5.02	11.21	36.02	-24.81
2404	8.0	ePA	1	10.00	10.000	10.00	10.000	13.01	19.999	30.00	-16.99	5.02	18.03	36.02	-17.99
2441	8.0	ePA	38	10.00	10.000	9.52	8.954	12.78	18.967	30.00	-17.22	5.02	17.80	36.02	-18.22
2476	8.0	ePA	73	10.00	10.000	9.51	8.933	12.77	18.923	30.00	-17.23	5.02	17.79	36.02	-18.23
2404	8.0	iPA	1	3.79	2.393	2.70	1.862	6.29	4.256	30.00	-23.71	5.02	11.31	36.02	-24.71
2441	8.0	iPA	38	3.72	2.355	2.63	1.832	6.22	4.188	30.00	-23.78	5.02	11.24	36.02	-24.78
2476	8.0	iPA	73	3.68	2.333	2.74	1.879	6.25	4.217	30.00	-23.75	5.02	11.27	36.02	-24.75

Table 7-9. Average Conducted Output Power Measurements TxBF (Bluetooth HDR)

FCC ID: BCGA2301 IC: 579C-A2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Note:

Per ANSI C63.10-2013 and KDB 662911 D01 v02r01 Section E)1), the conducted powers at Antenna 4a and Antenna 2a were first measured separately during TxBF transmission as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Per ANSI C63.10-2013 Section 14.4.3, the directional gain is calculated using the following formula, where G_N is the gain of the nth antenna and N_{ANT} , the total number of antennas used.

$$\text{Directional gain} = 10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}] \text{ dBi}$$

Sample TxBF Calculation:

At 2404MHz the average conducted output power was measured to be 10.00 dBm for Antenna 4a and 9.69 dBm for Antenna 2a.

$$\text{Antenna 4a} + \text{Antenna 2a} = \text{TxBF}$$

$$(10.00\text{dBm} + 9.69 \text{ dBm}) = (10.00 \text{ mW} + 9.31 \text{ mW}) = 19.32 \text{ mW} = 12.86 \text{ dBm}$$

Sample e.i.r.p. Calculation:

At 2404MHz, the average conducted output power was calculated to be 12.86 dBm with directional gain of 5.02 dBi.

$$\text{e.i.r.p. (dBm)} = \text{Conducted Power (dBm)} + \text{Ant gain (dBi)}$$

$$12.86 \text{ dBm} + 5.02 \text{ dBi} = 17.88 \text{ dBm}$$

FCC ID: BCGA2301 IC: 579C-A2301			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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7.4 Power Spectral Density – Bluetooth (HDR)

§15.247(e); RSS-247 [5.2]

Test Overview and Limit

The peak power density is 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.

The maximum permissible power spectral density is 8 dBm in any 3 kHz band.

Test Procedure Used

ANSI C63.10-2013 – Section 11.10.2 Method PKPSD

KDB 558074 D01 v05r02 – Section 8.4 DTS Maximum Power Spectral Density level in the fundamental emission

ANSI C63.10-2013 – Section 14.3.2.2 Measure-and-Sum Technique

KDB 662911 D01 v02r01 – Section E)2) Measure-and-Sum Technique

Test Settings

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 1MHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. 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 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 27 of 101

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V 9.0 11/16/2020

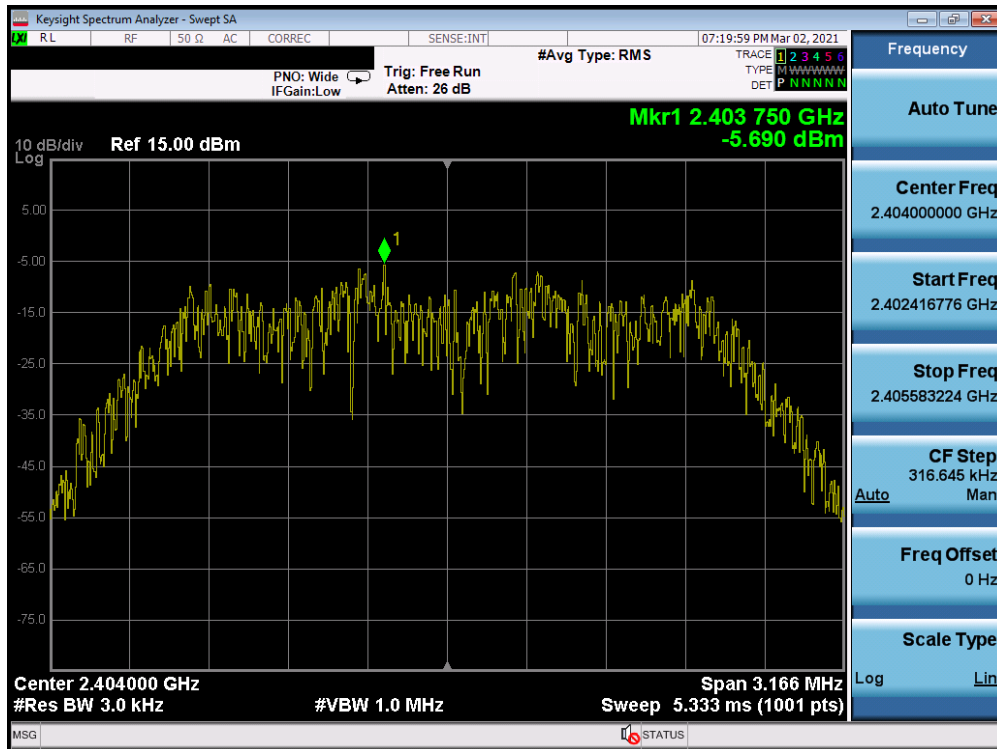
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Antenna 4a

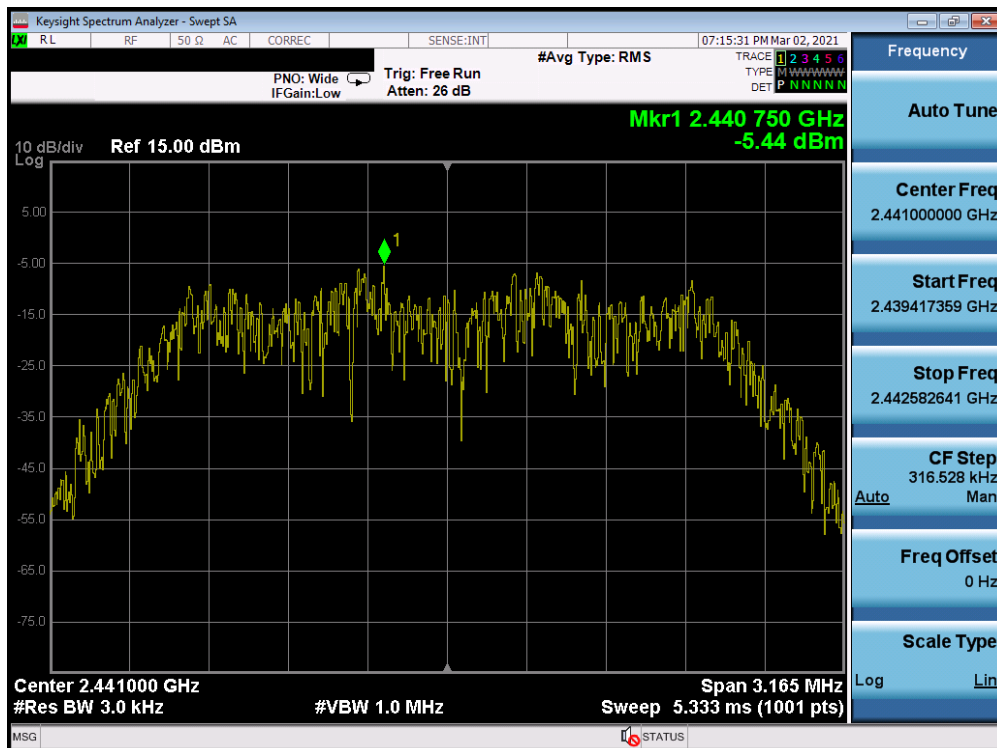
Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Measured Power Spectral Density [dBm / 3kHz]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]
2404	4.0	ePA	1	-5.69	8.0	-13.69
2441	4.0	ePA	38	-5.44	8.0	-13.44
2476	4.0	ePA	73	-5.99	8.0	-13.99
2404	4.0	iPA	1	-12.33	8.0	-20.33
2441	4.0	iPA	38	-12.13	8.0	-20.13
2476	4.0	iPA	73	-12.84	8.0	-20.84
2404	8.0	ePA	1	-8.56	8.0	-16.56
2441	8.0	ePA	38	-8.40	8.0	-16.40
2476	8.0	ePA	73	-8.45	8.0	-16.45
2404	8.0	iPA	1	-14.92	8.0	-22.92
2441	8.0	iPA	38	-14.51	8.0	-22.51
2476	8.0	iPA	73	-14.63	8.0	-22.63

Table 7-10. Conducted Power Density Measurements Antenna 4a

FCC ID: BCGA2301 IC: 579C-A2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 28 of 101

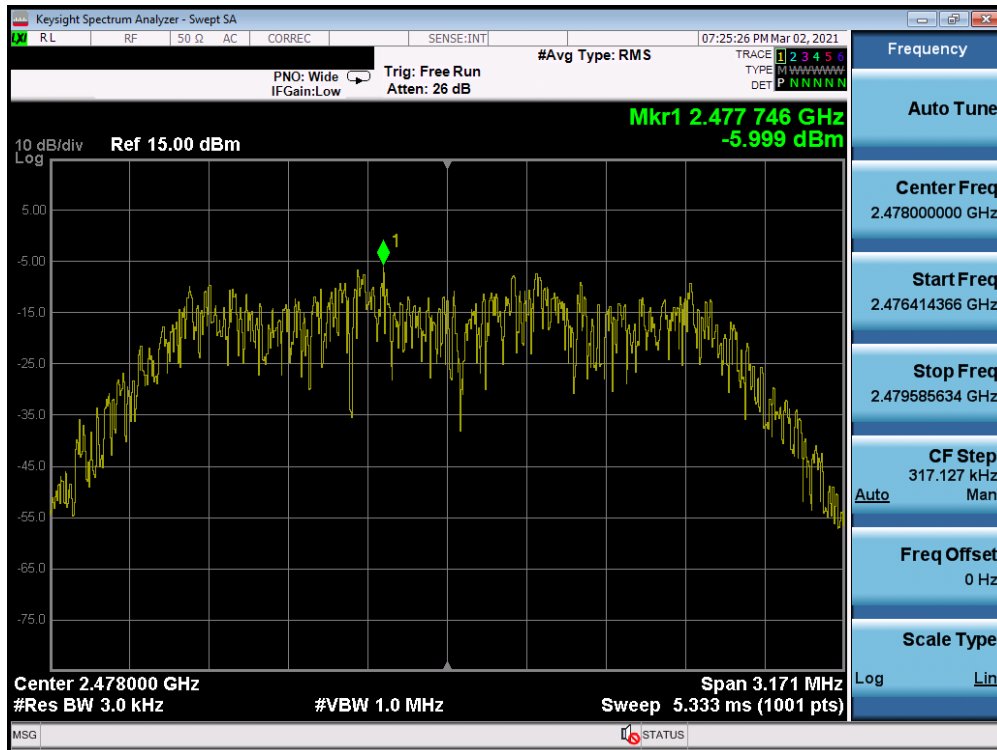


Plot 7-13. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 1)

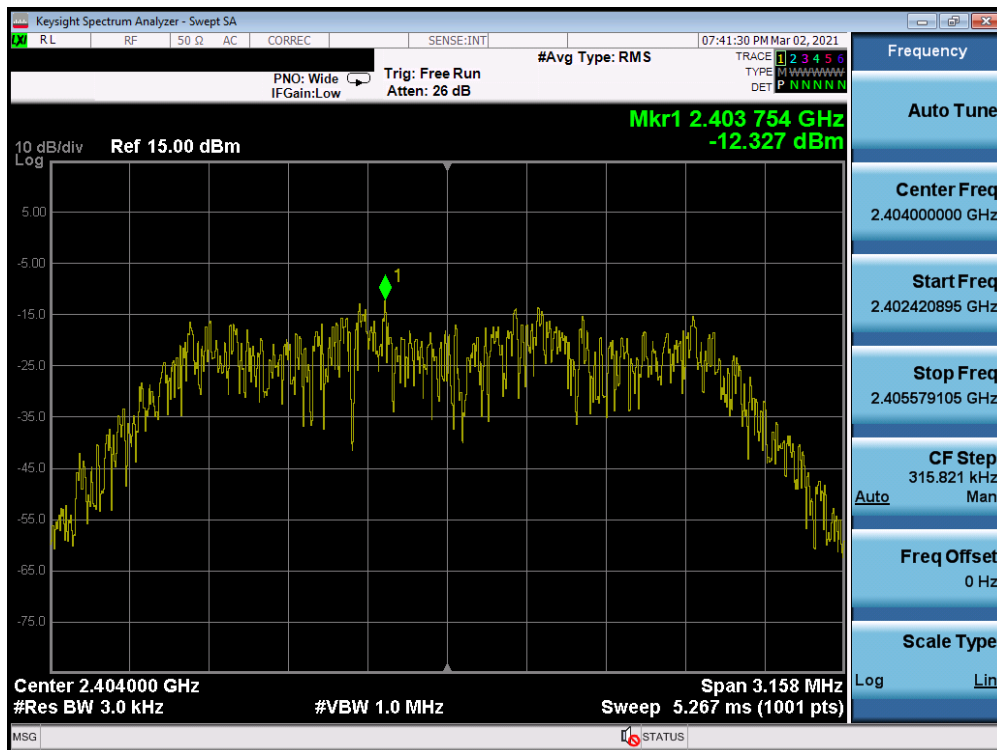


Plot 7-14. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 38)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 29 of 101

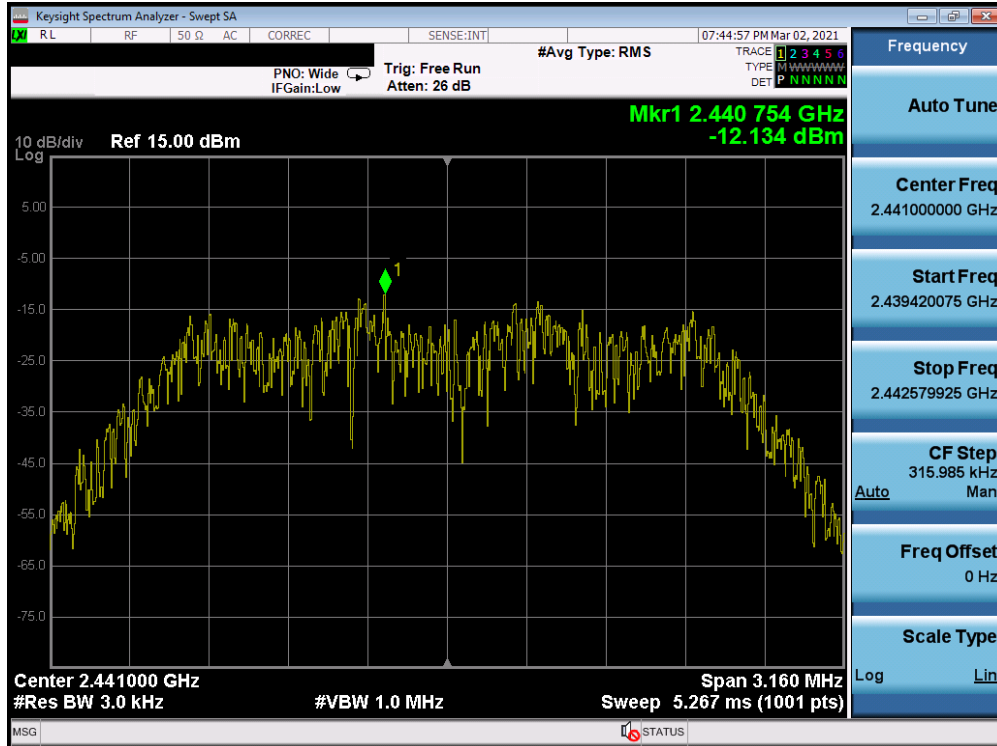


Plot 7-15. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 73)

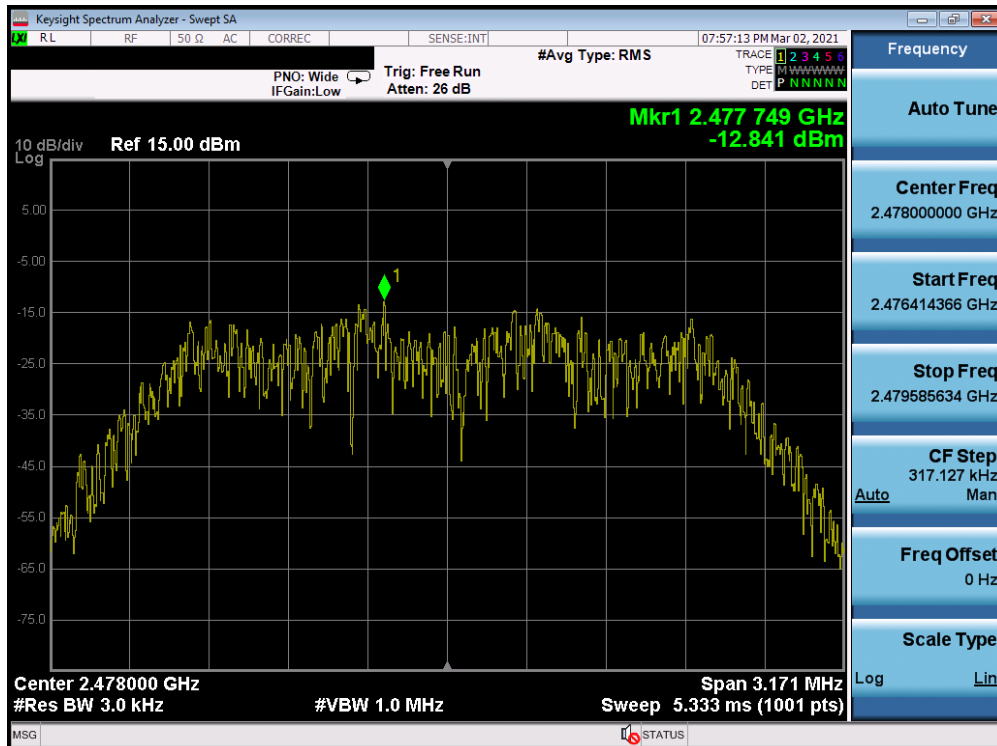


Plot 7-16. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301	 Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 30 of 101

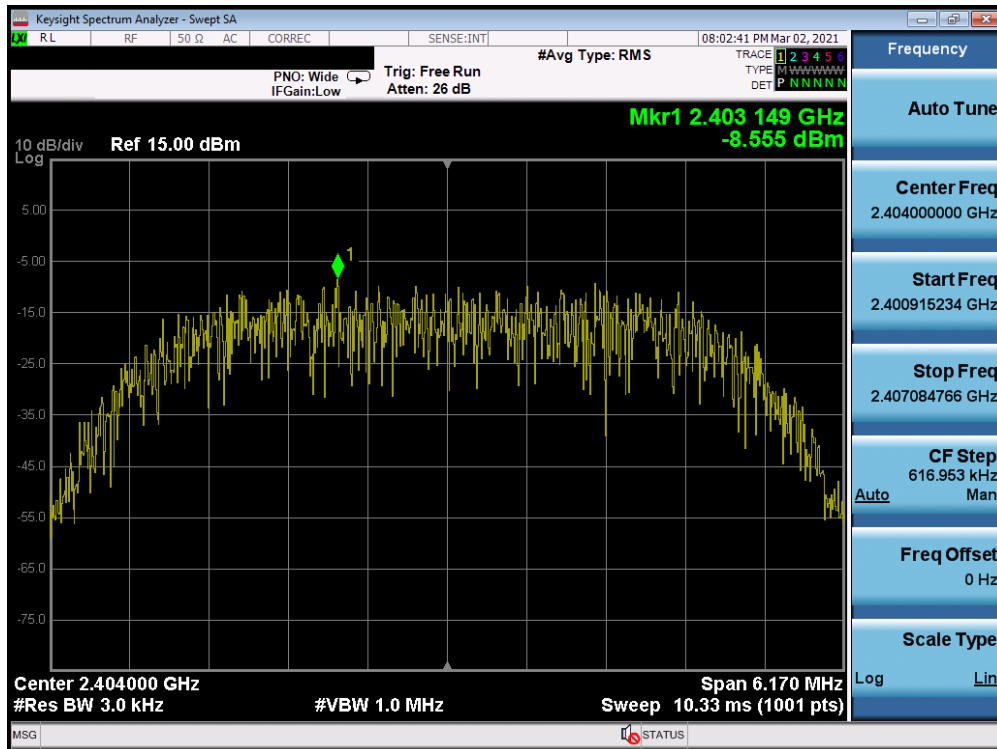


Plot 7-17. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 38)

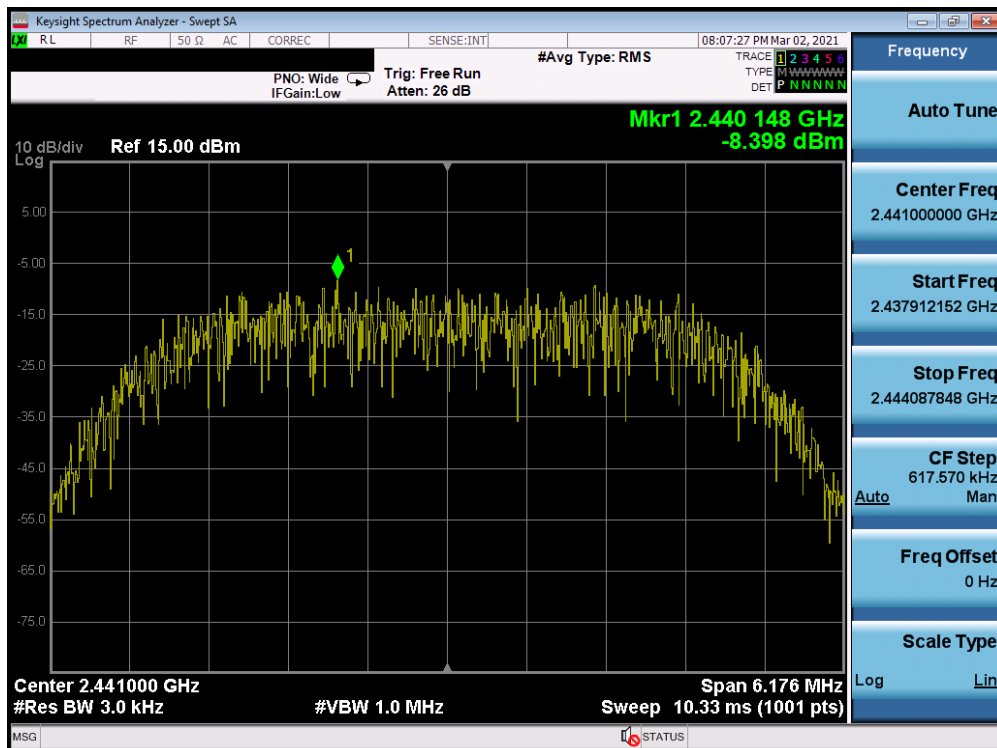


Plot 7-18. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 73)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 31 of 101

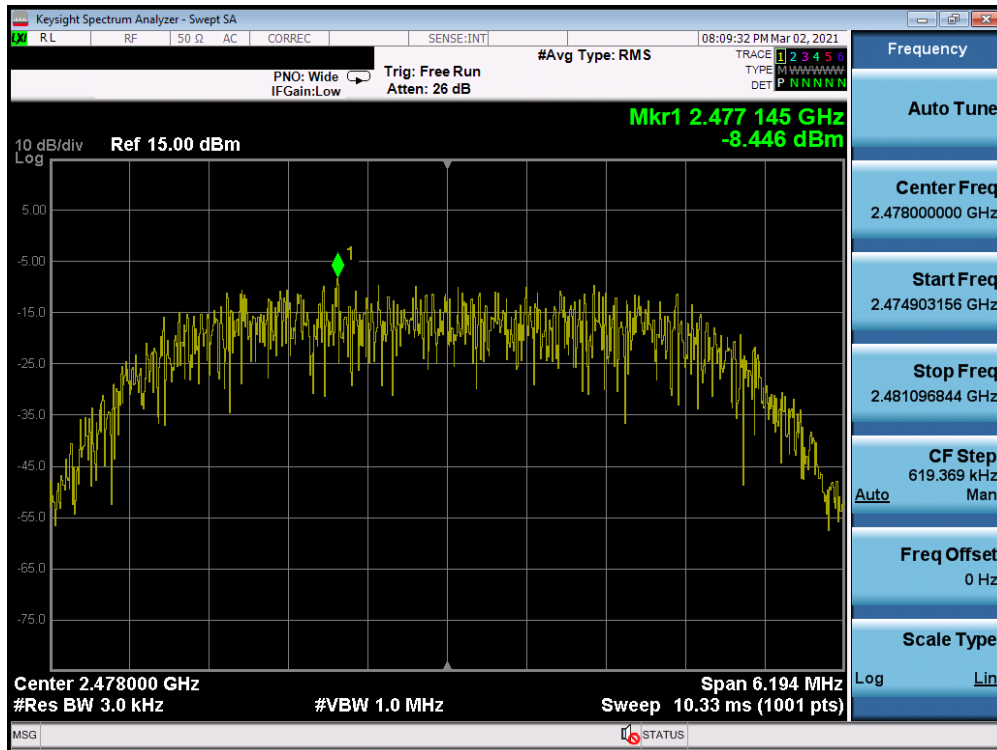


Plot 7-19. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 1)

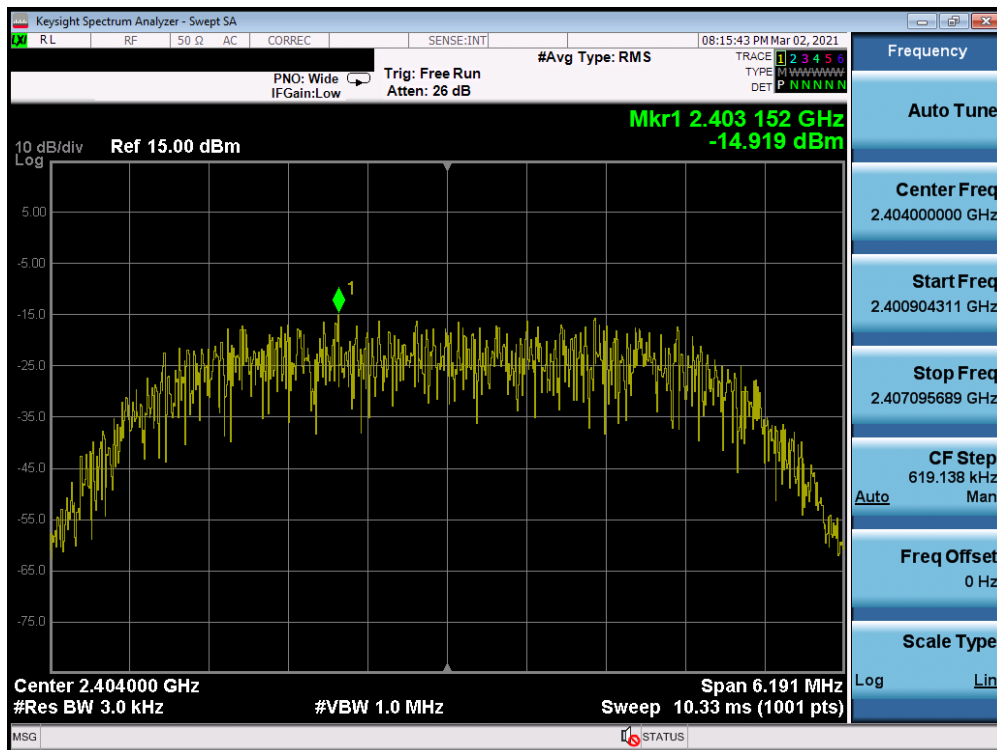


Plot 7-20. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 38)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 32 of 101

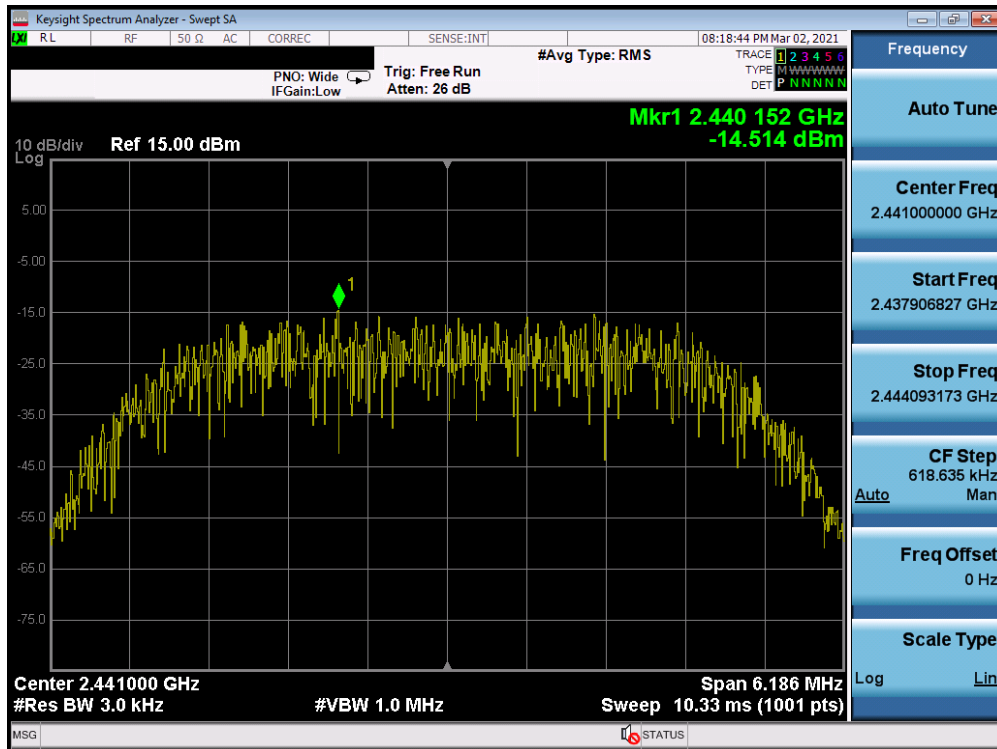


Plot 7-21. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 73)

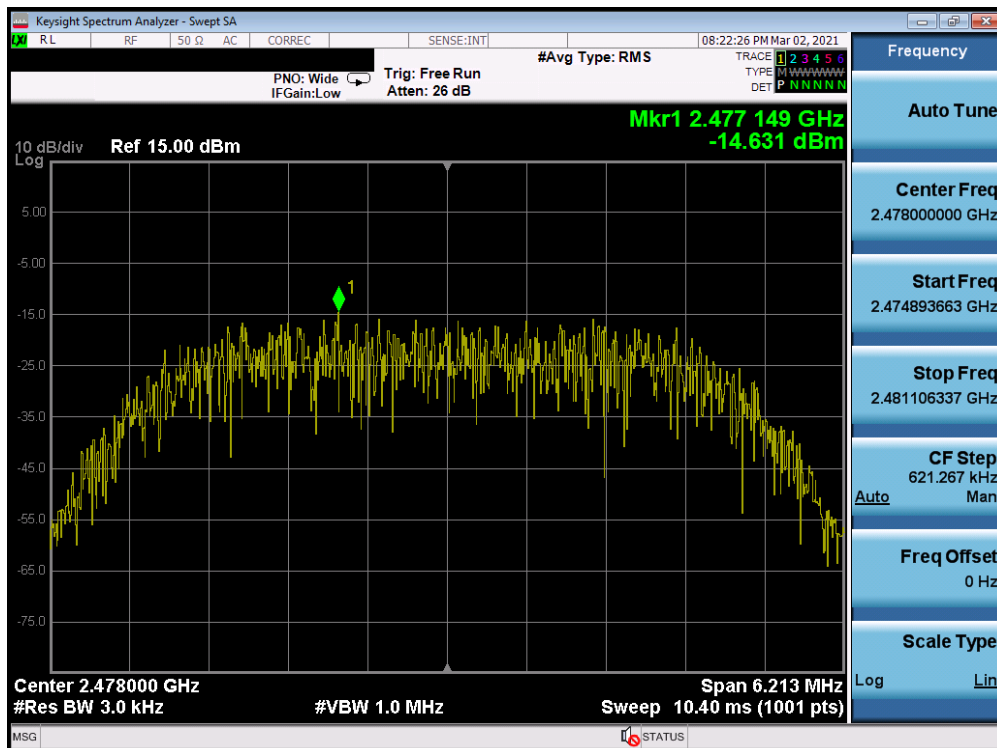


Plot 7-22. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, iPA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301	 Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-23. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, iPA – Ch. 38)



Plot 7-24. Power Spectral Density Plot Antenna 4a (Bluetooth (HDR8), 8Mbps, iPA – Ch. 73)

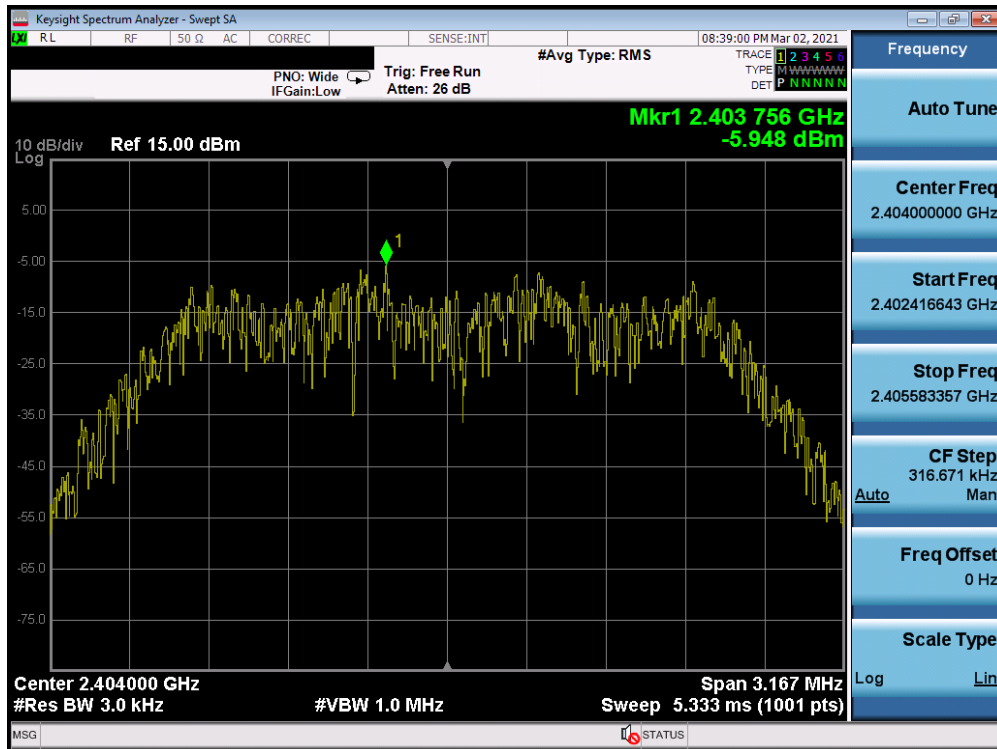
FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 34 of 101

Antenna 2a

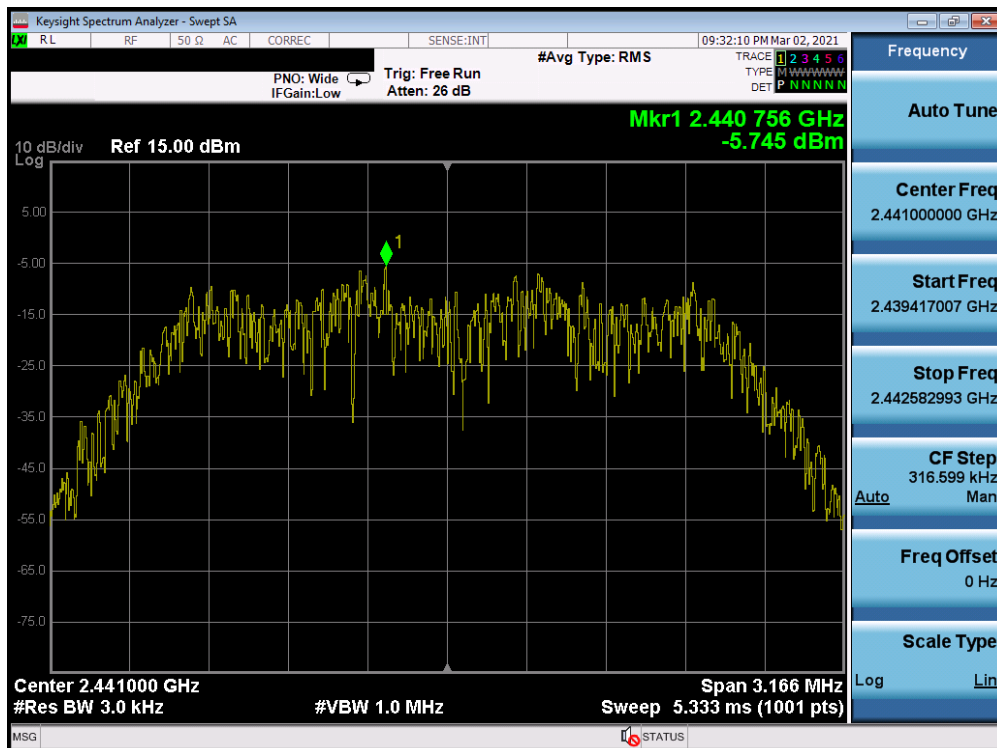
Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Measured Power Spectral Density [dBm / 3kHz]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]
2404	4.0	ePA	1	-5.95	8.0	-13.95
2441	4.0	ePA	38	-5.75	8.0	-13.75
2476	4.0	ePA	73	-6.47	8.0	-14.47
2404	4.0	iPA	1	-13.34	8.0	-21.34
2441	4.0	iPA	38	-13.57	8.0	-21.57
2476	4.0	iPA	73	-13.24	8.0	-21.24
2404	8.0	ePA	1	-8.80	8.0	-16.80
2441	8.0	ePA	38	-8.29	8.0	-16.29
2476	8.0	ePA	73	-8.53	8.0	-16.53
2404	8.0	iPA	1	-15.32	8.0	-23.32
2441	8.0	iPA	38	-15.56	8.0	-23.56
2476	8.0	iPA	73	-15.77	8.0	-23.77

Table 7-11. Conducted Power Density Measurements Antenna 2a

FCC ID: BCGA2301 IC: 579C-A2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 35 of 101

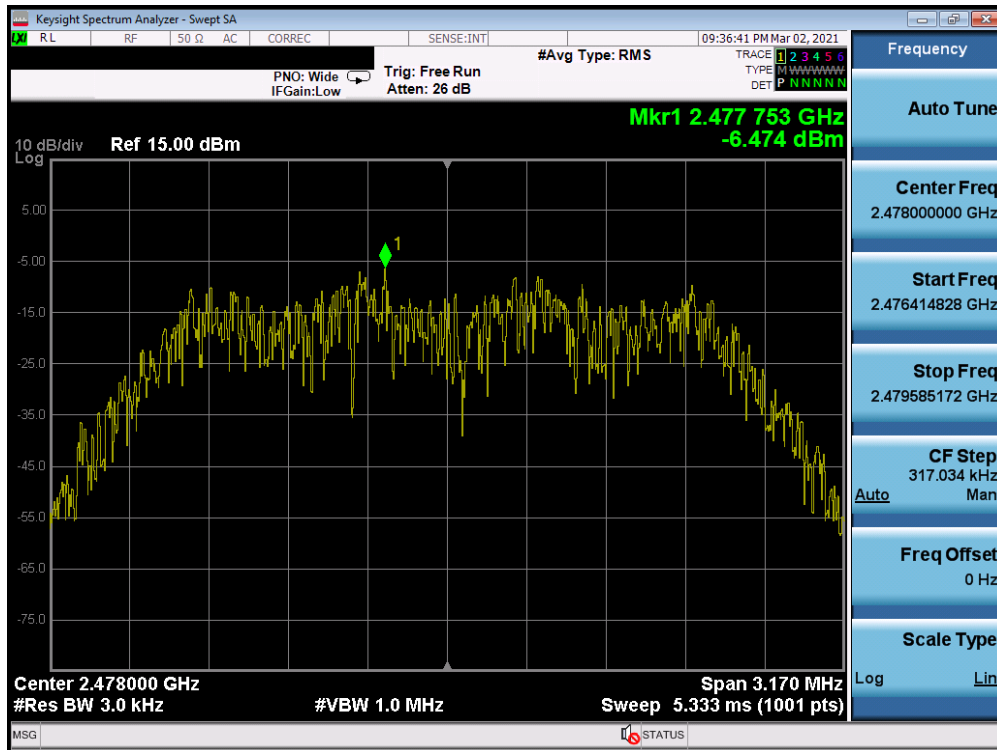


Plot 7-25. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 1)

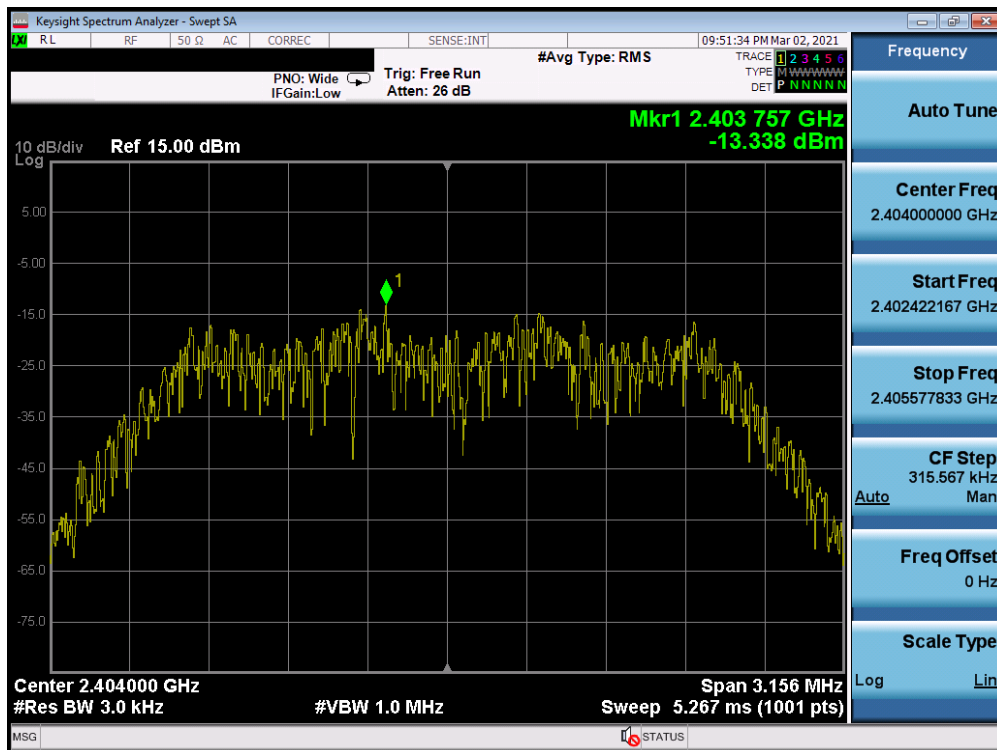


Plot 7-26. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 38)

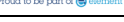
FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 36 of 101

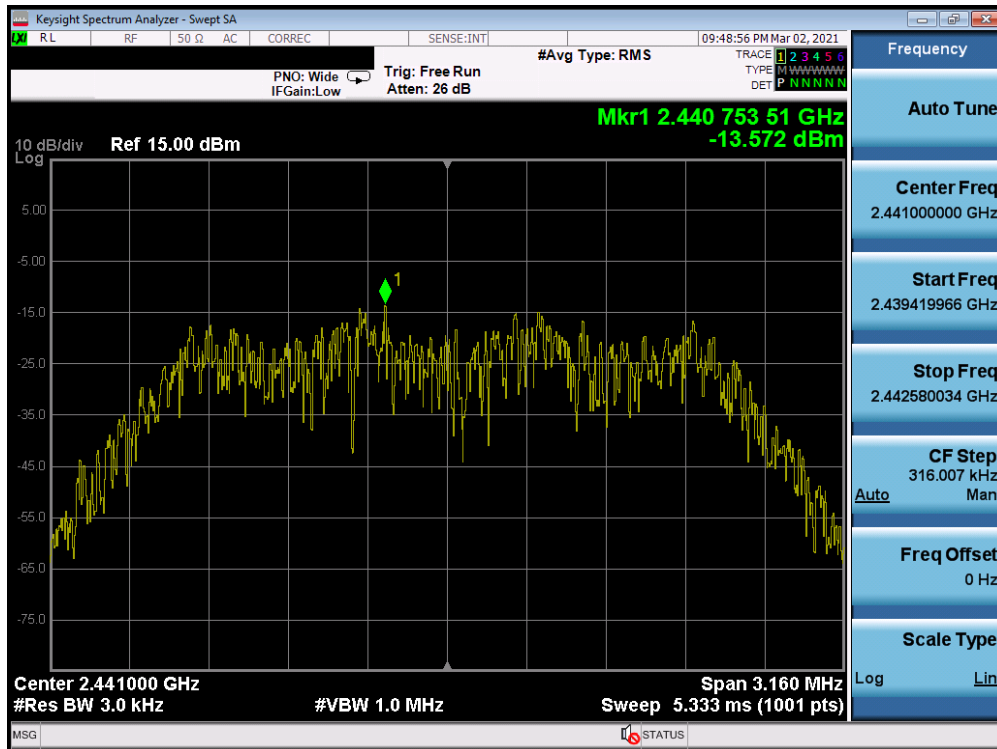


Plot 7-27. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 73)

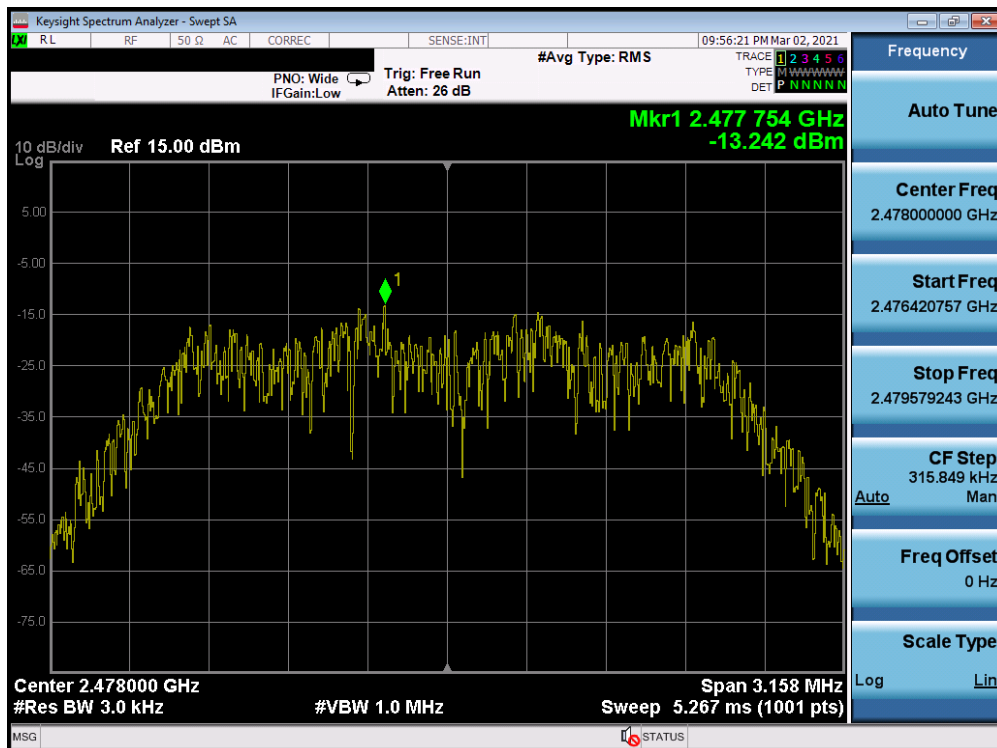


Plot 7-28. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301	 Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 37 of 101

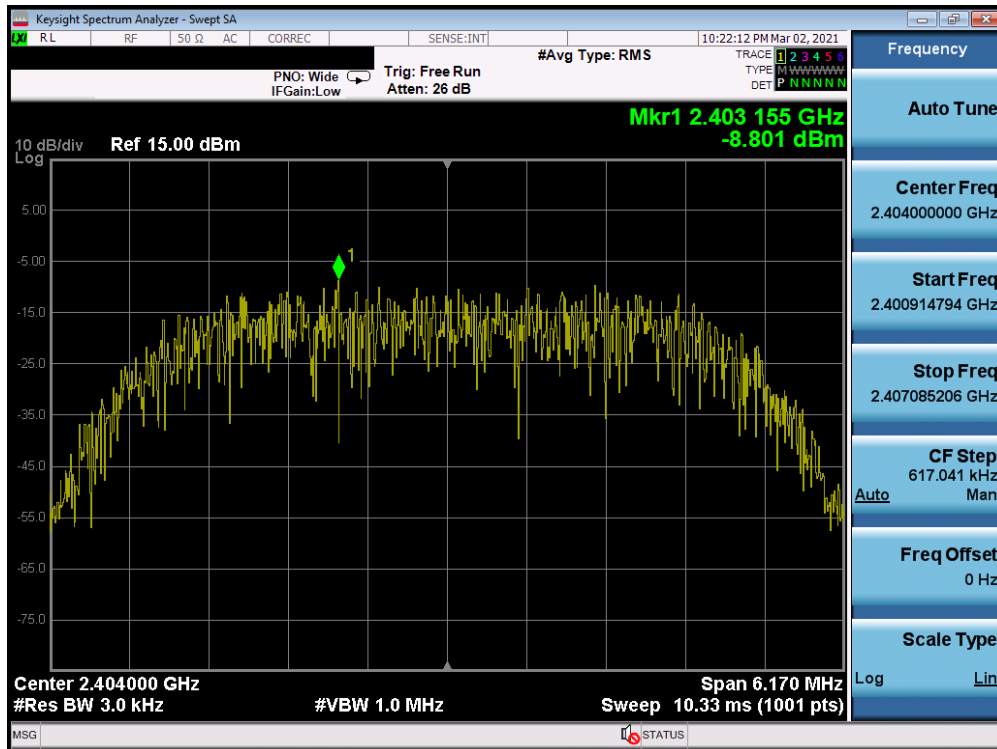


Plot 7-29. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 38)

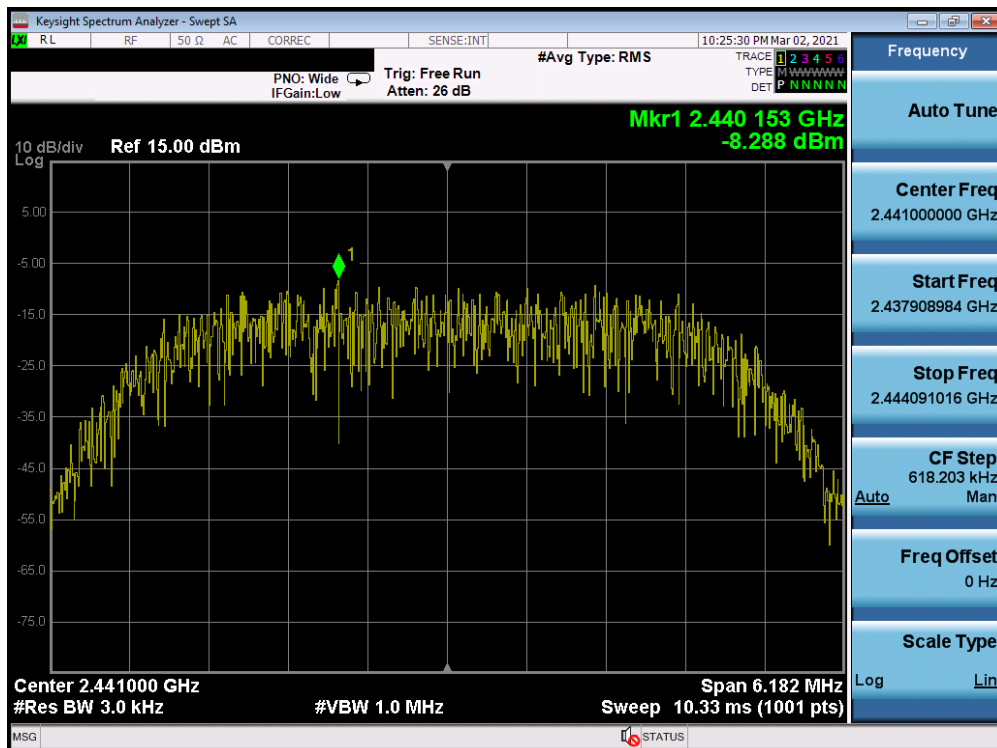


Plot 7-30. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 73)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 38 of 101

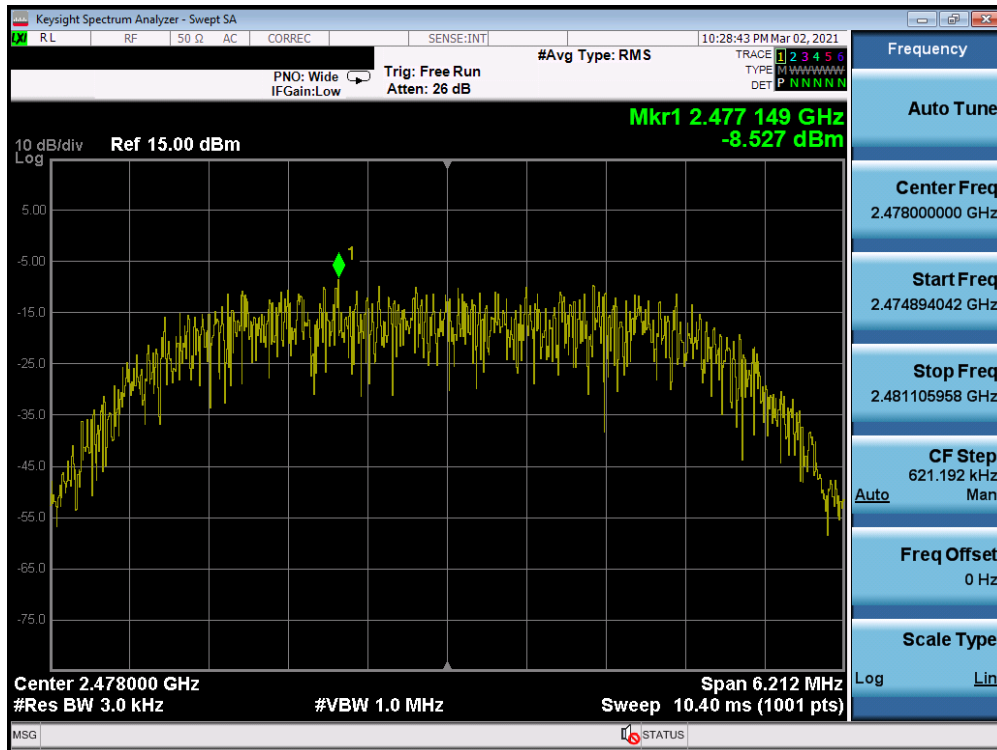


Plot 7-31. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 1)

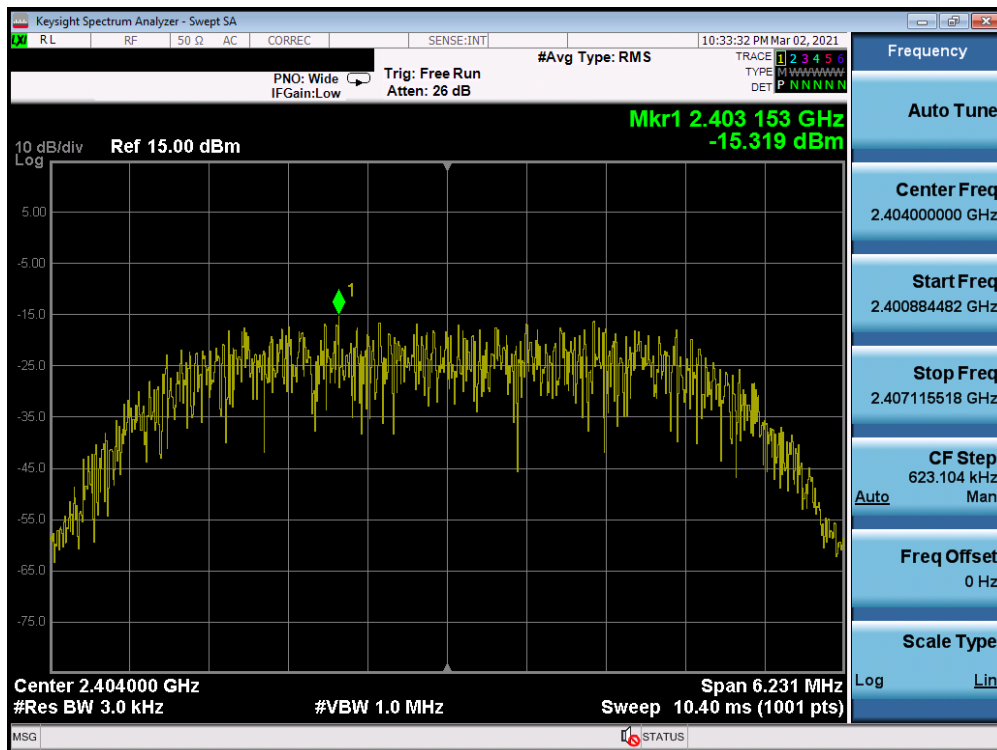


Plot 7-32. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 38)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 39 of 101

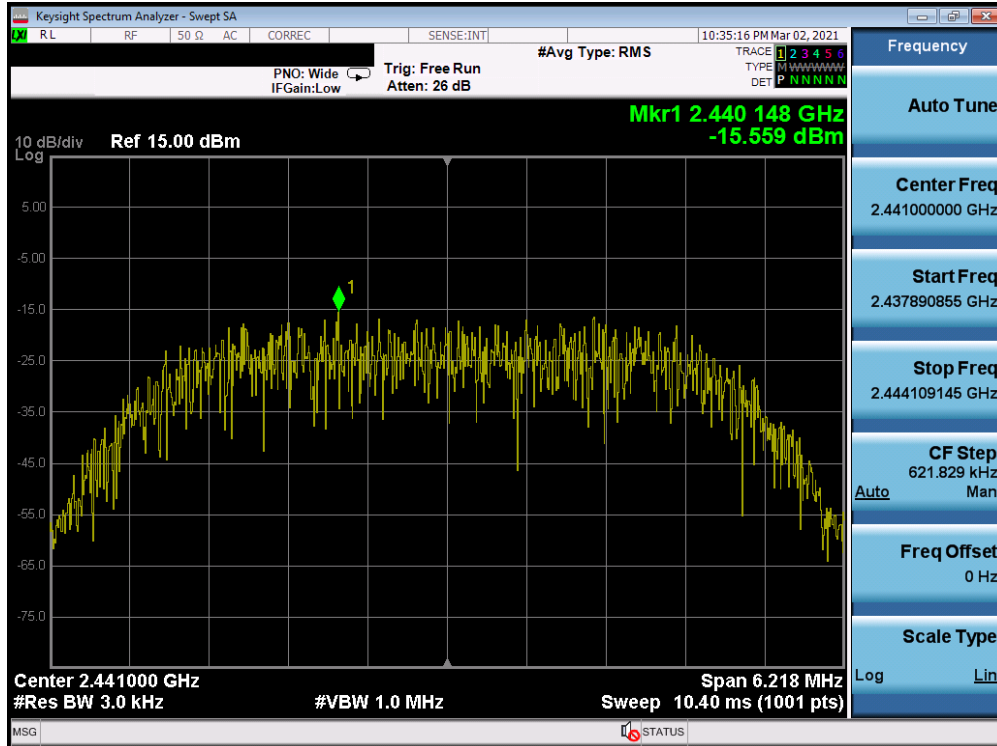


Plot 7-33. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 73)

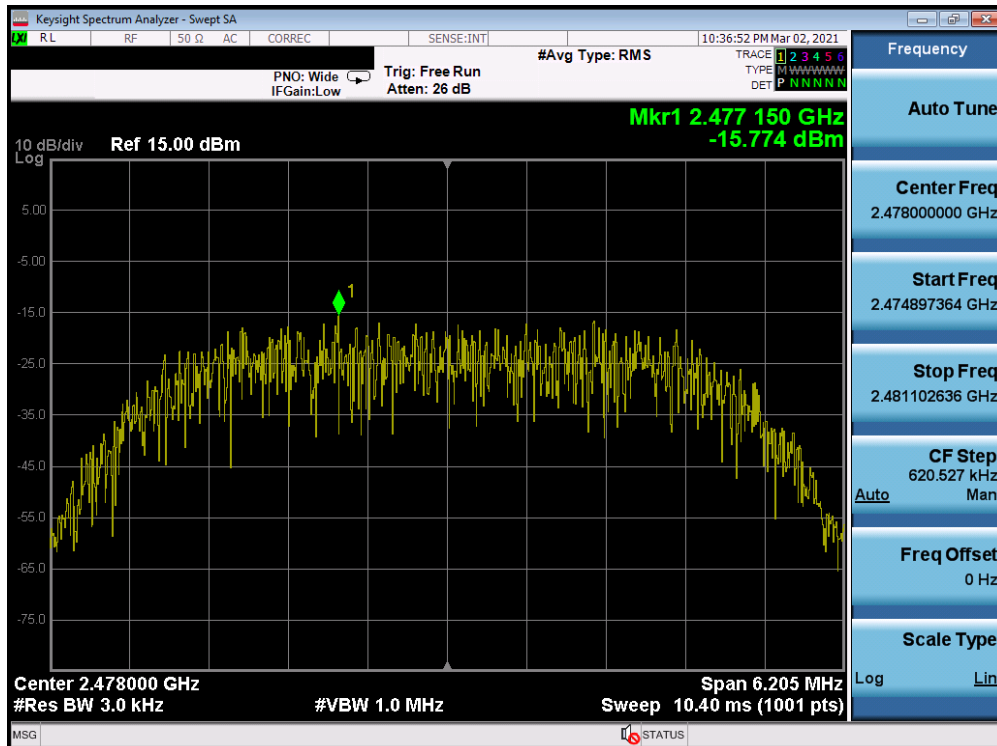


Plot 7-34. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, iPA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-35. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, iPA – Ch. 38)



Plot 7-36. Power Spectral Density Plot Antenna 2a (Bluetooth (HDR8), 8Mbps, iPA – Ch. 73)

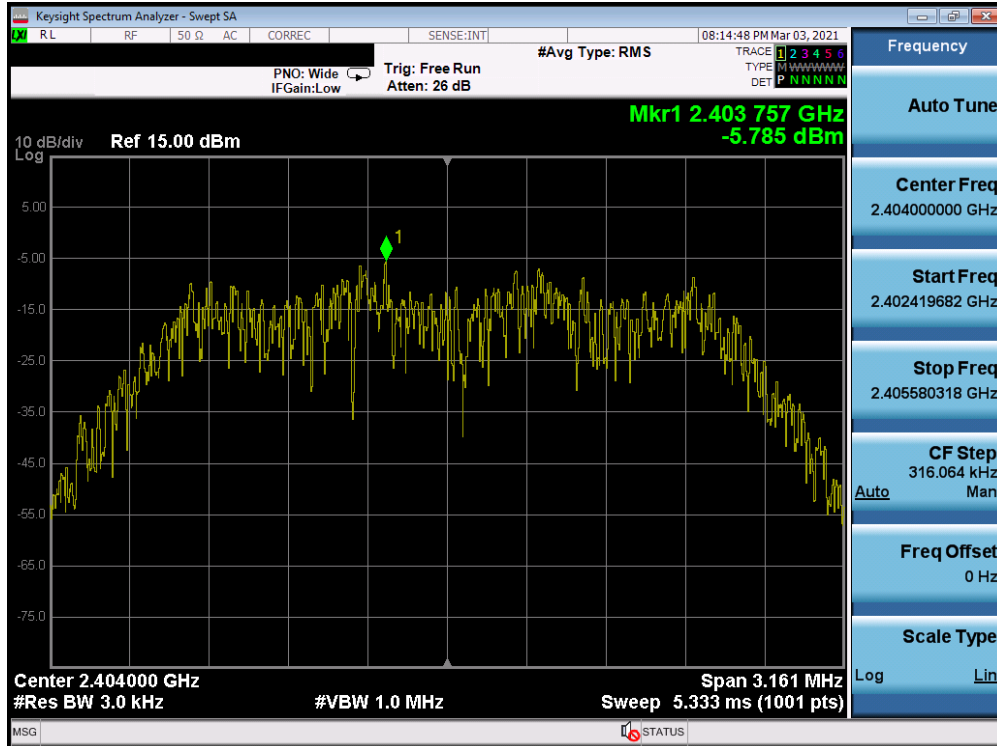
FCC ID: BCGA2301 IC: 579C-A2301	 Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 41 of 101

Tx-BF (Beamforming Mode)

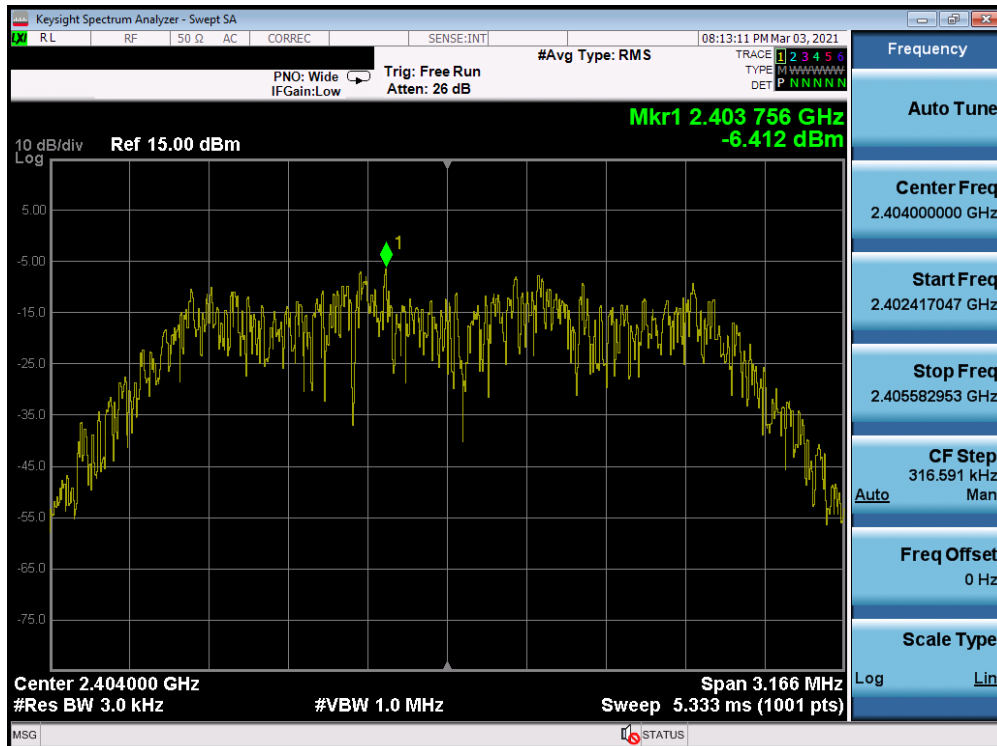
Frequency [MHz]	Data Rate [Mbps]	Power Scheme	Channel No.	Measured Power Spectral Density [dBm / 3kHz]			Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]
				Antenna 4a	Antenna 2a	Summed		
2404	4.0	ePA	1	-5.79	-6.41	-3.08	8.0	-11.08
2441	4.0	ePA	38	-6.12	-6.37	-3.23	8.0	-11.23
2476	4.0	ePA	73	-6.04	-6.22	-3.12	8.0	-11.12
2404	4.0	iPA	1	-12.28	-11.76	-9.00	8.0	-17.00
2441	4.0	iPA	38	-11.58	-13.06	-9.25	8.0	-17.25
2476	4.0	iPA	73	-12.28	-13.34	-9.77	8.0	-17.77
2404	8.0	ePA	1	-5.21	-6.65	-2.86	8.0	-10.86
2441	8.0	ePA	38	-4.96	-7.01	-2.85	8.0	-10.85
2476	8.0	ePA	73	-4.94	-6.91	-2.80	8.0	-10.80
2404	8.0	iPA	1	-13.60	-13.94	-10.76	8.0	-18.76
2441	8.0	iPA	38	-13.35	-14.18	-10.73	8.0	-18.73
2476	8.0	iPA	73	-13.53	-15.86	-11.53	8.0	-19.53

Table 7-12. Conducted Power Density Measurements TxBF

FCC ID: BCGA2301 IC: 579C-A2301	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 42 of 101

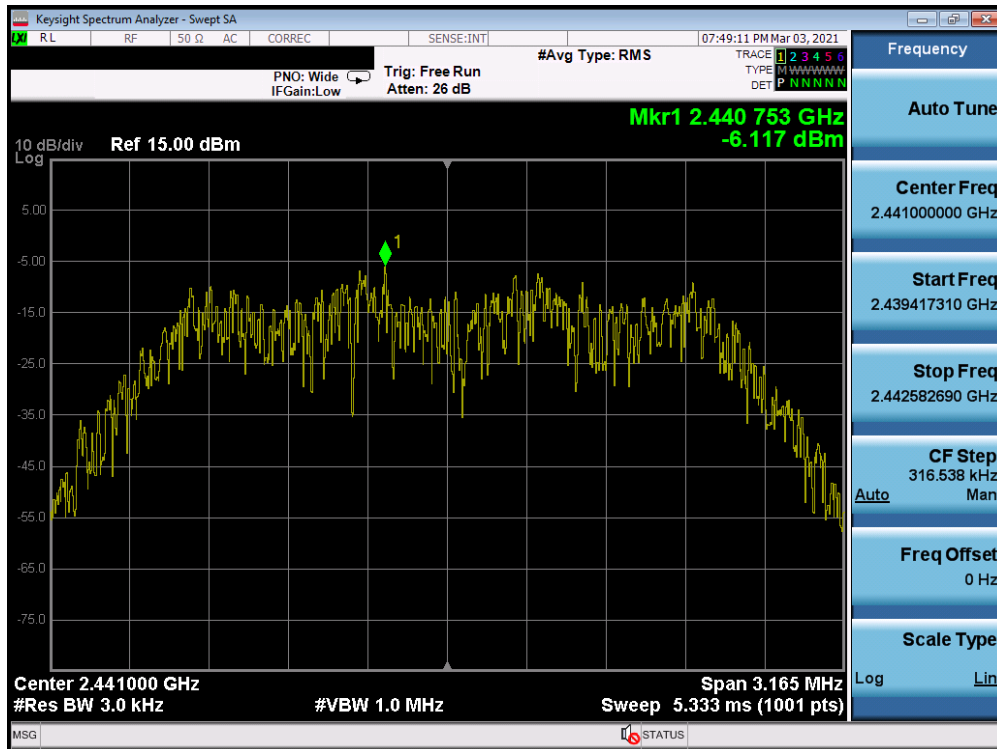


Plot 7-37. Power Spectral Density Plot TxBF Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 1)

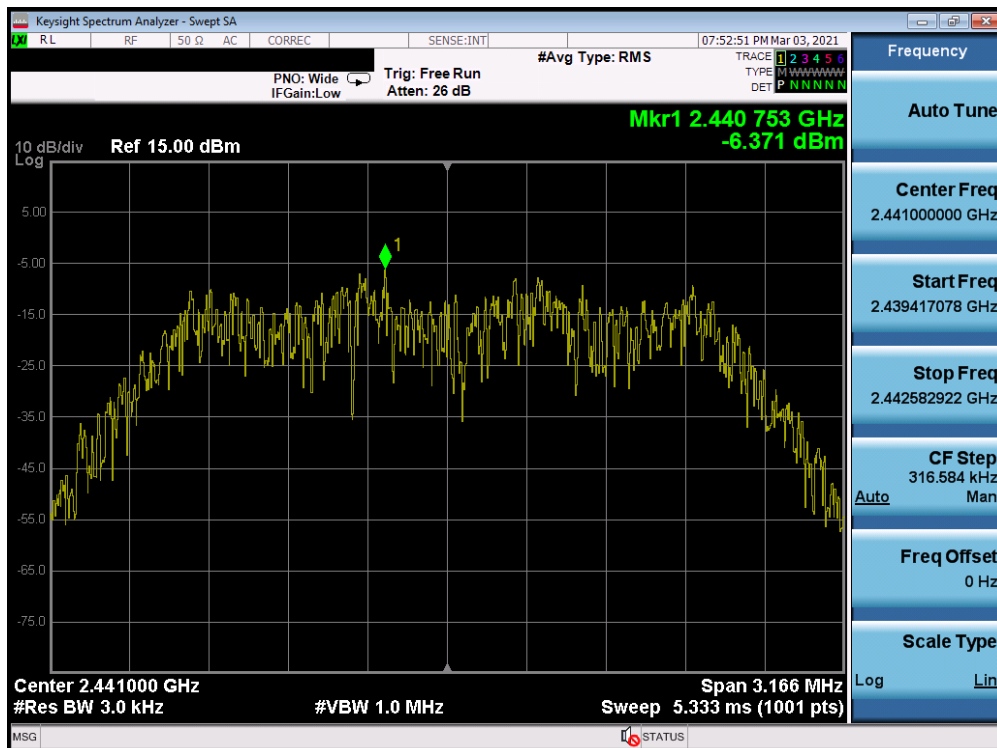


Plot 7-38. Power Spectral Density Plot TxBF Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 43 of 101

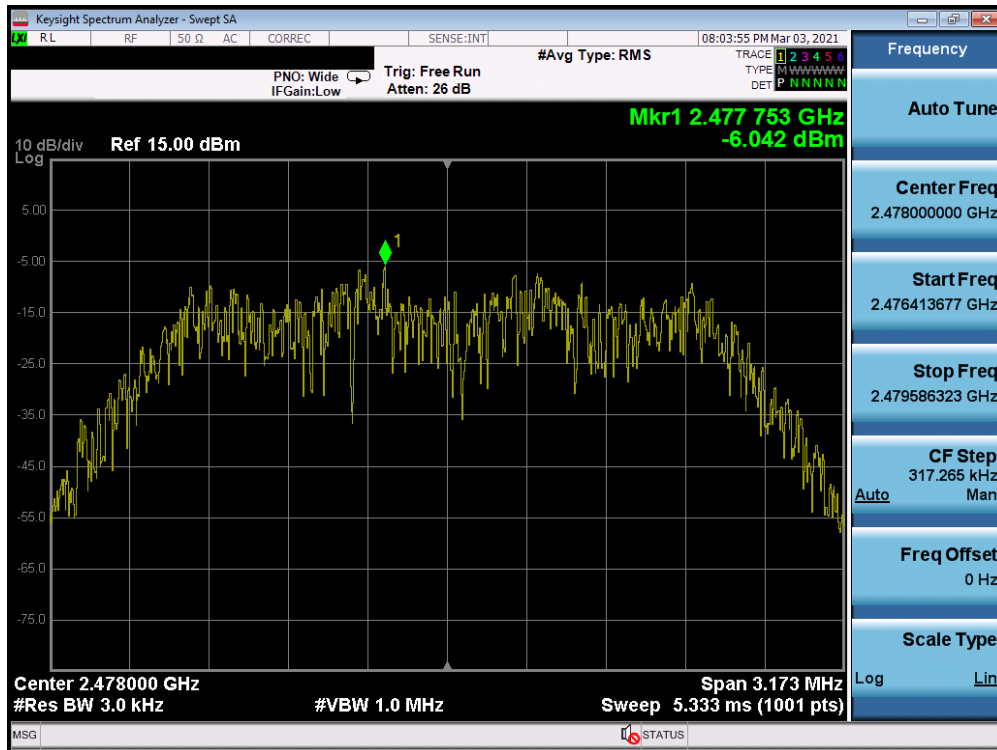


Plot 7-39. Power Spectral Density Plot Tx BF Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 38)

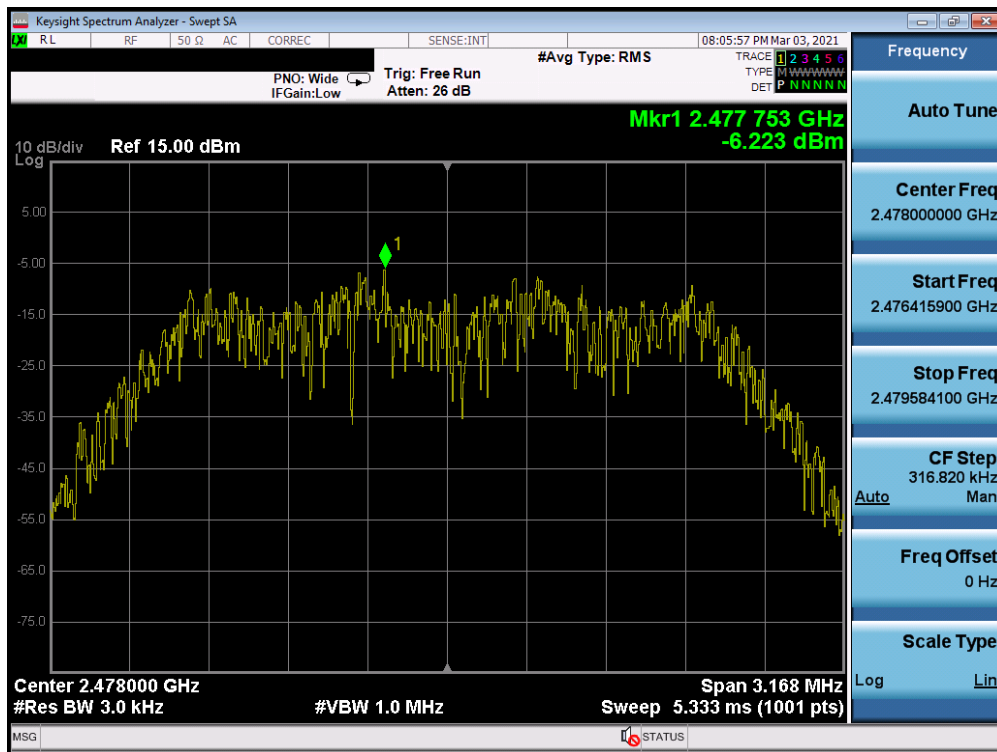


Plot 7-40. Power Spectral Density Plot Tx BF Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 38)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 44 of 101

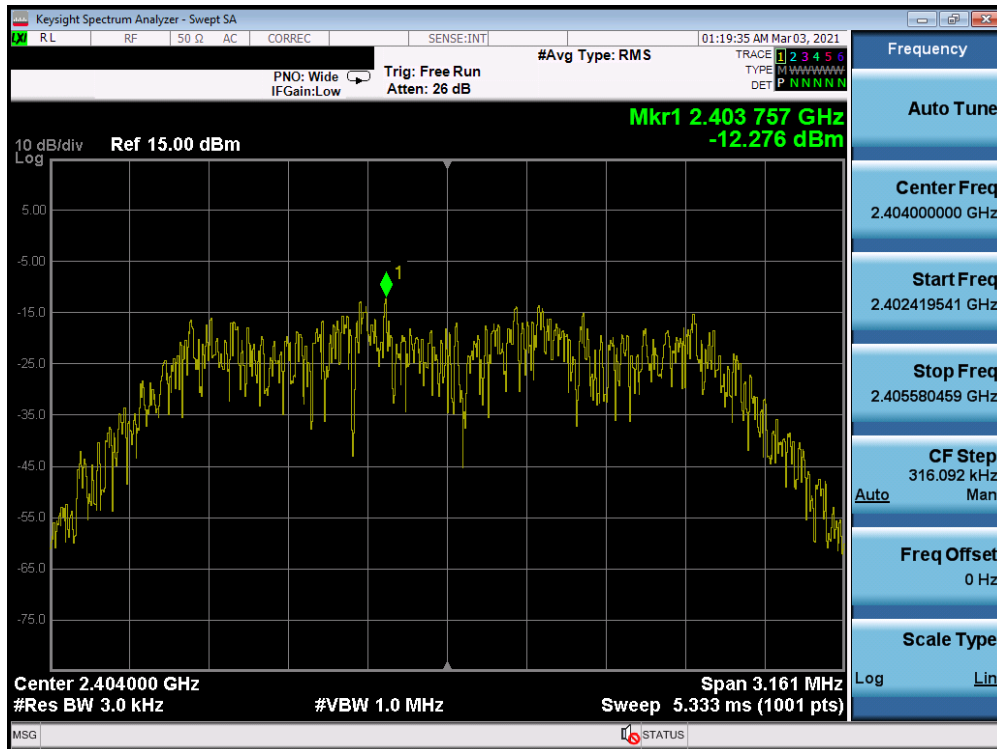


Plot 7-41. Power Spectral Density Plot TxBF Antenna 4a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 73)

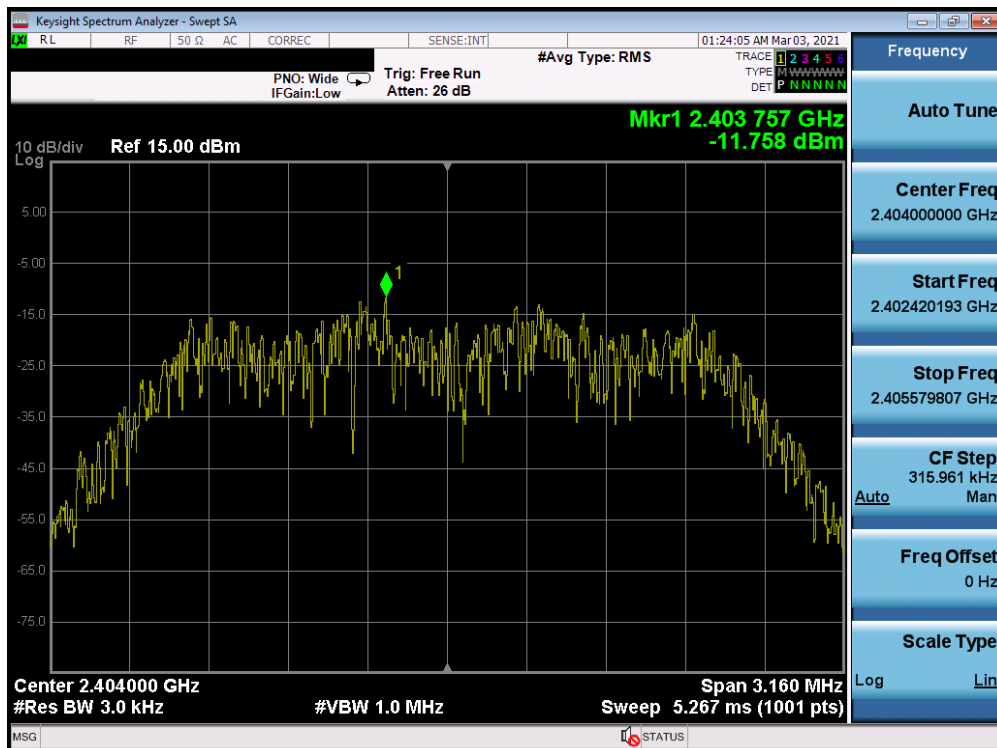


Plot 7-42. Power Spectral Density Plot TxBF Antenna 2a (Bluetooth (HDR4), 4Mbps, ePA – Ch. 73)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 45 of 101

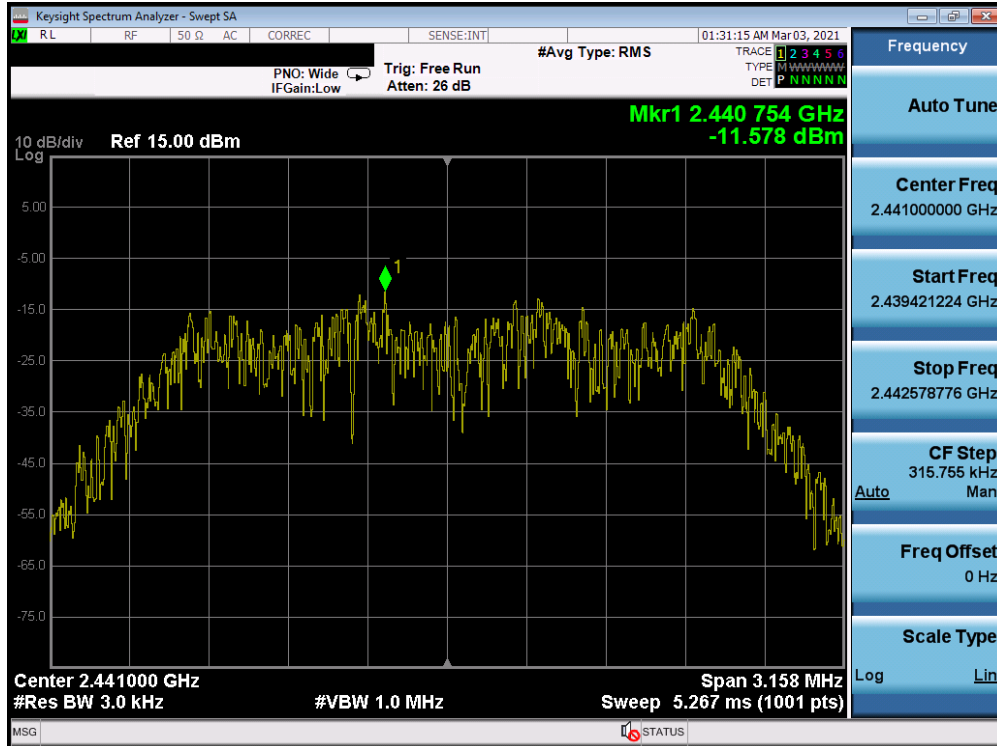


Plot 7-43. Power Spectral Density Plot Tx BF Antenna 4a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 1)

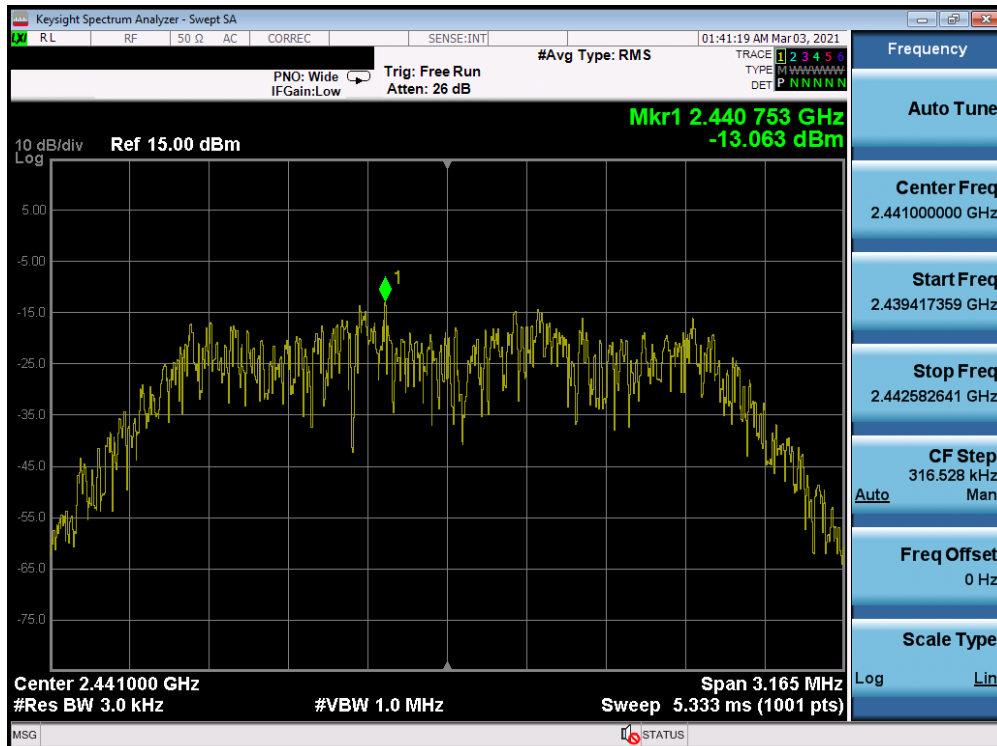


Plot 7-44. Power Spectral Density Plot Tx BF Antenna 2a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 46 of 101

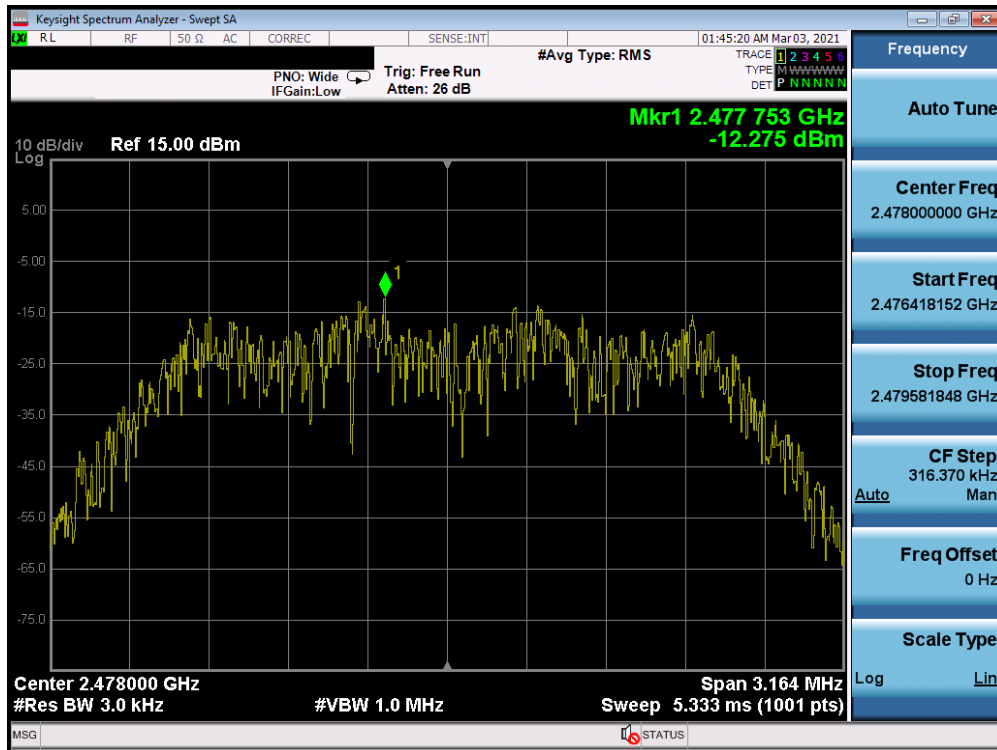


Plot 7-45. Power Spectral Density Plot TxBF Antenna 4a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 38)

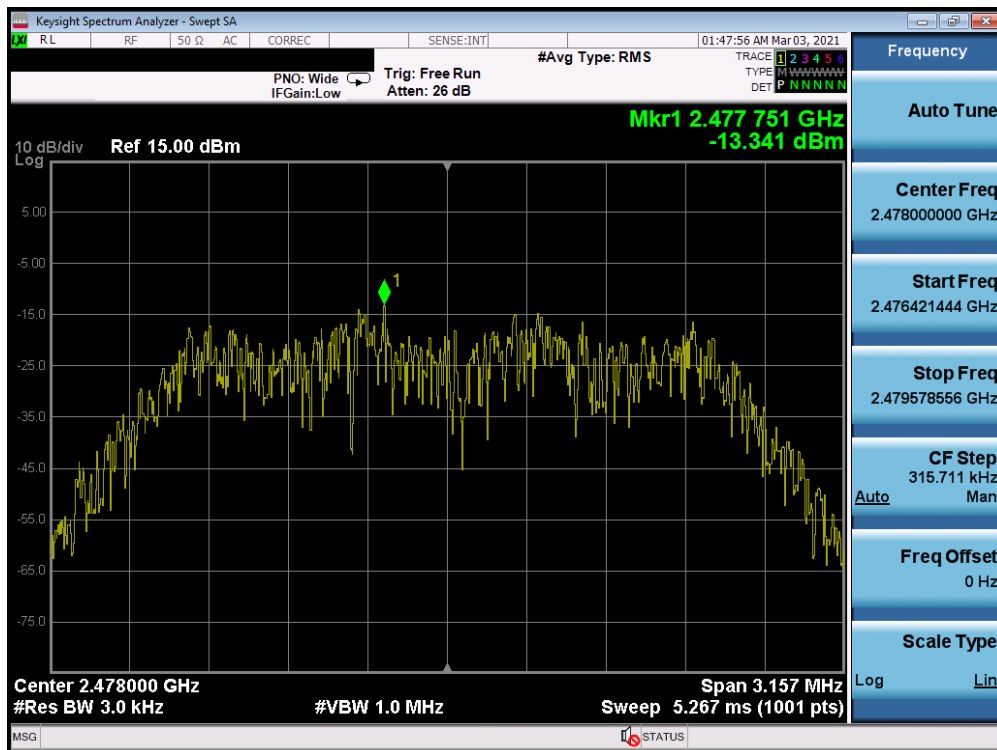


Plot 7-46. Power Spectral Density Plot TxBF Antenna 2a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 38)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 47 of 101

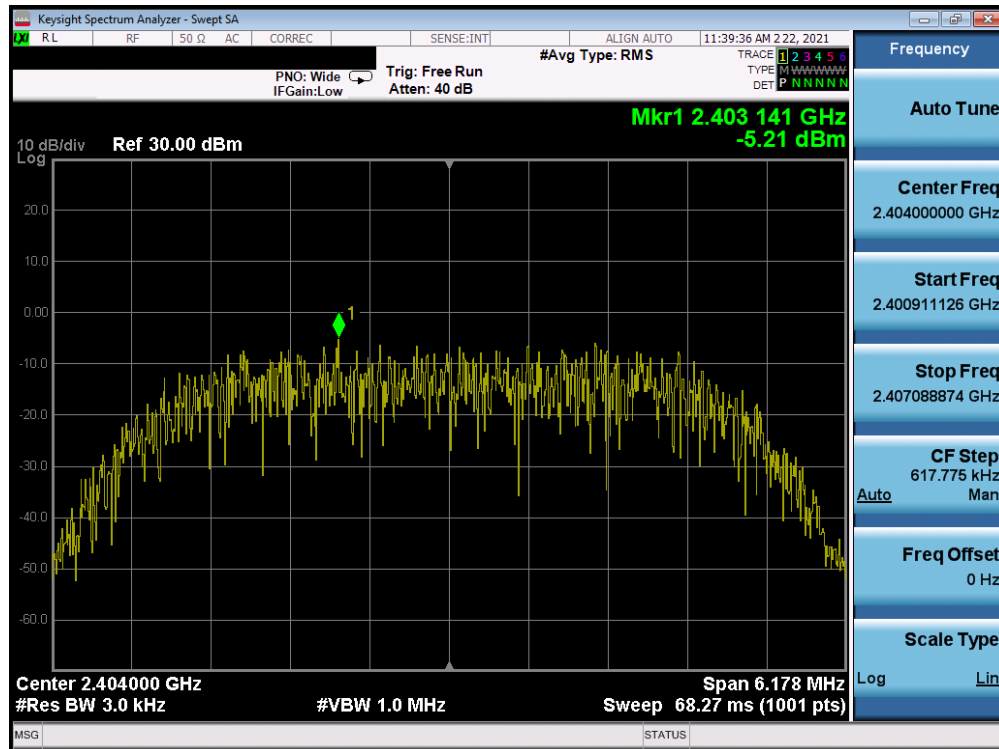


Plot 7-47. Power Spectral Density Plot TxBF Antenna 4a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 73)

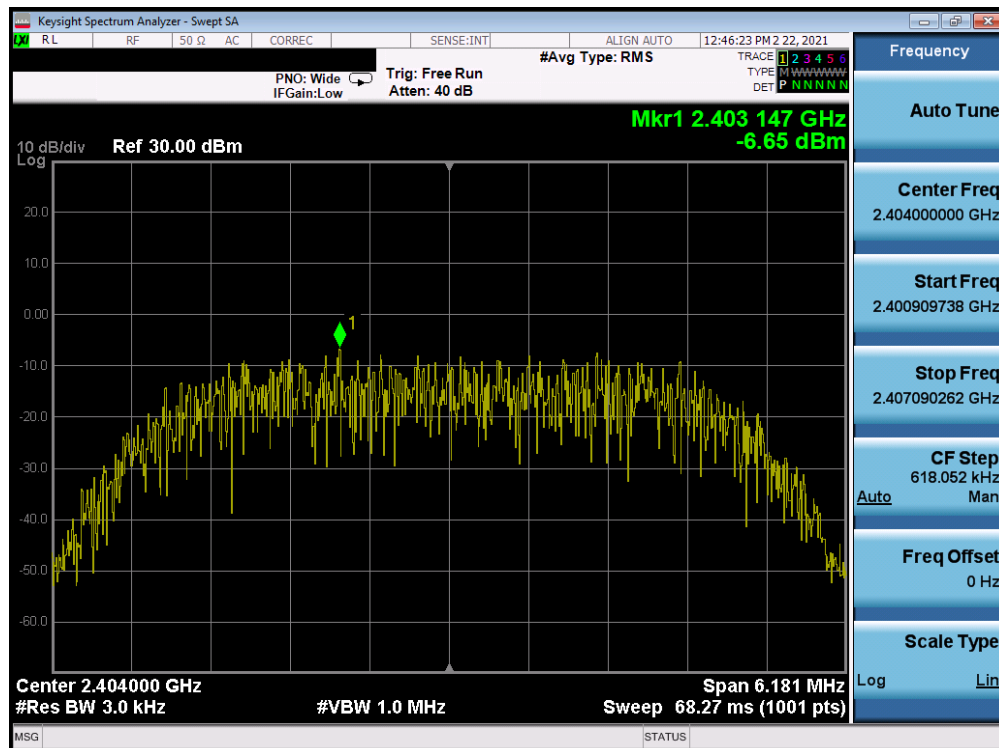


Plot 7-48. Power Spectral Density Plot TxBF Antenna 2a (Bluetooth (HDR4), 4Mbps, iPA – Ch. 73)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 48 of 101

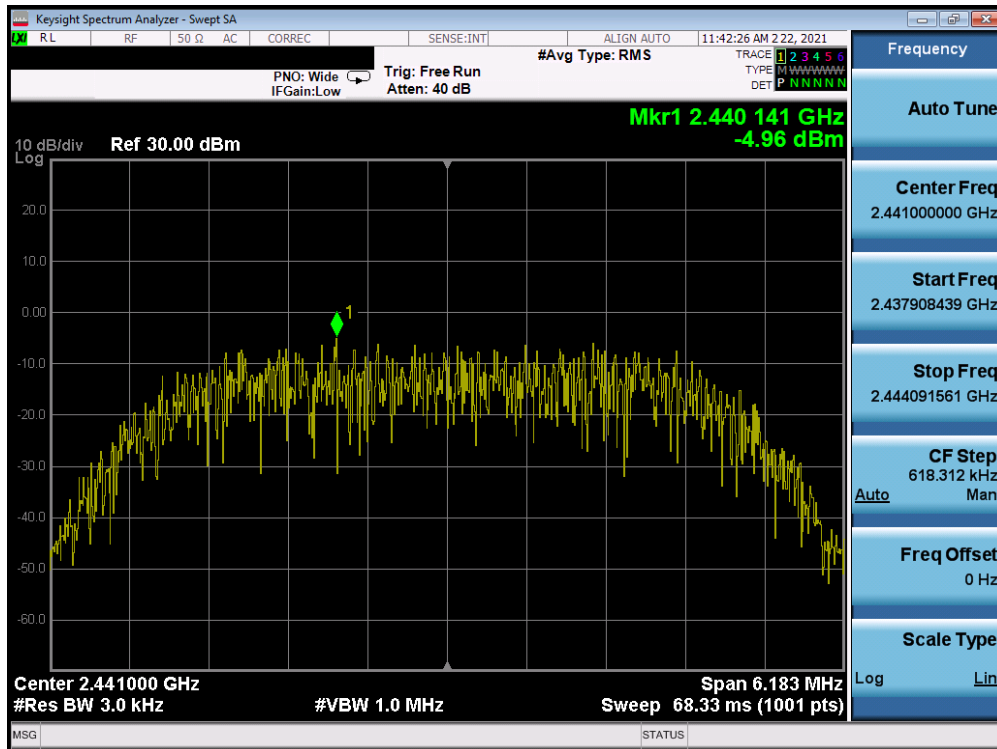


Plot 7-49. Power Spectral Density Plot TxBF Antenna 4a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 1)

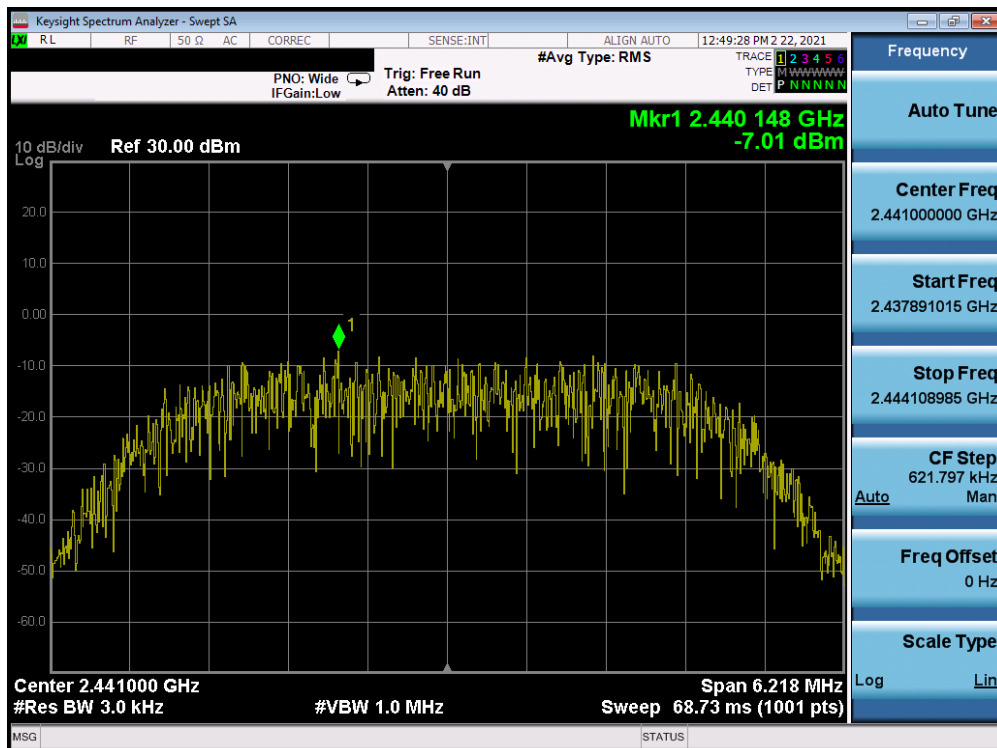


Plot 7-50. Power Spectral Density Plot TxBF Antenna 2a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 1)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 49 of 101



Plot 7-51. Power Spectral Density Plot TxBF Antenna 4a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 38)



Plot 7-52. Power Spectral Density Plot TxBF Antenna 2a (Bluetooth (HDR8), 8Mbps, ePA – Ch. 38)

FCC ID: BCGA2301 IC: 579C-A2301	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2101020002-11.BCG	Test Dates: 12/15/2020-2/25/2021	EUT Type: Tablet Device	Page 50 of 101