



MEASUREMENT REPORT

FCC PART 15.247 / ISSED RSS-247 WLAN 802.11b/g/n

Applicant Name:

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

Date of Testing:

07/16/2020 - 09/08/2020

Test Site/Location:

PCTEST Lab. Morgan Hill, CA, USA

Test Report Serial No.:

1C2004270029-06.BCG

FCC ID:

BCGA2324

IC:

579C-A2324

APPLICANT:

Apple Inc.

Application Type:

Certification

Model/HVIN:

A2324

EUT Type:

Tablet Device

Frequency Range:

2412 – 2472MHz

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,
KDB 662911 D01 v02r01

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.

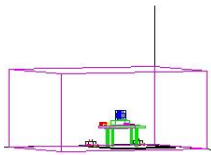

Randy Ortanez
President

FCC ID: BCGA2324	 PCTEST Proud to be part of  element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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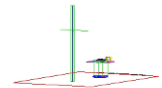
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Mode	Tx Frequency (MHz)	Ant 3a				Ant 1a			
		Avg Conducted		Peak Conducted		Avg Conducted		Peak Conducted	
		Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
802.11b	2412 - 2472	125.893	21.00	237.684	23.76	125.893	21.00	234.423	23.70
802.11g	2412 - 2472	111.944	20.49	217.771	23.38	112.202	20.50	375.837	25.75
802.11n	2412 - 2472	112.202	20.50	504.661	27.03	110.662	20.44	386.367	25.87

EUT Overview SISO

Mode	Tx Frequency (MHz)	Ant 3a				Ant 1a				CDD			
		Avg Conducted		Peak Conducted		Avg Conducted		Peak Conducted		Avg Conducted		Peak Conducted	
		Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
802.11g	2412 - 2472	89.125	19.50	325.837	25.13	89.125	19.50	334.965	25.25	178.238	22.51	660.693	28.20
802.11n	2412 - 2472	89.125	19.50	422.669	26.26	89.125	19.50	440.555	26.44	178.238	22.51	862.979	29.36

EUT Overview CDD

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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 17025-2005 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: BCGA2324**. The test data contained in this report pertains only to the emissions due to the EUT's WLAN (DTS) transmitter.

Test Device Serial No.: DLXD1008Q8MW, DLXD1013Q8MQ, DLX0226001FPWV22A, DLX0226002CPWV22A

2.2 Device Capabilities

This device contains the following capabilities:

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

This device supports BT Beamforming

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442		

Table 2-1. 802.11b/g/n Frequency/ Channel Operations

Note: The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section 6.0 b) of KDB 558074 D01 v05r02 and ANSI C63.10-2013. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Measured Duty Cycles				
802.11 Mode/Band		Duty Cycle [%]		
		Ant 3a	Ant 1a	CDD/SDM
2.4GHz	b	100.0	100.0	N/A
	g	98.7	98.5	98.1
	n	90.9	91.8	86.5

Table 2-2. Measured Duty Cycles

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The device employs CDD technology. Below are the possible configurations.

WiFi Configurations		SISO		SDM		CDD	
		ANT 3a	ANT 1a	ANT 3a	ANT 1a	ANT 3a	ANT 1a
2.4GHz	11b	✓	✓	✗	✗	✗	✗
	11g	✓	✓	✓	✓	✓	✓
	11n	✓	✓	✓	✓	✓	✓

Table 2-3. Frequency / Channel Operations

✓ = Support ; ✗ = NOT Support

SISO = Single Input Single Output

SDM = Spatial Diversity Multiplexing – CDD function

CDD = Cyclic Delay Diversity - 2Tx Function

Data Rates Supported: 1Mbps, 2Mbps, 5.5Mbps, 11Mbps (b)
6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps (g)
6.5/7.2Mbps, 13/14.4Mbps, 19.5/21.7Mbps, 26/28.9Mbps, 39/43.3Mbps,
52/57.8Mbps, 58.5/65Mbps, 65/72.2Mbps (n)
13/14.4Mbps, 26/28.9Mbps, 39/43.3Mbps, 52/57.8Mbps, 78/86.7Mbps,
104/115.6Mbps, 117/130Mbps, 130/144.4Mbps (CDD n)

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	LTE / GSM / WCDMA	UNII
		802.11 b/g/n/ax	BDR, EDR, HDR4/8, LE	Mid band/ High band	802.11 a/n/ax
1a	Config 1	✓	✗	✓	✗
	Config 2	✗	✓	✓	✗
2a	Config 3	✗	✗	✓	✓
3a	Config 4	✓	✗	✓	✗
	Config 5	✗	✓	✓	✗

Table 2-4. 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 2 and reported in BTLE and LTE test reports.

2.3 Antenna Description

Following antennas were used for the testing.

Frequency [GHz]	Antenna Gain (dBi)	
	Antenna 3a	Antenna 1a
2.4	0.30	1.00

Table 2-5. Highest Antenna Gain

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2.4 Test Support Equipment

1	Apple MacBook	Model: A1398	S/N: C2QKP008F6F3
	w/AC/DC Adapter	Model: A1435	S/N: N/A
2	Apple USB-C Cable	Model: Chimp	S/N: 420A57
3	USB-C Cable	Model: A146	S/N: N/A
	w/ AC Adapter	Model: A2305	S/N: N/A
4	Apple Pencil	Model: N/A	S/N: GQX91220J13LL6U7AS
5	DC Power Supply	Model: KPS3010D	S/N: N/A

Table 2-6. 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 testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, Section 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 EUT powered by AC/DC was the worst case.

- 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

802.11n CDD mode test data provided in this report covers 802.11n SDM.

For 802.11ax test results, see separate WLAN (OFDMA) report, 1C2004270029-07.BCG

2.6 Software and Firmware

The test was conducted with firmware version 18A325 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 65-6. 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 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 7.9. 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 antennas of the EUT are **permanently attached**.
- There are no provisions for connections to an external antenna.

Conclusion:

The EUT unit 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 C63.10-2013. 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	1.30
Line Conducted Disturbance	2.34
Radiated Disturbance (<1GHz)	4.15
Radiated Disturbance (>1GHz)	4.59
Radiated Disturbance (>18GHz)	4.96

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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	10/29/2019	Annual	10/29/2020	184005
Anritsu	MA2411B	Pulse Power Sensor	10/29/2019	Annual	10/29/2020	1726261
Anritsu	MA2411B	Pulse Power Sensor	10/29/2019	Annual	10/29/2020	1726262
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	10/29/2019	Annual	10/29/2020	T058701-02
COM-POWER	LIN-120A	LISN	3/4/2020	Annual	3/4/2021	241297
ETS-Lindgren	3142E-PA	Pre-Amplifier (30MHz - 6GHz)	9/19/2019	Annual	9/19/2020	213236
ETS-Lindgren	3142E	BiConiLog Antenna (30MHz - 6GHz)	1/6/2020	Annual	1/6/2021	224569
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	9/13/2019	Annual	9/13/2020	101570
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	9/19/2019	Annual	9/19/2020	100051
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Antenna (400MHz-18GHz)	11/14/2019	Annual	11/14/2020	101057
Rohde & Schwarz	HFH2-Z2	Loop Antenna	3/12/2020	Annual	3/12/2021	100546

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: BCGA2324

FCC Classification: Digital Transmission System (DTS)

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
15.247(b)(3)	RSS-247 [5.4]	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, 7.8
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits (RSS-Gen[8.8])	AC LINE CONDUCTED	PASS	Section 7.9

Table 7-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots 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 conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "WLAN Automation," Version 3.5.
- 5) 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.

FCC ID: BCGA2324	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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7.2 6dB Bandwidth Measurement

§15.247(a.2); RSS-247 [5.2]

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 its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates 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

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform 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

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

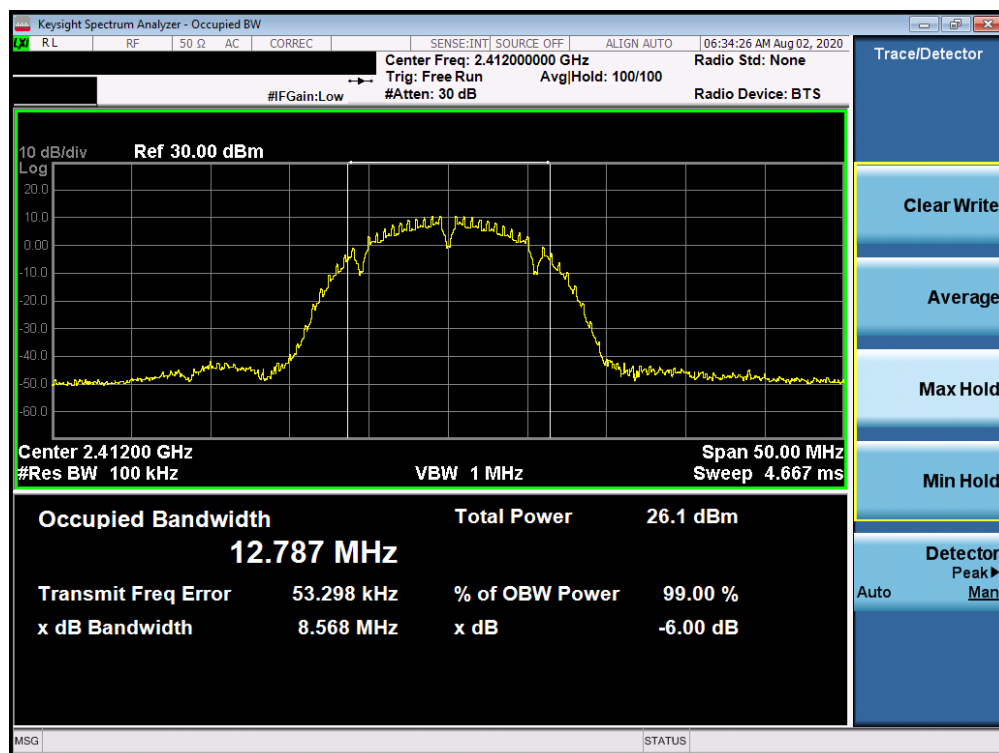
All antenna configurations were investigated and only the worst case is reported.

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Antenna 3a 6 dB Bandwidth Measurements

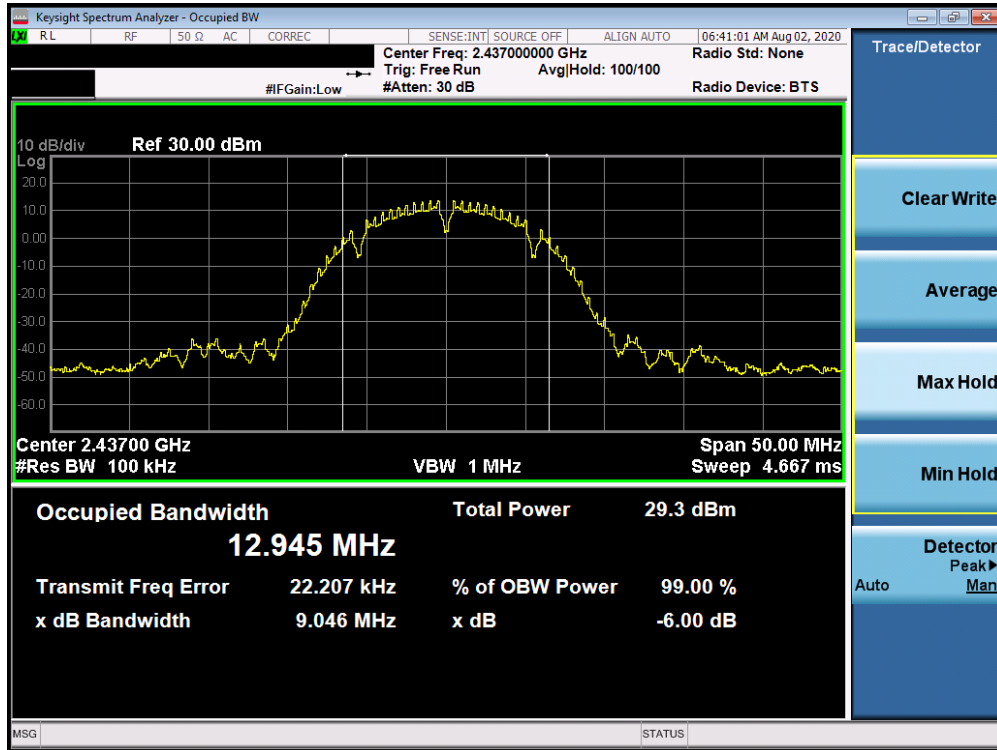
Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
2412	1	b	1	8.57	0.500	Pass
2437	6	b	1	9.05	0.500	Pass
2462	11	b	1	8.60	0.500	Pass
2412	1	g	6	16.09	0.500	Pass
2437	6	g	6	15.93	0.500	Pass
2462	11	g	6	16.09	0.500	Pass
2412	1	n	65/72.2 (MCS7)	16.91	0.500	Pass
2437	6	n	65/72.2 (MCS7)	17.24	0.500	Pass
2462	11	n	65/72.2 (MCS7)	16.94	0.500	Pass

Table 7-2. Conducted Bandwidth Measurements ANT 3a

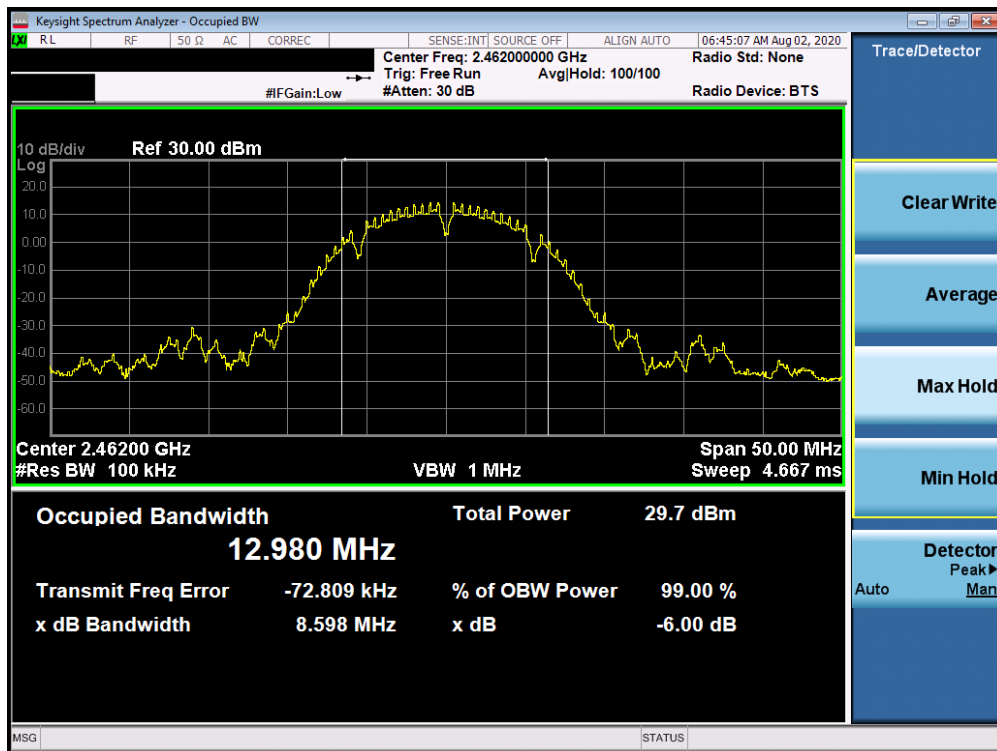


Plot 7-1. 6dB Bandwidth Plot ANT 3a (802.11b – Ch. 1)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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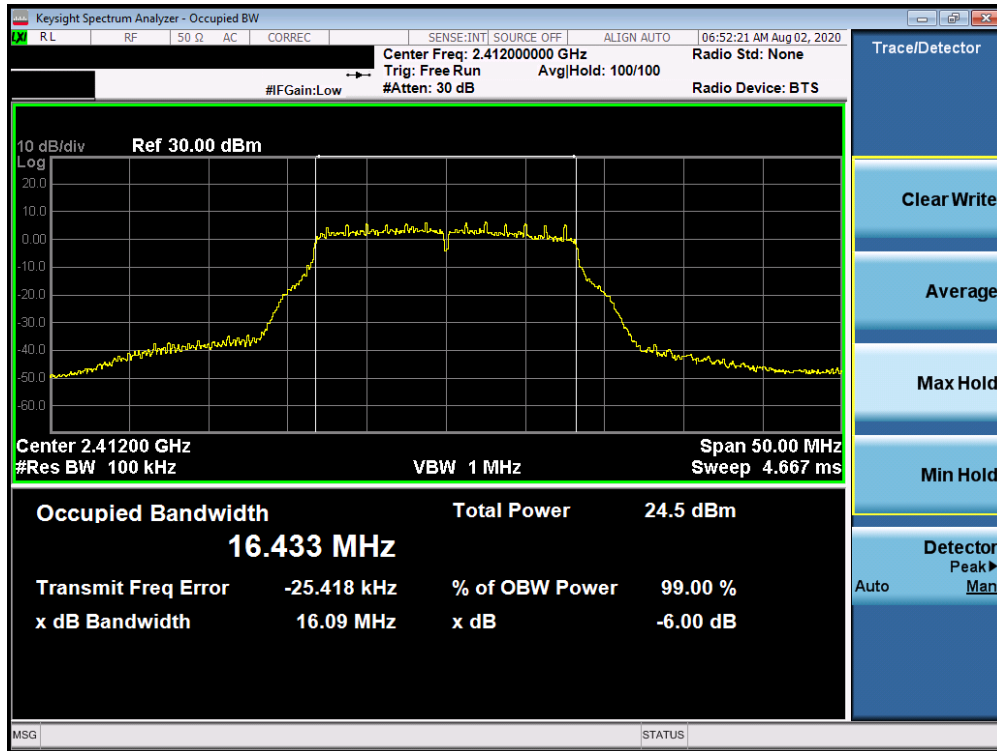


Plot 7-2. 6dB Bandwidth Plot ANT 3a (802.11b – Ch. 6)

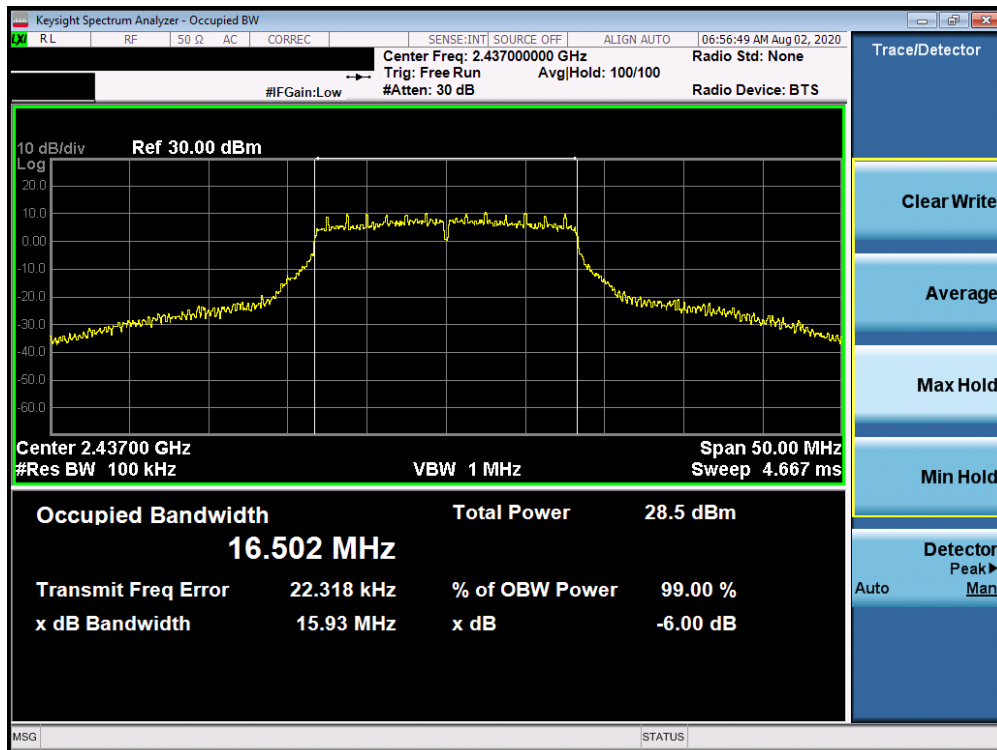


Plot 7-3. 6dB Bandwidth Plot ANT 3a (802.11b – Ch. 11)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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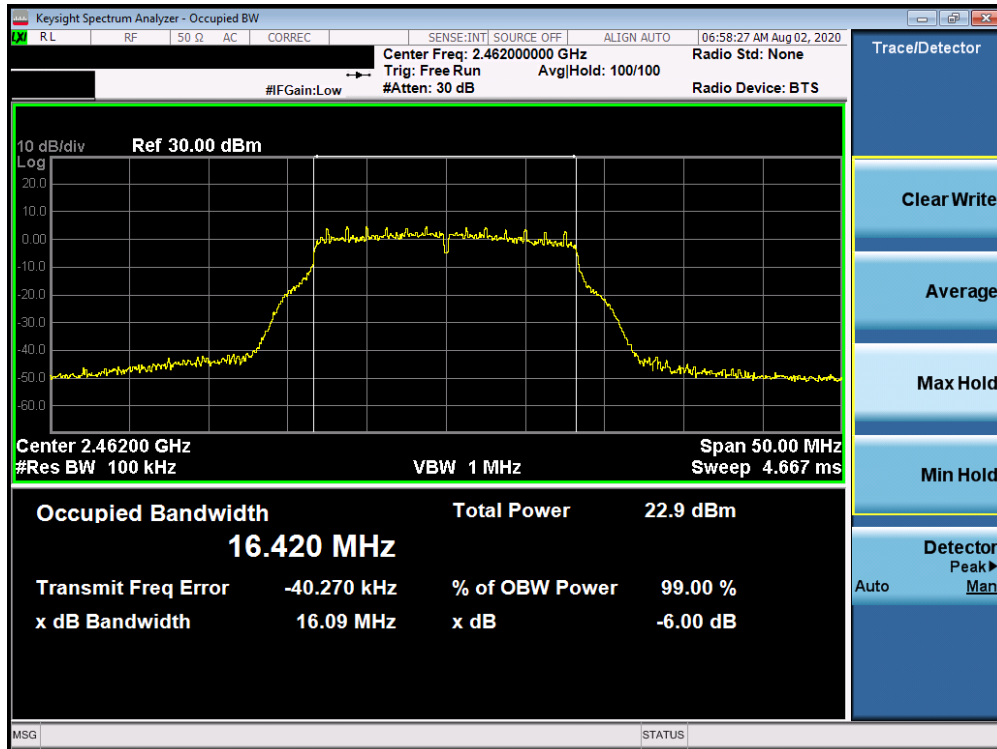


Plot 7-4. 6dB Bandwidth Plot ANT 3a (802.11g – Ch. 1)

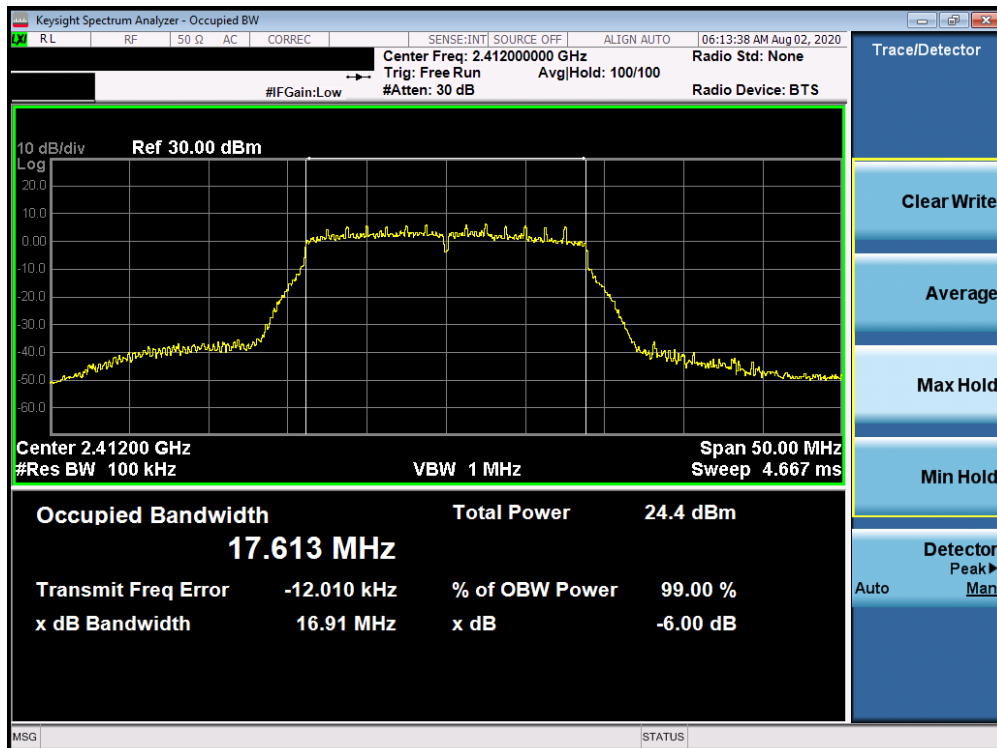


Plot 7-5. 6dB Bandwidth Plot ANT 3a (802.11g – Ch. 6)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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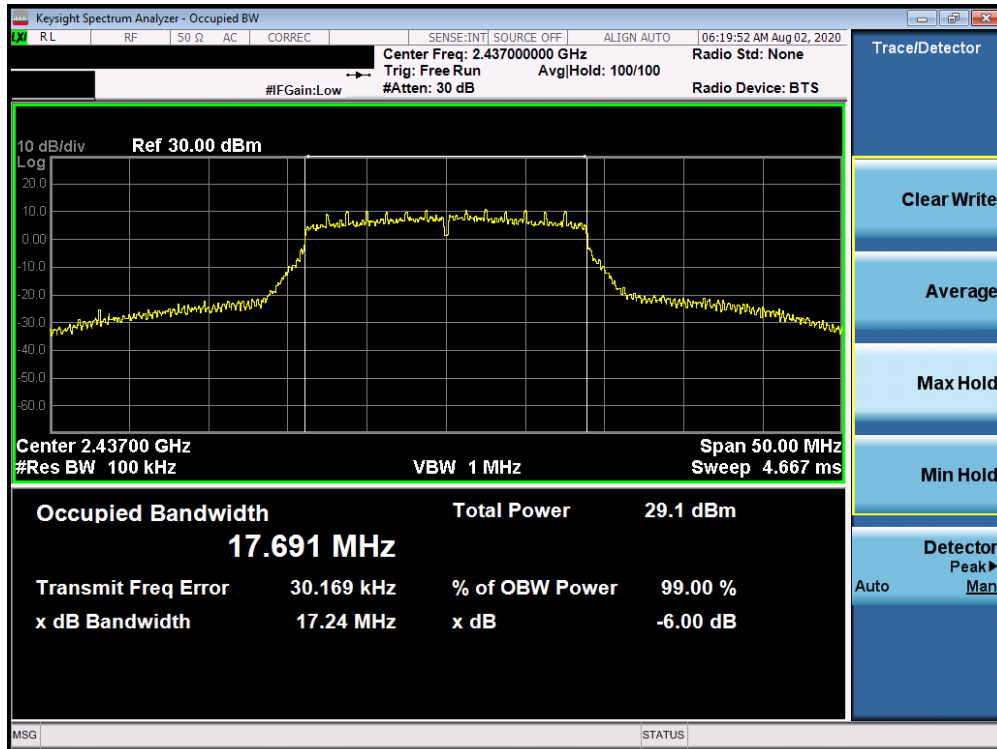


Plot 7-6. 6dB Bandwidth Plot ANT 3a (802.11g – Ch. 11)

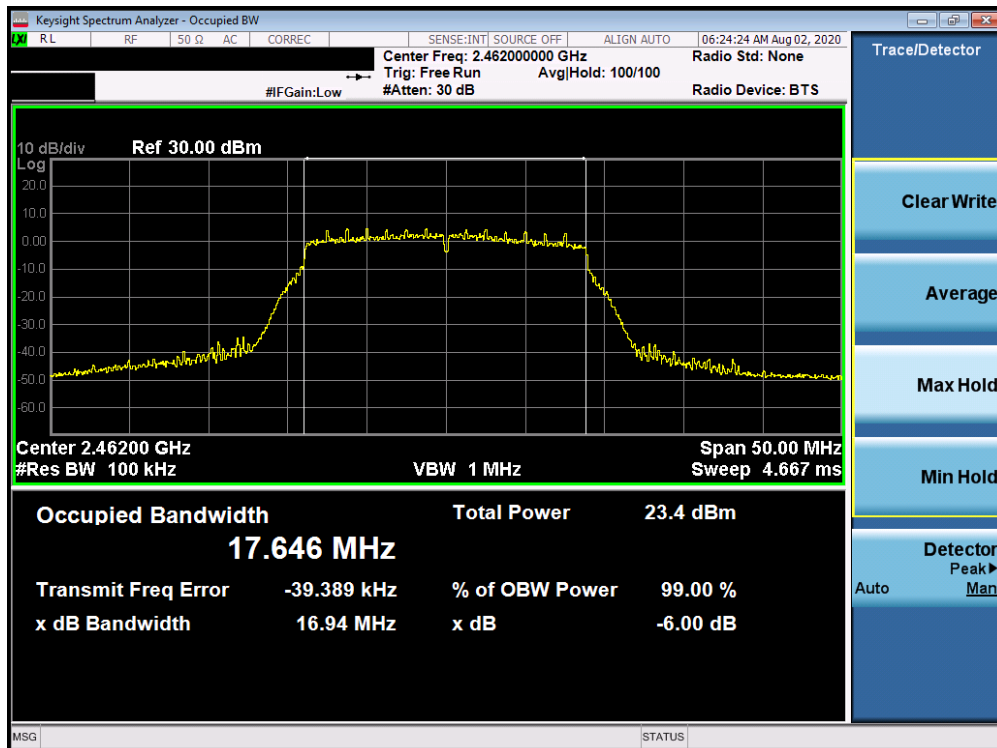


Plot 7-7. 6dB Bandwidth Plot ANT 3a (802.11n (2.4GHz) – Ch. 1)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-8. 6dB Bandwidth Plot ANT 3a (802.11n (2.4GHz) – Ch. 6)



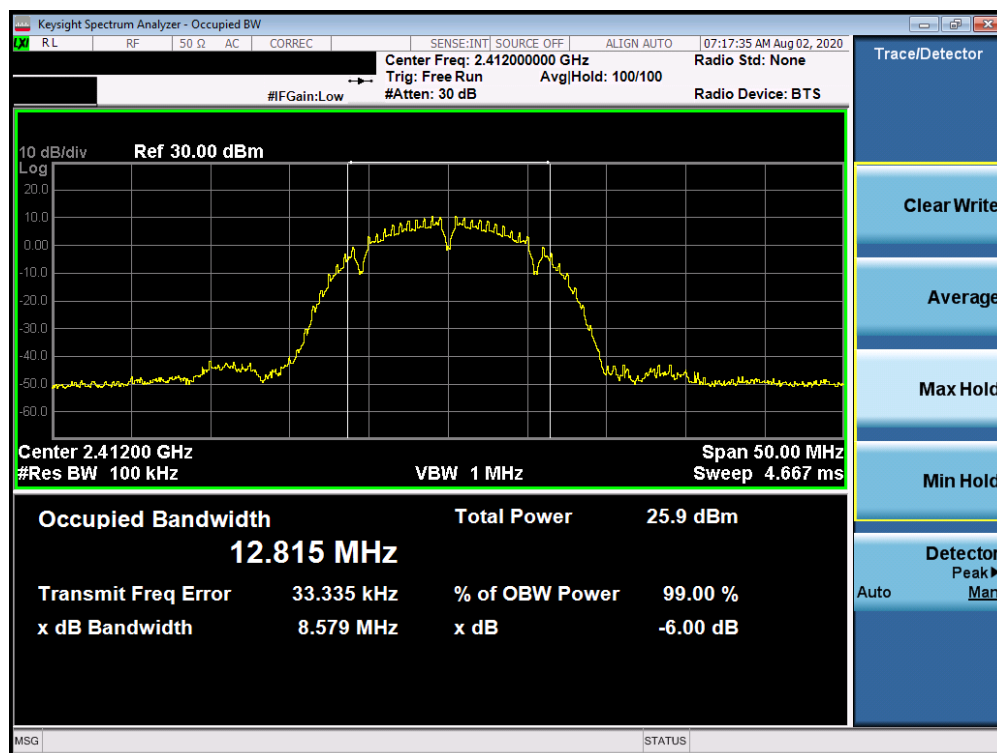
Plot 7-9. 6dB Bandwidth Plot ANT 3a (802.11n (2.4GHz) – Ch. 11)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Antenna 1a 6 dB Bandwidth Measurements

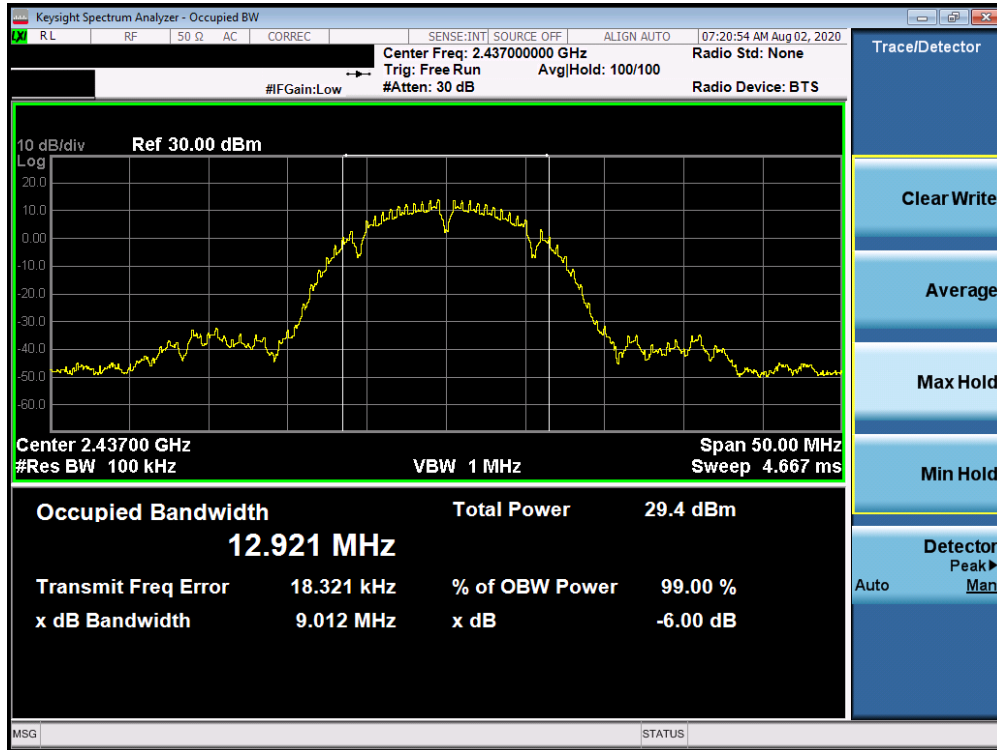
Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
2412	1	b	1	8.58	0.500	Pass
2437	6	b	1	9.01	0.500	Pass
2462	11	b	1	8.13	0.500	Pass
2412	1	g	6	15.81	0.500	Pass
2437	6	g	6	16.34	0.500	Pass
2462	11	g	6	16.33	0.500	Pass
2412	1	n	65/72.2 (MCS7)	17.73	0.500	Pass
2437	6	n	65/72.2 (MCS7)	17.72	0.500	Pass
2462	11	n	65/72.2 (MCS7)	17.76	0.500	Pass

Table 7-3. Conducted Bandwidth Measurements ANT 1a

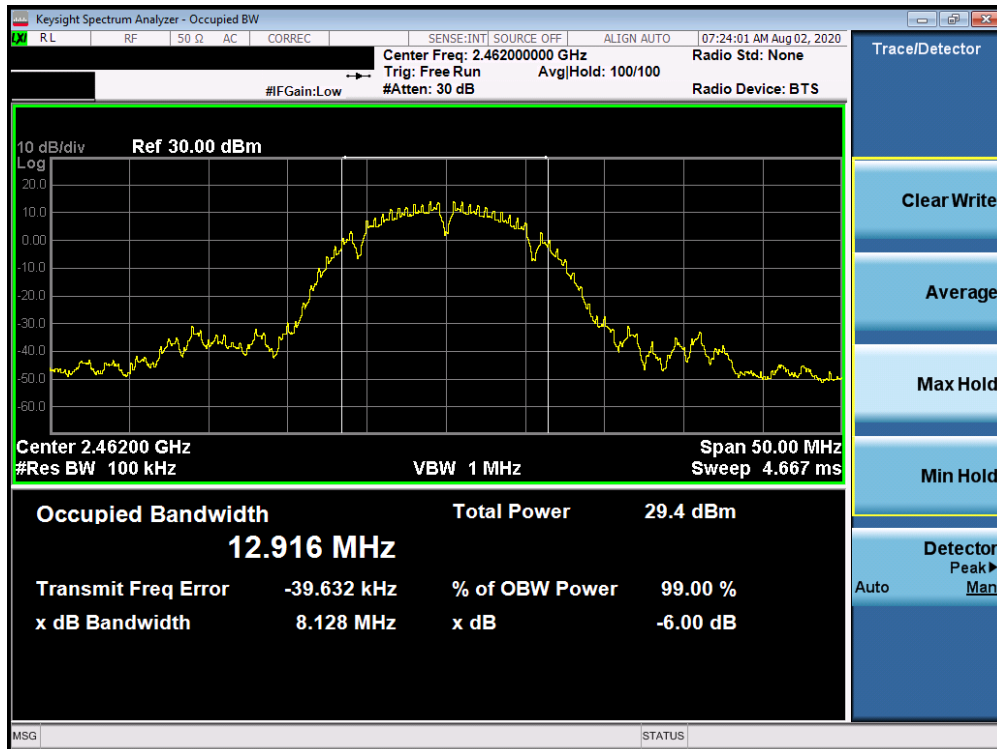


Plot 7-10. 6dB Bandwidth Plot ANT 1a (802.11b – Ch. 1)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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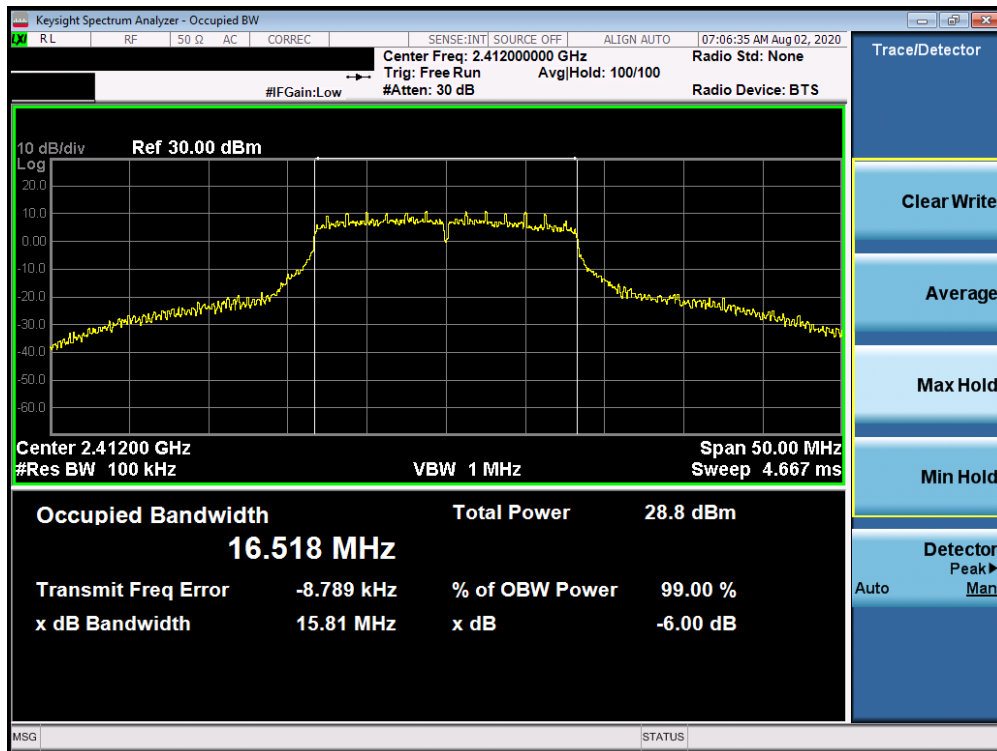


Plot 7-11. 6dB Bandwidth Plot ANT 1a (802.11b – Ch. 6)

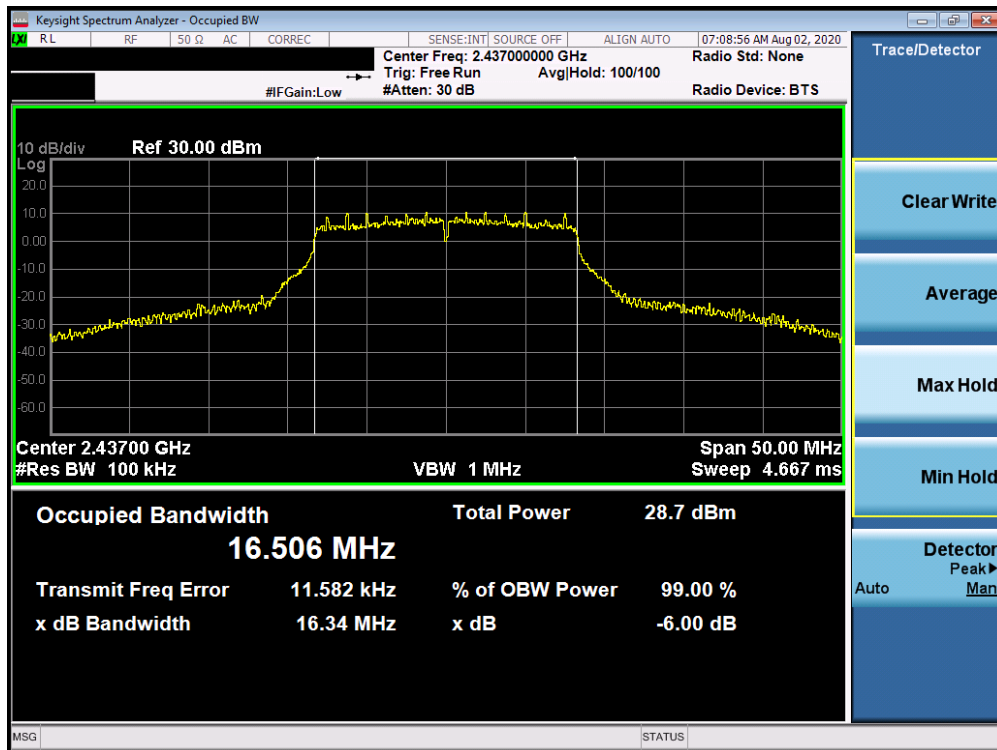


Plot 7-12. 6dB Bandwidth Plot ANT 1a (802.11b – Ch. 11)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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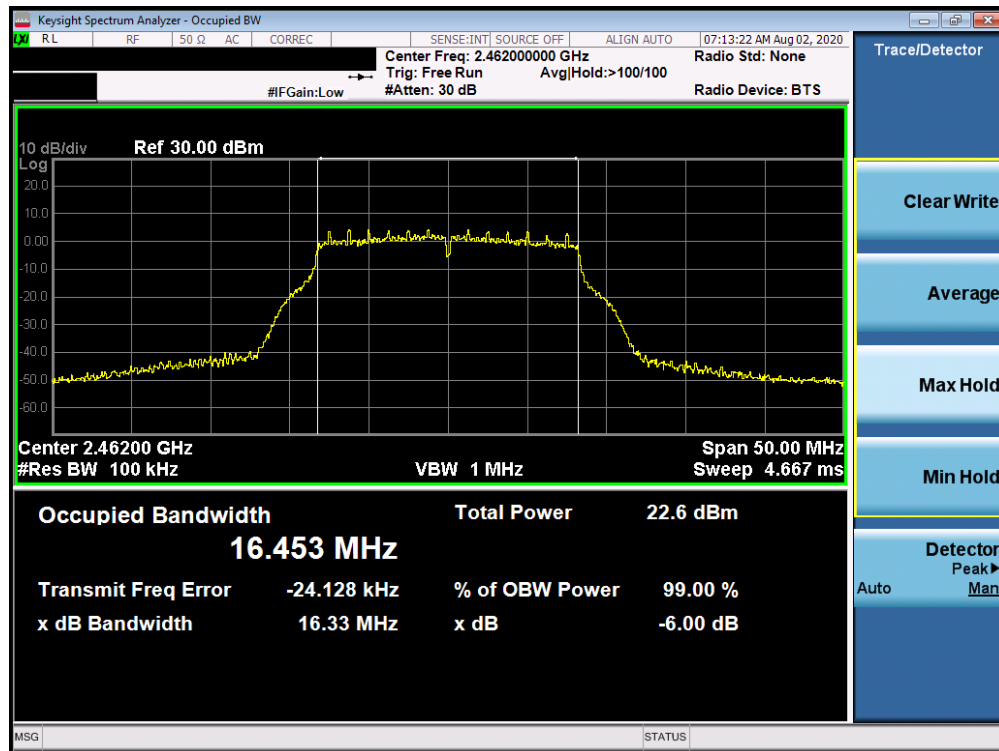


Plot 7-13. 6dB Bandwidth Plot ANT 1a (802.11g – Ch. 1)

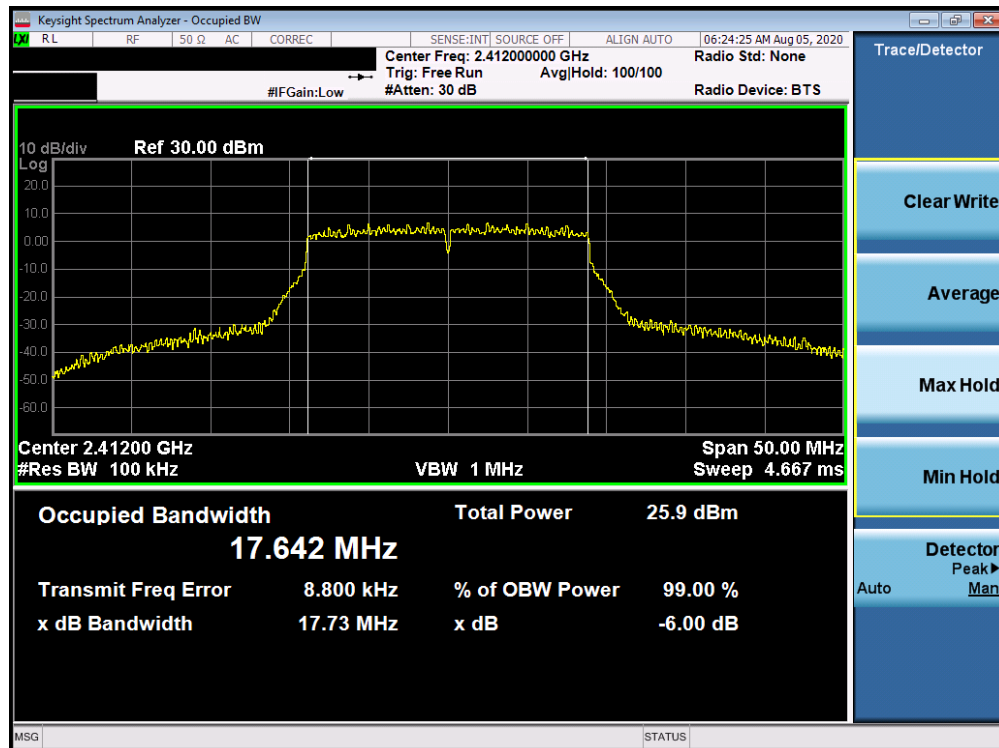


Plot 7-14. 6dB Bandwidth Plot ANT 1a (802.11g – Ch. 6)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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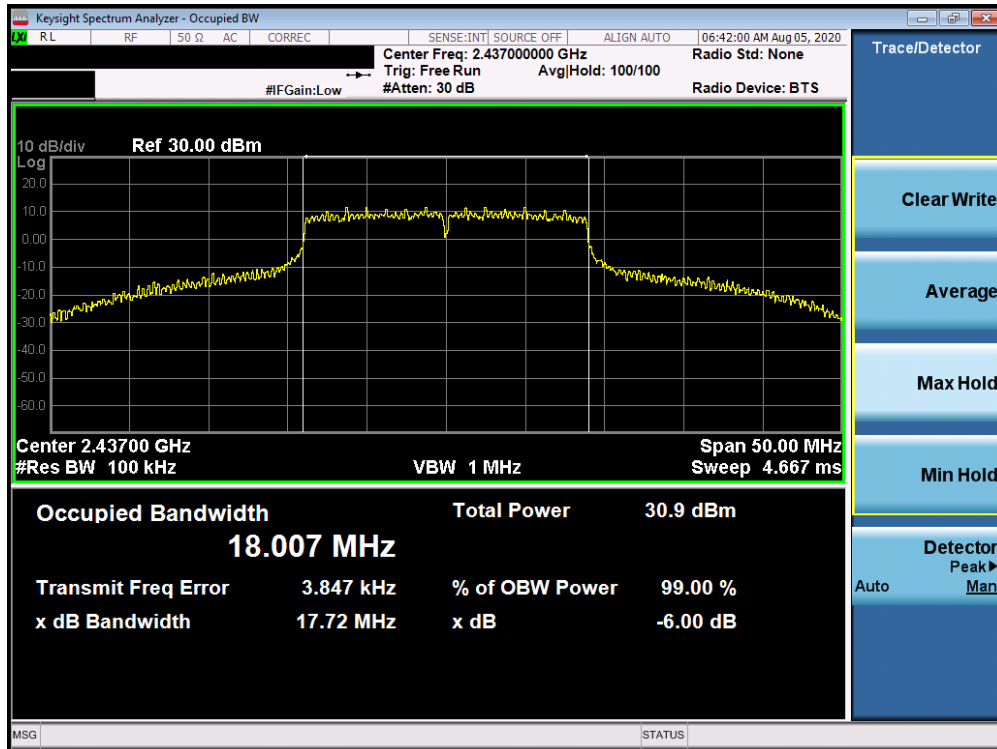


Plot 7-15. 6dB Bandwidth Plot ANT 1a (802.11g – Ch. 11)

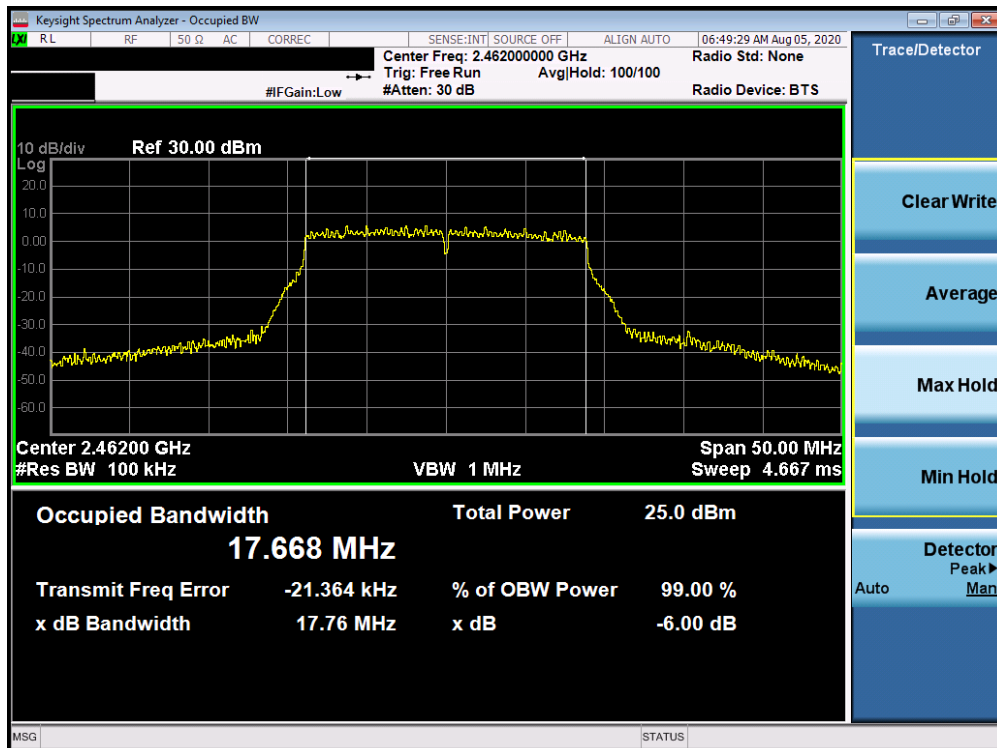


Plot 7-16. 6dB Bandwidth Plot ANT 1a (802.11n (2.4GHz) – Ch. 1)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-17. 6dB Bandwidth Plot ANT 1a (802.11n (2.4GHz) – Ch. 6)



Plot 7-18. 6dB Bandwidth Plot ANT 1a (802.11n (2.4GHz) – Ch. 11)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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7.3 Output Power Measurement

§15.247(b.3); RSS-247 [5.4]

Test Overview and Limits

A transmitter antenna terminal of EUT is connected to the input of an RF power sensor. Measurement is made using a broadband power meter capable of making peak and average measurements while the EUT is operating at its maximum duty cycle, 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 DTSSs 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 PKPM1 Peak Power Method
KDB 558074 D01 v05r02 – Section 8.3.1.3 PKPM1 Peak-reading Power Meter Method
ANSI C63.10-2013 – Section 11.9.2.3.2 Method AVGPM-G
KDB 558074 D01 v05r02 – Section 8.3.2.3 Measurement using a Power Meter (PM)
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)

Peak 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 pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

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 diagrams below.



Figure 7-2. Test Instrument & Measurement Setup for Power Meter Measurements

Test Notes

1. For 802.11b, the worst case data rate was found to be 1Mbps
2. For 802.11g, the worst case data rate was found to be 6Mbps
3. For 802.11n, the worst case data rate was found to be MCS7 for SISO and MCS15 for CDD.

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7.3.1 Average Output Power Measurement

§15.247(b.3); RSS-247 [5.4]

Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
			802.11b	802.11g	802.11n						
2412	1	AVG	18.42	14.00	14.00	30.00	-11.58	0.30	18.72	36.02	-17.30
2417	2	AVG	20.00	17.44	17.48	30.00	-10.00	0.30	20.30	36.02	-15.72
2422	3	AVG	20.91	19.48	19.47	30.00	-9.09	0.30	21.21	36.02	-14.81
2427	4	AVG	20.96	20.49	20.50	30.00	-9.04	0.30	21.26	36.02	-14.76
2432	5	AVG	20.76	20.45	20.49	30.00	-9.24	0.30	21.06	36.02	-14.96
2437	6	AVG	21.00	20.47	20.50	30.00	-9.00	0.30	21.30	36.02	-14.72
2442	7	AVG	21.00	20.49	20.47	30.00	-9.00	0.30	21.30	36.02	-14.72
2447	8	AVG	20.91	18.91	19.00	30.00	-9.09	0.30	21.21	36.02	-14.81
2452	9	AVG	20.90	18.48	18.47	30.00	-9.10	0.30	21.20	36.02	-14.82
2457	10	AVG	21.00	17.00	17.00	30.00	-9.00	0.30	21.30	36.02	-14.72
2462	11	AVG	20.99	13.95	13.95	30.00	-9.01	0.30	21.29	36.02	-14.73
2467	12	AVG	18.50	11.50	11.50	30.00	-11.50	0.30	18.80	36.02	-17.22
2472	13	AVG	15.00	10.49	10.49	30.00	-15.00	0.30	15.30	36.02	-20.72

Table 7-4. Average Conducted Output Power Measurements ANT 3a

Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
			802.11b	802.11g	802.11n						
2412	1	AVG	18.50	13.87	13.95	30.00	-11.50	1.00	19.50	36.02	-16.52
2417	2	AVG	20.00	17.50	17.40	30.00	-10.00	1.00	21.00	36.02	-15.02
2422	3	AVG	20.83	19.50	19.41	30.00	-9.17	1.00	21.83	36.02	-14.19
2427	4	AVG	20.90	20.41	20.25	30.00	-9.10	1.00	21.90	36.02	-14.12
2432	5	AVG	20.81	20.50	20.44	30.00	-9.19	1.00	21.81	36.02	-14.21
2437	6	AVG	21.00	20.35	20.42	30.00	-9.00	1.00	22.00	36.02	-14.02
2442	7	AVG	21.00	20.40	20.32	30.00	-9.00	1.00	22.00	36.02	-14.02
2447	8	AVG	21.00	19.00	18.82	30.00	-9.00	1.00	22.00	36.02	-14.02
2452	9	AVG	21.00	18.40	18.37	30.00	-9.00	1.00	22.00	36.02	-14.02
2457	10	AVG	20.94	16.88	17.00	30.00	-9.06	1.00	21.94	36.02	-14.08
2462	11	AVG	20.97	13.90	13.81	30.00	-9.03	1.00	21.97	36.02	-14.05
2467	12	AVG	18.50	11.38	11.50	30.00	-11.50	1.00	19.50	36.02	-16.52
2472	13	AVG	14.91	10.44	10.50	30.00	-15.09	1.00	15.91	36.02	-20.11

Table 7-5. Average Conducted Output Power Measurements ANT 1a

FCC ID: BCGA2324	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
			Ant 3a	Ant 1a	Summed						
2412	1	AVG	13.46	13.50	16.49	30.00	-13.51	3.67	20.16	36.02	-15.86
2417	2	AVG	16.50	16.50	19.51	30.00	-10.49	3.67	23.18	36.02	-12.84
2422	3	AVG	18.50	18.46	21.49	30.00	-8.51	3.67	25.16	36.02	-10.86
2427	4	AVG	19.45	19.50	22.49	30.00	-7.51	3.67	26.16	36.02	-9.86
2432	5	AVG	19.45	19.44	22.46	30.00	-7.54	3.67	26.13	36.02	-9.89
2437	6	AVG	19.49	19.50	22.51	30.00	-7.49	3.67	26.18	36.02	-9.84
2442	7	AVG	19.50	19.50	22.51	30.00	-7.49	3.67	26.18	36.02	-9.84
2447	8	AVG	18.40	18.40	21.41	30.00	-8.59	3.67	25.08	36.02	-10.94
2452	9	AVG	18.00	17.92	20.97	30.00	-9.03	3.67	24.64	36.02	-11.38
2457	10	AVG	16.50	16.41	19.47	30.00	-10.53	3.67	23.14	36.02	-12.88
2462	11	AVG	13.50	13.50	16.51	30.00	-13.49	3.67	20.18	36.02	-15.84
2467	12	AVG	11.00	10.93	13.98	30.00	-16.02	3.67	17.65	36.02	-18.37
2472	13	AVG	10.00	9.91	12.97	30.00	-17.03	3.67	16.64	36.02	-19.38

Table 7-6. Average Conducted Output Power Measurements CDD (802.11g)

Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
			Ant 3a	Ant 1a	Summed						
2412	1	AVG	13.40	13.50	16.46	30.00	-13.54	3.67	20.13	36.02	-15.89
2417	2	AVG	16.50	16.50	19.51	30.00	-10.49	3.67	23.18	36.02	-12.84
2422	3	AVG	18.50	18.50	21.51	30.00	-8.49	3.67	25.18	36.02	-10.84
2427	4	AVG	19.50	19.42	22.47	30.00	-7.53	3.67	26.14	36.02	-9.88
2432	5	AVG	19.50	19.50	22.51	30.00	-7.49	3.67	26.18	36.02	-9.84
2437	6	AVG	19.50	19.40	22.46	30.00	-7.54	3.67	26.13	36.02	-9.89
2442	7	AVG	19.50	19.50	22.51	30.00	-7.49	3.67	26.18	36.02	-9.84
2447	8	AVG	18.50	18.50	21.51	30.00	-8.49	3.67	25.18	36.02	-10.84
2452	9	AVG	18.00	18.00	21.01	30.00	-8.99	3.67	24.68	36.02	-11.34
2457	10	AVG	16.50	16.50	19.51	30.00	-10.49	3.67	23.18	36.02	-12.84
2462	11	AVG	13.50	13.50	16.51	30.00	-13.49	3.67	20.18	36.02	-15.84
2467	12	AVG	11.00	11.00	14.01	30.00	-15.99	3.67	17.68	36.02	-18.34
2472	13	AVG	10.00	10.00	13.01	30.00	-16.99	3.67	16.68	36.02	-19.34

Table 7-7. Average Conducted Output Power Measurements CDD (802.11n)

FCC ID: BCGA2324	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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7.3.2 Peak Output Power Measurement

§15.247(b.3); RSS-247 [5.4]

Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
			802.11b	802.11g	802.11n						
2412	1	PEAK	21.18	20.60	24.48	30.00	-5.52	0.30	24.78	36.02	-11.24
2417	2	PEAK	22.66	20.46	26.16	30.00	-3.84	0.30	26.46	36.02	-9.56
2422	3	PEAK	23.53	22.36	26.75	30.00	-3.25	0.30	27.05	36.02	-8.97
2427	4	PEAK	23.63	23.38	26.99	30.00	-3.01	0.30	27.29	36.02	-8.73
2432	5	PEAK	23.42	23.18	27.03	30.00	-2.97	0.30	27.33	36.02	-8.69
2437	6	PEAK	23.68	23.27	27.00	30.00	-3.00	0.30	27.30	36.02	-8.72
2442	7	PEAK	23.76	23.32	26.96	30.00	-3.04	0.30	27.26	36.02	-8.76
2447	8	PEAK	23.47	21.64	26.73	30.00	-3.27	0.30	27.03	36.02	-8.99
2452	9	PEAK	23.55	21.39	26.52	30.00	-3.48	0.30	26.82	36.02	-9.20
2457	10	PEAK	23.68	19.88	26.10	30.00	-3.90	0.30	26.40	36.02	-9.62
2462	11	PEAK	23.61	16.73	24.34	30.00	-5.66	0.30	24.64	36.02	-11.38
2467	12	PEAK	21.24	18.32	22.29	30.00	-7.71	0.30	22.59	36.02	-13.43
2472	13	PEAK	17.67	18.11	21.35	30.00	-8.65	0.30	21.65	36.02	-14.37

Table 7-8. Peak Conducted Output Power Measurements ANT 3a

Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
			802.11b	802.11g	802.11n						
2412	1	PEAK	21.30	20.37	20.67	30.00	-8.70	1.00	22.30	36.02	-13.72
2417	2	PEAK	22.67	23.78	24.11	30.00	-5.89	1.00	25.11	36.02	-10.91
2422	3	PEAK	23.48	25.16	25.27	30.00	-4.73	1.00	26.27	36.02	-9.75
2427	4	PEAK	23.53	25.70	25.72	30.00	-4.28	1.00	26.72	36.02	-9.30
2432	5	PEAK	23.36	25.75	25.87	30.00	-4.13	1.00	26.87	36.02	-9.15
2437	6	PEAK	23.63	25.63	25.81	30.00	-4.19	1.00	26.81	36.02	-9.21
2442	7	PEAK	23.60	25.57	25.72	30.00	-4.28	1.00	26.72	36.02	-9.30
2447	8	PEAK	23.61	24.81	24.87	30.00	-5.13	1.00	25.87	36.02	-10.15
2452	9	PEAK	23.70	24.50	24.60	30.00	-5.40	1.00	25.60	36.02	-10.42
2457	10	PEAK	23.54	23.37	23.77	30.00	-6.23	1.00	24.77	36.02	-11.25
2462	11	PEAK	23.55	20.65	20.57	30.00	-6.45	1.00	24.55	36.02	-11.47
2467	12	PEAK	21.22	17.97	18.56	30.00	-8.78	1.00	22.22	36.02	-13.80
2472	13	PEAK	17.67	18.28	18.23	30.00	-11.72	1.00	19.28	36.02	-16.74

Table 7-9. Peak Conducted Output Power Measurements ANT 1a

FCC ID: BCGA2324	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 28 of 134

Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
			Ant 3a	Ant 1a	Summed						
2412	1	PEAK	19.97	20.10	23.05	30.00	-6.95	3.67	26.72	36.02	-9.30
2417	2	PEAK	23.10	22.97	26.05	30.00	-3.95	3.67	29.72	36.02	-6.30
2422	3	PEAK	24.50	24.50	27.51	30.00	-2.49	3.67	31.18	36.02	-4.84
2427	4	PEAK	25.05	25.23	28.15	30.00	-1.85	3.67	31.82	36.02	-4.20
2432	5	PEAK	25.10	25.15	28.14	30.00	-1.86	3.67	31.81	36.02	-4.21
2437	6	PEAK	25.10	25.11	28.12	30.00	-1.88	3.67	31.79	36.02	-4.23
2442	7	PEAK	25.13	25.25	28.20	30.00	-1.80	3.67	31.87	36.02	-4.15
2447	8	PEAK	24.46	24.52	27.50	30.00	-2.50	3.67	31.17	36.02	-4.85
2452	9	PEAK	24.13	24.22	27.19	30.00	-2.81	3.67	30.86	36.02	-5.16
2457	10	PEAK	23.14	22.90	26.03	30.00	-3.97	3.67	29.70	36.02	-6.32
2462	11	PEAK	20.20	20.08	23.15	30.00	-6.85	3.67	26.82	36.02	-9.20
2467	12	PEAK	17.58	17.45	20.53	30.00	-9.47	3.67	24.20	36.02	-11.82
2472	13	PEAK	17.50	17.34	20.43	30.00	-9.57	3.67	24.10	36.02	-11.92

Table 7-10. Peak Conducted Output Power Measurements CDD (802.11g)

Freq [MHz]	Channel	Detector	Conducted Power [dBm]			Conducted Power Limit [dBm]	Conducted Power Margin [dB]	Directional Ant. Gain [dBi]	Max e.i.r.p. [dBm]	Max e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
			Ant 3a	Ant 1a	Summed						
2412	1	PEAK	22.61	22.80	25.72	30.00	-4.28	3.67	29.39	36.02	-6.63
2417	2	PEAK	25.60	25.65	28.64	30.00	-1.36	3.67	32.31	36.02	-3.71
2422	3	PEAK	25.83	26.04	28.95	30.00	-1.05	3.67	32.62	36.02	-3.40
2427	4	PEAK	26.21	26.36	29.30	30.00	-0.70	3.67	32.97	36.02	-3.05
2432	5	PEAK	26.22	26.42	29.33	30.00	-0.67	3.67	33.00	36.02	-3.02
2437	6	PEAK	26.16	26.37	29.28	30.00	-0.72	3.67	32.95	36.02	-3.07
2442	7	PEAK	26.26	26.44	29.36	30.00	-0.64	3.67	33.03	36.02	-2.99
2447	8	PEAK	25.95	26.07	29.02	30.00	-0.98	3.67	32.69	36.02	-3.33
2452	9	PEAK	25.80	25.85	28.84	30.00	-1.16	3.67	32.51	36.02	-3.51
2457	10	PEAK	25.11	25.14	28.14	30.00	-1.86	3.67	31.81	36.02	-4.21
2462	11	PEAK	23.05	22.92	26.00	30.00	-4.00	3.67	29.67	36.02	-6.35
2467	12	PEAK	20.89	21.07	23.99	30.00	-6.01	3.67	27.66	36.02	-8.36
2472	13	PEAK	20.25	20.00	23.14	30.00	-6.86	3.67	26.81	36.02	-9.21

Table 7-11. Peak Conducted Output Power Measurements CDD (802.11n)

FCC ID: BCGA2324	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 29 of 134

Note:

Per ANSI C63.10-2013 and KDB 662911 D01 v02r01 Section E)1), the conducted powers at ANT 3a and ANT 1a were first measured separately during CDD transmission as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Sample CDD Calculation:

At 2412MHz the average conducted output power was measured to be N/A dBm for ANT 3a and N/A dBm for ANT 1a.

$$\text{ANT 3a} + \text{ANT 1a} = \text{CDD}$$

$$(\text{N/A dBm} + \text{N/A dBm}) = (\text{N/A mW} + \text{N/A mW}) = \text{N/A mW} = \text{N/A dBm}$$

FCC ID: BCGA2324	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 30 of 134

7.4 Power Spectral Density

§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 its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated and the worst case configuration results are reported in this section.

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

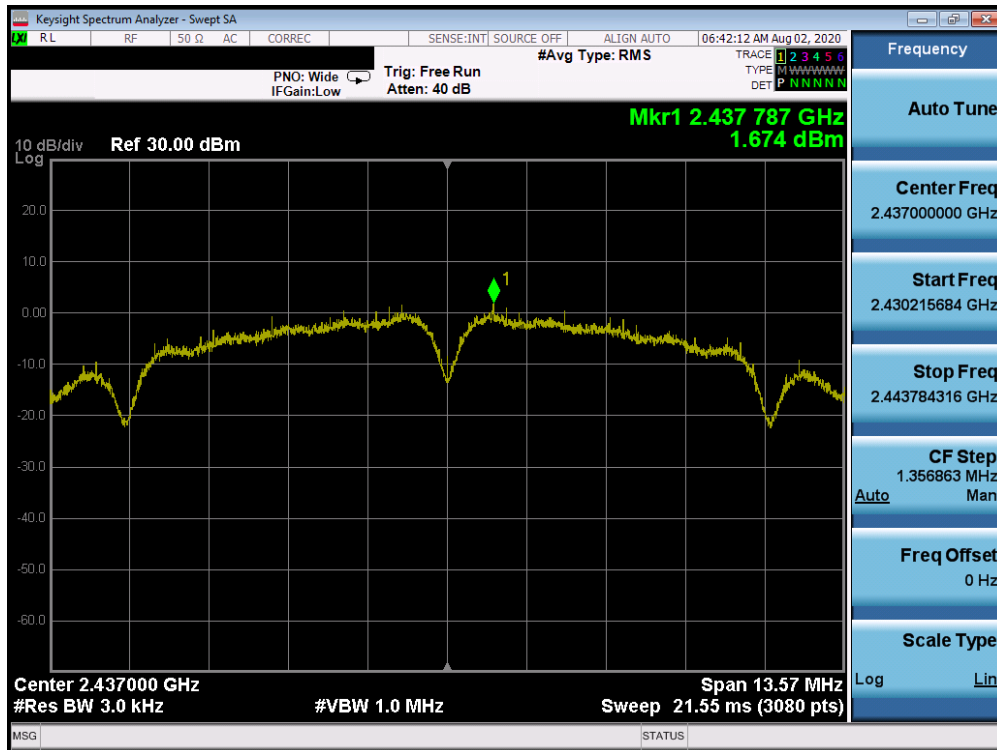
None

FCC ID: BCGA2324	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 31 of 134

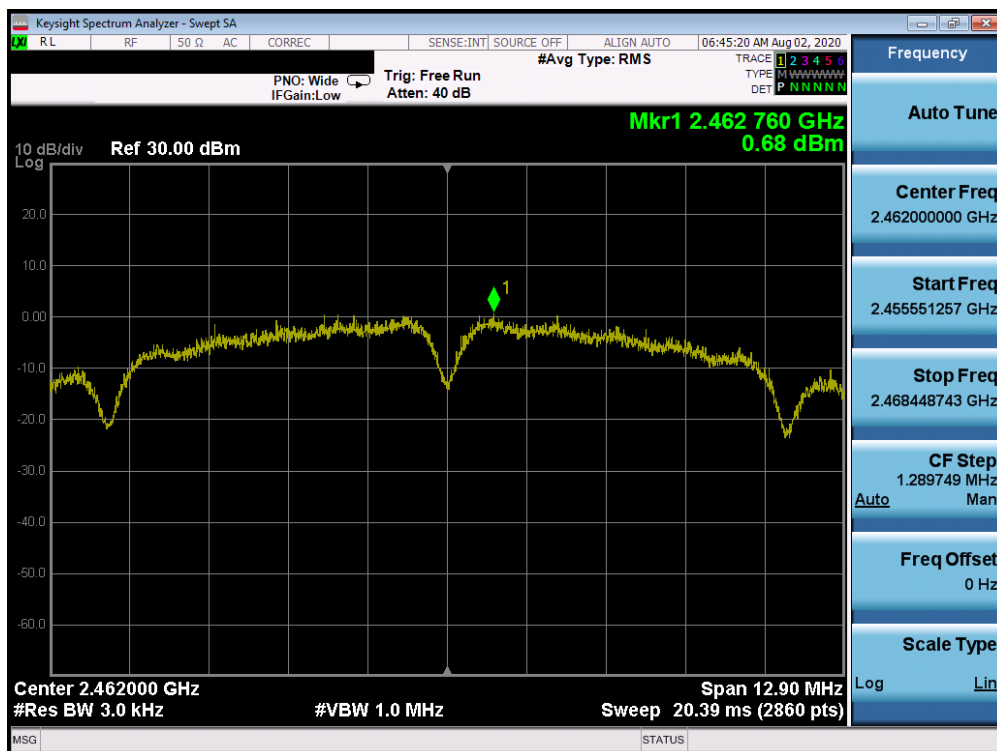
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V 10.2 04/22/2020

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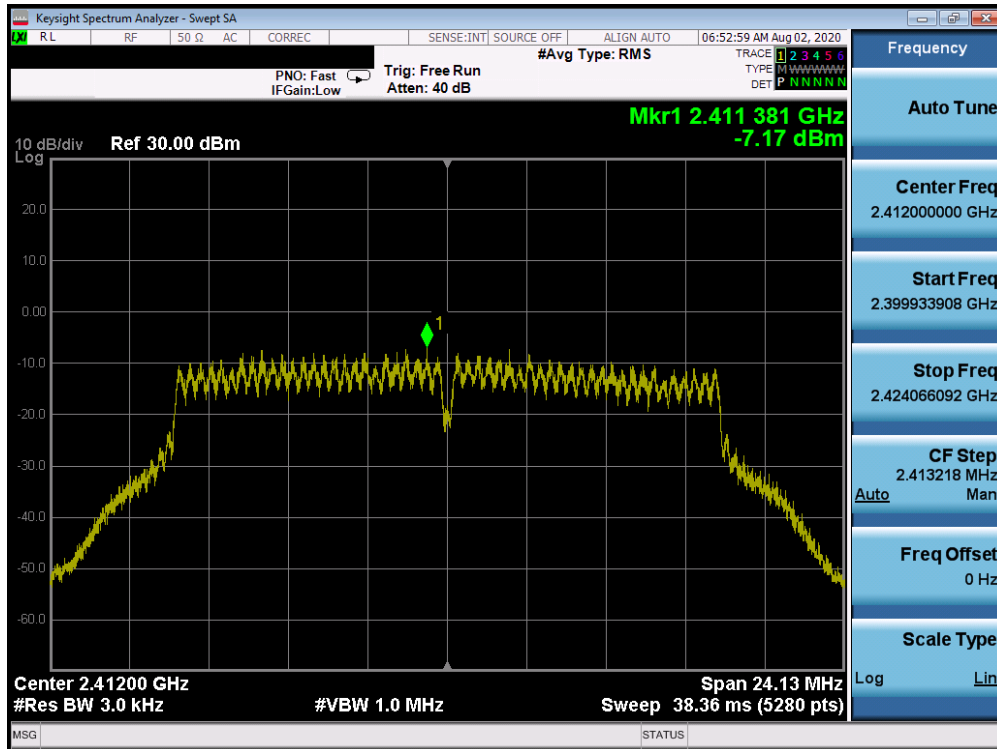


Plot 7-20. Power Spectral Density Plot ANT 3a (802.11b – Ch. 6)

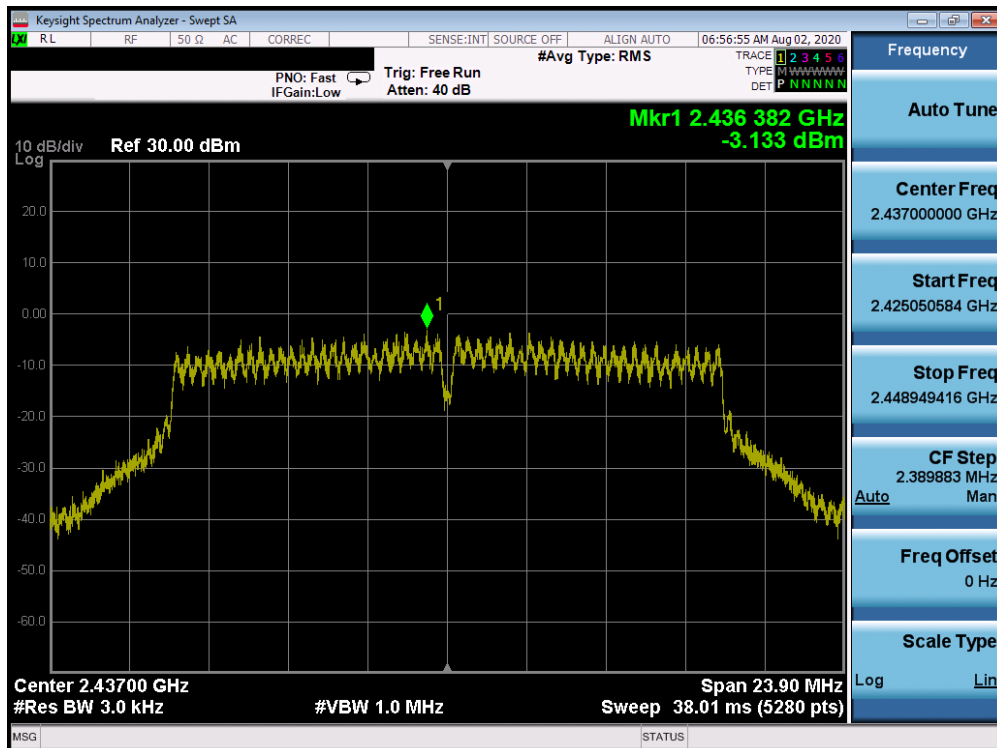


Plot 7-21. Power Spectral Density Plot ANT 3a (802.11b – Ch. 11)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 33 of 134

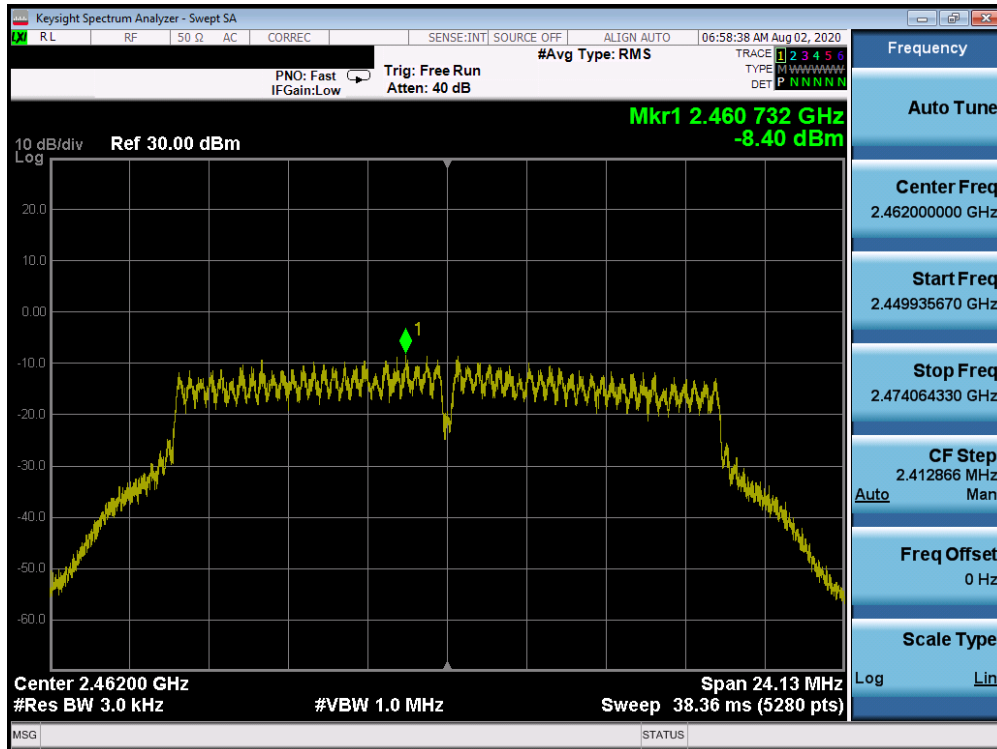


Plot 7-22. Power Spectral Density Plot ANT 3a (802.11g – Ch. 1)

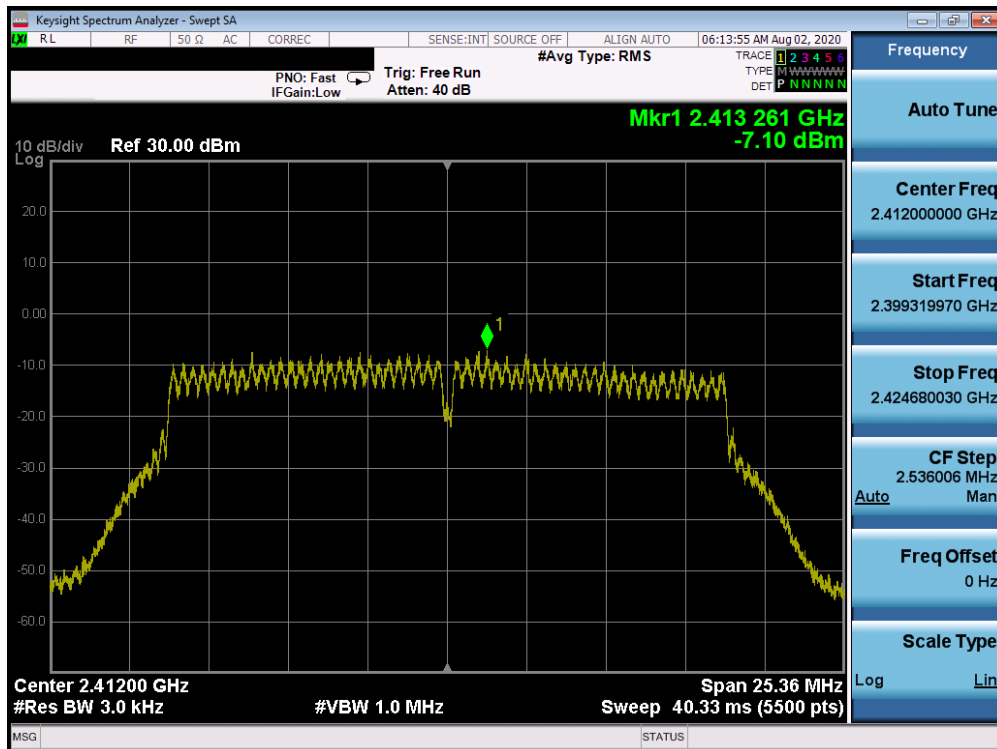


Plot 7-23. Power Spectral Density Plot ANT 3a (802.11g – Ch. 6)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 34 of 134

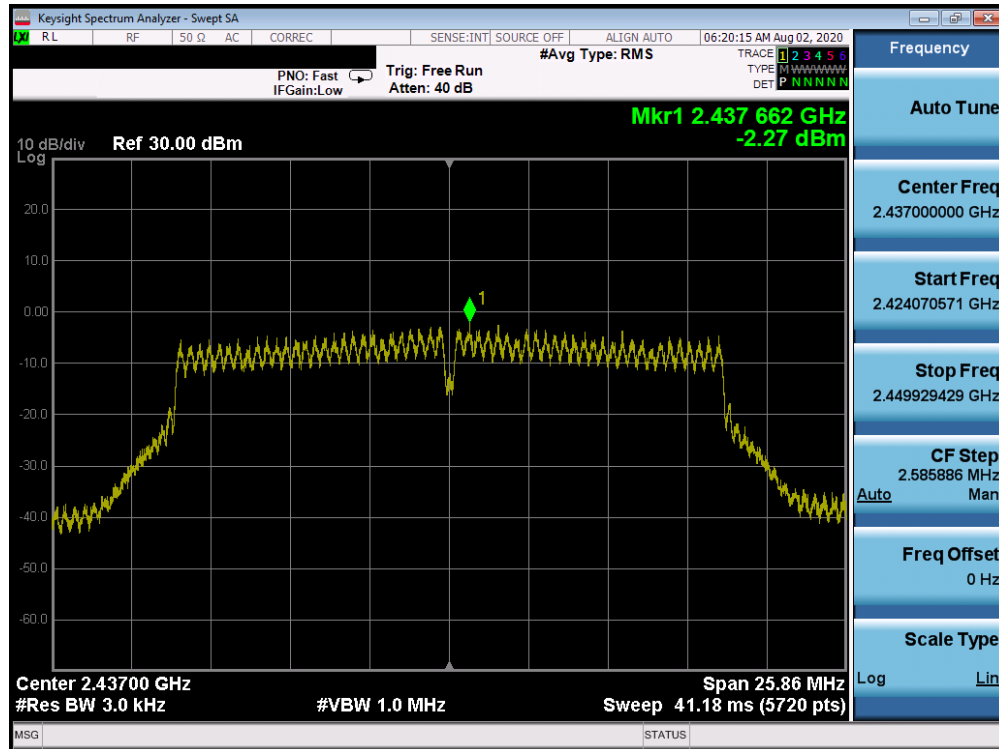


Plot 7-24. Power Spectral Density Plot ANT 3a (802.11g – Ch. 11)

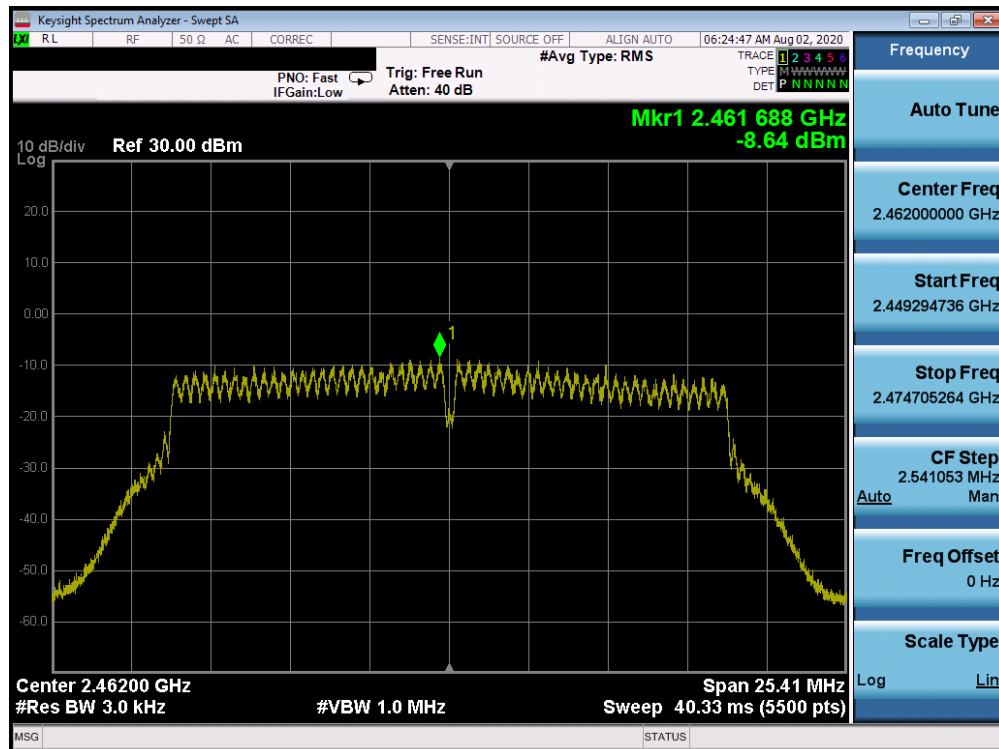


Plot 7-25. Power Spectral Density Plot ANT 3a (802.11n (2.4GHz) – Ch. 1)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 35 of 134



Plot 7-26. Power Spectral Density Plot ANT 3a (802.11n (2.4GHz) – Ch. 6)



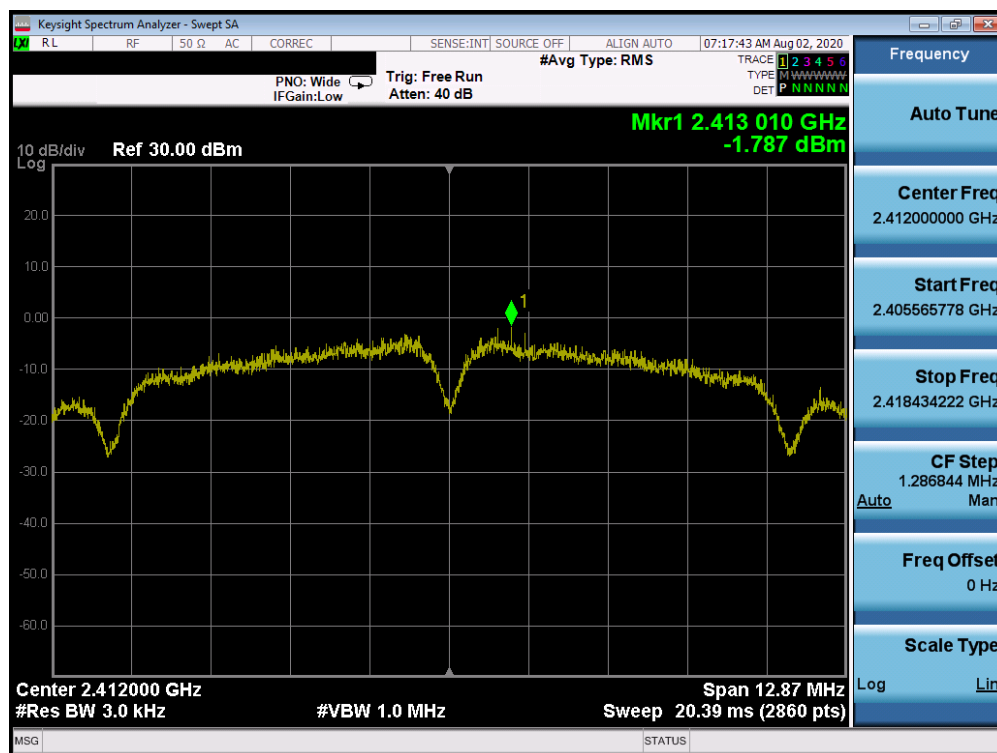
Plot 7-27. Power Spectral Density Plot ANT 3a (802.11n (2.4GHz) – Ch. 11)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 36 of 134

Antenna 1a Power Spectral Density Measurements

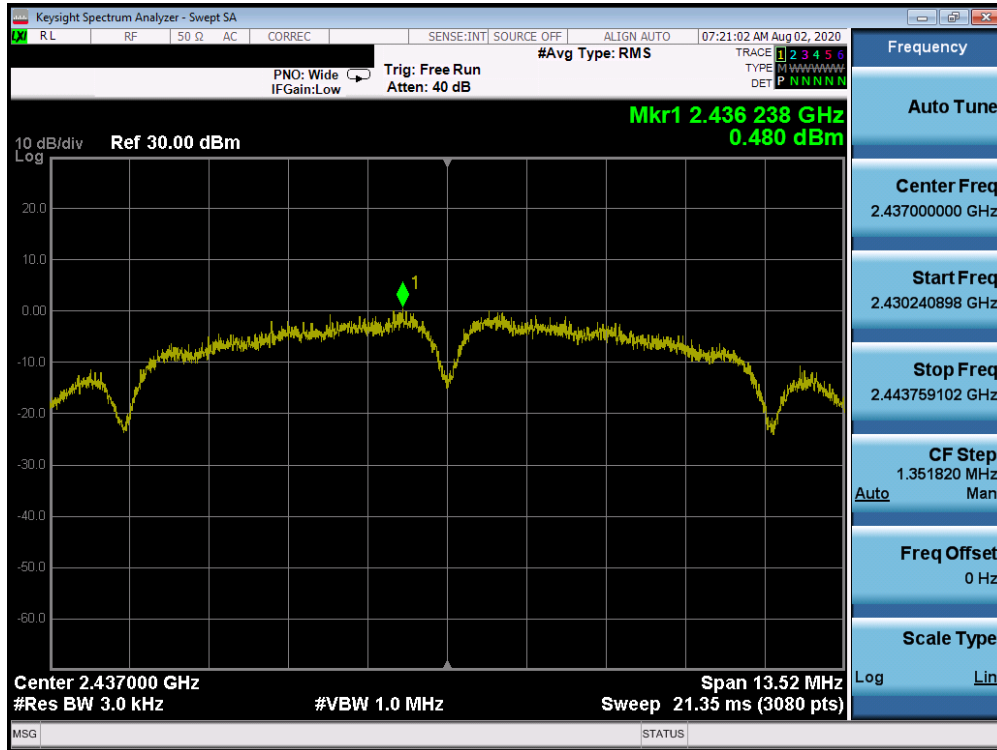
Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Power Spectral Density [dBm / 3kHz]	Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]	Pass / Fail
2412	1	b	1	-1.79	8.00	-9.79	Pass
2437	6	b	1	0.48	8.00	-7.52	Pass
2462	11	b	1	0.45	8.00	-7.55	Pass
2412	1	g	6	-2.43	8.00	-10.43	Pass
2437	6	g	6	-2.09	8.00	-10.09	Pass
2462	11	g	6	-9.50	8.00	-17.50	Pass
2412	1	n	65/72.2 (MCS7)	-6.44	8.00	-14.44	Pass
2437	6	n	65/72.2 (MCS7)	-1.17	8.00	-9.17	Pass
2462	11	n	65/72.2 (MCS7)	-7.11	8.00	-15.11	Pass

Table 7-13. Conducted Power Density Measurements ANT 1a

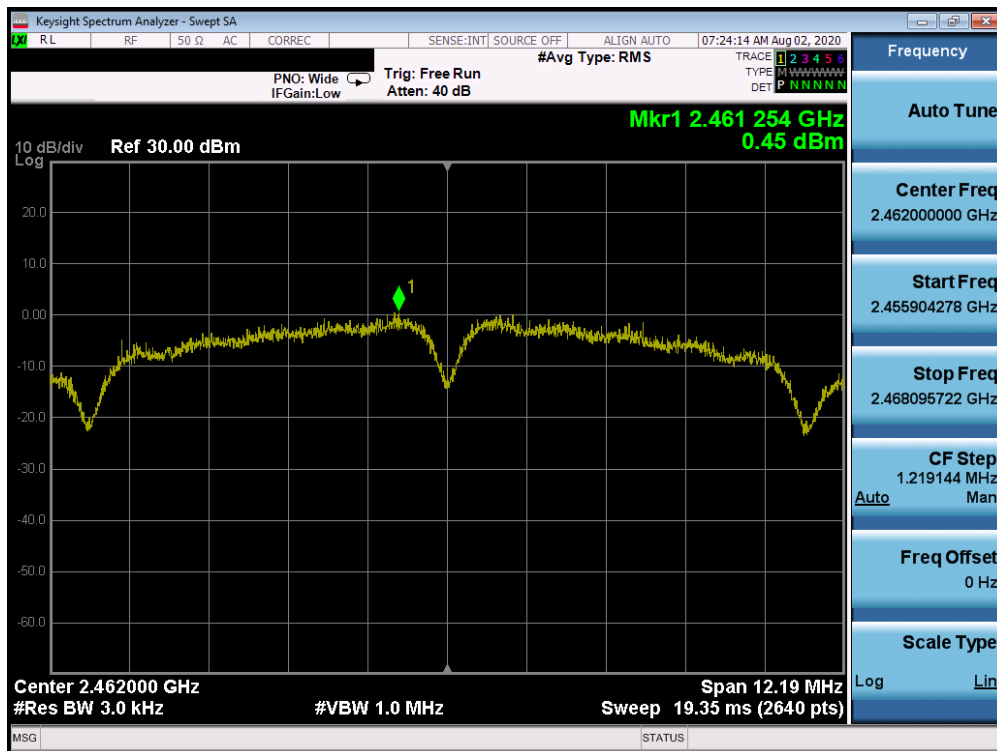


Plot 7-28. Power Spectral Density Plot ANT 1a (802.11b – Ch. 1)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 37 of 134

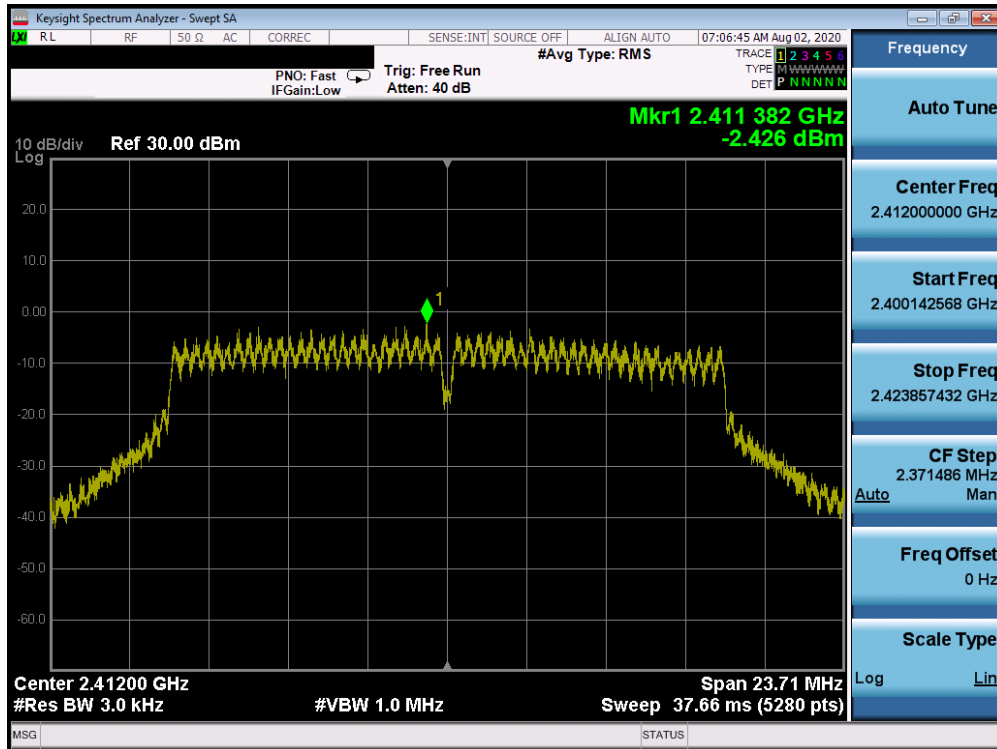


Plot 7-29. Power Spectral Density Plot ANT 1a (802.11b – Ch. 6)

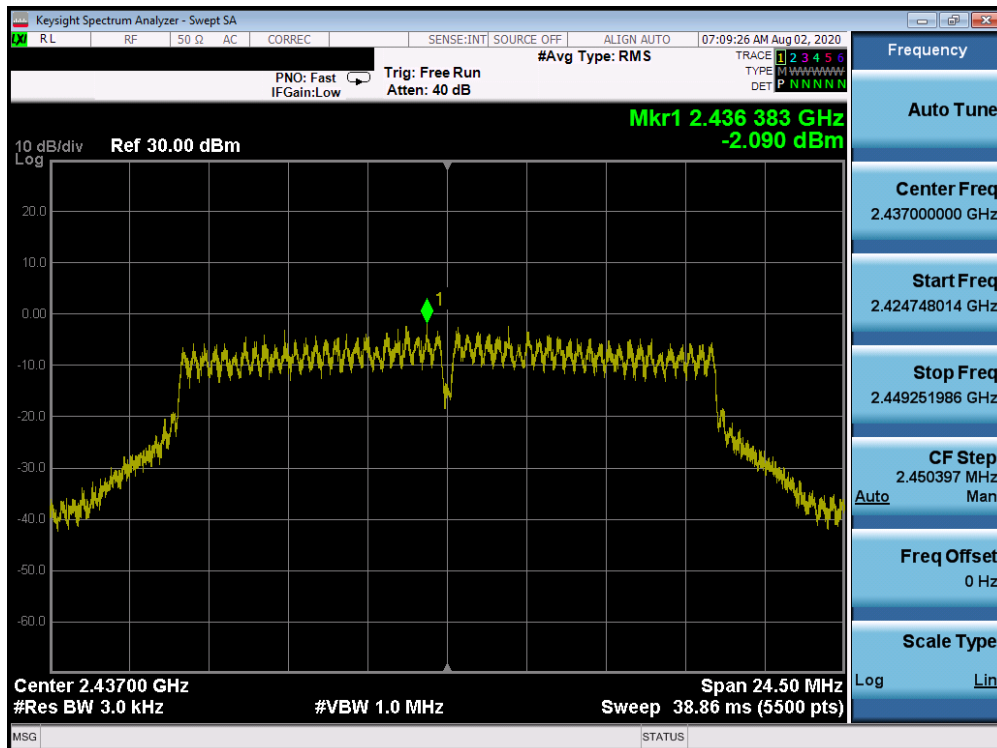


Plot 7-30. Power Spectral Density Plot ANT 1a (802.11b – Ch. 11)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 38 of 134



Plot 7-31. Power Spectral Density Plot ANT 1a (802.11g – Ch. 1)

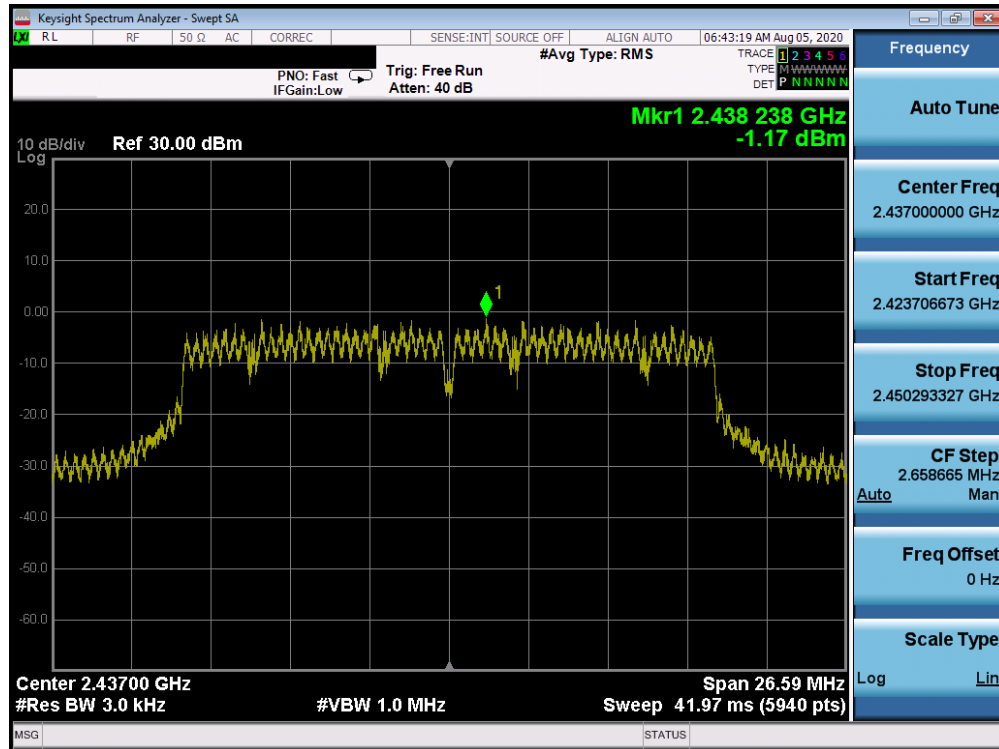


Plot 7-32. Power Spectral Density Plot ANT 1a (802.11g – Ch. 6)

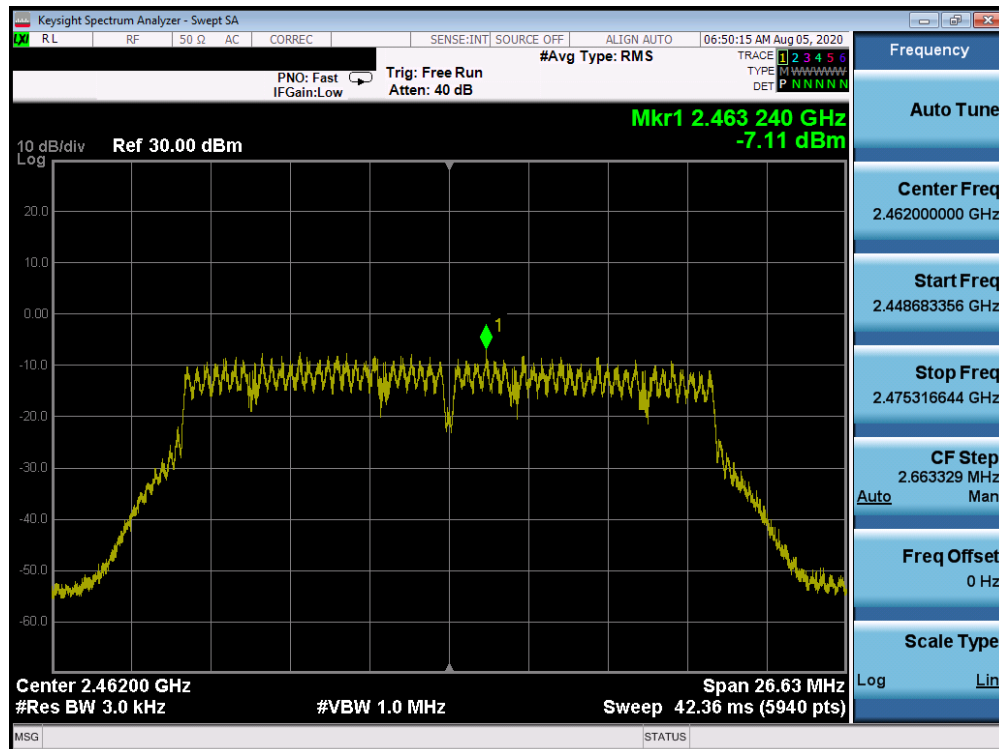
FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 39 of 134



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Plot 7-35. Power Spectral Density Plot ANT 1a (802.11n (2.4GHz) – Ch. 6)



Plot 7-36. Power Spectral Density Plot ANT 1a (802.11n (2.4GHz) – Ch. 11)

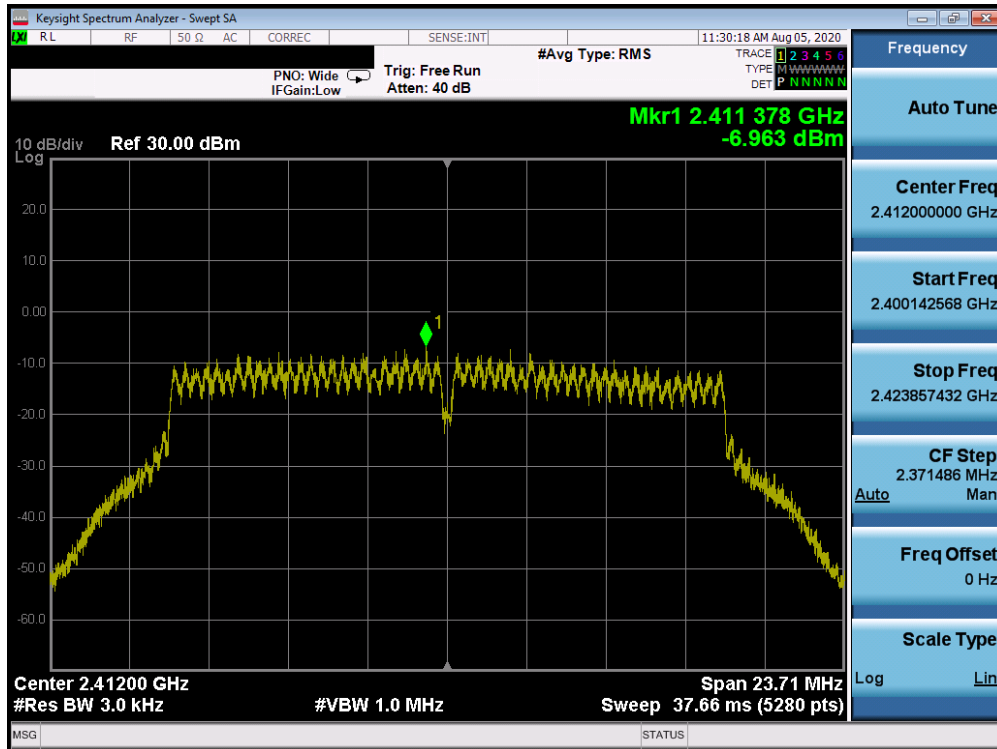
FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 41 of 134

CDD Power Spectral Density Measurements

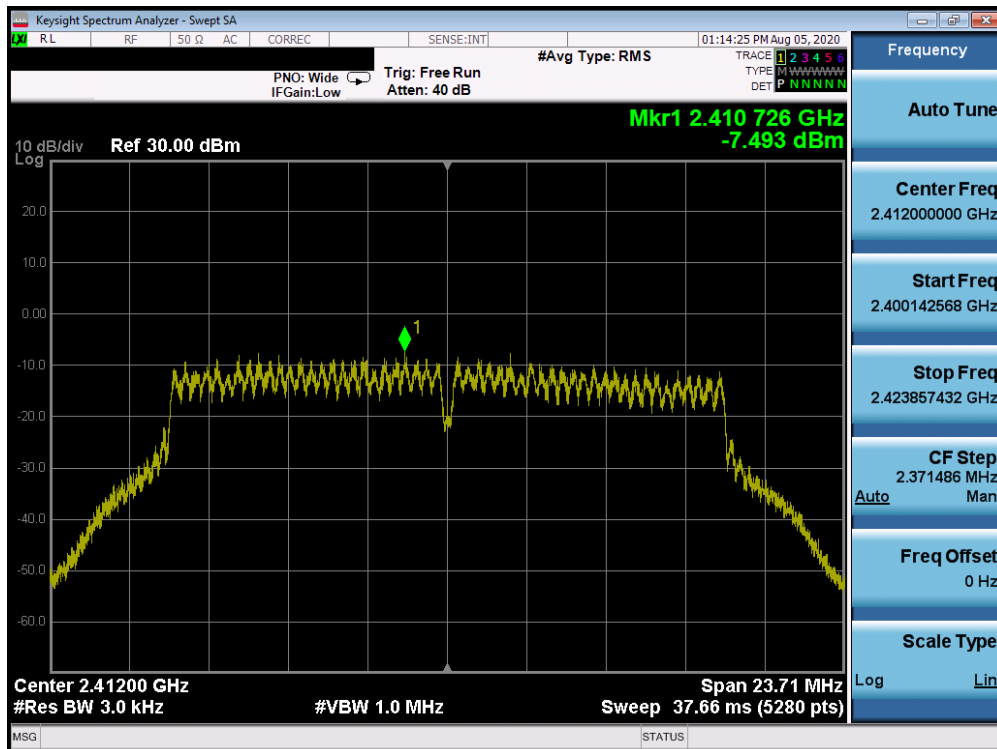
Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured Power Spectral Density [dBm / 3kHz]			Maximum Permissible Power Density [dBm / 3kHz]	Margin [dB]	Pass / Fail
				Ant 3a	Ant 1a	Summed			
2412	1	g	6	-6.96	-7.49	-4.21	8.00	-12.21	Pass
2437	6	g	6	-2.07	-2.42	0.77	8.00	-7.23	Pass
2462	11	g	6	-9.96	-8.84	-6.35	8.00	-14.35	Pass
2412	1	n	130/144.4 (MCS15)	-6.25	-6.58	-3.40	8.00	-11.40	Pass
2437	6	n	130/144.4 (MCS15)	-2.12	-1.61	1.15	8.00	-6.85	Pass
2462	11	n	130/144.4 (MCS15)	-7.92	-7.52	-4.71	8.00	-12.71	Pass

Table 7-14.CDD Conducted Power Density Measurements

FCC ID: BCGA2324	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 42 of 134

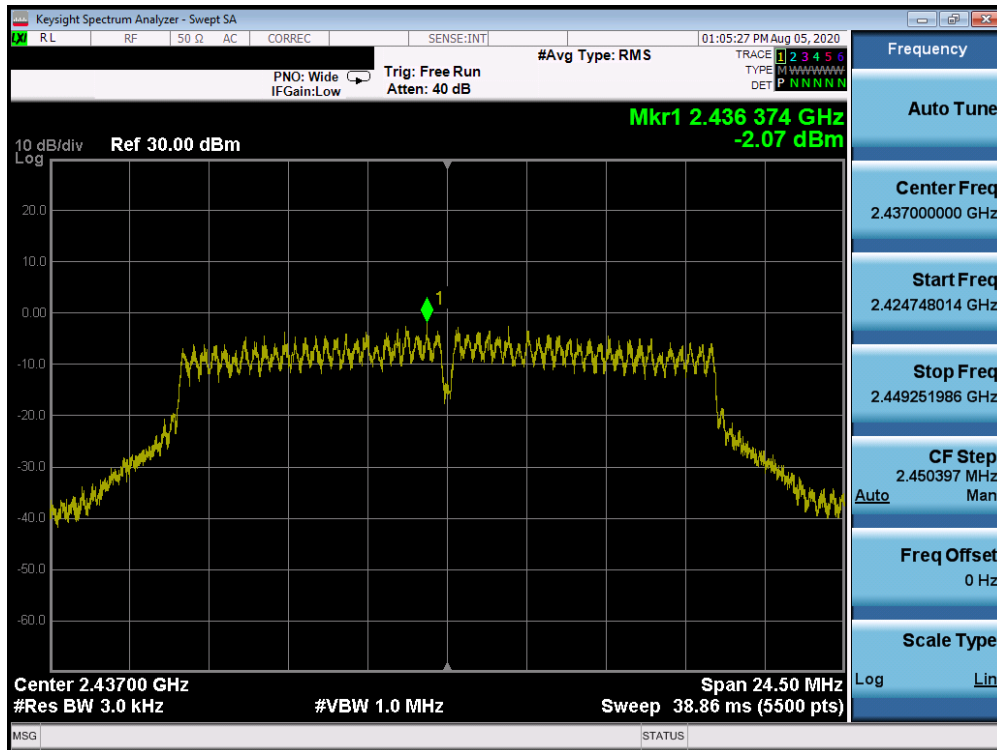


Plot 7-37. Power Spectral Density Plot CDD ANT 3a (802.11g – Ch. 1)

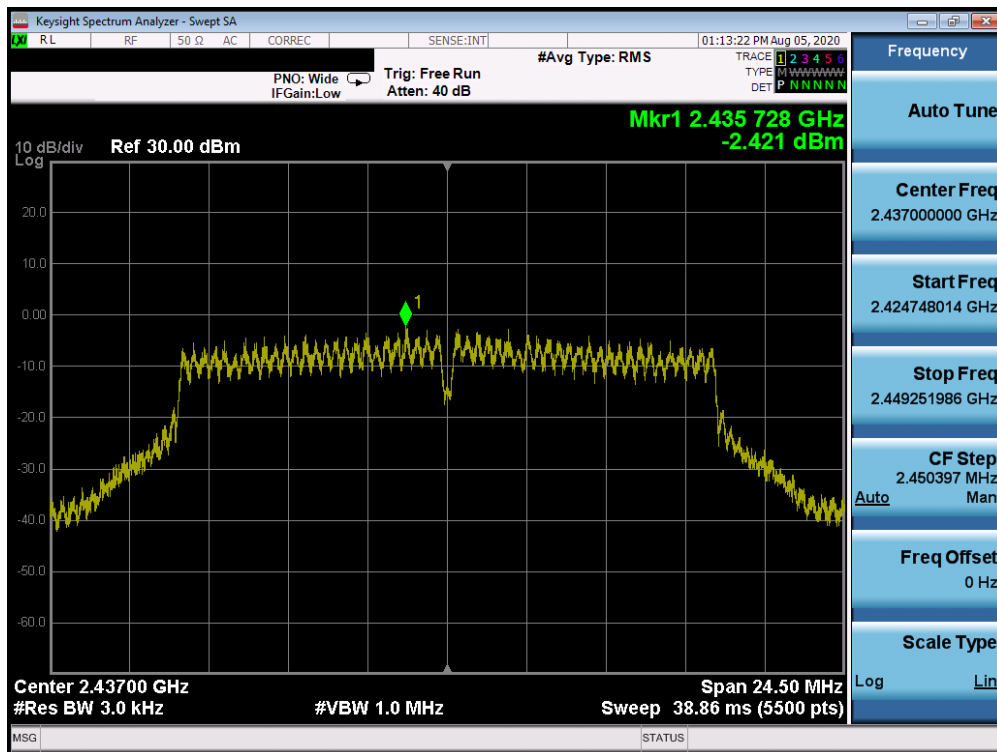


Plot 7-38. Power Spectral Density Plot CDD ANT 1a (802.11g – Ch. 1)

FCC ID: BCGA2324	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 43 of 134

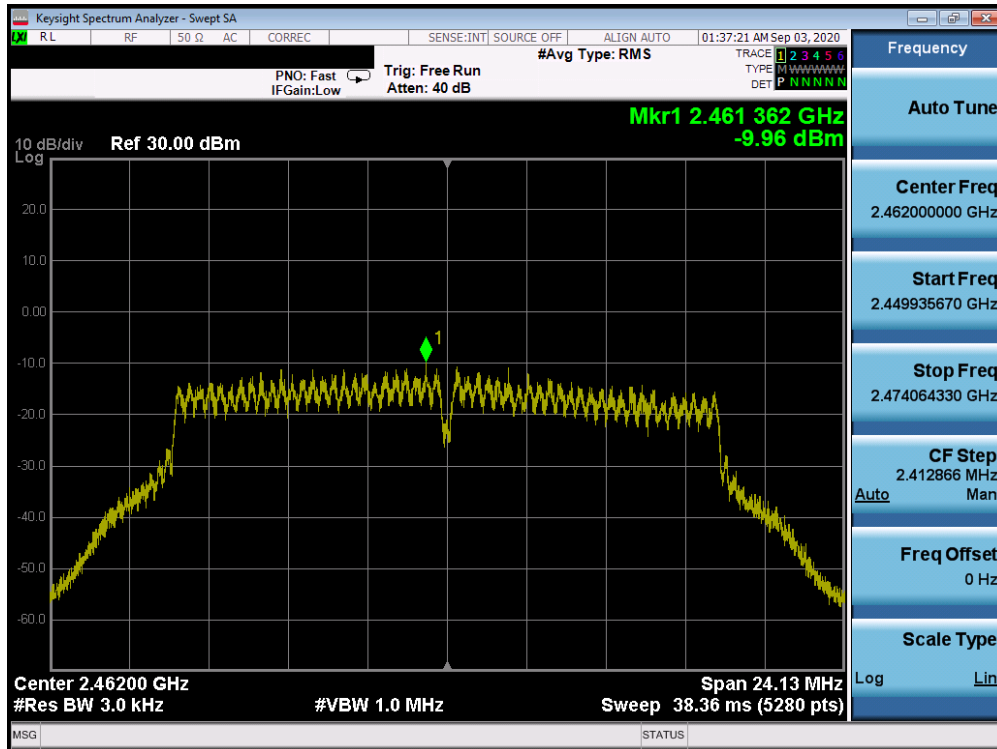


Plot 7-39. Power Spectral Density Plot CDD ANT 3a (802.11g – Ch. 6)

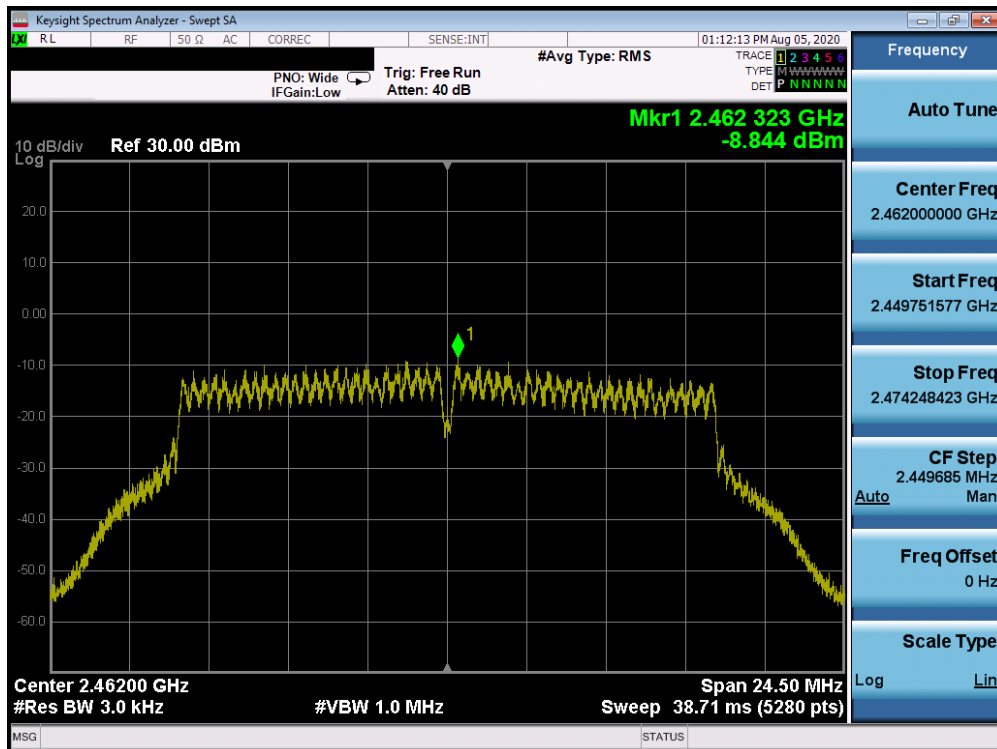


Plot 7-40. Power Spectral Density Plot CDD ANT 1a (802.11g – Ch. 6)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 44 of 134

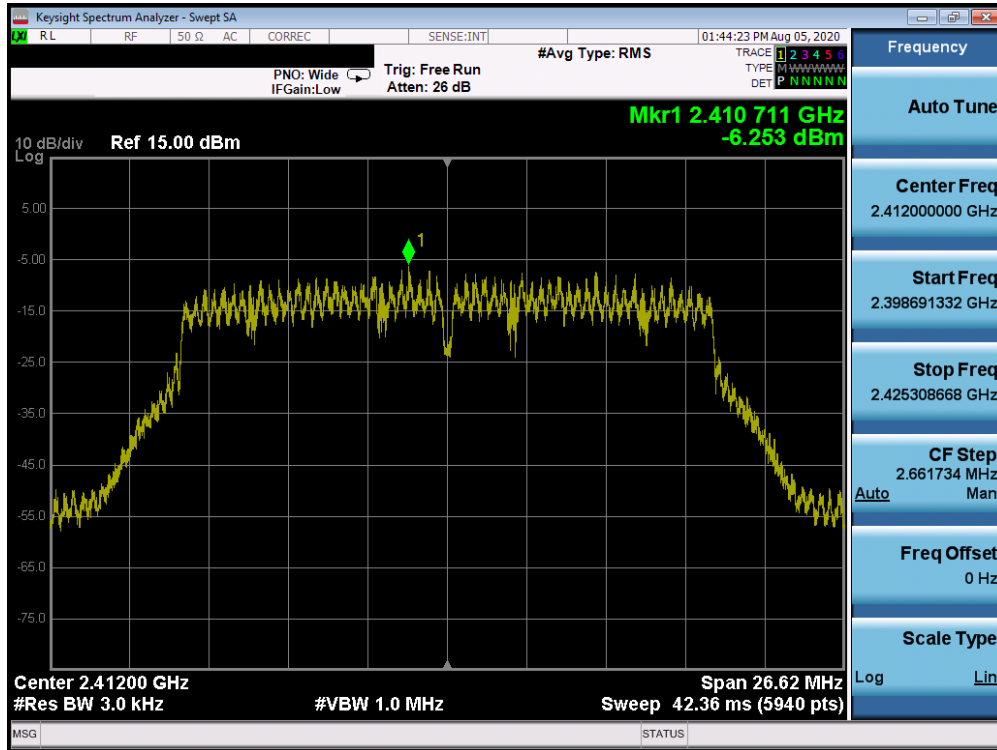


Plot 7-41. Power Spectral Density Plot CDD ANT 3a (802.11g – Ch. 11)

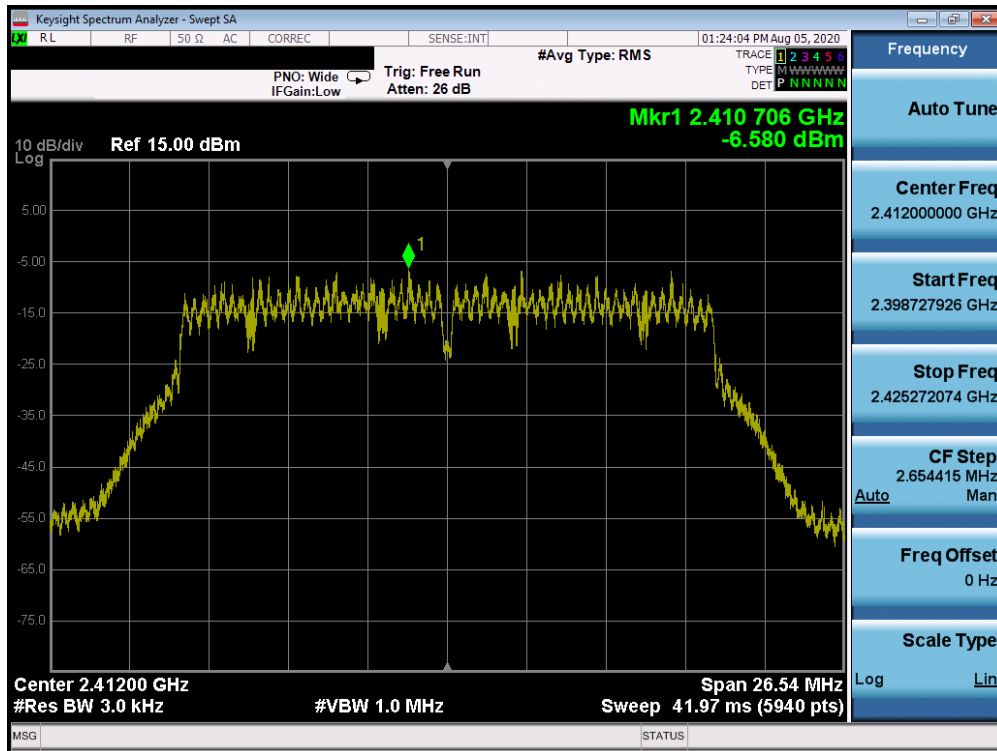


Plot 7-42. Power Spectral Density Plot CDD ANT 1a (802.11g – Ch. 11)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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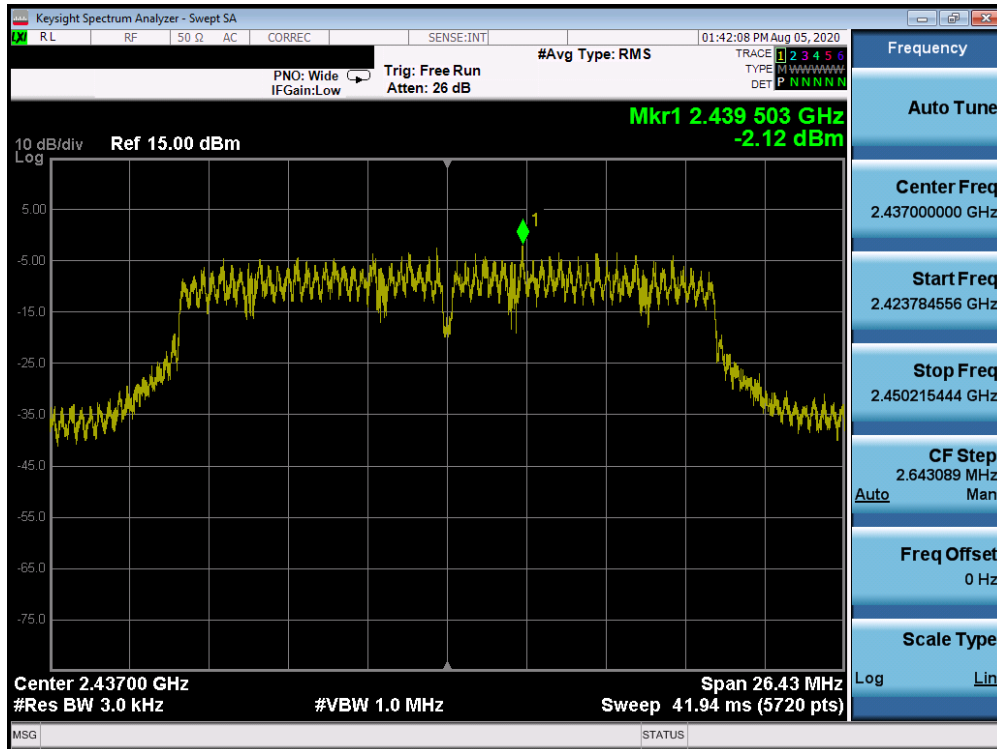


Plot 7-43. Power Spectral Density Plot CDD ANT 3a (802.11n (2.4GHz) – Ch. 1)

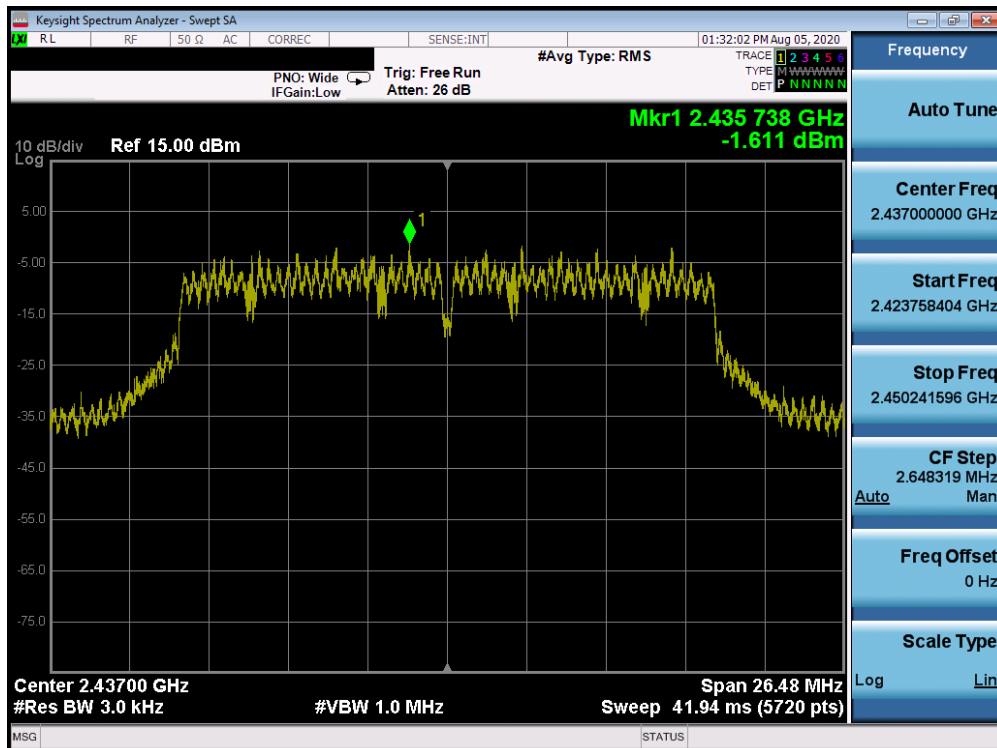


Plot 7-44. Power Spectral Density Plot CDD ANT 1a (802.11n (2.4GHz) – Ch. 1)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 46 of 134

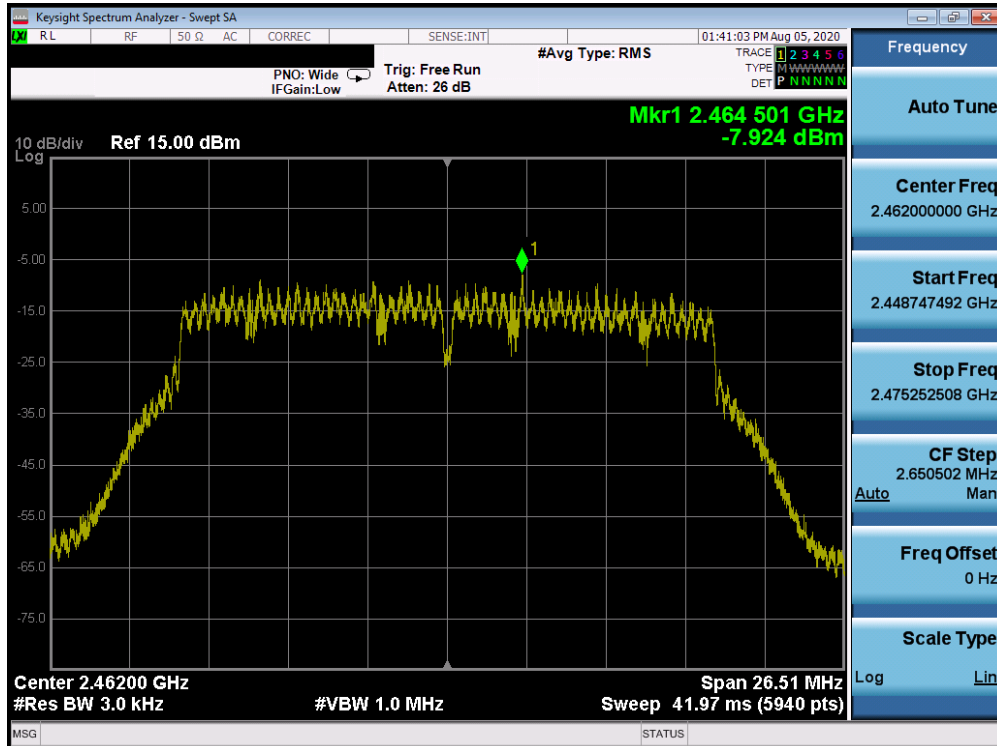


Plot 7-45. Power Spectral Density Plot CDD ANT 3a (802.11n (2.4GHz) – Ch. 6)

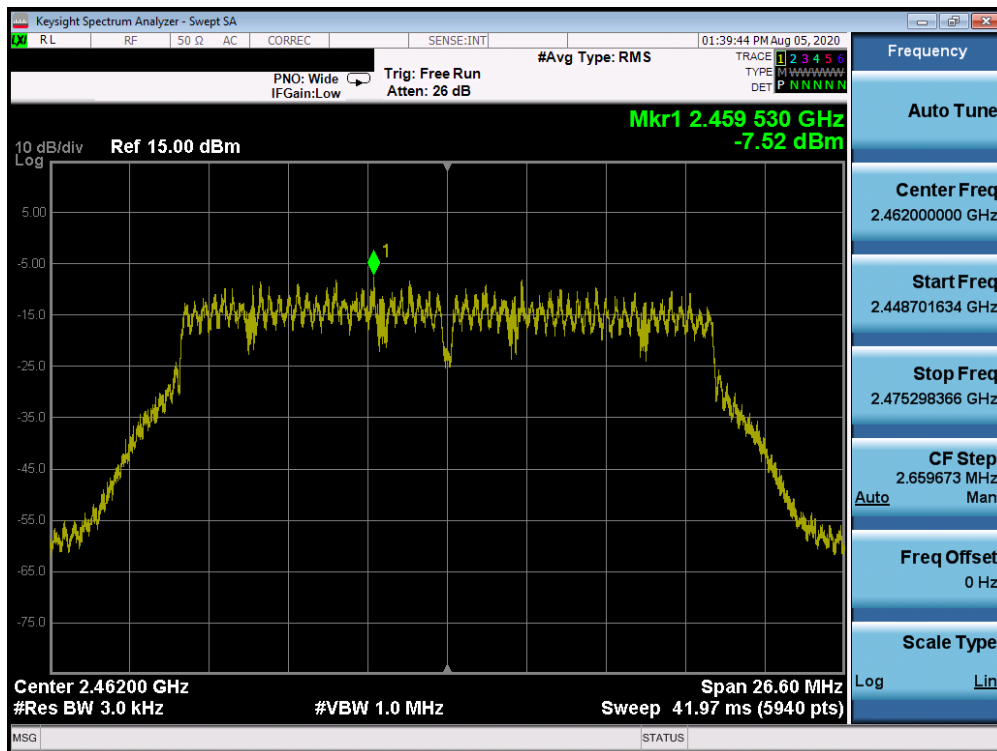


Plot 7-46. Power Spectral Density Plot CDD ANT 1a (802.11n (2.4GHz) – Ch. 6)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-47. Power Spectral Density Plot CDD ANT 3a (802.11n (2.4GHz) – Ch. 11)



Plot 7-48. Power Spectral Density Plot CDD ANT 1a (802.11n (2.4GHz) – Ch. 11)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 48 of 134

Note:

Per ANSI C63.10-2013 Section 14.3.2.2 and KDB 662911 D01 v02r01 Section E)2), the power spectral density at ANT 3a and ANT 1a were first measured separately as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Sample CDD Calculation:

At 2412MHz the average conducted power spectral density was measured to be 4.19 dBm for ANT 3a and 3.84 dBm for ANT 1a.

$$\text{ANT 3a} + \text{ANT 1a} = \text{CDD}$$

$$(4.19 \text{ dBm} + 3.84 \text{ dBm}) = (2.624 \text{ mW} + 2.421 \text{ mW}) = 5.045 \text{ mW} = 7.03 \text{ dBm}$$

FCC ID: BCGA2324	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 49 of 134

7.5 Conducted Authorized Band Edge

§15.247(d); RSS-247 [5.5]

Test Overview and Limit

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. For the following out of band conducted spurious emissions plots at the band edge, the EUT was set at a data rate of 1Mbps for “b” mode, 6 Mbps for “g” mode, and 65/72.2Mbps for “n” mode as these settings produced the worst-case emissions.

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the PSD procedure (Section 7.4).

Test Procedure Used

ANSI C63.10-2013 – Section 11.11.3
KDB 558074 D01 v05r02 – Section 8.7.2

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 100kHz
4. VBW = 1MHz
5. Detector = Peak
6. Number of sweep points $\geq 2 \times \text{Span/RBW}$
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

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



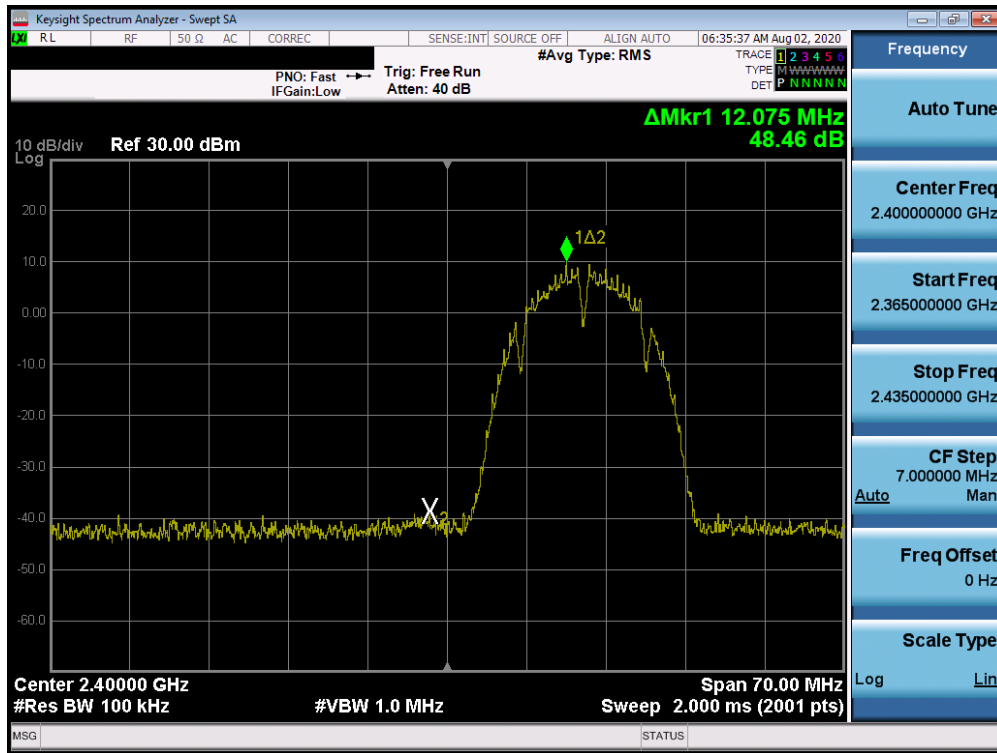
Figure 7-4. Test Instrument & Measurement Setup

Test Notes

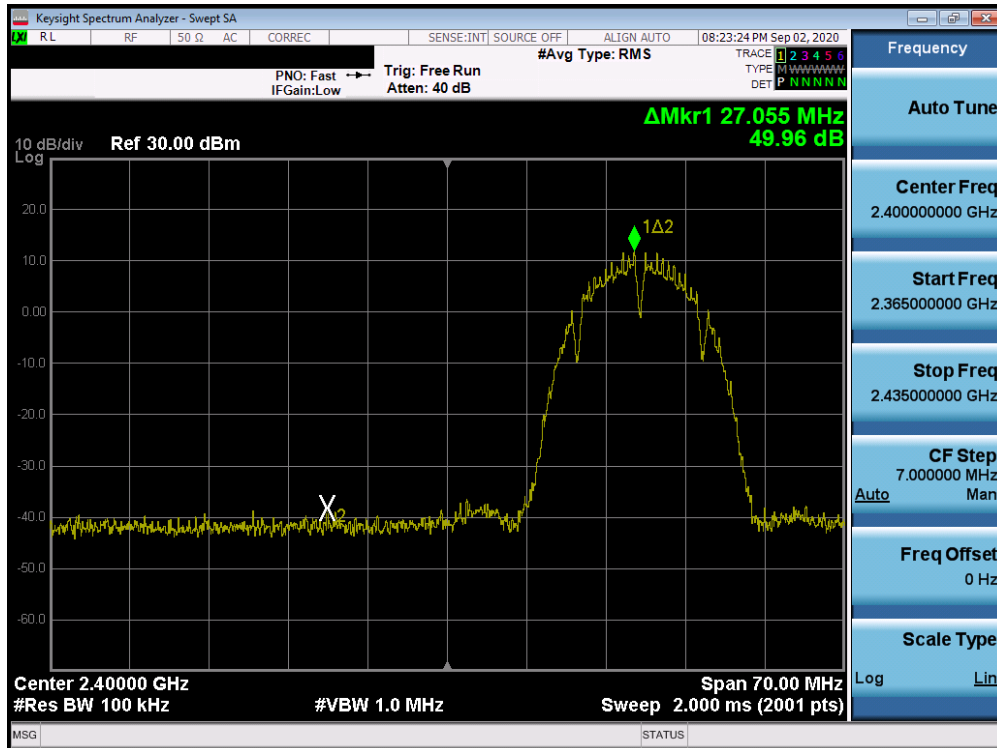
All antenna configurations were investigated and only the worst case is reported.

FCC ID: BCGA2324	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Antenna 3a Conducted Emissions at the Band Edge

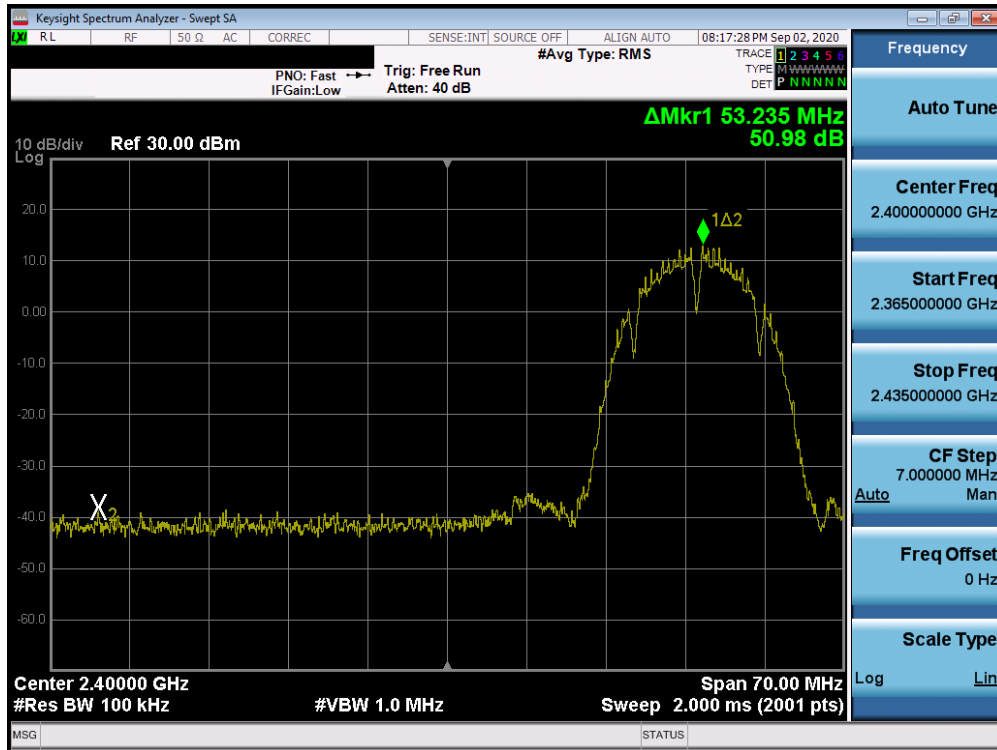


Plot 7-49. Band Edge Plot ANT 3a (802.11b – Ch. 1)

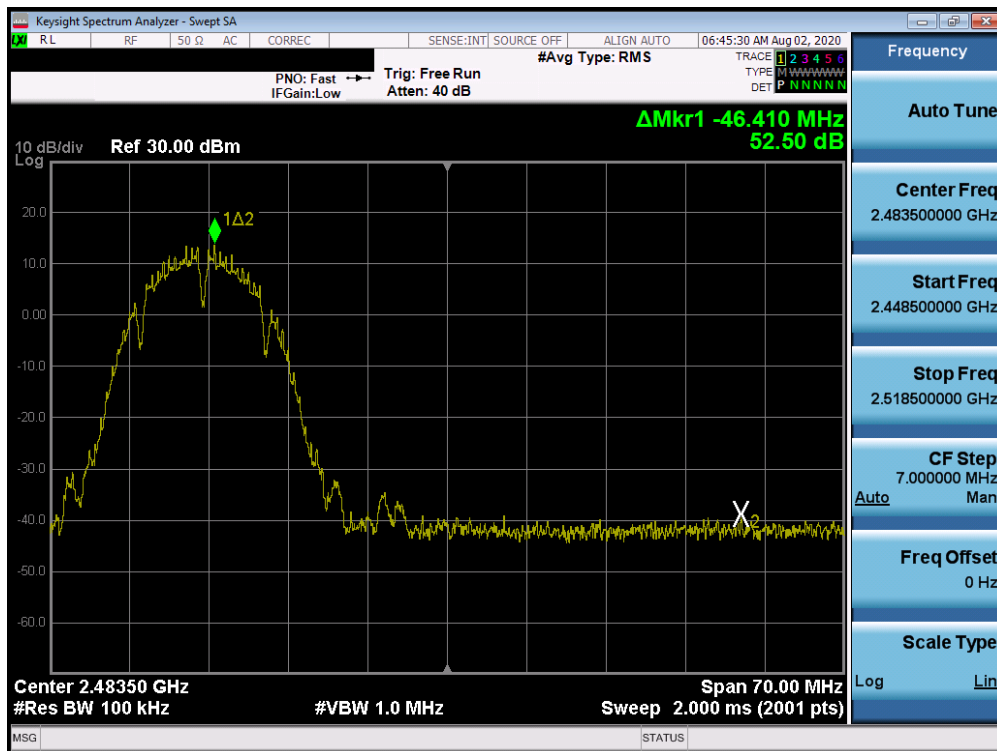


Plot 7-50. Band Edge Plot ANT 3a (802.11b – Ch. 2)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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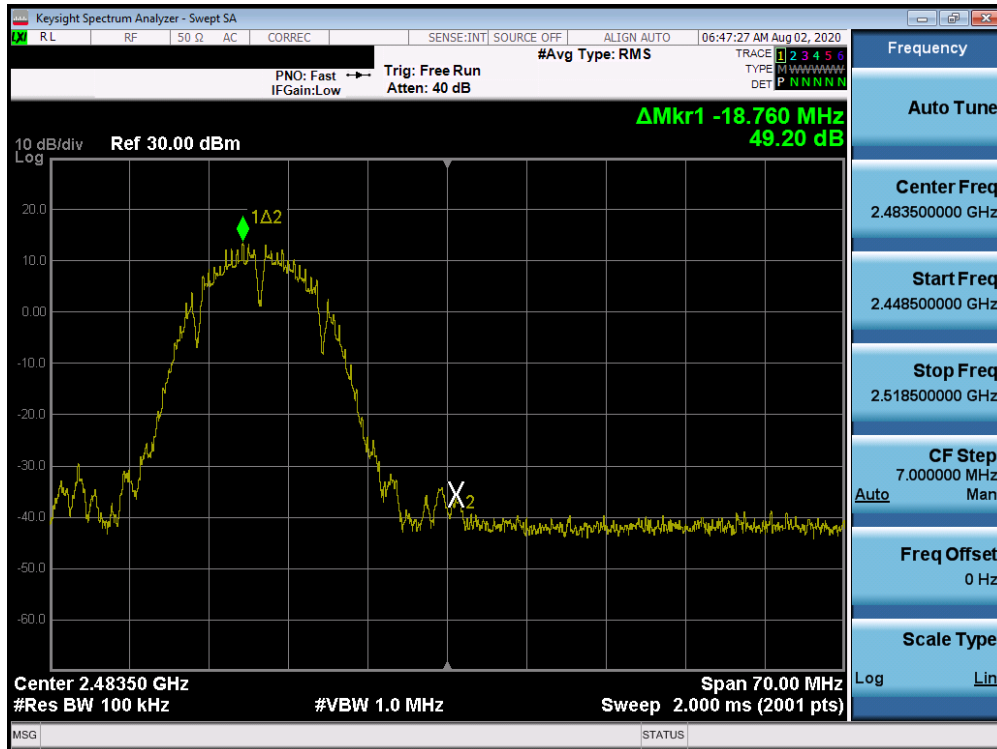


Plot 7-51. Band Edge Plot ANT 3a (802.11b – Ch. 3)

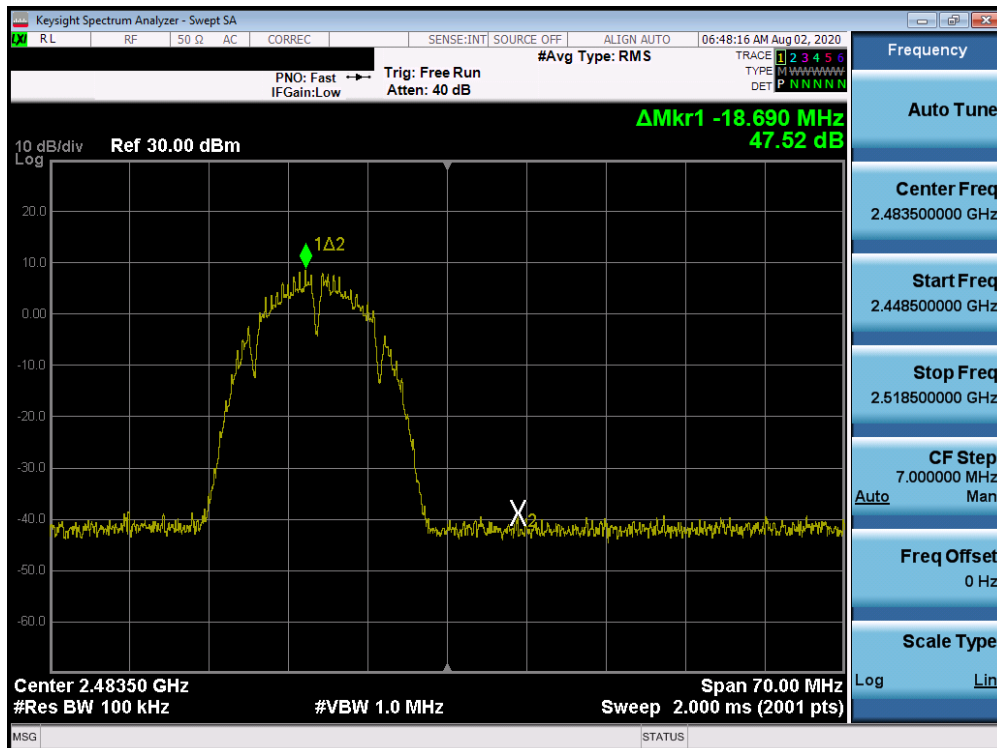


Plot 7-52. Band Edge Plot ANT 3a (802.11b – Ch. 11)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 52 of 134

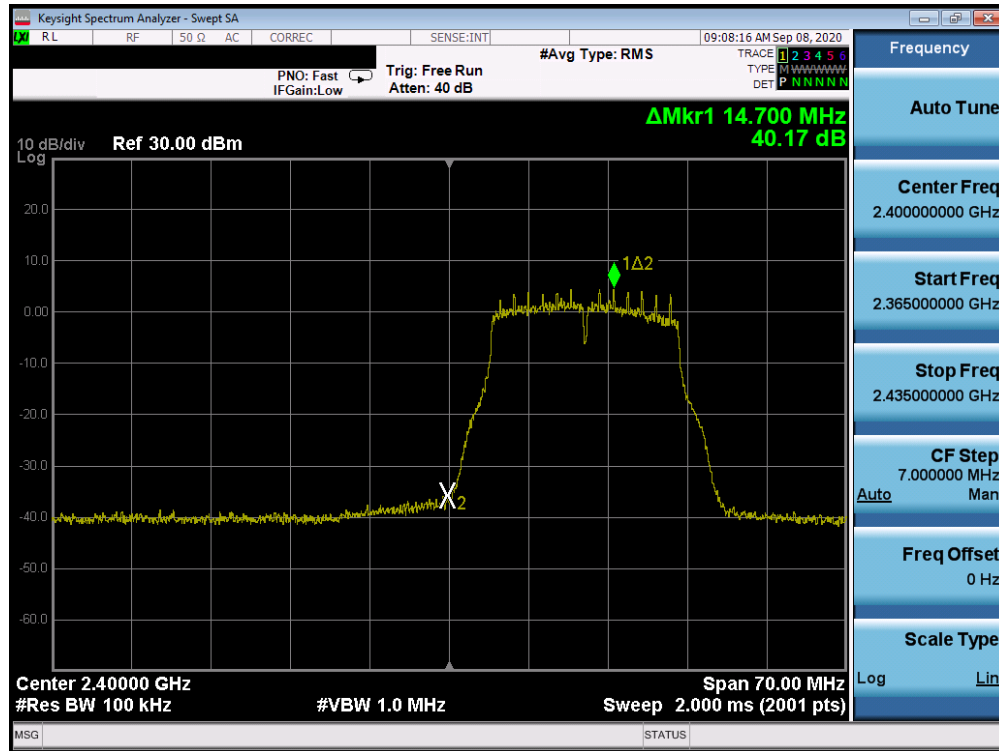


Plot 7-53. Band Edge Plot ANT 3a (802.11b - Ch. 12)

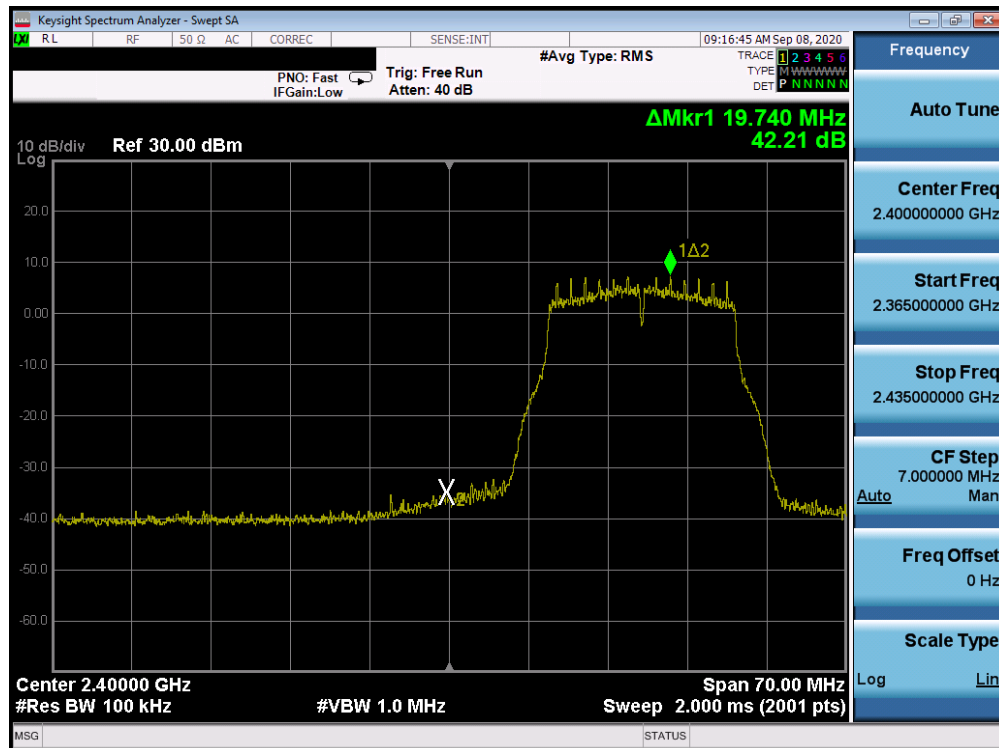


Plot 7-54. Band Edge Plot ANT 3a (802.11b - Ch. 13)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 53 of 134

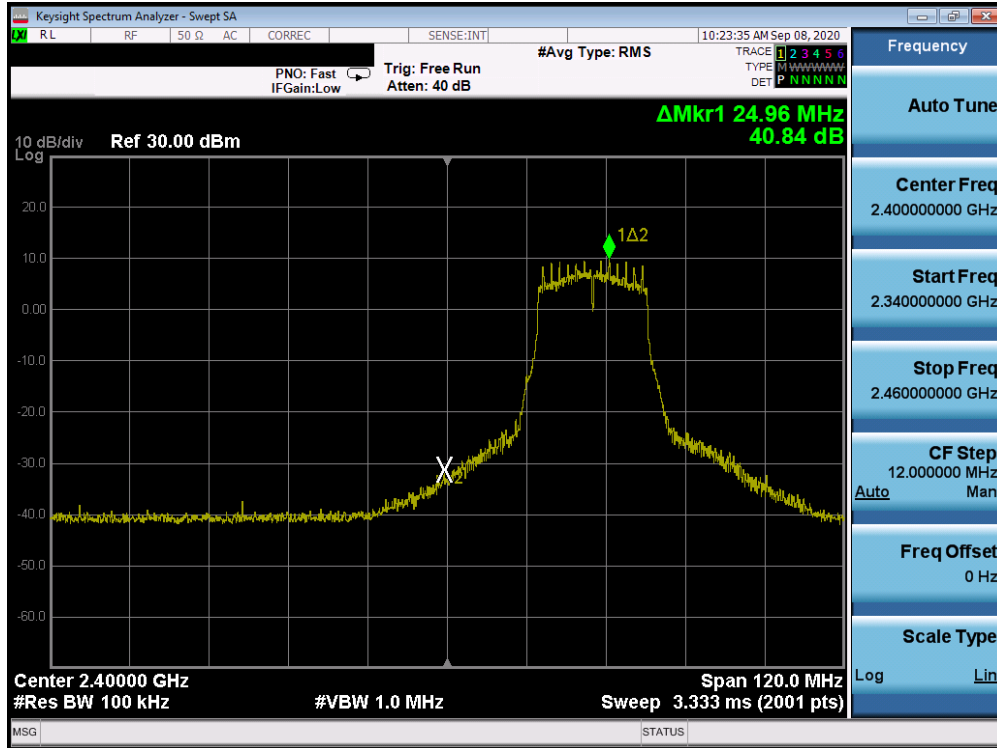


Plot 7-55. Band Edge Plot ANT 3a (802.11g- Ch. 1)

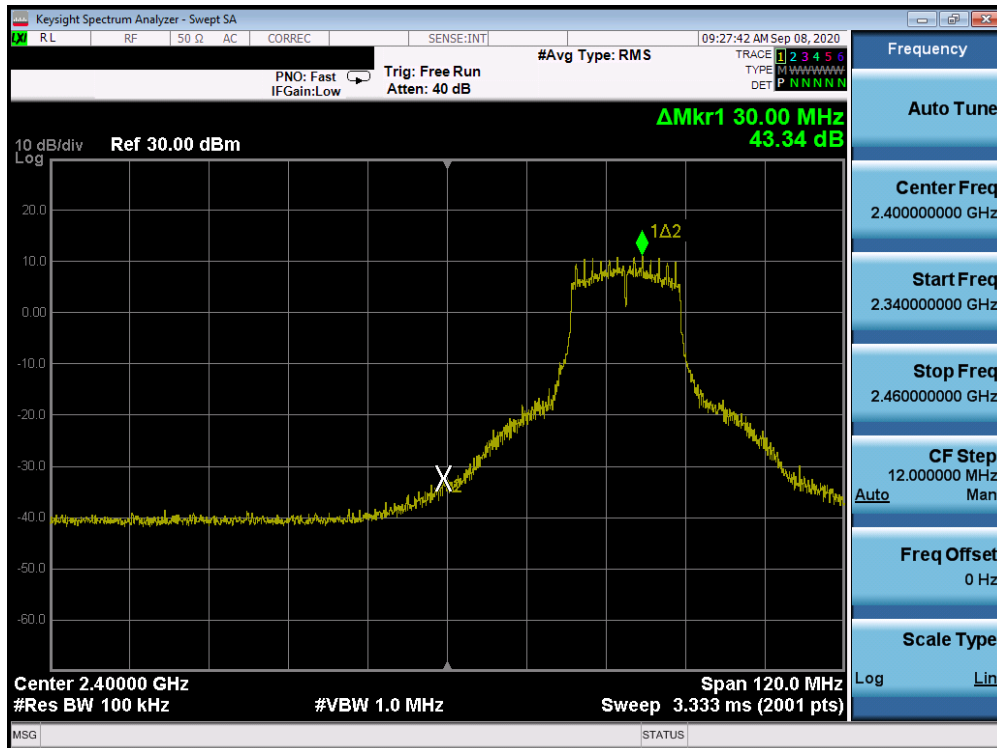


Plot 7-56. Band Edge Plot ANT 3a (802.11g- Ch. 2)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 54 of 134

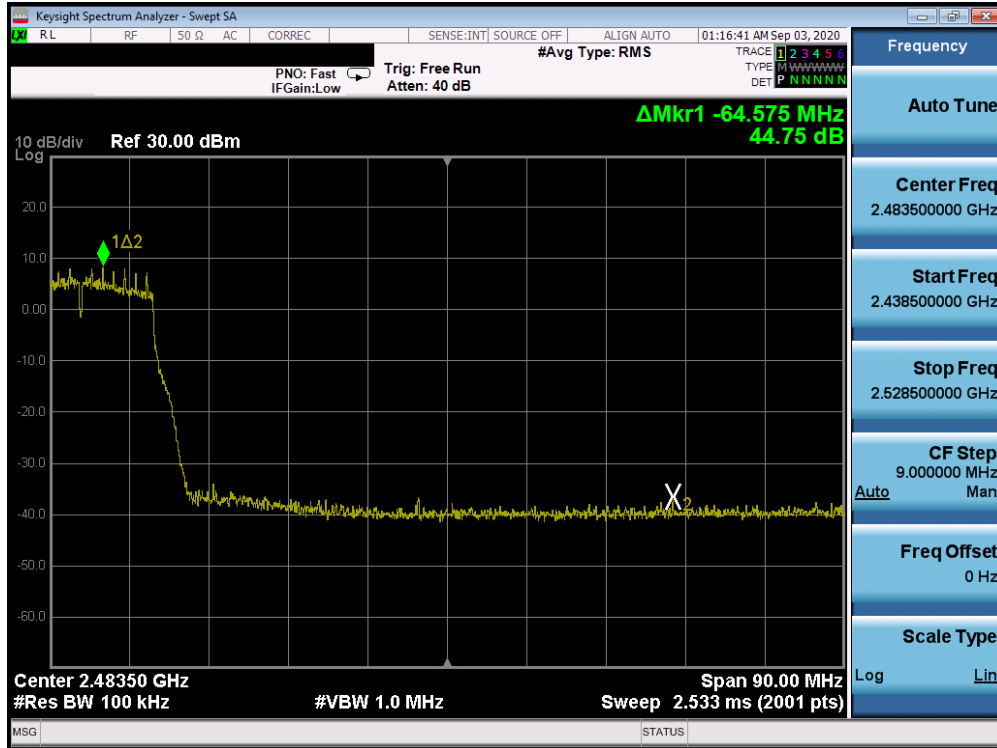


Plot 7-57. Band Edge Plot ANT 3a (802.11g- Ch. 3)

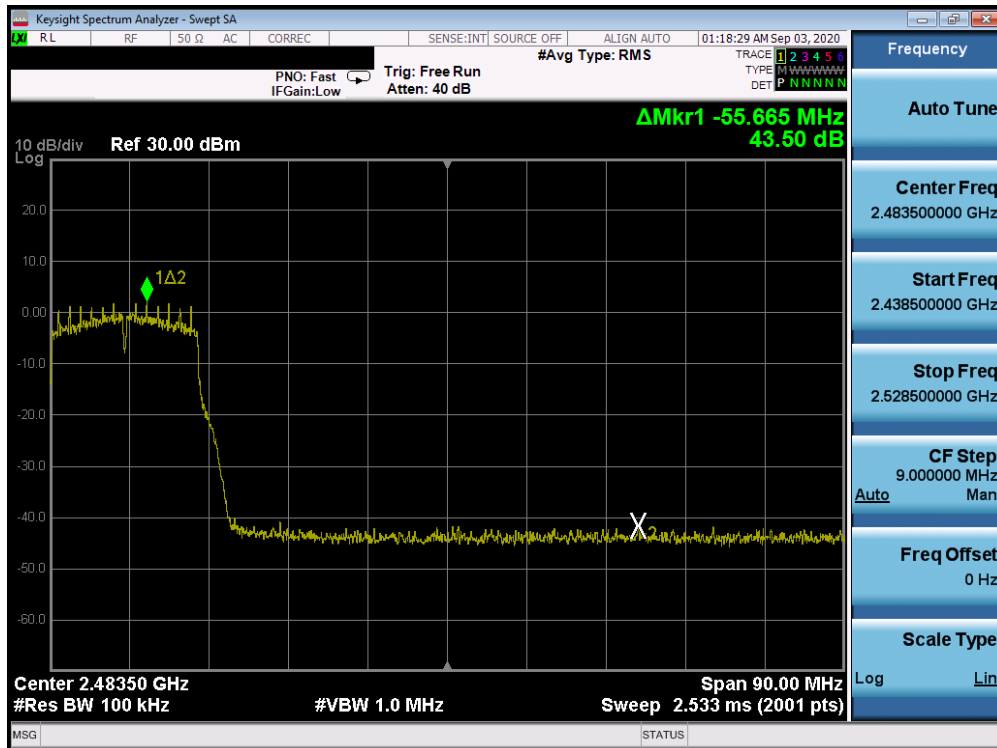


Plot 7-58. Band Edge Plot ANT 3a (802.11g- Ch. 4)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 55 of 134

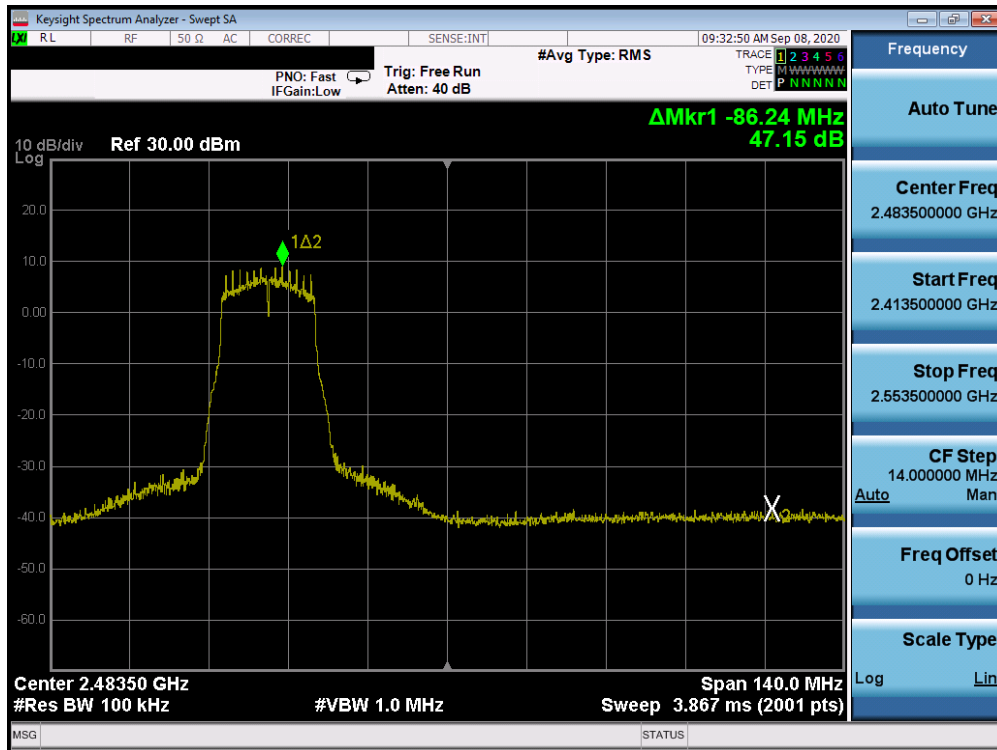


Plot 7-59. Band Edge Plot ANT 3a (802.11g – Ch. 7)

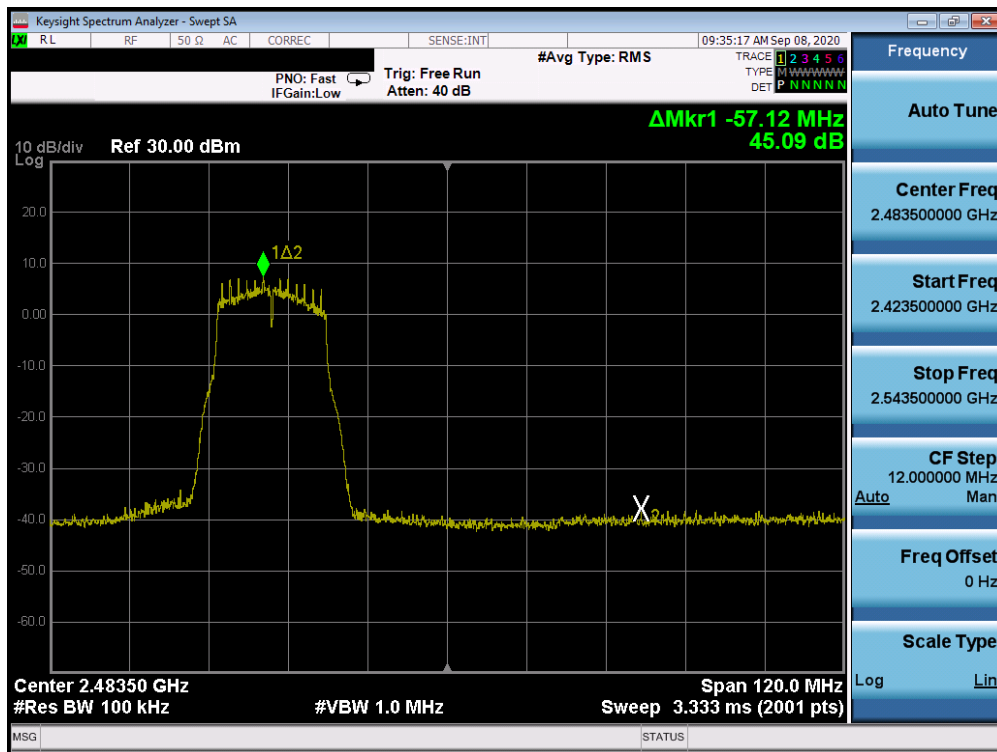


Plot 7-60. Band Edge Plot ANT 3a (802.11g – Ch. 8)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 56 of 134

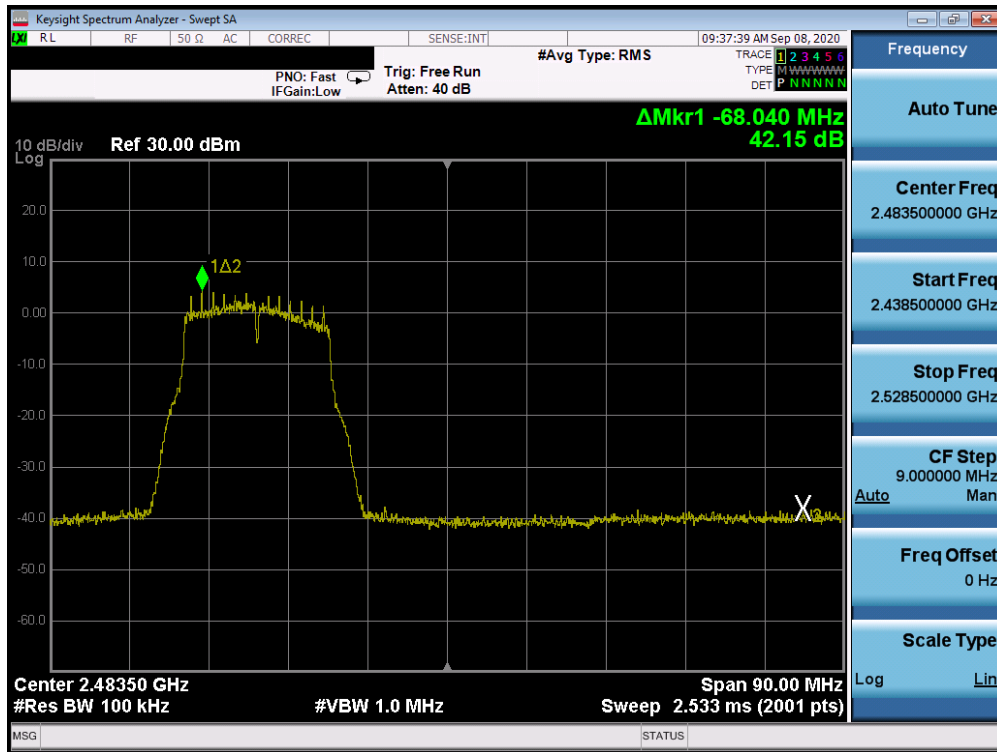


Plot 7-61. Band Edge Plot ANT 3a (802.11g – Ch. 9)

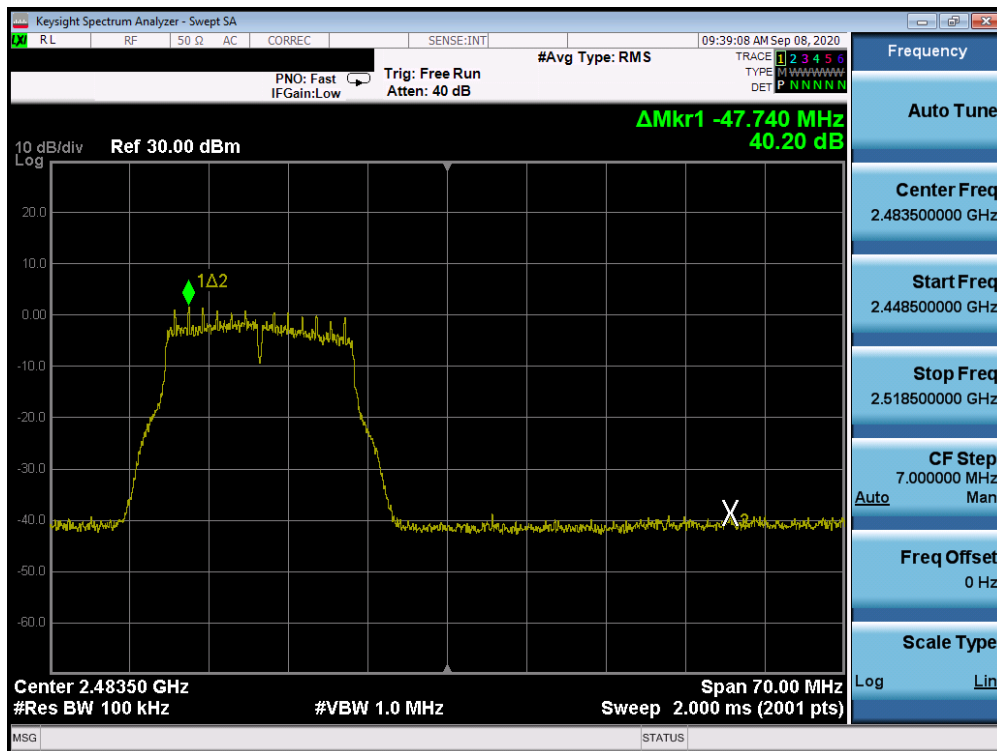


Plot 7-62. Band Edge Plot ANT 3a (802.11g – Ch. 10)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 57 of 134

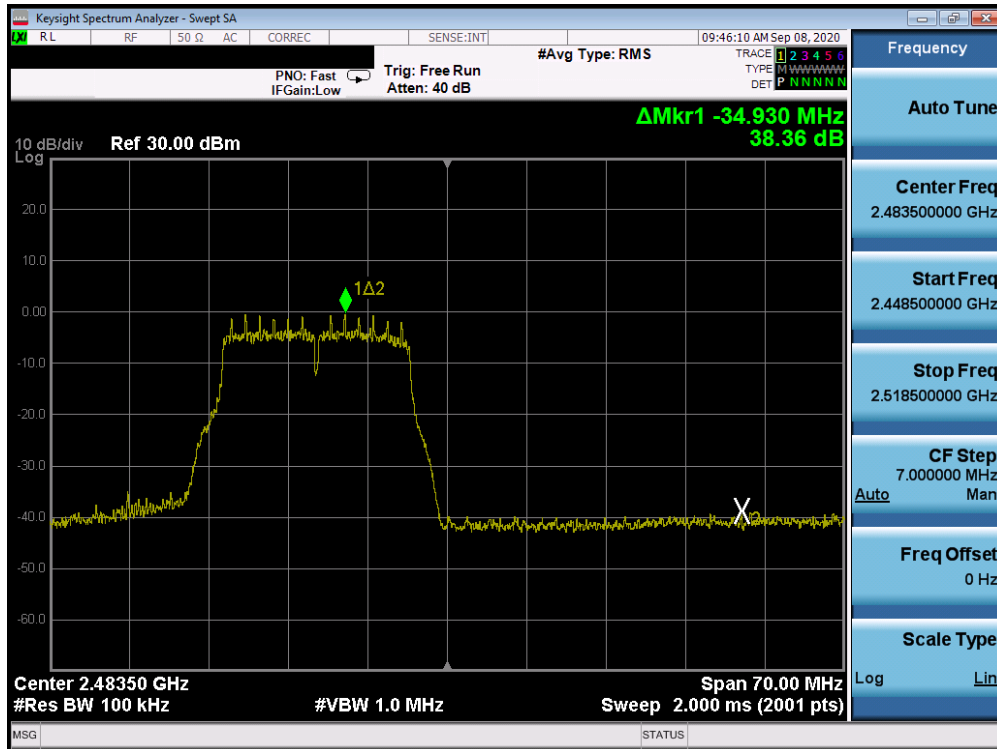


Plot 7-63. Band Edge Plot ANT 3a (802.11g - Ch. 11)

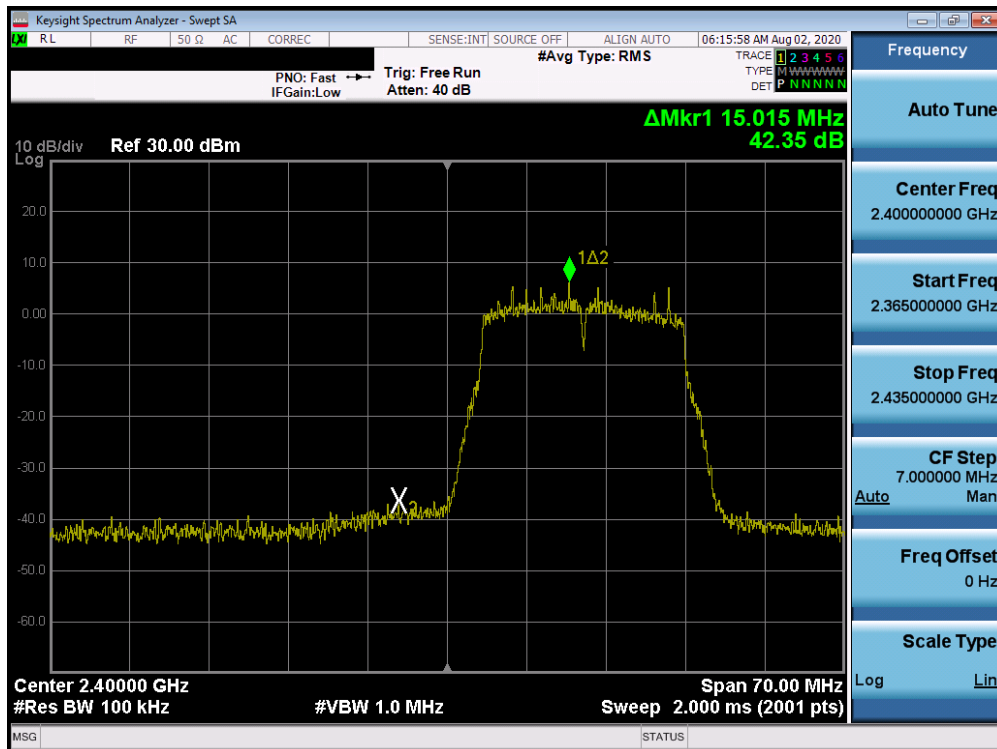


Plot 7-64. Band Edge Plot ANT 3a (802.11g - Ch. 12)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 58 of 134

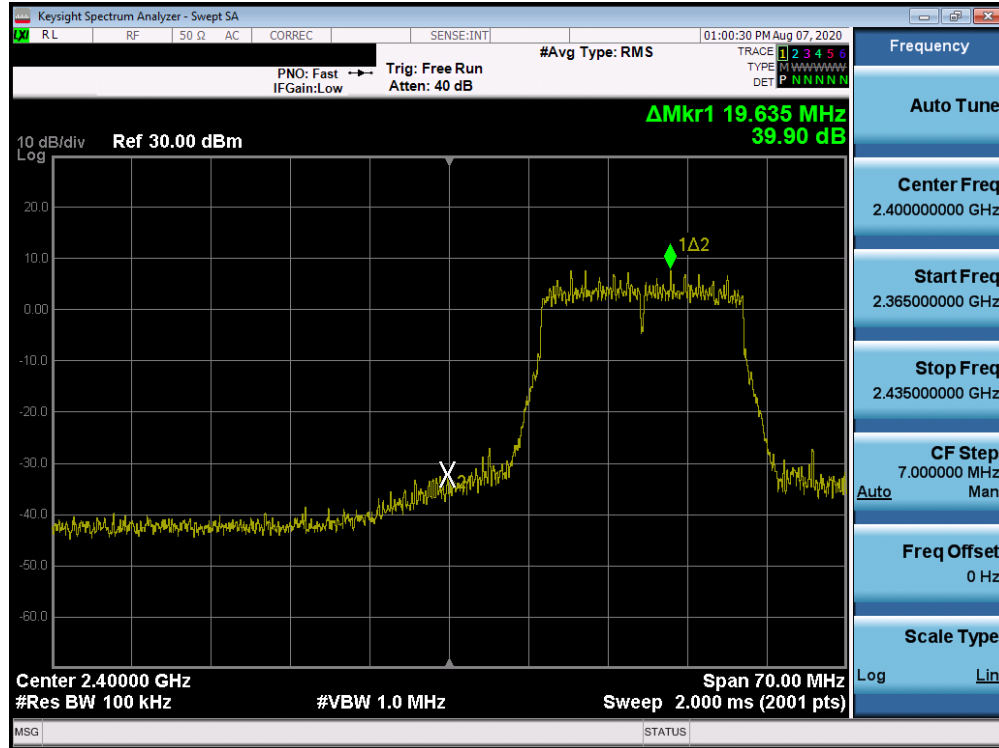


Plot 7-65. Band Edge Plot ANT 3a (802.11g – Ch. 13)

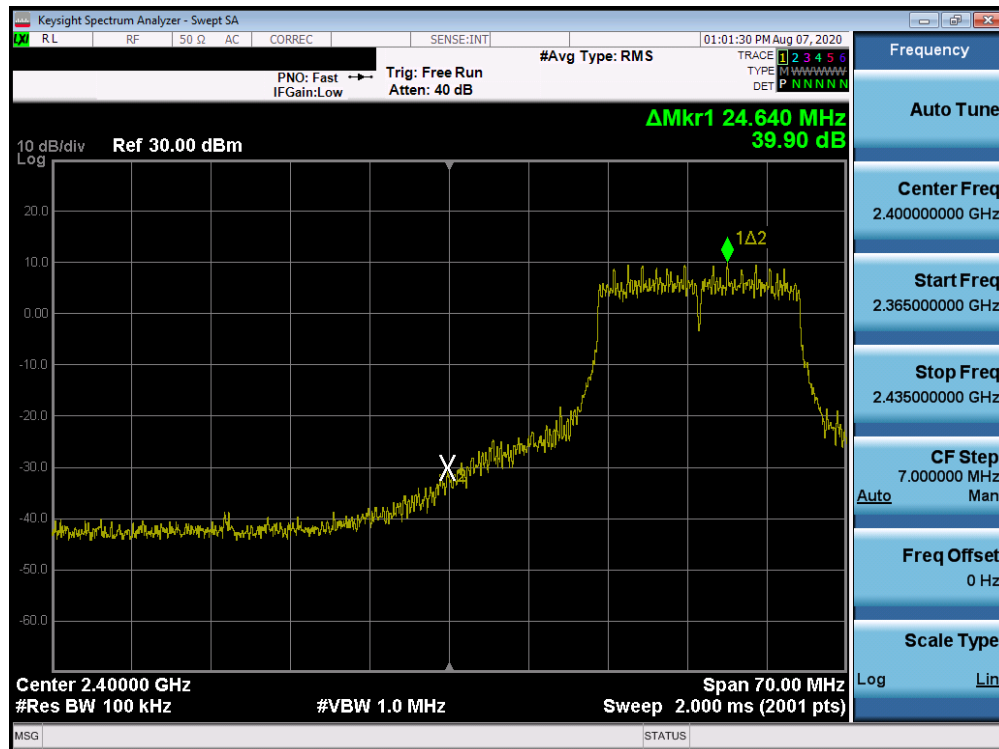


Plot 7-66. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 1)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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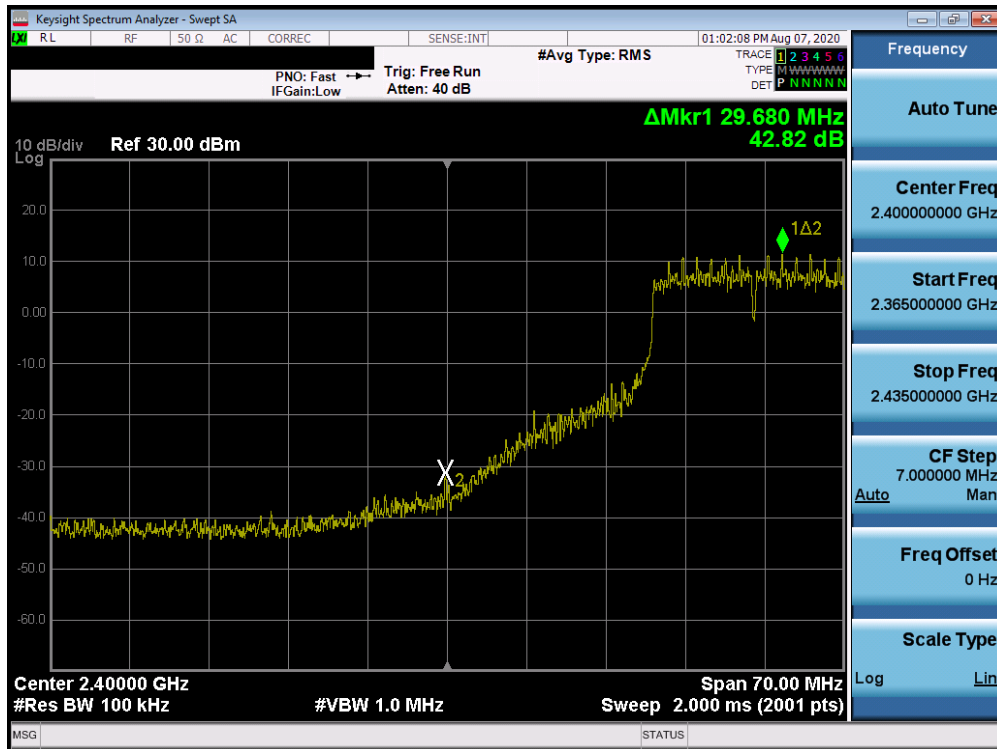


Plot 7-67. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 2)

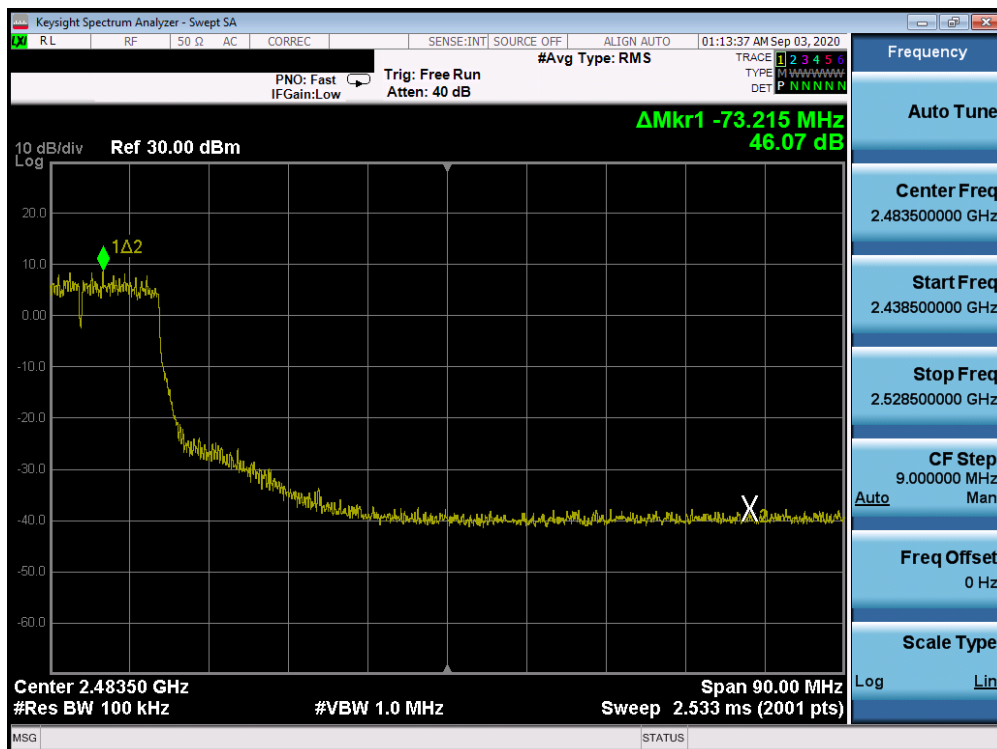


Plot 7-68. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 3)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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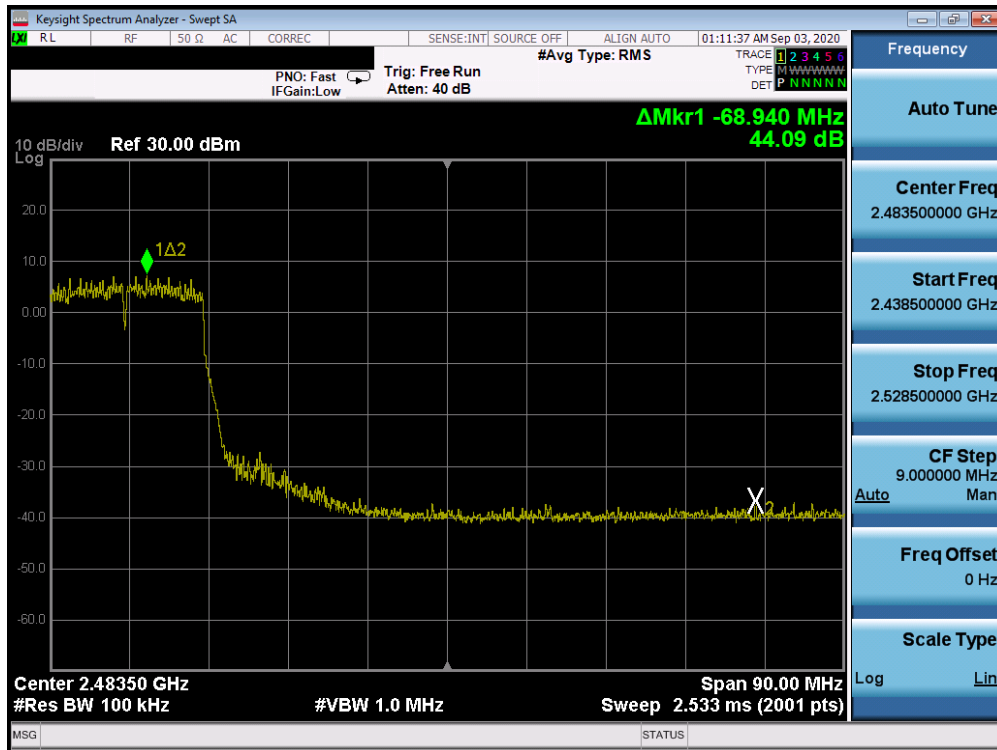


Plot 7-69. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 4)

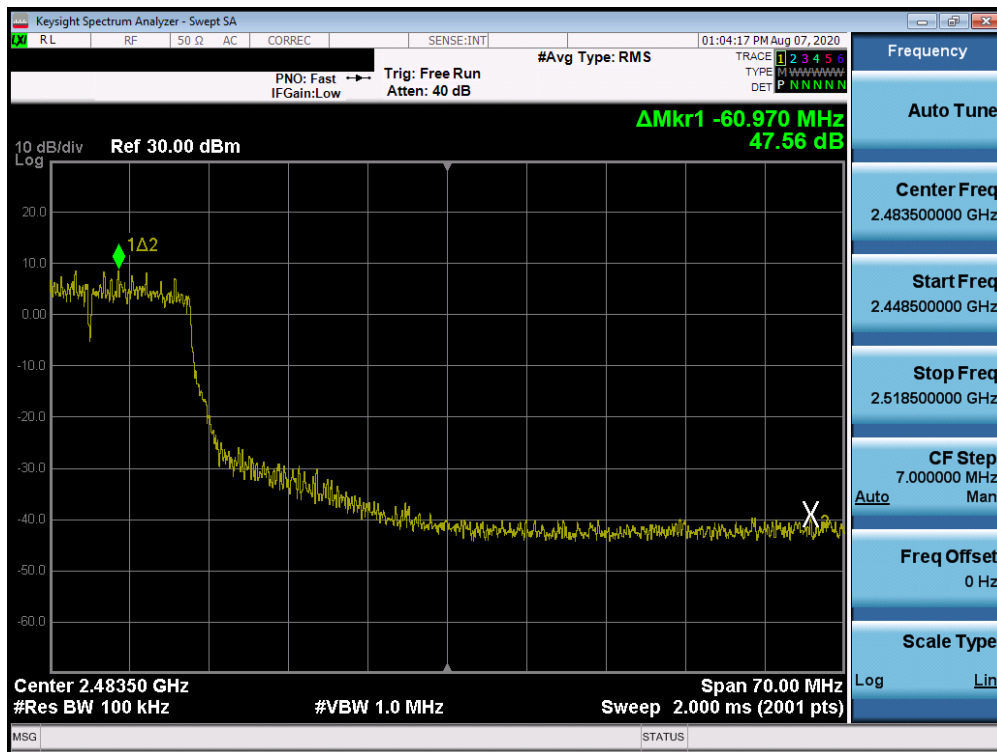


Plot 7-70. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 7)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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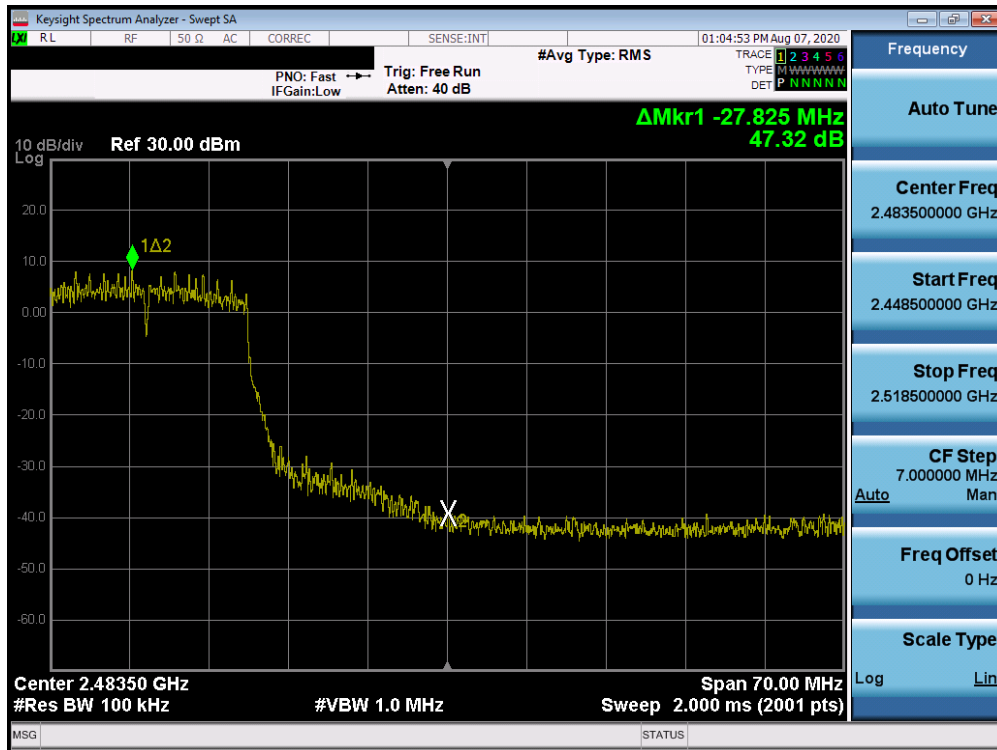


Plot 7-71. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 8)

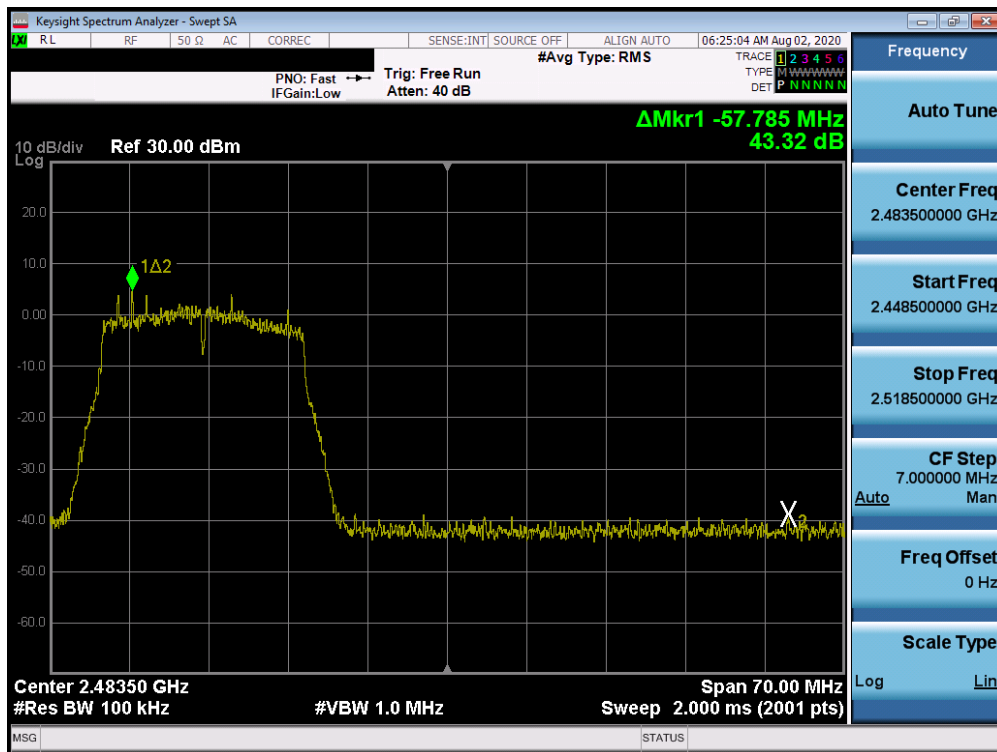


Plot 7-72. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 9)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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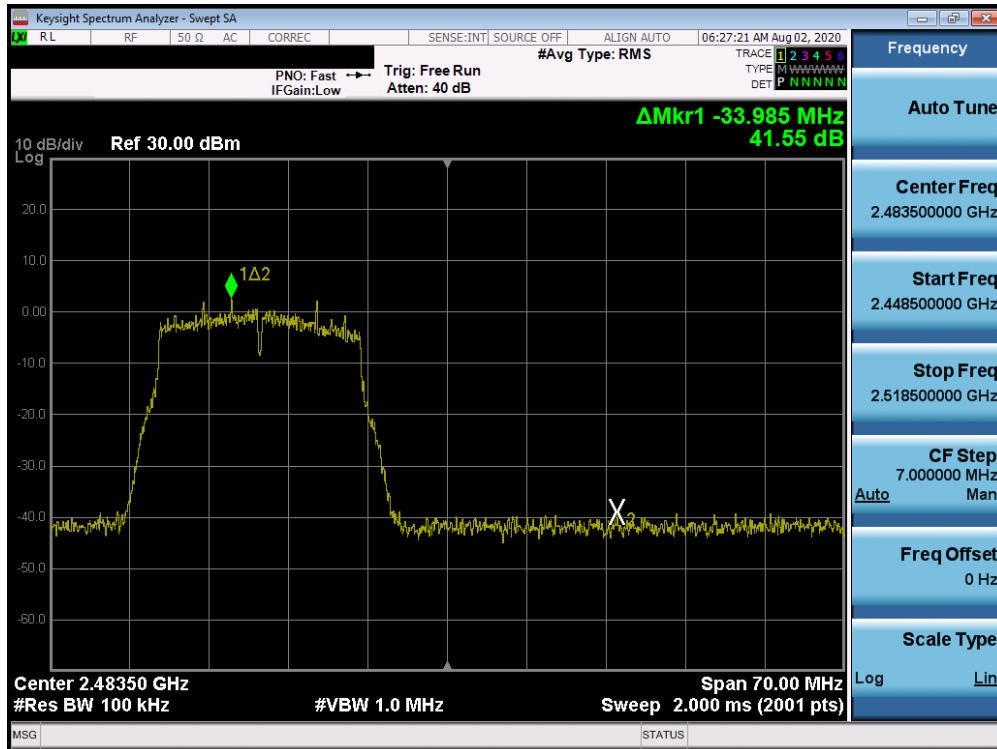


Plot 7-73. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 10)

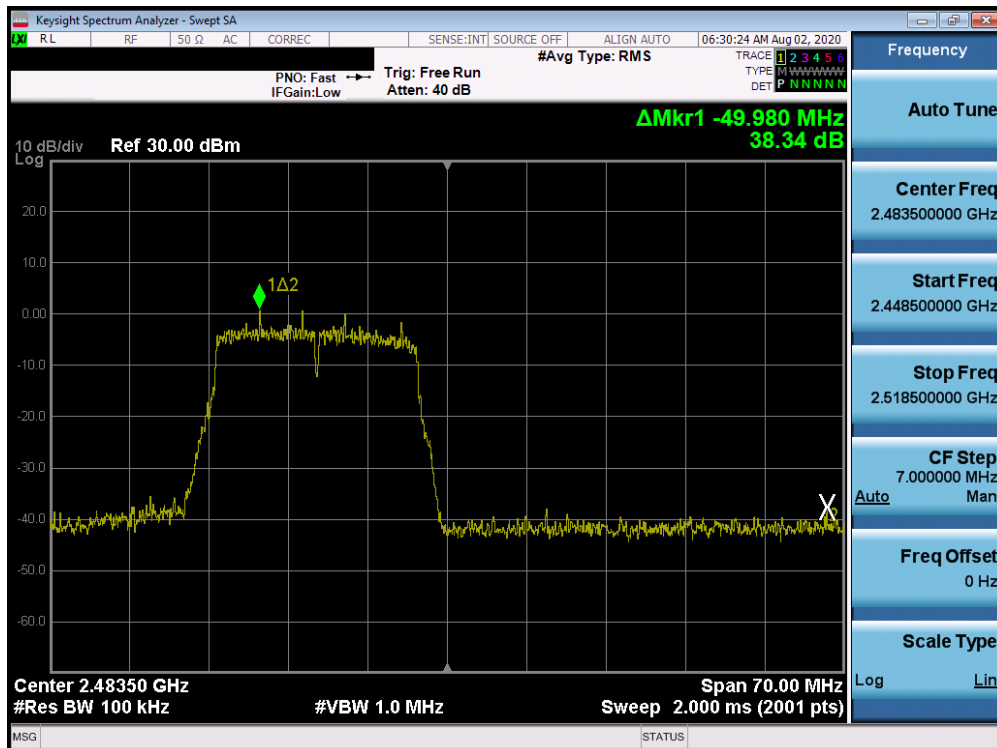


Plot 7-74. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 11)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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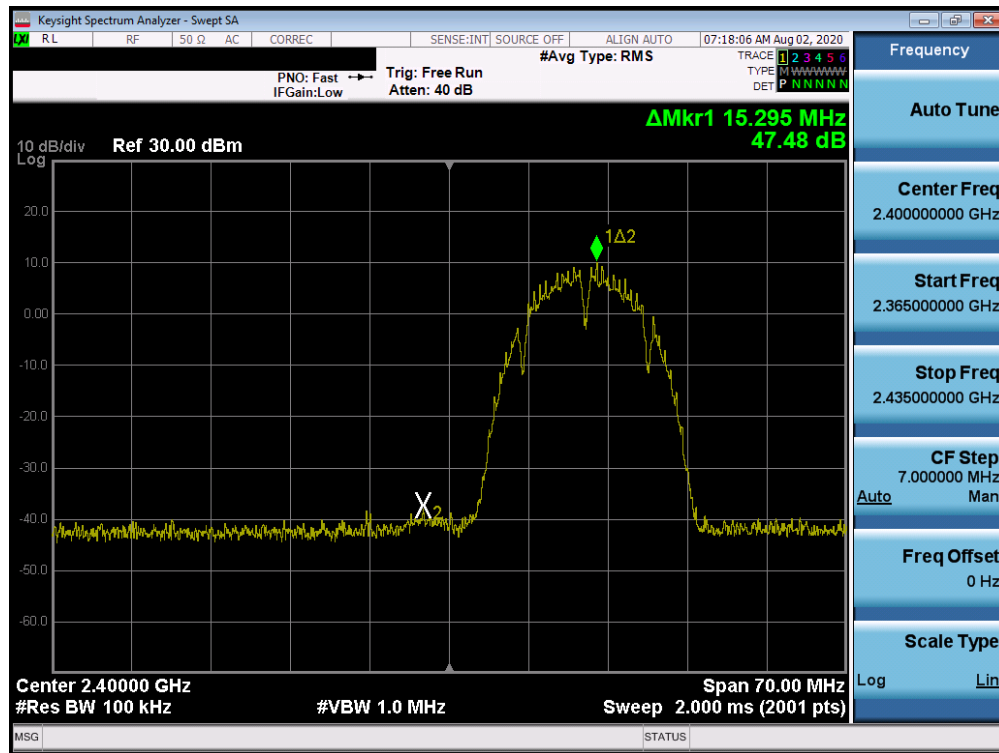
Plot 7-75. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 12)



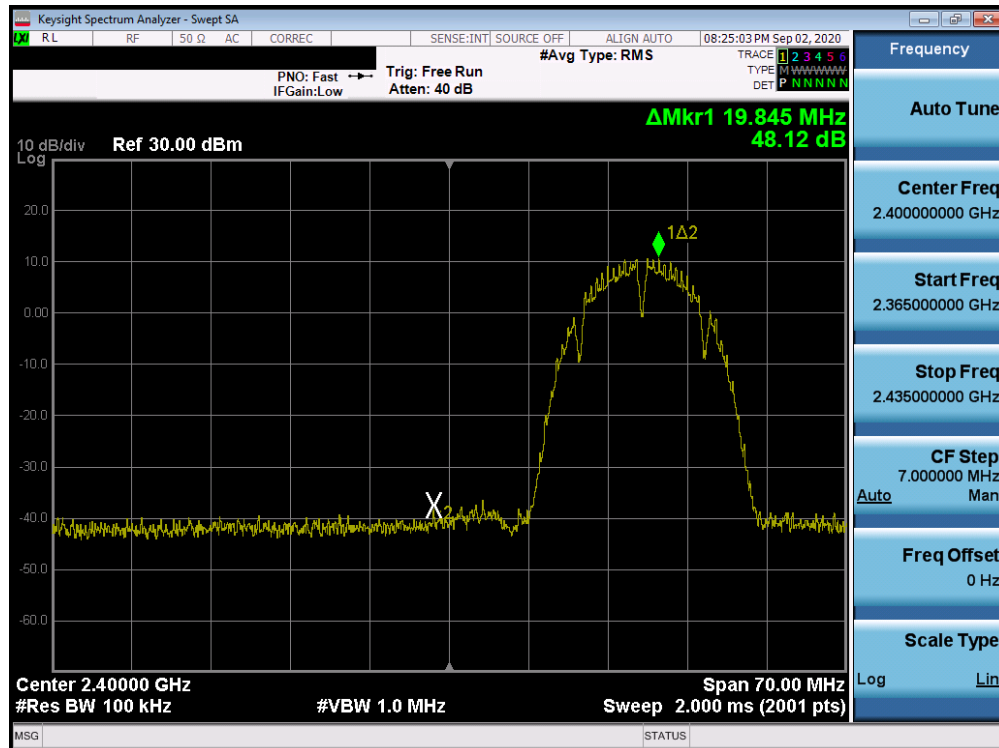
Plot 7-76. Band Edge Plot ANT 3a (802.11n (2.4GHz) – Ch. 13)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2004270029-06.BCG	Test Dates: 07/16/2020 - 09/08/2020	EUT Type: Tablet Device	Page 64 of 134

Antenna 1a Conducted Emissions at the Band Edge

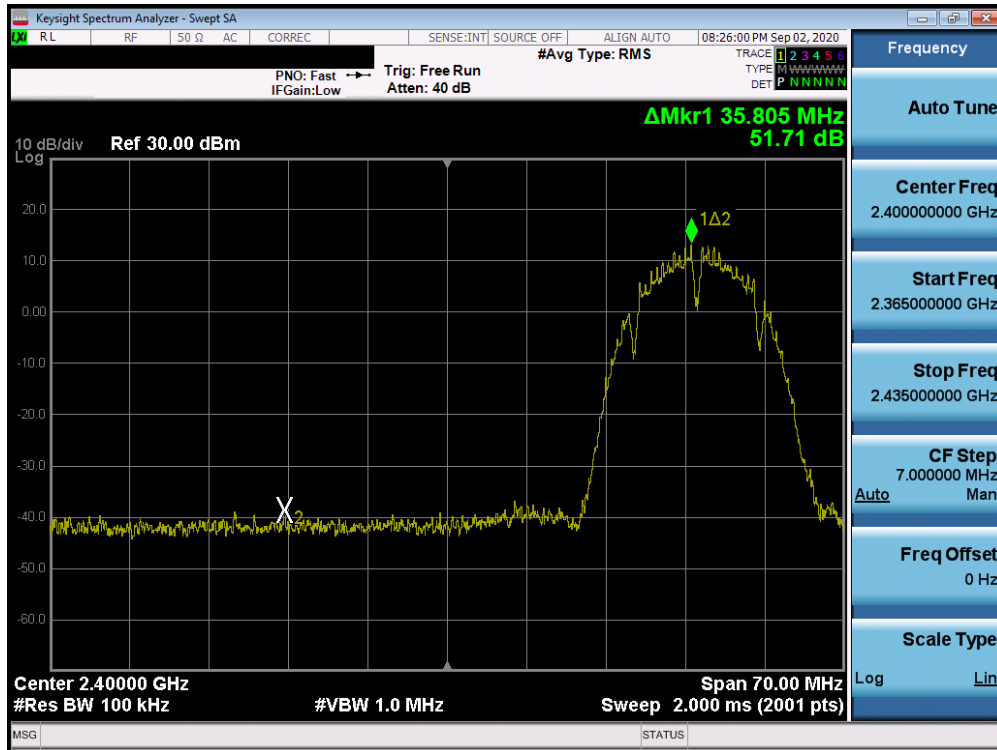


Plot 7-77. Band Edge Plot ANT 1a (802.11b – Ch. 1)

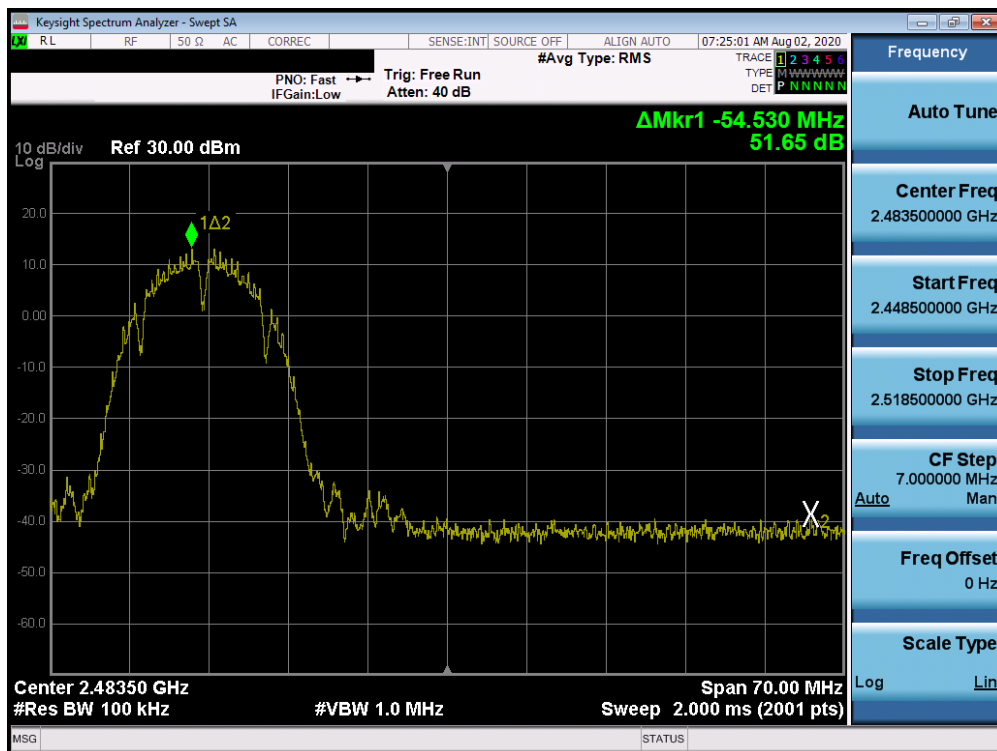


Plot 7-78. Band Edge Plot ANT 1a (802.11b – Ch. 2)

FCC ID: BCGA2324	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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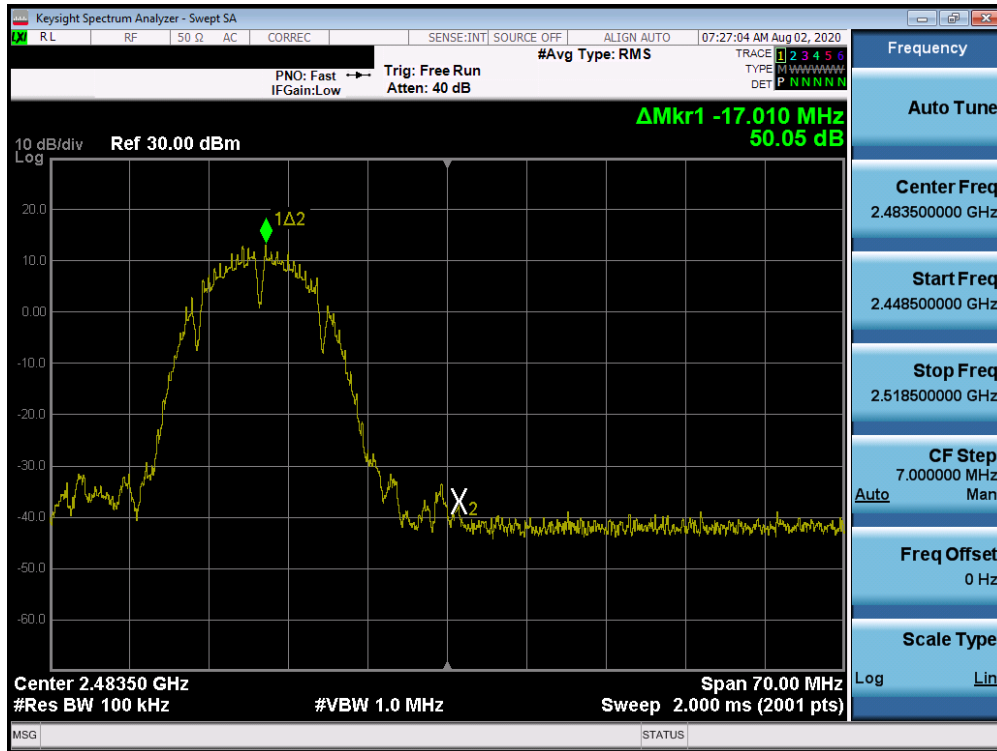


Plot 7-79. Band Edge Plot ANT 1a (802.11b – Ch. 3)

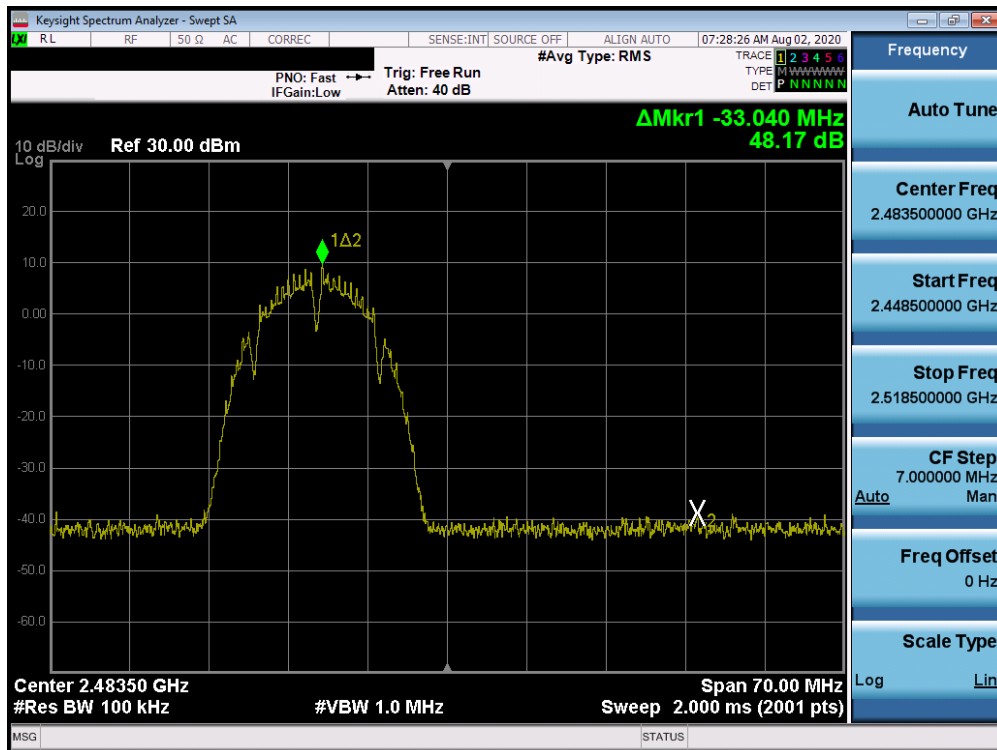


Plot 7-80. Band Edge Plot ANT 1a (802.11b – Ch. 11)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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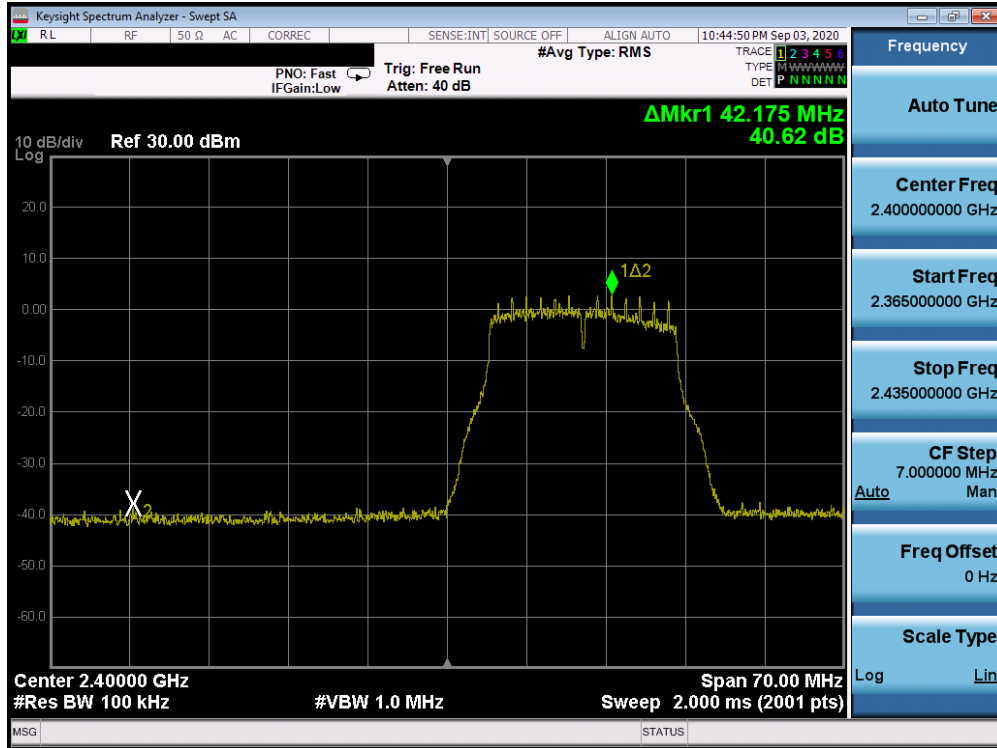


Plot 7-81. Band Edge Plot ANT 1a (802.11b – Ch. 12)

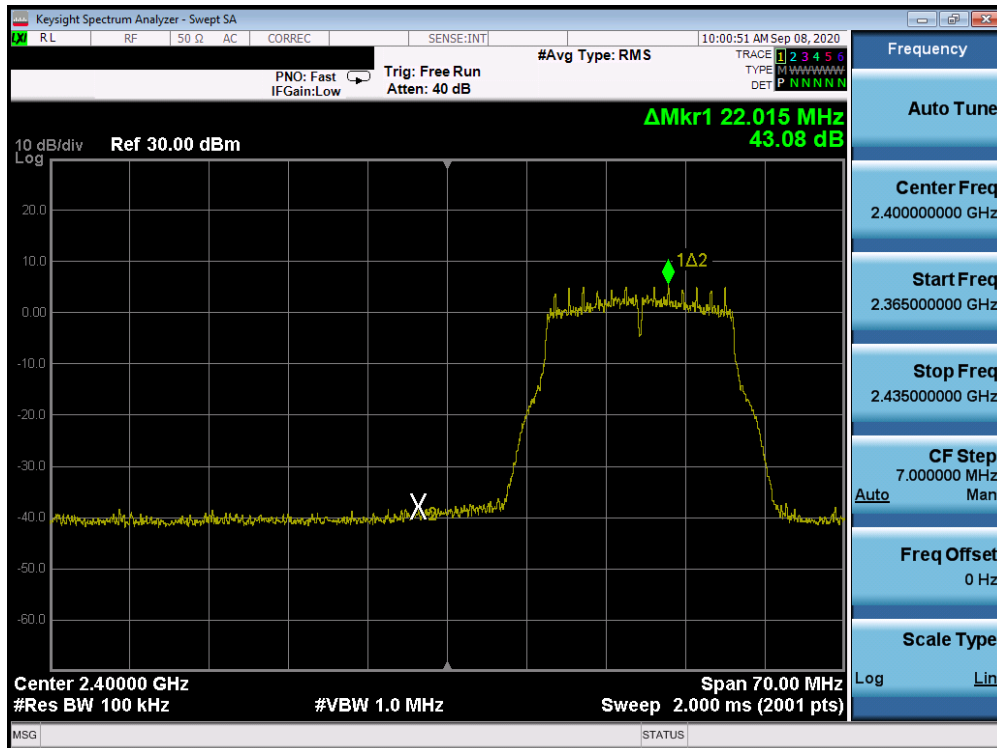


Plot 7-82. Band Edge Plot ANT 1a (802.11b – Ch. 13)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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Plot 7-83. Band Edge Plot ANT 1a (802.11g- Ch. 1)



Plot 7-84. Band Edge Plot ANT 1a (802.11g- Ch. 2)

FCC ID: BCGA2324		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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