



# Element Washington DC LLC

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## DATA REFERENCE REPORT

### FCC PART 15.407 / ISED RSS-247 UNII 802.11a/n/ac/ax(SU)

**Applicant Name:**

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

**Date of Testing:**

05/30/2022 – 09/30/2022

**Test Site/Location:**

Element Washington DC LLC, Morgan Hill, CA, USA

**Test Report Serial No.:**

1C2205090029-18.BCG

<b>FCC ID:</b>	<b>BCGA2437</b>
<b>IC:</b>	<b>579C-A2437</b>
<b>APPLICANT:</b>	<b>Apple Inc.</b>

**Reference Model/HVIN:**

A2764

**Variant Model/HVIN:**

A2437 (A2766)

**EUT Type:**

Tablet Device

**Frequency Range:**

5180 – 5825MHz

**Modulation Type:**

OFDM

**FCC Classification:**

Unlicensed National Information Infrastructure (UNII)

**FCC Rule Part(s):**

Part 15 Subpart E (15.407)

**ISED Specification:**

RSS-247 Issue 2

**Test Procedure(s):**ANSI C63.10-2013, KDB 789033 D02 v02r01,  
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 789033 D02 v02r01. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortiz  
Executive Vice President



FCC ID: BCGA2437 IC: 579C-A2437	element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 1 of 21

V 10.5 12/15/2021

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## T A B L E   O F   C O N T E N T S

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1.0	INTRODUCTION .....	3
1.1	Scope .....	3
1.2	ELEMENT WASHINGTON DC LLC Test Location.....	3
1.3	Test Facility / Accreditations.....	3
2.0	PRODUCT INFORMATION.....	4
2.1	Equipment Description .....	4
2.2	Device Capabilities .....	4
2.3	Antenna Description .....	8
2.4	Test Support Equipment.....	8
2.5	Test Configuration .....	9
2.6	Software and Firmware .....	9
2.7	EMI Suppression Device(s)/Modifications .....	9
3.0	DESCRIPTION OF TESTS .....	10
3.1	Evaluation Procedure .....	10
3.2	Radiated Emissions.....	10
3.3	Environmental Conditions.....	11
4.0	ANTENNA REQUIREMENTS .....	12
5.0	MEASUREMENT UNCERTAINTY .....	13
6.0	TEST EQUIPMENT CALIBRATION DATA .....	14
7.0	TEST RESULTS (SPOT-CHECK DATA) .....	15
7.1	Summary .....	15
7.2	Radiated Spurious Emissions.....	16
8.0	CONCLUSION.....	20
9.0	APPENDIX A: REFERENCE MODEL TEST REPORT.....	21

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 2 of 21

## 1.0 INTRODUCTION

### 1.1 Scope

Per manufacturer declaration, there are two tablet device models, A2764 and A2437 (A2766), with high degree of similarity, reference model FCC ID: BCGA2764 / IC: 579C-A2764 and variant model **FCC ID: BCGA2437 / IC: 579C-A2437**. 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: BCGA2764 / IC: 579C-A2764, while radiated spot-check verification has been performed on variant model **FCC ID: BCGA2437 / IC: 579C-A2437**. 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
NII	BCGA2764 579C-A2764	1C2205090028-19.BCG	RF UNII Test Report

**Table 1-1. Reference Model Details**

Reference model FCC ID: BCGA2764 / IC: 579C-A2764 test report has been included in Appendix A.

### 1.2 Element Washington DC LLC Test Location

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

### 1.3 Test Facility / Accreditations

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

- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- Element Washington DC LLC facility is a registered (22831) test laboratory with the site description on file with ISED.

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 3 of 21

## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Tablet Device FCC ID: BCGA2437 and IC: 579C-A2437**. The test data contained in this report pertains only to the emissions due to the EUT's UNII 802.11a/n/ac/ax (SU) transmitter.

**Test Device Serial No.:** VT04VPHP2V, HHQXGQDW0V

### 2.2 Device Capabilities

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

This device supports BT Beamforming.

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
36	5180	52	5260	100	5500	149	5745
:	:	:	:	:	:	:	:
42	5210	56	5280	116	5580	157	5785
:	:	:	:	:	:	:	:
48	5240	64	5320	144	5720	165	5825

Table 2-1. 802.11a / 802.11n / 802.11ac / 802.11ax (20MHz) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
38	5190	54	5270	102	5510	151	5755
:	:	:	:	:	:	:	:
46	5230	62	5310	110	5550	159	5795
				:	:		
				142	5710		

Table 2-2. 802.11n / 802.11ac / 802.11ax (40MHz BW) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
42	5210	58	5290	106	5530	155	5775
				:	:		
				138	5690		

Table 2-3. 802.11ac / 802.11ax (80MHz BW) Frequency / Channel Operations

Band 1		Band 2A		Band 2C	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
50	5250	50	5250	114	5570

Table 2-4. 802.11ac / 802.11ax (160MHz BW) Frequency / Channel Operations

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 4 of 21

**Notes:**

- TDWR channels are not supported for ISED.
- 5GHz NII operation is possible in 20MHz, 40MHz, 80MHz and 160MHz channel bandwidths. 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 B2(b) KDB 789033 D02 v02r01 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 [%]		
		Antenna 5b	Antenna 4a	MIMO
5GHz	a (Low Rate)	97.3	97.8	97.6
	a (Mid Rate)	96.0	95.9	96.3
	a (High Rate)	89.6	90.7	91.7
	n (HT20) (Low Rate)	96.8	96.9	94.6
	n (HT20) (Mid Rate)	94.1	94.4	90.2
	n (HT20) (High Rate)	92.1	91.7	86.1
	ax(SU) (HT20 Low Rate)	96.3	95.9	95.9
	ax(SU) (HT20 Mid Rate)	93.2	93.2	93.3
	ax(SU) (HT20 High Rate)	86.9	87.1	86.7
	n (HT40 Low Rate)	94.0	94.2	90.2
	n (HT40 Mid Rate)	90.0	89.8	85.0
	n (HT40 High Rate)	86.9	86.7	81.7
	ax(SU) (HT40 Low Rate)	93.6	93.7	93.5
	ax(SU) (HT40 Mid Rate)	89.7	89.8	90.1
	ax(SU) (HT40 High Rate)	82.9	82.9	83.3
	ac (HT80 Low Rate)	89.2	88.9	83.4
	ac (HT80 Mid Rate)	83.3	84.1	79.1
	ac (HT80 High Rate)	78.0	77.7	74.8
	ax(SU) (HT80 Low Rate)	87.3	89.0	88.4
	ax(SU) (HT80 Mid Rate)	83.9	83.8	83.5
	ax(SU) (HT80 High Rate)	78.7	78.2	78.2
	ac (HT160 Low Rate)	85.1	85.0	79.9
	ac (HT160 Mid Rate)	79.3	79.0	76.2
	ac (HT160 High Rate)	73.8	73.9	75.1
	ax(SU) (HT160 Low Rate)	84.3	85.3	84.9
	ax(SU) (HT160 Mid Rate)	80.9	81.6	81.6
	ax(SU) (HT160 High Rate)	77.9	78.0	76.2

**Table 2-5. Measured Duty Cycles**

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 5 of 21



3. The device employs MIMO technology. Below are the possible configurations.

WiFi Configurations		SISO		CDD		SDM		STBC	
		Antenna 5b	Antenna 4a						
5GHz	11a	✓	✓	✓	✓	✗	✗	✗	✗
	11n (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax (SU) (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11n (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax (SU) (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ac (SU) (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ac (160MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax (SU) (160MHz)	✓	✓	✓	✓	✓	✓	✓	✓

Table 2-6. WIFI Configurations

✓ = Support ; ✗ = NOT Support

**SISO** = Single Input Single Output

**SDM** = Spatial Diversity Multiplexing – MIMO function

**CDD** = Cyclic Delay Diversity - 2Tx Function

**STBC** = Space-Time Block Coding – 2Tx Function

Data Rate(s) Tested: 6, 9, 12, 18, 24, 36, 48, 54Mbps (802.11a)  
6.5/7.2, 13/14.4, 19.5/21.7, 26/28.9, 39/43.3, 52/57.8, 58.5/65, 65/72.2 (n – 20MHz)  
13.5/15, 27/30, 40.5/45, 54/60, 81/90, 108/120, 121.5/135, 135/150 (n – 40MHz BW)  
29.3/32.5, 58.5/65, 87.8/97.5, 117/130, 175.5/195, 234/260, 263.3/292.5, 292.5/325, 351/390, 390/433.3 (ac – 80MHz BW)  
58/65, 117/130, 175.5/195, 234/260, 351/390, 468/520, 526.5/585, 585/650, 702/780, 780/866.7 (ac – 160MHz)  
13/14.4, 26.28.9, 39/43.3, 52/57.8, 78/86.7, 104/115.6, 117/130, 130/144.4Mbps (MIMO n/ac – 20MHz)  
156/173Mbps (MIMO ac – 20MHz)  
27/30, 54/60, 81/90, 108/120, 162/180, 216/240, 243,270, 270/300Mbps (MIMO n/ac – 40MHz) 324/360, 360/400Mbps (MIMO ac – 40MHz)  
58.5/65, 117/130, 175.5/195, 234/260, 351/780, 936/1040, 1053/1170, 1170/1300, 1402/1560, 1560/1733.4Mbps (MIMO ac – 80MHz)  
116/130, 234/260, 351/390, 468/520, 351/390, 468/520, 526.5/585, 585/650, 702/780, 780/866.7 (MIMO ac – 160MHz)  
8/8.6, 16/17.2, 24/25.8, 33/34.4, 49/51.6, 65/68.8, 73/77.4, 81/86.0, 98/103.2, 108/114.7, 122/129.0, 135/143.4 (ax – 20MHz)  
16/17.2, 33/34.4, 49/51.6, 65/68.8, 98/103.2, 130/137.6, 146/154.9, 163/172.1, 195/206.5, 217/229.4, 244/258.1, 271/286.8 (ax – 40MHz BW)  
34/36.0, 68/72.1, 102/108.1, 136/144.1, 204/216.2, 272/288.2, 306/324.4, 340/360.3, 408/432.4, 453/480.4, 510/540.4, 567/600.5 (ax – 80MHz BW)  
136.2/144.2, 2721/288.2, 408.2/432.4, 544.4, 576.4/816.6864.8, 1088.8/1153, 1225/1297, 1361.2/1441.2, 1633.4/1729.4, 1814.8/1921.6, 2041.6/2161.8, 2268.6/2402Mbps, (MIMO ax – 160MHz)

FCC ID: BCGA2437 IC: 579C-A2437		DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 6 of 21



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

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

**Table 2-7. Simultaneous Transmission Configurations**

✓ = Support; ✗ = Not Support

**Notes:**

All the above simultaneous transmission configurations have been tested and the worst case configurations was found to be configuration 2 (BT and LTE) and reported in RF Bluetooth and RF Part 96 test reports.

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

FCC ID: BCGA2437 IC: 579C-A2437		DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 7 of 21



## 2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Frequency [GHz]	Antenna Gain (dBi)	
	Antenna 5b	Antenna 4a
5.150 – 5.250	1.4	0.4
5.250 – 5.350	1.3	-0.6
5.470 – 5.725	1.5	-2.0
5.725 – 5.850	2.1	-1.3

Table 2-8. Highest Antenna Gain

## 2.4 Test Support Equipment

Test Support Equipment List				
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: Spartan	S/N: 000MKTR02U	
3	USB-C Cable w/ AC Adapter	Model: A246 Model: A2305	S/N: N/A S/N: N/A	
4	DC Power Supply	Model: KPS3010D	S/N: N/A	

Table 2-9. Test Support Equipment List

FCC ID: BCGA2437 IC: 579C-A2437	element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 8 of 21

## 2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013 and KDB 789033 D02 v02r01. 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, spot-check measurements have been conducted and reported. Spot-Check Test Plan can be referred to below Table 2-10.

Technology	Test Case	FCC ID: BCGA2437 IC: 579C-A2437	
		Mode	Channel
UNII (802.11a/n/ac/ax)	Radiated Spurious Emissions	MIMO Max Power 5.2/5.3/5.6/5.8 GHz: 11nHT20	M

**Table 2-10. FCC/ISED Approved Spot-Check Test Plan**

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

## 2.6 Software and Firmware

The test was conducted with firmware version 20A8359 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.

FCC ID: BCGA2437 IC: 579C-A2437	element		DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 9 of 21	

## 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 789033 D02 v02r01 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.

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 10 of 21



### 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).

FCC ID: BCGA2437 IC: 579C-A2437	element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 11 of 21

## 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.

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 12 of 21

## 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)	4.38
Radiated Disturbance (<1GHz)	4.75
Radiated Disturbance (>1GHz)	5.20
Radiated Disturbance (>18GHz)	4.72

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 13 of 21

## 6.0 TEST EQUIPMENT CALIBRATION DATA

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

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	6/10/2022	Annual	6/10/2023	MY49430244
Agilent Technologies	N9020A	MXA Signal Analyzer	4/26/2022	Annual	4/26/2023	MY56470202
Anritsu	ML2496A	Power Meter	11/29/2021	Annual	11/29/2022	1840005
Anritsu	MA2411B	Pulse Power Sensor	11/30/2021	Annual	11/30/2022	1726261
Anritsu	MA2411B	Pulse Power Sensor	11/30/2021	Annual	11/30/2022	1726262
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	1/19/2022	Annual	1/19/2023	T058701-02
Com-Power Corporation	LIN-120A	Line Impedance Stabilization Network (LISN)	3/7/2022	Annual	3/7/2023	241296
ETS-Lindgren	3142E	Biconilog Antenna (26-6000MHz)	10/21/2021	Annual	10/21/2022	208204
ETS-Lindgren	3117	Double Ridged Guide Horn Antenna (1-18GHz)	10/25/2021	Annual	10/25/2022	227597
Keysight Technology	N9040B	UXA Signal Analyzer	2/8/2022	Annual	2/8/2023	MY57212015
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz-6GHz)	1/6/2022	Annual	1/6/2023	102328
Rohde & Schwarz	ESW26	EMI Test Receiver	5/19/2022	Annual	5/19/2023	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	12/2/2021	Annual	12/2/2022	101570
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	3/4/2022	Annual	3/4/2023	101619
Rohde & Schwarz	FSVA3044	Signal Analyzer (up to 44 GHz)	5/12/2022	Annual	5/12/2023	101098
Rohde & Schwarz	HFH2-Z2	Loop Antenna	4/3/2022	Annual	4/3/2023	100546
Rohde & Schwarz	TC-TA18	Cross-Polarized Antenna 400MHz-18GHz	1/25/2022	Annual	1/25/2023	101063
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz-18GHz)	1/6/2022	Annual	1/6/2023	101639
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz-40GHz)	4/18/2022	Annual	4/18/2023	100050

**Table 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.

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 14 of 21

## 7.0 TEST RESULTS (SPOT-CHECK DATA)

### 7.1 Summary

Company Name: Apple Inc.  
 FCC ID: BCGA2437  
 IC: 579C-A2437  
 FCC Classification: Unlicensed National Information Infrastructure (UNII)

Technology	Test Configurations			Reference Model		Variant Model		Delta	
	Test Description	Channel	Measurement Frequency [MHz]	FCC ID: BCGA2764 IC: 579C-A2764		FCC ID: BCGA2437 IC: 579C-A2437			
				Peak [dB $\mu$ V/m]	Average [dB $\mu$ V/m]	Peak [dB $\mu$ V/m]	Average [dB $\mu$ V/m]	Peak [dB]	Average [dB]
UNII 802.11n	Radiated Spurious Emissions	40	15600	54.60	43.67	53.39	42.48	1.21	1.19
		56	15840	53.79	42.45	55.62	43.90	1.83	1.45
		116	16740	56.04	-	55.63	-	0.41	-
		157	17355	58.60	-	57.82	-	0.78	-

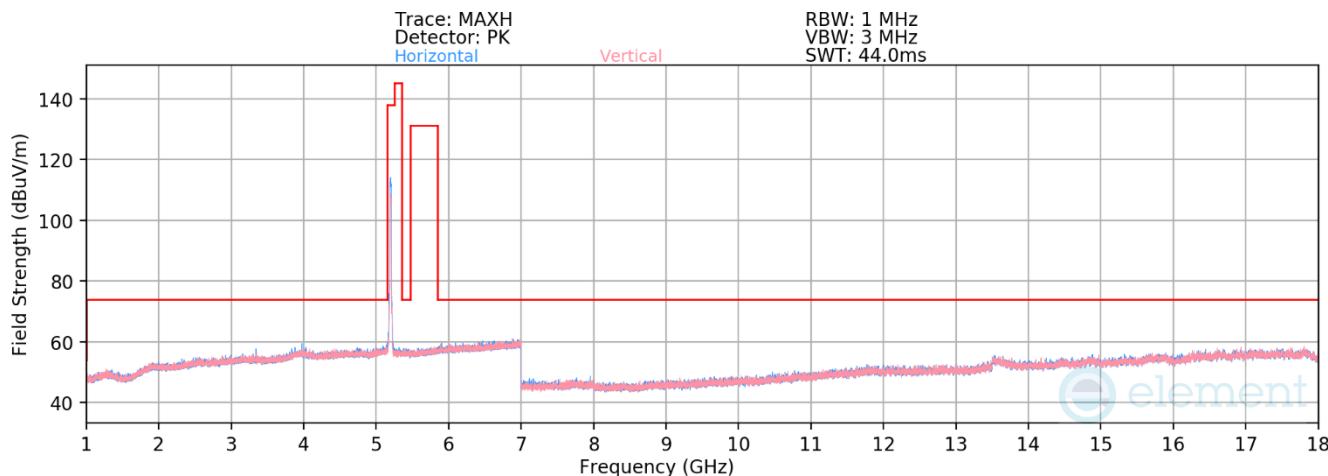
**Table 7-1. Worst Case Spot-check Results**

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.

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 15 of 21

## 7.2 Radiated Spurious Emissions

§15.407(b) §15.205 §15.209; RSS-Gen [8.9]



Plot 7-1. RSE above 1GHz CDD (802.11n – Ch.40)

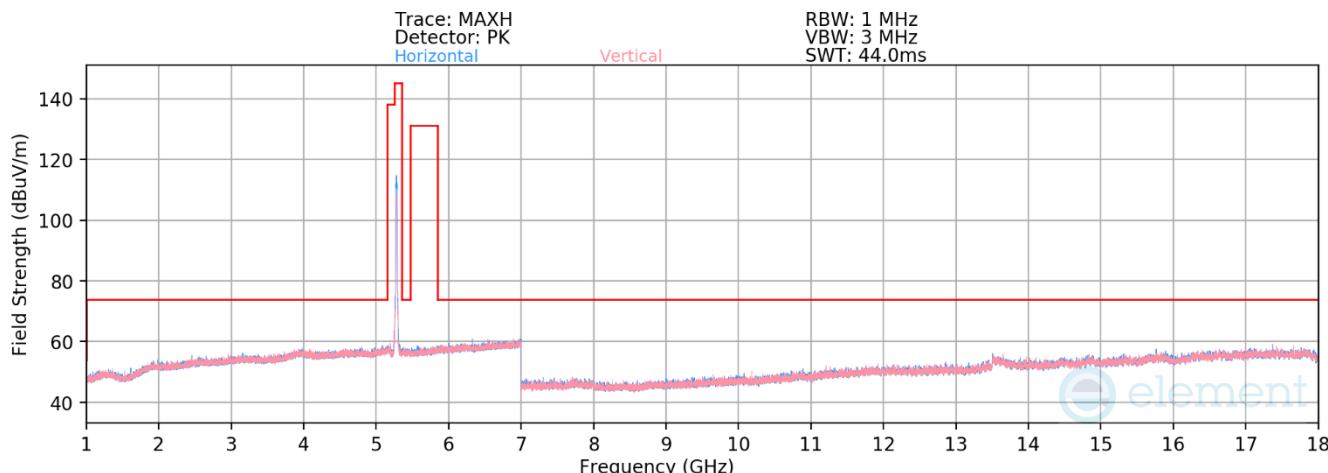
Mode: 802.11n  
 Data Rate: MCS8  
 Distance of Measurements: 3 Meters  
 Operating Frequency: 5200MHz  
 Channel: 40

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
10400.00	Peak	H	-	-	-70.34	14.29	50.95	68.20	-17.25
* 15600.00	Average	H	-	-	-83.70	19.18	42.48	53.98	-11.50
* 15600.00	Peak	H	-	-	-72.79	19.18	53.39	73.98	-20.59

Table 7-2. Radiated Measurements CDD

FCC ID: BCGA2437 IC: 579C-A2437	element DATA REFERENCE REPORT (CERTIFICATION)			Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device		

V 10.5 12/15/2021



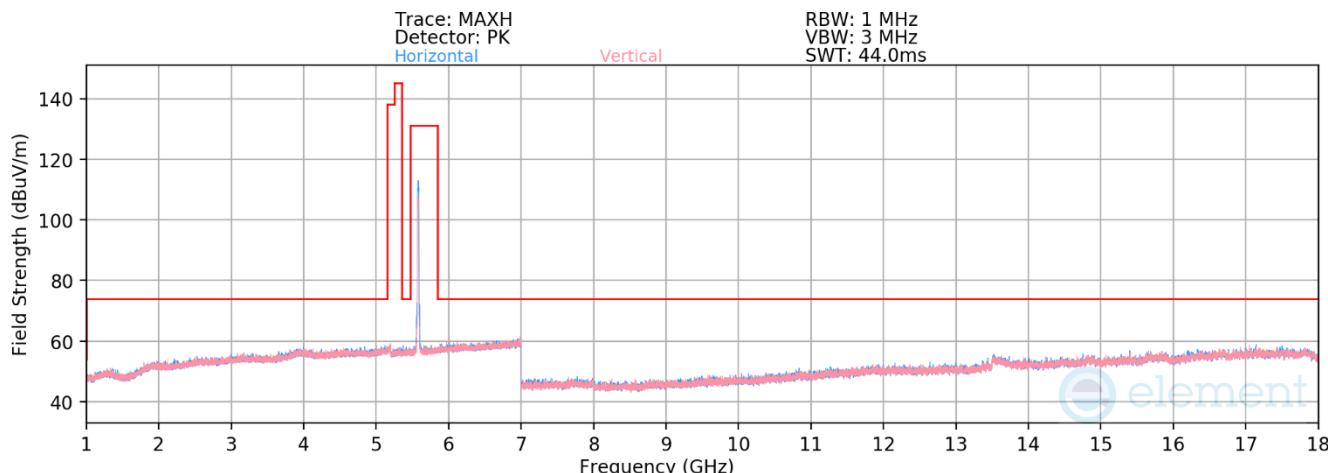
**Plot 7-2. RSE above 1GHz SDM (802.11n – Ch.56)**

Mode: 802.11n  
 Data Rate: MCS8  
 Distance of Measurements: 3 Meters  
 Operating Frequency: 5280MHz  
 Channel: 56

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
10560.00	Peak	H	-	-	-69.88	14.52	51.65	68.20	-16.55
* 15840.00	Average	H	-	-	-82.81	19.71	43.90	53.98	-10.08
* 15840.00	Peak	H	-	-	-71.09	19.71	55.62	73.98	-18.36

**Table 7-3. Radiated Measurements SDM**

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 17 of 21


**Plot 7-3. RSE above 1GHz SDM (802.11n – Ch.116)**

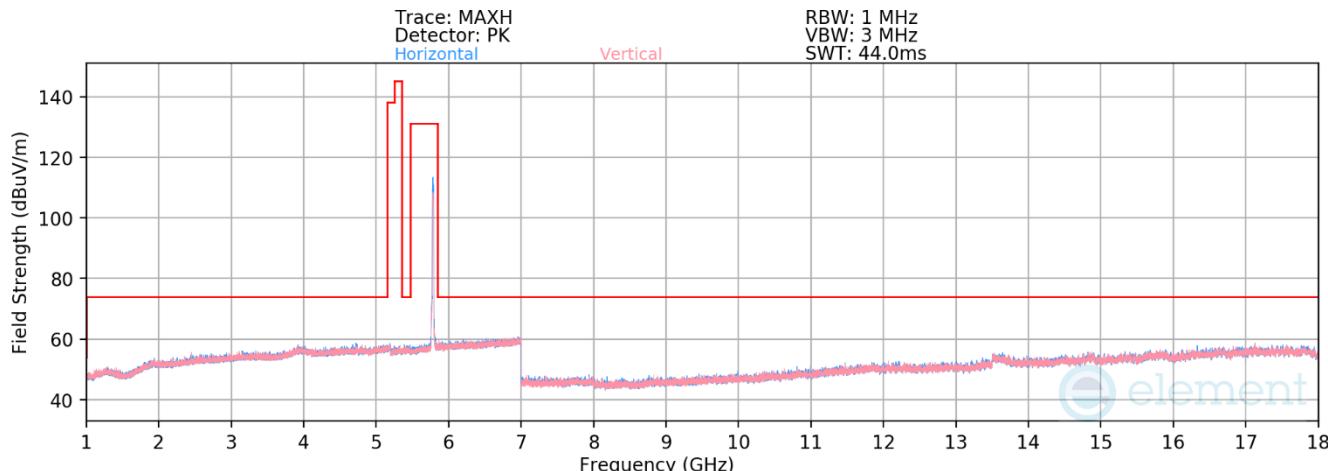
Mode: 802.11n  
 Data Rate: MCS8  
 Distance of Measurements: 3 Meters  
 Operating Frequency: 5580MHz  
 Channel: 116

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turtable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
* 11160.00	Average	H	-	-	-81.81	14.96	40.15	53.98	-13.82
* 11160.00	Peak	H	-	-	-70.71	14.96	51.26	73.98	-22.72
16740.00	Peak	H	-	-	-72.93	21.55	55.63	68.20	-12.57

**Table 7-4. Radiated Measurements SDM**

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)			Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device			

V 10.5 12/15/2021



Plot 7-4. RSE above 1GHz CDD (802.11n – Ch.157)

Mode: 802.11n  
 Data Rate: MCS8  
 Distance of Measurements: 3 Meters  
 Operating Frequency: 5785MHz  
 Channel: 157

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
* 11570.00	Average	H	-	-	-82.00	16.55	41.55	53.98	-12.43
* 11570.00	Peak	H	-	-	-70.78	16.55	52.77	73.98	-21.21
17355.00	Peak	H	-	-	-72.36	23.18	57.82	68.20	-10.38

Table 7-5. Radiated Measurements CDD

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 19 of 21

## 8.0 CONCLUSION

The spot-check data measured for variant model **FCC ID: BCGA2437 / IC: 579C-A2437** is in tolerance with reference model FCC ID: BCGA2764 / IC: 579C-A2764 per FCC/ISED Approved Data Referencing Test Plan.

FCC ID: BCGA2437 IC: 579C-A2437	 element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 20 of 21



## 9.0 APPENDIX A: REFERENCE MODEL TEST REPORT

Attached is the test report (1C2205090028-19.BCG) from reference model FCC ID: BCGA2764 / IC: 579C-A2764, which includes referenced data results.

FCC ID: BCGA2437 IC: 579C-A2437	element	DATA REFERENCE REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090029-18.BCG	Test Dates: 05/30/2022 – 09/30/2022	EUT Type: Tablet Device	Page 21 of 21



## Element Washington DC LLC

18855 Adams Court, Morgan Hill, CA 95037 USA

Tel. 410.290.6652 / Fax 410.290.6654

<http://www.element.com>



## MEASUREMENT REPORT

### FCC PART 15.407 / ISED RSS-247 UNII 802.11a/n/ac/ax(SU)

**Applicant Name:**

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

**Date of Testing:**

05/30/2022-09/30/2022

**Test Site/Location:**

Element Washington DC LLC Morgan Hill, CA, USA

**Test Report Serial No.:**

1C2205090028-19.BCG

<b>FCC ID:</b>	<b>BCGA2764</b>
<b>IC:</b>	<b>579C-A2764</b>
<b>APPLICANT:</b>	<b>Apple Inc.</b>

**Application Type:**

Certification

**Model/HVIN:**

A2764

**EUT Type:**

Tablet Device

**Frequency Range:**

5180 – 5825MHz

**Modulation Type:**

OFDM

**FCC Classification:**

Unlicensed National Information Infrastructure (UNII)

**FCC Rule Part(s):**

Part 15 Subpart E (15.407)

**ISED Specification:**

RSS-247 Issue 2

**Test Procedure(s):**

ANSI C63.10-2013, KDB 789033 D02 v02r01

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 789033 D02 v02r01. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez

Executive Vice President



CERT #2041.02

FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 1 of 365

V 10.5 12/15/2021

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## T A B L E   O F   C O N T E N T S

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1.0	INTRODUCTION .....	7
1.1	Scope.....	7
1.2	Element Washington DC LLC Test Location.....	7
1.3	Test Facility / Accreditations.....	7
2.0	PRODUCT INFORMATION .....	8
2.1	Equipment Description .....	8
2.2	Device Capabilities.....	8
2.3	Antenna Description.....	11
2.4	Test Support Equipment.....	11
2.5	Test Configuration.....	11
2.6	Software and Firmware .....	12
2.7	EMI Suppression Device(s)/Modifications.....	12
3.0	DESCRIPTION OF TESTS .....	13
3.1	Evaluation Procedure.....	13
3.2	AC Line Conducted Emissions .....	13
3.3	Radiated Emissions.....	14
3.4	Environmental Conditions.....	14
4.0	ANTENNA REQUIREMENTS .....	15
5.0	MEASUREMENT UNCERTAINTY .....	16
6.0	TEST EQUIPMENT CALIBRATION DATA.....	17
7.0	TEST RESULTS .....	18
7.1	Summary.....	18
7.2	26dB & 99% Bandwidth Measurement – 802.11a/n/ac/ax(SU) .....	20
7.3	6dB & 99% Bandwidth Measurement – 802.11a/n/ac/ax(SU) .....	51
7.4	Conducted Output Power and Max EIRP Measurement – 802.11a/n/ac/ax(SU).....	60
7.5	Maximum Power Spectral Density – 802.11a/n/ac/ax(SU).....	97
7.6	Radiated Spurious Emissions – Above 1GHz .....	197
7.7	Radiated Spurious Emissions – Below 1GHz .....	354
7.8	AC Line-Conducted Emissions Measurement.....	359
8.0	CONCLUSION.....	365

FCC ID: BCGA2764 IC: 579C-A2764	 <b>element</b>		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device		Page 2 of 365

## MEASUREMENT REPORT

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				SDM					
				Antenna 5b		Antenna 4a		Antenna 5b		Antenna 4a		Summed	
				Max. Power (mW)	Max. Power (dBm)								
1	20	802.11a/n	5180 - 5240	87.902	19.44	87.297	19.41	50.119	17.00	49.204	16.92	99.083	19.96
2A		802.11a/n	5260 - 5320	89.125	19.50	89.125	19.50	49.204	16.92	49.317	16.93	98.401	19.93
2C		802.11a/n	5500 - 5720	88.512	19.47	89.125	19.50	49.204	16.92	48.529	16.86	97.724	19.90
3		802.11a/n	5745 - 5825	88.308	19.46	87.902	19.44	88.716	19.48	88.308	19.46	174.181	22.41
1	40	802.11n	5190 - 5230	84.723	19.28	85.310	19.31	85.901	19.34	85.507	19.32	171.396	22.34
2A		802.11n	5270 - 5310	83.946	19.24	85.114	19.30	84.140	19.25	88.512	19.47	172.584	22.37
2C		802.11n	5510 - 5710	89.125	19.50	89.125	19.50	89.125	19.50	88.105	19.45	176.198	22.46
3		802.11n	5755 - 5795	86.696	19.38	86.896	19.39	86.896	19.39	86.696	19.38	173.780	22.40
1	80	802.11ac	5210	17.660	12.47	17.298	12.38	17.338	12.39	16.788	12.25	34.119	15.33
2A		802.11ac	5290	32.285	15.09	32.961	15.18	30.061	14.78	30.761	14.88	60.814	17.84
2C		802.11ac	5530 - 5690	86.298	19.36	85.901	19.34	89.125	19.50	84.333	19.26	173.380	22.39
3		802.11ac	5775	78.705	18.96	77.446	18.89	77.983	18.92	76.913	18.86	154.882	21.90
1	160	802.11ac	5250	7.925	8.99	7.798	8.92	6.982	8.44	6.699	8.26	13.677	11.36
2C		802.11ac	5570	12.445	10.95	12.078	10.82	11.220	10.50	10.940	10.39	22.182	13.46
1	20	802.11ax (SU)	5180 - 5240	84.140	19.25	88.716	19.48	50.119	17.00	49.659	16.96	99.770	19.99
2A		802.11ax (SU)	5260 - 5320	85.507	19.32	89.125	19.50	48.753	16.88	50.119	17.00	98.855	19.95
2C		802.11ax (SU)	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.231	20.01
3		802.11ax (SU)	5745 - 5825	89.125	19.50	87.297	19.41	87.498	19.42	86.696	19.38	173.780	22.40
1	40	802.11ax (SU)	5190 - 5230	88.308	19.46	87.700	19.43	89.125	19.50	84.140	19.25	173.380	22.39
2A		802.11ax (SU)	5270 - 5310	84.723	19.28	88.512	19.47	87.700	19.43	86.497	19.37	174.181	22.41
2C		802.11ax (SU)	5510 - 5710	88.920	19.49	88.512	19.47	89.125	19.50	88.920	19.49	177.419	22.49
3		802.11ax (SU)	5755 - 5795	89.125	19.50	89.125	19.50	86.896	19.39	88.920	19.49	172.584	22.37
1	80	802.11ax (SU)	5210	15.740	11.97	15.031	11.77	14.521	11.62	14.093	11.49	28.642	14.57
2A		802.11ax (SU)	5290	28.184	14.50	27.164	14.34	27.925	14.46	26.730	14.27	54.702	17.38
2C		802.11ax (SU)	5530 - 5690	89.125	19.50	85.901	19.34	86.298	19.36	87.700	19.43	174.181	22.41
3		802.11ax (SU)	5775	62.661	17.97	61.802	17.91	63.096	18.00	59.156	17.72	122.180	20.87
1	160	802.11ax (SU)	5250	7.586	8.80	7.852	8.95	6.761	8.30	6.761	8.30	7.015	8.46
2C		802.11ax (SU)	5570	9.462	9.76	9.977	9.99	9.840	9.93	9.840	9.93	9.594	9.82

### FCC EUT Overview (Low Data Rate)

FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 3 of 365

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				SDM					
				Antenna 5b		Antenna 4a		Antenna 5b		Antenna 4a		Summed	
				Max. Power (mW)	Max. Power (dBm)								
1	20	802.11a/n	5180 - 5240	56.234	17.50	56.234	17.50	31.405	14.97	31.405	14.97	62.806	17.98
2A		802.11a/n	5260 - 5320	89.125	19.50	89.125	19.50	49.204	16.92	49.317	16.93	98.401	19.93
2C		802.11a/n	5500 - 5720	88.512	19.47	89.125	19.50	49.204	16.92	48.529	16.86	97.724	19.90
3		802.11a/n	5745 - 5825	88.308	19.46	87.902	19.44	88.716	19.48	88.308	19.46	174.181	22.41
1	40	802.11n	5190 - 5230	84.723	19.28	85.310	19.31	54.325	17.35	55.847	17.47	110.154	20.42
2A		802.11n	5270 - 5310	83.946	19.24	85.114	19.30	84.140	19.25	88.512	19.47	172.584	22.37
2C		802.11n	5510 - 5710	87.498	19.42	89.125	19.50	88.308	19.46	88.105	19.45	176.198	22.46
3		802.11n	5755 - 5795	86.696	19.38	86.896	19.39	86.896	19.39	86.696	19.38	173.780	22.40
1	80	802.11ac	5210	17.660	12.47	17.298	12.38	17.338	12.39	16.788	12.25	34.119	15.33
2A		802.11ac	5290	32.285	15.09	32.961	15.18	30.061	14.78	30.761	14.88	60.814	17.84
2C		802.11ac	5530 - 5690	86.298	19.36	85.901	19.34	89.125	19.50	84.333	19.26	173.380	22.39
3		802.11ac	5775	78.705	18.96	77.446	18.89	77.983	18.92	76.913	18.86	154.882	21.90
1	160	802.11ac	5250	7.925	8.99	7.798	8.92	6.982	8.44	6.699	8.26	13.677	11.36
1		802.11ax (SU)	5180 - 5240	55.590	17.45	54.702	17.38	31.550	14.99	31.405	14.97	62.951	17.99
2A		802.11ax (SU)	5260 - 5320	85.507	19.32	89.125	19.50	48.753	16.88	50.119	17.00	98.855	19.95
2C		802.11ax (SU)	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.231	20.01
3	40	802.11ax (SU)	5745 - 5825	89.125	19.50	87.297	19.41	87.498	19.42	86.696	19.38	173.780	22.40
1		802.11ax (SU)	5190 - 5230	88.308	19.46	87.700	19.43	55.976	17.48	55.976	17.48	111.944	20.49
2A		802.11ax (SU)	5270 - 5310	84.723	19.28	88.512	19.47	87.700	19.43	86.497	19.37	174.181	22.41
2C		802.11ax (SU)	5510 - 5710	88.920	19.49	88.512	19.47	89.125	19.50	88.920	19.49	177.419	22.49
3	80	802.11ax (SU)	5755 - 5795	89.125	19.50	89.125	19.50	86.896	19.39	88.920	19.49	172.584	22.37
1		802.11ax (SU)	5210	15.740	11.97	15.031	11.77	14.521	11.62	14.093	11.49	28.642	14.57
2A		802.11ax (SU)	5290	28.184	14.50	27.164	14.34	27.925	14.46	26.730	14.27	54.702	17.38
2C		802.11ax (SU)	5530 - 5690	89.125	19.50	85.901	19.34	86.298	19.36	87.700	19.43	174.181	22.41
3	160	802.11ax (SU)	5775	62.661	17.97	61.802	17.91	63.096	18.00	59.156	17.72	122.180	20.87
1		802.11ax (SU)	5250	7.586	8.80	7.852	8.95	6.761	8.30	7.015	8.46	13.772	11.39
2C		802.11ax (SU)	5570	9.462	9.76	9.977	9.99	9.840	9.93	9.594	9.82	19.454	12.89

### ISED EUT Overview (Low Data Rate)

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				SDM					
				Antenna 5b		Antenna 4a		Antenna 5b		Antenna 4a		Summed	
				Max. Power (mW)	Max. Power (dBm)								
1	20	802.11a/n	5180 - 5240	56.234	17.50	56.234	17.50	31.405	14.97	31.405	14.97	62.806	17.98
2A		802.11a/n	5260 - 5320	89.125	19.50	89.125	19.50	49.204	16.92	49.317	16.93	98.401	19.93
2C		802.11a/n	5500 - 5720	88.512	19.47	89.125	19.50	49.204	16.92	48.529	16.86	97.724	19.90
3		802.11a/n	5745 - 5825	88.308	19.46	87.902	19.44	88.716	19.48	88.308	19.46	174.181	22.41
1	40	802.11n	5190 - 5230	84.723	19.28	85.310	19.31	54.325	17.35	55.847	17.47	110.154	20.42
2A		802.11n	5270 - 5310	83.946	19.24	85.114	19.30	84.140	19.25	88.512	19.47	172.584	22.37
2C		802.11n	5510 - 5710	87.498	19.42	89.125	19.50	88.308	19.46	88.105	19.45	176.198	22.46
3		802.11n	5755 - 5795	86.696	19.38	86.896	19.39	86.896	19.39	86.696	19.38	173.780	22.40
1	80	802.11ac	5210	17.660	12.47	17.298	12.38	17.338	12.39	16.788	12.25	34.119	15.33
2A		802.11ac	5290	32.285	15.09	32.961	15.18	30.061	14.78	30.761	14.88	60.814	17.84
2C		802.11ac	5530 - 5690	86.298	19.36	85.901	19.34	89.125	19.50	84.333	19.26	173.380	22.39
3		802.11ac	5775	78.705	18.96	77.446	18.89	77.983	18.92	76.913	18.86	154.882	21.90
1	160	802.11ac	5250	7.925	8.99	7.798	8.92	6.982	8.44	6.699	8.26	13.677	11.36
1		802.11ax (SU)	5180 - 5240	55.590	17.45	54.702	17.38	31.550	14.99	31.405	14.97	62.951	17.99
2A		802.11ax (SU)	5260 - 5320	85.507	19.32	89.125	19.50	48.753	16.88	50.119	17.00	98.855	19.95
2C		802.11ax (SU)	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.231	20.01
3	40	802.11ax (SU)	5745 - 5825	89.125	19.50	87.297	19.41	87.498	19.42	86.696	19.38	173.780	22.40
1		802.11ax (SU)	5190 - 5230	88.308	19.46	87.700	19.43	55.976	17.48	55.976	17.48	111.944	20.49
2A		802.11ax (SU)	5270 - 5310	84.723	19.28	88.512	19.47	87.700	19.43	86.497	19.37	174.181	22.41
2C		802.11ax (SU)	5510 - 5710	88.920	19.49	88.512	19.47	89.125	19.50	88.920	19.49	177.419	22.49
3	80	802.11ax (SU)	5755 - 5795	89.125	19.50	89.125	19.50	86.896	19.39	88.920	19.49	172.584	22.37
1		802.11ax (SU)	5210	15.740	11.97	15.031	11.77	14.521	11.62	14.093	11.49	28.642	14.57
2A		802.11ax (SU)	5290	28.184	14.50	27.164	14.34	27.925	14.46	26.730	14.27	54.702	17.38
2C		802.11ax (SU)	5530 - 5690	89.125	19.50	85.901	19.34	86.298	19.36	87.700	19.43	174.181	22.41
3	160	802.11ax (SU)	5775	62.661	17.97	61.802	17.91	63.096	18.00	59.156	17.72	122.180	20.87
1		802.11ax (SU)	5250	7.586	8.80	7.852	8.95	6.761	8.30	6.761	8.30	7.015	8.46
2C		802.11ax (SU)	5570	9.462	9.76	9.977	9.99	9.840	9.93	9.594	9.82	9.840	9.82

### FCC EUT Overview (Mid Data Rate)

FCC ID: BCGA2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 4 of 365

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UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				SDM					
				Antenna 5b		Antenna 4a		Antenna 5b		Antenna 4a		Summed	
				Max. Power (mW)	Max. Power (dBm)								
1	20	802.11a/n	5180 - 5240	56.105	17.49	56.234	17.50	31.189	14.94	31.550	14.99	62.661	17.97
2A		802.11a/n	5260 - 5320	88.716	19.48	88.512	19.47	50.003	16.99	50.003	16.99	100.000	20.00
2C		802.11a/n	5500 - 5720	88.512	19.47	88.512	19.47	49.888	16.98	50.119	17.00	99.083	19.96
3		802.11a/n	5745 - 5825	88.308	19.46	88.920	19.49	88.512	19.47	89.125	19.50	177.011	22.48
1	40	802.11n	5190 - 5230	85.901	19.34	87.902	19.44	56.105	17.49	54.576	17.37	110.662	20.44
2A		802.11n	5270 - 5310	86.497	19.37	88.920	19.49	88.920	19.49	86.696	19.38	175.792	22.45
2C		802.11n	5510 - 5710	87.902	19.44	87.498	19.42	87.096	19.40	84.528	19.27	171.791	22.35
3		802.11n	5755 - 5795	84.723	19.28	85.704	19.33	86.298	19.36	88.716	19.48	174.181	22.41
1	80	802.11ac	5210	15.812	11.99	15.171	11.81	13.397	11.27	13.428	11.28	26.853	14.29
2A		802.11ac	5290	27.040	14.32	27.227	14.35	27.102	14.33	26.853	14.29	53.951	17.32
2C		802.11ac	5530 - 5690	84.333	19.26	87.297	19.41	85.114	19.30	83.176	19.20	168.267	22.26
3		802.11ac	5775	69.502	18.42	66.988	18.26	70.307	18.47	66.069	18.20	136.458	21.35
1	160	802.11ac	5250	7.534	8.77	7.568	8.79	6.776	8.31	6.839	8.35	13.614	11.34
2C		802.11ac	5570	10.765	10.32	11.066	10.44	9.616	9.83	9.397	9.73	19.011	12.79
1	20	802.11ax (SU)	5180 - 5240	56.234	17.50	56.105	17.49	31.550	14.99	31.477	14.98	62.806	17.98
2A		802.11ax (SU)	5260 - 5320	87.297	19.41	88.920	19.49	50.003	16.99	50.119	17.00	100.231	20.01
2C		802.11ax (SU)	5500 - 5720	86.497	19.37	89.125	19.50	50.119	17.00	50.119	17.00	99.083	19.96
3		802.11ax (SU)	5745 - 5825	88.920	19.49	88.716	19.48	89.125	19.50	86.512	19.47	177.628	22.50
1	40	802.11ax (SU)	5190 - 5230	84.140	19.25	84.918	19.29	54.576	17.37	56.234	17.50	110.917	20.45
2A		802.11ax (SU)	5270 - 5310	86.298	19.36	84.333	19.26	88.512	19.47	89.125	19.50	177.828	22.50
2C		802.11ax (SU)	5510 - 5710	85.114	19.30	87.498	19.42	88.716	19.48	85.310	19.31	174.181	22.41
3		802.11ax (SU)	5755 - 5795	87.297	19.41	87.700	19.43	89.125	19.50	86.896	19.39	176.198	22.46
1	80	802.11ax (SU)	5210	13.996	11.46	13.614	11.34	12.474	10.96	12.331	10.91	24.831	13.95
2A		802.11ax (SU)	5290	22.336	13.49	21.429	13.31	22.336	13.49	22.131	13.45	44.463	16.48
2C		802.11ax (SU)	5530 - 5690	88.512	19.47	84.140	19.25	84.918	19.29	87.096	19.40	172.187	22.36
3		802.11ax (SU)	5775	42.462	16.28	44.259	16.46	43.251	16.36	44.566	16.49	87.902	19.44
1	160	802.11ax (SU)	5250	7.870	8.96	7.709	8.87	7.031	8.47	7.031	8.47	6.982	8.44
2C		802.11ax (SU)	5570	8.670	9.38	8.570	9.33	7.534	8.77	7.534	8.77	7.516	8.76

### ISED EUT Overview (Mid Data Rate)

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				SDM					
				Antenna 5b		Antenna 4a		Antenna 5b		Antenna 4a		Summed	
				Max. Power (mW)	Max. Power (dBm)								
1	20	802.11a/n	5180 - 5240	87.096	19.40	88.920	19.49	50.119	17.00	48.529	16.86	98.175	19.92
2A		802.11a/n	5260 - 5320	88.716	19.48	88.920	19.49	49.431	16.94	50.119	17.00	99.312	19.97
2C		802.11a/n	5500 - 5720	88.105	19.45	87.498	19.42	50.119	17.00	49.317	16.93	99.083	19.96
3		802.11a/n	5745 - 5825	87.096	19.40	88.920	19.49	85.901	19.34	88.920	19.49	174.985	22.43
1	40	802.11n	5190 - 5230	88.308	19.46	85.507	19.32	89.125	19.50	84.528	19.27	173.780	22.40
2A		802.11n	5270 - 5310	87.096	19.40	86.099	19.35	87.498	19.42	84.333	19.26	171.791	22.35
2C		802.11n	5510 - 5710	88.716	19.48	87.297	19.41	87.902	19.44	87.297	19.41	175.388	22.44
3		802.11n	5755 - 5795	87.096	19.40	88.308	19.46	84.723	19.28	88.920	19.49	172.982	22.38
1	80	802.11ac	5210	13.804	11.40	13.836	11.41	12.503	10.97	12.589	11.00	25.119	14.00
2A		802.11ac	5290	21.878	13.40	22.080	13.44	21.380	13.30	21.878	13.40	43.251	16.36
2C		802.11ac	5530 - 5690	86.099	19.35	87.498	19.42	85.507	19.32	84.140	19.25	169.824	22.30
3		802.11ac	5775	55.976	17.48	52.481	17.20	48.084	16.82	49.091	16.91	97.275	19.88
1	160	802.11ac	5250	6.792	8.32	6.918	8.40	6.310	8.00	5.970	7.76	12.274	10.89
2C		802.11ac	5570	8.913	9.50	8.610	9.35	7.943	9.00	7.516	8.76	15.453	11.89
1	20	802.11ax (SU)	5180 - 5240	87.297	19.41	85.704	19.33	49.774	16.97	49.774	16.97	99.083	19.96
2A		802.11ax (SU)	5260 - 5320	87.297	19.41	88.512	19.47	49.888	16.98	49.431	16.94	99.312	19.97
2C		802.11ax (SU)	5500 - 5720	86.696	19.38	87.902	19.44	49.659	16.96	48.641	16.87	97.724	19.90
3		802.11ax (SU)	5745 - 5825	88.105	19.45	87.096	19.40	89.125	19.50	87.700	19.43	174.985	22.43
1	40	802.11ax (SU)	5190 - 5230	87.096	19.40	86.099	19.35	84.723	19.28	85.114	19.30	169.824	22.30
2A		802.11ax (SU)	5270 - 5310	86.497	19.37	88.512	19.47	84.140	19.25	87.297	19.41	171.396	22.34
2C		802.11ax (SU)	5510 - 5710	87.700	19.43	88.920	19.49	88.716	19.48	88.512	19.47	177.419	22.49
3		802.11ax (SU)	5755 - 5795	88.716	19.48	87.498	19.42	86.099	19.35	86.896	19.39	172.982	22.38
1	80	802.11ax (SU)	5210	13.032	11.15	12.647	11.02	12.388	10.93	12.445	10.95	24.831	13.95
2A		802.11ax (SU)	5290	19.953	13.00	19.953	13.00	19.724	12.95	19.320	12.86	39.084	15.92
2C	160	802.11ax (SU)	5530 - 5690	88.920	19.49	87.297	19.41	88.308	19.46	85.310	19.31	173.780	22.40
3		802.11ax (SU)	5775	38.548	15.86	39.084	15.92	39.628	15.98	38.282	15.83	77.983	18.92
1	160	802.11ax (SU)	5250	7.079	8.50	6.887	8.38	5.998	7.78	6.053	7.82	12.050	10.81
2C		802.11ax (SU)	5570	6.950	8.42	7.079	8.50	6.902	8.39	7.015	8.46	13.932	11.44

### FCC EUT Overview (High Data Rate)

FCC ID: BCGA2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 5 of 365

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				SDM				
				Antenna 5b		Antenna 4a		Antenna 5b		Antenna 4a		Summed
				Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)						
1	20	802.11a/n	5180 - 5240	56.105	17.49	56.234	17.50	30.974	14.91	31.333	14.96	62.230
2A		802.11a/n	5260 - 5320	88.716	19.48	88.920	19.49	49.431	16.94	50.119	17.00	99.312
2C		802.11a/n	5500 - 5720	88.105	19.45	87.498	19.42	50.119	17.00	49.317	16.93	99.083
3		802.11a/n	5745 - 5825	87.096	19.40	88.920	19.49	85.901	19.34	88.920	19.49	174.985
1	40	802.11n	5190 - 5230	88.308	19.46	85.507	19.32	54.828	17.39	55.976	17.48	110.917
2A		802.11n	5270 - 5310	87.096	19.40	86.099	19.35	87.498	19.42	84.333	19.26	171.791
2C		802.11n	5510 - 5710	85.704	19.33	85.704	19.33	87.902	19.44	87.297	19.41	175.388
3		802.11n	5755 - 5795	87.096	19.40	88.308	19.46	84.723	19.28	88.920	19.49	172.982
1	80	802.11ac	5210	13.804	11.40	13.836	11.41	12.503	10.97	12.589	11.00	25.119
2A		802.11ac	5290	21.878	13.40	22.080	13.44	21.380	13.30	21.878	13.40	43.251
2C		802.11ac	5530 - 5690	86.099	19.35	87.498	19.42	85.507	19.32	84.140	19.25	169.824
3		802.11ac	5775	55.976	17.48	52.481	17.20	48.084	16.82	49.091	16.91	97.275
1	160	802.11ac	5250	6.792	8.32	6.918	8.40	6.310	8.00	5.970	7.76	12.274
2C		802.11ac	5570	8.913	9.50	8.610	9.35	7.943	9.00	7.516	8.76	15.453
1	20	802.11ax (SU)	5180 - 5240	54.954	17.40	56.105	17.49	31.550	14.99	31.477	14.98	63.096
2A		802.11ax (SU)	5260 - 5320	87.297	19.41	88.512	19.47	49.888	16.98	49.431	16.94	99.312
2C		802.11ax (SU)	5500 - 5720	86.696	19.38	87.902	19.44	49.659	16.96	48.641	16.87	97.724
3		802.11ax (SU)	5745 - 5825	88.105	19.45	87.096	19.40	89.125	19.50	87.700	19.43	174.985
1	40	802.11ax (SU)	5190 - 5230	87.096	19.40	86.099	19.35	54.576	17.37	55.335	17.43	109.901
2A		802.11ax (SU)	5270 - 5310	86.497	19.37	88.512	19.47	84.140	19.25	87.297	19.41	171.396
2C		802.11ax (SU)	5510 - 5710	84.140	19.25	86.099	19.35	88.716	19.48	88.512	19.47	177.419
3		802.11ax (SU)	5755 - 5795	88.716	19.48	87.498	19.42	86.099	19.35	86.896	19.39	172.982
1	80	802.11ax (SU)	5210	13.032	11.15	12.647	11.02	12.388	10.93	12.445	10.95	24.831
2A		802.11ax (SU)	5290	19.953	13.00	19.953	13.00	19.724	12.95	19.320	12.86	39.084
2C		802.11ax (SU)	5530 - 5690	88.920	19.49	87.297	19.41	88.308	19.46	85.310	19.31	173.780
3		802.11ax (SU)	5775	38.548	15.86	39.084	15.92	39.628	15.98	38.282	15.83	77.983
1	160	802.11ax (SU)	5250	7.079	8.50	6.887	8.38	5.998	7.78	5.998	7.78	6.053
2C		802.11ax (SU)	5570	6.950	8.42	7.079	8.50	6.902	8.39	6.902	8.39	7.015

**ISED EUT Overview (High Data Rate)**

FCC ID: BCGA2764	
IC: 579C-A2764	
Test Report S/N:	Test Dates: 05/30/2022-09/30/2022
1C2205090028-19.BCG	EUT Type: Tablet Device

**MEASUREMENT REPORT (CERTIFICATION)**
**Approved by:**  
 Technical Manager

Page 6 of 365

V 10.5 12/15/2021

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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 Element Washington DC LLC Test Location

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

### 1.3 Test Facility / Accreditations

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

- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- Element Washington DC LLC facility is a registered (22831) test laboratory with the site description on file with ISED.

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 7 of 365

## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Tablet Device FCC ID: BCGA2764** and **IC: 579C-A2764**. The test data contained in this report pertains only to the emissions due to the EUT's UNII 802.11a/n/ac/ax(SU) transmitter.

**Test Device Serial No.:** DLX219300191M9C1K, Q26GK4Q9C7, YX4KGQGJD4, F662N44RVW

### 2.2 Device Capabilities

This device contains the following capabilities:

802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, 802.11a/ax WIFI 6E, Bluetooth (1x, EDR, LE1M, LE2M, HDR4, HDR8), WPT, NB UNII (1x, HDR4, HDR8)

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
36	5180	52	5260	100	5500	149	5745
:	:	:	:	:	:	:	:
42	5210	56	5280	116	5580	157	5785
:	:	:	:	:	:	:	:
48	5240	64	5320	144	5720	165	5825

Table 2-1. 802.11a / 802.11n / 802.11ac / 802.11ax (20MHz) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
38	5190	54	5270	102	5510	151	5755
:	:	:	:	:	:	:	:
46	5230	62	5310	110	5550	159	5795
				142	5710		

Table 2-2. 802.11n / 802.11ac / 802.11ax (40MHz BW) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
42	5210	58	5290	106	5530	155	5775
				138	5690		

Table 2-3. 802.11ac / 802.11ax (80MHz BW) Frequency / Channel Operations

Band 1		Band 2A		Band 2C	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
50	5250	50	5250	114	5570

Table 2-4. 802.11ac / 802.11ax (160MHz BW) Frequency / Channel Operations

FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 8 of 365 V 10.5 12/15/2021

**Notes:**

1. 5GHz NII operation is possible in 20MHz, 40MHz, 80MHz and 160MHz channel bandwidths. 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 B)2)b) KDB 789033 D02 v02r01 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 [%]		
		Antenna 5b	Antenna 4a	MIMO
5GHz	a (Low Rate)	97.3	97.8	97.6
	a (Mid Rate)	96.0	95.9	96.3
	a (High Rate)	89.6	90.7	91.7
	n (HT20) (Low Rate)	96.8	96.9	94.6
	n (HT20) (Mid Rate)	94.1	94.4	90.2
	n (HT20) (High Rate)	92.1	91.7	86.1
	ax(SU) (HT20 Low Rate)	96.3	95.9	95.9
	ax(SU) (HT20 Mid Rate)	93.2	93.2	93.3
	ax(SU) (HT20 High Rate)	86.9	87.1	86.7
	n (HT40 Low Rate)	94.0	94.2	90.2
	n (HT40 Mid Rate)	90.0	89.8	85.0
	n (HT40 High Rate)	86.9	86.7	81.7
	ax(SU) (HT40 Low Rate)	93.6	93.7	93.5
	ax(SU) (HT40 Mid Rate)	89.7	89.8	90.1
	ax(SU) (HT40 High Rate)	82.9	82.9	83.3
	ac (HT80 Low Rate)	89.2	88.9	83.4
	ac (HT80 Mid Rate)	83.3	84.1	79.1
	ac (HT80 High Rate)	78.0	77.7	74.8
	ax(SU) (HT80 Low Rate)	87.3	89.0	88.4
	ax(SU) (HT80 Mid Rate)	83.9	83.8	83.5
	ax(SU) (HT80 High Rate)	78.7	78.2	78.2
	ac (HT160 Low Rate)	85.1	85.0	79.9
	ac (HT160 Mid Rate)	79.3	79.0	76.2
	ac (HT160 High Rate)	73.8	73.9	75.1
	ax(SU) (HT160 Low Rate)	84.3	85.3	84.9
	ax(SU) (HT160 Mid Rate)	80.9	81.6	81.6
	ax(SU) (HT160 High Rate)	77.9	78.0	76.2

**Table 2-5. Measured Duty Cycles**

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 9 of 365



2. The device employs MIMO technology. Below are the possible configurations.

WiFi Configurations		SISO		CDD		SDM		STBC	
		Antenna 5b	Antenna 4a						
5GHz	11a	✓	✓	✓	✓	✗	✗	✗	✗
	11n (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11n (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ac (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ac (160MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (160MHz)	✓	✓	✓	✓	✓	✓	✓	✓

Table 2-6. WIFI Configurations

✓ = Support ; ✗ = NOT Support

**SISO** = Single Input Single Output

**SDM** = Spatial Diversity Multiplexing – MIMO function

**CDD** = Cyclic Delay Diversity -- 2Tx Function

**STBC** = Space Time Block Coding – 2Tx Function

Data Rate(s) Tested: 6, 9, 12, 18, 24, 36, 48, 54Mbps (802.11a)  
6.5/7.2, 13/14.4, 19.5/21.7, 26/28.9, 39/43.3, 52/57.8, 58.5/65, 65/72.2 (n – 20MHz)  
13.5/15, 27/30, 40.5/45, 54/60, 81/90, 108/120, 121.5/135, 135/150 (n – 40MHz BW)  
29.3/32.5, 58.5/65, 87.8/97.5, 117/130, 175.5/195, 234/260, 263.3/292.5, 292.5/325, 351/390, 390/433.3 (ac – 80MHz BW)  
58/65, 117/130, 175.5/195, 234/260, 351/390, 468/520, 526.5/585, 585/650, 702/780, 780/866.7 (ac 160MHz)  
13/14.4, 26.28.9, 39/43.3, 52/57.8, 78/86.7, 104/115.6, 117/130, 130/144.4Mbps (MIMO n/ac – 20MHz)  
156/173Mbps (MIMO ac – 20MHz)  
27/30, 54/60, 81/90, 108/120, 162/180, 216/240, 243,270, 270/300Mbps (MIMO n/ac – 40MHz) 324/360, 360/400Mbps (MIMO ac – 40MHz)  
58.5/65, 117/130, 175.5/195, 234/260, 351/780, 936/1040, 1053/1170, 1170/1300, 1402/1560, 1560/1733.4Mbps (MIMO ac – 80MHz)  
116/130, 234/260, 351/390, 468/520, 351/390, 468/520, 526.5/585, 585/650, 702/780, 780/866.7 (MIMO ac – 160MHz)  
8/8.6, 16/17.2, 24/25.8, 33/34.4, 49/51.6, 65/68.8, 73/77.4, 81/86.0, 98/103.2, 108/114.7, 122/129.0, 135/143.4 (ax – 20MHz)  
16/17.2, 33/34.4, 49/51.6, 65/68.8, 98/103.2, 130/137.6, 146/154.9, 163/172.1, 195/206.5, 217/229.4, 244/258.1, 271/286.8 (ax – 40MHz BW)  
34/36.0, 68/72.1, 102/108.1, 136/144.1, 204/216.2, 272/288.2, 306/324.4, 340/360.3, 408/432.4, 453/480.4, 510/540.4, 567/600.5 (ax – 80MHz BW)  
136.2/144.2, 2721/288.2, 408.2/432.4, 544.4, 576.4/816.6864.8, 1088.8/1153, 1225/1297, 1361.2/1441.2, 1633.4/1729.4, 1814.8/1921.6, 2041.6/2161.8, 2268.6/2402Mbps, (MIMO ax – 160MHz)

FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 10 of 365 V 10.5 12/15/2021

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## 2.3 Antenna Description

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

Frequency [GHz]	Antenna Gain (dBi)	
	Antenna 5b	Antenna 4a
5.150 – 5.250	1.4	0.4
5.250 – 5.350	1.3	-0.6
5.470 – 5.725	1.5	-2.0
5.725 – 5.850	2.1	-1.3

**Table 2-7. Highest Antenna Gain**

## 2.4 Test Support Equipment

Test Support Equipment List				
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: Spartan	S/N: 000MKTR02U	
3	USB-C Cable w/ AC Adapter	Model: A246 Model: A2305	S/N: N/A S/N: N/A	
4	Apple Pencil	Model: N/A	S/N: GQXGSXBJKM9	
5	DC Power Supply	Model: KPS3010D	S/N: N/A	

**Table 2-8. Test Support Equipment List**

## 2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013 and KDB 789033 D02 v02r01. 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, and 7.5 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.

FCC ID: BCGA2764 IC: 579C-A2764	element		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device		

V 10.5 12/15/2021

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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 HT20/40, 11ax(SU) HE20/40/80/160 and acVHT80/160 2TX CDD/SDM mode test data provided in this report covers 802.11n HT20/40, 11ax(SU) HE20/40/80/160 and 802.11ac VHT80/VHT160 STBC mode.

802.11ac VHT20 and VHT40 mode are different from 802.11n HT20 and HT40 only in control messages and have the same power settings.

The data rates have been classified into three different groups; low data rate, middle data rate, and high data rate. All three groups of data rate have been investigated and only the worst case data rate per group is reported. The worst case data rate for each group per mode are as follows:

- 802.11a:
  - Low Data Rate: 12Mbps
  - Mid Data Rate: 24Mbps
  - High Data Rate: 54Mbps
- 802.11n HT20/40:
  - Low Data Rate: MCS2/MCS10 (SISO/CDD/SDM)
  - Mid Data Rate: MCS4/MCS12(SISO/CDD/SDM)
  - High Data Rate: MCS7/MCS15 (SISO/CDD/SDM)
- 802.11ac VHT80/160:
  - Low Data Rate: MCS2(SISO/CDD/SDM)
  - Mid Data Rate: MCS4(SISO/CDD/SDM)
  - High Data Rate: MCS9(SISO/CDD/SDM)
- 802.11ax(SU) HE20/HE40/HE80/HE160
  - Low Data Rate: MCS2
  - Mid Data Rate: MCS4
  - High Data Rate: MCS11

**Notes:**

For 802.11ax-RU test result, see separate UNII 802.11ax (OFDMA) report, 1C2205090028-20.BCG

## 2.6 Software and Firmware

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

## 2.7 EMI Suppression Device(s)/Modifications

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

FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 12 of 365

## 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 789033 D02 v02r01 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 ground plane. Power cables for support equipment were routed down to the second LISN while ensuring that that 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 7.8. 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.

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 13 of 365

### 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 used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

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).

FCC ID: BCGA2764 IC: 579C-A2764	 element		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device		Page 14 of 365

## 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 connection to an external antenna.

### Conclusion:

The EUT complies with the requirement of §15.203.

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 15 of 365

## 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	1.77
Line Conducted Disturbance	2.70
Radiated Disturbance (<30MHz)	4.38
Radiated Disturbance (30MHz - 1GHz)	4.75
Radiated Disturbance (1 - 18GHz)	5.20
Radiated Disturbance (>18GHz)	4.72

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 16 of 365

## 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	6/10/2022	Annual	6/10/2023	MY49430244
Agilent Technologies	N9020A	MXA Signal Analyzer	4/26/2022	Annual	4/26/2023	MY56470202
Anritsu	ML2496A	Power Meter	11/29/2021	Annual	11/29/2022	1840005
Anritsu	MA2411B	Pulse Power Sensor	11/30/2021	Annual	11/30/2022	1726261
Anritsu	MA2411B	Pulse Power Sensor	11/30/2021	Annual	11/30/2022	1726262
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	1/19/2022	Annual	1/19/2023	T058701-02
Com-Power Corporation	LIN-120A	Line Impedance Stabilization Network (LISN)	3/7/2022	Annual	3/7/2023	241296
ETS-Lindgren	3142F	Biconilog Antenna (26-6000MHz)	10/21/2021	Annual	10/21/2022	208204
ETS-Lindgren	3117	Double Ridged Guide Horn Antenna (1-18GHz)	10/25/2021	Annual	10/25/2022	227597
Keysight Technology	N9040B	UXA Signal Analyzer	2/8/2022	Annual	2/8/2023	MY57212015
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz-6GHz)	1/6/2022	Annual	1/6/2023	102328
Rohde & Schwarz	ESW26	EMI Test Receiver	5/19/2022	Annual	5/19/2023	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	12/2/2021	Annual	12/2/2022	101570
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	3/4/2022	Annual	3/4/2023	101619
Rohde & Schwarz	FSVA3044	Signal Analyzer (up to 44 GHz)	5/12/2022	Annual	5/12/2023	101098
Rohde & Schwarz	HFH2-ZZ	Loop Antenna	4/3/2022	Annual	4/3/2023	100546
Rohde & Schwarz	TC-TA18	Cross-Polarized Antenna 400MHz-18GHz	1/25/2022	Annual	1/25/2023	101063
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz-18GHz)	1/6/2022	Annual	1/6/2023	101639
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz-40GHz)	4/18/2022	Annual	4/18/2023	100050

**Table 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.

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 17 of 365

## 7.0 TEST RESULTS

### 7.1 Summary

Company Name: Apple Inc.  
 FCC ID: BCGA2764  
 IC: 579C-A2764  
 FCC Classification: Unlicensed National Information Infrastructure (UNII)

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407	RSS-Gen [6.7]	26dB Bandwidth	N/A	CONDUCTED	N/A	Section 7.2
15.407(e)	RSS-Gen [6.7]	6dB Bandwidth	>500kHz(5725-5850MHz)		PASS	Section 7.3
2.1049	RSS-Gen [6.7]	Occupied Bandwidth	N/A		PASS	Section 7.2, Section 7.3
15.407 (a.1.iv), (a.2), (a.3)	RSS-247 [6.2]	Maximum Conducted Output Power	Maximum conducted powers must meet the limits detailed in 15.407 (a) (RSS-247 [6.2])		PASS	Section 7.4
15.407 (a.1.iv), (a.2), (a.3)	RSS-247 [6.2]	Maximum Power Spectral Density	Maximum power spectral density must meet the limits detailed in 15.407 (a) (RSS-247 [6.2])		PASS	Section 7.5
15.407(h)	RSS-247 [6.3]	Dynamic Frequency Selection	See DFS Test Report		PASS	See DFS Test Report (1C22050900 28-18.BCG)
15.407(b.1), (2), (3), (4)	RSS-247 [6.2]	Undesirable Emissions	Undesirable emissions must meet the limits detailed in 15.407(b) (RSS-247 [6.2])	RADIATED	PASS	Section 7.6
15.205, 15.407(b.1), (4),	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])		PASS	Section 7.6, 7.7
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 (RSS-Gen [8.8]) limits	LINE CONDUCTED	PASS	Section 7.8

**Table 7-1. Summary of Test Results**

FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 18 of 365

**Notes:**

- 1) All channels, modes, and modulations/data rates were investigated among all UNII bands. 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 Element "UNII Automation," Version 7.0.
- 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 Element "Chamber Automation," Version 1.3.1.
- 6) Per RSS-247 Section 6.2.3, transmission on channels which overlap the 5600-5650 MHz is prohibited. This device operates under these frequencies only under the control of a certified master device and does not support active scanning on these channels. This device does not transmit any beacons or initiate any transmissions in UNII Bands 2A or 2C.

FCC ID: BCGA2764 IC: 579C-A2764	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 19 of 365

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## 7.2 26dB & 99% Bandwidth Measurement – 802.11a/n/ac/ax(SU) §2.1049; §15.407; RSS-Gen [6.7]

### Test Overview and Limit

The bandwidth at 26dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2013 and KDB 789033 D02 v02r01, and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

***The 26dB bandwidth is used to determine the conducted power limits.***

### Test Procedure Used

ANSI C63.10-2013 – Section 12.4  
KDB 789033 D02 v02r01 – Section C

### Test Settings

1. The signal analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to  $X = 26$ . The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth
3. VBW  $\geq 3 \times$  RBW
4. Detector = Peak
5. Trace mode = max hold

### Test Setup

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



**Figure 7-1. Test Instrument & Measurement Setup**

### Test Notes

1. All antenna configurations and data rates were investigated and only the worst case are reported.
2. The data rates have been classified into three different groups; low data rate, middle data rate, and high data rate. All three data rate groups of data rate have been investigated and only the worst case data rate per group is reported.
3. Low, mid, and high channels were tested and tabular data has been reported. Only mid channel bandwidth plots have been reported.

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 20 of 365



## Antenna 5b 26dB & 99% Bandwidth Measurements

Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	19.5/21.7 (MCS2)	17.77
	5200	40	n (20MHz)	19.5/21.7 (MCS2)	17.72
	5240	48	n (20MHz)	19.5/21.7 (MCS2)	17.69
	5180	36	ax (SU) (20MHz)	24/25.8 (MCS2)	19.15
	5200	40	ax (SU) (20MHz)	24/25.8 (MCS2)	19.04
	5240	48	ax (SU) (20MHz)	24/25.8 (MCS2)	19.07
	5190	38	n (40MHz)	40.5/45 (MCS2)	36.51
	5230	46	n (40MHz)	40.5/45 (MCS2)	36.25
	5190	38	ax (SU) (40MHz)	49/51.6 (MCS2)	38.09
	5230	46	ax (SU) (40MHz)	49/51.6 (MCS2)	37.93
	5210	42	ac (80MHz)	87.8/97.5 (MCS2)	75.57
	5210	42	ax (SU) (80MHz)	102/108.1 (MCS2)	77.23
Band 1/2	5250	50	ac (160MHz)	175.5/195 (MCS2)	154.52
	5250	50	ax (SU) (160MHz)	204.2/216.2 (MCS2)	156.44
Band 2A	5260	52	n (20MHz)	19.5/21.7 (MCS2)	17.73
	5280	56	n (20MHz)	19.5/21.7 (MCS2)	17.69
	5320	64	n (20MHz)	19.5/21.7 (MCS2)	17.78
	5260	52	ax (SU) (20MHz)	24/25.8 (MCS2)	19.00
	5280	56	ax (SU) (20MHz)	24/25.8 (MCS2)	19.02
	5320	64	ax (SU) (20MHz)	24/25.8 (MCS2)	19.08
	5270	54	n (40MHz)	40.5/45 (MCS2)	36.36
	5310	62	n (40MHz)	40.5/45 (MCS2)	36.49
	5270	54	ax (SU) (40MHz)	49/51.6 (MCS2)	37.95
	5310	62	ax (SU) (40MHz)	49/51.6 (MCS2)	38.08
	5290	58	ac (80MHz)	87.8/97.5 (MCS2)	75.60
	5290	58	ax (SU) (80MHz)	102/108.1 (MCS2)	77.26
Band 2C	5500	100	n (20MHz)	19.5/21.7 (MCS2)	17.80
	5580	116	n (20MHz)	19.5/21.7 (MCS2)	17.74
	5720	144	n (20MHz)	19.5/21.7 (MCS2)	17.67
	5500	100	ax (SU) (20MHz)	24/25.8 (MCS2)	19.05
	5580	116	ax (SU) (20MHz)	24/25.8 (MCS2)	18.99
	5600	120	ax (SU) (20MHz)	24/25.8 (MCS2)	19.02
	5510	102	n (40MHz)	40.5/45 (MCS2)	36.40
	5550	110	n (40MHz)	40.5/45 (MCS2)	36.35
	5710	142	n (40MHz)	40.5/45 (MCS2)	36.30
	5510	102	ax (SU) (40MHz)	49/51.6 (MCS2)	38.06
	5550	110	ax (SU) (40MHz)	49/51.6 (MCS2)	37.92
	5710	142	ax (SU) (40MHz)	49/51.6 (MCS2)	37.91
	5530	106	ac (80MHz)	87.8/97.5 (MCS2)	75.69
	5690	138	ac (80MHz)	87.8/97.5 (MCS2)	75.50
	5530	106	ax (SU) (80MHz)	102/108.1 (MCS2)	77.32
	5690	138	ax (SU) (80MHz)	102/108.1 (MCS2)	77.17
	5570	114	ac (160MHz)	175.5/195 (MCS2)	154.51
	5570	114	ax (SU) (160MHz)	204.2/216.2 (MCS2)	156.58

Table 7-2. Conducted Bandwidth Measurements Antenna 5b (Low Data Rate)

FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 21 of 365

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	39/43.3 (MCS4)	17.71	21.23
	5200	40	n (20MHz)	39/43.3 (MCS4)	17.73	20.96
	5240	48	n (20MHz)	39/43.3 (MCS4)	17.76	21.08
	5180	36	ax (SU) (20MHz)	49/51.6 (MCS4)	19.03	21.09
	5200	40	ax (SU) (20MHz)	49/51.6 (MCS4)	19.05	21.24
	5240	48	ax (SU) (20MHz)	49/51.6 (MCS4)	19.03	21.78
	5190	38	n (40MHz)	81/90 (MCS4)	36.28	41.97
	5230	46	n (40MHz)	81/90 (MCS4)	36.52	43.00
	5190	38	ax (SU) (40MHz)	98/103.2 (MCS4)	38.00	41.96
	5230	46	ax (SU) (40MHz)	98/103.2 (MCS4)	38.11	58.34
	5210	42	ac (80MHz)	175.5/195 (MCS4)	75.89	81.21
	5210	42	ax (SU) (80MHz)	204/216.2 (MCS4)	77.28	81.81
	5250	50	ac (160MHz)	351/390 (MCS4)	154.74	164.50
	5250	50	ax (SU) (160MHz)	408.3/432.4 (MCS4)	156.58	165.30
Band 2A	5260	52	n (20MHz)	39/43.3 (MCS4)	17.74	20.85
	5280	56	n (20MHz)	39/43.3 (MCS4)	17.72	20.56
	5320	64	n (20MHz)	39/43.3 (MCS4)	17.75	20.89
	5260	52	ax (SU) (20MHz)	49/51.6 (MCS4)	19.03	21.16
	5280	56	ax (SU) (20MHz)	49/51.6 (MCS4)	19.03	20.77
	5320	64	ax (SU) (20MHz)	49/51.6 (MCS4)	19.03	21.92
	5270	54	n (40MHz)	81/90 (MCS4)	36.34	41.83
	5310	62	n (40MHz)	81/90 (MCS4)	36.29	41.95
	5270	54	ax (SU) (40MHz)	98/103.2 (MCS4)	37.97	41.75
	5310	62	ax (SU) (40MHz)	98/103.2 (MCS4)	37.95	43.44
	5290	58	ac (80MHz)	175.5/195 (MCS4)	76.06	81.43
	5290	58	ax (SU) (80MHz)	204/216.2 (MCS4)	77.24	81.66
	5500	100	n (20MHz)	39/43.3 (MCS4)	17.73	20.58
	5580	116	n (20MHz)	39/43.3 (MCS4)	17.76	20.79
Band 2C	5720	144	n (20MHz)	39/43.3 (MCS4)	17.72	20.79
	5500	100	ax (SU) (20MHz)	49/51.6 (MCS4)	19.05	21.12
	5580	116	ax (SU) (20MHz)	49/51.6 (MCS4)	19.06	21.37
	5600	120	ax (SU) (20MHz)	49/51.6 (MCS4)	19.01	21.12
	5720	144	ax (SU) (20MHz)	49/51.6 (MCS4)	19.03	21.11
	5510	102	n (40MHz)	81/90 (MCS4)	36.35	42.07
	5550	110	n (40MHz)	81/90 (MCS4)	36.36	41.28
	5710	142	n (40MHz)	81/90 (MCS4)	36.41	41.86
	5510	102	ax (SU) (40MHz)	98/103.2 (MCS4)	37.96	42.05
	5550	110	ax (SU) (40MHz)	98/103.2 (MCS4)	37.95	41.67
	5710	142	ax (SU) (40MHz)	98/103.2 (MCS4)	37.94	41.52
	5530	106	ac (80MHz)	175.5/195 (MCS4)	76.02	81.18
	5690	138	ac (80MHz)	175.5/195 (MCS4)	76.09	82.09
	5530	106	ax (SU) (80MHz)	204/216.2 (MCS4)	77.37	81.81
	5690	138	ax (SU) (80MHz)	204/216.2 (MCS4)	77.20	81.80
	5570	114	ac (160MHz)	351/390 (MCS4)	154.84	164.50
	5570	114	ax (SU) (160MHz)	408.3/432.4 (MCS4)	156.69	166.20

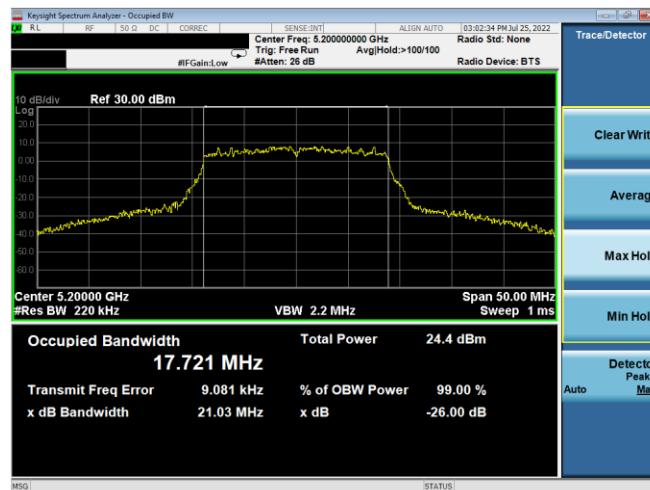
**Table 7-3. Conducted Bandwidth Measurements Antenna 5b (Mid Data Rate)**

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 22 of 365

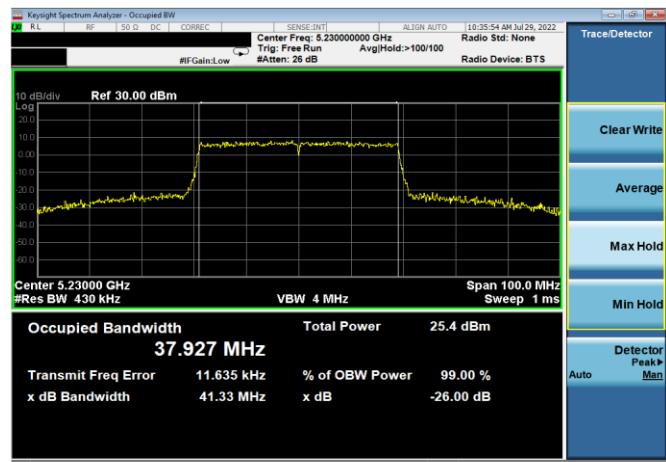
	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	65/72.2 (MCS7)	17.80	20.91
	5200	40	n (20MHz)	65/72.2 (MCS7)	17.86	21.05
	5240	48	n (20MHz)	65/72.2 (MCS7)	17.85	21.21
	5180	36	ax (SU) (20MHz)	135/143.4 (MCS11)	19.00	21.06
	5200	40	ax (SU) (20MHz)	135/143.4 (MCS11)	19.13	28.33
	5240	48	ax (SU) (20MHz)	135/143.4 (MCS11)	19.04	22.24
	5190	38	n (40MHz)	135/150 (MCS7)	36.39	40.95
	5230	46	n (40MHz)	135/150 (MCS7)	36.84	58.25
	5190	38	ax (SU) (40MHz)	271/286.8 (MCS11)	37.87	41.11
	5230	46	ax (SU) (40MHz)	271/286.8 (MCS11)	38.32	74.11
	5210	42	ac (80MHz)	390/433.3 (MCS9)	75.95	81.55
	5210	42	ax (SU) (80MHz)	390/433.3 (MCS9)	77.06	81.54
	5250	50	ac (160MHz)	780/866.7 (MCS9)	155.03	165.00
	5250	50	ax (SU) (160MHz)	1134.3/1201 (MCS11)	156.15	165.70
Band 2A	5260	52	n (20MHz)	65/72.2 (MCS7)	17.89	21.61
	5280	56	n (20MHz)	65/72.2 (MCS7)	17.82	20.92
	5320	64	n (20MHz)	65/72.2 (MCS7)	17.82	20.93
	5260	52	ax (SU) (20MHz)	135/143.4 (MCS11)	19.09	23.62
	5280	56	ax (SU) (20MHz)	135/143.4 (MCS11)	19.03	21.94
	5320	64	ax (SU) (20MHz)	135/143.4 (MCS11)	19.00	21.00
	5270	54	n (40MHz)	135/150 (MCS7)	36.63	44.69
	5310	62	n (40MHz)	135/150 (MCS7)	36.51	41.17
	5270	54	ax (SU) (40MHz)	271/286.8 (MCS11)	38.26	63.02
	5310	62	ax (SU) (40MHz)	271/286.8 (MCS11)	37.90	41.21
	5290	58	ac (80MHz)	390/433.3 (MCS9)	75.92	81.77
	5290	58	ax (SU) (80MHz)	567/600.5 (MCS11)	77.15	81.18
	5500	100	n (20MHz)	65/72.2 (MCS7)	17.80	21.09
	5580	116	n (20MHz)	65/72.2 (MCS7)	17.82	20.86
	5720	144	n (20MHz)	65/72.2 (MCS7)	17.83	21.02
Band 2C	5500	100	ax (SU) (20MHz)	135/143.4 (MCS11)	19.05	21.36
	5580	116	ax (SU) (20MHz)	135/143.4 (MCS11)	19.08	21.54
	5600	120	ax (SU) (20MHz)	135/143.4 (MCS11)	19.01	22.98
	5720	144	ax (SU) (20MHz)	135/143.4 (MCS11)	19.06	22.45
	5510	102	n (40MHz)	135/150 (MCS7)	36.44	41.38
	5550	110	n (40MHz)	135/150 (MCS7)	36.54	41.35
	5710	142	n (40MHz)	135/150 (MCS7)	36.59	41.77
	5510	102	ax (SU) (40MHz)	271/286.8 (MCS11)	37.85	41.32
	5550	110	ax (SU) (40MHz)	271/286.8 (MCS11)	37.98	41.09
	5710	142	ax (SU) (40MHz)	271/286.8 (MCS11)	38.04	50.40
	5530	106	ac (80MHz)	390/433.3 (MCS9)	75.93	81.85
	5690	138	ac (80MHz)	390/433.3 (MCS9)	76.15	82.21
	5530	106	ax (SU) (80MHz)	567/600.5 (MCS11)	77.04	81.39
	5690	138	ax (SU) (80MHz)	567/600.5 (MCS11)	77.20	81.65
	5570	114	ac (160MHz)	780/866.7 (MCS9)	155.22	165.00
	5570	114	ax (SU) (160MHz)	1134.3/1201 (MCS11)	156.36	165.40

**Table 7-4. Conducted Bandwidth Measurements Antenna 5b (High Data Rate)**

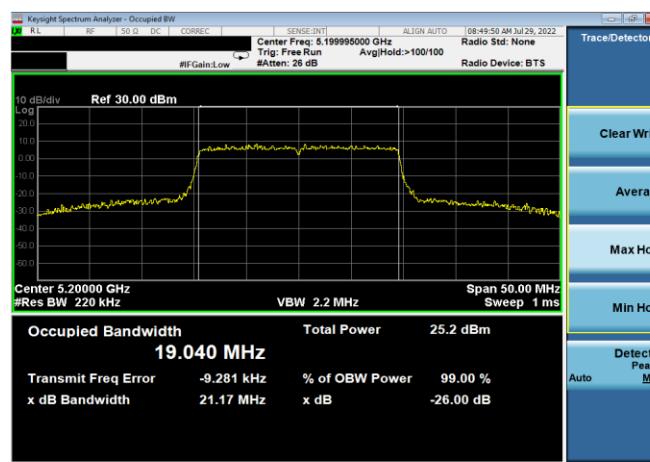
FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 23 of 365

**Low Data Rate**


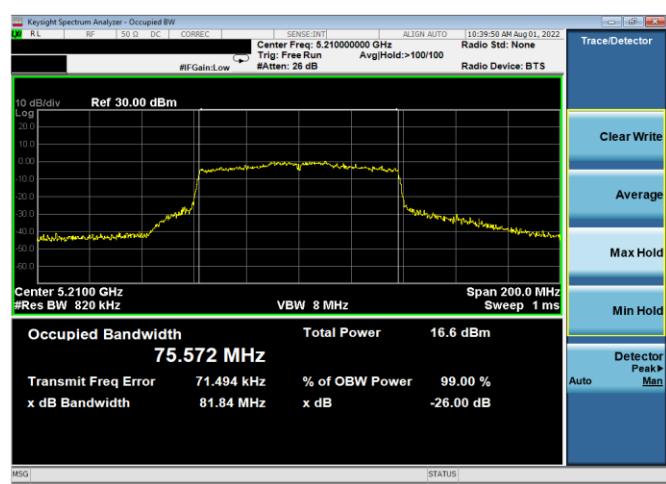
Plot 7-1. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 40, MCS2)



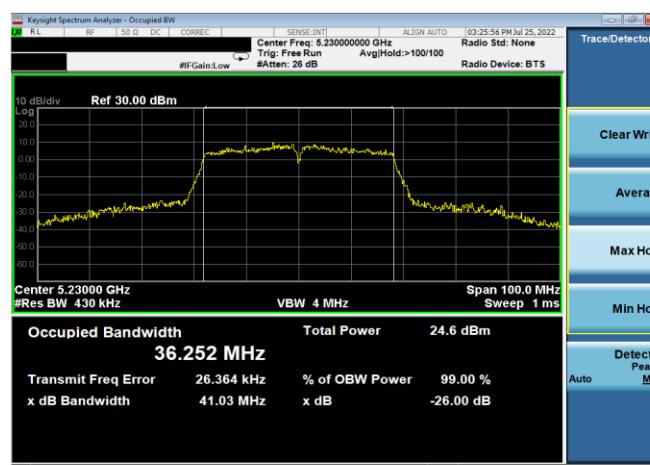
Plot 7-4. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 46, MCS2)



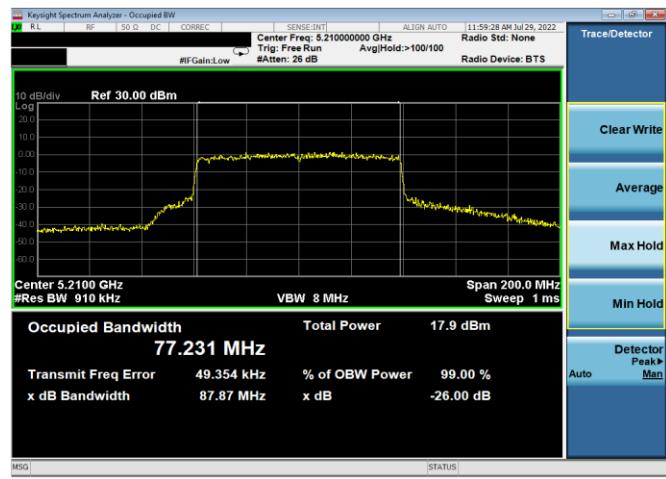
Plot 7-2. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 40, MCS2)



Plot 7-5. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 42, MCS2)

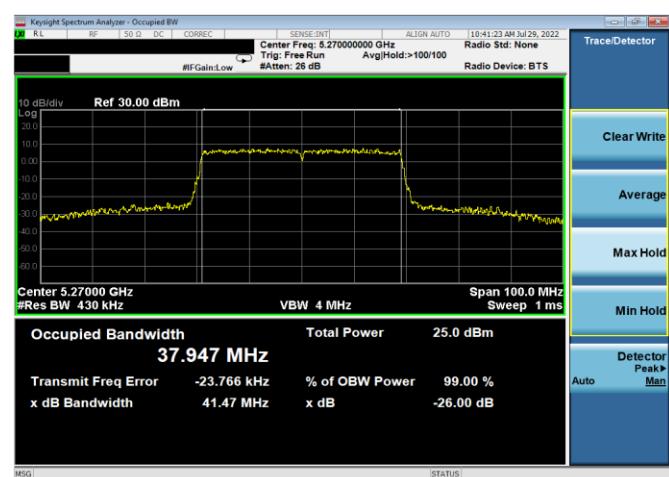
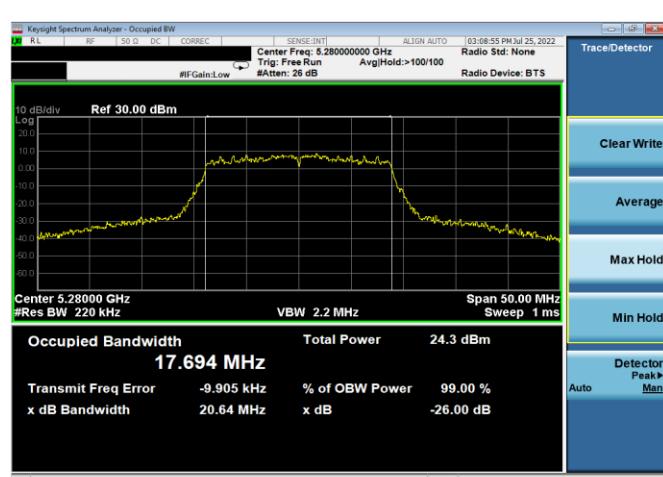
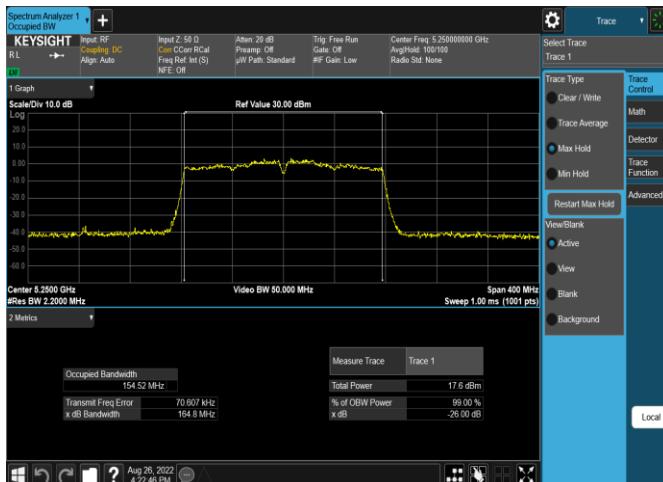


Plot 7-3. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 46, MCS2)



Plot 7-6. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 42, MCS2)

FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 24 of 365



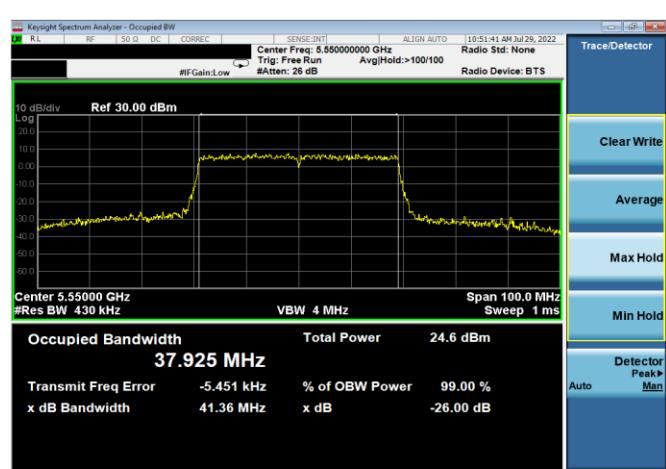
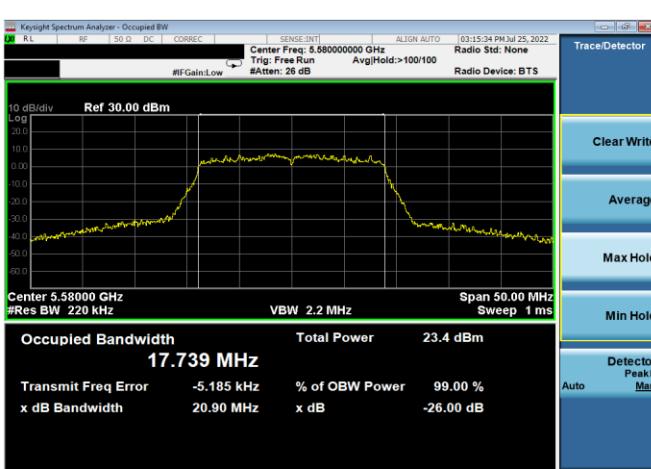
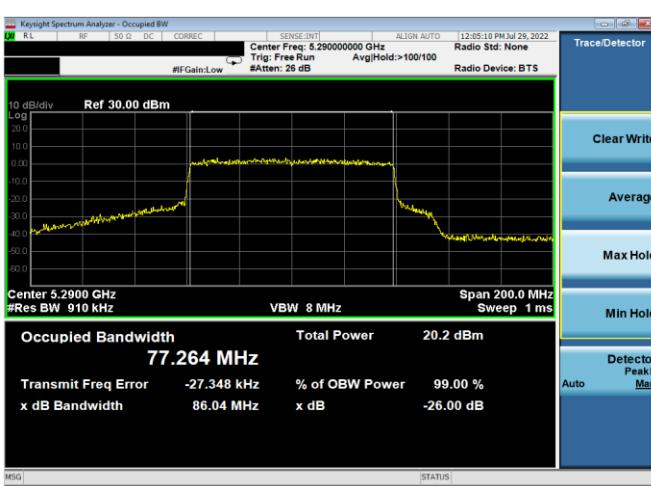
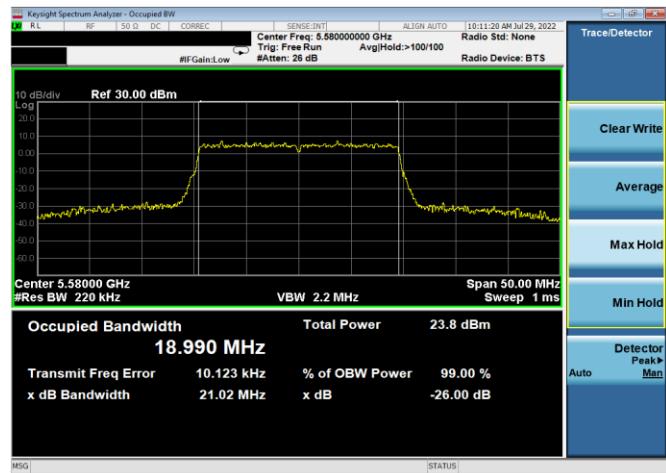
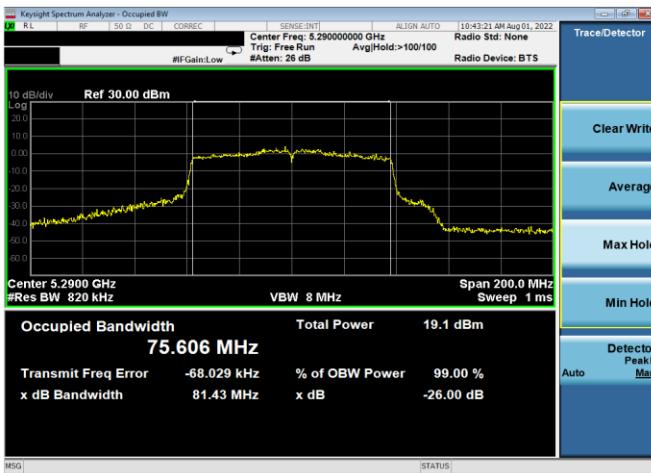
FCC ID: BCGA2764	IC: 579C-A2764
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022


**MEASUREMENT REPORT  
(CERTIFICATION)**
**Approved by:**  
Technical Manager

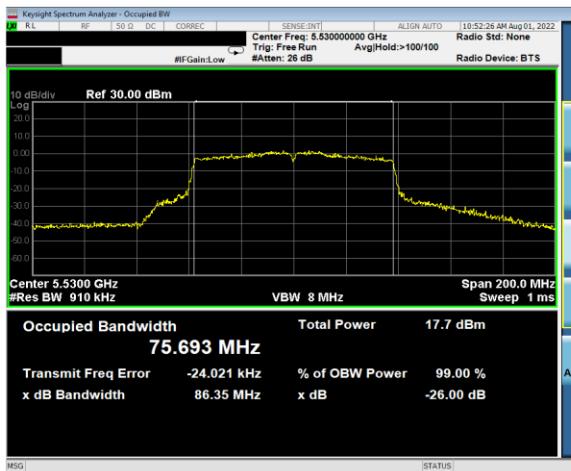
Page 25 of 365

V 10.5 12/15/2021

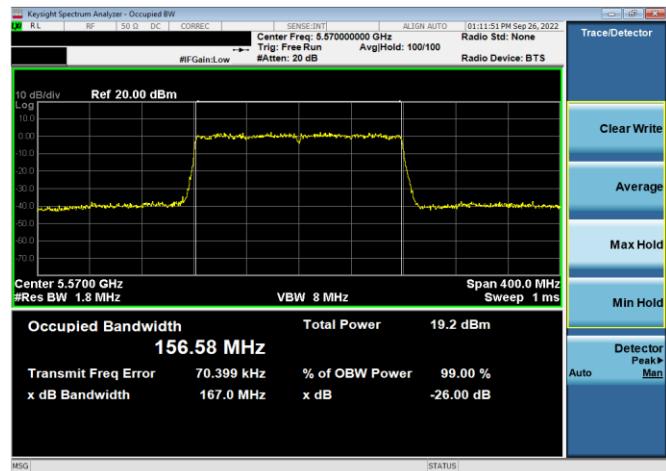
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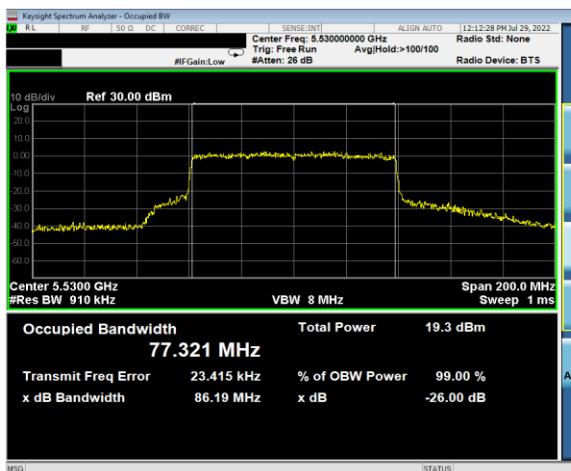
FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 26 of 365



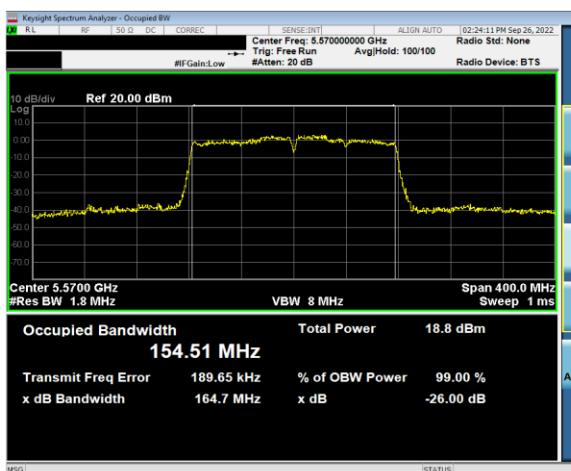
Plot 7-19. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 106, MCS2)



Plot 7-22. 26dB BW & 99% OBW Antenna 5b (160MHz BW 802.11ax – Ch. 114, MCS2)

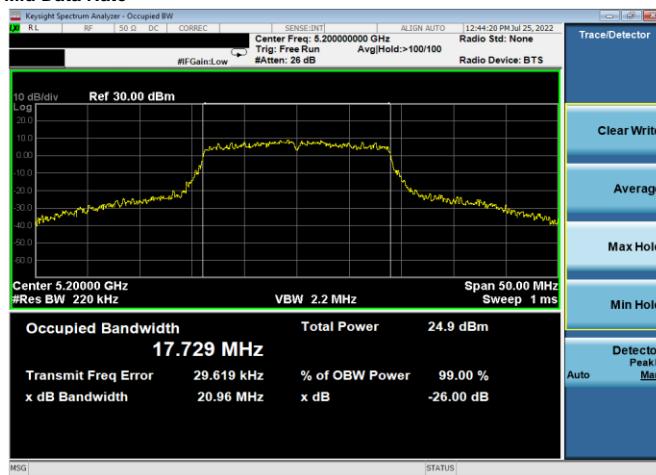
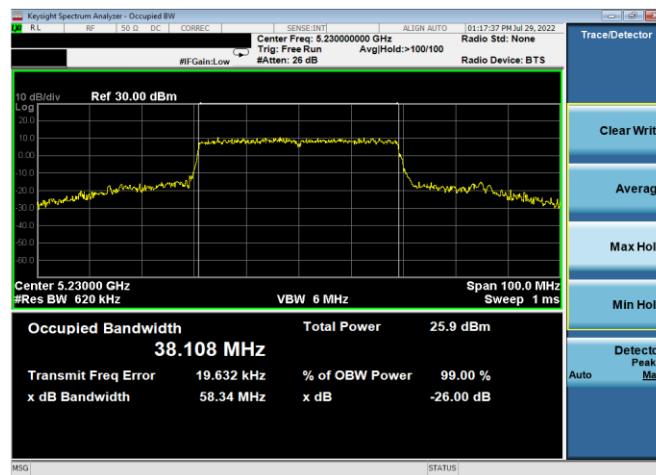
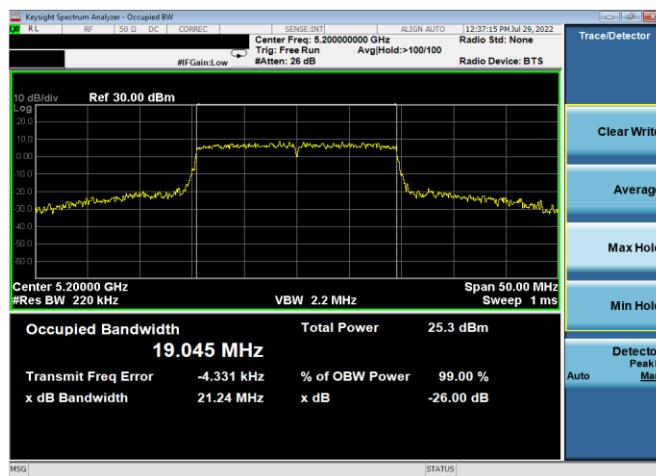
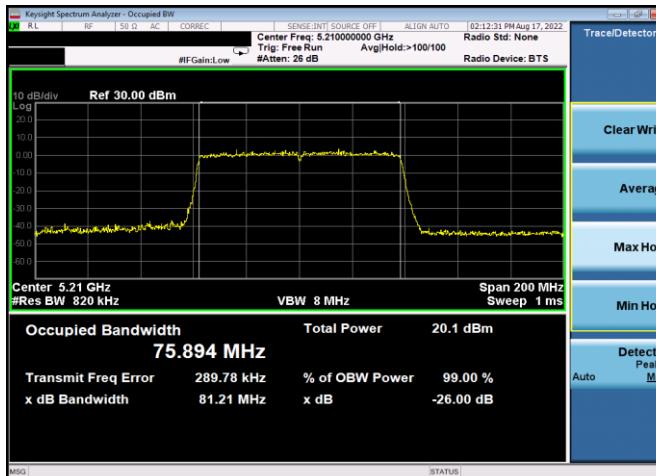
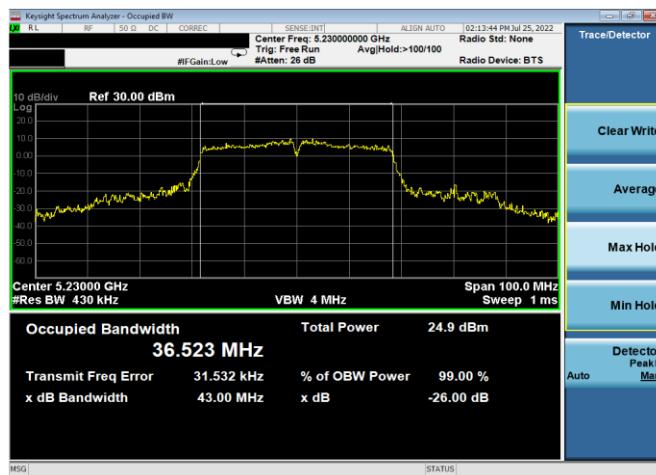
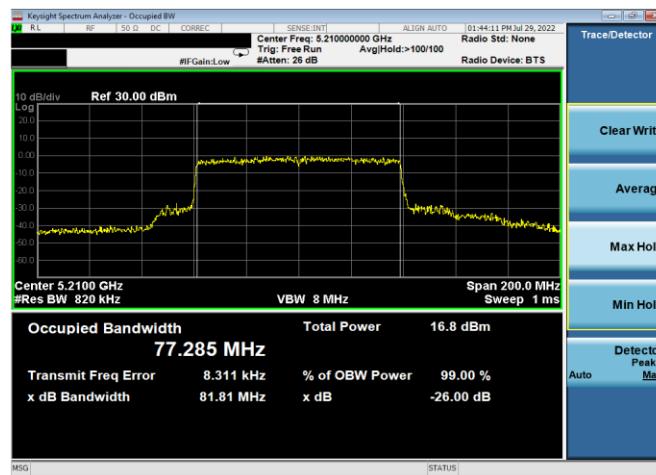


Plot 7-20. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 106, MCS2)

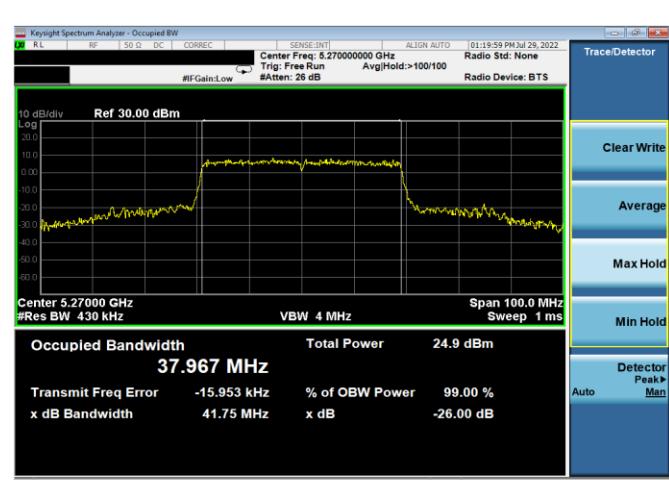
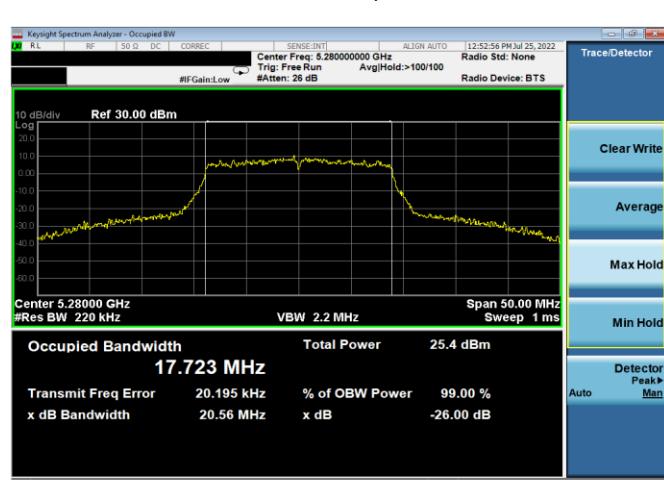
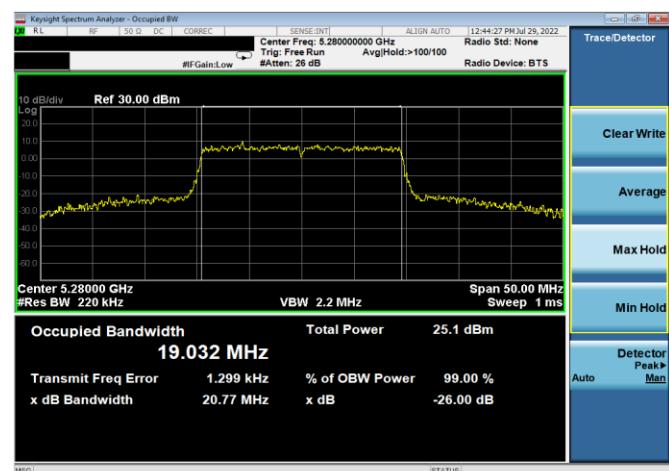


Plot 7-21. 26dB BW & 99% OBW Antenna 5b (160MHz BW 802.11ac – Ch. 114, MCS2)

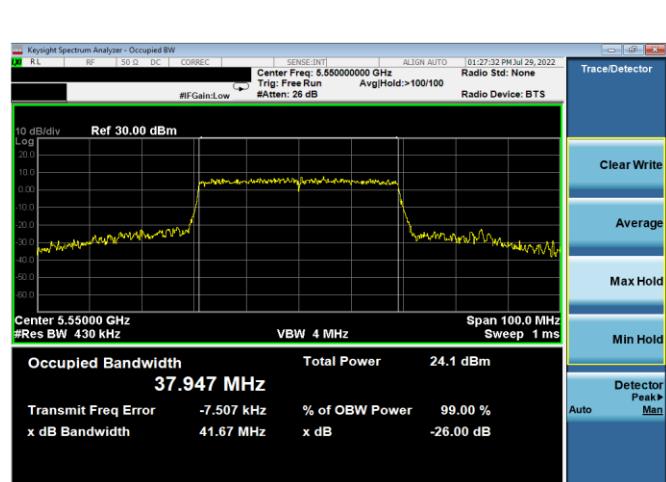
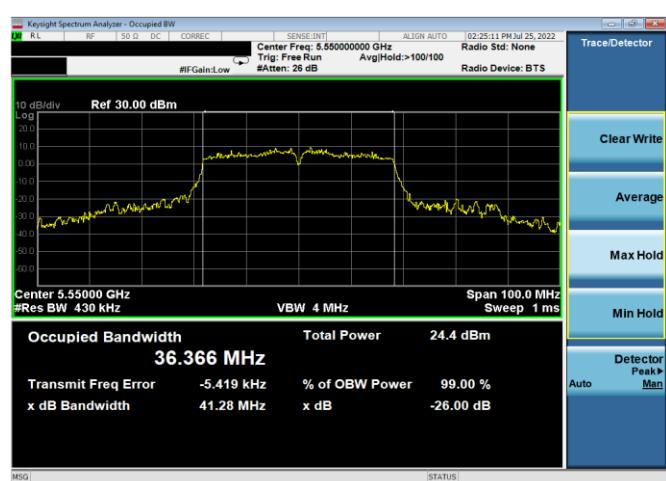
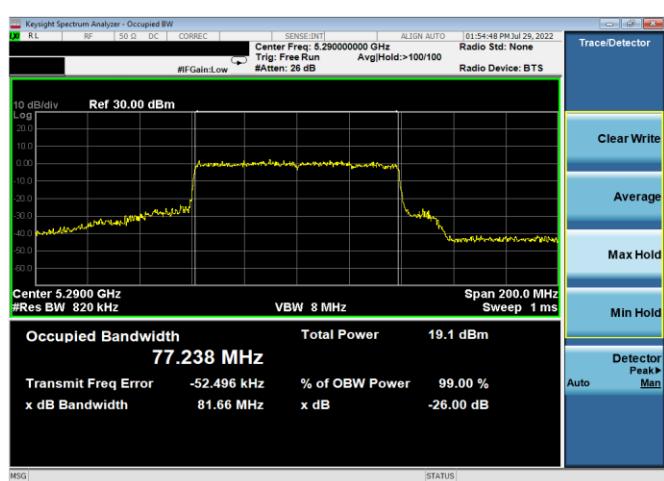
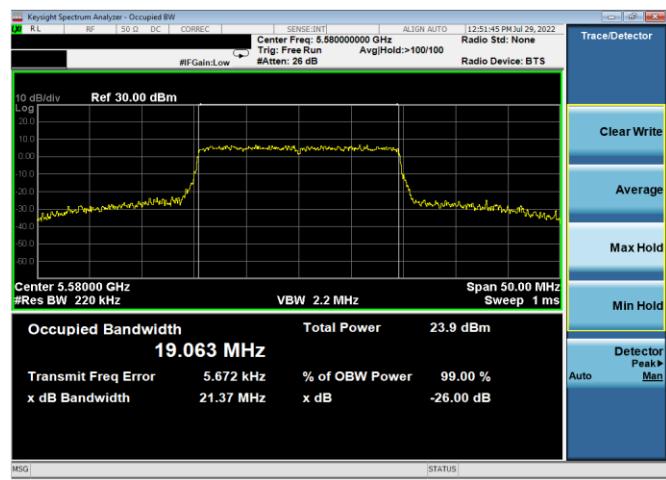
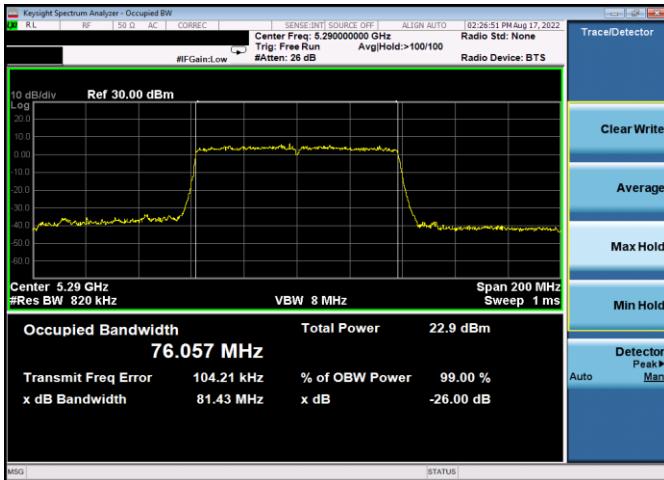
FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 27 of 365

**Mid Data Rate**

**Plot 7-23. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 40, MCS4)**

**Plot 7-26. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 46, MCS4)**

**Plot 7-24. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 40, MCS4)**

**Plot 7-27. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 42, MCS4)**

**Plot 7-25. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 46, MCS4)**

**Plot 7-28. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 42, MCS4)**

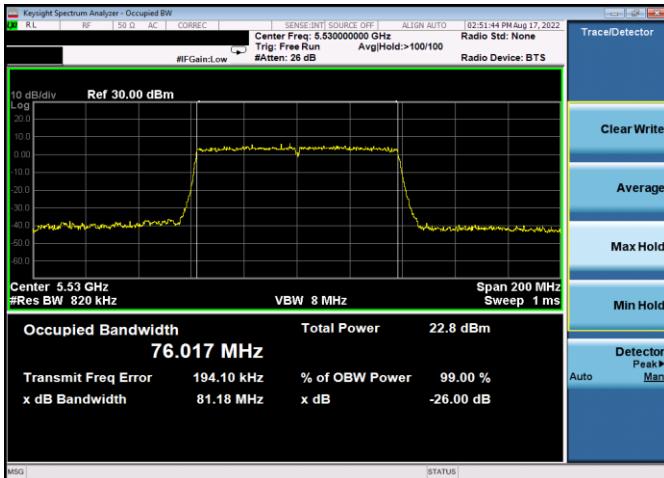
FCC ID: BCGA2764 IC: 579C-A2764	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 28 of 365



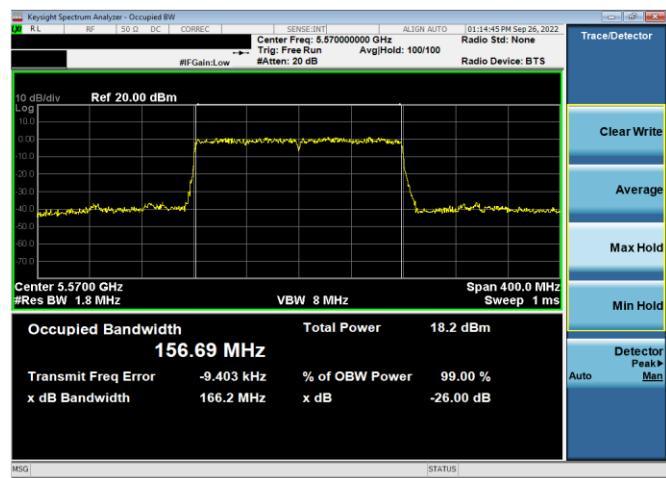
FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 29 of 365



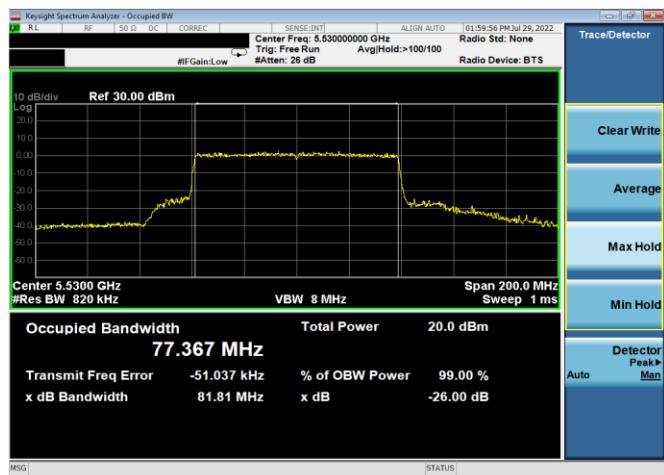
FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 30 of 365



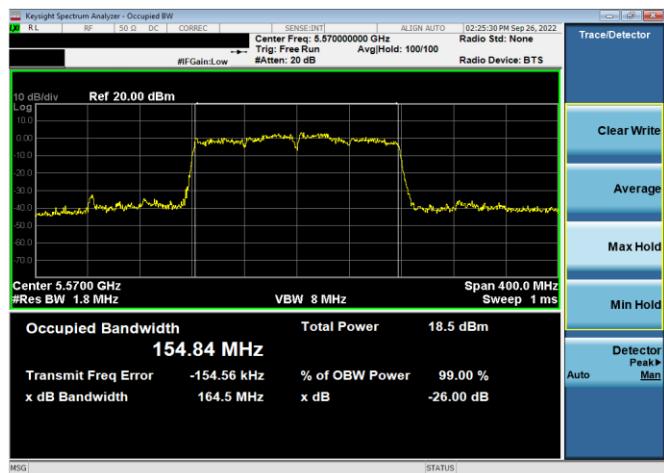
Plot 7-41. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 106, MCS4)



Plot 7-44. 26dB BW & 99% OBW Antenna 5b (160MHz BW 802.11ax – Ch. 114, MCS4)



Plot 7-42. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 106, MCS4)



Plot 7-43. 26dB BW & 99% OBW Antenna 5b (160MHz BW 802.11ac – Ch. 114, MCS4)

FCC ID: BCGA2764 IC: 579C-A2764		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090028-19.BCG	Test Dates: 05/30/2022-09/30/2022	EUT Type: Tablet Device	Page 31 of 365