

**MEASUREMENT REPORT**  
**FCC PART 15.407 / ISED RSS-247 UNII 802.11ax OFDMA**

**Applicant Name:**

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

**Date of Testing:**

2/20/2023 - 5/9/2023

**Test Report Issue Date:**

11/30/2023

**Test Site/Location:**

Element Materials Technology Morgan Hill, CA, USA

**Test Report Serial No.:**

1C2302130007-06.BCG

<b>FCC ID:</b>	<b>BCGA2117</b>
<b>IC:</b>	<b>579C-A2117</b>
<b>APPLICANT:</b>	<b>Apple Inc.</b>

**Application Type:**

Certification

**Model/HVIN:**

A2117

**EUT Type:**

Head Mounted Device

**Frequency Range:**

5180 – 5825MHz

**Modulation Type:**

OFDMA

**FCC Classification:**

Unlicensed National Information Infrastructure (UNII)

**FCC Rule Part(s):**

Part 15 Subpart E (15.407)

**ISED Specification:**

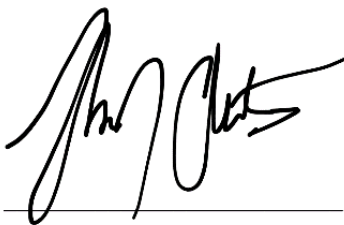
RSS-247 Issue 3

**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

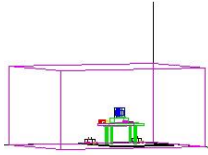


<b>FCC ID:</b> BCGA2117 <b>IC:</b> 579C-A2117		<b>MEASUREMENT REPORT</b> <b>(CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 1 of 263

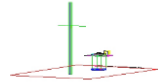
## TABLE OF CONTENTS

1.0	INTRODUCTION.....	4
1.1	Scope.....	4
1.2	Element Materials Technology Morgan Hill Test Location.....	4
1.3	Test Facility / Accreditations.....	4
2.0	PRODUCT INFORMATION.....	5
2.1	Equipment Description.....	5
2.2	Device Capabilities.....	5
2.3	Antenna Description.....	8
2.4	Test Support Equipment.....	9
2.5	Test Configuration.....	10
2.6	Software and Firmware.....	10
2.7	EMI Suppression Device(s)/Modifications.....	10
3.0	DESCRIPTION OF TESTS.....	11
3.1	Evaluation Procedure.....	11
3.2	AC Line Conducted Emissions.....	11
3.3	Radiated Emissions.....	12
3.4	Environmental Conditions.....	12
4.0	ANTENNA REQUIREMENTS.....	13
5.0	MEASUREMENT UNCERTAINTY.....	14
6.0	TEST EQUIPMENT CALIBRATION DATA.....	15
7.0	TEST RESULTS.....	16
7.1	Summary.....	16
7.2	26dB & 99% Bandwidth Measurement – 802.11ax OFDMA.....	17
7.3	6dB & 99% Bandwidth Measurement – 802.11ax OFDMA.....	36
7.4	Conducted Output Power and Max EIRP Measurement – 802.11ax OFDMA.....	43
7.5	Maximum Power Spectral Density – 802.11ax OFDMA.....	74
7.6	Radiated Spurious Emission – Above 1GHz.....	137
7.6.1	Ant 1 Radiated Spurious Emission.....	141
7.6.2	Ant 2 Radiated Spurious Emission.....	165
7.6.3	CDD Radiated Spurious Emissions.....	189
7.6.4	Ant 1 Radiated Band Edge Measurements (20MHz BW).....	221
7.6.6	Ant 1 Radiated Band Edge Measurements (40MHz BW).....	224
7.6.7	Ant 1 Radiated Band Edge Measurements (80MHz BW).....	228
7.6.8	Ant 2 Radiated Band Edge Measurements (20MHz BW).....	232
7.6.9	Ant 2 Radiated Band Edge Measurements (40MHz BW).....	235
7.6.10	Ant 2 Radiated Band Edge Measurements (80MHz BW).....	239
7.6.11	CDD Radiated Band Edge Measurements (20MHz BW).....	243
7.6.12	CDD Radiated Band Edge Measurements (40MHz BW).....	246
7.6.13	CDD Radiated Band Edge Measurements (80MHz BW).....	249
7.7	Radiated Spurious Emissions – Below 1GHz.....	252
7.8	AC Line Conducted Emissions Measurement.....	257
8.0	CONCLUSION.....	263

<b>FCC ID:</b> BCGA2117 <b>IC:</b> 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 2 of 263



# MEASUREMENT REPORT



UNII Band	Channel Bandwidth (MHz)	Tx Frequency (MHz)	SISO				CDD					
			Antenna Ant 1		Antenna Ant 2		Antenna Ant 1		Antenna Ant 2		Summed	
			Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	5180 - 5240	86.497	19.37	89.125	19.50	44.055	16.44	44.668	16.50	88.308	19.46
2A		5260 - 5320	88.105	19.45	86.099	19.35	44.055	16.44	44.259	16.46	87.902	19.44
2C		5500 - 5720	88.920	19.49	89.125	19.50	44.668	16.50	44.668	16.50	89.331	19.51
3		5745 - 5825	99.312	19.97	100.000	20.00	98.175	19.92	100.000	20.00	198.153	22.97
1	40	5190 - 5230	85.704	19.33	89.125	19.50	74.989	18.75	74.131	18.70	149.279	21.74
2A		5270 - 5310	96.828	19.86	97.275	19.88	77.268	18.88	75.858	18.80	153.109	21.85
2C		5510 - 5710	99.083	19.96	100.000	20.00	79.068	18.98	77.804	18.91	155.597	21.92
3		5755 - 5795	98.855	19.95	100.000	20.00	98.401	19.93	100.000	20.00	198.153	22.97
1	80	5210	39.174	15.93	39.537	15.97	37.239	15.71	37.239	15.71	73.282	18.65
2A		5290	55.208	17.42	56.234	17.50	44.463	16.48	44.055	16.44	88.308	19.46
2C		5530 - 5690	99.312	19.97	99.541	19.98	97.499	19.89	98.855	19.95	196.336	22.93
3		5775	95.940	19.82	98.175	19.92	98.855	19.95	100.000	20.00	198.609	22.98

## FCC EUT Overview

UNII Band	Channel Bandwidth (MHz)	Tx Frequency (MHz)	SISO				CDD/SDM					
			Antenna Ant 1		Antenna Ant 2		Antenna Ant 1		Antenna Ant 2		Summed	
			Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	5180 - 5240	31.623	15.00	31.550	14.99	17.701	12.48	17.539	12.44	34.594	15.39
2A		5260 - 5320	88.105	19.45	86.099	19.35	44.055	16.44	44.259	16.46	87.902	19.44
2C		5500 - 5720	88.920	19.49	89.125	19.50	44.668	16.50	44.668	16.50	89.331	19.51
3		5745 - 5825	99.312	19.97	100.000	20.00	98.175	19.92	100.000	20.00	198.153	22.97
1	40	5190 - 5230	55.463	17.44	55.847	17.47	98.855	19.95	99.541	19.98	198.609	22.98
2A		5270 - 5310	96.828	19.86	97.275	19.88	77.268	18.88	75.858	18.80	153.109	21.85
2C		5510 - 5710	99.083	19.96	100.000	20.00	79.250	18.99	77.804	18.91	155.597	21.92
3		5755 - 5795	98.855	19.95	100.000	20.00	98.175	19.92	100.000	20.00	197.242	22.95
1	80	5210	31.623	15.00	31.550	14.99	11.455	10.59	11.588	10.64	23.067	13.63
2A		5290	55.208	17.42	56.234	17.50	17.783	12.50	17.660	12.47	35.400	15.49
2C		5530 - 5690	99.312	19.97	99.541	19.98	97.499	19.89	98.855	19.95	196.336	22.93
3		5775	95.940	19.82	98.175	19.92	78.343	18.94	76.208	18.82	154.525	21.89

## ISED EUT Overview

FCC ID: BCGA2117 IC: 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 3 of 263

## 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 Materials Technology Morgan Hill Test Location

These measurement tests were conducted at the Element Materials Technology Morgan Hill 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 Materials Technology located in Morgan Hill, CA 95037, U.S.A.**

- Element Materials Technology Morgan Hill 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 Materials Technology Morgan Hill facility is a registered (22831) test laboratory with the site description on file with ISED.
- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Recognition Agreements (MRAs).

FCC ID: BCGA2117 IC: 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 4 of 263

V 10.5 12/15/2021

## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Head Mounted Device FCC ID: BCGA2117** and **IC: 579C-A2117**. The test data contained in this report pertains only to the emissions due to the EUT's UNII 802.11ax - RU transmitter.

**Test Device Serial No.:** GPG3017001F20N78X, PYVWK6LLC6, WFGF7D9H60, MHP0XYH0XK, HP14K0WJ0Q

### 2.2 Device Capabilities

This device contains the following capabilities:

802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE1M, LE2M, HDR4, HDR8), NB UNII (1x, LE1M, LE2M, HDR4, HDR8, HDRp4, HDRp8).

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

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 5 of 263

**Notes:**

1. TDWR channels are not supported for ISED.
2. 5GHz NII operation is possible in 20MHz, 40MHz, and 80MHz 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) of 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 [%]		
		Ant1	Ant2	CDD/SDM
5GHz	11ax(RU) RU26 HE20	89.7	89.9	90.2
	11ax(RU) RU52 HE20	89.1	89.6	88.5
	11ax(RU) RU242 HE20	86.6	86.0	88.3
	11ax(RU) RU26 HE40	90.0	90.0	90.0
	11ax(RU) RU52 HE40	89.6	89.7	89.5
	11ax(RU) RU484 HE40	87.5	87.6	87.4
	11ax(RU) RU26 HE80	90.4	90.1	89.6
	11ax(RU) RU52 HE80	89.7	88.7	89.3
	11ax(RU) RU996 HE80	87.5	88.6	87.1

**Table 2-4. Measured Duty Cycles**

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 6 of 263

3. The device employs CDD/SDM technology. Below are the possible configurations.

WiFi Configurations		SISO		CDD		SDM		STBC	
		Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2
5GHz	11ax (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓

**Table 2-5. WIFI Configurations**

✓ = Support ; ✗ = NOT Support

**SISO** = Single Input Single Output

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

**SDM** = Spatial Diversity Multiplexing – CDD/SDM function

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

Data Rate(s) Support: 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, 135/143.4Mbps (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, 271/286.8Mbps (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, 567/600.5Mbps (ax – 80MHz BW)  
 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, 271/286.8Mbps (MIMO ax – 20MHz 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, 567/600.5Mbps (MIMO ax – 40MHz BW)  
 68/72, 136/144.1, 204/216.2, 272/288.2, 408/432.4, 544/576.4, 612/648.8, 680/720.6, 816/864.8, 906/960.8, 1020/1080.8, 1134/1201Mbps (MIMO ax – 80MHz BW)

FCC ID: BCGA2117 IC: 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 7 of 263

This device supports simultaneous transmission operations. The table below shows all configurations possible.

Simultaneous Tx Config	Ant1			Ant2			NB UNII_L		NB UNII_R
	WLAN 2.4G 802.11 b/g/n/ax	BT 2.4G BDR, EDR, HDR4/8, LE1M/2M, HDRp4/p8	WIFI 5G 802.11 a/n/ac/ax	WLAN 2.4G 802.11 b/g/n/ax	BT 2.4G BDR, EDR, HDR4/8, LE1M/2M, HDRp4/p8	WIFI 5G 802.11 a/n/ac/ax	BT 2.4G BDR, HDR4/8, LE1M/2M, HDRp4/p8	NB_UNII 5G BDR, HDR4/8, LE1M/2M, HDRp4/p8	NB_UNII 5G BDR, HDR4/8, LE1M/2M, HDRp4/p8
Config 1	✓	✗	✓	✗	✗	✗	✗	✓	✓
Config 2	✗	✗	✗	✓	✗	✓	✗	✓	✓
Config 3	✗	✓	✓	✗	✗	✗	✗	✓	✓
Config 4	✗	✓	✗	✗	✗	✓	✗	✓	✓
Config 5	✗	✓	✓	✗	✓	✗	✗	✗	✗
Config 6	✗	✓	✗	✗	✓	✓	✗	✗	✗
Config 7	✓	✗	✓	✗	✗	✗	✓	✓	✓
Config 8	✓	✗	✗	✗	✗	✓	✓	✓	✓
Config 9	✓	✗	✓	✗	✓	✗	✗	✗	✗
Config 10	✓	✗	✗	✗	✓	✓	✗	✗	✗
Config 11	✓	✗	✓	✓	✗	✓	✗	✗	✗
Config 12	✗	✓	✓	✗	✗	✓	✗	✗	✗
Config 13	✓	✗	✓	✗	✗	✓	✓	✗	✗

**Table 2-6. Simultaneous Transmission Configurations**

✓ = Support; ✗ = Not Support

**Note:**

All of the above simultaneous transmission configurations have been tested and the worst case configuration was found to be config 7 and reported in UNII 802.11 (OFDM), Bluetooth LE, NB UNII LE, and WLAN 802.11 (OFDM) test reports.

### 2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Frequency [GHz]	Antenna Gain (dBi)	
	Ant 1	Ant 2
5.150 – 5.250	3.30	2.50
5.250 – 5.350	3.40	2.30
5.470 – 5.725	2.60	1.80
5.725 – 5.850	1.20	2.30

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

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 8 of 263



## 2.4 Test Support Equipment

1	Apple Macbook Pro	Model:	A2289	S/N:	C02DV7VGMD6T
	w/ AD/DC Adapter	Model:	A2164	S/N:	N/A
2	Apple USB-C Cable	Model:	Spartan	S/N:	000MKTR02U
3	Right Temple	Model:	N/A	S/N:	HTFGR70005J000020R
	Left Temple	Model:	N/A	S/N:	HTFGR40004A00002GY
	Headband	Model:	N/A	S/N:	GKNGNC0001H0000215
4	Light Seal	Model:	N/A	S/N:	GKNGQF000RX00003KB
	Light Seal Padding	Model:	N/A	S/N:	GKNGQ8001RD00002XA
5	EUT Power Pack	Model:	N/A	S/N:	HTFGQW0009800001MV

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

<b>FCC ID:</b> BCGA2117 <b>IC:</b> 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 9 of 263

## 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 with power pack was also investigated with and without charger.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz and above 18GHz were tested with the highest transmitting power and the worst case channel.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

For AC line conducted and radiated test below 1GHz, following configuration were investigated and EUT powered by AC/DC adaptor to USB-C Power Pack to Magnetic Charging Cable was the worst case.

- EUT powered by AC/DC adaptor to USB-C Power Pack to Magnetic Charging Cable
- EUT powered by host PC via USB-C Power Pack to Magnetic Charging Cable

802.11ax-RU HE20/40/80 2TX CDD/SDM mode test data provided in this report covers 802.11ax-RU HE20/40/80 2TX STBC mode.

For 802.11a/n/ac/ax-SU test results, see separate UNII report, 1C2302130007-07.BCG.

## 2.6 Software and Firmware

The test was conducted with firmware version 20.94.1.18 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.

<b>FCC ID:</b> BCGA2117 <b>IC:</b> 579C-A2117	 <b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device
		Page 10 of 263

## 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.

<b>FCC ID:</b> BCGA2117 <b>IC:</b> 579C-A2117	 <b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device
		Page 11 of 263

### 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 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

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).

<b>FCC ID:</b> BCGA2117 <b>IC:</b> 579C-A2117	 <b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG		<b>Test Dates:</b> 2/20/2023 - 5/9/2023
		Page 12 of 263

## 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.

<b>FCC ID:</b> BCGA2117 <b>IC:</b> 579C-A2117	 <b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device
		Page 13 of 263

V 10.5 12/15/2021

## 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: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 14 of 263

V 10.5 12/15/2021

## 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 #
Agilent	N9020A	MXA Signal Analyzer	4/26/2022	Annual	4/26/2023	MY56470202
Anritsu	MA2411B	Pulse Power Sensor	5/19/2022	Annual	5/19/2023	1911106
Anritsu	ML2496A	Power Meter	10/17/2022	Annual	10/17/2023	2002005
ETS-Lindgren	3117	Double Ridged Guide Horn Antenna (1-18 GHz)	5/24/2022	Annual	5/24/2023	240049
Keysight Technologies	N9030A	PXA Signal Analyzer	6/10/2022	Annual	6/10/2023	MY49430244
Rohde & Schwarz	180-442A-KF	Horn (Small)	3/6/2023	Annual	3/6/2024	T058701-2
Rohde & Schwarz	ENV216	Two-Line V-Network	3/30/2023	Annual	3/30/2024	101364
Rohde & Schwarz	FSVA3044	Signal Analyzer 44GHz	5/12/2022	Annual	5/12/2023	101098
Rohde & Schwarz	FSW43	Signal and Spectrum Analyzer 2Hz to 43GHz	5/19/2022	Annual	5/19/2023	104093
Rohde & Schwarz	FSW67	Signal and Spectrum Analyzer (2Hz-67GHz)	4/21/2022	Annual	4/21/2023	101366
Rohde & Schwarz	HFH-222	9kHz - 30MHz Loop Antenna	4/13/2022	Annual	4/13/2023	100546
Rohde & Schwarz	TS-PR1	Preamplifier - Antenna System; 30MHz - 1GHz	4/18/2022	Annual	4/18/2023	102081
Rohde & Schwarz	TS-PR18	Pre Amplifier 1-18GHz	3/3/2023	Annual	3/3/2024	102130
Rohde & Schwarz	TS-PR1840	Pre Amplifier 18-40GHz	4/18/2022	Annual	4/18/2023	100050
Schwarzbeck	VULB9162	Biconilog Antenna - (30MHz-6GHz)	7/27/2022	Annual	7/27/2023	121034

**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: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 15 of 263

## 7.0 TEST RESULTS

### 7.1 Summary

Company Name: Apple Inc.  
 FCC ID: BCGA2117  
 IC: 579C-A2117  
 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		N/A	Section 7.2, 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	RADIATED	PASS	See DFS Test Report (1C2302130 007-11.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])		PASS	Section 7.6
15.205, 15.407(b.1), (4), (5), (6)	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	AC LINE CONDUCTED	PASS	Section 7.8

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

#### Notes:

- 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.
- 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.
- 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.
- 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.
- 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 2.
- 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.
- 802.11ax OFDMA testing was performed for all signal tone configurations as specified by the 802.11ax standard. Worst case results are determined and reported per the guidance provided at the October 2018 TCB Workshop.
- Only one RU index could be selected at a time so no contiguous or non-contiguous RU's were considered for testing.

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 16 of 263



## 7.2 26dB & 99% Bandwidth Measurement – 802.11ax OFDMA

§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 – Subclause 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 configs were investigated and only the worst case is reported.
2. All RU's were investigated and only worst case partially-loaded and fully-loaded RU's were 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: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 17 of 263

V 10.5 12/15/2021

## Ant 1 26dB & 99% Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	RU Size	RU Index	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	ax (20MHz)	26	0	135/143.4 (MCS11)	18.28	19.78
				26	4	135/143.4 (MCS11)	17.37	19.10
				26	8	135/143.4 (MCS11)	18.48	20.34
	5200	40	ax (20MHz)	26	0	135/143.4 (MCS11)	18.28	19.68
				26	4	135/143.4 (MCS11)	17.32	18.91
				26	8	135/143.4 (MCS11)	18.47	20.17
	5240	48	ax (20MHz)	26	0	135/143.4 (MCS11)	18.25	19.57
				26	4	135/143.4 (MCS11)	17.41	19.17
				26	8	135/143.4 (MCS11)	18.55	20.27
	5190	38	ax (40MHz)	26	0	271/286.8 (MCS11)	18.42	20.24
				26	8	271/286.8 (MCS11)	19.73	22.29
				26	17	271/286.8 (MCS11)	18.22	20.02
	5230	46	ax (40MHz)	26	0	271/286.8 (MCS11)	18.33	20.22
				26	8	271/286.8 (MCS11)	19.79	21.57
				26	17	271/286.8 (MCS11)	18.37	20.68
	5210	42	ax (80MHz)	26	0	567/600.5 (MCS11)	18.18	19.56
				26	18	567/600.5 (MCS11)	37.69	39.87
				26	36	567/600.5 (MCS11)	19.43	21.26

**Table 7-2. Conducted BW Measurements Ant 1 (RU26)**

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 18 of 263

	Frequency [MHz]	Channel No.	802.11 Mode	RU Size	RU Index	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 2A	5260	52	ax (20MHz)	52	37	135/143.4 (MCS11)	18.22	20.09
				52	38	135/143.4 (MCS11)	17.38	19.78
				52	40	135/143.4 (MCS11)	18.43	20.49
	5300	60	ax (20MHz)	52	37	135/143.4 (MCS11)	18.16	20.30
				52	38	135/143.4 (MCS11)	17.49	19.94
				52	40	135/143.4 (MCS11)	18.48	20.67
	5320	64	ax (20MHz)	52	37	135/143.4 (MCS11)	18.25	20.03
				52	38	135/143.4 (MCS11)	17.39	19.74
				52	40	135/143.4 (MCS11)	18.54	20.86
	5270	54	ax (40MHz)	52	37	271/286.8 (MCS11)	18.26	21.19
				52	40	271/286.8 (MCS11)	19.18	22.68
				52	44	271/286.8 (MCS11)	18.25	21.86
5310	62	ax (40MHz)	52	37	271/286.8 (MCS11)	18.31	21.12	
			52	40	271/286.8 (MCS11)	19.11	22.84	
			52	44	271/286.8 (MCS11)	18.25	21.66	
5290	58	ax (80MHz)	52	37	567/600.5 (MCS11)	18.01	19.81	
			52	44	567/600.5 (MCS11)	18.73	22.42	
			52	52	567/600.5 (MCS11)	19.56	22.10	
Band 2C	5500	100	ax (20MHz)	52	37	135/143.4 (MCS11)	18.22	20.06
				52	38	135/143.4 (MCS11)	17.50	19.98
				52	40	135/143.4 (MCS11)	18.51	20.73
	5580	116	ax (20MHz)	52	37	135/143.4 (MCS11)	18.21	20.01
				52	38	135/143.4 (MCS11)	17.49	19.99
				52	40	135/143.4 (MCS11)	18.53	20.88
	5700	140	ax (20MHz)	52	37	135/143.4 (MCS11)	18.25	20.24
				52	38	135/143.4 (MCS11)	17.44	19.62
				52	40	135/143.4 (MCS11)	18.48	20.73
	5720	144	ax (20MHz)	52	37	135/143.4 (MCS11)	18.29	20.23
				52	38	135/143.4 (MCS11)	17.47	19.73
				52	40	135/143.4 (MCS11)	18.52	20.83
	5510	102	ax (40MHz)	52	37	271/286.8 (MCS11)	18.35	21.26
				52	40	271/286.8 (MCS11)	19.56	23.02
				52	44	271/286.8 (MCS11)	18.12	21.14
	5550	110	ax (40MHz)	52	37	271/286.8 (MCS11)	18.22	20.65
				52	40	271/286.8 (MCS11)	19.32	22.69
				52	44	271/286.8 (MCS11)	18.29	21.27
	5670	134	ax (40MHz)	52	37	271/286.8 (MCS11)	18.41	21.47
				52	40	271/286.8 (MCS11)	19.50	24.01
				52	44	271/286.8 (MCS11)	18.21	21.63
	5710	142	ax (40MHz)	52	37	271/286.8 (MCS11)	18.26	20.86
				52	40	271/286.8 (MCS11)	19.41	23.33
				52	44	271/286.8 (MCS11)	18.32	21.77
5530	106	ax (80MHz)	52	37	567/600.5 (MCS11)	18.08	20.74	
			52	44	567/600.5 (MCS11)	18.63	22.16	
			52	52	567/600.5 (MCS11)	18.67	21.67	
5690	138	ax (80MHz)	52	37	567/600.5 (MCS11)	18.01	20.20	
			52	44	567/600.5 (MCS11)	19.81	24.87	
			52	52	567/600.5 (MCS11)	19.01	22.37	

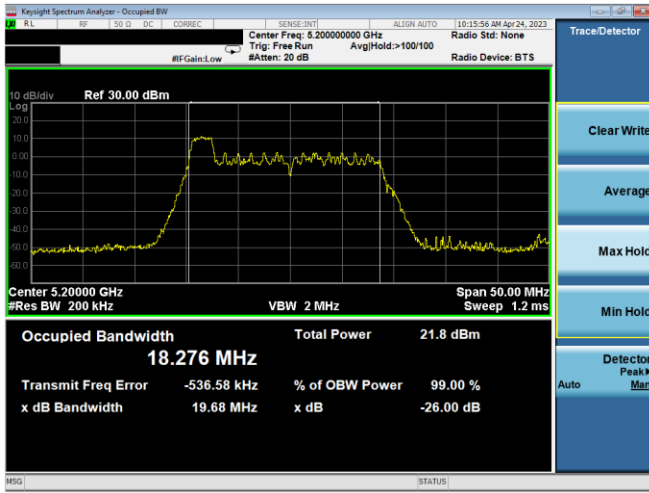
**Table 7-3. Conducted BW Measurements Ant 1 (RU52)**

FCC ID: BCGA2117 IC: 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 19 of 263

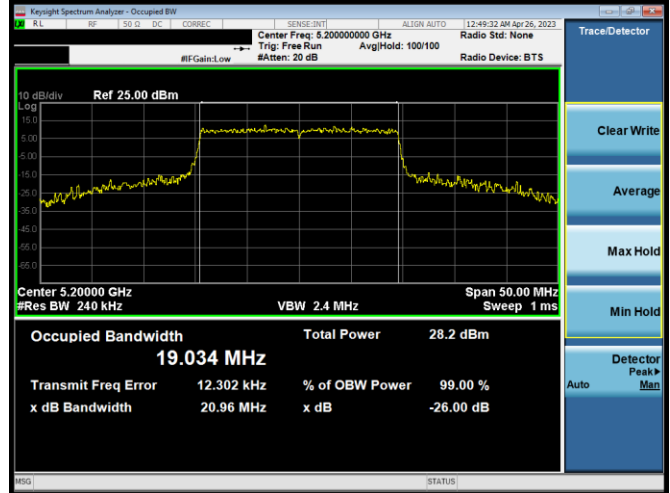
	Frequency [MHz]	Channel No.	802.11 Mode	RU Size	RU Index	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	ax (20MHz)	242	61	135/143.4 (MCS11)	19.02	21.09
	5200	40	ax (20MHz)	242	61	135/143.4 (MCS11)	19.03	20.96
	5240	48	ax (20MHz)	242	61	135/143.4 (MCS11)	19.01	21.27
	5190	38	ax (40MHz)	484	65	271/286.8 (MCS11)	37.94	41.84
	5230	46	ax (40MHz)	484	65	271/286.8 (MCS11)	38.57	74.31
	5210	42	ax (80MHz)	996	67	567/600.5 (MCS11)	76.98	81.56
Band 2A	5260	52	ax (20MHz)	242	61	135/143.4 (MCS11)	19.02	21.25
	5300	60	ax (20MHz)	242	61	135/143.4 (MCS11)	19.10	21.36
	5320	64	ax (20MHz)	242	61	135/143.4 (MCS11)	19.03	21.19
	5270	54	ax (40MHz)	484	65	271/286.8 (MCS11)	38.95	77.64
	5310	62	ax (40MHz)	484	65	271/286.8 (MCS11)	37.94	41.57
	5290	58	ax (80MHz)	996	67	567/600.5 (MCS11)	77.03	82.35
Band 2C	5500	100	ax (20MHz)	242	61	135/143.4 (MCS11)	19.05	21.15
	5580	116	ax (20MHz)	242	61	135/143.4 (MCS11)	19.21	29.38
	5700	140	ax (20MHz)	242	61	135/143.4 (MCS11)	19.03	21.35
	5720	144	ax (20MHz)	242	61	135/143.4 (MCS11)	19.10	22.44
	5510	102	ax (40MHz)	484	65	271/286.8 (MCS11)	38.02	42.13
	5550	110	ax (40MHz)	484	65	271/286.8 (MCS11)	38.85	77.58
	5670	134	ax (40MHz)	484	65	271/286.8 (MCS11)	37.98	41.96
	5710	142	ax (40MHz)	484	65	271/286.8 (MCS11)	38.10	68.51
	5530	106	ax (80MHz)	996	67	567/600.5 (MCS11)	77.08	82.15
	5690	138	ax (80MHz)	996	67	567/600.5 (MCS11)	77.43	106.32

**Table 7-4. Conducted BW Measurements Ant 1 (Fully – loaded RU)**

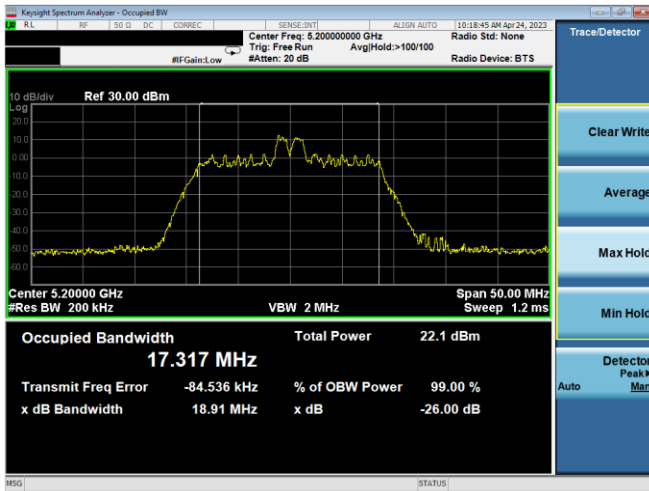
FCC ID: BCGA2117 IC: 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 20 of 263



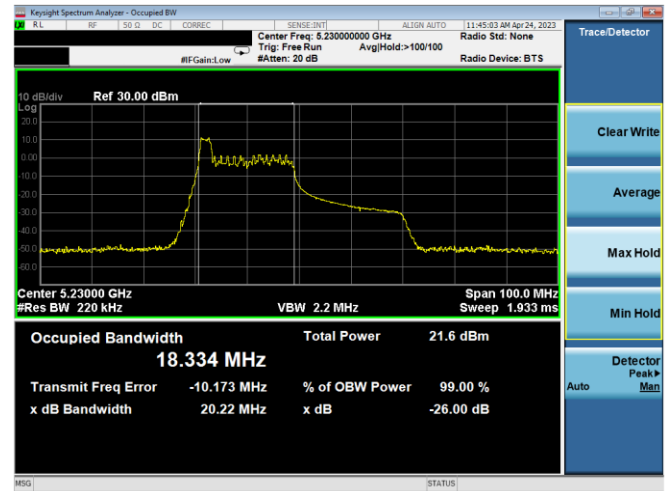
Plot 7-1. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 0 – RU26 – Ch.40)



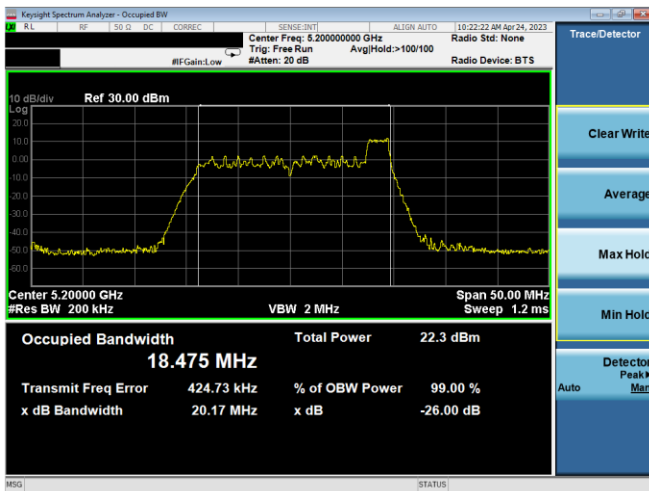
Plot 7-4. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax– RU242 – Ch.40)



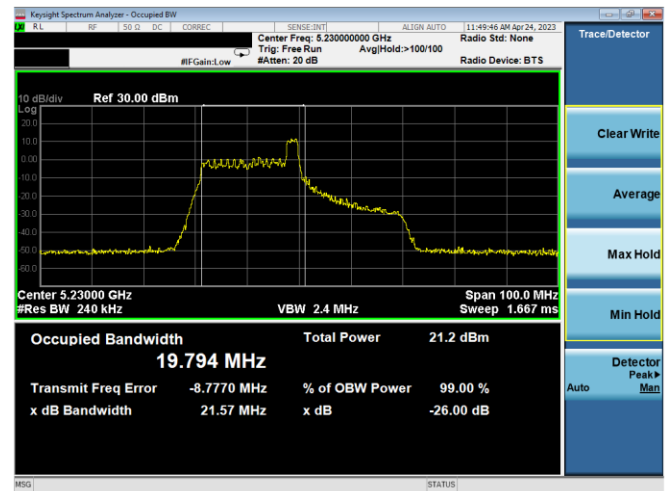
Plot 7-2. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 4 – RU26 – Ch.40)



Plot 7-5. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 0 – RU26 – Ch.46)

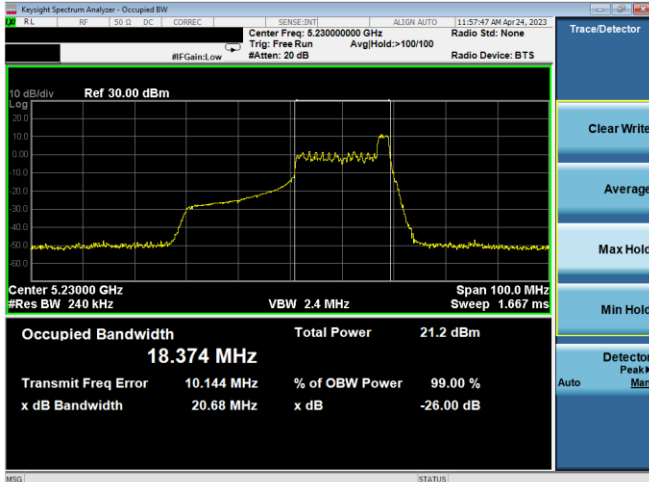


Plot 7-3. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 8 – RU26 – Ch.40)

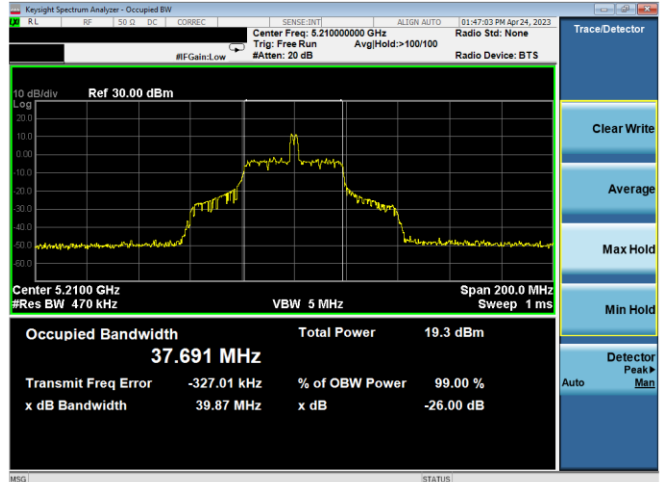


Plot 7-6. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 8 – RU26 – Ch.46)

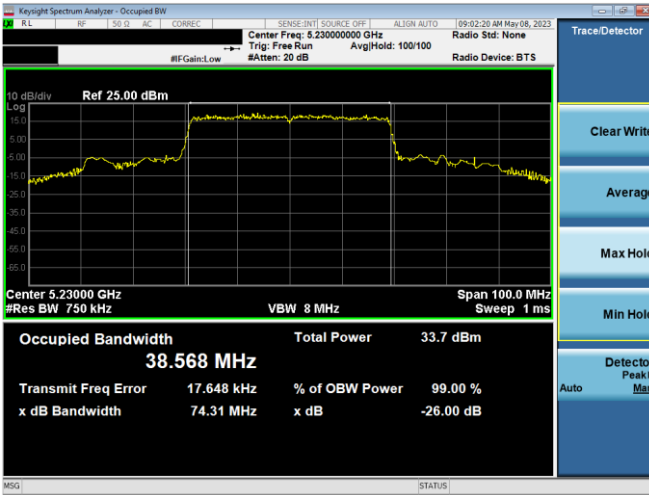
FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 21 of 263



Plot 7-7. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 17 – RU26 – Ch.46)



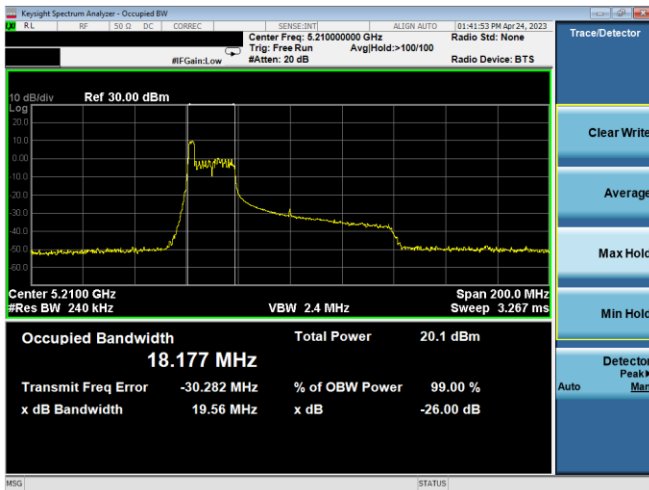
Plot 7-10. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 18 – RU26 – Ch.42)



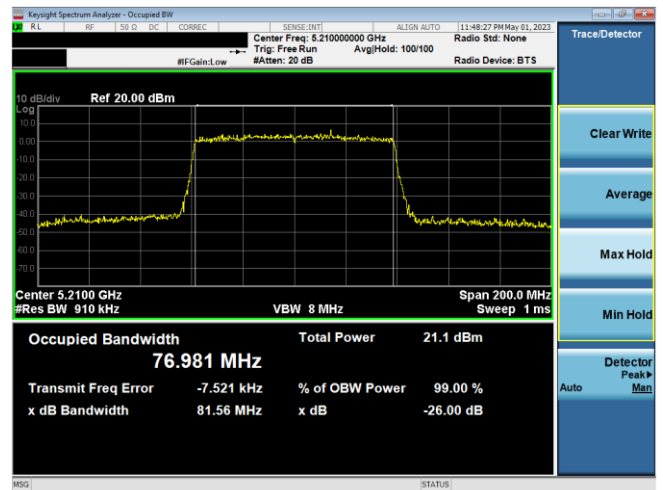
Plot 7-8. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax – RU484 – Ch.46)



Plot 7-11. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 36 – RU26 – Ch.42)

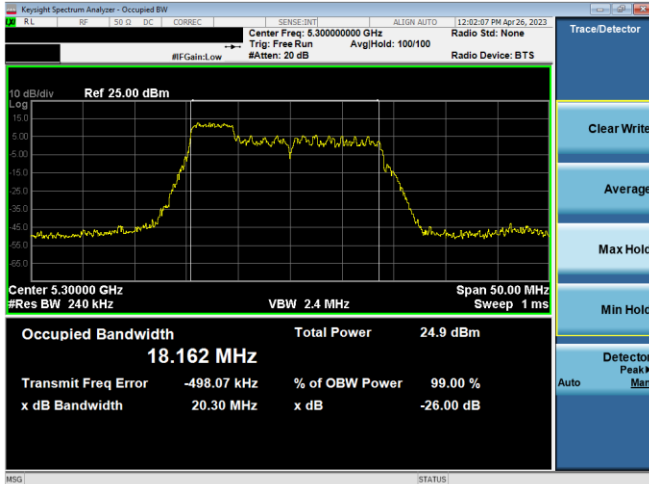


Plot 7-9. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 0 – RU26 – Ch.42)

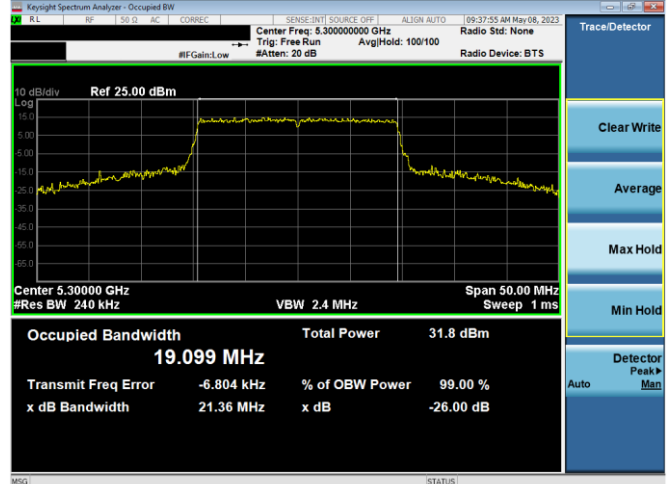


Plot 7-12. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax – RU996 – Ch.42)

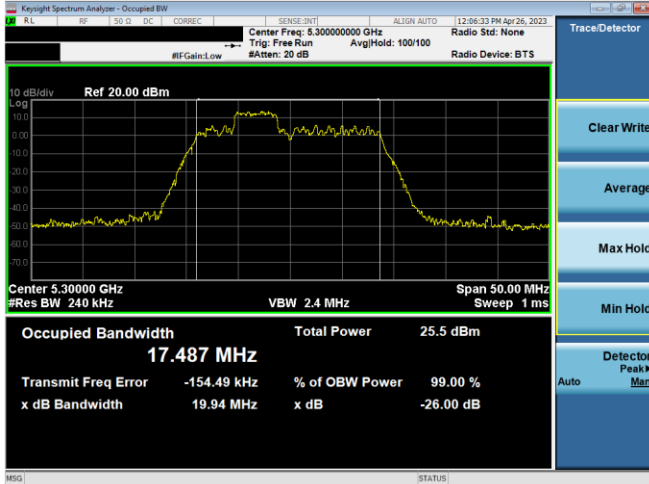
FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 22 of 263



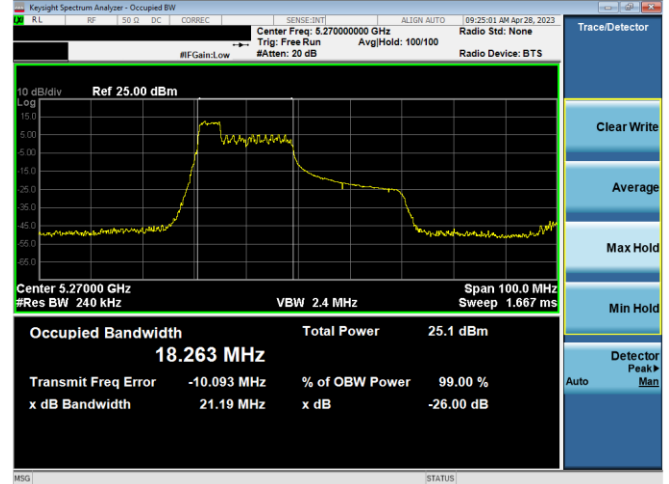
Plot 7-13. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 37 – RU52 – Ch.60)



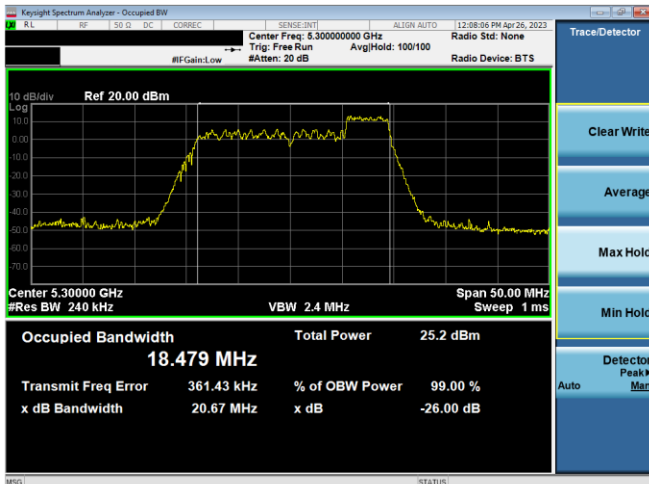
Plot 7-16. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax– RU242 – Ch.60)



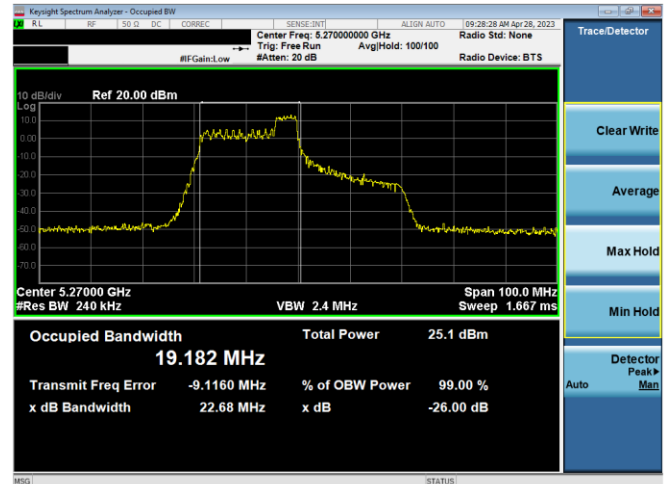
Plot 7-14. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 38 – RU52 – Ch.60)



Plot 7-17. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 37 – RU52 – Ch.54)

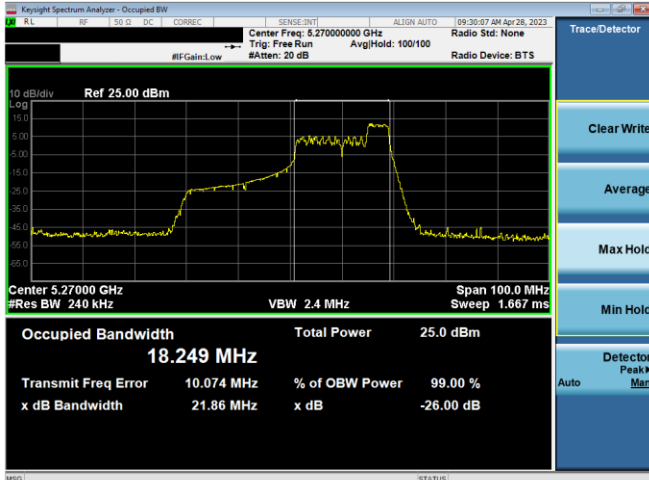


Plot 7-15. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 40– RU52 – Ch.60)

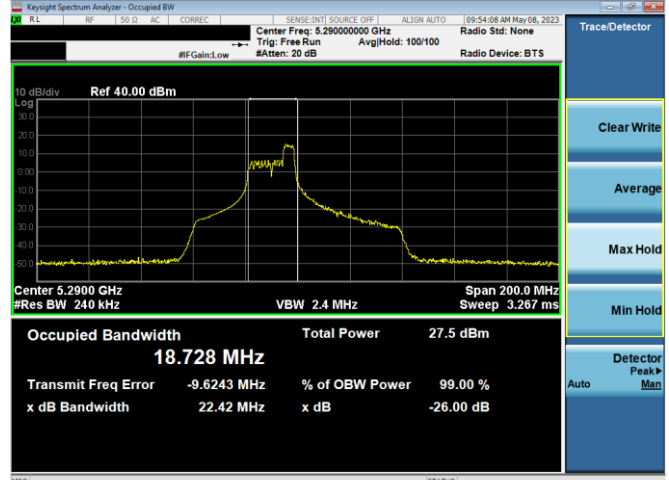


Plot 7-18. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 40 – RU52 – Ch.54)

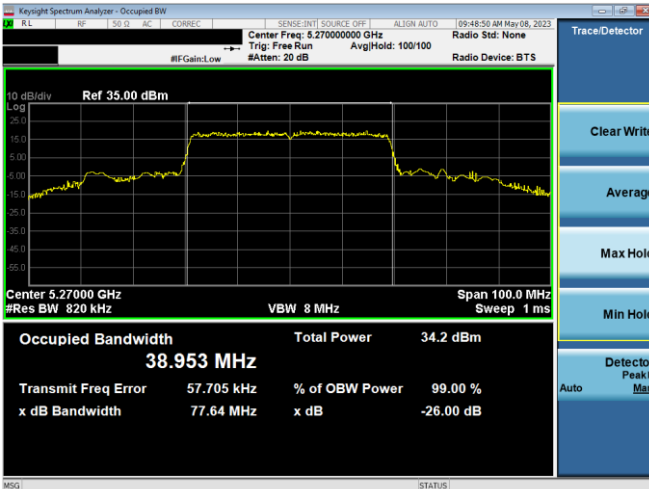
FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 23 of 263



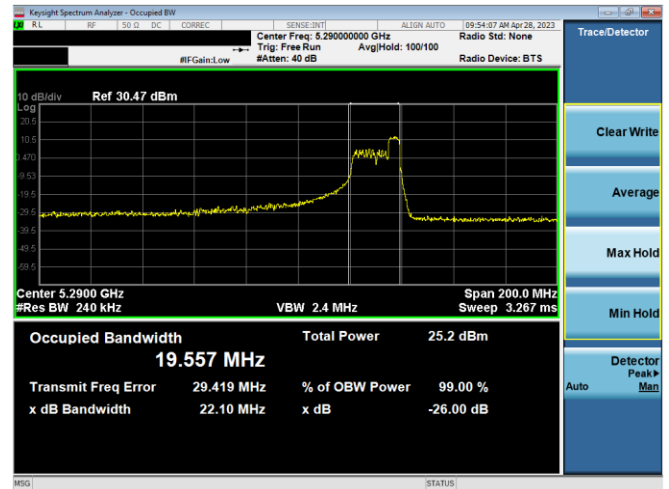
Plot 7-19. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 44 – RU52 – Ch.54)



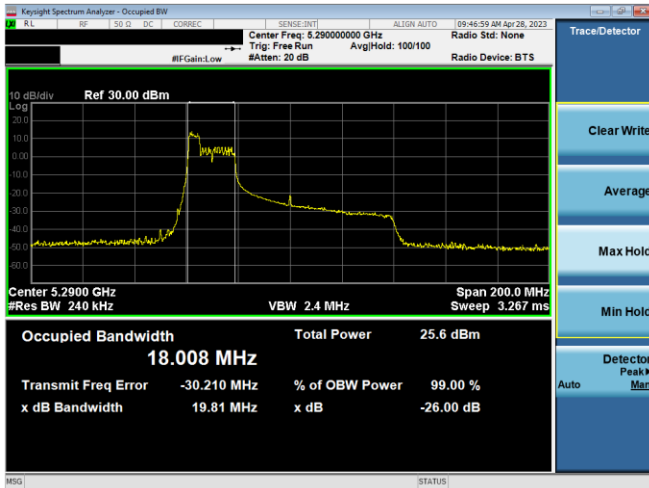
Plot 7-22. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 44 – RU52 – Ch.58)



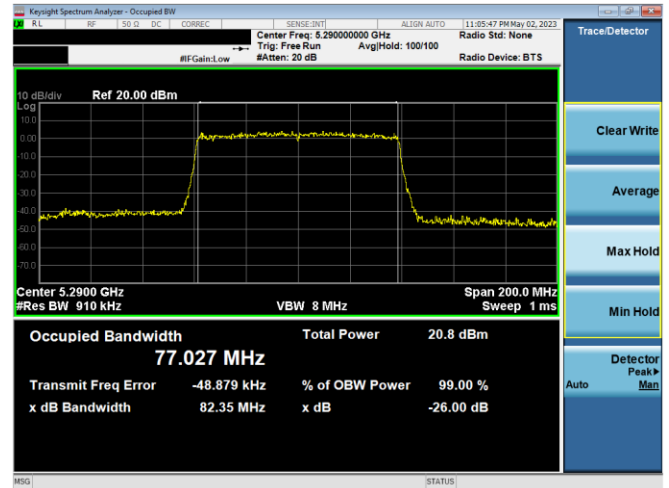
Plot 7-20. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax – RU484 – Ch.54)



Plot 7-23. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 52 – RU52 – Ch.58)



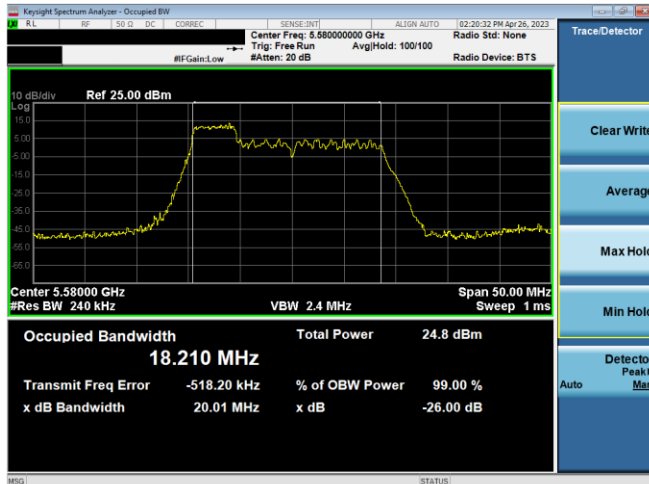
Plot 7-21. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 37 – RU52 – Ch.58)



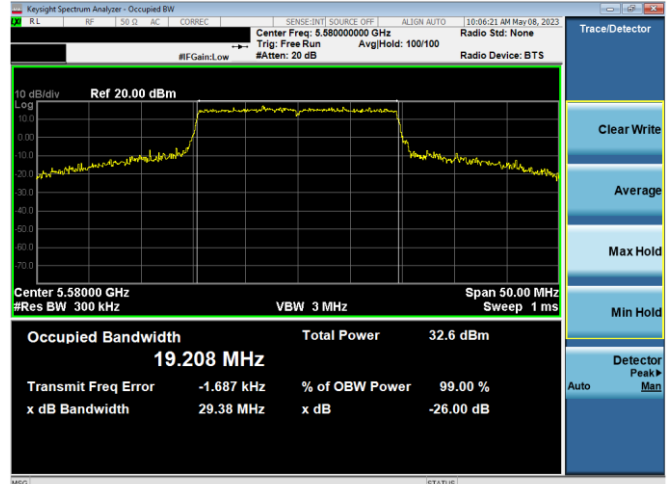
Plot 7-24. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax – RU996 – Ch.58)

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 24 of 263

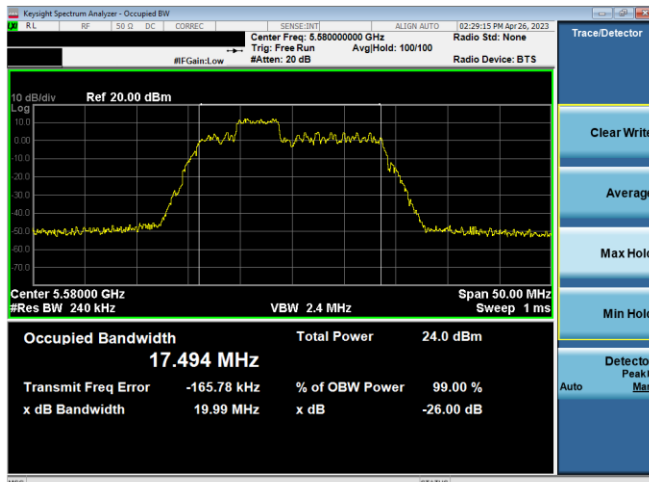




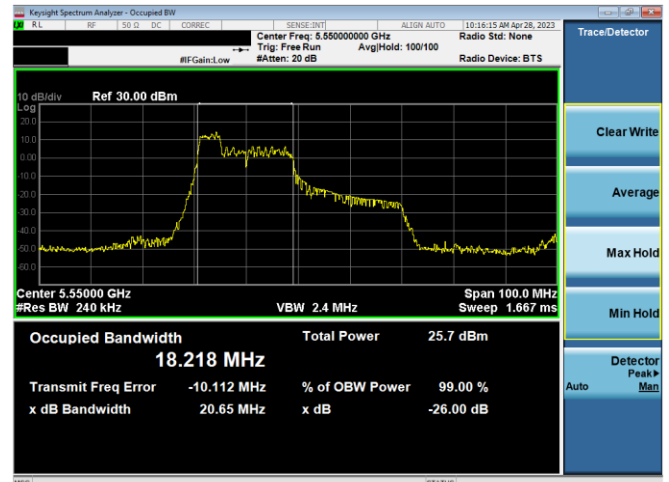
Plot 7-25. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 37 – RU52 – Ch.116)



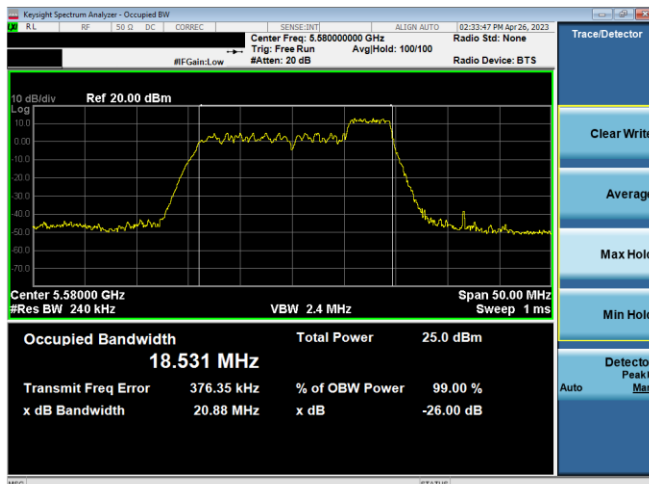
Plot 7-28. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax – RU242 – Ch.116)



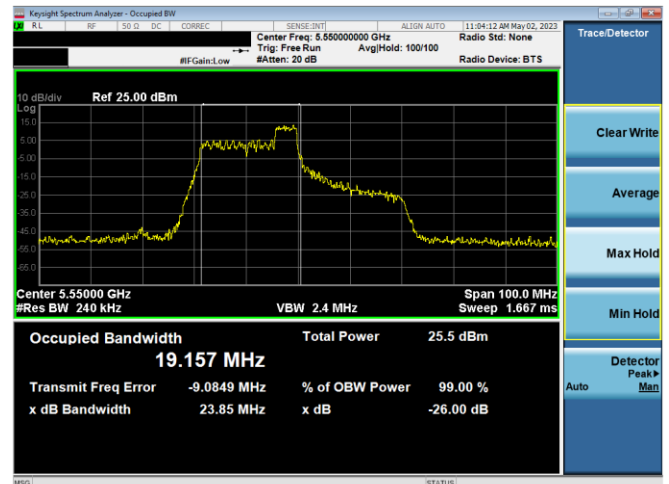
Plot 7-26. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 38 – RU52 – Ch.116)



Plot 7-29. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 37 – RU52 – Ch.110)

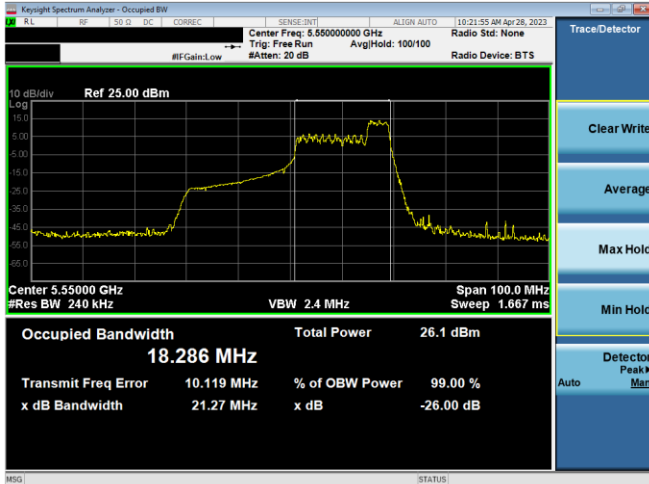


Plot 7-27. 26dB BW & 99% OBW Ant 1 (20MHz BW 11ax Index 40 – RU52 – Ch.116)

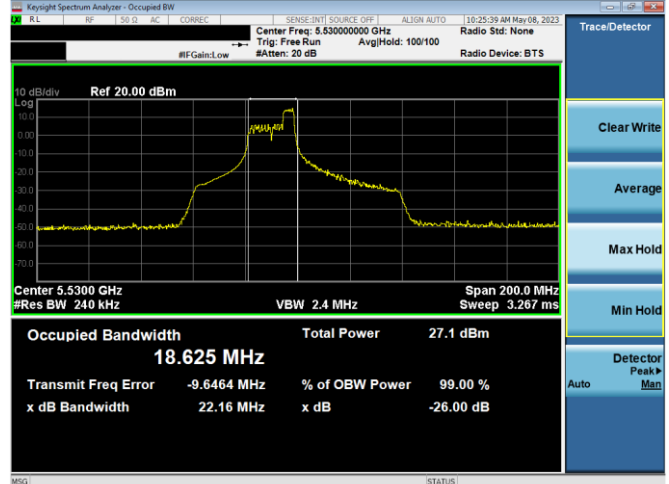


Plot 7-30. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 40 – RU52 – Ch.110)

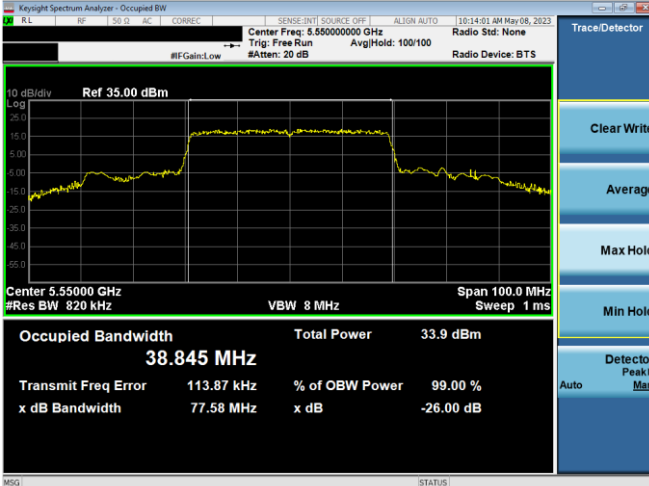
FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 25 of 263



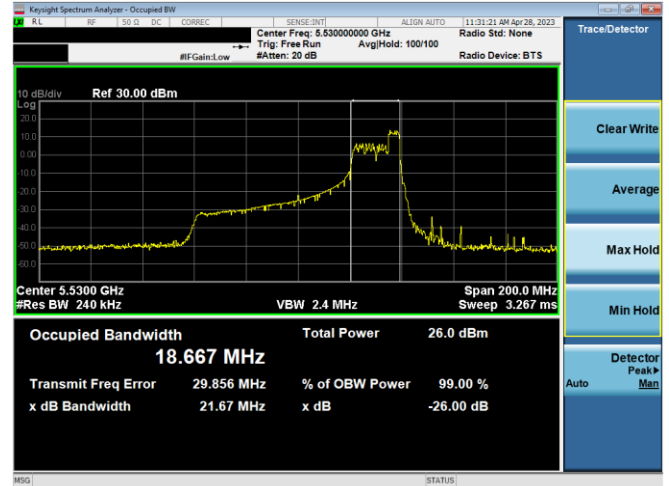
Plot 7-31. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax Index 44 – RU52 – Ch.110)



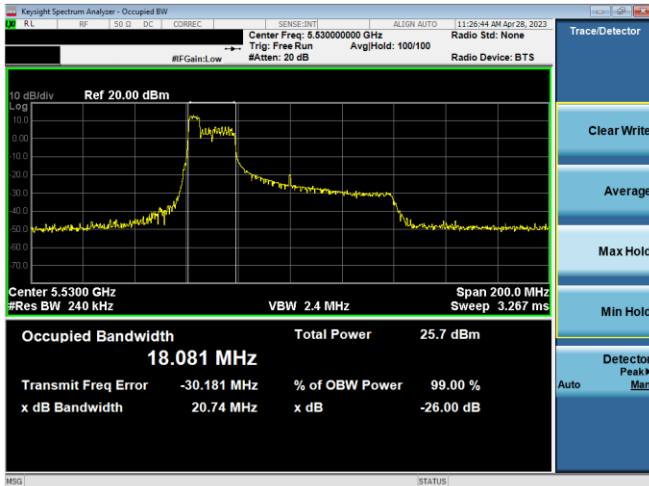
Plot 7-34. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 44 – RU52 – Ch.106)



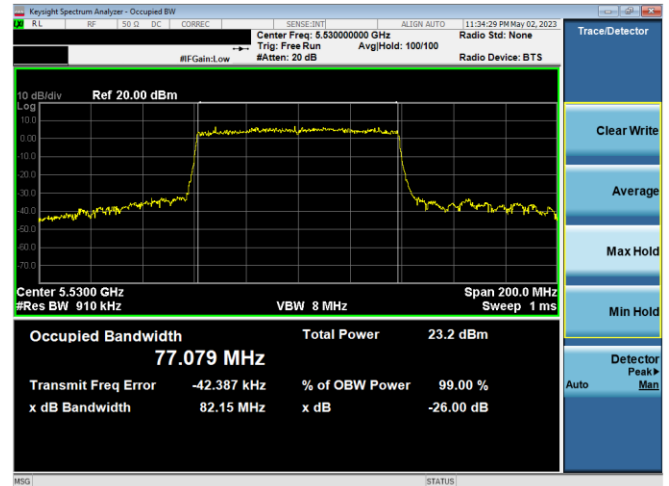
Plot 7-32. 26dB BW & 99% OBW Ant 1 (40MHz BW 11ax – RU484 – Ch.110)



Plot 7-35. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 52 – RU52 – Ch.106)



Plot 7-33. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax Index 37 – RU52 – Ch.106)



Plot 7-36. 26dB BW & 99% OBW Ant 1 (80MHz BW 11ax – RU996 – Ch.106)

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 26 of 263

## Ant 2 26dB & 99% Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	RU Size	RU Index	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	ax (20MHz)	26	0	135/143.4 (MCS11)	18.30	19.89
				26	4	135/143.4 (MCS11)	17.37	19.15
				26	8	135/143.4 (MCS11)	18.50	20.36
	5200	40	ax (20MHz)	26	0	135/143.4 (MCS11)	18.27	19.75
				26	4	135/143.4 (MCS11)	17.37	19.22
				26	8	135/143.4 (MCS11)	18.51	20.36
	5240	48	ax (20MHz)	26	0	135/143.4 (MCS11)	18.26	19.78
				26	4	135/143.4 (MCS11)	17.40	19.20
				26	8	135/143.4 (MCS11)	18.55	20.43
	5190	38	ax (40MHz)	26	0	271/286.8 (MCS11)	18.42	20.30
				26	8	271/286.8 (MCS11)	19.76	21.35
				26	17	271/286.8 (MCS11)	18.30	19.88
	5230	46	ax (40MHz)	26	0	271/286.8 (MCS11)	18.37	20.21
				26	8	271/286.8 (MCS11)	20.08	21.83
				26	17	271/286.8 (MCS11)	18.38	20.39
5210	42	ax (80MHz)	26	0	567/600.5 (MCS11)	18.10	19.52	
			26	18	567/600.5 (MCS11)	37.64	39.98	
			26	36	567/600.5 (MCS11)	18.92	20.91	

**Table 7-5. Conducted Bandwidth Measurements Ant 2 (RU26)**

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 27 of 263

	Frequency [MHz]	Channel No.	802.11 Mode	RU Size	RU Index	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]	
Band 2A	5260	52	ax (20MHz)	52	37	135/143.4 (MCS11)	18.23	20.19	
				52	38	135/143.4 (MCS11)	17.46	19.85	
				52	40	135/143.4 (MCS11)	18.53	20.80	
	5300	60	ax (20MHz)	52	37	135/143.4 (MCS11)	18.23	20.10	
				52	38	135/143.4 (MCS11)	17.45	19.90	
				52	40	135/143.4 (MCS11)	18.53	20.75	
	5320	64	ax (20MHz)	52	37	135/143.4 (MCS11)	18.24	20.13	
				52	38	135/143.4 (MCS11)	17.49	19.98	
				52	40	135/143.4 (MCS11)	18.54	20.50	
	5270	54	ax (40MHz)	52	37	271/286.8 (MCS11)	18.26	20.77	
				52	40	271/286.8 (MCS11)	19.57	23.61	
				52	44	271/286.8 (MCS11)	18.23	21.41	
	5310	62	ax (40MHz)	52	37	271/286.8 (MCS11)	18.27	20.48	
				52	40	271/286.8 (MCS11)	19.14	22.81	
				52	44	271/286.8 (MCS11)	18.28	21.61	
	5290	58	ax (80MHz)	52	37	567/600.5 (MCS11)	18.02	20.23	
				52	44	567/600.5 (MCS11)	20.41	25.62	
				52	52	567/600.5 (MCS11)	18.87	21.54	
	Band 2C	5500	100	ax (20MHz)	52	37	135/143.4 (MCS11)	18.21	20.17
					52	38	135/143.4 (MCS11)	17.45	19.82
					52	40	135/143.4 (MCS11)	18.50	20.68
5580		116	ax (20MHz)	52	37	135/143.4 (MCS11)	18.20	19.72	
				52	38	135/143.4 (MCS11)	17.11	18.55	
				52	40	135/143.4 (MCS11)	18.21	19.92	
5700		140	ax (20MHz)	52	37	135/143.4 (MCS11)	18.28	20.66	
				52	38	135/143.4 (MCS11)	17.45	19.83	
				52	40	135/143.4 (MCS11)	18.48	20.61	
5720		144	ax (20MHz)	52	37	135/143.4 (MCS11)	18.28	20.13	
				52	38	135/143.4 (MCS11)	17.43	19.72	
				52	40	135/143.4 (MCS11)	18.53	20.63	
5510		102	ax (40MHz)	52	37	271/286.8 (MCS11)	18.30	20.63	
				52	40	271/286.8 (MCS11)	19.37	22.96	
				52	44	271/286.8 (MCS11)	18.20	21.32	
5550		110	ax (40MHz)	52	37	271/286.8 (MCS11)	18.20	21.36	
				52	40	271/286.8 (MCS11)	19.10	24.00	
				52	44	271/286.8 (MCS11)	18.18	21.46	
5670		134	ax (40MHz)	52	37	271/286.8 (MCS11)	18.07	21.74	
				52	40	271/286.8 (MCS11)	19.35	22.98	
				52	44	271/286.8 (MCS11)	18.09	21.20	
5710	142	ax (40MHz)	52	37	271/286.8 (MCS11)	18.27	21.61		
			52	40	271/286.8 (MCS11)	19.44	22.88		
			52	44	271/286.8 (MCS11)	18.21	21.75		
5530	106	ax (80MHz)	52	37	567/600.5 (MCS11)	17.96	20.10		
			52	44	567/600.5 (MCS11)	20.27	26.03		
			52	52	567/600.5 (MCS11)	18.65	21.97		
5690	138	ax (80MHz)	52	37	567/600.5 (MCS11)	18.09	20.04		
			52	44	567/600.5 (MCS11)	20.17	24.75		
			52	52	567/600.5 (MCS11)	18.86	22.26		

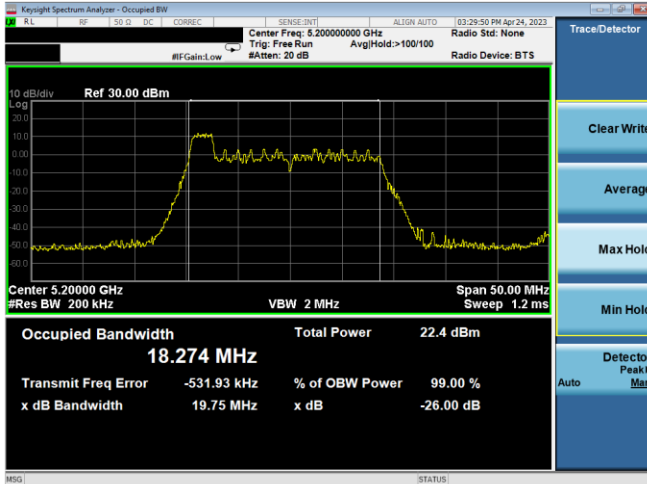
**Table 7-6. Conducted Bandwidth Measurements Ant 2 (RU52)**

FCC ID: BCGA2117 IC: 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 28 of 263

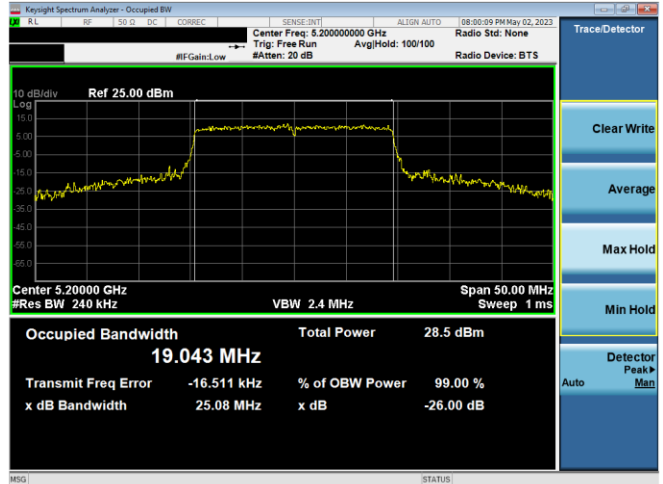
	Frequency [MHz]	Channel No.	802.11 Mode	RU Size	RU Index	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	ax (20MHz)	242	61	135/143.4 (MCS11)	19.04	21.30
	5200	40	ax (20MHz)	242	61	135/143.4 (MCS11)	19.04	25.08
	5240	48	ax (20MHz)	242	61	135/143.4 (MCS11)	19.06	24.71
	5190	38	ax (40MHz)	484	65	271/286.8 (MCS11)	37.96	42.01
	5230	46	ax (40MHz)	484	65	271/286.8 (MCS11)	38.48	72.81
	5210	42	ax (80MHz)	996	67	567/600.5 (MCS11)	77.01	82.01
Band 2A	5260	52	ax (20MHz)	242	61	135/143.4 (MCS11)	19.07	21.20
	5300	60	ax (20MHz)	242	61	135/143.4 (MCS11)	19.07	21.20
	5320	64	ax (20MHz)	242	61	135/143.4 (MCS11)	19.07	24.94
	5270	54	ax (40MHz)	484	65	271/286.8 (MCS11)	38.74	77.11
	5310	62	ax (40MHz)	484	65	271/286.8 (MCS11)	38.22	68.69
	5290	58	ax (80MHz)	996	67	567/600.5 (MCS11)	37.92	42.00
Band 2C	5500	100	ax (20MHz)	242	61	135/143.4 (MCS11)	77.16	81.91
	5580	116	ax (20MHz)	242	61	135/143.4 (MCS11)	19.03	21.32
	5700	140	ax (20MHz)	242	61	135/143.4 (MCS11)	19.01	21.14
	5720	144	ax (20MHz)	242	61	135/143.4 (MCS11)	19.04	22.50
	5510	102	ax (40MHz)	484	65	271/286.8 (MCS11)	38.01	42.13
	5550	110	ax (40MHz)	484	65	271/286.8 (MCS11)	38.72	77.10
	5670	134	ax (40MHz)	484	65	271/286.8 (MCS11)	37.97	41.82
	5710	142	ax (40MHz)	484	65	271/286.8 (MCS11)	38.19	68.71
	5530	106	ax (80MHz)	996	67	567/600.5 (MCS11)	77.22	82.17
	5690	138	ax (80MHz)	996	67	567/600.5 (MCS11)	77.39	113.11

**Table 7-7. Conducted Bandwidth Measurements Ant 2 (Fully- loaded RU)**

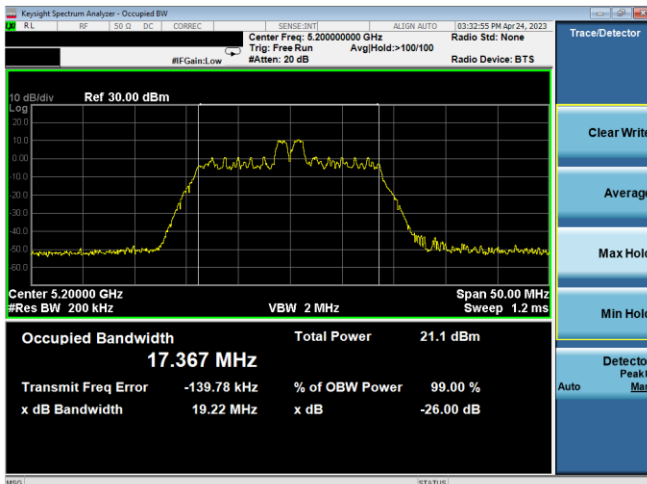
FCC ID: BCGA2117 IC: 579C-A2117		<b>MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1C2302130007-06.BCG	<b>Test Dates:</b> 2/20/2023 - 5/9/2023	<b>EUT Type:</b> Head Mounted Device	Page 29 of 263



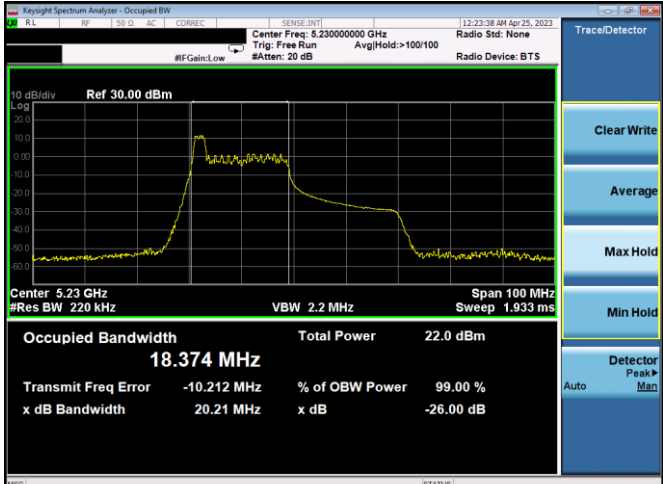
Plot 7-37. 26dB BW & 99% OBW Ant 2 (20MHz BW 11ax Index 0 – RU26 – Ch.40)



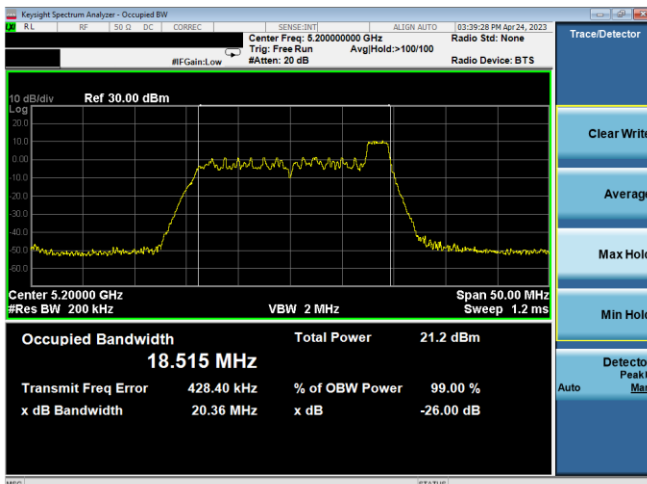
Plot 7-40. 26dB BW & 99% OBW Ant 2 (20MHz BW 11ax– RU242 – Ch.40)



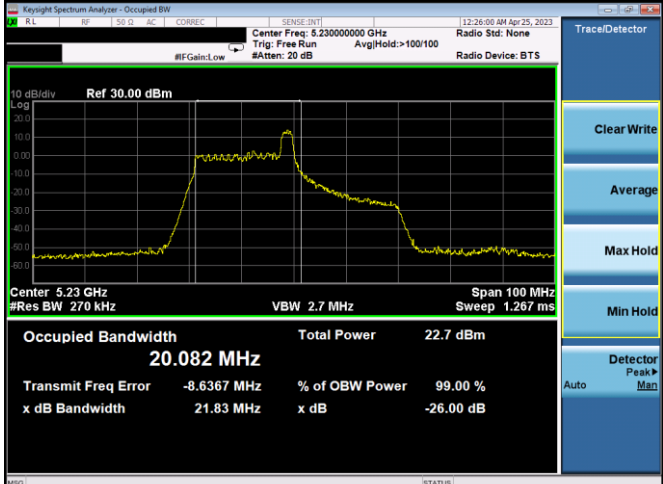
Plot 7-38. 26dB BW & 99% OBW Ant 2 (20MHz BW 11ax Index 4 – RU26 – Ch.40)



Plot 7-41. 26dB BW & 99% OBW Ant 2 (40MHz BW 11ax Index 0 – RU26 – Ch.46)

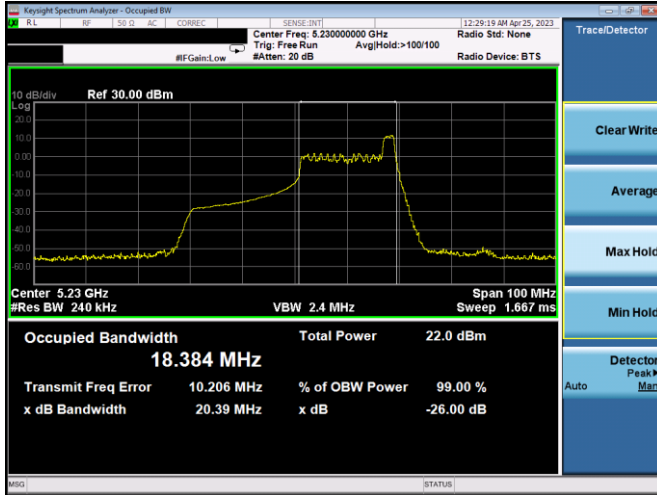


Plot 7-39. 26dB BW & 99% OBW Ant 2 (20MHz BW 11ax Index 8– RU26 – Ch.40)

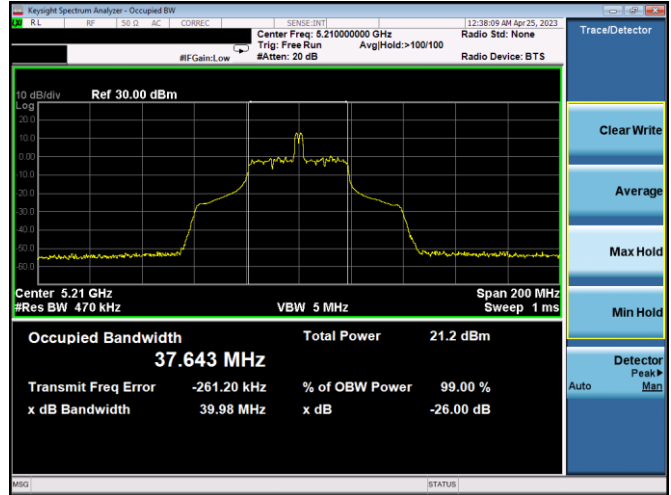


Plot 7-42. 26dB BW & 99% OBW Ant 2 (40MHz BW 11ax Index 8 – RU26 – Ch.46)

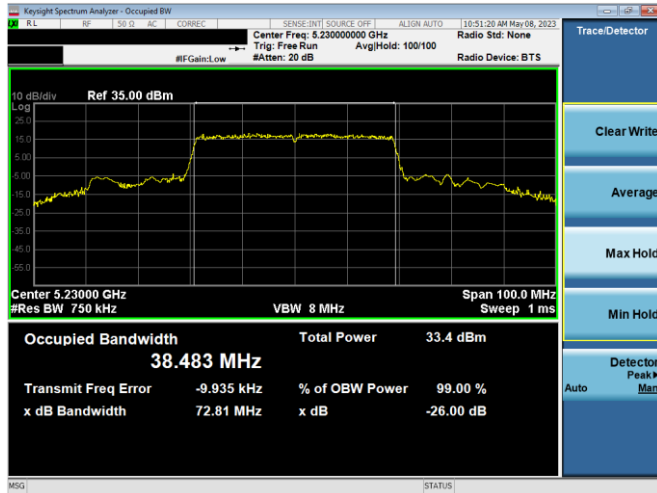
FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 30 of 263



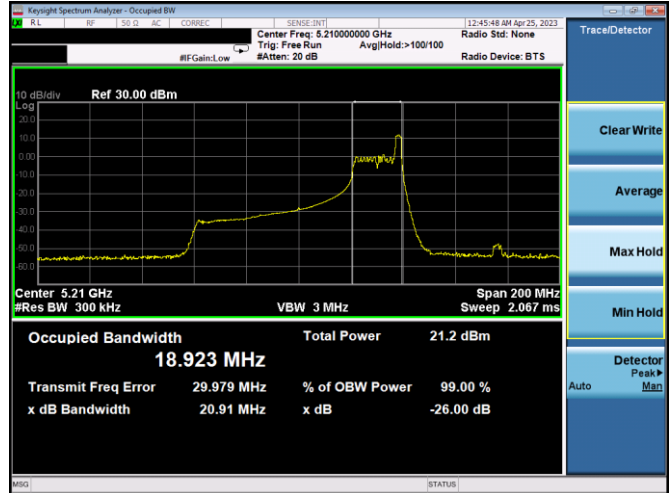
Plot 7-43. 26dB BW & 99% OBW Ant 2 (40MHz BW 11ax Index 17 – RU26 – Ch.46)



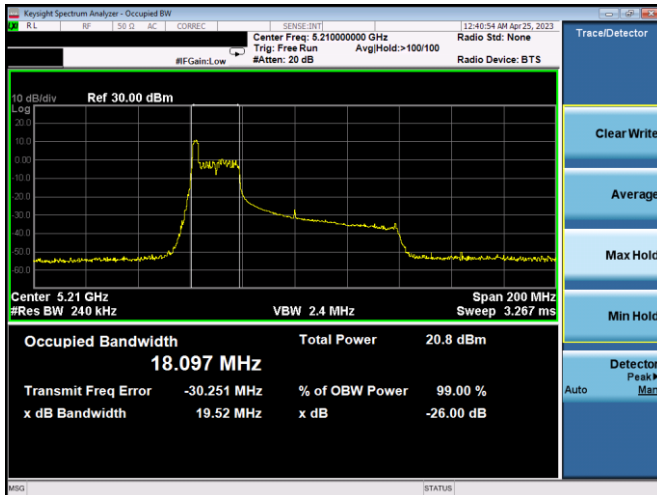
Plot 7-46. 26dB BW & 99% OBW Ant 2 (80MHz BW 11ax Index 18 – RU26 – Ch.42)



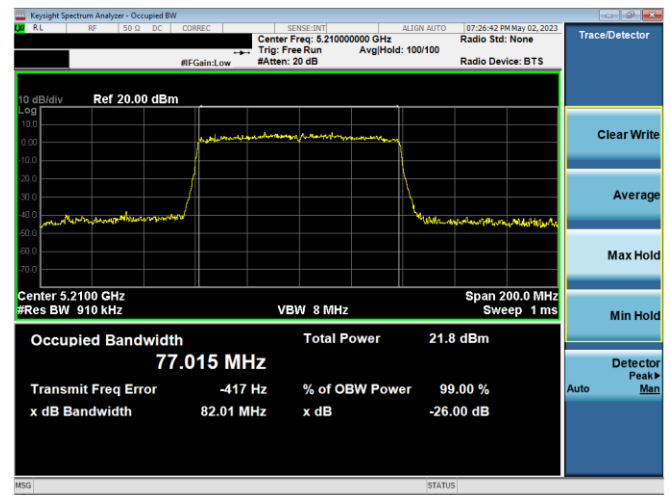
Plot 7-44. 26dB BW & 99% OBW Ant 2 (40MHz BW 11ax – RU484 – Ch.46)



Plot 7-47. 26dB BW & 99% OBW Ant 2 (80MHz BW 11ax Index 36 – RU26 – Ch.42)

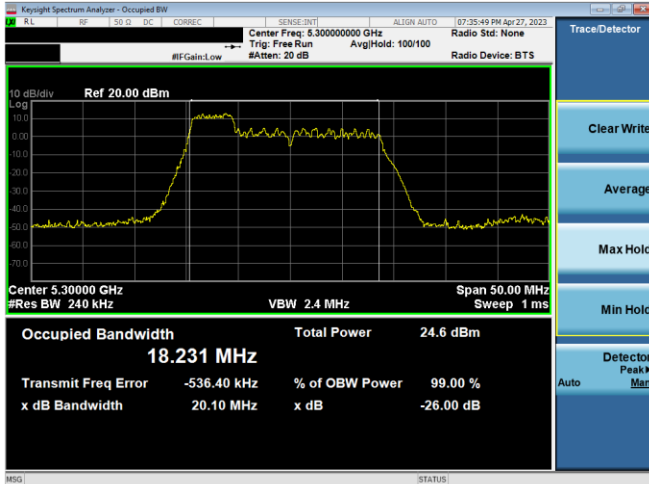


Plot 7-45. 26dB BW & 99% OBW Ant 2 (80MHz BW 11ax Index 0 – RU26 – Ch.42)

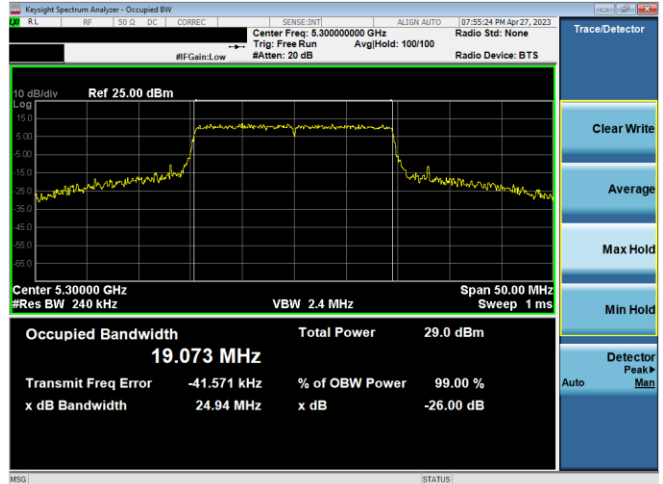


Plot 7-48. 26dB BW & 99% OBW Ant 2 (80MHz BW 11ax – RU996 – Ch.42)

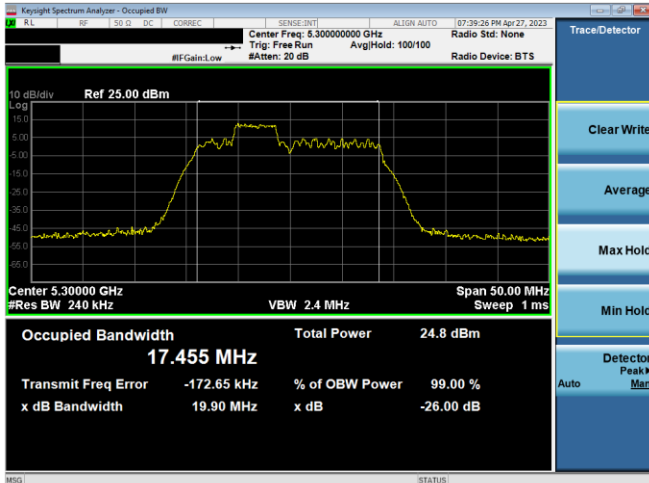
FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 31 of 263



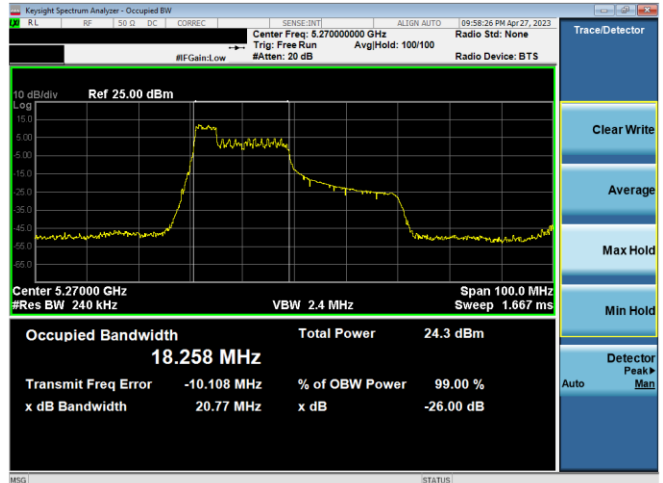
Plot 7-49. 26dB BW & 99% OBW Ant 2 (20MHz BW 11ax Index 37 – RU52 – Ch.60)



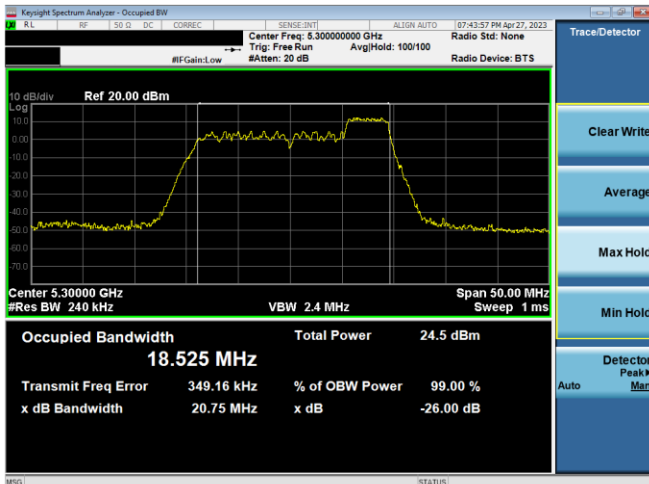
Plot 7-52. 26dB BW & 99% OBW Ant 2 (20MHz BW 11ax– RU242 – Ch.60)



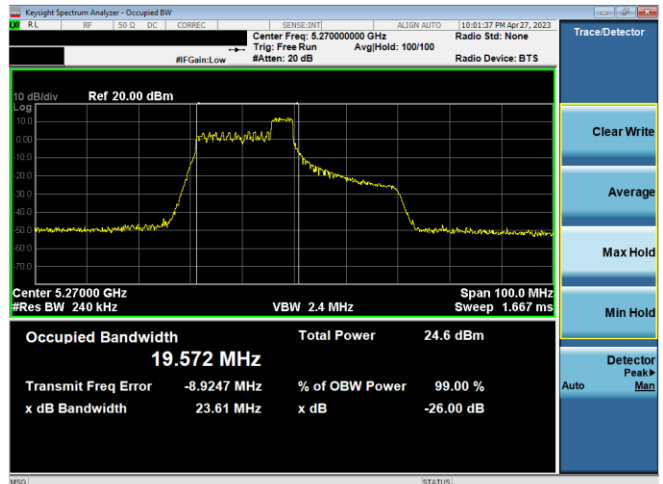
Plot 7-50. 26dB BW & 99% OBW Ant 2 (20MHz BW 11ax Index 38 – RU52 – Ch.60)



Plot 7-53. 26dB BW & 99% OBW Ant 2 (40MHz BW 11ax Index 37 – RU52 – Ch.54)



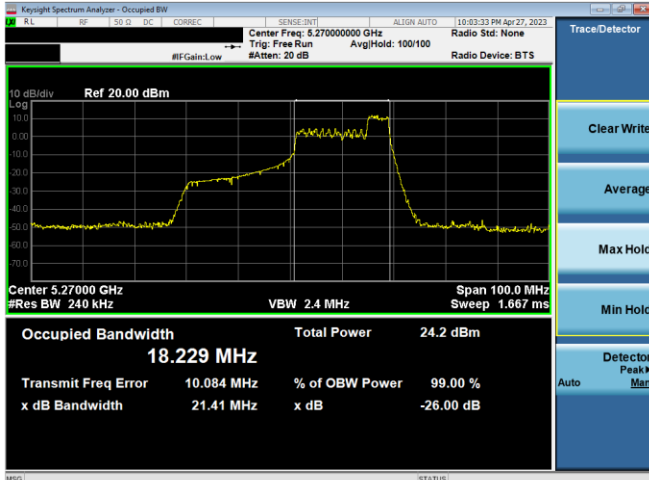
Plot 7-51. 26dB BW & 99% OBW Ant 2 (20MHz BW 11ax Index 40– RU52 – Ch.60)



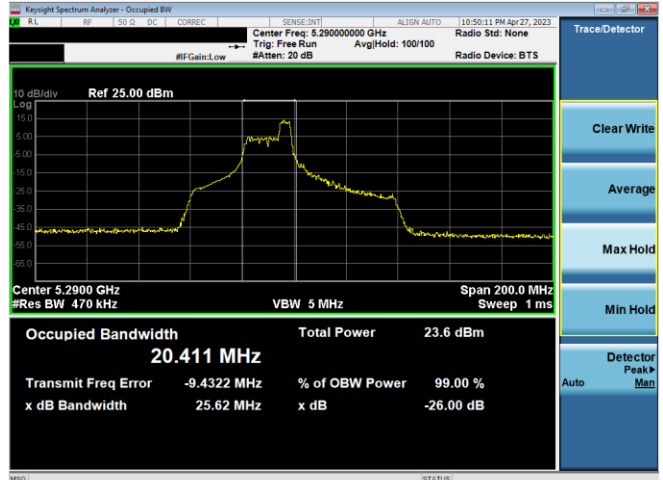
Plot 7-54. 26dB BW & 99% OBW Ant 2 (40MHz BW 11ax Index 44 – RU52 – Ch.54)

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 32 of 263

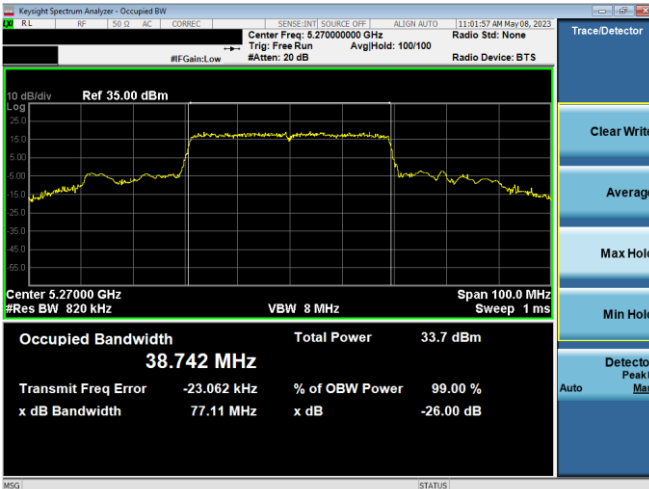




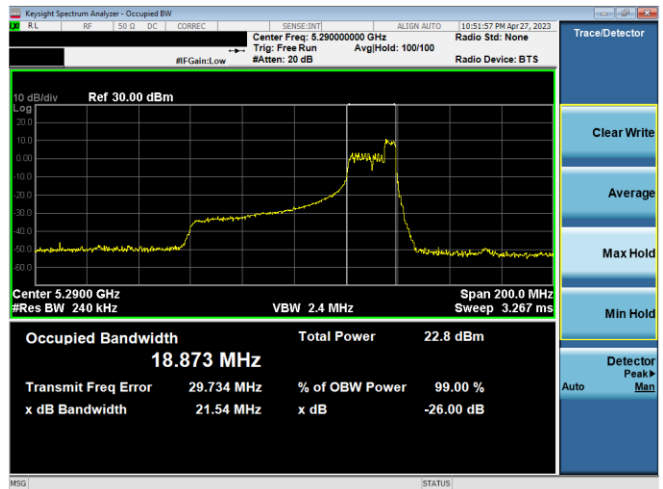
Plot 7-55. 26dB BW & 99% OBW Ant 2 (40MHz BW 11ax Index 44 – RU52 – Ch.54)



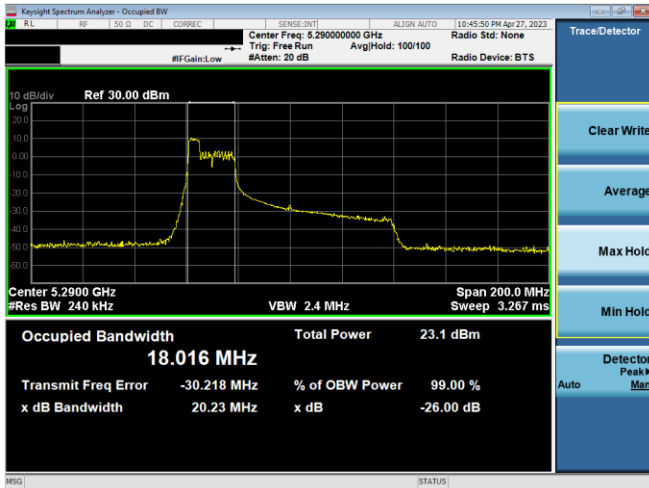
Plot 7-58. 26dB BW & 99% OBW Ant 2 (80MHz BW 11ax Index 44 – RU52 – Ch.58)



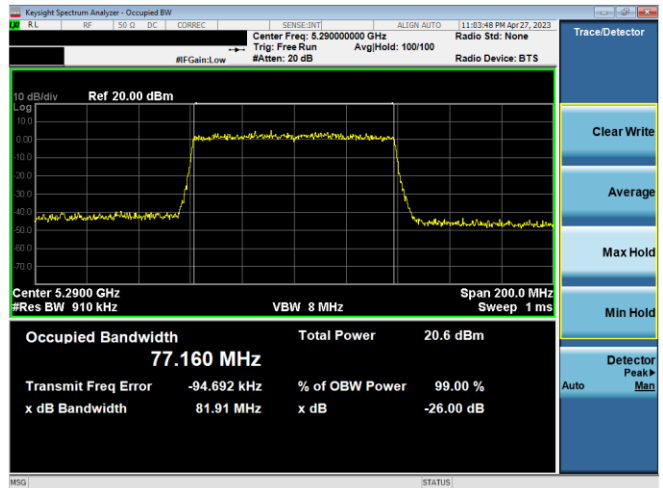
Plot 7-56. 26dB BW & 99% OBW Ant 2 (40MHz BW 11ax – RU484 – Ch.54)



Plot 7-59. 26dB BW & 99% OBW Ant 2 (80MHz BW 11ax Index 52 – RU52 – Ch.58)



Plot 7-57. 26dB BW & 99% OBW Ant 2 (80MHz BW 11ax Index 37 – RU52 – Ch.58)



Plot 7-60. 26dB BW & 99% OBW Ant 2 (80MHz BW 11ax – RU996 – Ch.58)

FCC ID: BCGA2117 IC: 579C-A2117		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2302130007-06.BCG	Test Dates: 2/20/2023 - 5/9/2023	EUT Type: Head Mounted Device	Page 33 of 263