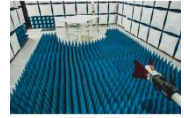




Element Materials Technology

(formerly PCTEST)
18855 Adams Court, Morgan Hill, CA 95037 USA
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<http://www.element.com>



MEASUREMENT REPORT FCC PART 15.407 Narrowband UNII BDR/LE/HDR

Applicant Name:

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

Date of Testing:

6/26/2024 - 8/19/2024

Test Report Issue Date:

8/21/2024

Test Site/Location:

Element Materials Technology Morgan Hill, CA, USA

Test Report Serial No.:

1C2405230024-06.BCG

FCC ID:

BCG-A3053

APPLICANT:

Apple Inc.

Application Type:

Certification

Model:

A3053

EUT Type:

Wireless Earbud

Frequency Range:

5157 – 5245MHz, 5731 – 5844MHz

Modulation Type:

GFSK, $\pi/4$ DQPSK

FCC Classification:

Unlicensed National Information Infrastructure (UNII)

FCC Rule Part(s):

Part 15 Subpart E (15.407)

Test Procedure(s):

ANSI C63.10-2020, KDB 789033 D02 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 C63.10-2020 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

Prepared by: WKR0000006184

Reviewed by: WKR0000005849



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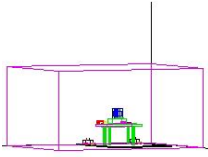
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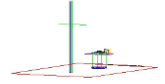
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UNII Band	Tx Frequency [MHz]	Mode	Max. Power [mW]	Max. Power [dBm]
1	5157 - 5245	NB UNII BDR	7.907	8.98
		NB UNII LE2M	9.908	9.96
		NB UNII HDR4	7.727	8.88
		NB UNII HDR8	7.816	8.93
		NB UNII HDRp4	3.890	5.90
		NB UNII HDRp8	3.846	5.85
3	5731 - 5844	NB UNII BDR	9.817	9.92
		NB UNII LE2M	12.050	10.81
		NB UNII HDR4	8.851	9.47
		NB UNII HDR8	8.831	9.46
		NB UNII HDRp4	4.467	6.50
		NB UNII HDRp8	4.446	6.48

FCC EUT Overview

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 Element Materials Technology Test Location

These measurement tests were conducted at the Element Materials Technology 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.

- Element Materials Technology 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 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 designed by NIST under the U.S. and Canada Mutual Recognition Agreements (MRAs)

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Wireless Left Earbud FCC ID: BCG-A3053**. The test data contained in this report pertains only to the emissions due to the EUT's Narrowband UNII transmitter.

- This Narrowband UNII module has been tested by manufacturer and the following were confirmed:
 - A) The hopping sequence is pseudorandom
 - B) The receiver input bandwidth equals the transmit bandwidth
 - C) The receiver hops in sequence with the transmit signal
 - D) Narrowband UNII can only hop within the same UNII band and cannot hop between bands

Test Device Serial No.: H5RH6A005C00000RP1, H5RH71002CJ0000B30, H5RH71002CF0000B30, H5RH71002CE0000B30, H5RH6A005C50000RP1

2.2 Device Capabilities

This device contains the following capabilities:

Bluetooth (1x, EDR, LE1M, LE2M, HDR4, HDR8, HDRp4, HDRp8), NB UNII (1x, LE2M, HDR4, HDR8, HDRp4, HDRp8).

Band 1	Band 3
Frequency (MHz)	Frequency (MHz)
5157	5731
:	:
5201	5788
:	:
5245	5844

Table 2-1. NB UNII BDR/LE/HDR Frequency of Operations

Note: This device is capable of operating in hopping and non-hopping mode. The EUT can hop between different channels in the U-NII Band 1 & U-NII Band 3. 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 C63.10-2020. 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:

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Measured Duty Cycles			
Band	Frequency (MHz)	Mode	Duty Cycle [%]
UNII-1	5157-5245	NB UNII BDR	76.5
		NB UNII LE2M	80.0
		NB UNII HDR4	77.9
		NB UNII HDR8	78.2
		NB UNII HDRp4	87.3
		NB UNII HDRp8	87.8
UNII-3	5731-5844	NB UNII BDR	76.5
		NB UNII LE2M	80.0
		NB UNII HDR4	77.9
		NB UNII HDR8	78.2
		NB UNII HDRp4	87.2
		NB UNII HDRp8	88.0

Table 2-2. Measured Duty Cycles

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2.3 Antenna Description

The following antenna gains provided by the manufacturer were used for testing.

Frequency [MHz]	Antenna Gain (dBi)
5157 - 5245	-4.7
5731 – 5844	-2.9

Table 2-3. Highest Antenna Gain

2.4 Test Support Equipment

1	Apple MacBook Pro w/AC/DC Adapter	Model: A2141 Model: A2166	S/N: C02H604EQ05D S/N: C4H042705ZNP0WA6
2	Apple Airpod Charging Case Apple Airpod (Right)	Model: A3058 Model: A3050	S/N: Q2474W2F77 S/N: H5RH72001JA0000B31
3	USB-C Cable w/ AC Adapter	Model: A246C Model: A2305	S/N: N/A S/N: N/A
4	Apple USB-C Cable	Model: Spartan	S/N: 000MKTR02U

Table 2-4. Test Support Equipment List

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2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2020 and KDB 789033 D02 v02r01. ANSI C63.10-2020 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, and 7.5 for antenna port conducted emissions test setups.

The worst case configuration was investigated with and without charging case. The worst case configuration found was used for all testing.

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 configurations were investigated.

- EUT charged by charging case and powered by AC/DC adaptor with USB-C cable.
- EUT charged by charging case and powered by host PC with USB-C cable.

2.6 Software and Firmware

The test was conducted with firmware version 7A343 installed on the EUT.

2.7 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2020) 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.

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3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

Per KDB 414788 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).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

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

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

Conclusion:

The EUT complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

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

Contribution	Expanded Uncertainty (\pm dB)
Conducted Bench Top Measurements	2.07
AC Line Conducted Disturbance	1.91
Radiated Disturbance (<30MHz)	4.12
Radiated Disturbance (30MHz - 1GHz)	4.85
Radiated Disturbance (1 - 18GHz)	5.08
Radiated Disturbance (>18GHz)	5.22

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6.0 TEST EQUIPMENT CALIBRATION DATA

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

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent Technologies	N9030A	3Hz-26.5GHz PXA Signal Analyzer	10/18/2023	Annual	10/18/2024	MY55330128
Anritsu	ML2495A	Power Meter	7/8/2024	Annual	7/8/2025	1039008
Anritsu	MA2411B	Pulse Power Sensor	7/1/2024	Annual	7/1/2025	1911105
Anritsu	MA2411B	Pulse Power Sensor	11/8/2023	Annual	11/8/2024	1027293
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	3/14/2024	Annual	3/14/2025	T058701-01
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	4/9/2024	Annual	4/9/2025	00218555
Mini-Circuits	FLC-1.5FT-SMSM+	30MHz-27GHz Conducted Cable *	9/14/2023	Annual	9/14/2024	16113316
Keysight Technology	N9040B	UXA Signal Analyzer	5/28/2024	Annual	5/28/2025	MY57212015
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	8/15/2023	Annual	8/15/2024	101639
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	5/29/2024	Annual	5/29/2025	101619
Rohde & Schwarz	ESW44	EMI Test Receiver	5/1/2024	Annual	5/1/2025	101867
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	7/3/2024	Annual	7/3/2025	102356
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	6/10/2024	Annual	6/10/2025	100057
Rohde & Schwarz	HFH2-Z2	Loop Antenna	6/21/2024	Annual	6/21/2025	100519
Rohde & Schwarz	ENV216	Two-Line V-Network	4/24/2024	Annual	4/24/2025	101364
Schwarzbeck	VULB 9162	Bilog Antenna (30MHz - 6GHz)	4/29/2024	Annual	4/29/2025	00304

Table 6-1. Test Equipment List

Note:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
2. * Denotes passive equipment that have been internally verified/calibrated.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCG-A3053
 FCC Classification: Unlicensed National Information Infrastructure (UNII)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407	26dB Bandwidth	N/A	CONDUCTED	N/A	Section 7.2
15.407(e)	6dB Bandwidth	>500kHz(5725-5850MHz)		PASS	Section 7.3
2.1049	Occupied Bandwidth	N/A		N/A	Section 7.2, 7.3
15.407 (a.1.iv), (a.3)	Maximum Conducted Output Power	Maximum conducted powers must meet the limits detailed in 15.407 (a)		PASS	Section 7.4
15.407 (a.1.iv), (a.3)	Maximum Power Spectral Density	Maximum power spectral density must meet the limits detailed in 15.407 (a)		PASS	Section 7.5
15.407(b.1), (4)	Undesirable Emissions	Undesirable emissions must meet the limits detailed in 15.407(b)	RADIATED	PASS	Section 7.6
15.205, 15.407(b.1), (4)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS	Section 7.6
15.207	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 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 “Conducted Automation Software” Version 1.1.0.
- 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 3.0.0.

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7.2 26dB & 99% Bandwidth Measurement

§2.1049; §15.407

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 C63.10-2020 and KDB 789033 D02 v02r01, and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

Test Procedure Used

ANSI C63.10-2020 – Subclause 12.5
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 x 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

None.

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud		Page 15 of 122

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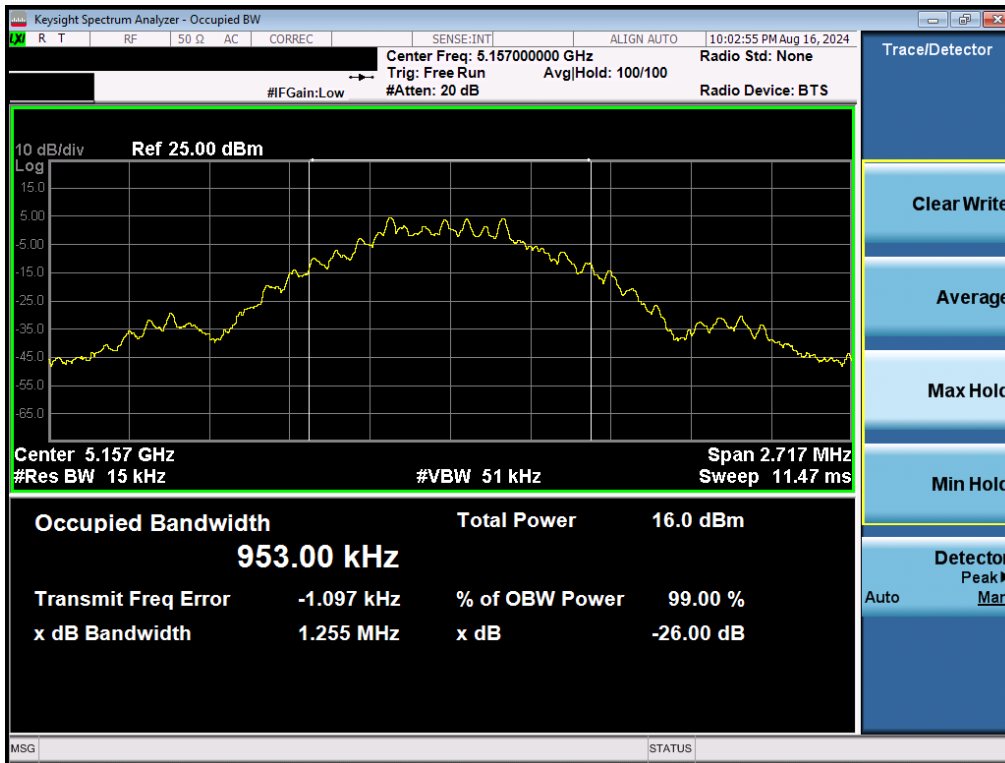
26dB & 99% Bandwidth Measurements

	Frequency [MHz]	Data Rate [Mbps]	Mode	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5157	1.0	NB UNII BDR	0.95	1.26
	5201	1.0	NB UNII BDR	0.95	1.25
	5245	1.0	NB UNII BDR	0.95	1.25
	5157	2.0	NB UNII LE2M	2.10	2.54
	5201	2.0	NB UNII LE2M	2.10	2.54
	5245	2.0	NB UNII LE2M	2.10	2.54
	5157	4.0	NB UNII HDR4	2.26	2.53
	5201	4.0	NB UNII HDR4	2.26	2.53
	5245	4.0	NB UNII HDR4	2.26	2.53
	5157	8.0	NB UNII HDR8	4.48	5.10
	5201	8.0	NB UNII HDR8	4.47	5.08
	5245	8.0	NB UNII HDR8	4.46	5.05
	5157	4.0	NB UNII HDRp4	2.41	2.70
	5201	4.0	NB UNII HDRp4	2.40	2.70
	5245	4.0	NB UNII HDRp4	2.41	2.70
	5157	8.0	NB UNII HDRp8	4.86	5.41
	5201	8.0	NB UNII HDRp8	4.87	5.41
	5245	8.0	NB UNII HDRp8	4.87	5.52

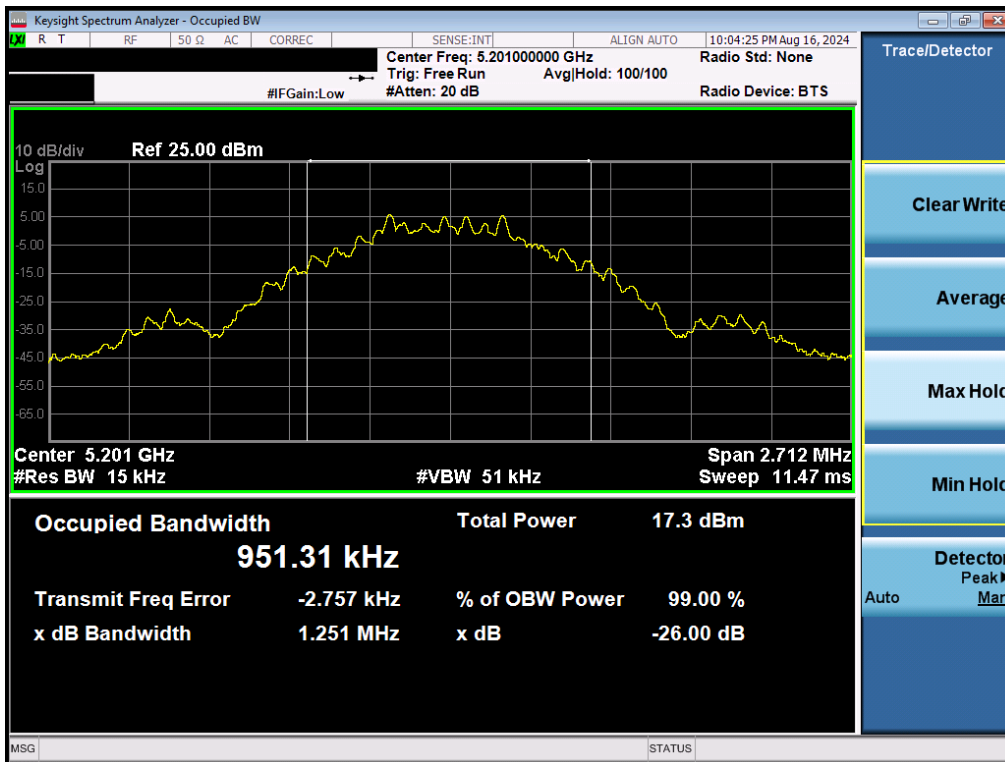
Table 7-2. Conducted BW Measurements

FCC ID: BCG-A3053			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 16 of 122	

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Plot 7-1. 26dB BW & 99% OBW (NB UNII BDR – 5157MHz)

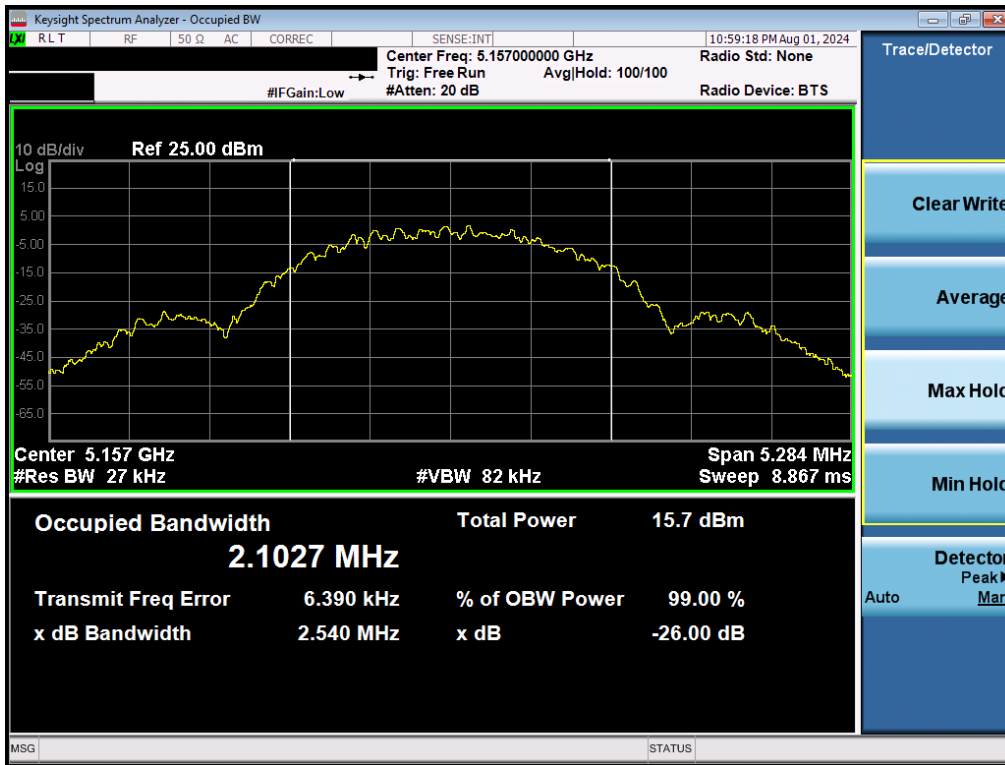


Plot 7-2. 26dB BW & 99% OBW (NB UNII BDR – 5201MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 17 of 122

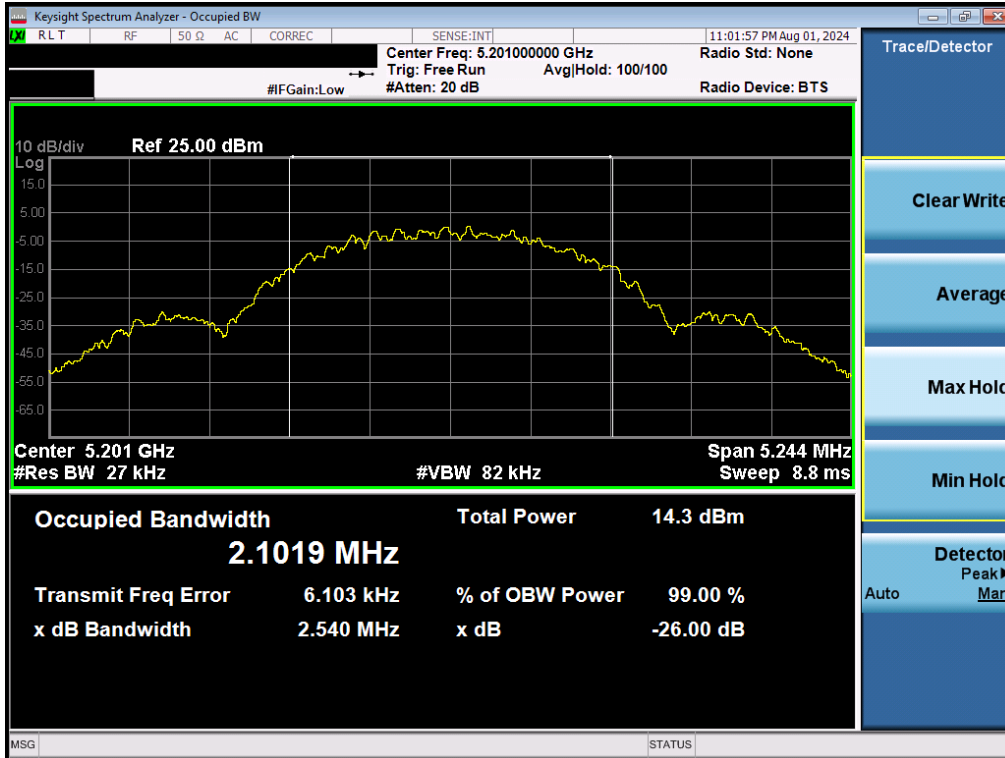


Plot 7-3. 26dB BW & 99% OBW (NB UNII BDR – 5245MHz)

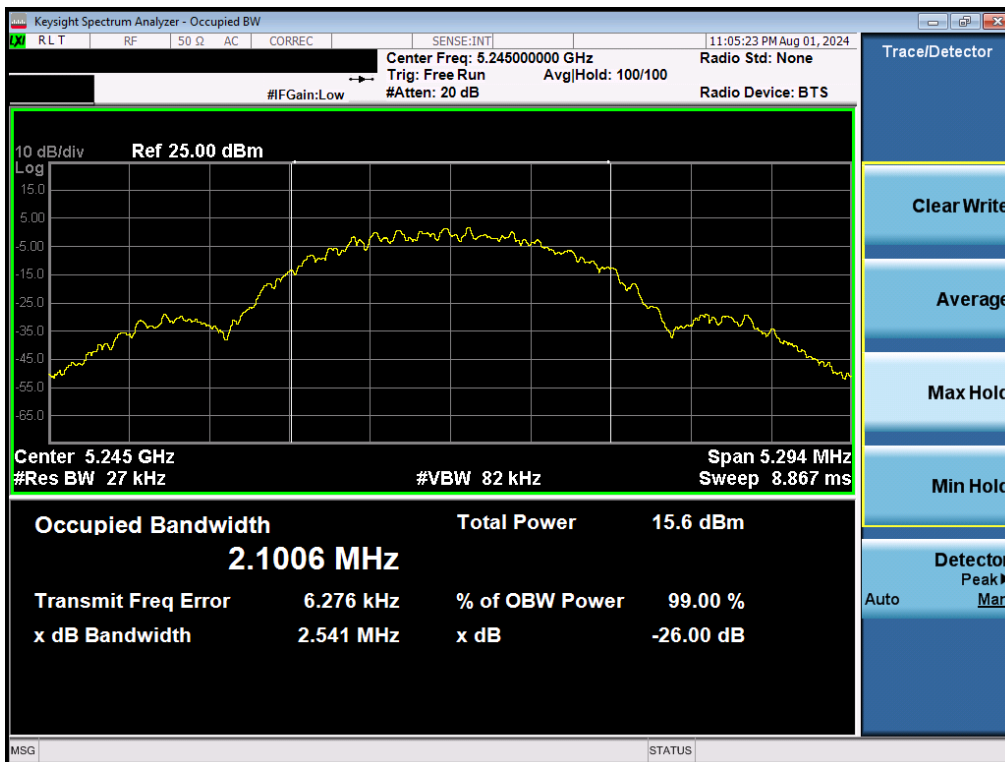


Plot 7-4. 26dB BW & 99% OBW (NB UNII LE2M – 5157MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 18 of 122

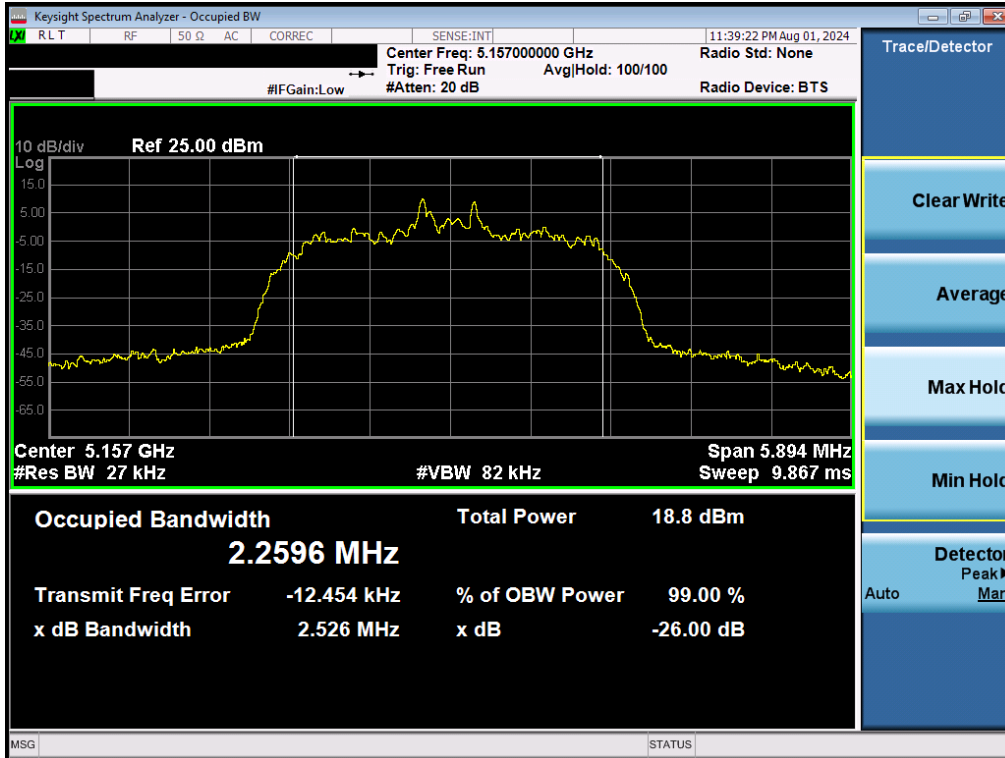


Plot 7-5. 26dB BW & 99% OBW (NB UNII LE2M – 5201MHz)

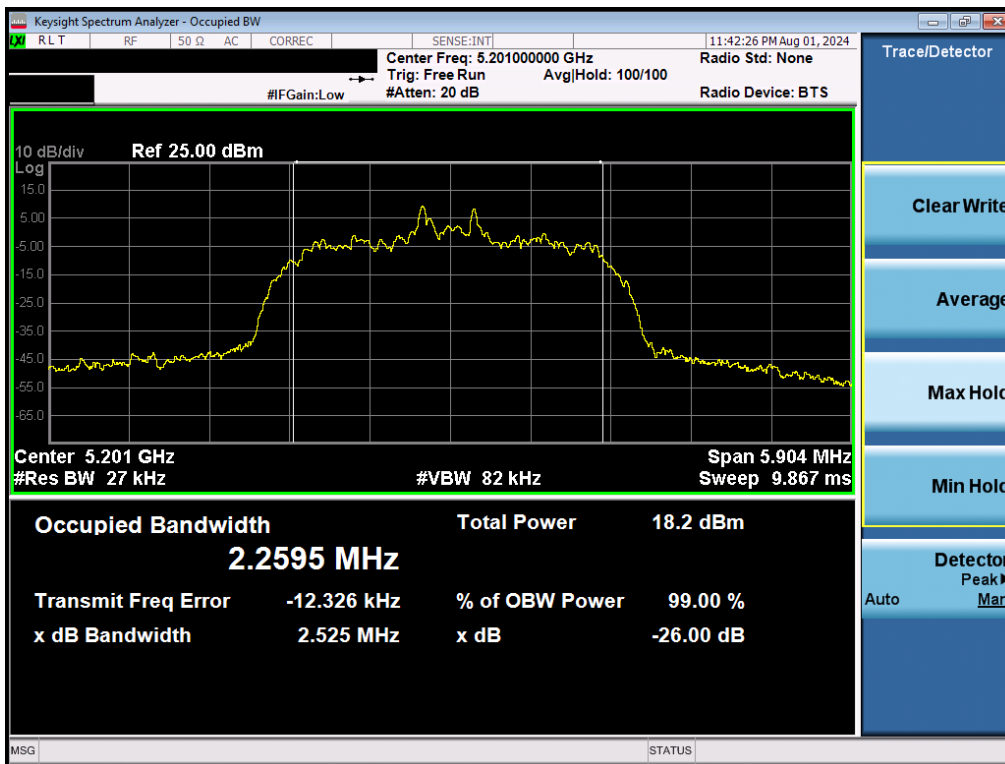


Plot 7-6. 26dB BW & 99% OBW (NB UNII LE2M – 5245MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 19 of 122

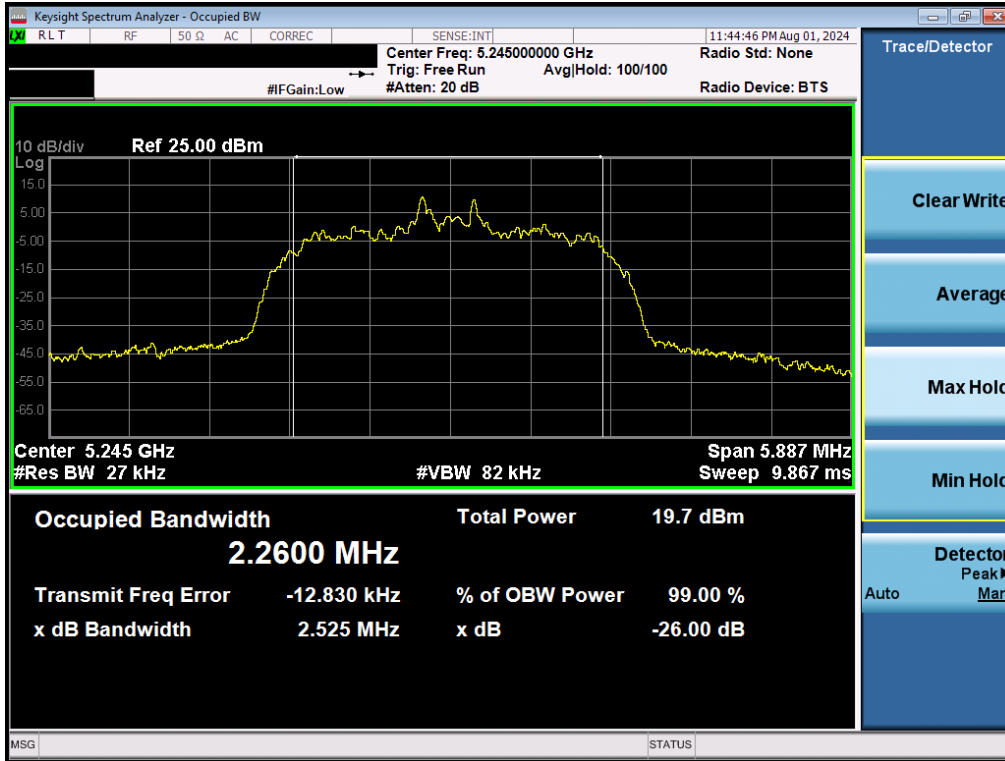


Plot 7-7. 26dB BW & 99% OBW (NB UNII HDR4 – 5157MHz)

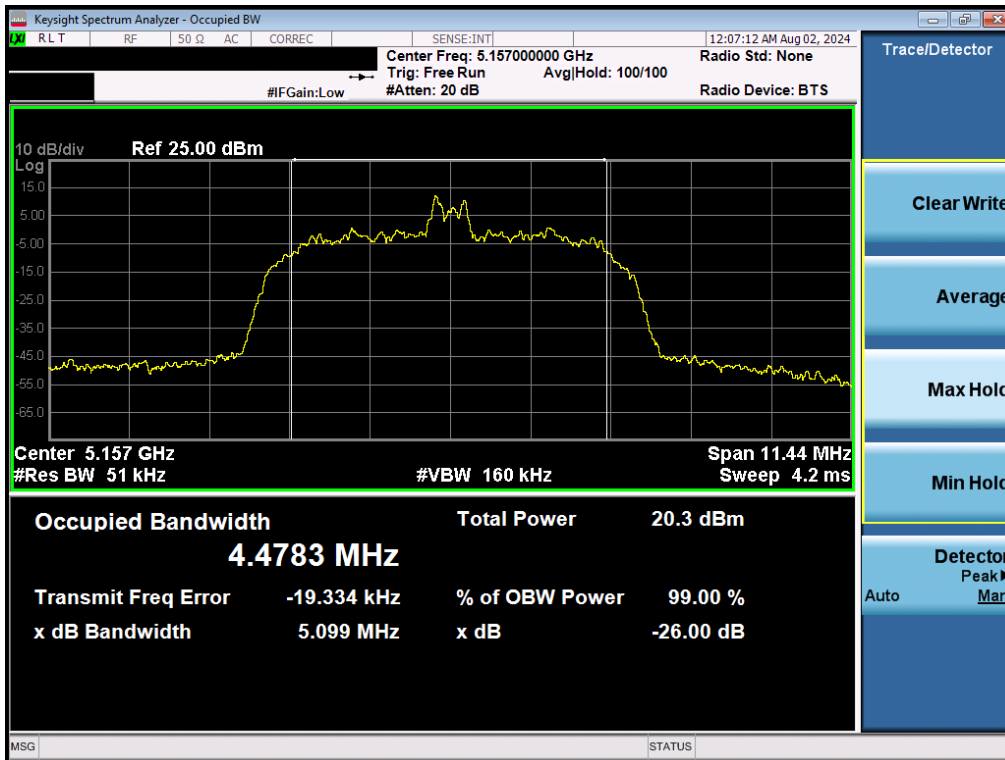


Plot 7-8. 26dB BW & 99% OBW (NB UNII HDR4 – 5201MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 20 of 122

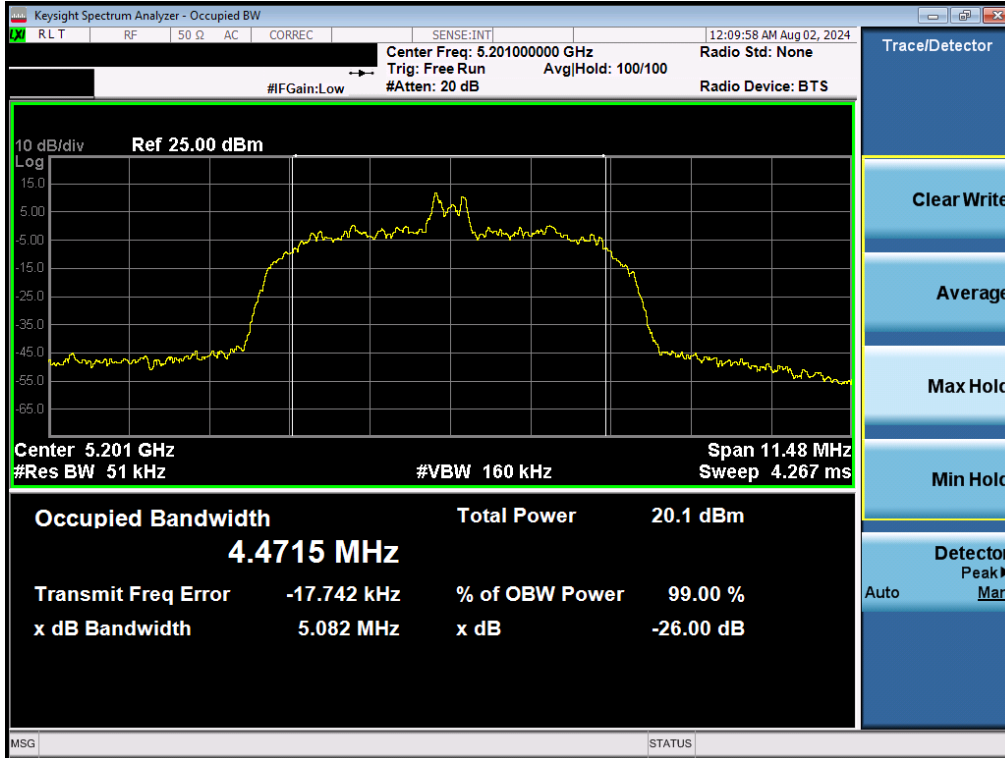


Plot 7-9. 26dB BW & 99% OBW (NB UNII HDR4 – 5245MHz)

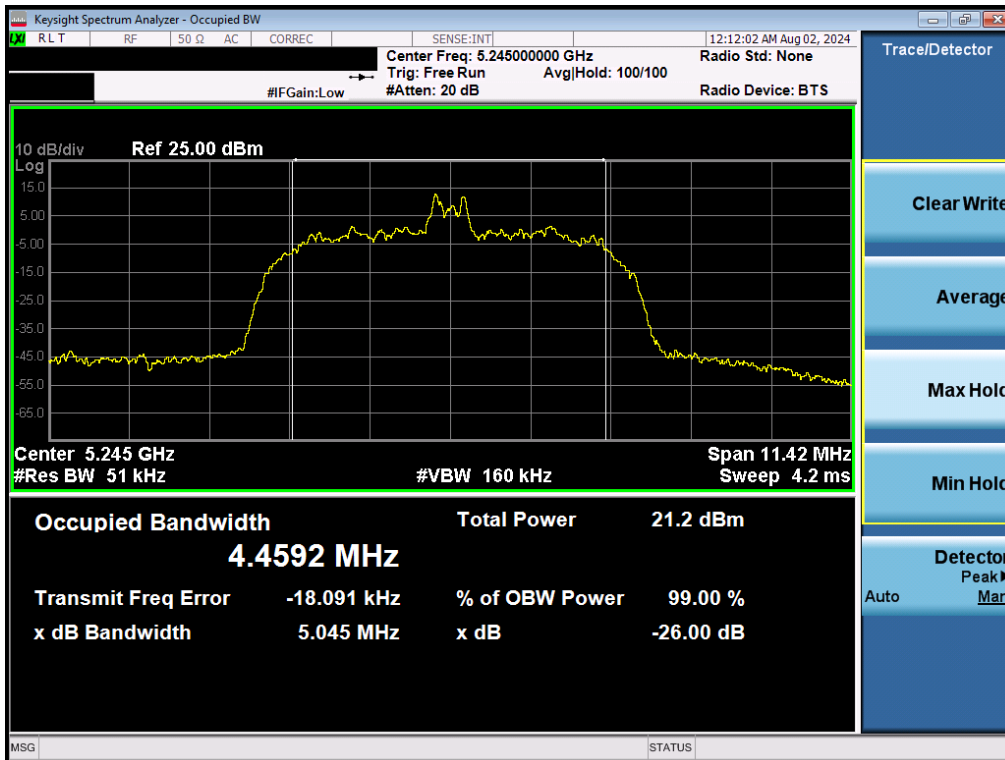


Plot 7-10. 26dB BW & 99% OBW (NB UNII HDR8 – 5157MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 21 of 122

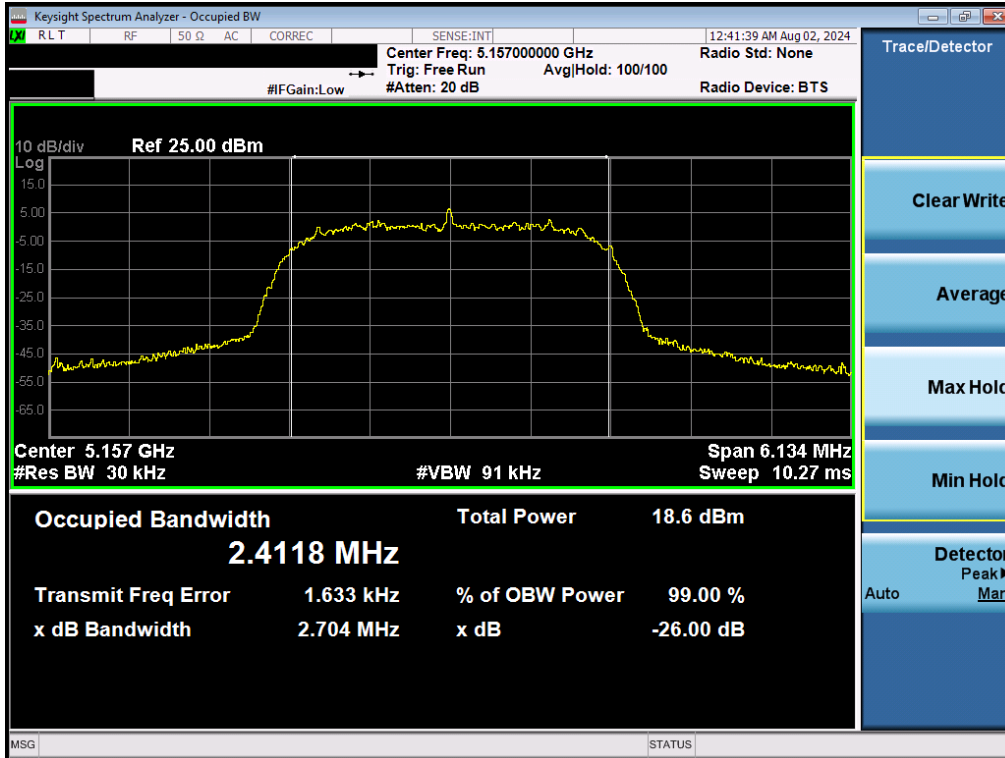


Plot 7-11. 26dB BW & 99% OBW (NB UNII HDR8 – 5201MHz)

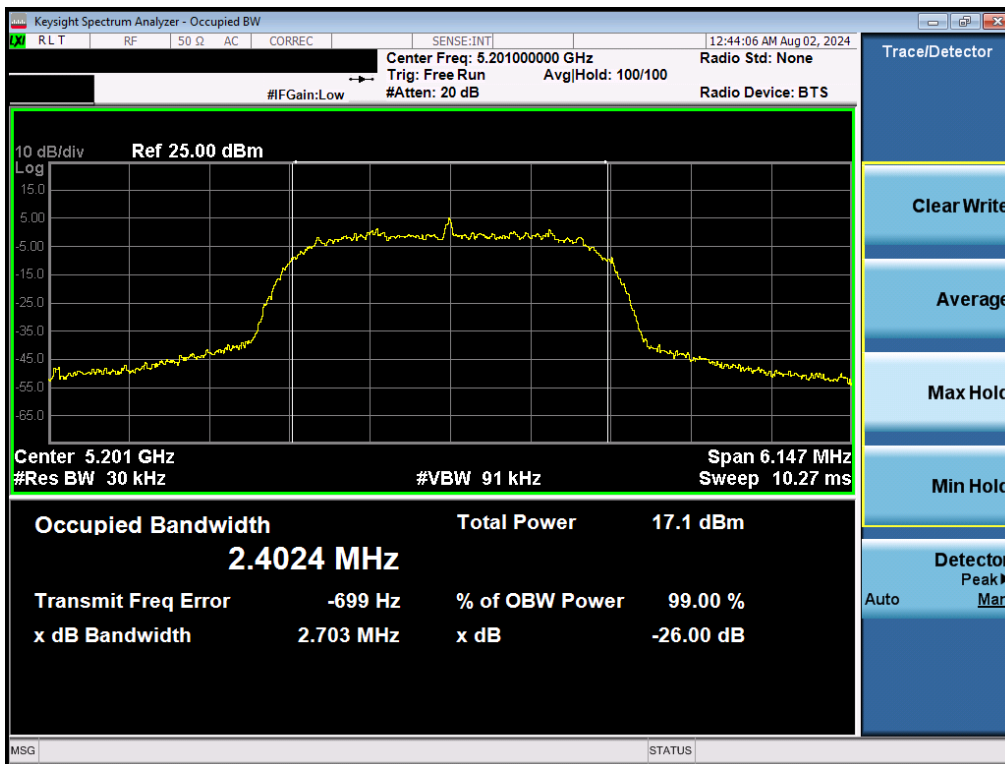


Plot 7-12. 26dB BW & 99% OBW (NB UNII HDR8 – 5245MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 22 of 122

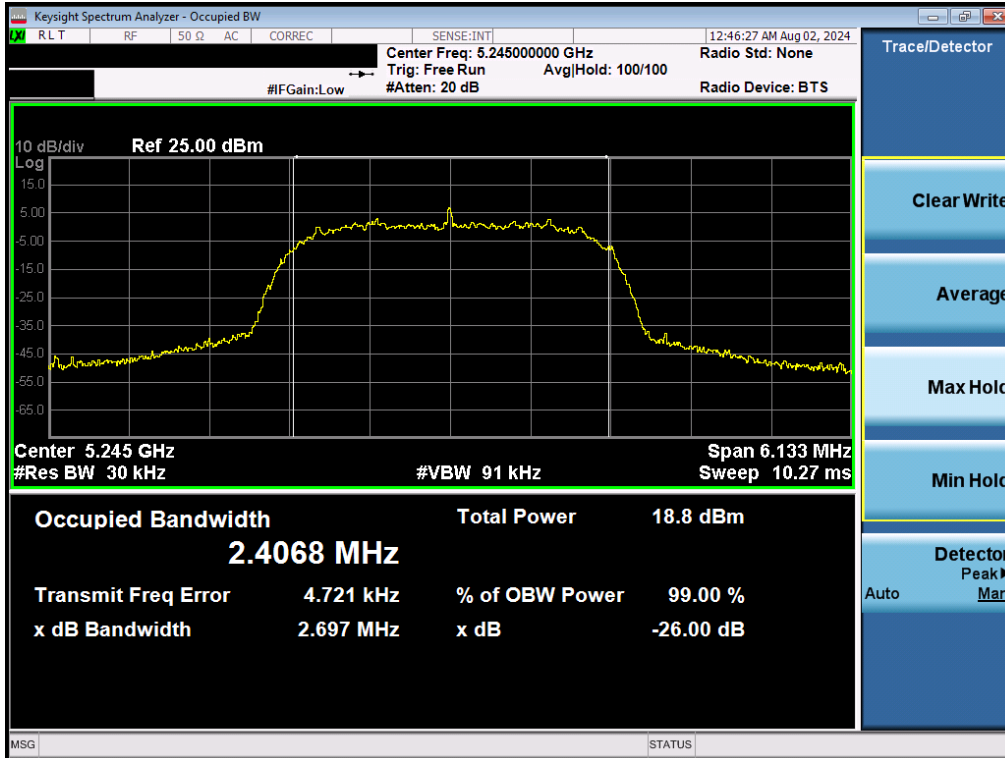


Plot 7-13. 26dB BW & 99% OBW (NB UNII HDRp4 – 5157MHz)

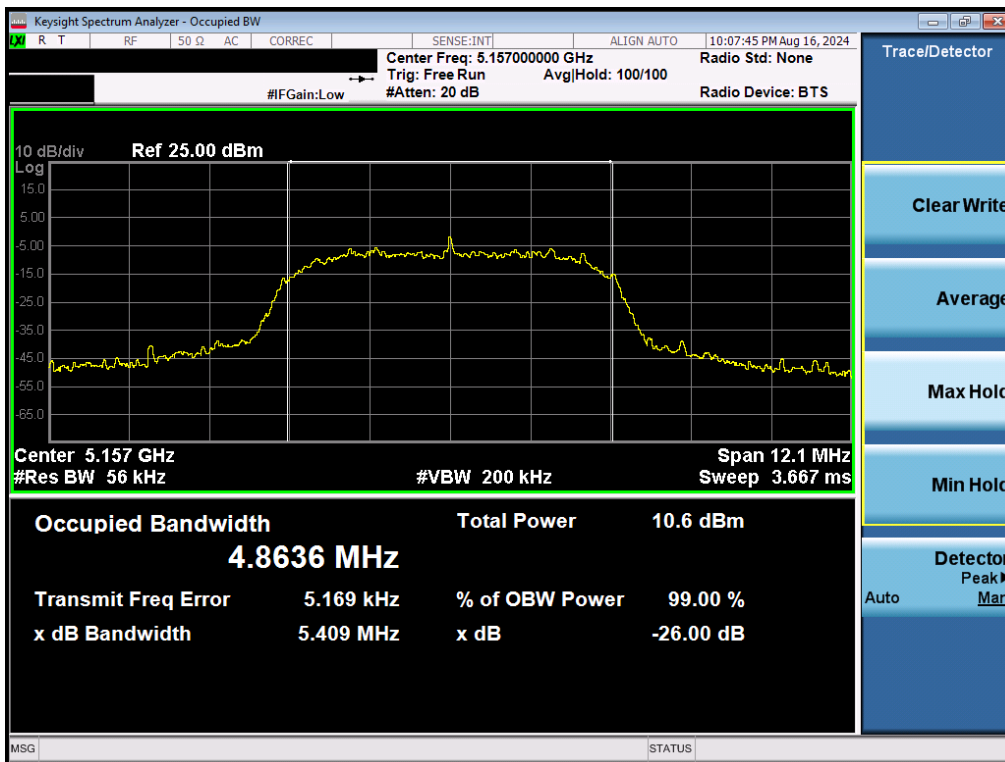


Plot 7-14. 26dB BW & 99% OBW (NB UNII HDRp4 – 5201MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 23 of 122

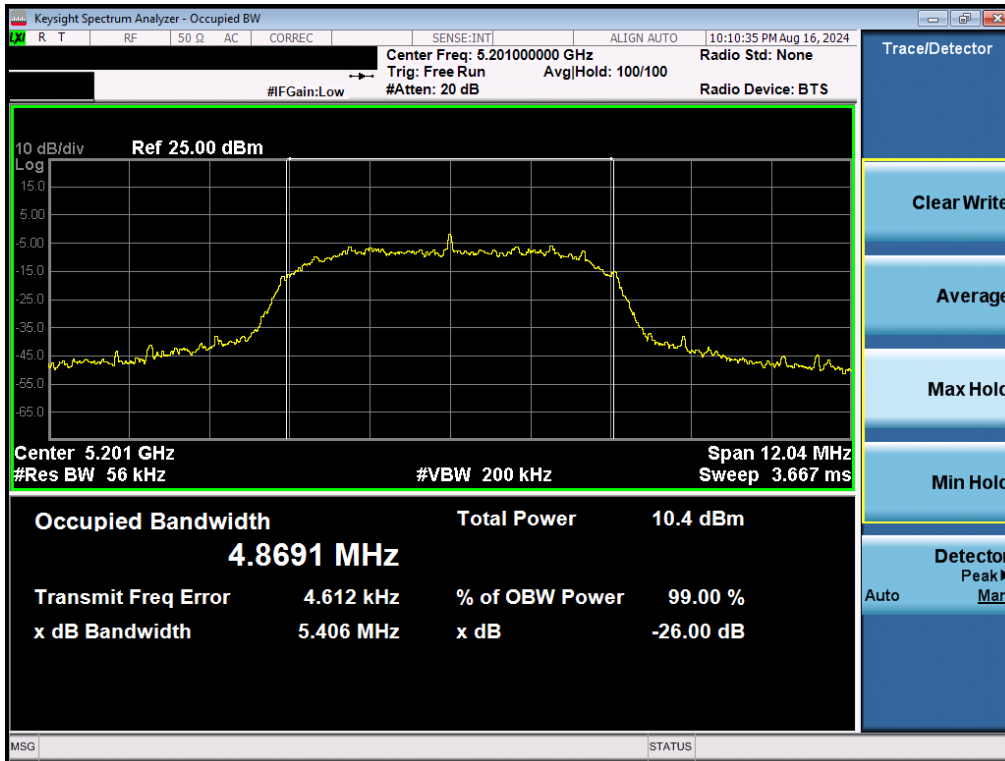


Plot 7-15. 26dB BW & 99% OBW (NB UNII HDRp4 – 5245MHz)

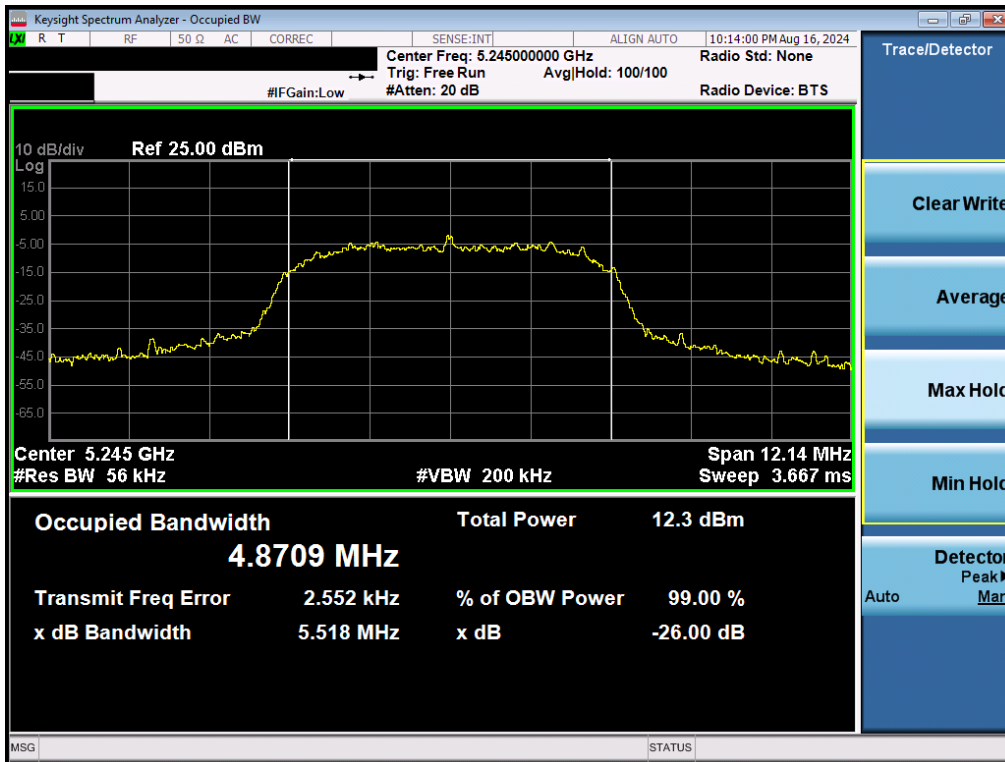


Plot 7-16. 26dB BW & 99% OBW (NB UNII HDRp8 – 5157MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 24 of 122



Plot 7-17. 26dB BW & 99% OBW (NB UNII HDRp8 – 5201MHz)



Plot 7-18. 26dB BW & 99% OBW (NB UNII HDRp8 – 5245MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 25 of 122

7.3 6dB & 99% Bandwidth Measurement
§2.1049; §15.407 (e)

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2020 and KDB 789033 D02 v02r01, and at the appropriate frequencies. The spectrum analyzer’s bandwidth measurement function is configured to measure the 6dB bandwidth.

In the 5.725 – 5.850GHz band, the 6dB bandwidth must be \geq 500 kHz.

Test Procedure Used

ANSI C63.10-2020 – Subclause 6.9.2
 KDB 789033 D02 v02r01 – Section C

Test Settings

1. The signal analyzers’ automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The “X” dB bandwidth parameter was set to X = 6. 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 = 100 kHz
3. VBW \geq 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple

Test Setup

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



Figure 7-2. Test Instrument & Measurement Setup

Test Notes

None.

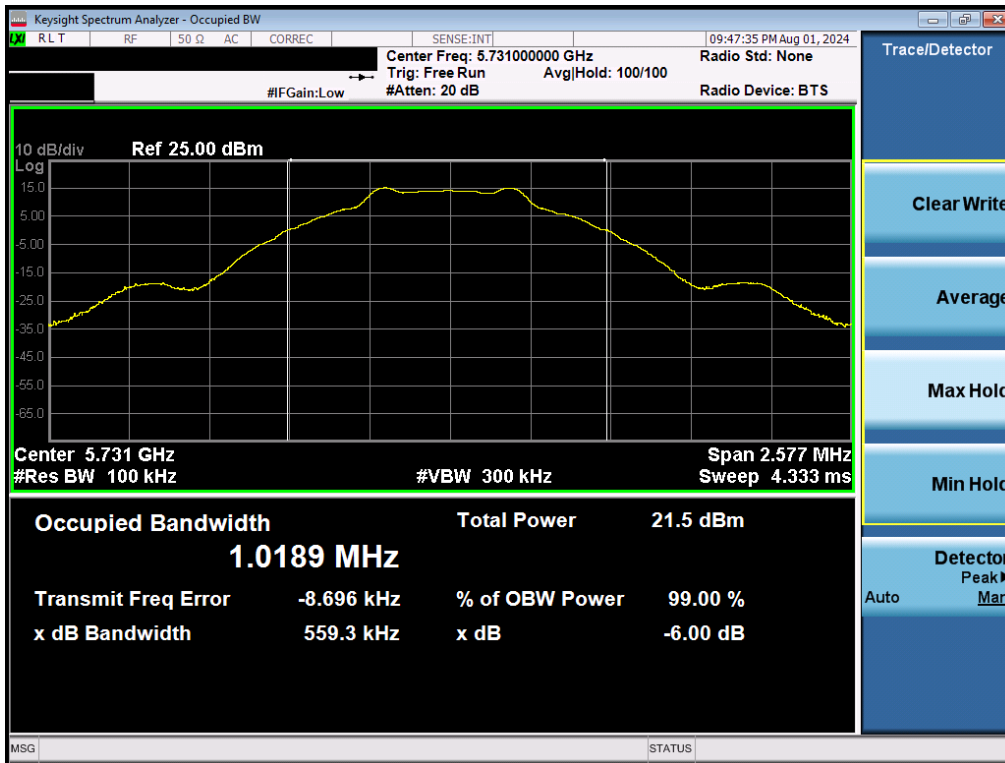
FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud		Page 26 of 122

6dB & 99% Bandwidth Measurements

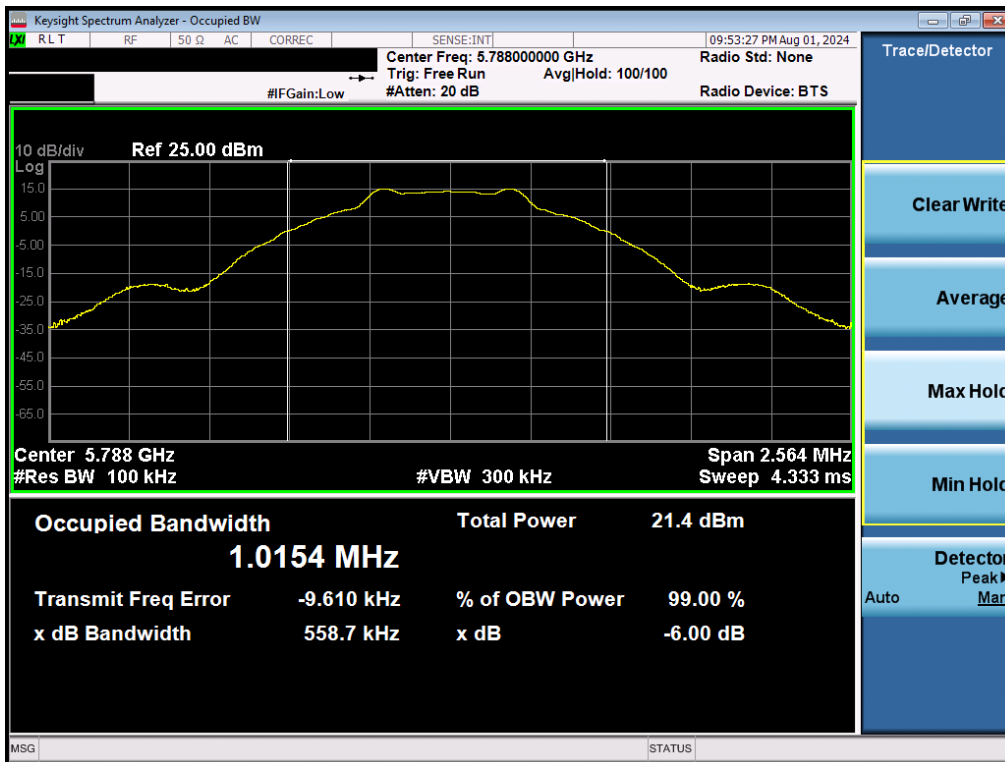
	Frequency [MHz]	Data Rate [Mbps]	Mode	Measured 99% Occupied Bandwidth [MHz]	Measured 6dB Bandwidth [MHz]	Minimum 6dB Bandwidth [MHz]	Pass / Fail
Band 3	5731	1.0	NB UNII BDR	1.02	0.56	0.50	Pass
	5788	1.0	NB UNII BDR	1.02	0.56	0.50	Pass
	5844	1.0	NB UNII BDR	1.01	0.56	0.50	Pass
	5731	2.0	NB UNII LE2M	2.06	1.13	0.50	Pass
	5788	2.0	NB UNII LE2M	2.06	1.12	0.50	Pass
	5844	2.0	NB UNII LE2M	2.06	1.13	0.50	Pass
	5731	4.0	NB UNII HDR4	2.30	0.55	0.50	Pass
	5788	4.0	NB UNII HDR4	2.30	0.55	0.50	Pass
	5844	4.0	NB UNII HDR4	2.30	0.55	0.50	Pass
	5731	8.0	NB UNII HDR8	4.51	0.58	0.50	Pass
	5788	8.0	NB UNII HDR8	4.52	0.58	0.50	Pass
	5844	8.0	NB UNII HDR8	4.51	0.58	0.50	Pass
	5731	4.0	NB UNII HDRp4	2.42	2.08	0.50	Pass
	5788	4.0	NB UNII HDRp4	2.41	2.09	0.50	Pass
	5844	4.0	NB UNII HDRp4	2.42	2.10	0.50	Pass
	5731	8.0	NB UNII HDRp8	4.83	4.09	0.50	Pass
	5788	8.0	NB UNII HDRp8	4.83	3.59	0.50	Pass
	5844	8.0	NB UNII HDRp8	4.80	4.10	0.50	Pass

Table 7-3. Conducted BW Measurements

FCC ID: BCG-A3053			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud		Page 27 of 122

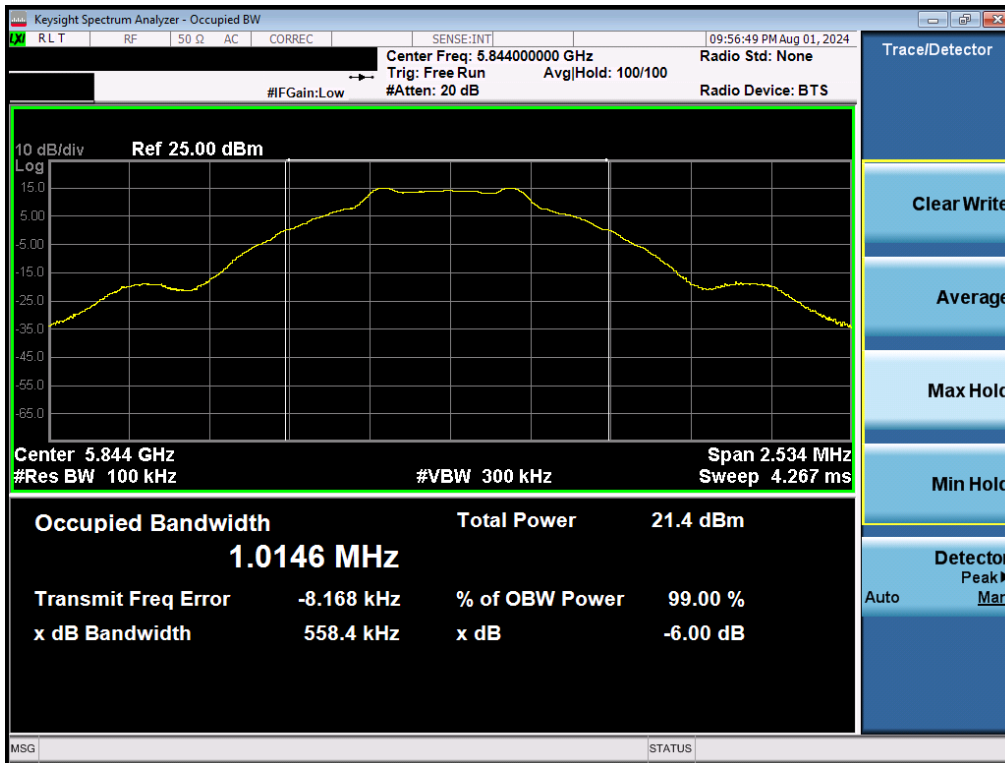


Plot 7-19. 6dB BW & 99% OBW (NB UNII BDR – 5731MHz)

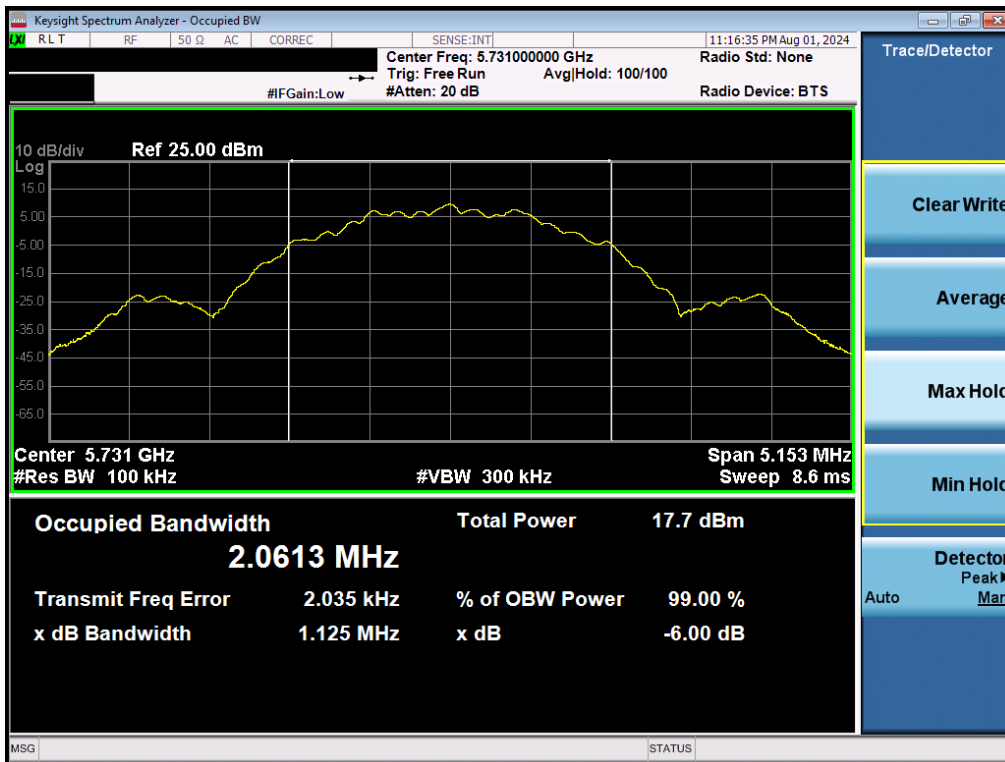


Plot 7-20. 6dB BW & 99% OBW (NB UNII BDR – 5788MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 28 of 122



Plot 7-21. 6dB BW & 99% OBW (NB UNII BDR – 5844MHz)

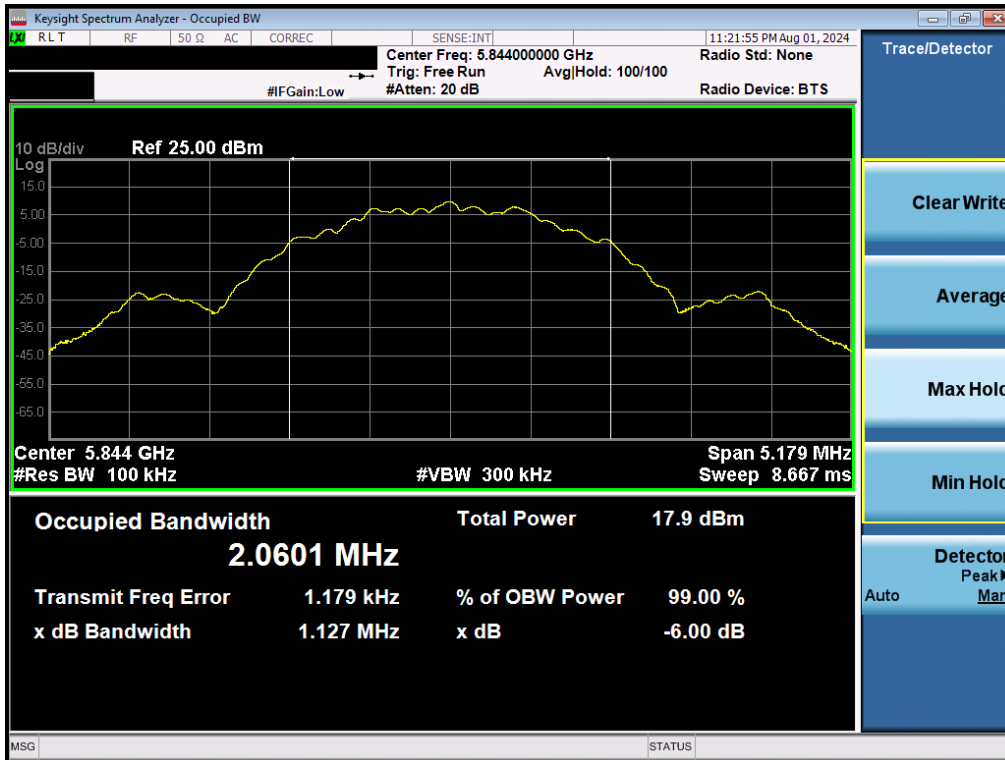


Plot 7-22. 6dB BW & 99% OBW (NB UNII LE2M – 5731MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 29 of 122

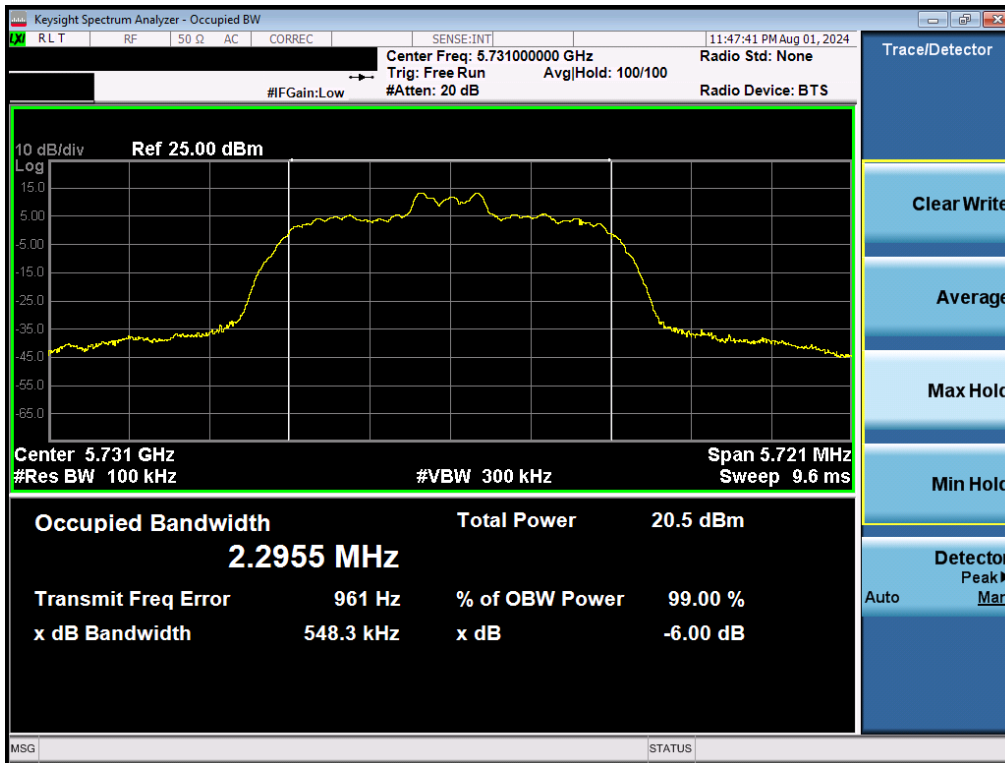


Plot 7-23. 6dB BW & 99% OBW (NB UNII LE2M – 5788MHz)

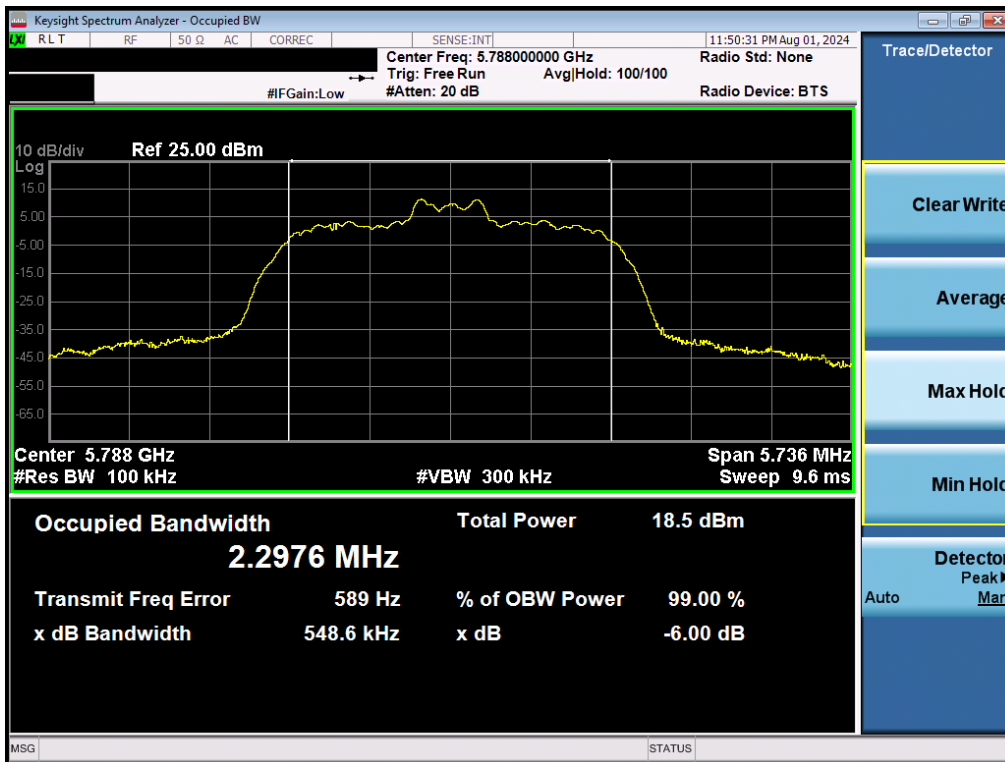


Plot 7-24. 6dB BW & 99% OBW (NB UNII LE2M – 5844MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 30 of 122

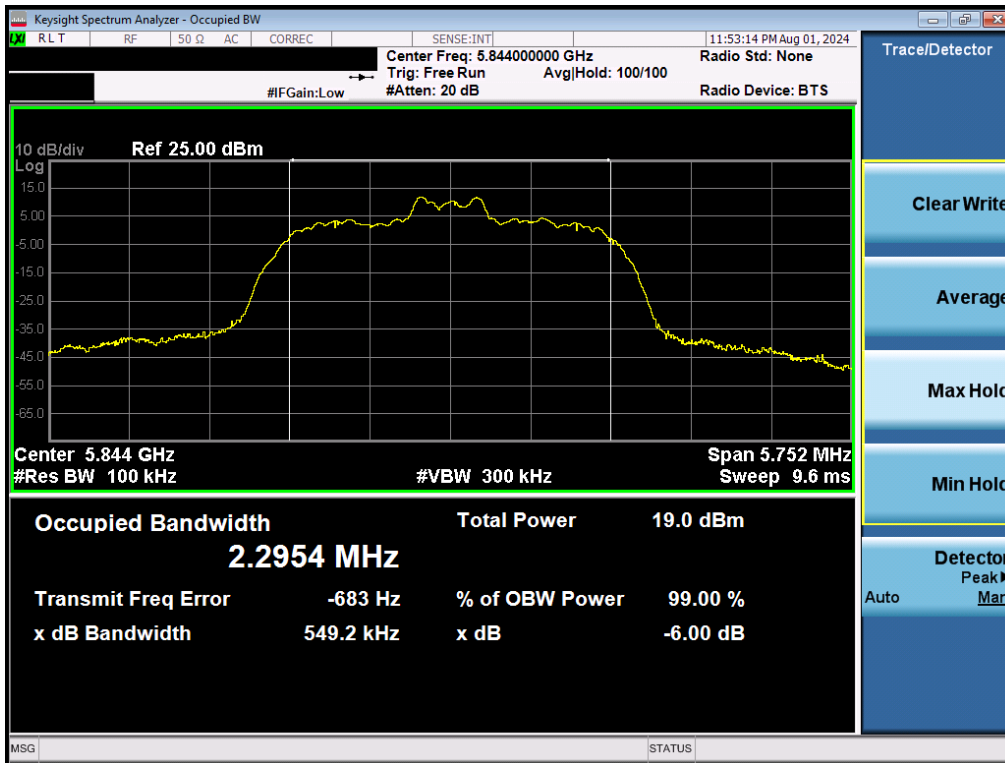


Plot 7-25. 6dB BW & 99% OBW (NB UNII HDR4 – 5731MHz)

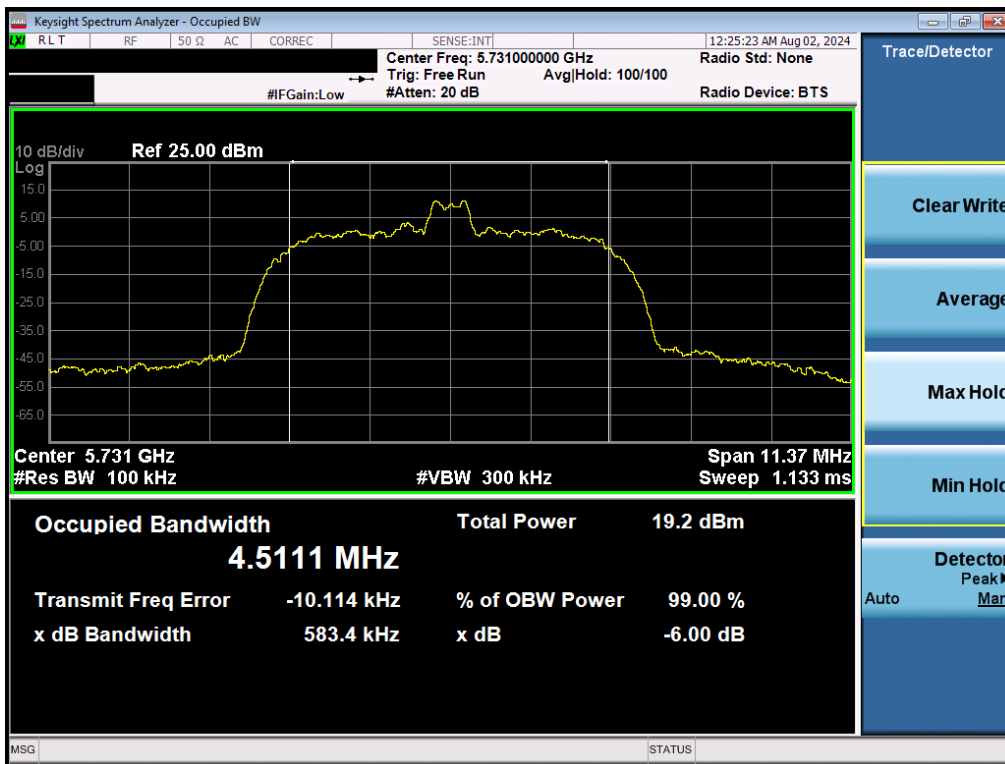


Plot 7-26. 6dB BW & 99% OBW (NB UNII HDR4 – 5788MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 31 of 122

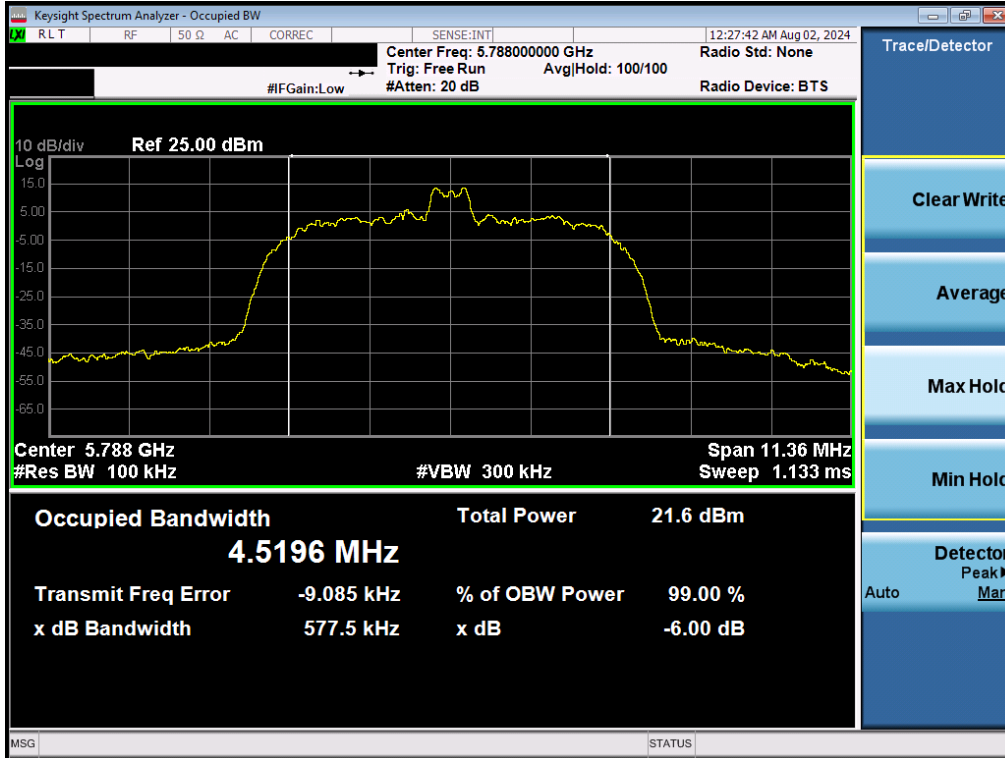


Plot 7-27. 6dB BW & 99% OBW (NB UNII HDR4 – 5844MHz)

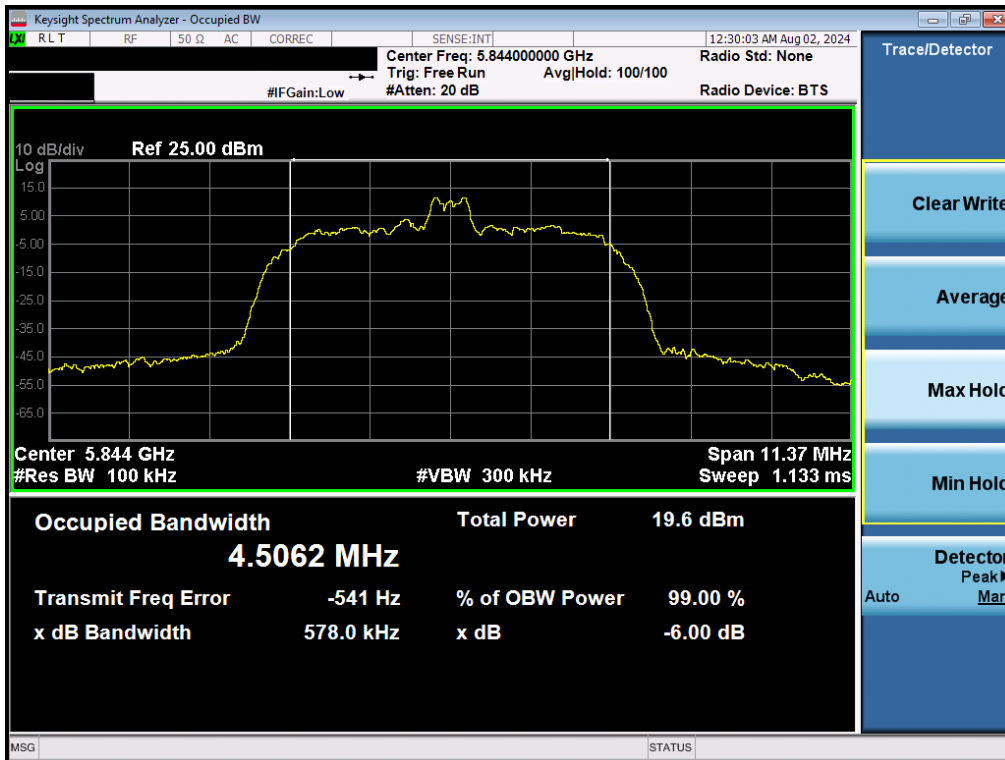


Plot 7-28. 6dB BW & 99% OBW (NB UNII HDR8 – 5731MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 32 of 122



Plot 7-29. 6dB BW & 99% OBW (NB UNII HDR8 – 5788MHz)

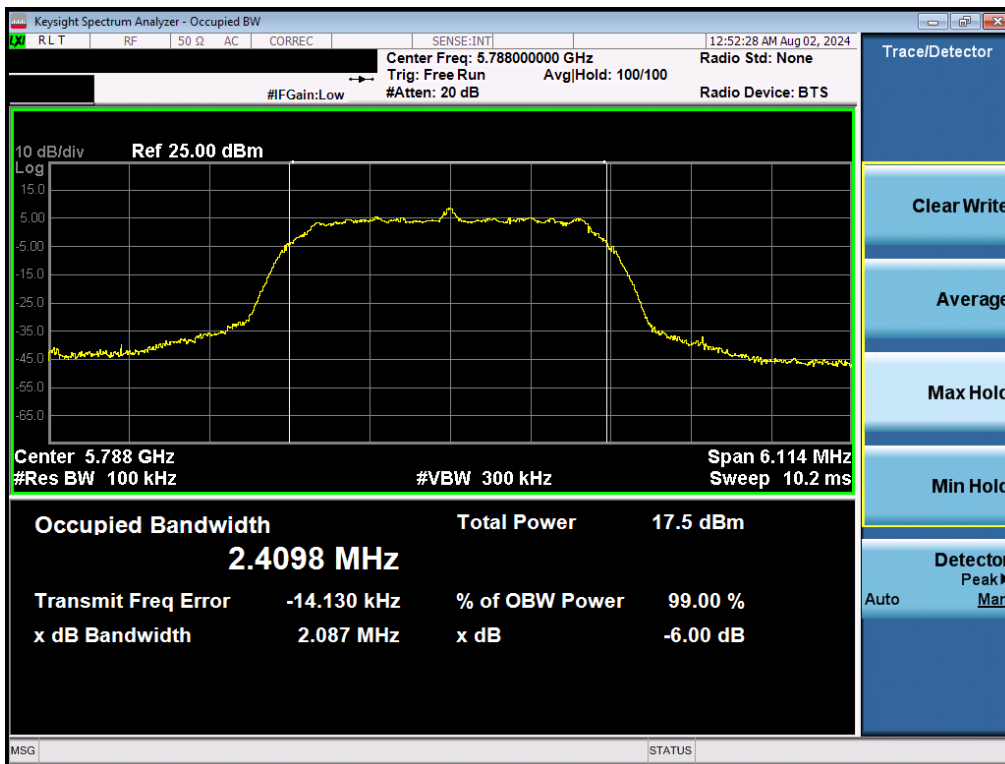


Plot 7-30. 6dB BW & 99% OBW (NB UNII HDR8 – 5844MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 33 of 122

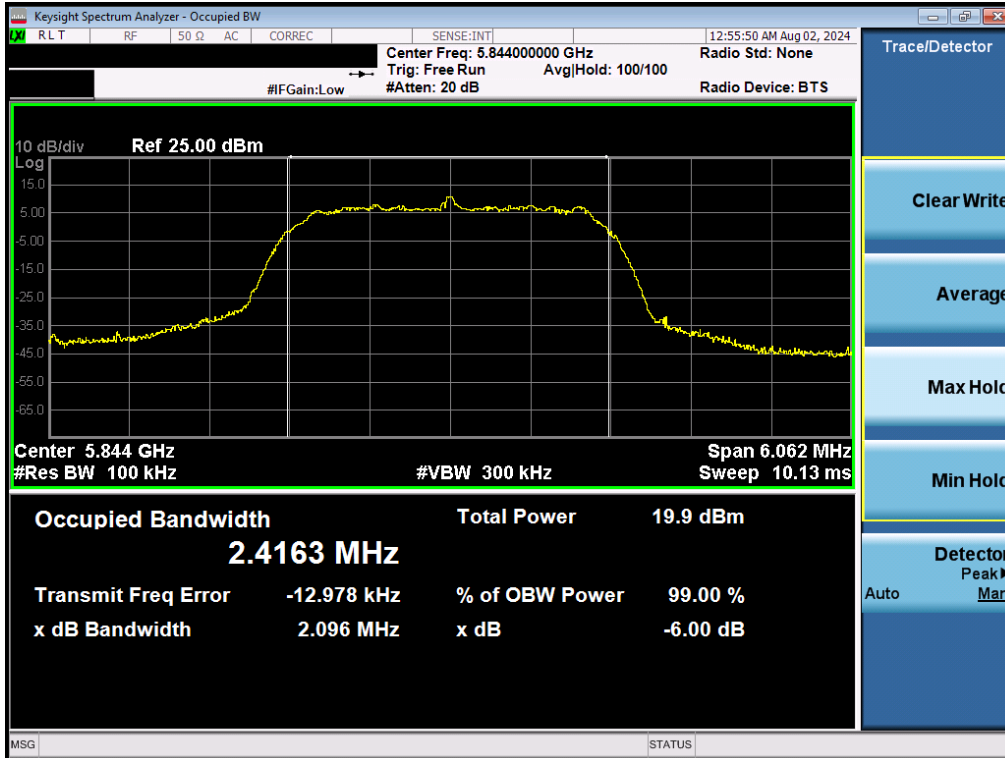


Plot 7-31. 6dB BW & 99% OBW (NB UNII HDRp4 – 5731MHz)

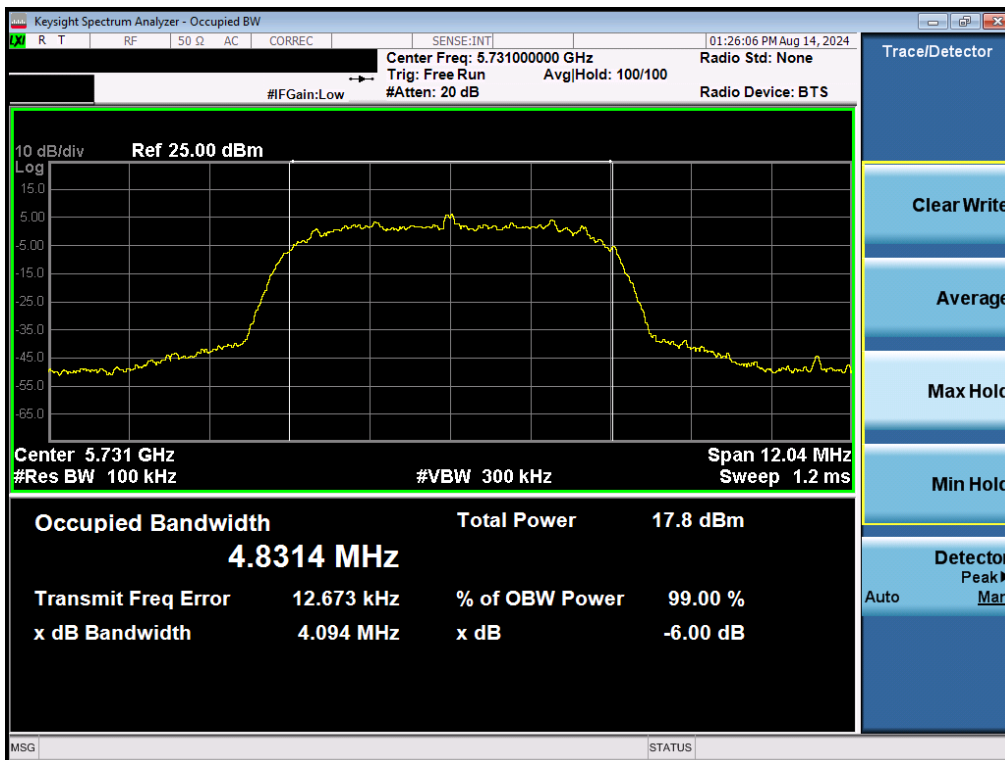


Plot 7-32. 6dB BW & 99% OBW (NB UNII HDRp4 – 5788MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 34 of 122

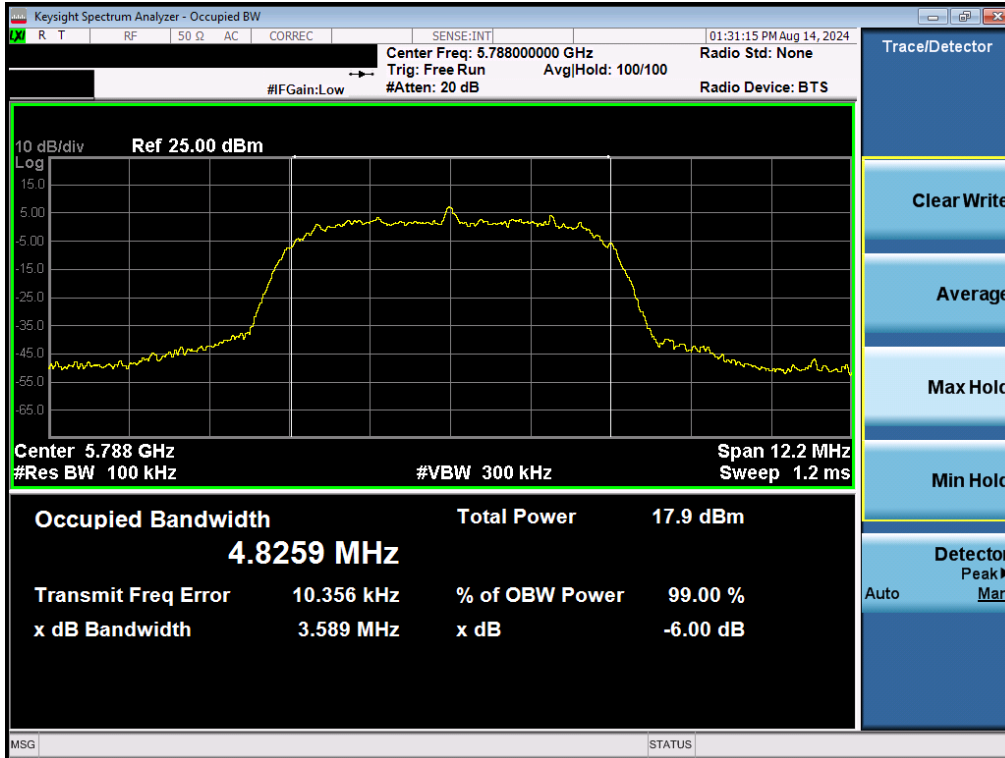


Plot 7-33. 6dB BW & 99% OBW (NB UNII HDRp4 – 5844MHz)



Plot 7-34. 6dB BW & 99% OBW (NB UNII HDRp8 – 5731MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 35 of 122



Plot 7-35. 6dB BW & 99% OBW (NB UNII HDRp8 – 5788MHz)



Plot 7-36. 6dB BW & 99% OBW (NB UNII HDRp8 – 5844MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 36 of 122

7.4 Conducted Output Power and Max EIRP Measurement

§15.407(a.1.iv) §15.407(a.3)

Test Overview and Limits

A transmitter antenna terminal of the EUT is connected to the input of an RF pulse power sensor. Measurement is made using a broadband average power meter while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2020 and KDB 789033 D02 v02r01, and at the appropriate frequencies.

In the 5.15 – 5.25GHz band, the maximum permissible conducted output power is 250mW (23.98dBm).

In the 5.725 – 5.850GHz band, the maximum permissible conducted output power is 1W (30dBm).

Test Procedure Used

ANSI C63.10-2020 – Subclause 12.4.3.2 Method PM-G
KDB 789033 D02 v02r01 – Section E)3)b) Method PM-G

Test Settings

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

Test Setup

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



Figure 7-3. Test Instrument & Measurement Setup

Test Notes

None

FCC ID: BCG-A3053			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud		Page 37 of 122

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Conducted Output Power Measurements

Frequency [MHz]	Detector	Mode	Conducted Powers [dBm]	Conducted Power Limit [dBm]	Conducted Power Margin [dB]
5157	AVG	NB UNII BDR	8.98	23.98	-15.00
5201	AVG	NB UNII BDR	8.78	23.98	-15.20
5245	AVG	NB UNII BDR	8.80	23.98	-15.18
5157	AVG	NB UNII LE2M	9.93	23.98	-14.05
5201	AVG	NB UNII LE2M	9.96	23.98	-14.02
5245	AVG	NB UNII LE2M	9.73	23.98	-14.25
5157	AVG	NB UNII HDR4	8.76	23.98	-15.22
5201	AVG	NB UNII HDR4	8.83	23.98	-15.15
5245	AVG	NB UNII HDR4	8.88	23.98	-15.10
5157	AVG	NB UNII HDR8	8.90	23.98	-15.08
5201	AVG	NB UNII HDR8	8.93	23.98	-15.05
5245	AVG	NB UNII HDR8	8.85	23.98	-15.13
5157	AVG	NB UNII HDRp4	5.78	23.98	-18.20
5201	AVG	NB UNII HDRp4	5.82	23.98	-18.16
5245	AVG	NB UNII HDRp4	5.90	23.98	-18.08
5157	AVG	NB UNII HDRp8	5.76	23.98	-18.22
5201	AVG	NB UNII HDRp8	5.83	23.98	-18.15
5245	AVG	NB UNII HDRp8	5.85	23.98	-18.13
5731	AVG	NB UNII BDR	9.75	30.00	-20.25
5788	AVG	NB UNII BDR	9.81	30.00	-20.19
5844	AVG	NB UNII BDR	9.92	30.00	-20.08
5731	AVG	NB UNII LE2M	10.60	30.00	-19.40
5788	AVG	NB UNII LE2M	10.81	30.00	-19.19
5844	AVG	NB UNII LE2M	10.73	30.00	-19.27
5731	AVG	NB UNII HDR4	9.43	30.00	-20.57
5788	AVG	NB UNII HDR4	9.44	30.00	-20.56
5844	AVG	NB UNII HDR4	9.47	30.00	-20.53
5731	AVG	NB UNII HDR8	9.35	30.00	-20.65
5788	AVG	NB UNII HDR8	9.38	30.00	-20.62
5844	AVG	NB UNII HDR8	9.46	30.00	-20.54
5731	AVG	NB UNII HDRp4	6.50	30.00	-23.50
5788	AVG	NB UNII HDRp4	6.44	30.00	-23.56
5844	AVG	NB UNII HDRp4	6.40	30.00	-23.60
5731	AVG	NB UNII HDRp8	6.48	30.00	-23.52
5788	AVG	NB UNII HDRp8	6.42	30.00	-23.58
5844	AVG	NB UNII HDRp8	6.45	30.00	-23.55

Table 7-4. FCC Maximum Conducted Output Power

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 38 of 122

7.5 Maximum Power Spectral Density

§15.407(a.1.iv) §15.407(a.3)

Test Overview and Limit

The spectrum analyzer was connected to the antenna terminal while the EUT was operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2020 and KDB 789033 D02 v02r01, and at the appropriate frequencies. Method SA-1, as defined in ANSI C63.10-2020 and KDB 789033 D02 v02r01, was used to measure the power spectral density.

In the 5.15 – 5.25GHz band, the maximum permissible power spectral density is 11dBm/MHz.

In the 5.725 – 5.850GHz band, the maximum permissible power spectral density is 30dBm/500kHz.

Test Procedure Used

ANSI C63.10-2020 – Subclause 12.4.2.2
KDB 789033 D02 v02r01 – Section F

Test Settings

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire emission bandwidth of the signal
3. RBW = 1MHz for U-NII 1, 500kHz for U-NII 3
4. VBW \geq 3MHz for U-NII 1, \geq 3 x RBW for U-NII 3
5. Number of sweep points \geq 2 x (span/RBW)
6. Sweep time = auto
7. Detector = power averaging (RMS)
8. Trigger was set to free run for all modes
9. Trace was averaged over 100 sweeps
10. The peak search function of the spectrum analyzer was used to find the peak of the spectrum.

Test Setup

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



Figure 7-4. Test Instrument & Measurement Setup

Test Notes

None

FCC ID: BCG-A3053			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud		Page 39 of 122

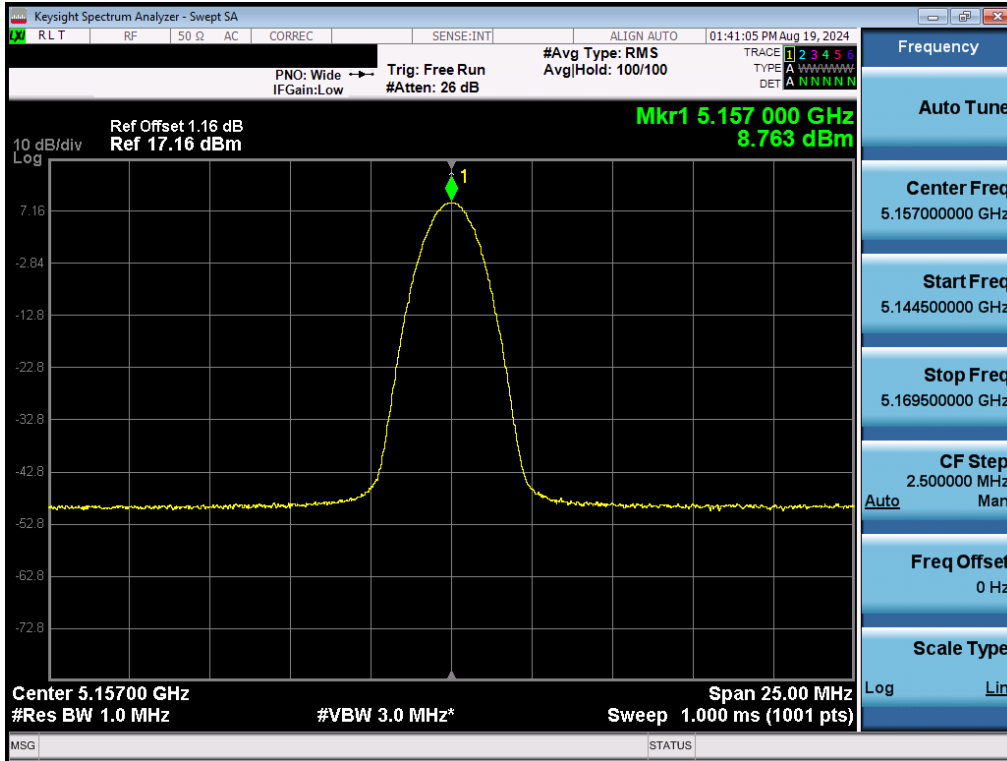
V 10.6 10/27/2023

Power Spectral Density Measurements

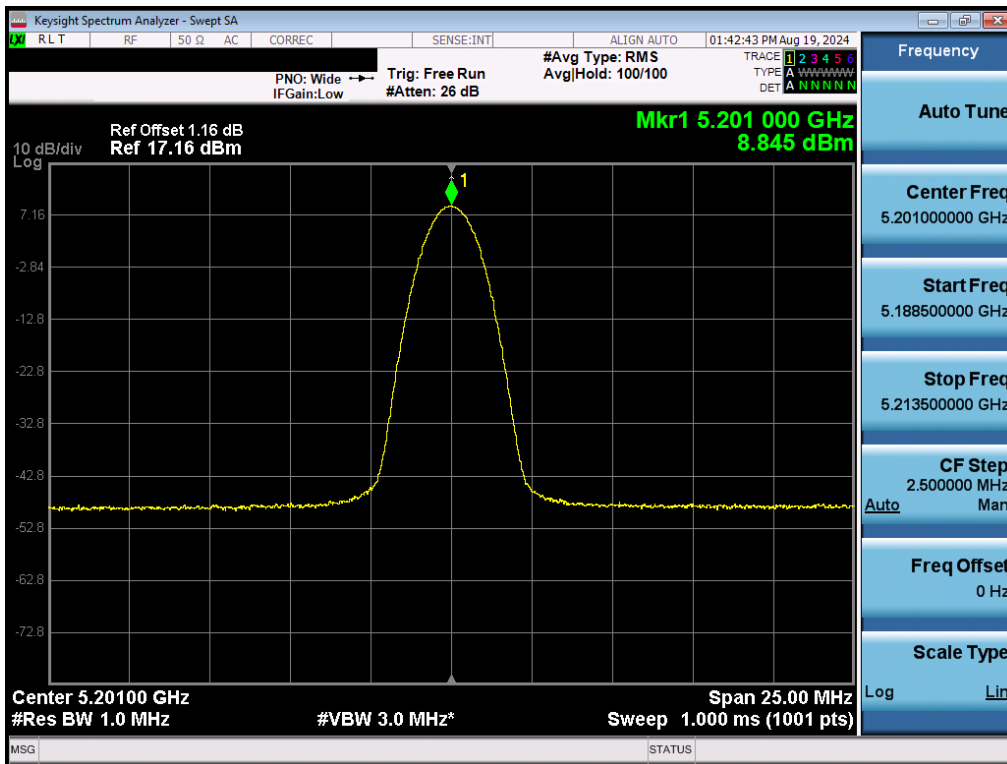
	Frequency [MHz]	Data Rate [Mbps]	Mode	Measured Power Density [dBm/MHz]	Max Power Density [dBm/MHz]	Margin [dB]
Band 1	5157	1.0	NB UNII BDR	8.76	11.00	-2.24
	5201	1.0	NB UNII BDR	8.85	11.00	-2.16
	5245	1.0	NB UNII BDR	8.69	11.00	-2.31
	5157	2.0	NB UNII LE2M	7.89	11.00	-3.11
	5201	2.0	NB UNII LE2M	8.10	11.00	-2.90
	5245	2.0	NB UNII LE2M	7.98	11.00	-3.02
	5157	4.0	NB UNII HDR4	7.27	11.00	-3.73
	5201	4.0	NB UNII HDR4	7.53	11.00	-3.47
	5245	4.0	NB UNII HDR4	7.09	11.00	-3.91
	5157	8.0	NB UNII HDR8	5.92	11.00	-5.08
	5201	8.0	NB UNII HDR8	6.18	11.00	-4.82
	5245	8.0	NB UNII HDR8	5.21	11.00	-5.80
	5157	4.0	NB UNII HDRp4	5.89	11.00	-5.11
	5201	4.0	NB UNII HDRp4	5.81	11.00	-5.19
	5245	4.0	NB UNII HDRp4	4.78	11.00	-6.23
	5157	8.0	NB UNII HDRp8	3.12	11.00	-7.88
	5201	8.0	NB UNII HDRp8	2.72	11.00	-8.28
	5245	8.0	NB UNII HDRp8	2.79	11.00	-8.21

Table 7-5. FCC Power Spectral Density Measurements

FCC ID: BCG-A3053			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 40 of 122	

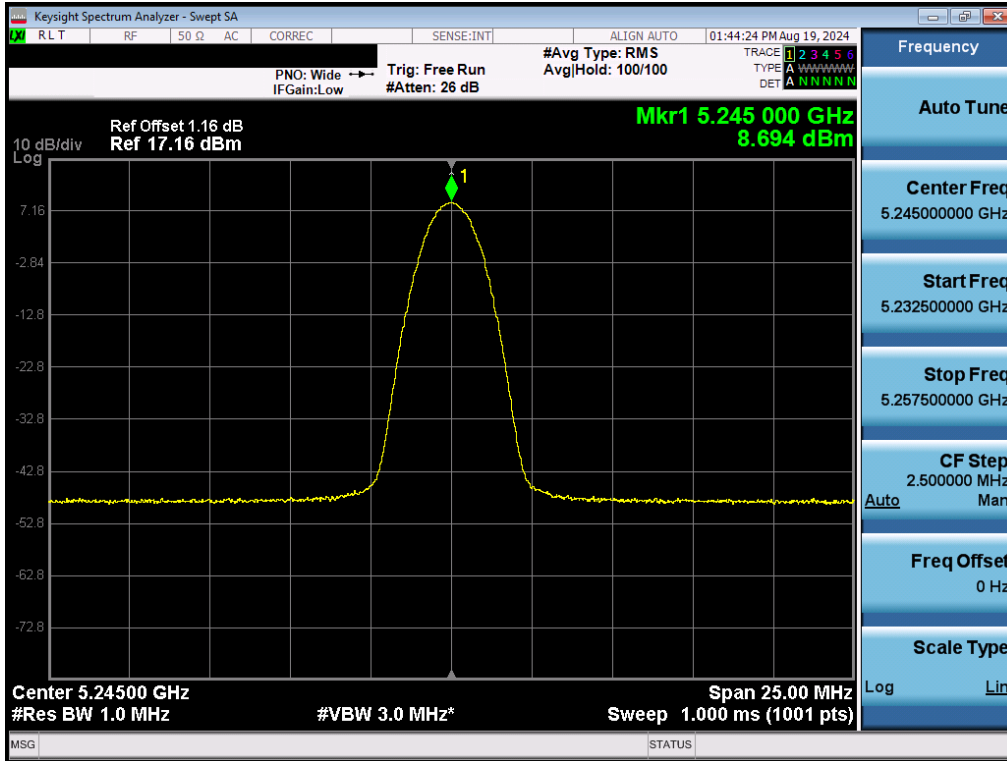


Plot 7-37. FCC PSD (NB UNII BDR – 5157MHz)

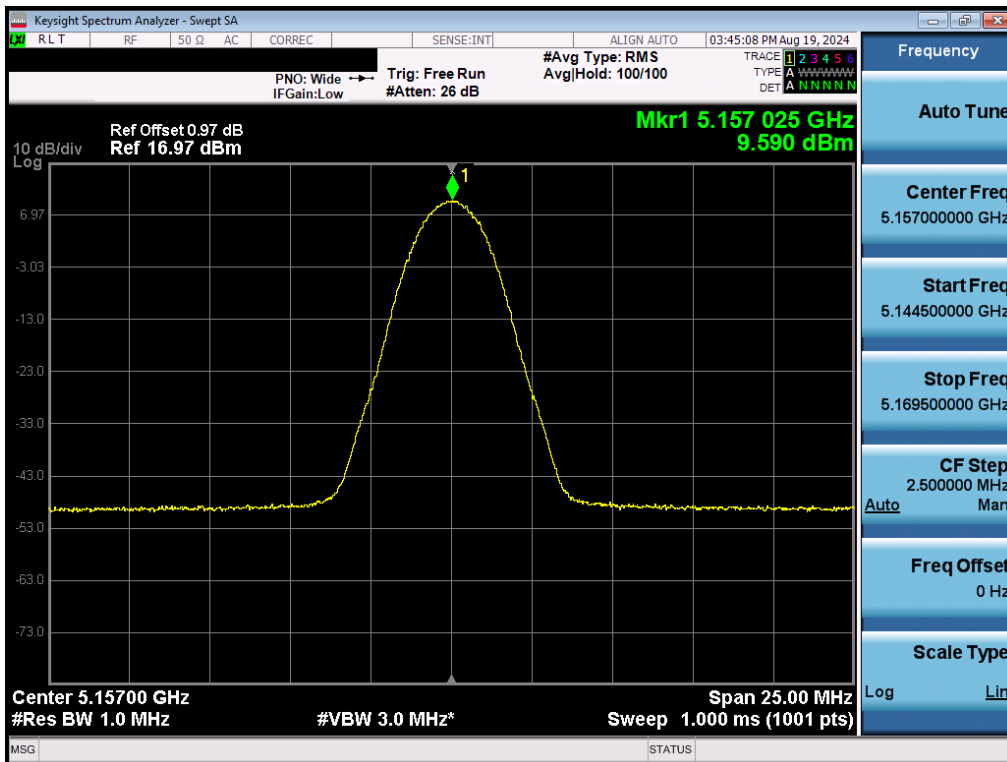


Plot 7-38. FCC PSD (NB UNII BDR – 5201MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 41 of 122

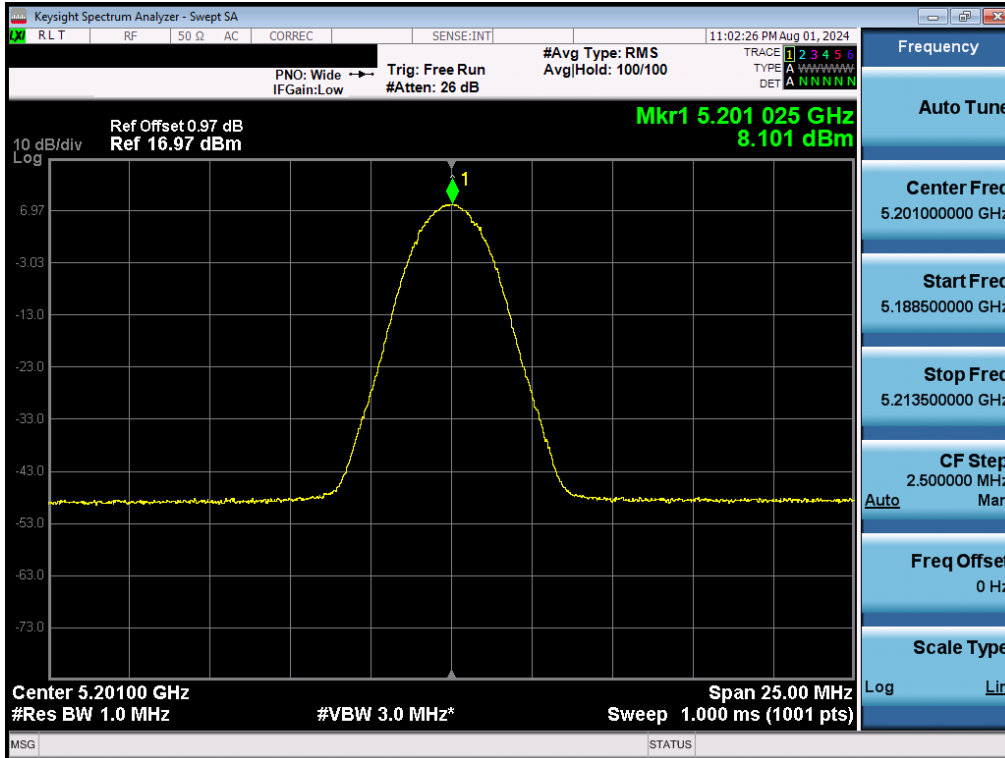


Plot 7-39. FCC PSD (NB UNII BDR – 5245MHz)

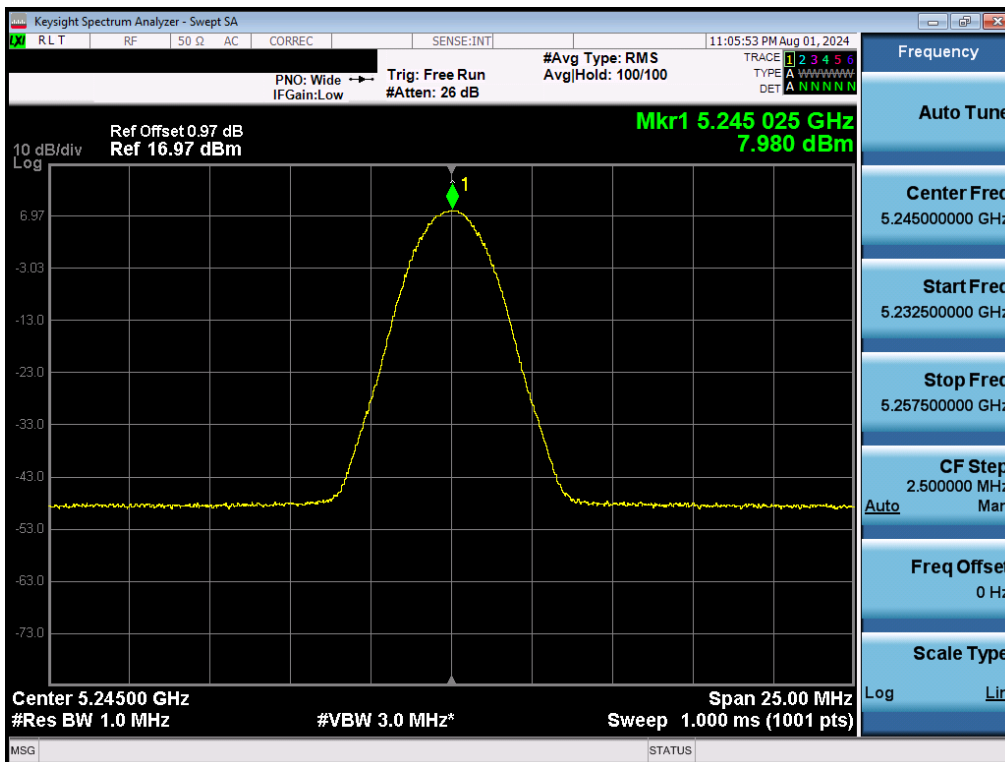


Plot 7-40. FCC PSD (NB UNII LE2M – 5157MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 42 of 122

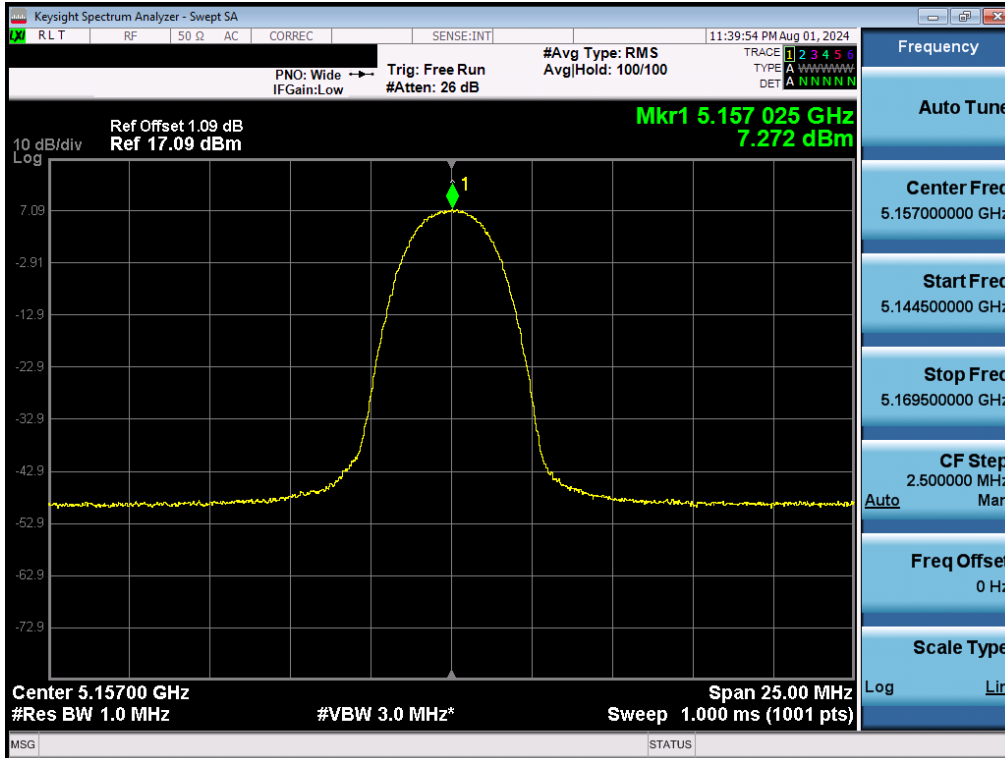


Plot 7-41. FCC PSD (NB UNII LE2M – 5201MHz)

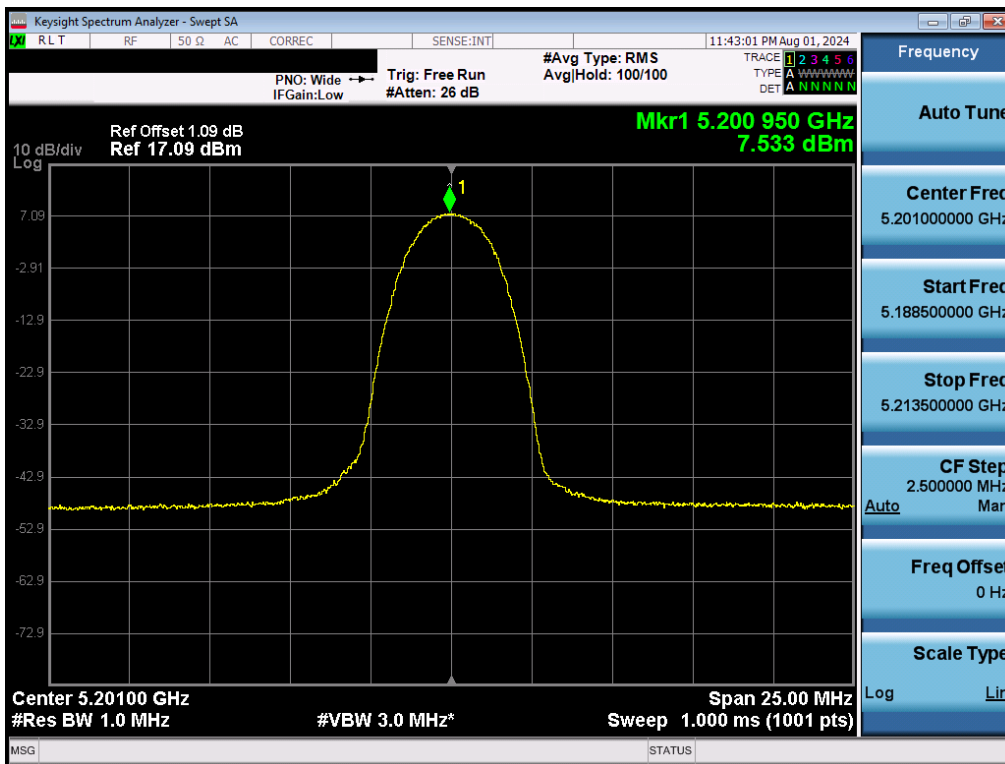


Plot 7-42. FCC PSD (NB UNII LE2M – 5245MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 43 of 122

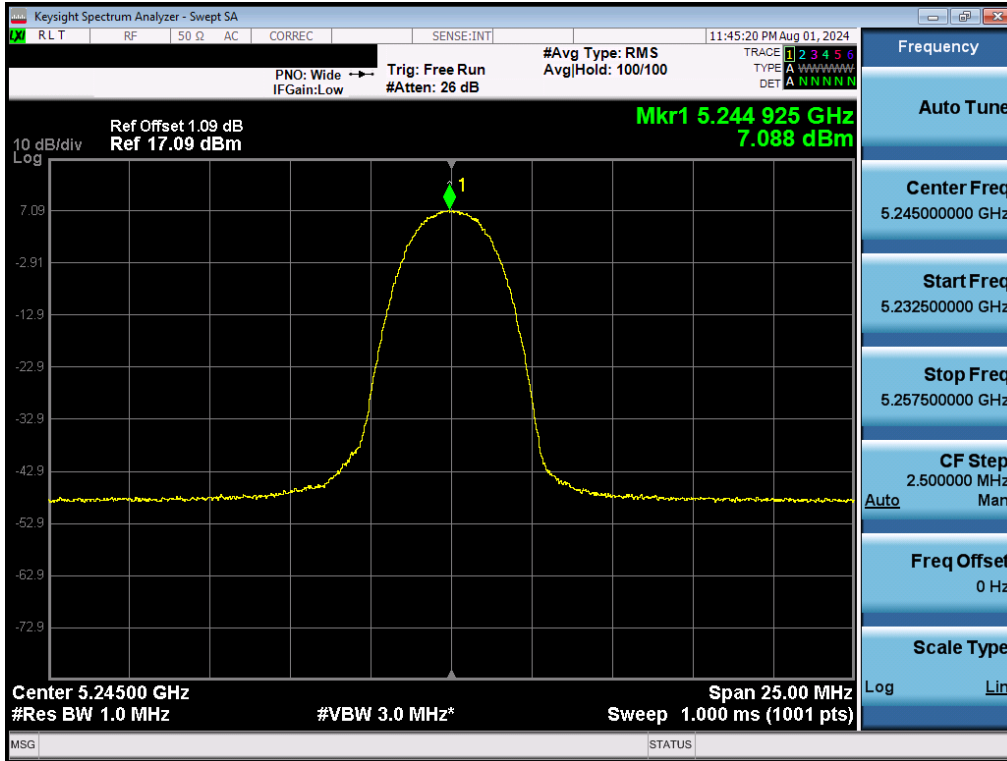


Plot 7-43. FCC PSD (NB UNII HDR4 – 5157MHz)

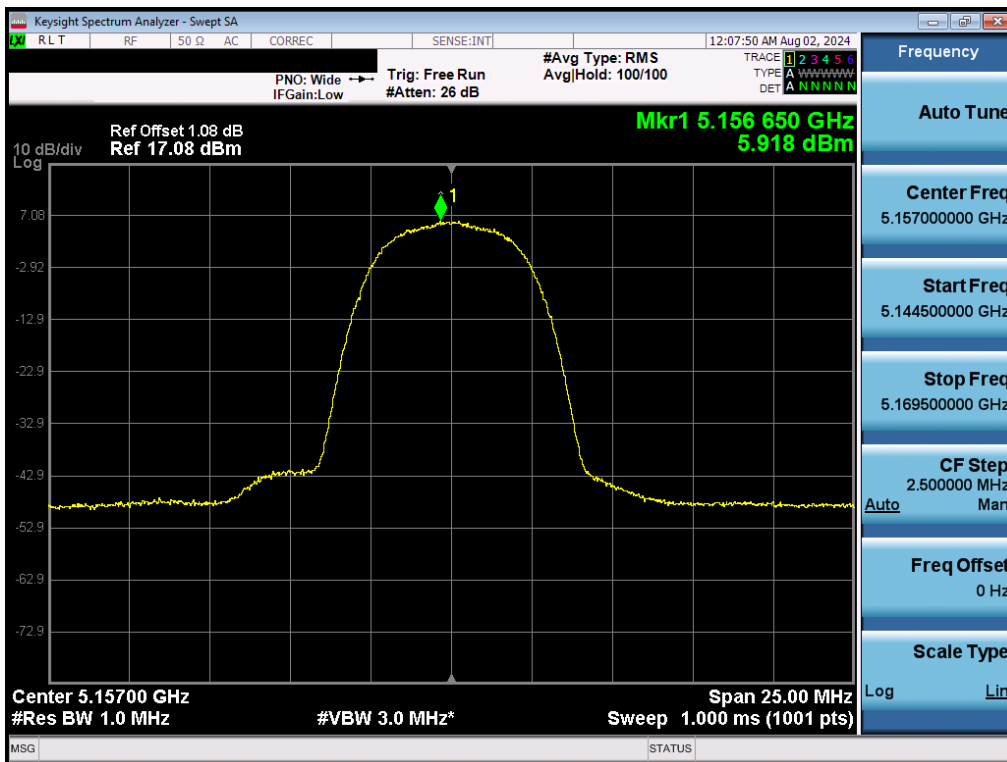


Plot 7-44. FCC PSD (NB UNII HDR4 – 5201MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 44 of 122

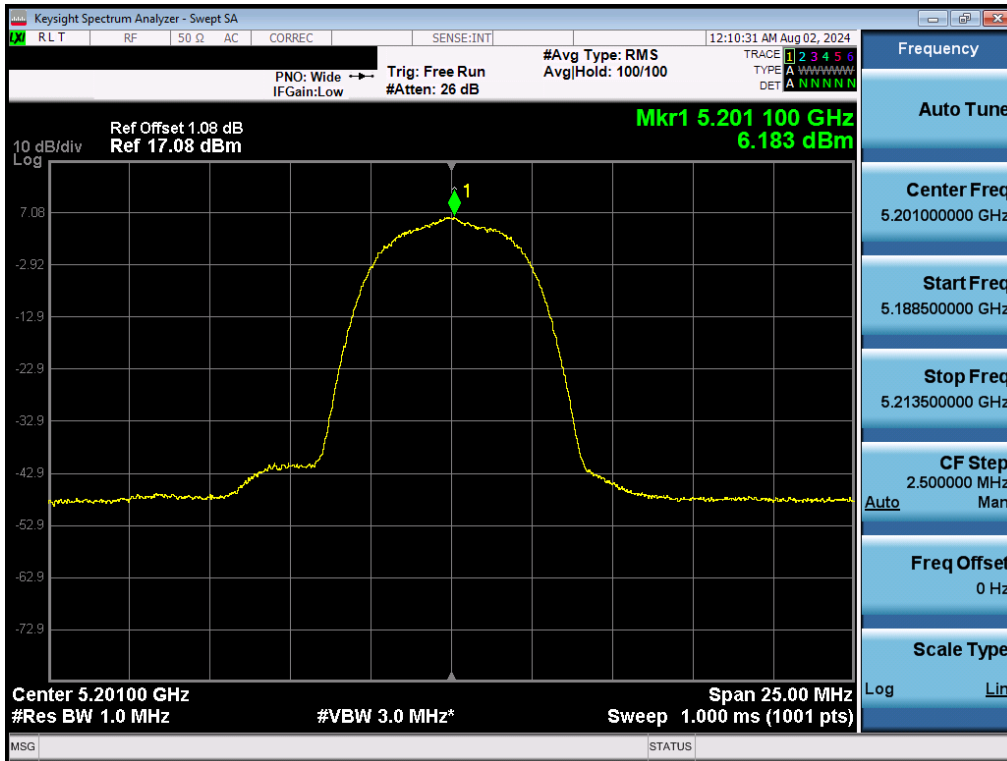


Plot 7-45. FCC PSD (NB UNII HDR4 – 5245MHz)

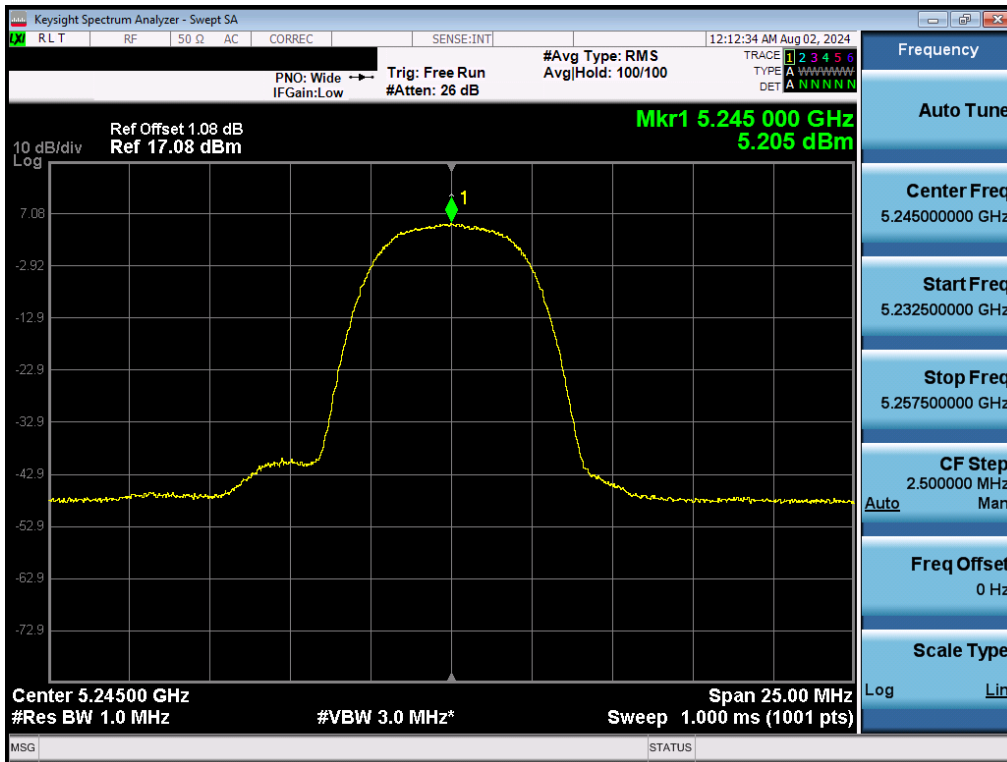


Plot 7-46. FCC PSD (NB UNII HDR8 – 5157MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 45 of 122

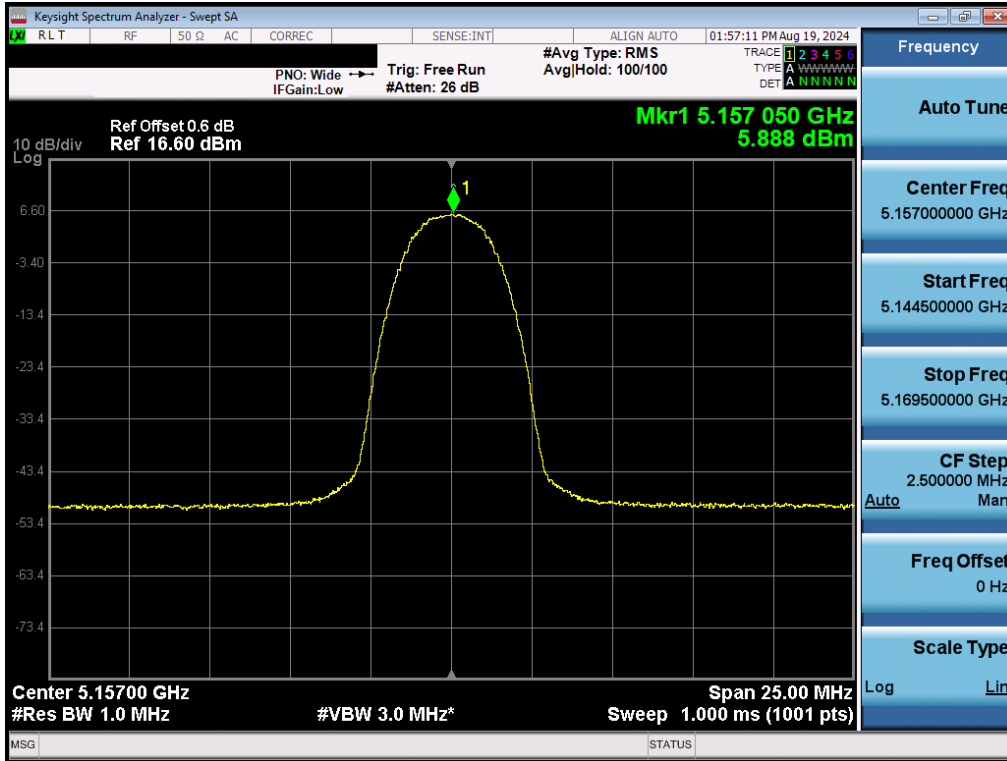


Plot 7-47. FCC PSD (NB UNII HDR8 – 5201MHz)

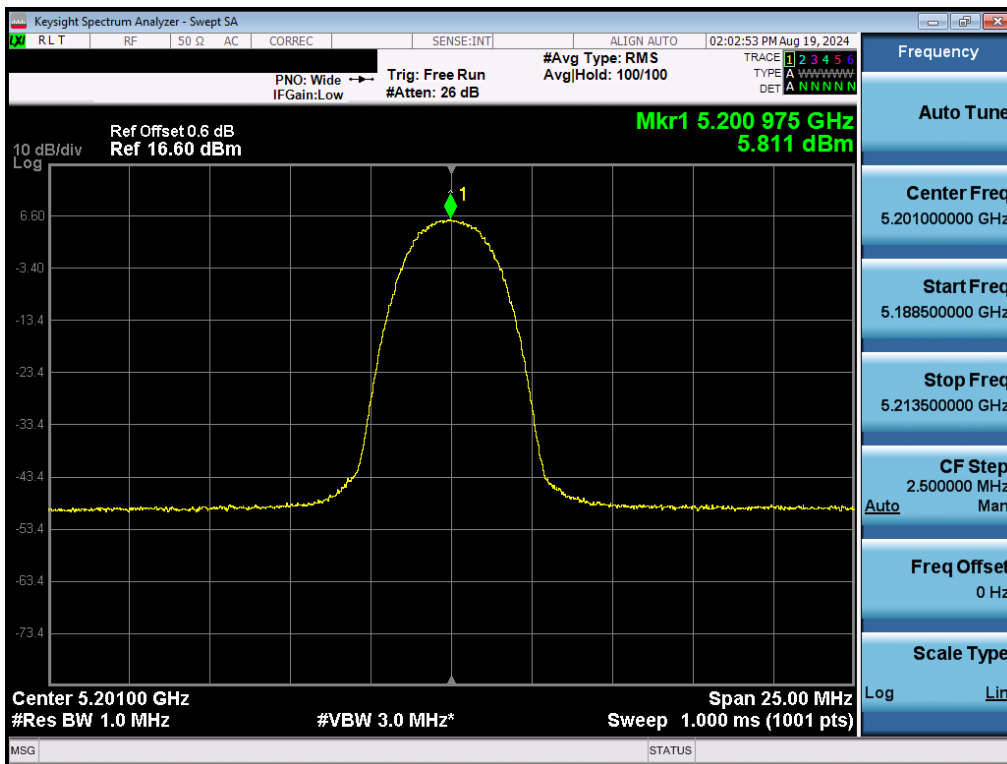


Plot 7-48. FCC PSD (NB UNII HDR8 – 5245MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 46 of 122

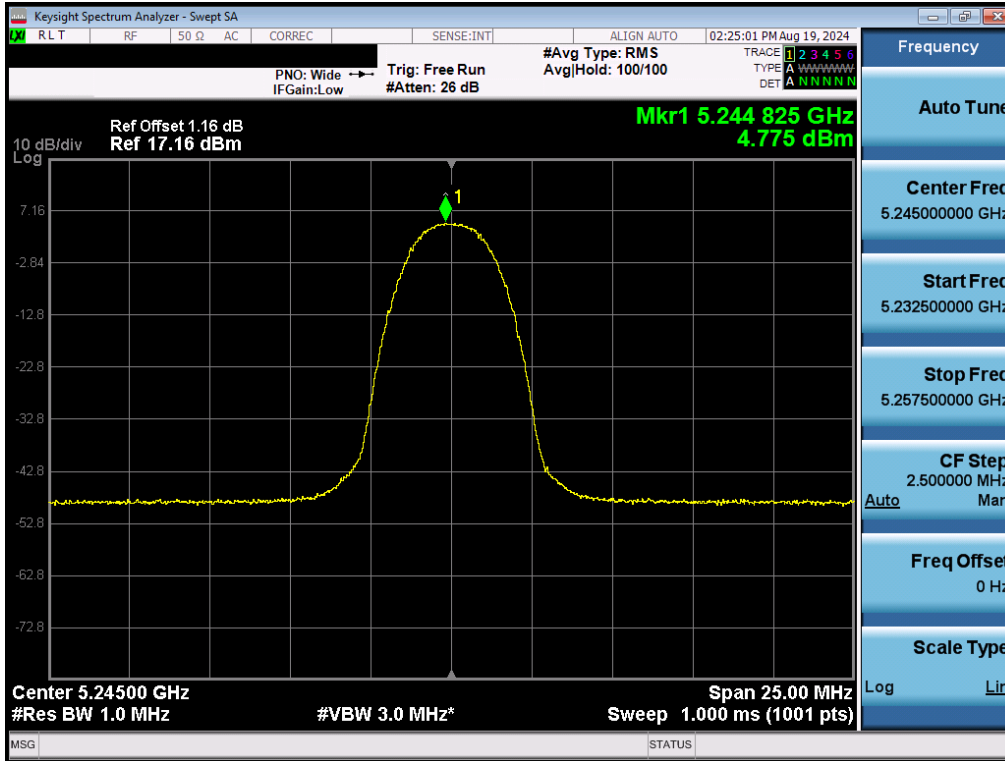


Plot 7-49. FCC PSD (NB UNII HDRp4 – 5157MHz)

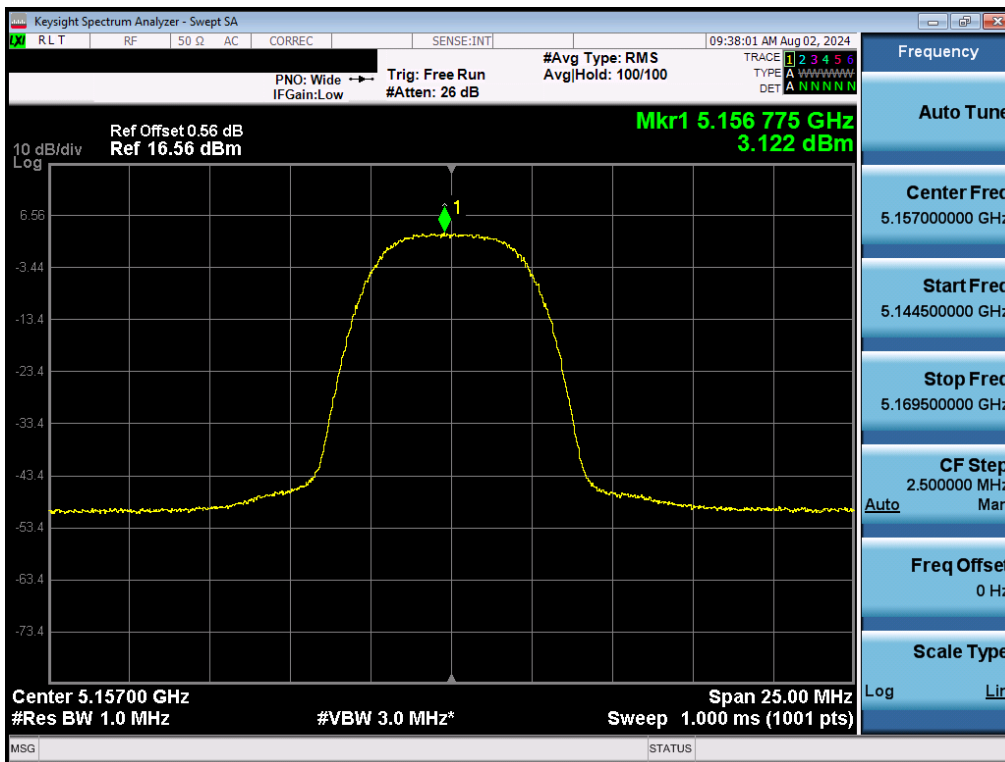


Plot 7-50. FCC PSD (NB UNII HDRp4 – 5201MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 47 of 122

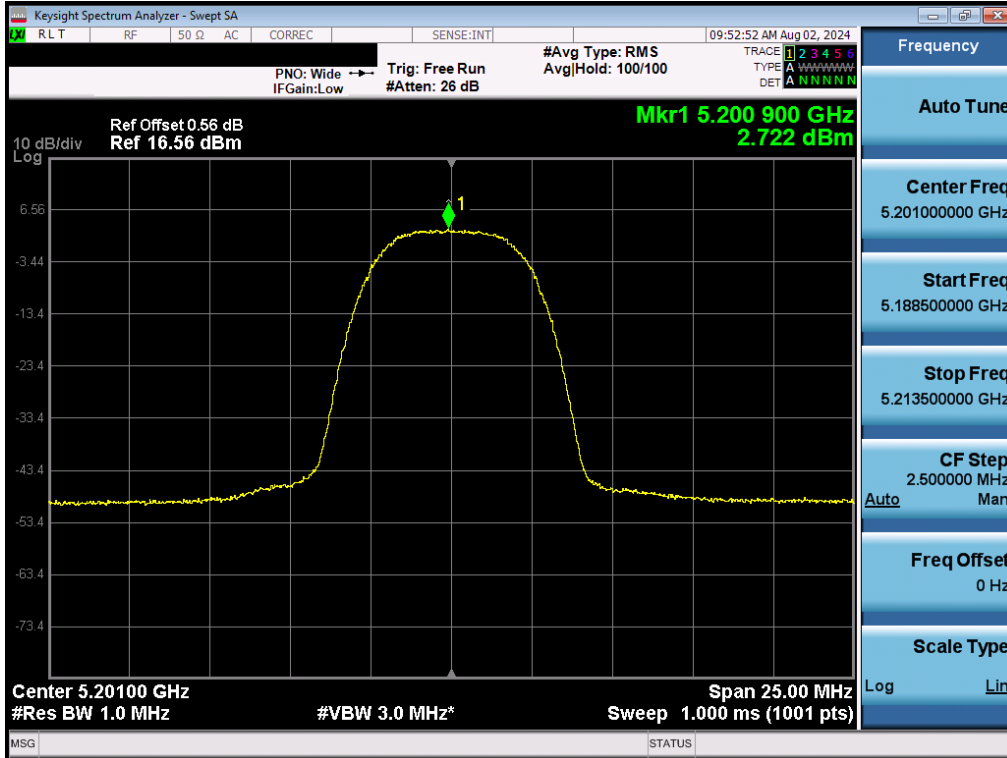


Plot 7-51. FCC PSD (NB UNII HDRp4 – 5245MHz)

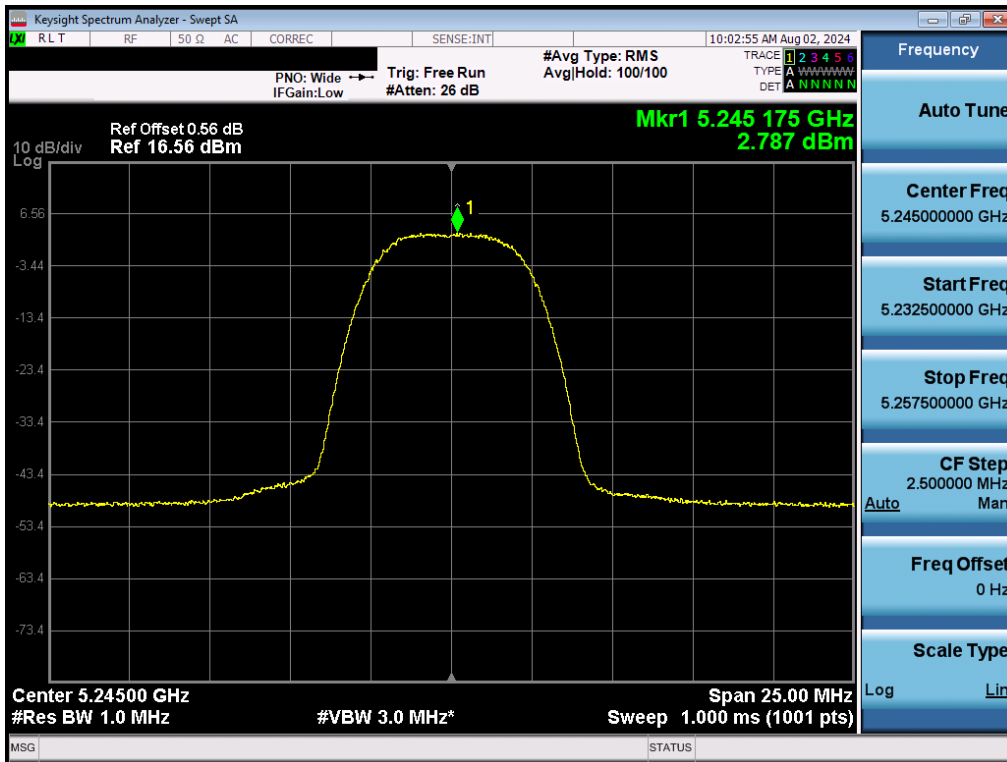


Plot 7-52. FCC PSD (NB UNII HDRp8 – 5157MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 48 of 122



Plot 7-53. FCC PSD (NB UNII HDRp8 – 5201MHz)



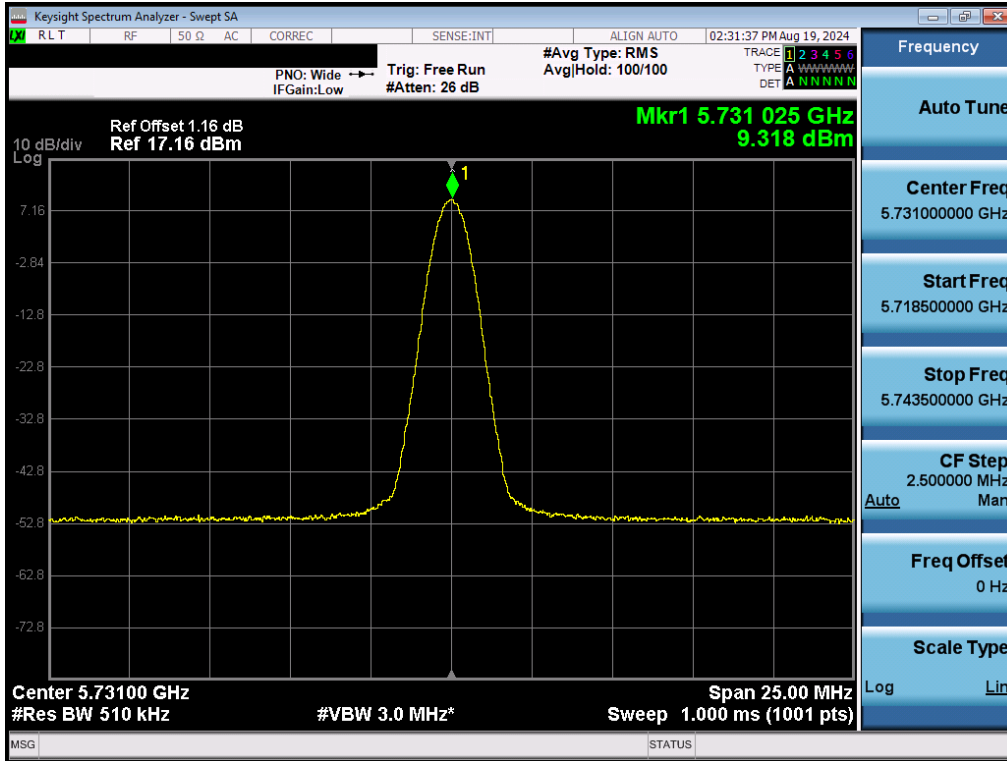
Plot 7-54. FCC PSD (NB UNII HDRp8 – 5245MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 49 of 122

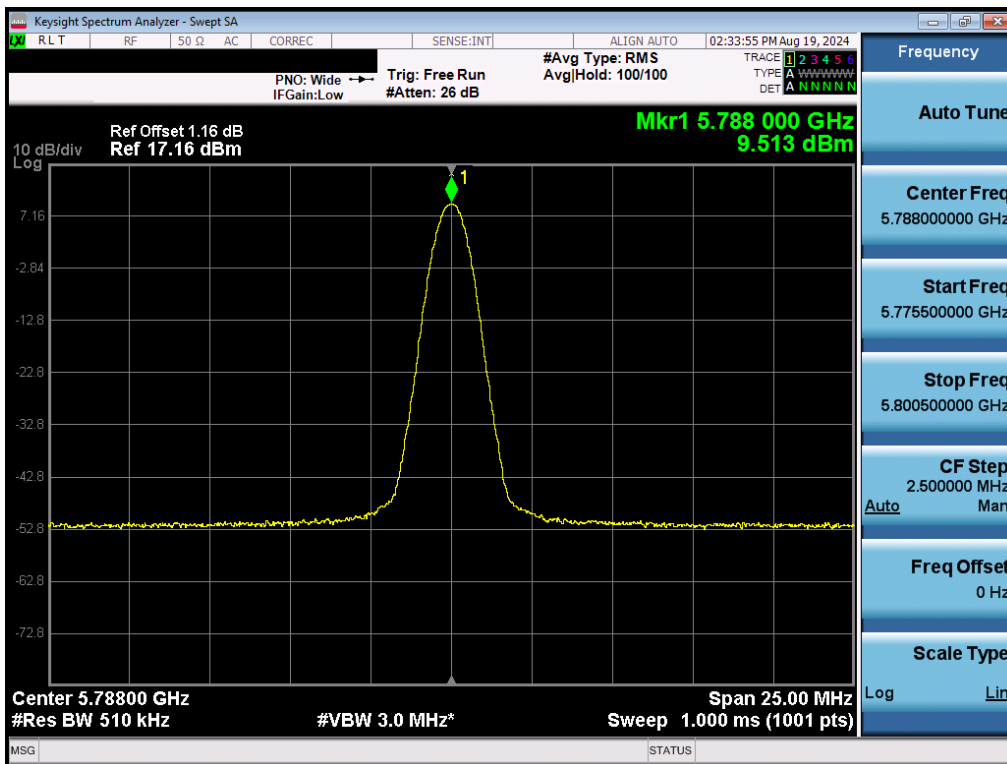
	Frequency [MHz]	Data Rate [Mbps]	Mode	Measured Power Density [dBm/500kHz]	Max Permissible Power Density [dBm/500kHz]	Margin [dB]
Band 3	5731	1.0	NB UNII BDR	9.32	30.00	-20.68
	5788	1.0	NB UNII BDR	9.51	30.00	-20.49
	5844	1.0	NB UNII BDR	9.63	30.00	-20.37
	5731	2.0	NB UNII LE2M	7.59	30.00	-22.41
	5788	2.0	NB UNII LE2M	7.58	30.00	-22.42
	5844	2.0	NB UNII LE2M	7.61	30.00	-22.39
	5731	4.0	NB UNII HDR4	5.80	30.00	-24.20
	5788	4.0	NB UNII HDR4	6.18	30.00	-23.82
	5844	4.0	NB UNII HDR4	7.35	30.00	-22.65
	5731	8.0	NB UNII HDR8	4.67	30.00	-25.33
	5788	8.0	NB UNII HDR8	3.45	30.00	-26.55
	5844	8.0	NB UNII HDR8	3.33	30.00	-26.67
	5731	4.0	NB UNII HDRp4	5.87	30.00	-24.13
	5788	4.0	NB UNII HDRp4	5.97	30.00	-24.03
	5844	4.0	NB UNII HDRp4	5.73	30.00	-24.27
	5731	8.0	NB UNII HDRp8	2.43	30.00	-27.57
	5788	8.0	NB UNII HDRp8	1.58	30.00	-28.43
	5844	8.0	NB UNII HDRp8	2.50	30.00	-27.50

Table 7-6. Power Spectral Density Measurements

FCC ID: BCG-A3053	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 50 of 122

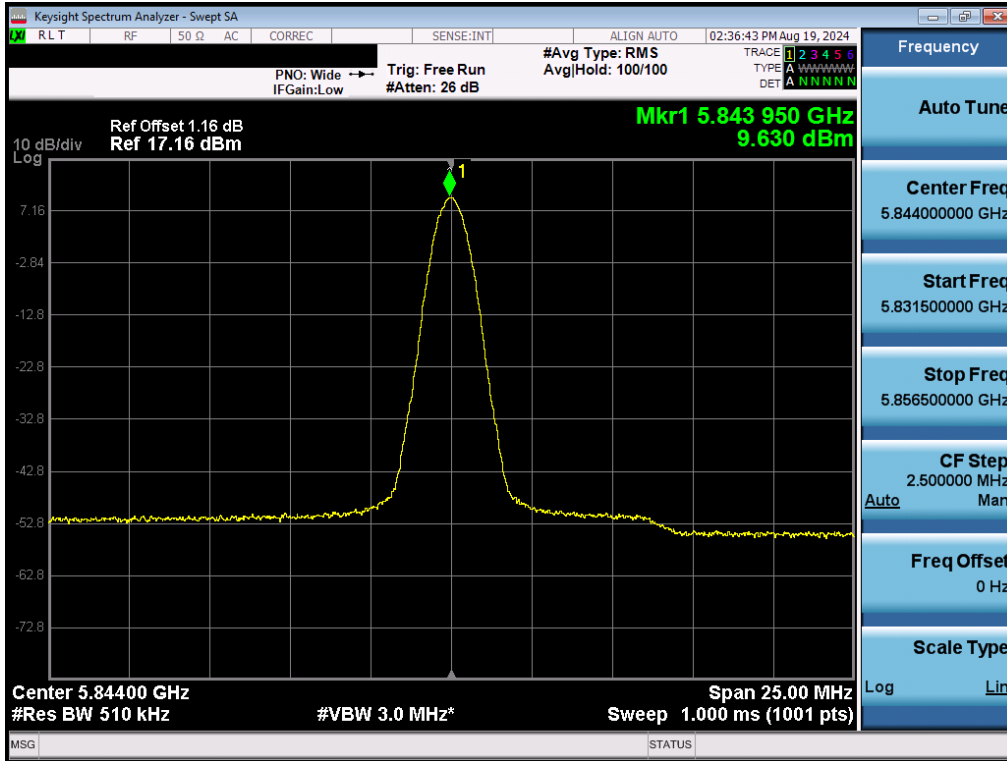


Plot 7-55. PSD (NB UNII BDR - 5731MHz)

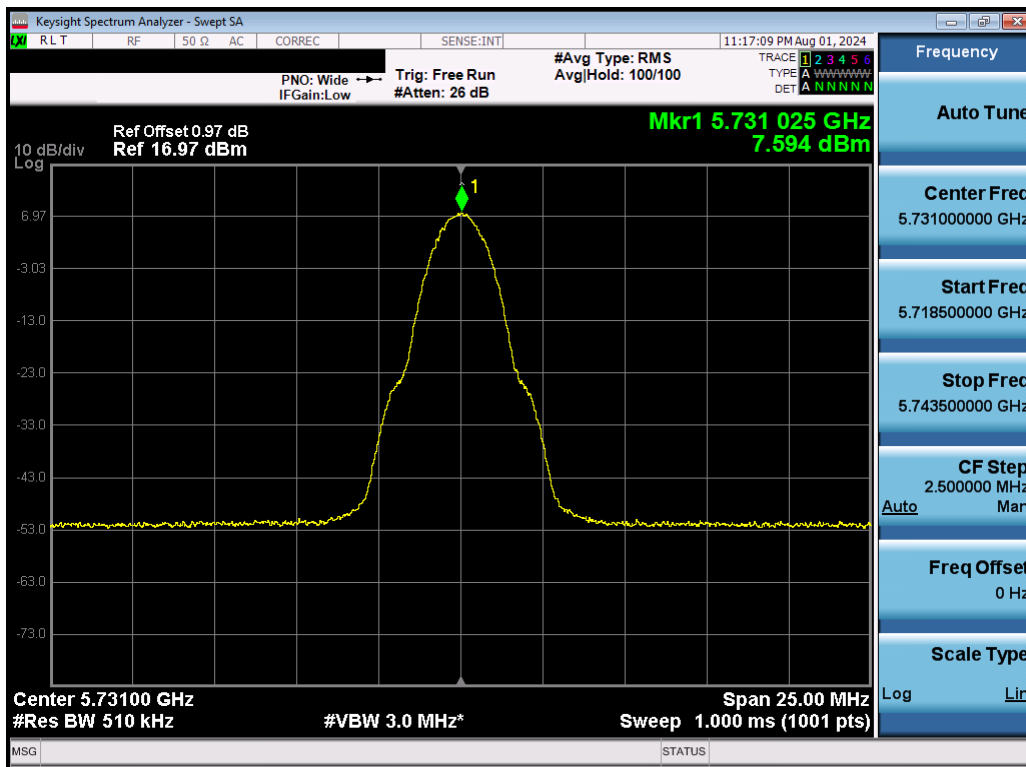


Plot 7-56. PSD (NB UNII BDR - 5788MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 51 of 122

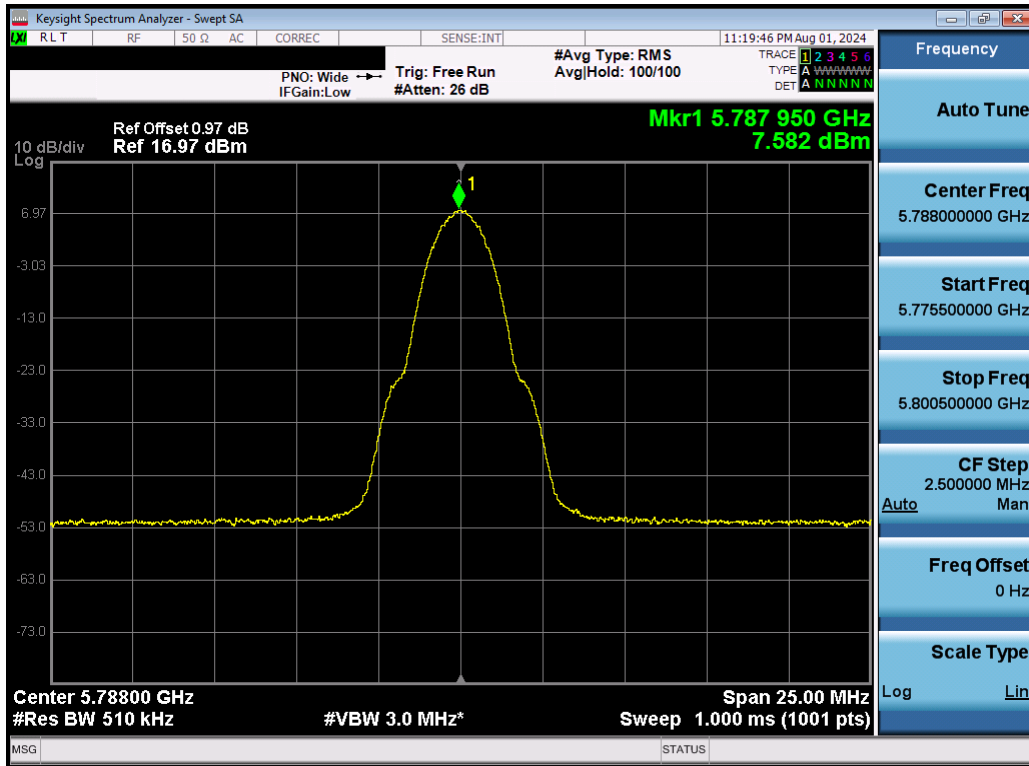


Plot 7-57. PSD (NB UNII BDR – 5844MHz)

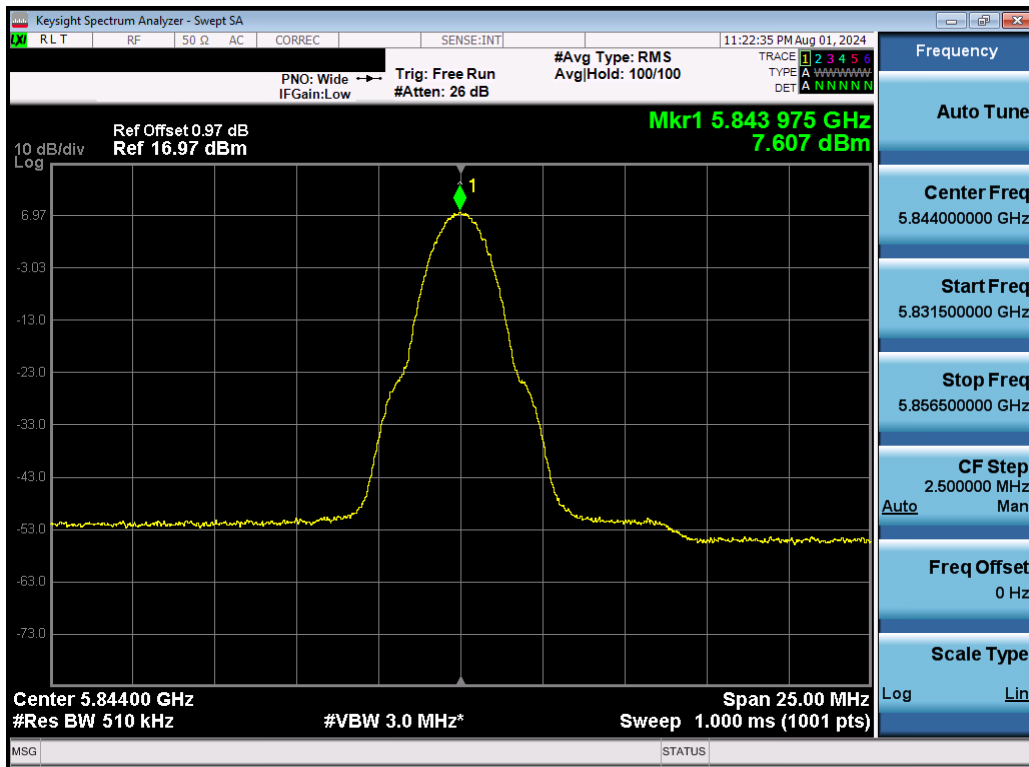


Plot 7-58. PSD (NB UNII LE2M – 5731MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 52 of 122

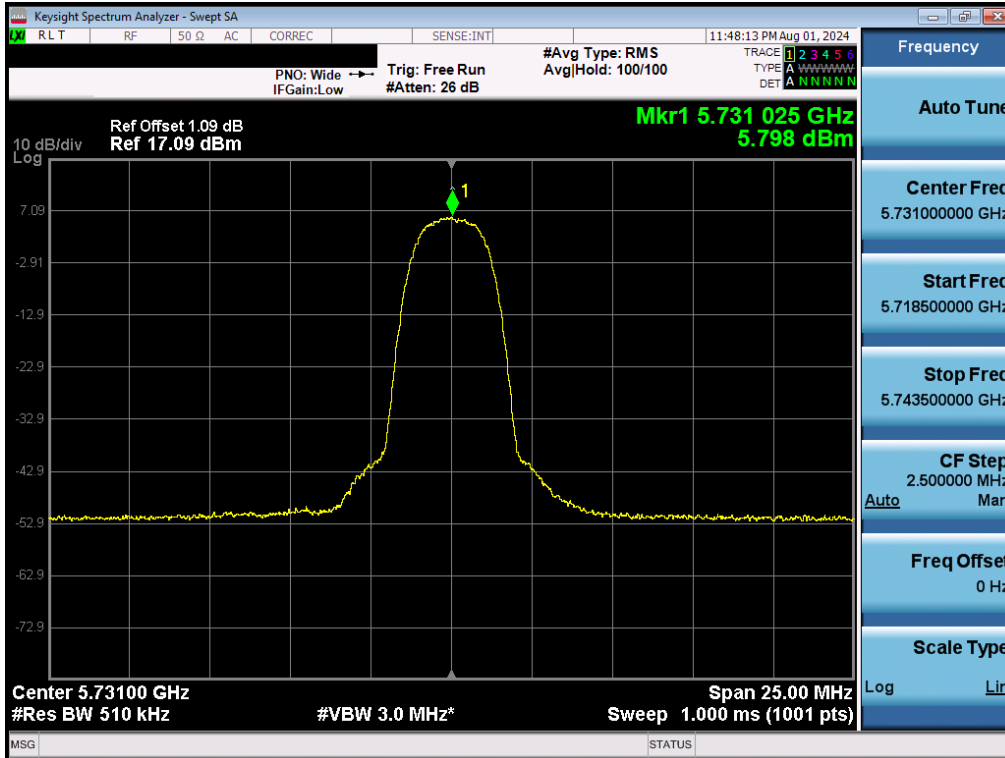


Plot 7-59. PSD (NB UNII LE2M – 5788MHz)

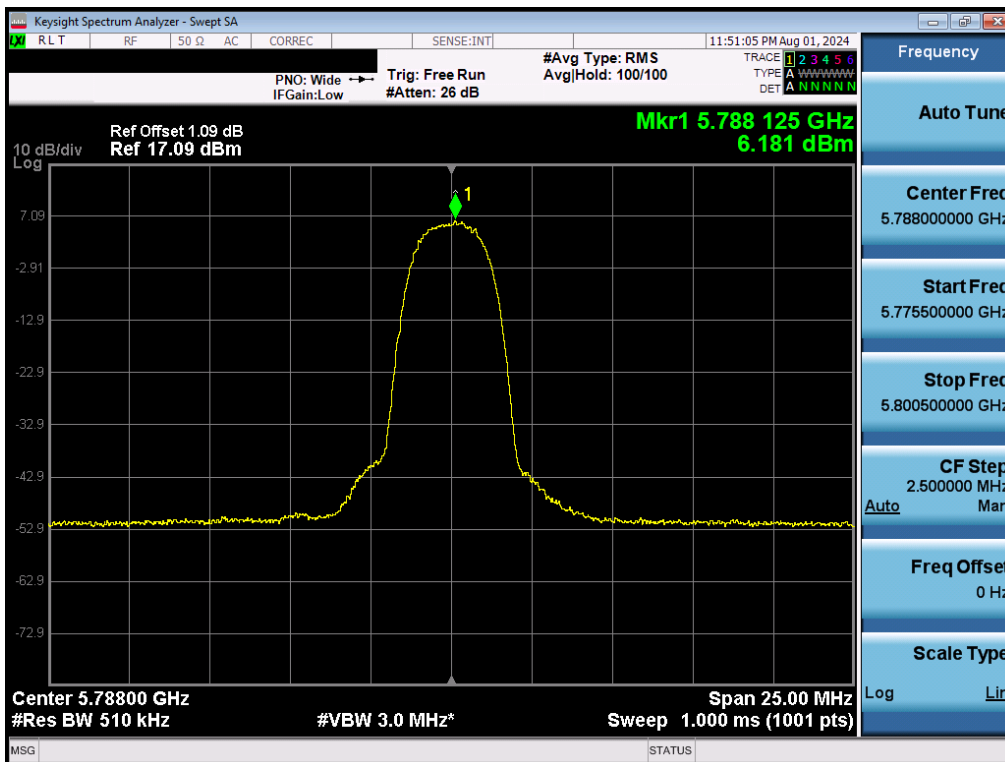


Plot 7-60. PSD (NB UNII LE2M – 5844MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 53 of 122

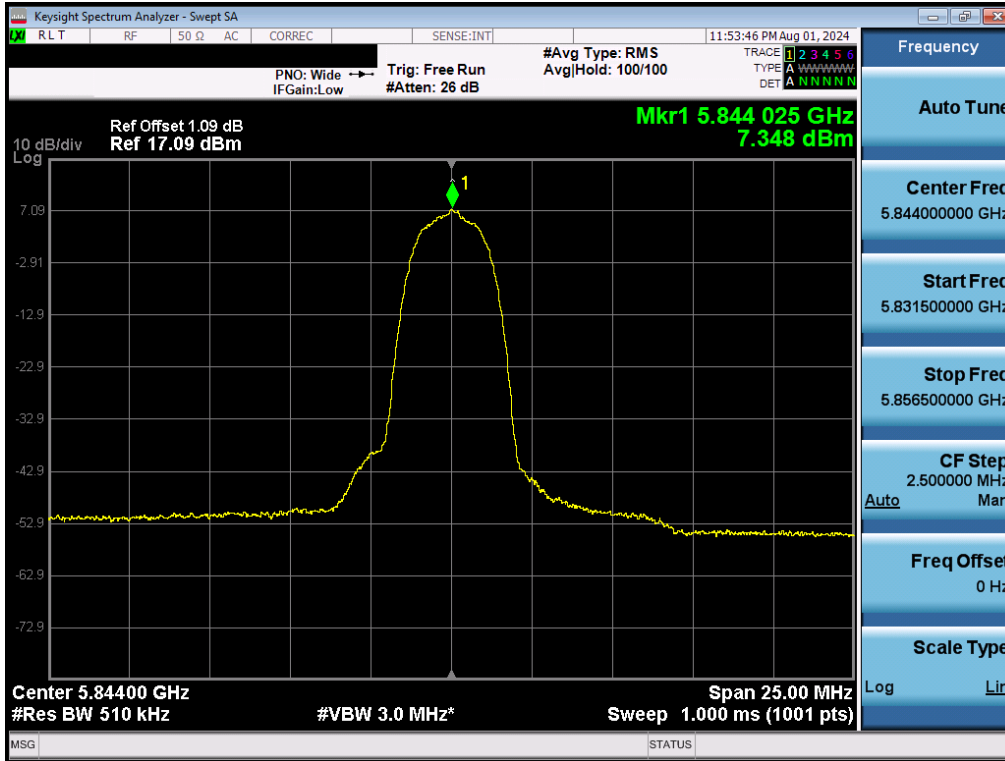


Plot 7-61. PSD (NB UNII HDR4 – 5731MHz)

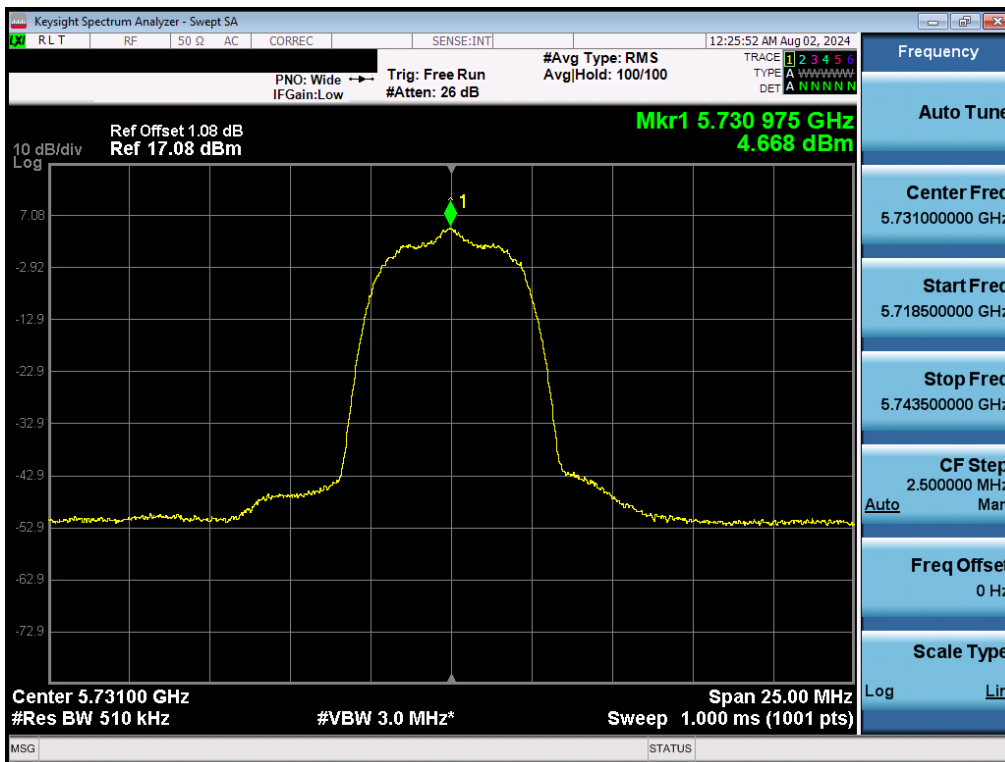


Plot 7-62. PSD (NB UNII HDR4 – 5788MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 54 of 122

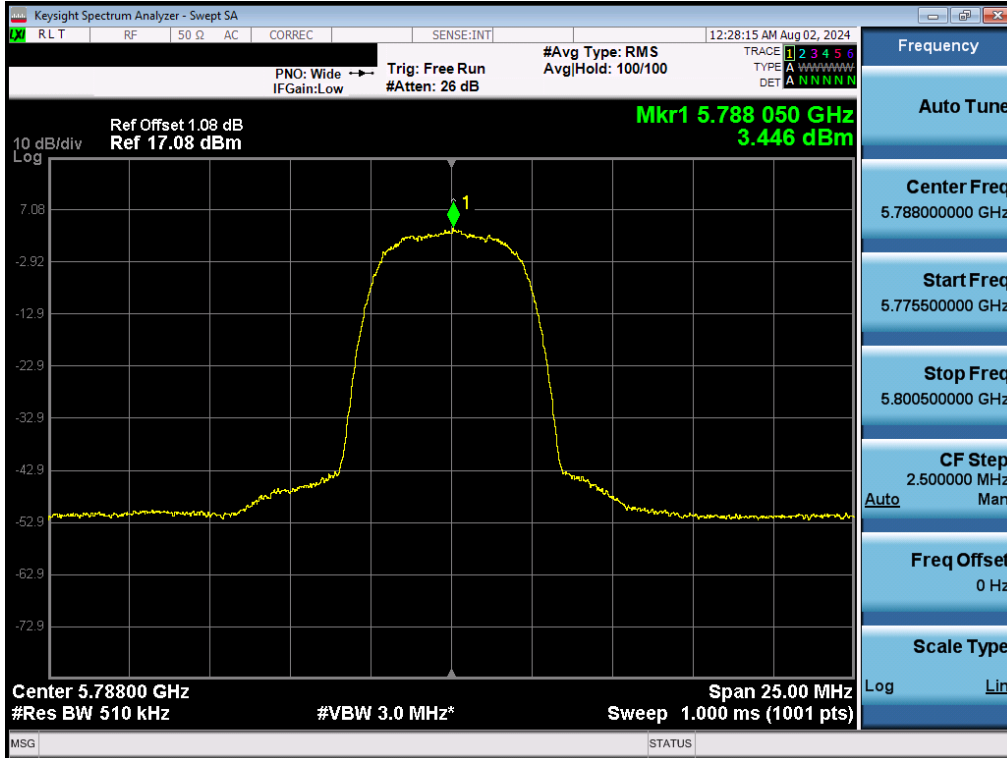


Plot 7-63. PSD (NB UNII HDR4 – 5844MHz)

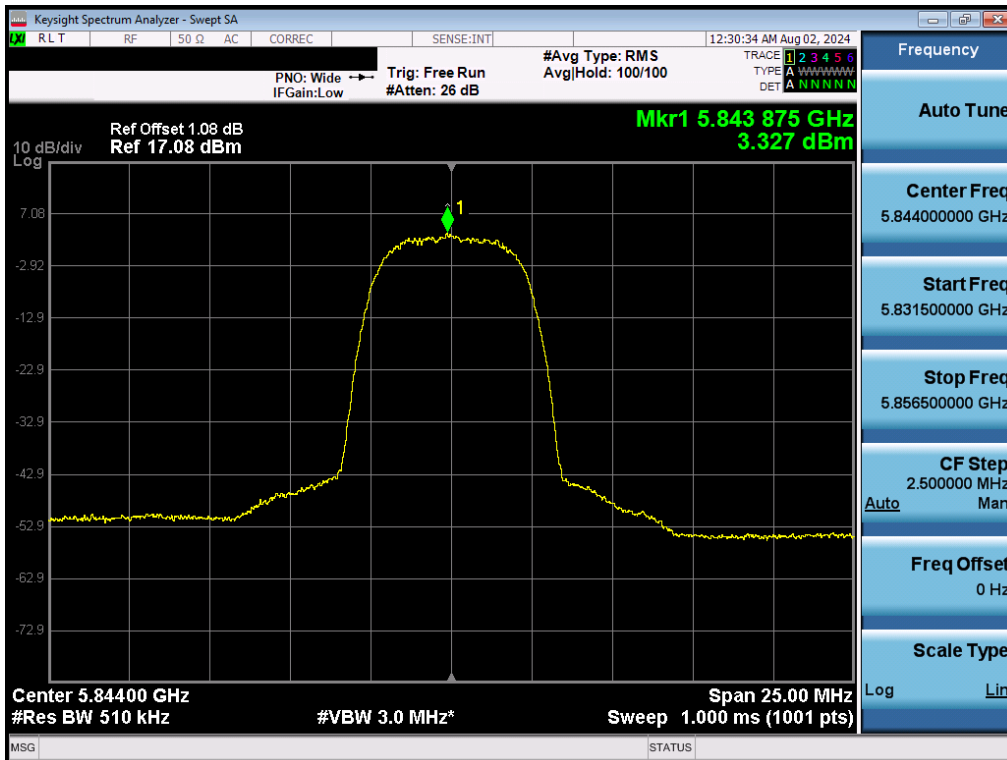


Plot 7-64. PSD (NB UNII HDR8 – 5731MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 55 of 122

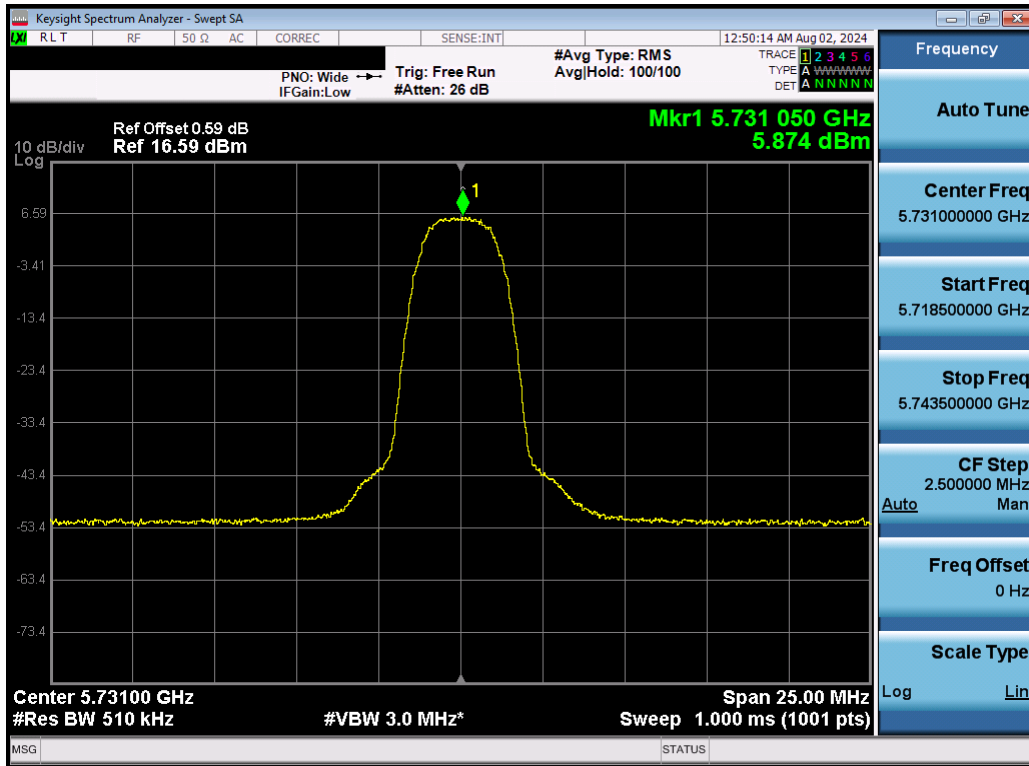


Plot 7-65. PSD (NB UNII HDR8 – 5788MHz)

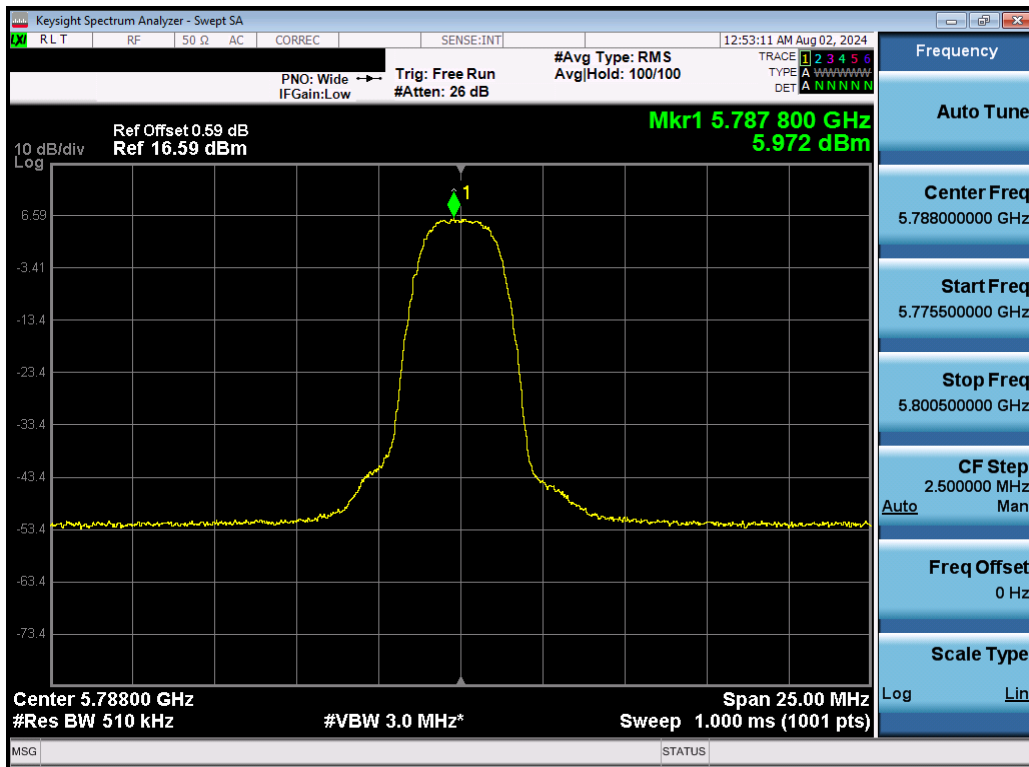


Plot 7-66. PSD (NB UNII HDR8 – 5844MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 56 of 122

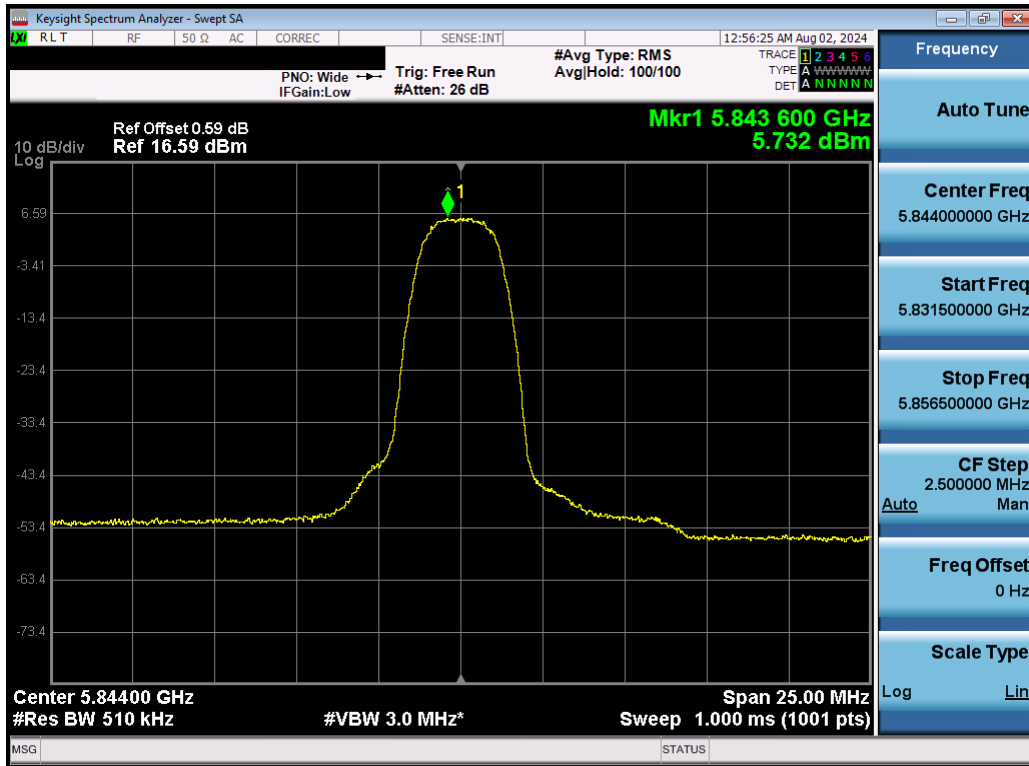


Plot 7-67. PSD (NB UNII HDRp4 – 5731MHz)

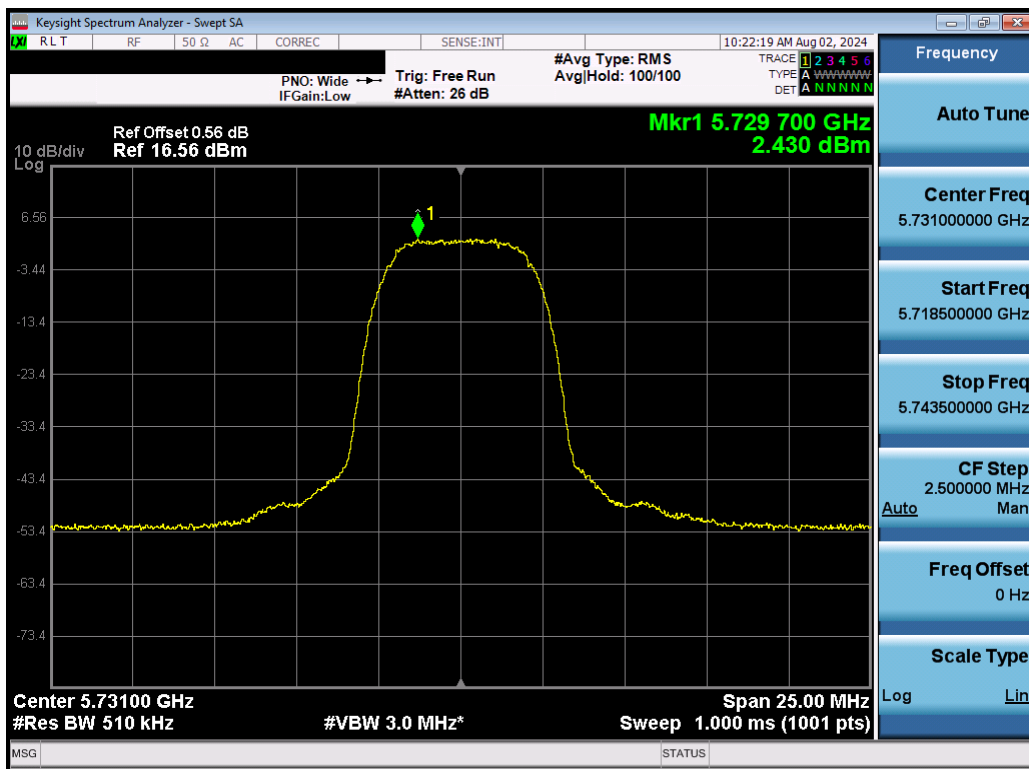


Plot 7-68. PSD (NB UNII HDRp4 – 5788MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 57 of 122

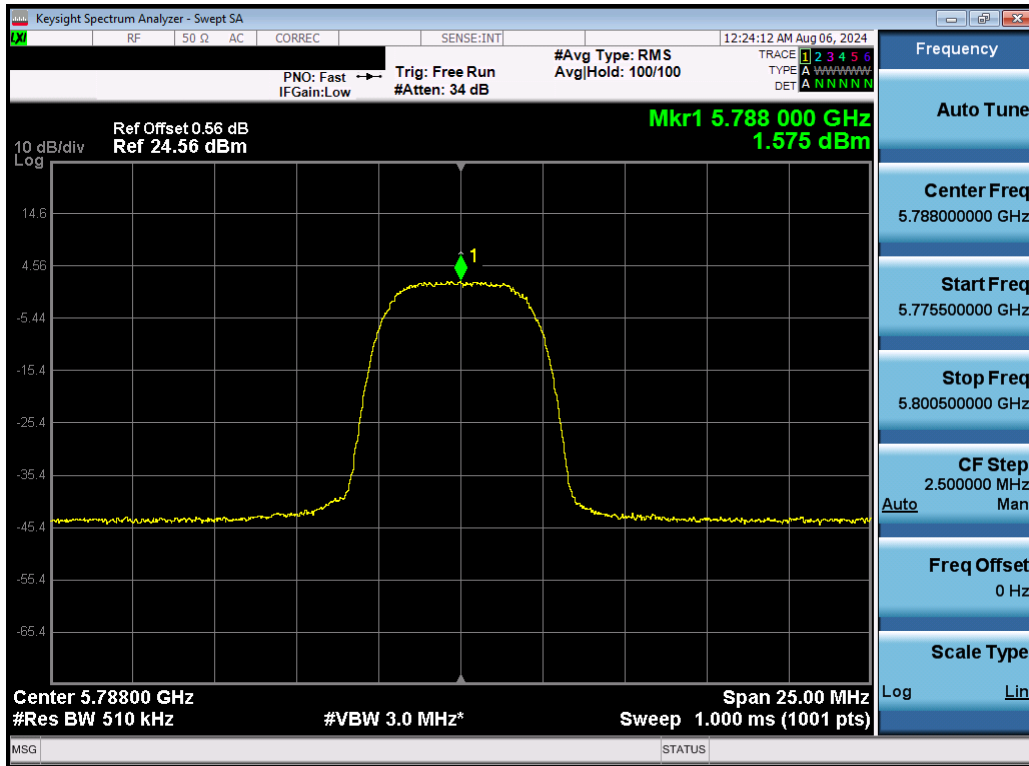


Plot 7-69. PSD (NB UNII HDRp4 – 5844MHz)

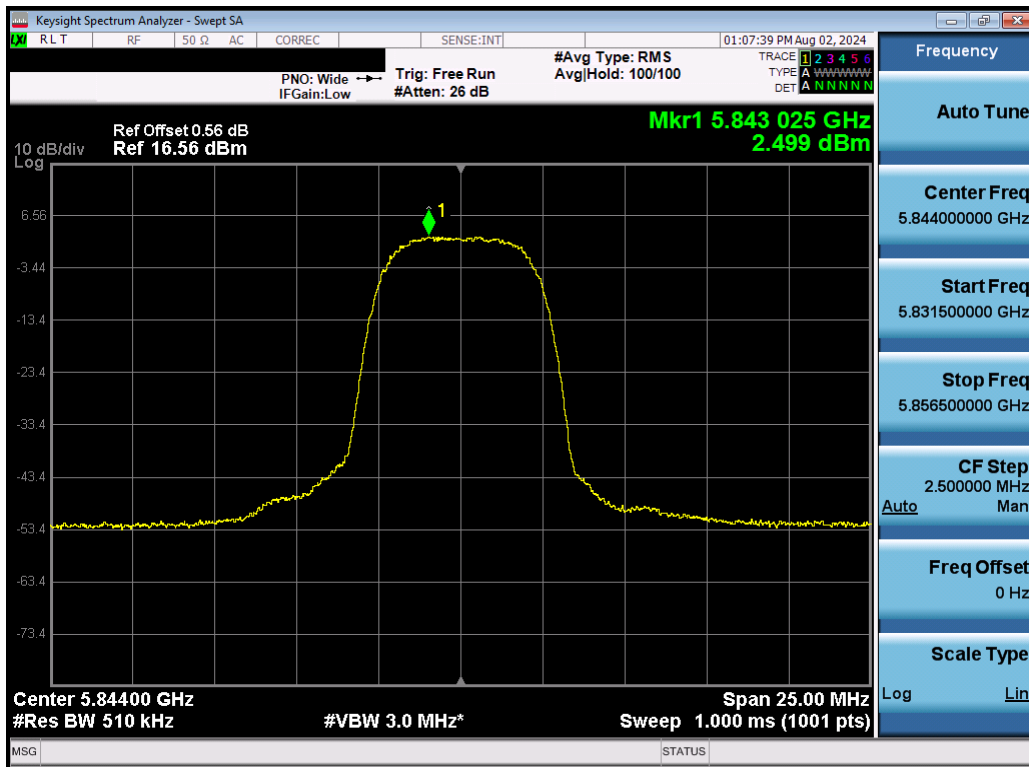


Plot 7-70. PSD (NB UNII HDRp8 – 5731MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 58 of 122



Plot 7-71. PSD (NB UNII HDRp8 – 5788MHz)



Plot 7-72. PSD (NB UNII HDRp8 – 5844MHz)

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 59 of 122

7.6 Radiated Spurious Emission – Above 1GHz

§15.407(b) §15.205 §15.209

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2020 and KDB 789033 D02 v02r01, and at the appropriate frequencies. All channels and power schemes were investigated among all UNII bands. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.25 GHz band shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the 5.725 – 5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 7-7 per Section 15.209.

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

Table 7-7. Radiated Limits

Test Procedures Used

ANSI C63.10-2020 – Subclauses 12.7.7.2, 12.7.6
KDB 789033 D02 v02r01 – Section G

FCC ID: BCG-A3053	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 1C2405230024-06.BCG	Test Dates: 6/26/2024 - 8/19/2024	EUT Type: Wireless Earbud	Page 60 of 122

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Test Settings

Average Field Strength Measurements

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

Peak Field Strength Measurements

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

Test Setup

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

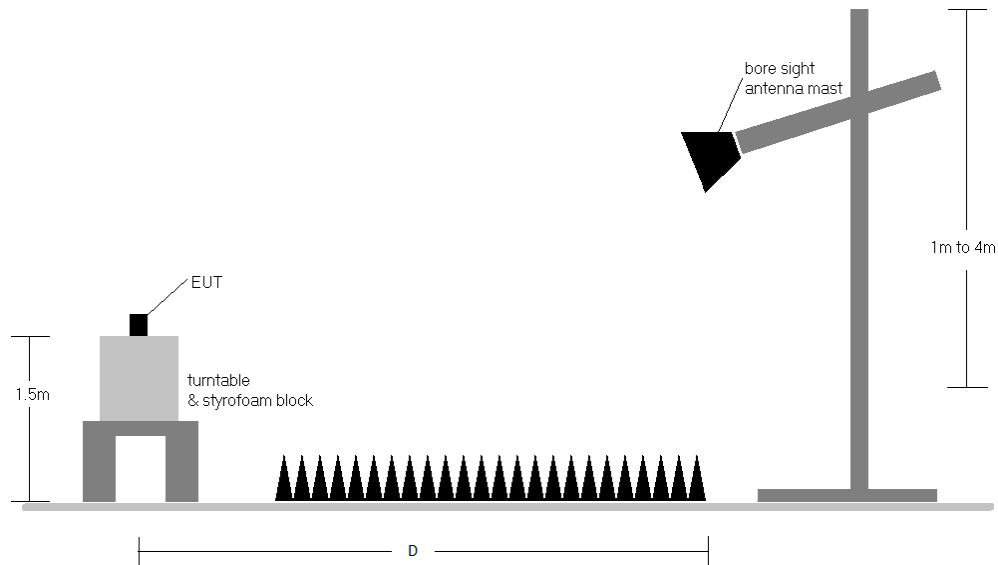


Figure 7-5. Test Instrument & Measurement Setup

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Test Notes

1. All emissions that lie in the restricted bands (denoted by a * next to the frequency) specified in §15.205 are below the limit shown in Table 7-7.
2. All spurious emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-7. All spurious emissions that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz. At a distance of 3 meters, the field strength limit in dB μ V/m can be determined by adding a “conversion” factor of 95.2dB to the EIRP limit of -27dBm/MHz to obtain the limit for out of band spurious emissions of 68.2dB μ V/m.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested with its standard battery.
5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas.
6. D is the measurement test distance and emissions 1-18GHz were measured at a 3 meters test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
8. All supported modulations have been tested on the unit and only worst case configuration is reported.

Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level [dB μ V/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m]
- AFCL [dB/m] = Antenna Factor [dB/m] + Cable Loss [dB] – Preamplifier Gain [dB]
- Margin [dB] = Field Strength Level [dB μ V/m] – Limit [dB μ V/m]

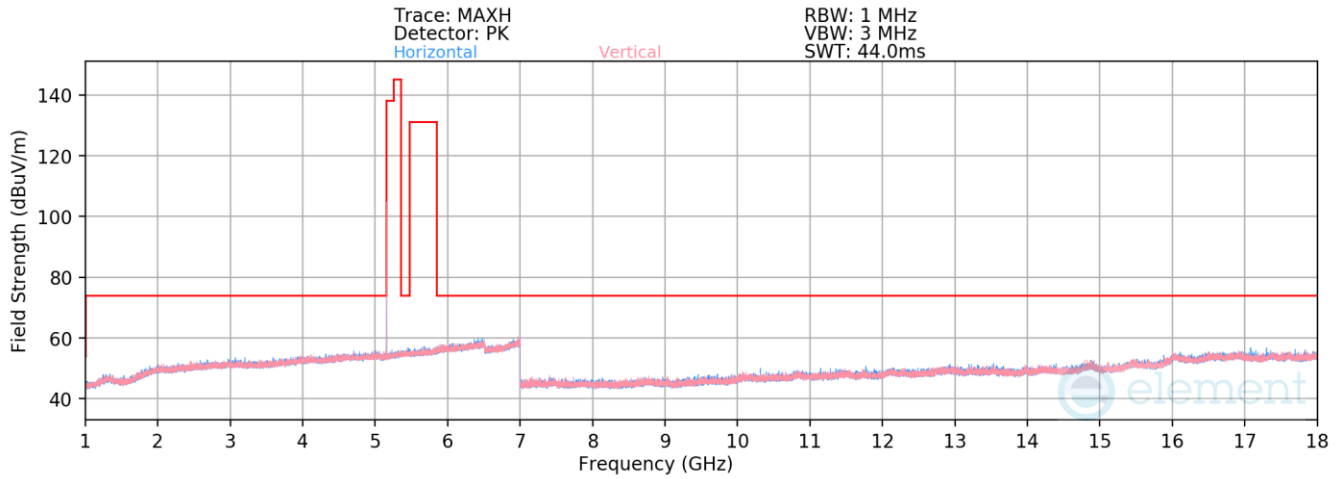
Radiated Band Edge Measurement Offset

- The amplitude offset shown in the radiated restricted band edge plots in Section 7.6 was calculated using the formula:
Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

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Radiated Spurious Emissions



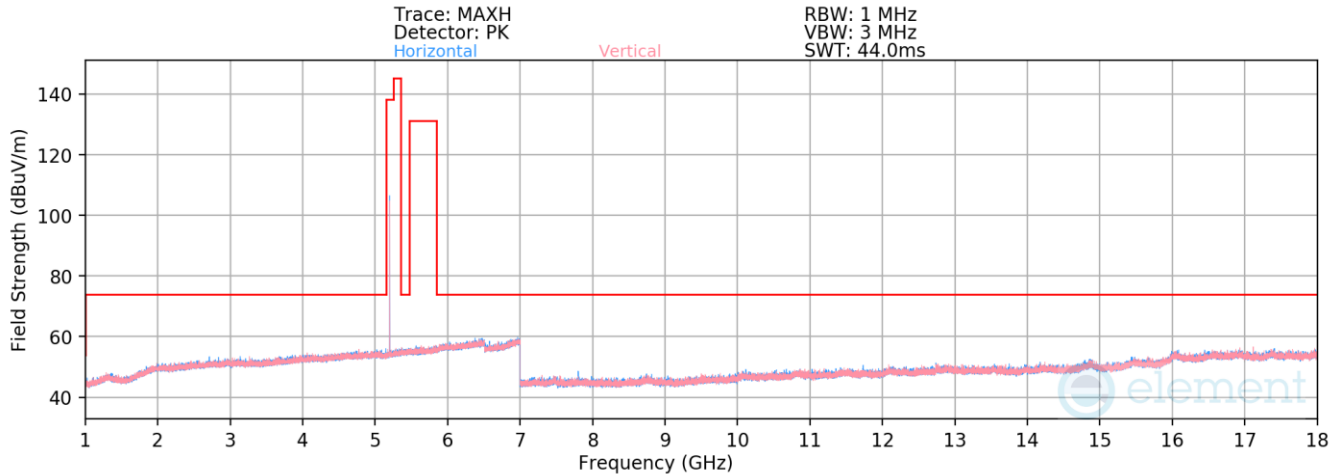
Plot 7-73. Radiated Spurious Emissions 1-18GHz (NB UNII BDR – 5157MHz)

Mode: BDR
 Data Rate: 1Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5157MHz

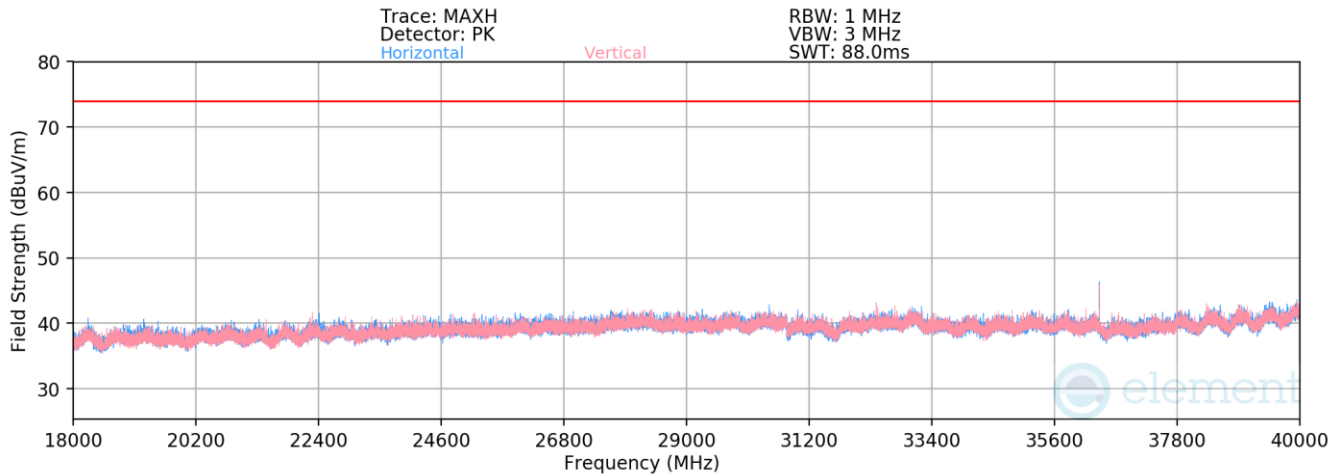
Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Duty Cycle Correction [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
10314.00	Peak	H	104	222	-65.63	8.13	0.00	49.50	68.23	-18.73
15471.00	Avg	V	308	115	-80.23	15.62	1.16	43.55	53.98	-10.43
15471.00	Peak	V	308	115	-69.63	15.62	0.00	52.99	73.98	-20.99

Table 7-8. Radiated Spurious Emission Measurements

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Plot 7-74. Radiated Spurious Emissions 1-18GHz (NB UNII BDR – 5201MHz)



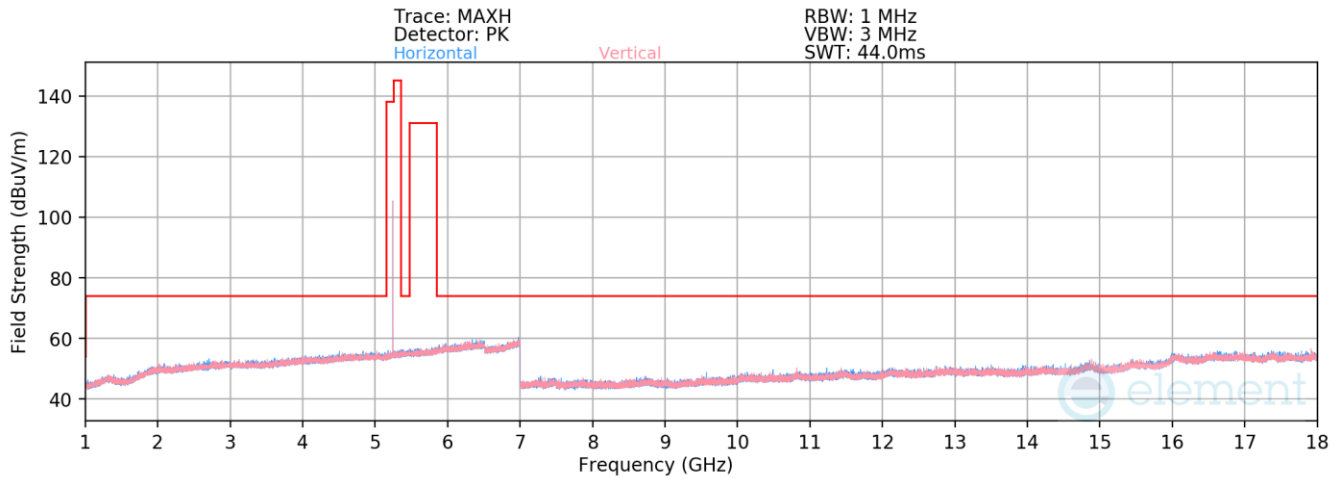
Plot 7-75. Radiated Spurious Emissions 18-40GHz (NB UNII BDR – 5201MHz)

Mode: BDR
 Data Rate: 1Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5201MHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Duty Cycle Correction [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
10402.00	Peak	H	100	222	-64.42	7.77	0.00	50.35	68.23	-17.88
* 15603.00	Avg	V	100	101	-80.37	15.89	1.16	43.68	53.98	-10.30
* 15603.00	Peak	V	100	101	-70.07	15.89	0.00	52.82	73.98	-21.16
* 20804.00	Avg	H	-	-	-70.70	-6.81	0.00	29.49	53.98	-24.49
* 20804.00	Peak	H	-	-	-59.16	-6.81	0.00	41.03	73.98	-32.95
26005.00	Peak	H	143	44	-60.42	-4.47	0.00	42.11	73.98	-31.87
* 31206.00	Avg	V	32	61	-68.78	-2.49	1.16	36.89	53.98	-17.09
* 31206.00	Peak	V	32	61	-58.99	-2.49	0.00	45.52	73.98	-28.46
36407.00	Peak	V	344	174	-52.62	-6.38	0.00	48.00	68.23	-20.23

Table 7-9. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
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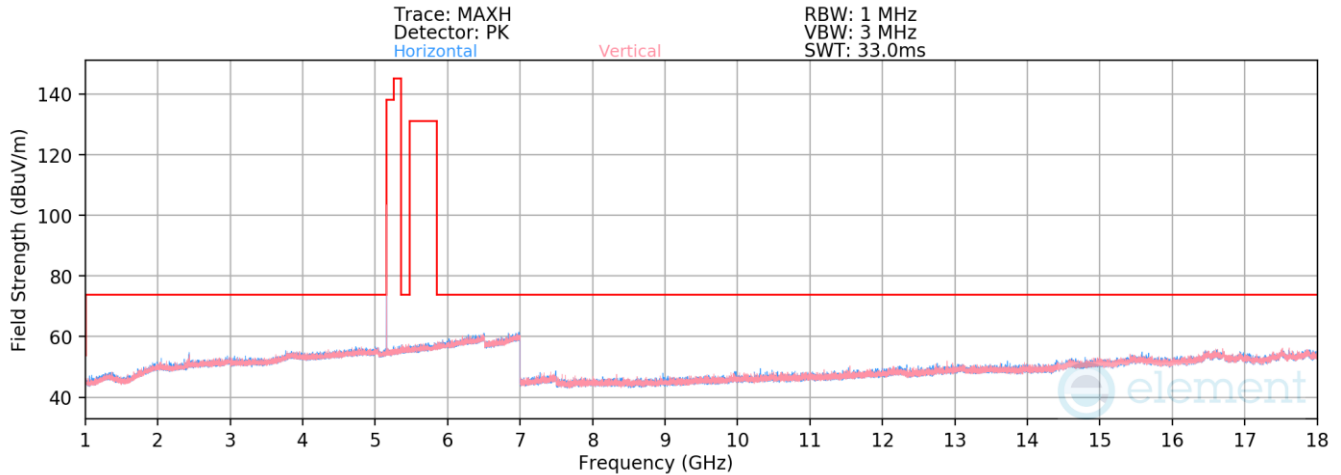
Plot 7-76. Radiated Spurious Emissions 1-18GHz (NB UNII BDR – 5245MHz)

Mode: BDR
 Data Rate: 1Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5245MHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Duty Cycle Correction [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
10490.00	Peak	H	100	223	-64.54	8.08	0.00	50.54	68.23	-17.69
* 15735.00	Avg	V	104	109	-80.92	15.79	1.16	43.03	53.98	-10.95
* 15735.00	Peak	V	104	109	-70.29	15.79	0.00	52.50	73.98	-21.48

Table 7-10. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
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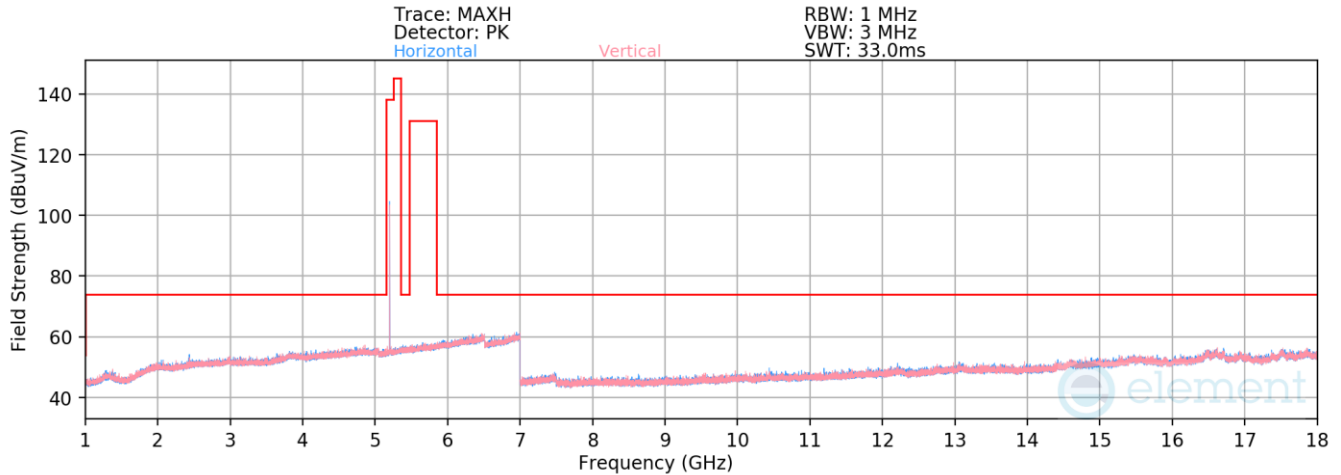
Plot 7-77. Radiated Spurious Emissions 1-18GHz (NB UNII LE2M – 5157MHz)

Mode: LE2M
 Data Rate: 2Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5157MHz

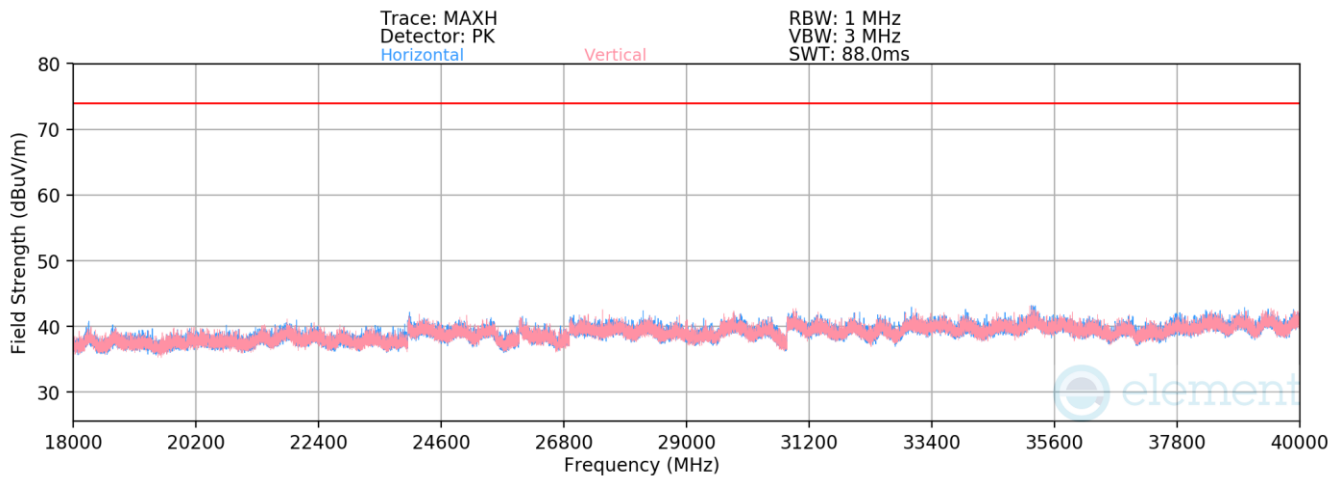
Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
10314.00	Peak	H	289	24	-65.86	8.58	49.72	68.23	-18.51
* 15471.00	Avg	V	-	-	-79.52	14.29	41.77	53.98	-12.21
* 15471.00	Peak	V	-	-	-68.81	14.29	52.48	73.98	-21.50

Table 7-11. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
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Plot 7-78. Radiated Spurious Emissions 1-18GHz (NB UNII LE2M – 5201MHz)



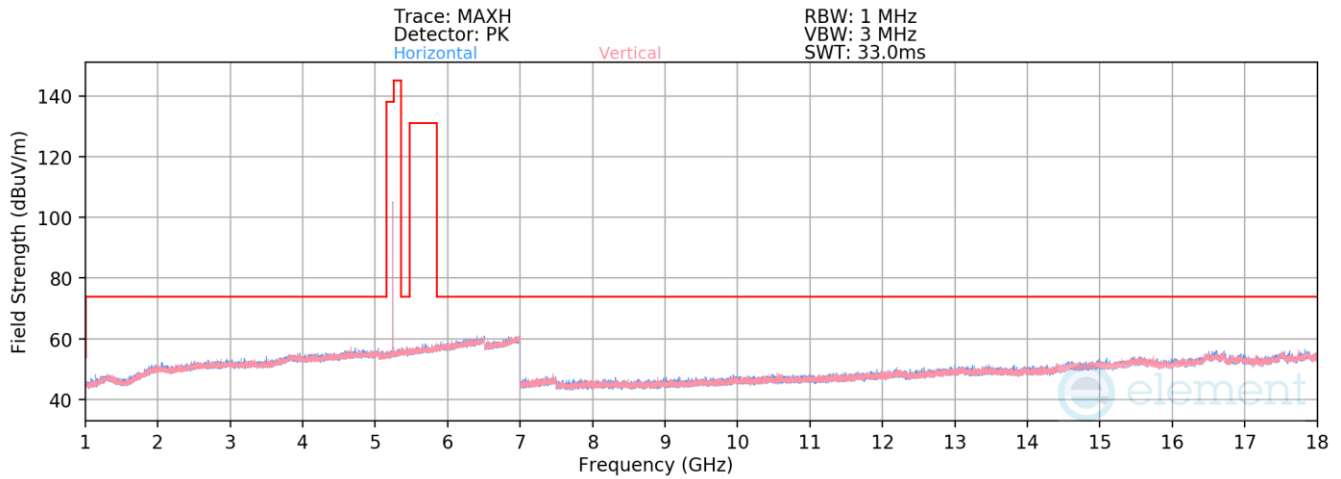
Plot 7-79. Radiated Spurious Emission 18-40GHz (NB UNII LE2M – 5201MHz)

Mode: LE2M
 Data Rate: 2Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5201MHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Duty Cycle Correction [dB]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
10402.00	Peak	H	135	28	-65.71	8.66	0.00	49.95	68.23	-18.28
* 15603.00	Avg	V	297	34	-78.87	14.05	0.64	42.82	53.98	-11.16
* 15603.00	Peak	V	297	34	-68.17	14.05	0.00	52.88	73.98	-21.10
* 20804.00	Avg	H	-	-	-71.93	-6.74	0.00	28.33	53.98	-25.65
* 20804.00	Peak	H	-	-	-60.48	-6.74	0.00	39.78	73.98	-34.20
26005.00	Peak	H	32	365	-61.54	-4.48	0.00	40.98	68.23	-27.25
* 31206.00	Avg	H	-	-	-75.07	-2.30	0.00	29.63	53.98	-24.35
* 31206.00	Peak	H	-	-	-63.71	-2.30	0.00	40.99	73.98	-32.99
36407.00	Peak	H	-	-	-59.27	-6.23	0.00	41.50	68.23	-26.73

Table 7-12. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
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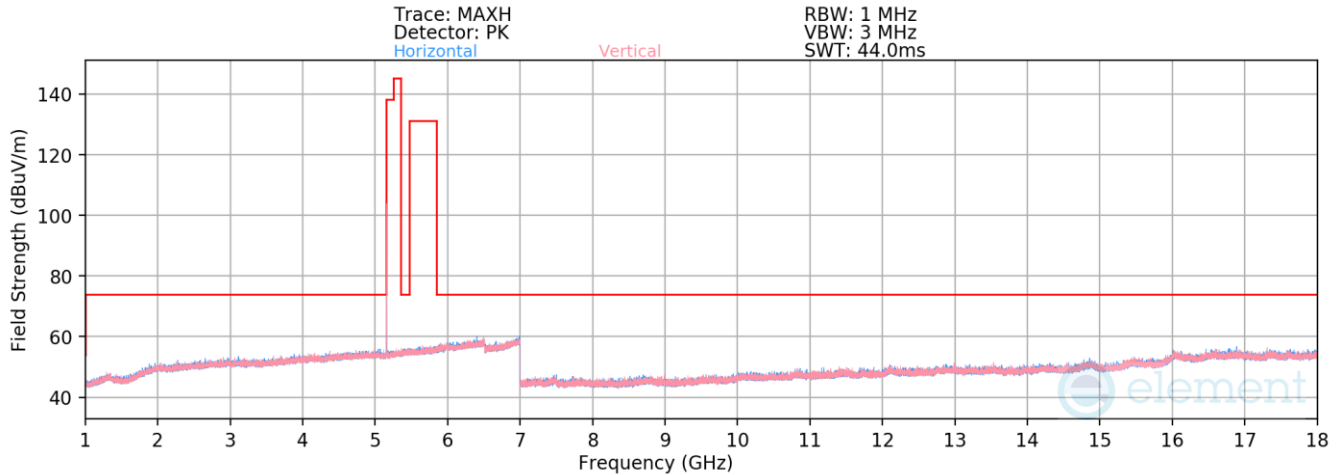
Plot 7-80. Radiated Spurious Emissions 1-18GHz (NB UNII LE2M – 5245MHz)

Mode: LE2M
 Data Rate: 2Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5245MHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
10490.00	Peak	V	345	83	-67.66	8.77	48.11	68.23	-20.12
* 15735.00	Avg	H	-	-	-78.71	13.36	41.65	53.98	-12.33
* 15735.00	Peak	H	-	-	-68.60	13.36	51.76	73.98	-22.22

Table 7-13. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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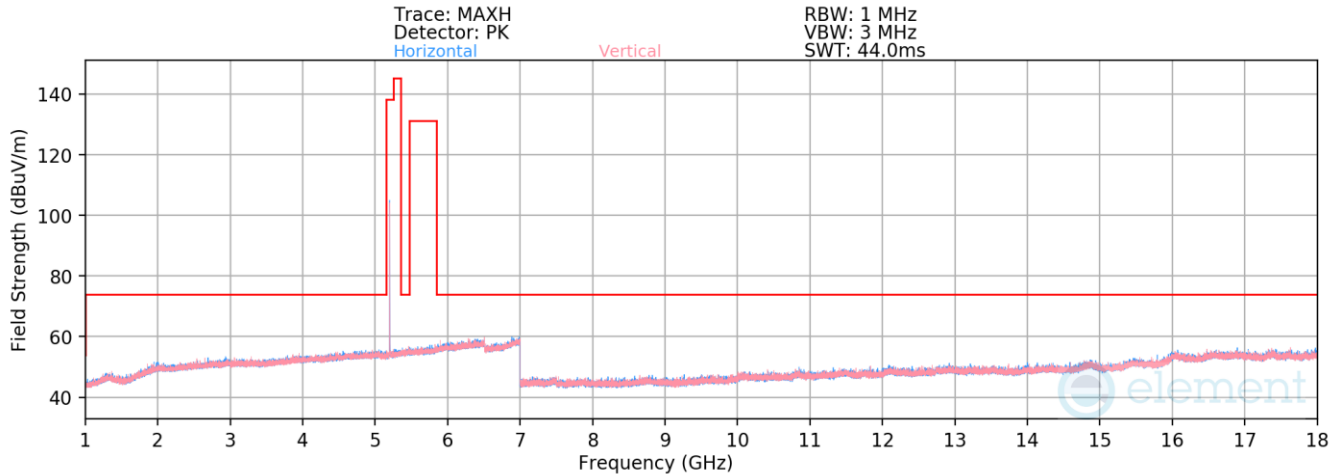
Plot 7-81. Radiated Spurious Emissions 1-18GHz (NB UNII HDR4 – 5157MHz)

Mode: HDR4
 Data Rate: 4Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5157MHz

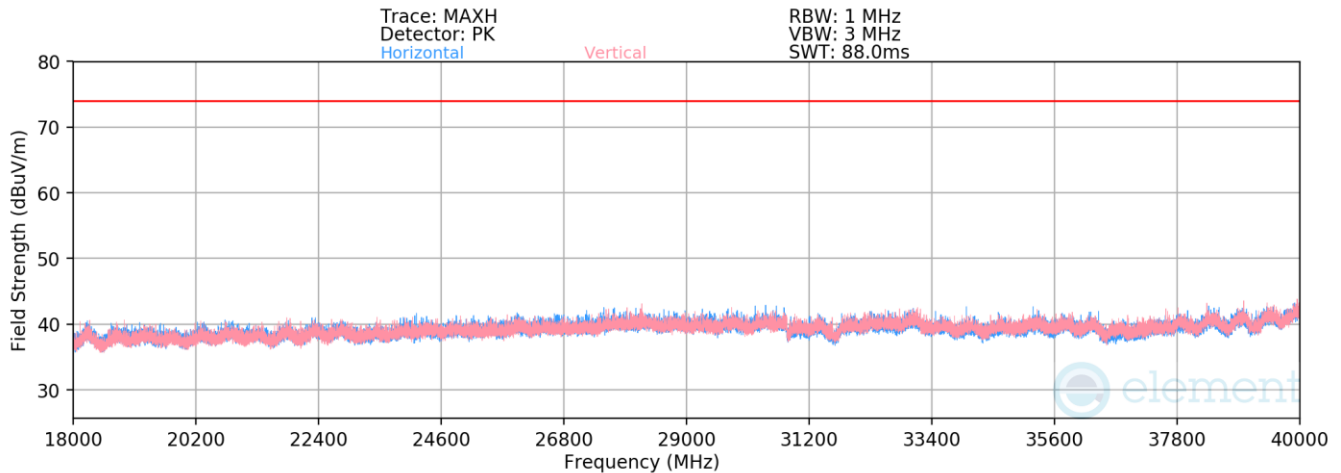
Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
10314.00	Peak	H	310	214	-65.98	8.10	49.12	73.98	-24.86
* 15471.00	Avg	H	-	-	-80.47	15.63	42.16	53.98	-11.82
* 15471.00	Peak	H	-	-	-68.90	15.60	53.70	73.98	-20.28

Table 7-14. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Plot 7-82. Radiated Spurious Emissions 1-18GHz (NB UNII HDR4 – 5201MHz)



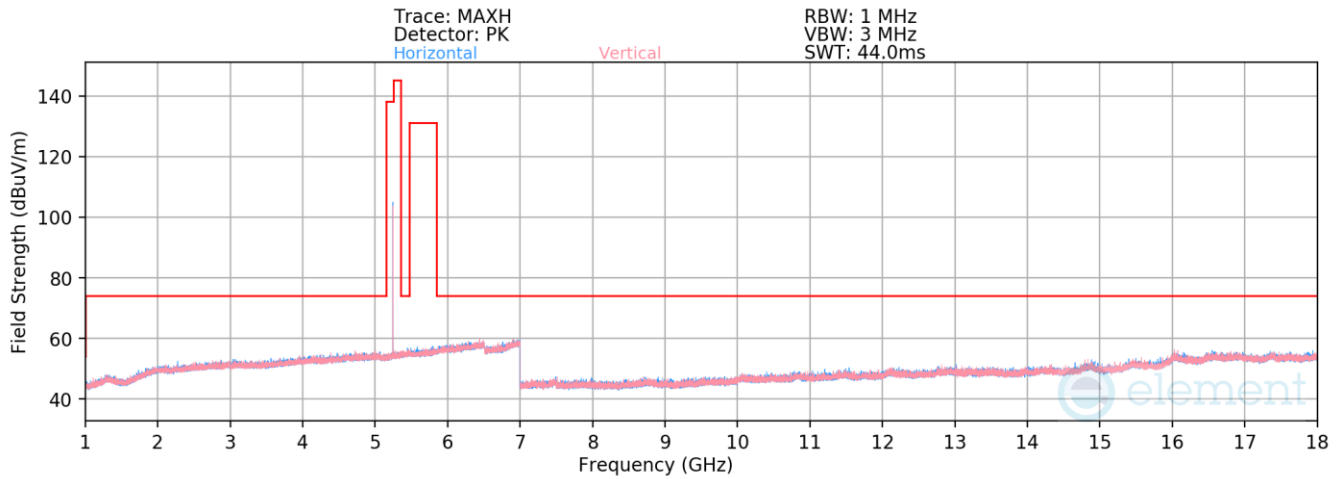
Plot 7-83. Radiated Spurious Emissions 18-40GHz (NB UNII HDR4 – 5201MHz)

Mode: HDR4
 Data Rate: 4Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5201MHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Duty Cycle Correction [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
10402.00	Peak	H	306	208	-66.14	7.76	0.00	48.62	68.23	-19.61
* 15603.00	Avg	H	-	-	-81.06	15.84	0.00	41.78	53.98	-12.20
* 15603.00	Peak	H	-	-	-70.46	15.84	0.00	52.38	73.98	-21.60
* 20804.00	Avg	H	242	330	-70.54	-6.81	1.09	30.74	53.98	-23.24
* 20804.00	Peak	H	242	330	-59.17	-6.81	0.00	41.02	73.98	-32.96
26005.00	Peak	H	-	-	-60.49	-4.47	0.00	42.04	68.23	-26.19
* 31206.00	Avg	V	333	47	-73.19	-2.49	1.09	32.41	53.98	-21.57
* 31206.00	Peak	V	333	47	-61.13	-2.49	0.00	43.38	73.98	-30.60
36407.00	Peak	V	11	187	-53.42	-6.38	0.00	47.20	68.23	-21.03

Table 7-15. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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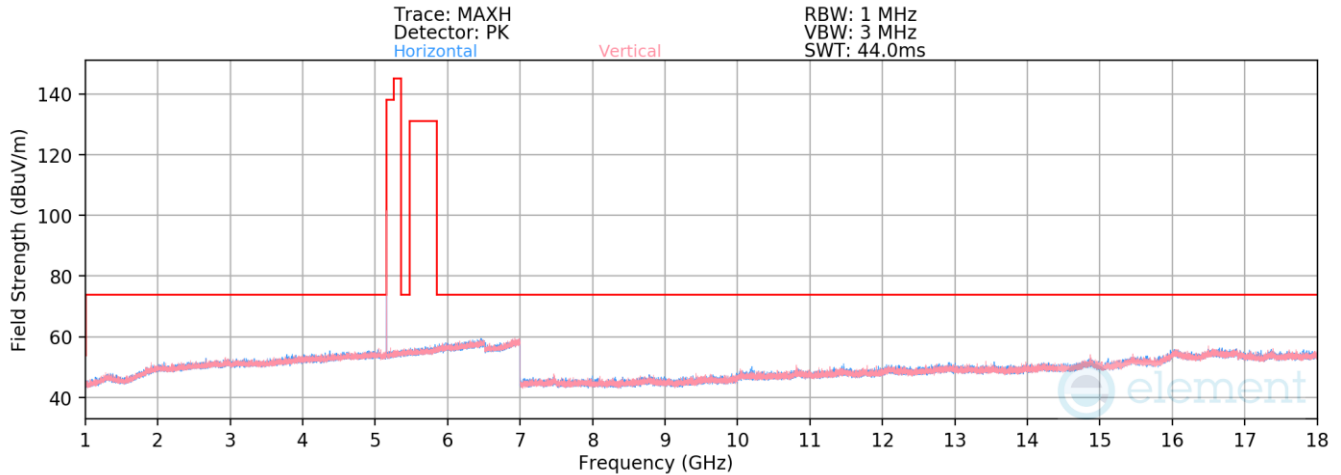
Plot 7-84. Radiated Spurious Emissions 1-18GHz (NB UNII HDR4 – 5245MHz)

Mode: HDR4
 Data Rate: 4Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5245MHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
10490.00	Peak	H	299	213	-65.53	7.99	49.46	68.23	-18.77
* 15735.00	Avg	H	-	-	-81.41	15.98	41.57	53.98	-12.41
* 15735.00	Peak	H	-	-	-70.69	15.98	52.29	73.98	-21.69

Table 7-16. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Plot 7-85. Radiated Spurious Emissions 1-18GHz (NB UNII HDRp4 – 5157MHz)

Mode: HDRp4
 Data Rate: 4Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 5157MHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
10314.00	Peak	H	104	265	-67.11	8.13	48.02	68.23	-20.21
* 15471.00	Avg	H	-	-	-80.78	15.62	41.84	53.98	-12.15
* 15471.00	Peak	H	-	-	-69.56	15.62	53.06	73.98	-20.92

Table 7-17. Radiated Spurious Emission Measurements

FCC ID: BCG-A3053		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
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