TEST REPORT

Product Name:	True Wireless Stereo Earbuds
Trade Mark:	EDIFIER、XEMAL、VOLONA
Model No. :	X3
HVIN:	EDF111
Report Number:	200728018RFC-1
Test Standards:	FCC 47 CFR Part 15 Subpart C RSS-247 Issue 2 RSS-Gen Issue 5
FCC ID:	Z9G-EDF111
IC:	10004A-EDF111
Test Result:	PASS
Date of Issue:	September 27, 2020

Prepared for:

Edifier International Limited
P.O. Box 6264 General Post Office Hong Kong.

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
16/F, Block A, Building 6, Baoneng Science and Technology Park,
Qingxiang Road No.1, Longhua New District, Shenzhen, China
TEL: +86-755-2823 0888
FAX: +86-755-2823 0886

Prepared by: Kieron Luo
Project Engineer

Reviewed by: Kevin Liang
Assistant Manager

Approved by: Billy Li
Technical Director

Date: September 27, 2020

Version

Version No.	Date	Description
V1.0	September 27, 2020	Original

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Edifier International Limited
Address of Applicant:	P.O. Box 6264 General Post Office Hong Kong.
Manufacturer:	Beijing Edifier Technology Co., Ltd
Address of Manufacturer:	8th floor,ZuoAn Building,NO.68 BeiSiHuanXiLu,Haidian District, Beijing 100080,CHINA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	True Wireless Stereo Earbuds	
Model No. :	X3	
HVIN:	EDF111	
Trade Mark:	EDIFIER、XEMAL、VOLONA	
DUT Stage:	Production Unit	
EUT Supports Function:	2.4 GHz ISM Band:	Bluetooth 5.0
Software Version:	V 1.0	
Hardware Version:	V 1.2	
Sample Received Date:	July 29, 2020	
Sample Tested Date:	August 14, 2020 to August 19, 2020	
Note: The model X3 /HVIN EDF111 are identical in circuitry design, PCB layout, electrical components used, internal wiring and functions, and only different in the product model.		

1.2.2 Description of Accessories

Battery(Charging box)-1	
Model No.:	AEC751437
Battery Type:	Lithium-ion Polymer Rechargeable Battery
Rated Voltage:	3.8 Vdc
Limited Charge Voltage:	4.35 Vdc
Rated Capacity:	350 mAh
Manufacturer:	Apower Electronics co.,Ltd.

Battery(Charging box)-2	
Model No.:	SP751437
Battery Type:	Lithium-ion Polymer Rechargeable Battery
Rated Voltage:	3.8 Vdc
Limited Charge Voltage:	4.35 Vdc
Rated Capacity:	350 mAh
Manufacturer:	HUIZHOU SUPER POLYPOWER BATTERY CO., LTD.

Battery(Earphones)-1	
Model No.:	SP601113C
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.8 Vdc
Limited Charge Voltage:	4.35 Vdc
Rated Capacity:	50 mAh
Manufacturer:	HUIZHOU SUPER POLYPOWER BATTERY CO., LTD.

Battery(Earphones)-2	
Model No.:	AEC601113
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.8 Vdc
Limited Charge Voltage:	4.35 Vdc
Rated Capacity:	50 mAh
Manufacturer:	Apower Electronics co.,Ltd.

Cable	
Description:	USB Type-C Plug Cable
Cable Type:	Unshielded without ferrite
Length:	0.5Meter, Unshielded without ferrite

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Band:	2400 MHz to 2483.5 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Bluetooth Version:	Bluetooth LE	
Type of Modulation:	GFSK	
Number of Channels:	40	
Channel Separation:	2 MHz	
Antenna Type:	FPC Antenna	
Antenna Gain:	Right Earbud	-0.83 dBi
	Left Earbud	0.24 dBi
Maximum Peak Power:	4.62 dBm	
Normal Test Voltage:	3.8 Vdc	

1.4 OTHER INFORMATION

Operation Frequency Each of Channel	
f = 2402 + 2k MHz, k = 0,…,39	
Note:	
f	is the operating frequency (MHz);
k	is the operating channel.

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	Lenovo	E450	SL10G10780	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.30 Meter	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.2 dB
2	Conducted emission 150KHz-30MHz	±2.7 dB
3	Radiated emission 9KHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.6 dB
5	Radiated emission 1GHz-18GHz	± 4.4 dB
6	Radiated emission 18GHz-26GHz	± 4.6 dB
7	Radiated emission 26GHz-40GHz	± 4.6 dB
8	Conducted spurious emissions	± 2.7 dB
9	RF Power, Conducted	± 0.9 dB
10	Occupied Bandwidth	± 1.86 %
11	Radio Frequency	2.4 GHz: ± 6.5 x 10^{-8}
12	Transmission Time	± 0.19 %

2. TEST SUMMARY

Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c) RSS-Gen Issue 5, Section 6.8	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2013 Clause 6.2	N/A NOTE 2
Conducted Peak Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 Issue 2, Section 5.4(d)	ANSI C63.10-2013 Clause 11.9.1.3	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 2, Section 5.2(a)	ANSI C63.10-2013 Clause 11.8.1	PASS
Occupied Bandwidth	RSS-Gen Issue 5, Section 6.7	RSS-Gen Issue 5, Section 6.7	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 2, Section 5.2(b)	ANSI C63.10-2013 Clause 11.10.2	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-Gen Issue 5, Section 6.13/8.9/8.10	ANSI C63.10-2013 Clause 11.11 & Clause 11.12	PASS
Band Edge Measurements (Radiated)	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.13	PASS

Note:

1) N/A: In this whole report not applicable.
2) Place earbud's into the charging case, they will turn off automatically, and the Bluetooth does not work.

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 03, 2018	Dec. 03, 2021
☒	Receiver	R&S	ESIB26	100114	Nov. 24, 2019	Nov. 23, 2020
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 16, 2019	Nov. 15, 2020
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 16, 2019	Nov. 15, 2020
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 16, 2019	Nov. 15, 2020
☒	Preamplifier	HP	8447F	2805A02960	Nov. 24, 2019	Nov. 23, 2020
☐	Broadband Antenna (Pre-amplifier)	ETS-LINDGREN	3142E-PA	00201891	Nov. 24, 2019	Nov. 23, 2020
☐	6dB Attenuator	Talent	RA6A5-N-18	18103002	Nov. 24, 2019	Nov. 23, 2020
☐	Horn Antenna	ETS-LINDGREN	3117	00164202	Nov. 16, 2019	Nov. 15, 2020
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	May 30, 2020	May 29, 2021
☐	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 16, 2019	Nov. 15, 2020
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☐	Highpass Filter (1.2GHz~18GHz)	Micro-Tronics	HPM50108	G552	Nov. 24, 2019	Nov. 23, 2020
☐	Highpass Filter (3GHz~18GHz)	Micro-Tronics	HPM50117	G005	Nov. 24, 2019	Nov. 23, 2020
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	EXG-B RF Analog Signal Generator	KEYSIGHT	N5171B	MY53051777	Nov. 24, 2019	Nov. 23, 2020
☒	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	Nov. 24, 2019	Nov. 23, 2020
☒	EXA Signal Analyzer	KEYSIGHT	N9010A	MY51440197	Nov. 24, 2019	Nov. 23, 2020
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Nov. 24, 2019	Nov. 23, 2020
☐	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	Nov. 24, 2019	Nov. 23, 2020
☐	4ch. Simultaneous Sampling 14 Bits 2MS/s	KEYSIGHT	U2531A	TW55193502	N/A	N/A
☒	Temp Humidity chamber	Votisch	VT4002	58566133290020	May. 11, 2020	May. 10, 2021
☐	Wideband Radio Communication Tester	R&S	CMW500	120932	Jul. 20, 2020	Jul. 19, 2021
☒	Shielding room	ETS-Lindgren	333	Euroshiedpn-TJ2343-S1608	Jun. 5, 2020	Jun. 4, 2021
☒	Temperature & Humidity Datalogger	CEM	DT-172	200408605	Jul. 24, 2020	Jul. 23, 2021
☒	Test Software	AutomationTestSystem	ECIT	Software Version: 1.0.7515.16529		

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NT/NV	+15 to +35	3.8	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Tested by
Conducted Peak Output Power	24.8	56.0	100.20	Swift Liu
6dB Bandwidth & Occupied Bandwidth	25.8	53.0	100.26	Asia Yan
Power Spectral Density	25.8	53.0	100.26	Asia Yan
Conducted Out of Band Emission	25.8	53.0	100.26	Asia Yan
Radiated Spurious Emissions	25.8	53.0	100.26	Asia Yan
Band Edge Measurements (Radiated)	25.6	53.0	100.26	Asia Yan

4.2 TEST CHANNELS

Type of Modulation	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
GFSK	2402 MHz to 2480 MHz	Channel 0	Channel 19	Channel 39
		2402 MHz	2440 MHz	2480 MHz

4.3 EUT TEST STATUS

Type of Modulation	Tx Function	Description
GFSK	1Tx	1. Keep the EUT in continuously transmitting with modulation test single.

Power Setting
Power Setting: not applicable, test used software default power level.

Test Software
Test software name: InstallBlueSuiteCda (BlueTest 3), 3_1_2_613

4.4 TEST SETUP

4.4.1 For Radiated Emissions test setup

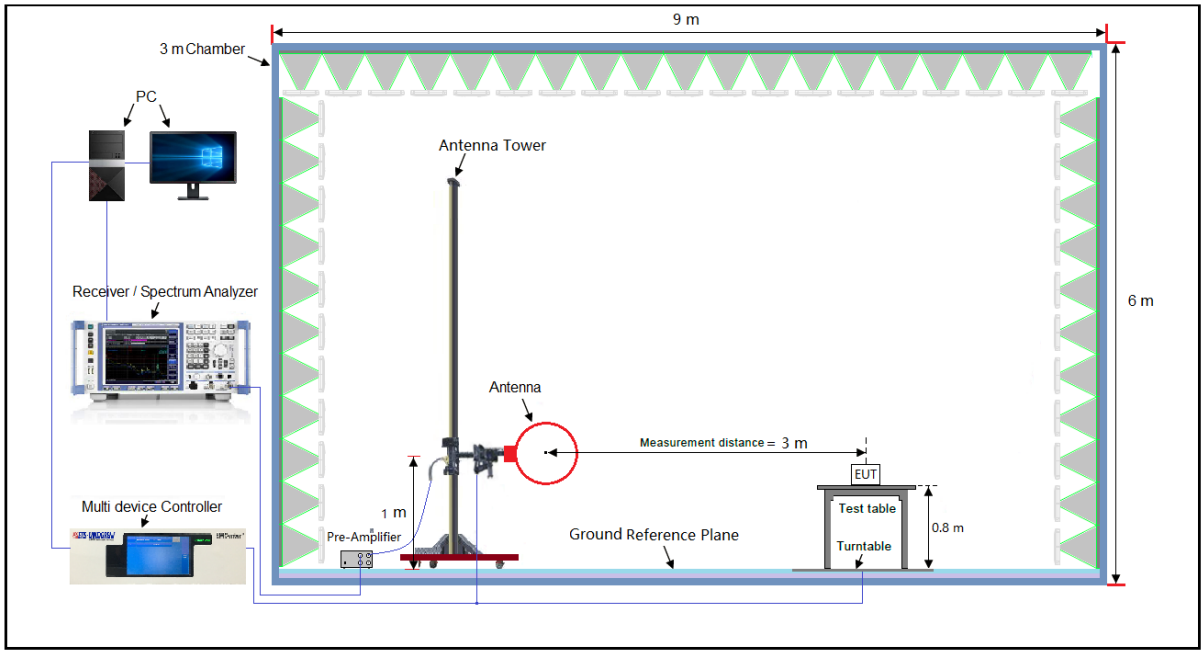


Figure 1. Below 30MHz

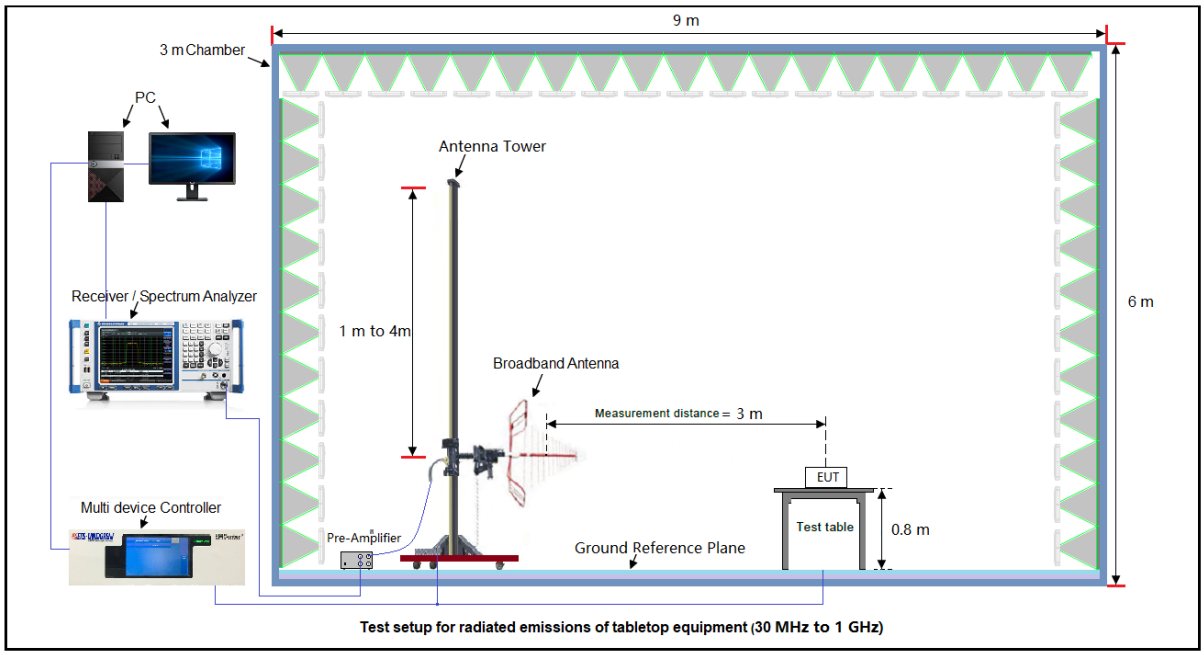


Figure 2. 30MHz to 1GHz

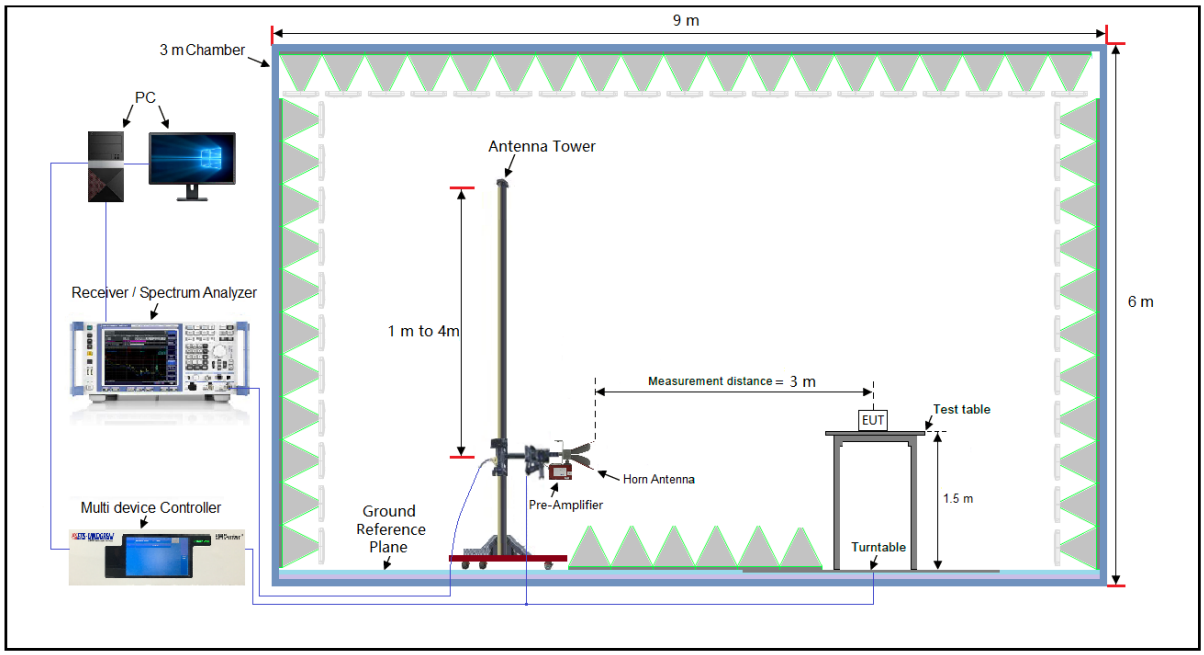
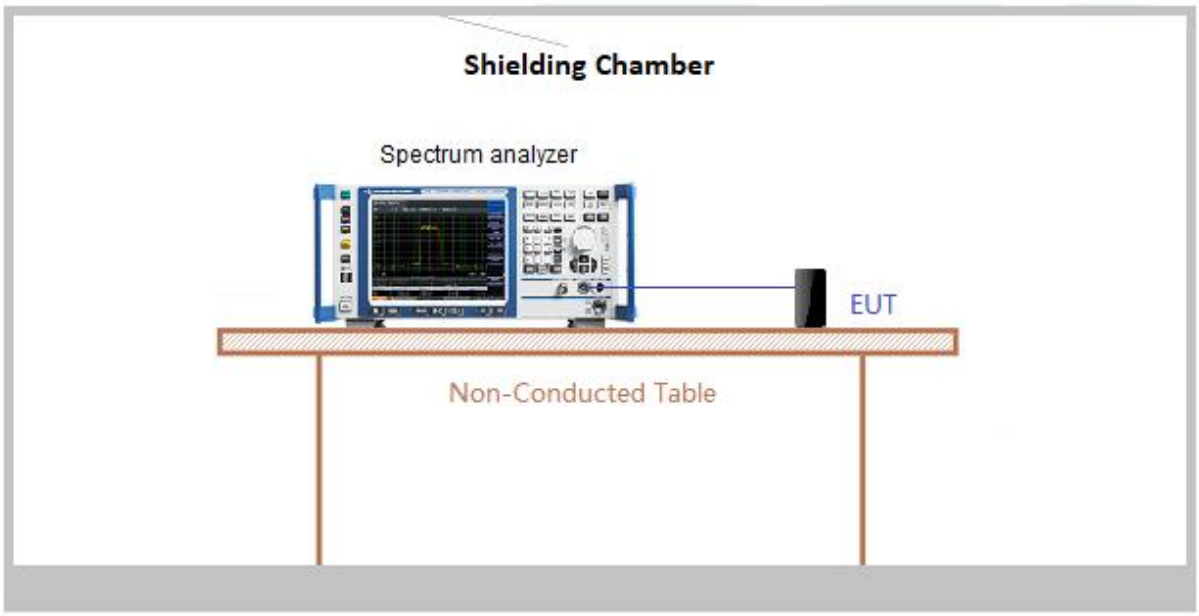


Figure 3. Above 1GHz

4.4.2 For Conducted RF test setup



4.5 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.8V battery. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

Frequency	Mode	Antenna Port	Worst-case axis positioning
Above 1GHz	1TX	Chain 0	Y axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.6 DUTY CYCLE

Test Procedure: ANSI C63.10-2013 Clause 11.6.

Test Results

Left Earbud

Type of Modulation	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)	Average Factor (dB)
GFSK	2.1200	2.5000	0.85	84.80	0.72	0.47	-1.43

Right Earbud

Type of Modulation	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)	Average Factor (dB)
GFSK	2.1300	2.5000	0.85	85.20	0.70	0.47	-1.39

Remark:

1) Duty cycle= On Time/ Period;

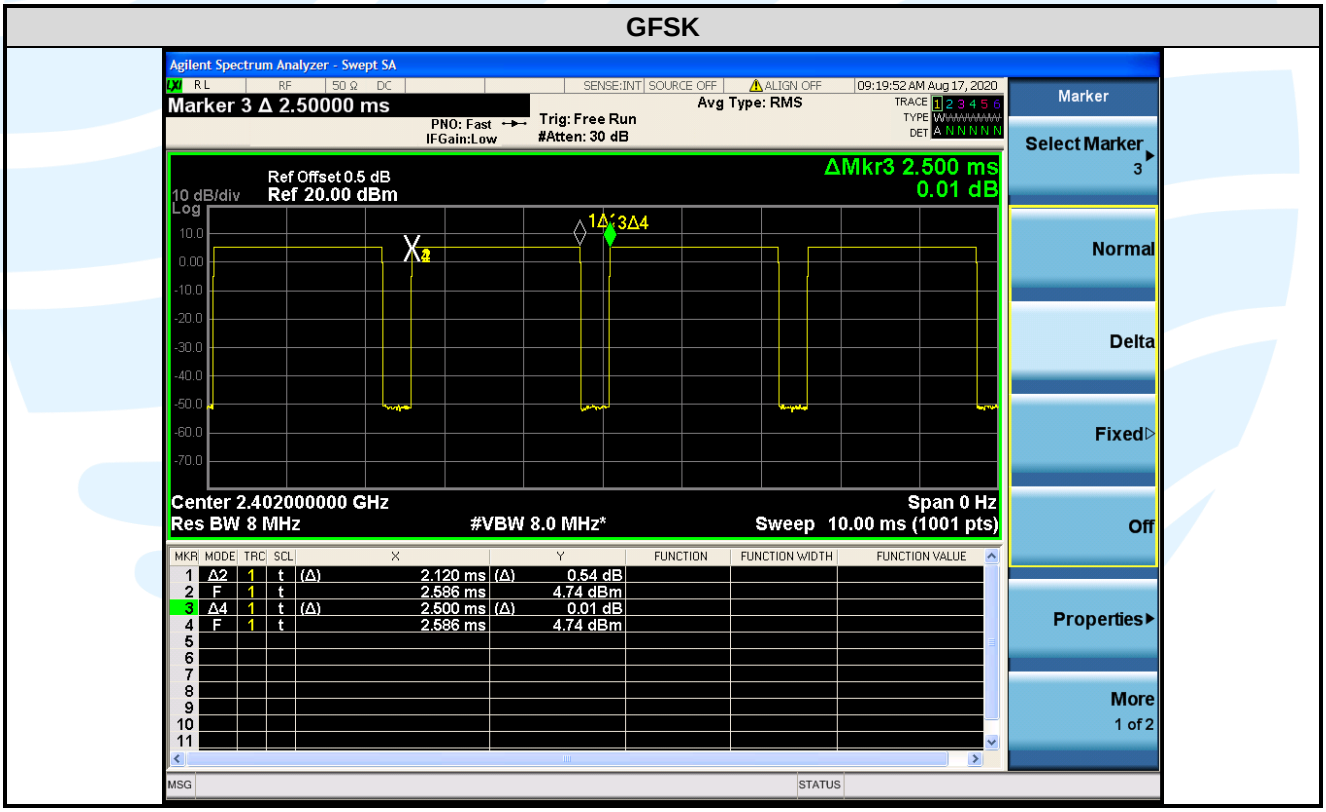
2) Duty Cycle factor = 10 * log(1/ Duty cycle);

3) Average factor = 20 $\log_{10}$ Duty Cycle.

The test plot as follows

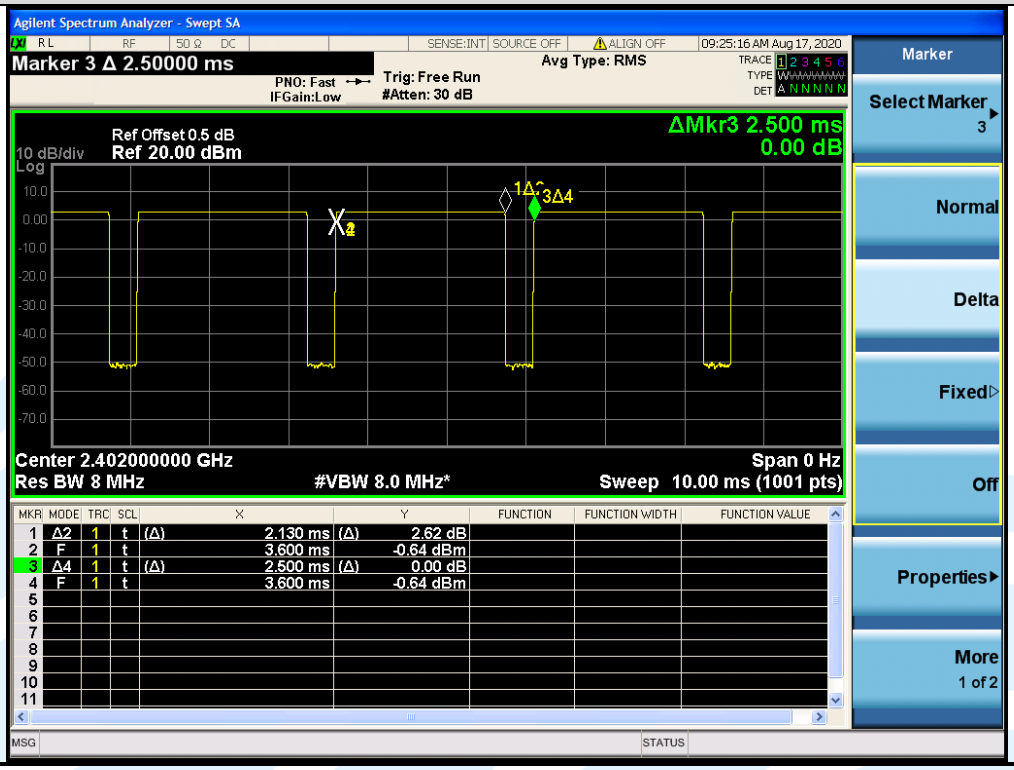
Left Earbud

GFSK



Right Earbud

GFSK



5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	RSS-247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
4	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
5	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices
6	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum system, and Hybrid system devices operating under Section 15.247 of the FCC rules

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **15.247(b) (4) requirement:** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. **RSS-Gen Issue 5, Section 6.8 requirement:** According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
EUT Antenna:
Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is Left Earbud 0.24 dBi and Right Earbud -0.83dBi.

5.3 CONDUCTED PEAK OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart C Section15.247 (b)(3)
RSS-247 Issue 2, Section 5.4(d)

Test Method: ANSI C63.10-2013 Clause 11.9.1.3

Limit: For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W.

Test Procedure:
1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
2. Measure out each test modes' peak or average output power, record the power level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.4.2 for details.

Instruments Used: Refer to section 3 for details

Test Results: Pass

Left Earbud

Type of Modulation	Channel	Frequency (MHz)	Maximum Conducted Peak Power (dBm)	Maximum Conducted Peak Power (mW)
GFSK	0	2402	**4.59**	**2.88**
	19	2440	4.51	2.82
	39	2480	4.30	2.69

Right Earbud

Type of Modulation	Channel	Frequency (MHz)	Maximum Conducted Peak Power (dBm)	Maximum Conducted Peak Power (mW)
GFSK	0	2402	2.03	1.60
	19	2440	3.48	2.23
	39	2480	**4.62**	**2.90**

Note: The max antenna gain of 0.24 dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.

5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 2, Section 5.2(a) RSS-Gen Issue 5, Section 6.7
Test Method:	ANSI C63.10-2013 Clause 11.8.1 RSS-Gen Issue 5, Section 6.7
Limit:	For digital transmission systems, the minimum 6 dB bandwidth shall be 500 kHz.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: **6dB Bandwidth** a) Set RBW = 100 kHz. b) Set the video bandwidth (VBW) ≥ 3 x RBW. c) Detector = Peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. **Occupied Bandwidth** a) Set RBW = 1% to 5% of the occupied bandwidth b) Set the video bandwidth (VBW) ≥ 3 x RBW. c) Detector = Peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.2 for details.
Instruments Used:	Refer to section 3 for details
Test Results:	

Left Earbud

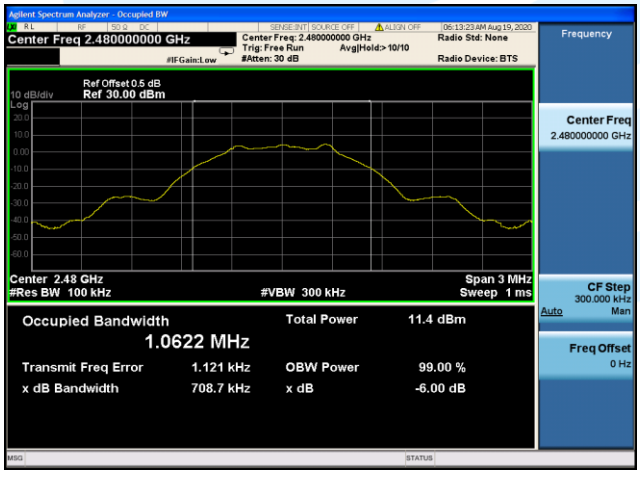
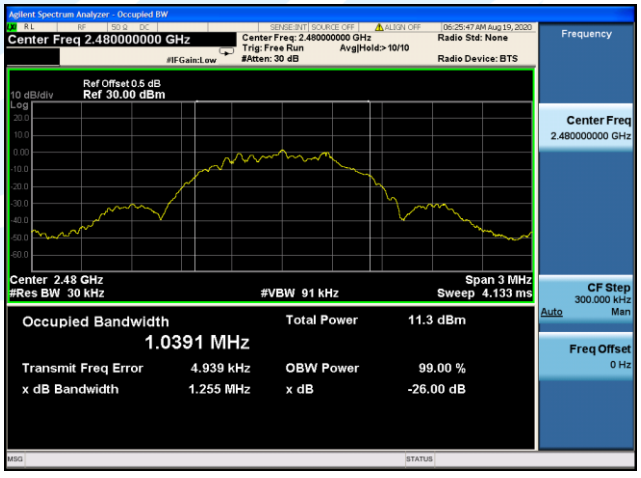
Type of Modulation	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limit	Pass / Fail
GFSK	0	2402	0.7182	1.0391	> 500 kHz	Pass
	19	2440	0.7094	1.0373	> 500 kHz	Pass
	39	2480	0.7087	1.0391	> 500 kHz	Pass

Right Earbud

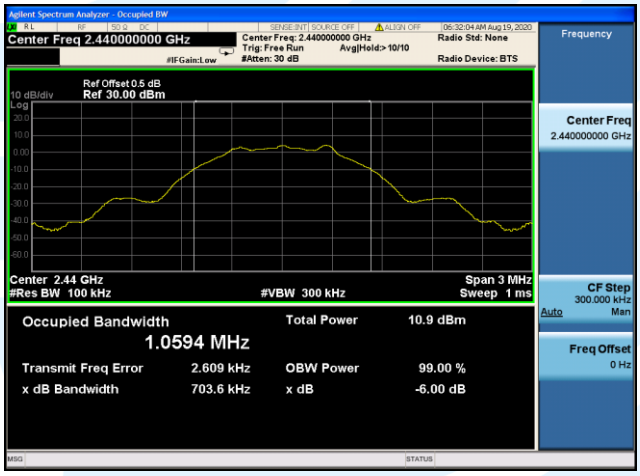
Type of Modulation	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limit	Pass / Fail
GFSK	0	2402	0.7082	1.0383	> 500 kHz	Pass
	19	2440	0.7036	1.0378	> 500 kHz	Pass
	39	2480	0.6981	1.0371	> 500 kHz	Pass

The test plots as follows:

Left Earbud

6 dB Bandwidth	Occupied Bandwidth
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

Right Earbud

6 dB Bandwidth	Occupied Bandwidth
Lowest Channel	
	
Middle Channel	
	
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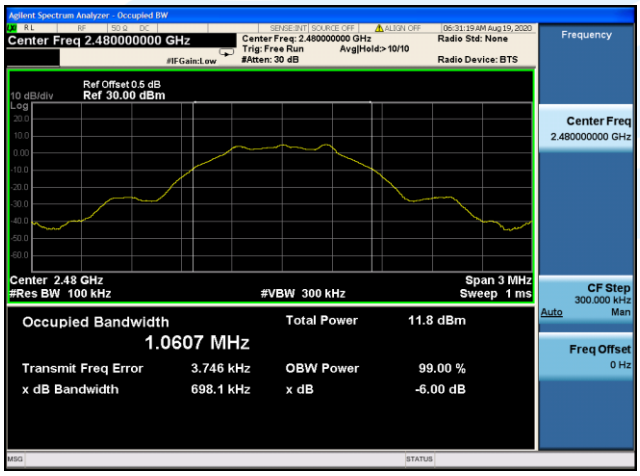
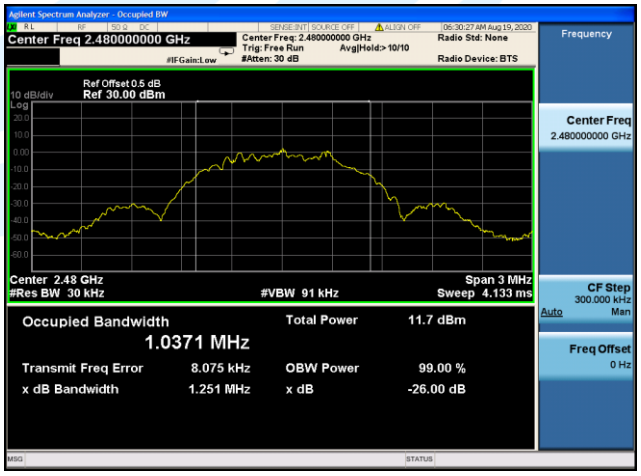
	

5.5 POWER SPECTRAL DENSITY

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (e)
RSS-247 Issue 2, Section 5.2(b)

Test Method: ANSI C63.10-2013 Clause 11.10.2

Limit: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ⩾ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.4.2 for details.

Instruments Used: Refer to section 3 for details

Test Results:

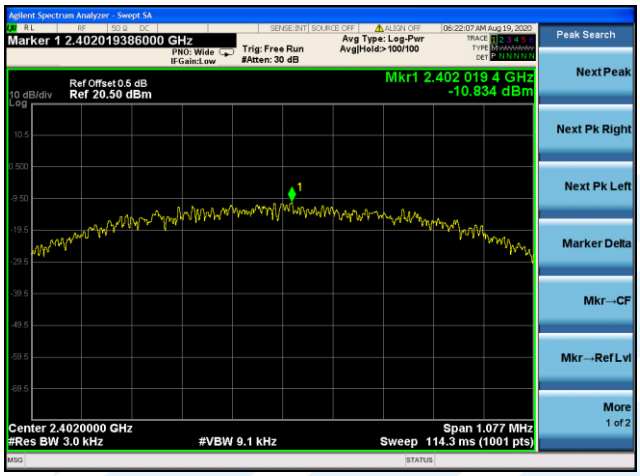
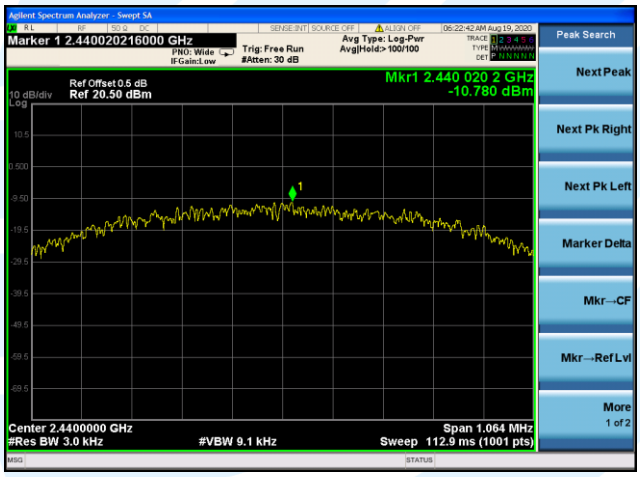
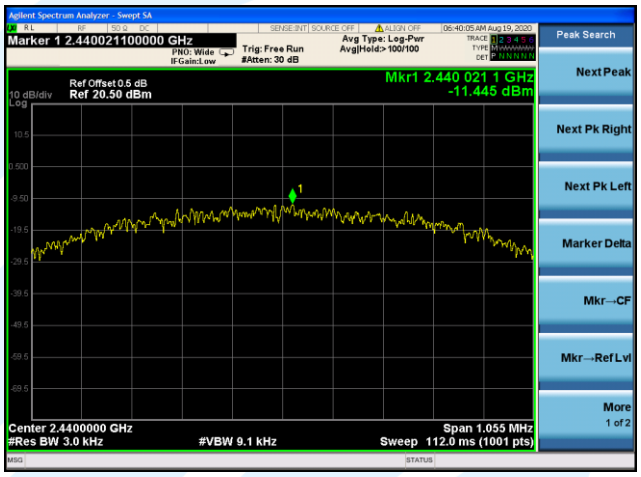
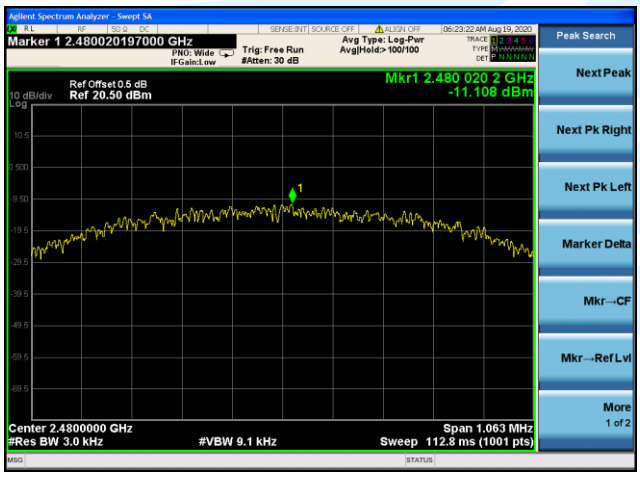
Left Earbud

Type of Modulation	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result (Pass / Fail)
GFSK	0	2402	-10.834	8	Pass
	19	2440	-10.780	8	Pass
	39	2480	-11.108	8	Pass

Right Earbud

Type of Modulation	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result (Pass / Fail)
GFSK	0	2402	-12.974	8	Pass
	19	2440	-11.445	8	Pass
	39	2480	-10.560	8	Pass

The test plots as follows:

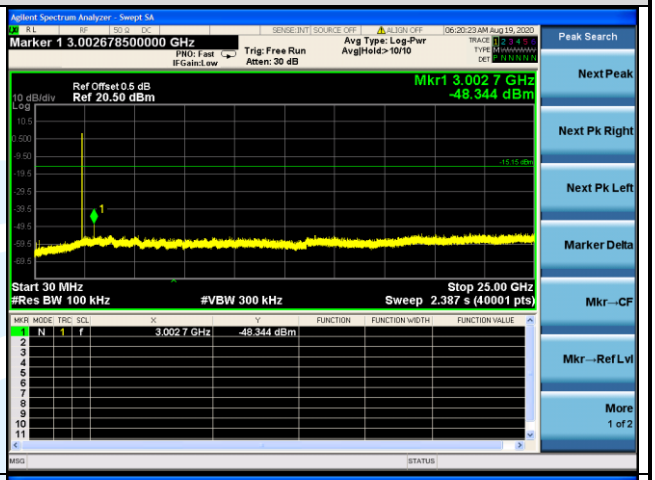
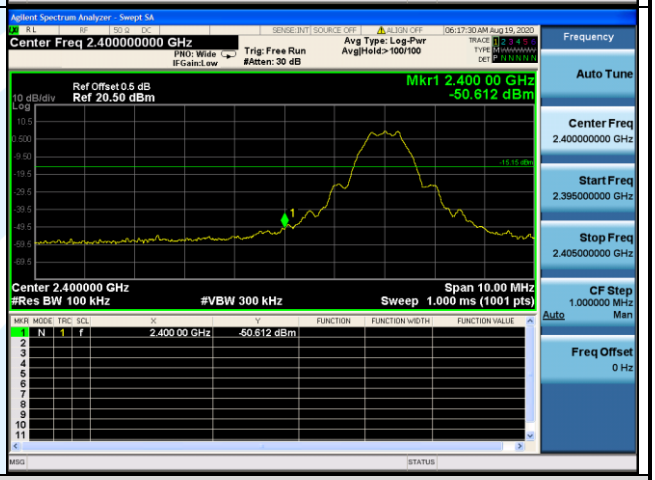
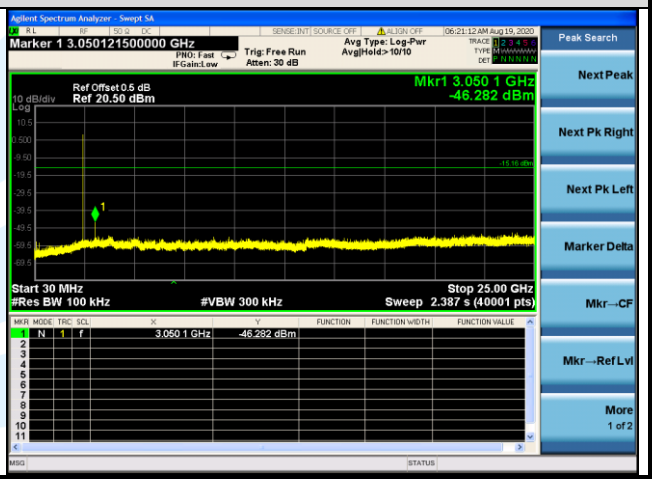
Left Earbud	Right Earbud
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

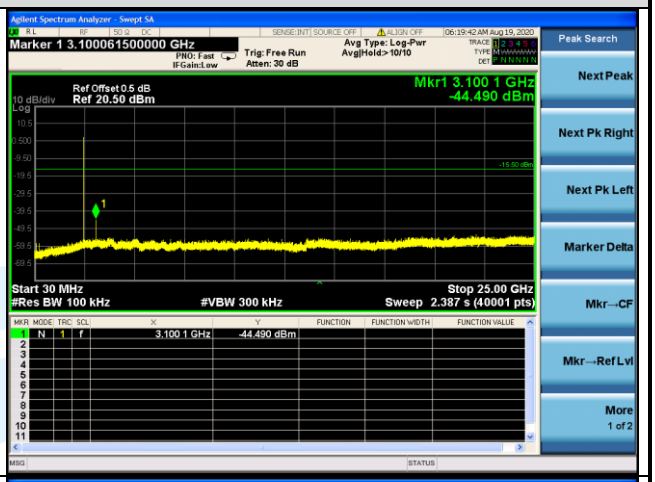
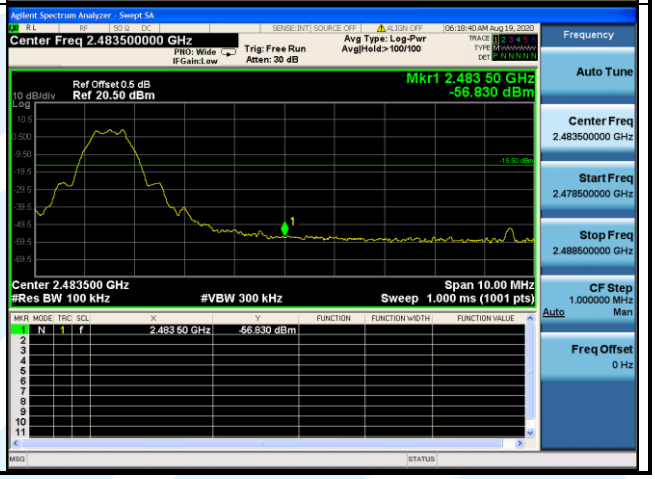
5.6 CONDUCTED OUT OF BAND EMISSION

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5
Test Method:	ANSI C63.10-2013 Clause 11.11
Limit:	In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: **Step 1: Reference level measurement** a) Set instrument center frequency to DTS channel center frequency. b) Set the span to ≥ 1.5 times the DTS bandwidth. c) Set the RBW = 100 kHz. d) Set the VBW ≥ 3 x RBW. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum PSD level. Note that the channel found to contain the maximum PSD level can be used to establish the reference level. **Step 2: Emission level measurement** a) Set RBW = 100 kHz. b) Set VBW ≥ 300 kHz. c) Detector = peak. d) Sweep = auto couple. e) Trace Mode = max hold. f) Allow trace to fully stabilize. g) Use the peak marker function to determine the maximum amplitude level. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.2 for details.
Instruments Used:	Refer to section 3 for details
Test Results:	Pass

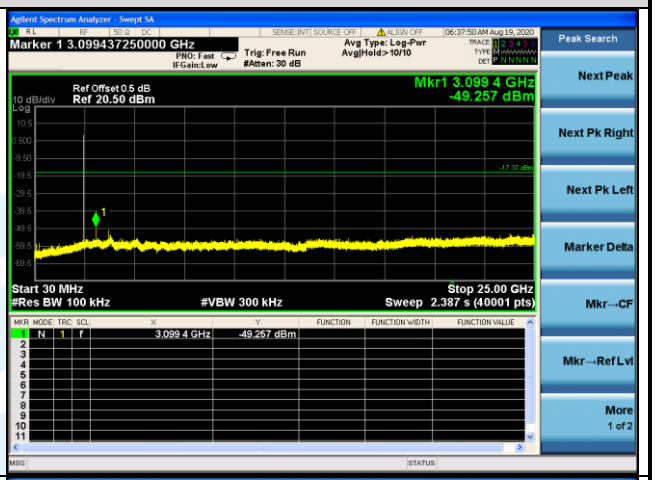
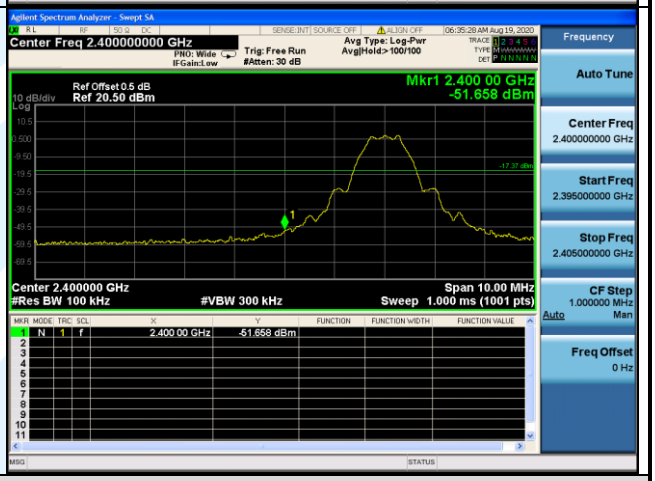
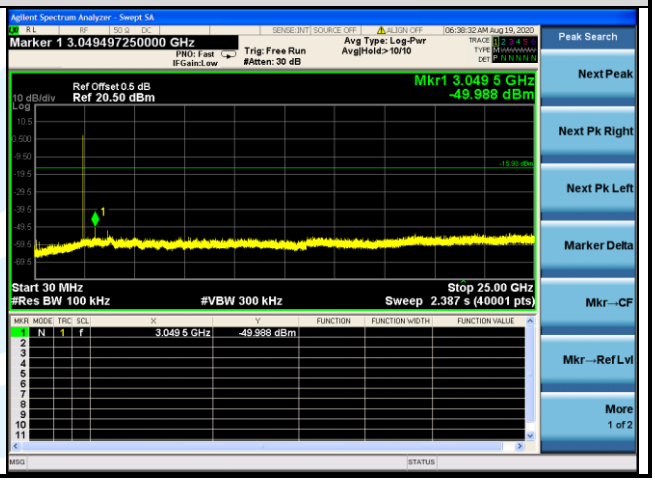
The test plot as follows:

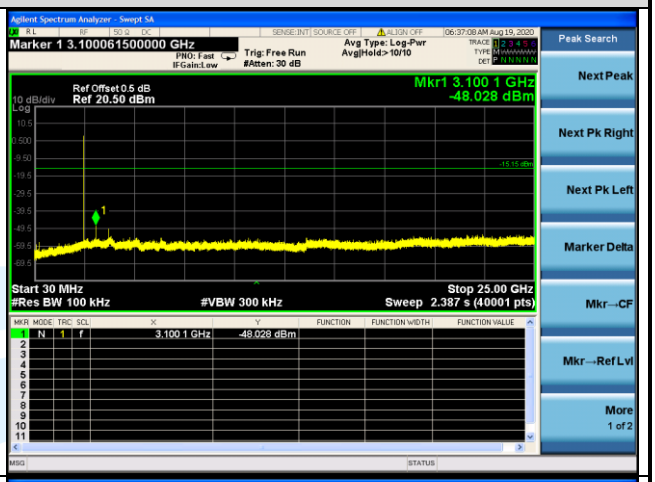
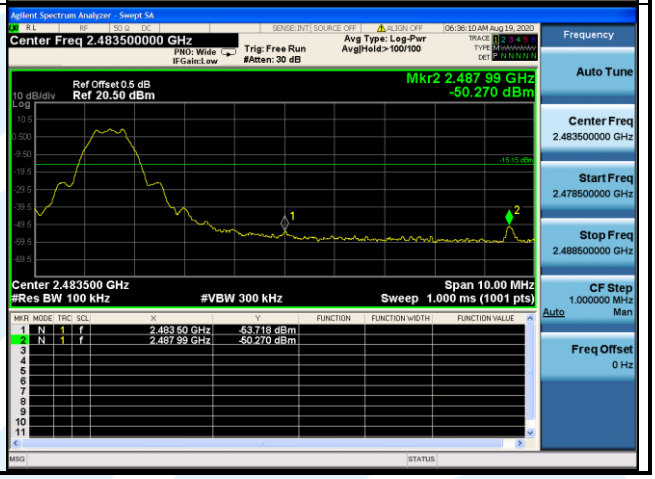
Left Earbud

In-Band Reference Level	Out of Band Emission
Lowest Channel	
	
	
Middle Channel	
	

Highest Channel	
	
	

Right Earbud

In-Band Reference Level	Out of Band Emission
Lowest Channel	
	
	
Middle Channel	
	

Highest Channel	
	
	

5.7 RADIATED SPURIOUS EMISSIONS

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209
RSS-Gen Issue 5, Section 6.13/8.9/8.10

Test Method: ANSI C63.10-2013 Clause 11.11 & Clause 11.12

Receiver Setup:

Frequency	RBW
0.009 MHz-0.150 MHz	200/300 kHz
0.150 MHz -30 MHz	9/10 kHz
30 MHz-1 GHz	100/120 kHz
Above 1 GHz	1 MHz

Limits:

Spurious Emissions

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009 MHz-0.490 MHz	2400/F(kHz)	--	--	300
0.490 MHz-1.705 MHz	24000/F(kHz)	--	--	30
1.705 MHz-30 MHz	30	--	--	30
30 MHz-88 MHz	100	40.0	Quasi-peak	3
88 MHz-216 MHz	150	43.5	Quasi-peak	3
216 MHz-960 MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1 GHz	500	54.0	Average	3

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

1. From 30 MHz to 1GHz test procedure as below:

1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

2. Above 1GHz test procedure as below:

1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).

2) Test the EUT in the lowest channel ,middle channel, the Highest channel
3) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the Y axis positioning which it is worse case.
4) Repeat above procedures until all frequencies measured was complete.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

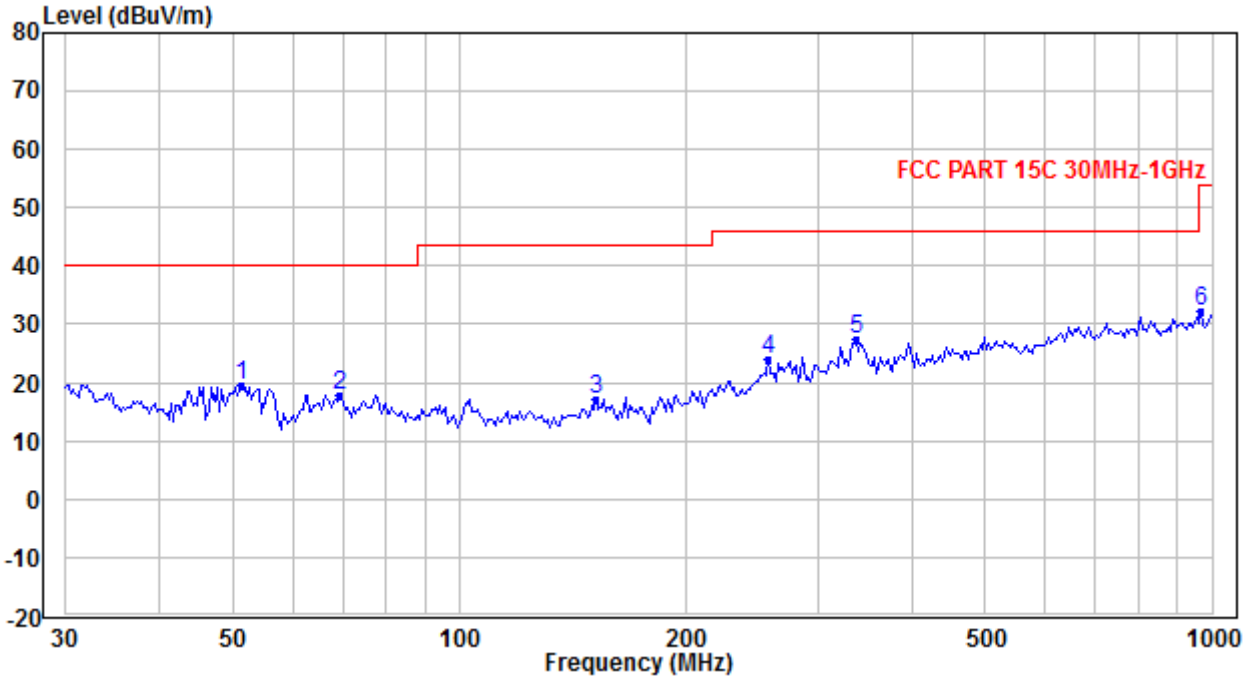
The measurement data as follows:

Radiated Emission Test Data (9 KHz ~ 30 MHz):
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

Radiated Emission Test Data (30 MHz ~ 1 GHz):

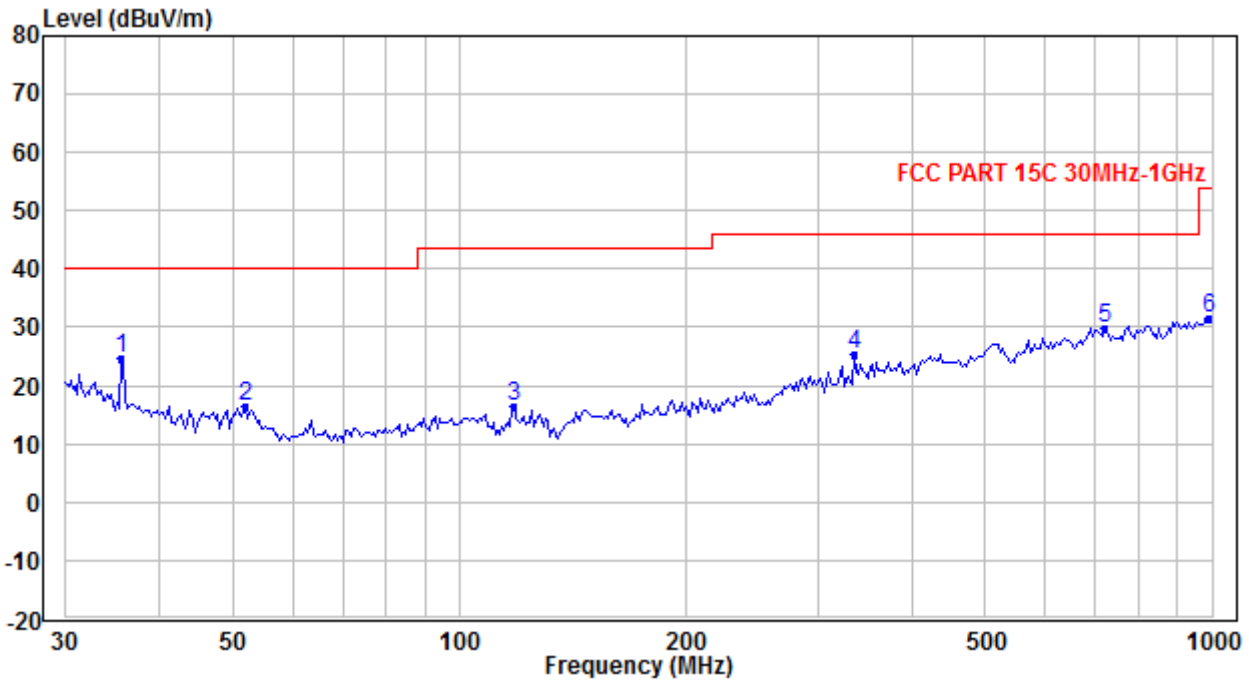
Left Earbud Worst-Case Configuration

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	51.176	34.92	-15.29	19.63	40.00	-20.37	QP
2	69.230	33.38	-15.51	17.87	40.00	-22.13	QP
3	152.090	28.46	-11.36	17.10	43.50	-26.40	QP
4	257.627	30.69	-6.54	24.15	46.00	-21.85	QP
5	336.482	32.16	-4.71	27.45	46.00	-18.55	QP
6	965.474	25.94	6.29	32.23	54.00	-21.77	QP

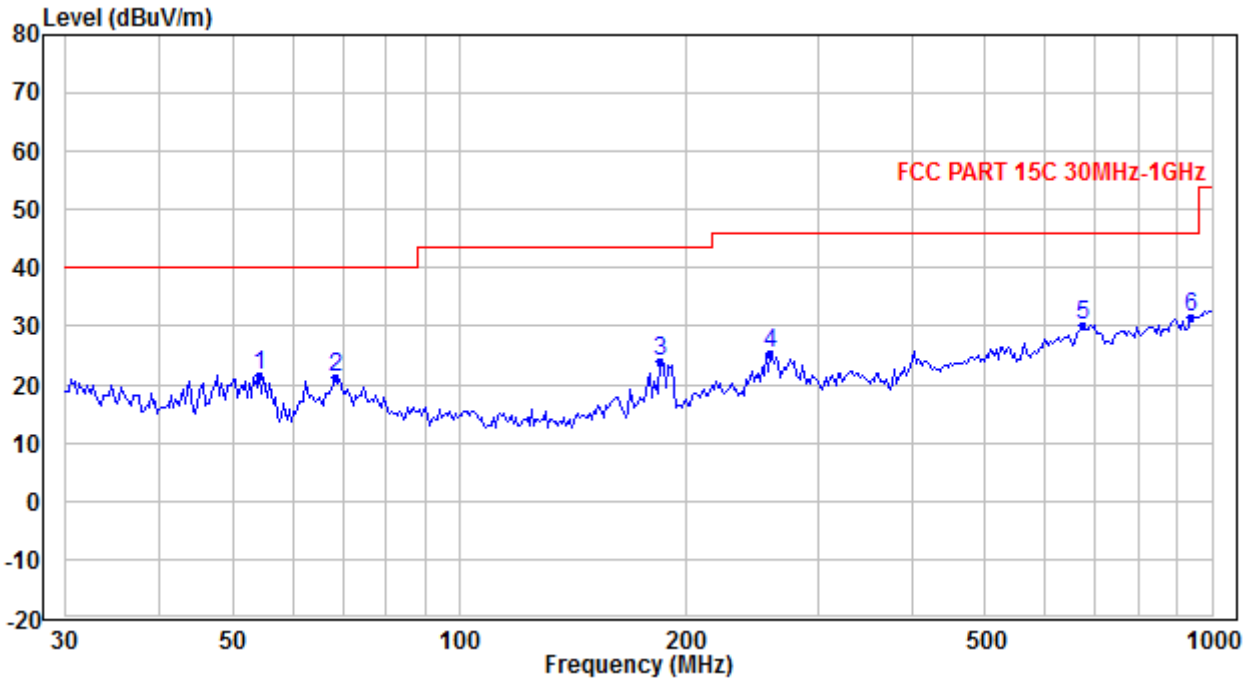
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	35.511	33.39	-8.85	24.54	40.00	-15.46	QP
2	51.900	31.09	-14.53	16.56	40.00	-23.44	QP
3	118.096	28.18	-11.68	16.50	43.50	-27.00	QP
4	334.126	30.08	-4.79	25.29	46.00	-20.71	QP
5	718.725	26.39	3.41	29.80	46.00	-16.20	QP
6	992.997	24.99	6.64	31.63	54.00	-22.37	QP

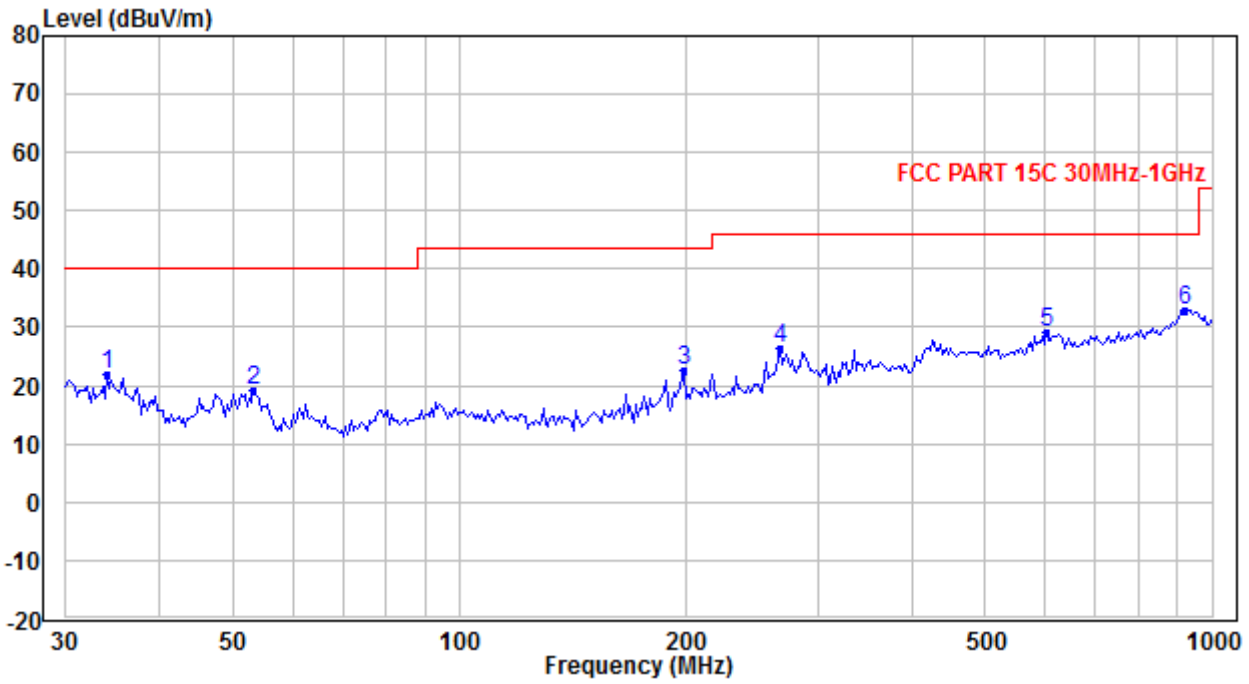
Radiated Emission Test Data (30 MHz ~ 1 GHz):
Right Earbud Worst-Case Configuration

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	54.135	36.44	-14.69	21.75	40.00	-18.25	QP
2	68.264	35.68	-14.40	21.28	40.00	-18.72	QP
3	185.163	34.36	-10.30	24.06	43.50	-19.44	QP
4	259.443	32.57	-7.14	25.43	46.00	-20.57	QP
5	674.677	27.74	2.32	30.06	46.00	-15.94	QP
6	938.714	25.66	5.93	31.59	46.00	-14.41	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	34.045	29.67	-7.79	21.88	40.00	-18.12	QP
2	53.379	33.82	-14.74	19.08	40.00	-20.92	QP
3	198.642	32.64	-9.99	22.65	43.50	-20.85	QP
4	266.839	33.49	-6.96	26.53	46.00	-19.47	QP
5	602.929	29.62	-0.35	29.27	46.00	-16.73	QP
6	919.132	28.22	4.69	32.91	46.00	-13.09	QP

Radiated Emission Test Data (Above 1GHz):

Left Earbud _Lowest Channel:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4804.00	50.27	-3.32	46.95	74.00	-27.05	Peak	Horizontal
2	4804.00	32.67	-3.32	29.35	54.00	-24.65	Average	Horizontal
3	7206.00	45.53	0.84	46.37	74.00	-27.63	Peak	Horizontal
4	7206.00	31.86	0.84	32.70	54.00	-21.30	Average	Horizontal
5	4804.00	44.90	-3.22	41.68	74.00	-32.32	Peak	Vertical
6	4804.00	33.57	-3.22	30.35	54.00	-23.65	Average	Vertical
7	7206.00	47.51	0.94	48.45	74.00	-25.55	Peak	Vertical
8	7206.00	32.77	0.94	33.71	54.00	-20.29	Average	Vertical

Left Earbud _Middle Channel:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4880.00	47.84	-3.24	44.60	74.00	-29.40	Peak	Horizontal
2	4880.00	33.10	-3.24	29.86	54.00	-24.14	Average	Horizontal
3	7320.00	42.08	0.98	43.06	74.00	-30.94	Peak	Horizontal
4	7320.00	31.57	0.98	32.55	54.00	-21.45	Average	Horizontal
5	4880.00	45.23	-3.06	42.17	74.00	-31.83	Peak	Vertical
6	4880.00	33.02	-3.06	29.96	54.00	-24.04	Average	Vertical
7	7320.00	48.01	1.08	49.09	74.00	-24.91	Peak	Vertical
8	7320.00	31.65	1.08	32.73	54.00	-21.27	Average	Vertical

Left Earbud _Highest Channel:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4960.00	42.99	-3.17	39.82	74.00	-34.18	Peak	Horizontal
2	4960.00	32.32	-3.17	29.15	54.00	-24.85	Average	Horizontal
3	7440.00	45.45	1.13	46.58	74.00	-27.42	Peak	Horizontal
4	7440.00	32.15	1.13	33.28	54.00	-20.72	Average	Horizontal
5	4960.00	44.33	-2.91	41.42	74.00	-32.58	Peak	Vertical
6	4960.00	32.68	-2.91	29.77	54.00	-24.23	Average	Vertical
7	7440.00	47.11	1.23	48.34	74.00	-25.66	Peak	Vertical
8	7440.00	31.60	1.23	32.83	54.00	-21.17	Average	Vertical

Radiated Emission Test Data (Above 1GHz):

Right Earbud _Lowest Channel:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4804.00	45.14	-3.32	41.82	74.00	-32.18	Peak	Horizontal
2	4804.00	33.71	-3.32	30.39	54.00	-23.61	Average	Horizontal
3	7206.00	43.40	0.84	44.24	74.00	-29.76	Peak	Horizontal
4	7206.00	32.22	0.84	33.06	54.00	-20.94	Average	Horizontal
5	4804.00	48.46	-3.22	45.24	74.00	-28.76	Peak	Vertical
6	4804.00	33.92	-3.22	30.70	54.00	-23.30	Average	Vertical
7	7206.00	44.48	0.94	45.42	74.00	-28.58	Peak	Vertical
8	7206.00	32.36	0.94	33.30	54.00	-20.70	Average	Vertical

Right Earbud _Middle Channel:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4880.00	45.86	-3.24	42.62	74.00	-31.38	Peak	Horizontal
2	4880.00	33.93	-3.24	30.69	54.00	-23.31	Average	Horizontal
3	7320.00	50.12	0.98	51.10	74.00	-22.90	Peak	Horizontal
4	7320.00	32.95	0.98	33.93	54.00	-20.07	Average	Horizontal
5	4880.00	49.30	-3.06	46.24	74.00	-27.76	Peak	Vertical
6	4880.00	34.28	-3.06	31.22	54.00	-22.78	Average	Vertical
7	7320.00	51.85	1.08	52.93	74.00	-21.07	Peak	Vertical
8	7320.00	33.02	1.08	34.10	54.00	-19.90	Average	Vertical

Right Earbud _Highest Channel:

No.	Frequency (MHz)	Reading (dBuV/m)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4960.00	48.27	-3.17	45.10	74.00	-28.90	Peak	Horizontal
2	4960.00	34.45	-3.17	31.28	54.00	-22.72	Average	Horizontal
3	7440.00	51.19	1.13	52.32	74.00	-21.68	Peak	Horizontal
4	7440.00	33.68	1.13	34.81	54.00	-19.19	Average	Horizontal
5	4960.00	47.10	-2.91	44.19	74.00	-29.81	Peak	Vertical
6	4960.00	34.21	-2.91	31.30	54.00	-22.70	Average	Vertical
7	7440.00	49.27	1.23	50.50	74.00	-23.50	Peak	Vertical
8	7440.00	33.16	1.23	34.39	54.00	-19.61	Average	Vertical

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit

5.8 BAND EDGE MEASUREMENTS (RADIATED)

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209
RSS-247 Issue 2, Section 5.5

Test Method: ANSI C63.10-2013 Clause 11.13

Limits:

Radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).

Frequency	Limit (dBμV/m @3m)	Remark
30 MHz-88 MHz	40.0	Quasi-peak Value
88 MHz-216 MHz	43.5	Quasi-peak Value
216 MHz-960 MHz	46.0	Quasi-peak Value
960 MHz-1 GHz	54.0	Quasi-peak Value
Above 1 GHz	54.0	Average Value
	74.0	Peak Value

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

Radiated band edge measurements at 2390 MHz and 2483.5 MHz were made with the unit transmitting in the low end of the channel range and the high end closest to the restricted bands respectively. The emissions were made on the 966 Semi-Chamber. Use (resolution bandwidth (RBW) = 1 MHz, video bandwidth (VBW) = 3 MHz for peak levels and RBW = 1 MHz and VBW = 10 Hz or 1/T for average levels).

1. Use radiated spurious emission test procedure described in clause 5.10. The transmitter output (antenna port) was connected to the test receiver.
2. Set the PK and AV limit line.
3. Record the fundamental emission and emissions out of the band-edge.
4. Determine band-edge compliance as required.

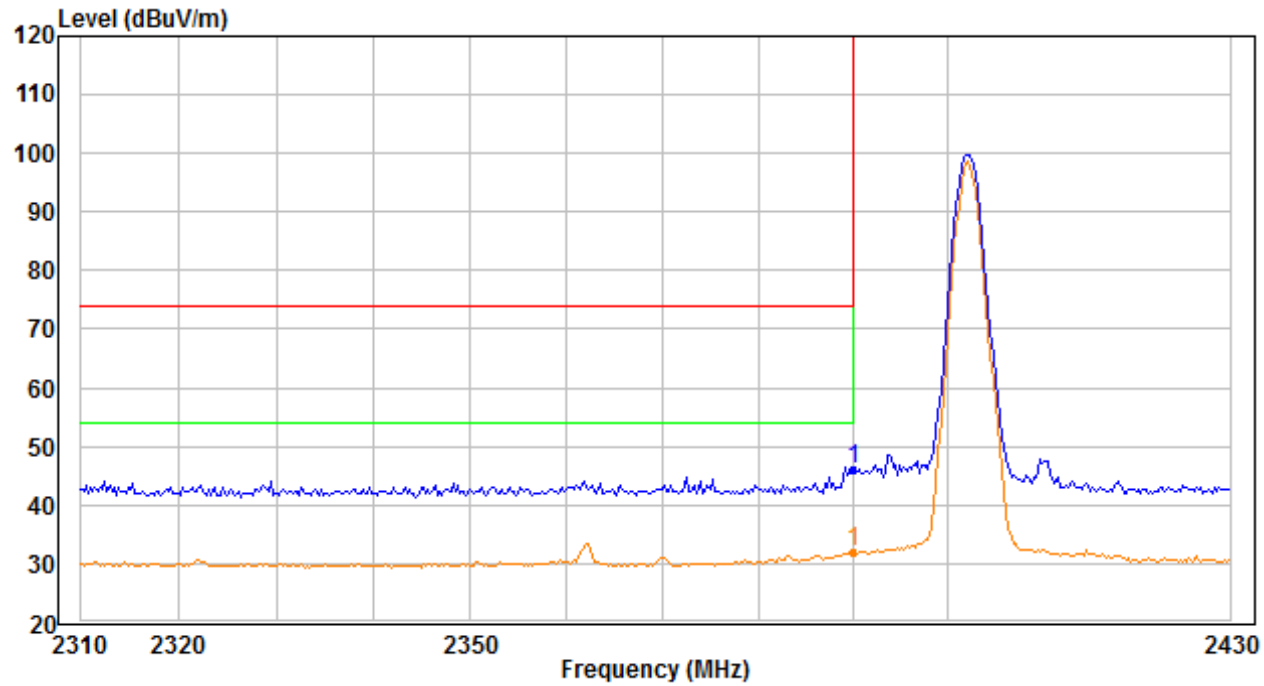
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

Left Earbud

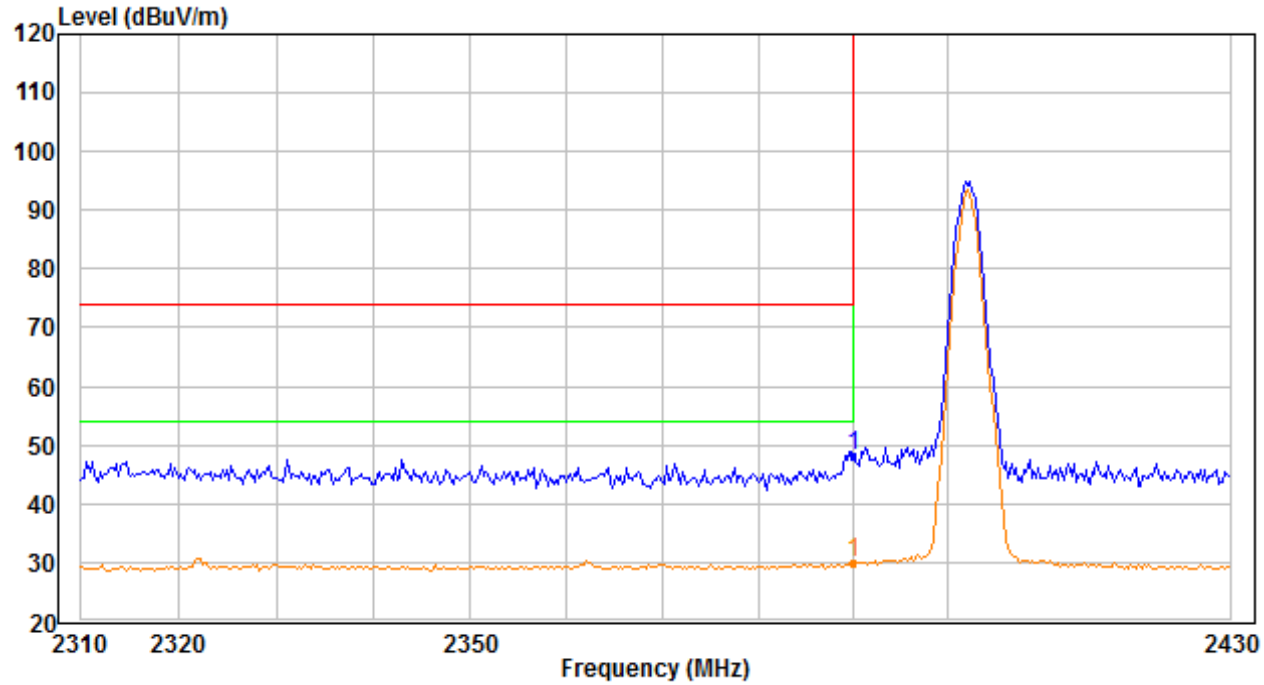
Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	46.26	74.00	31.88	54.00	Pass

Left Earbud

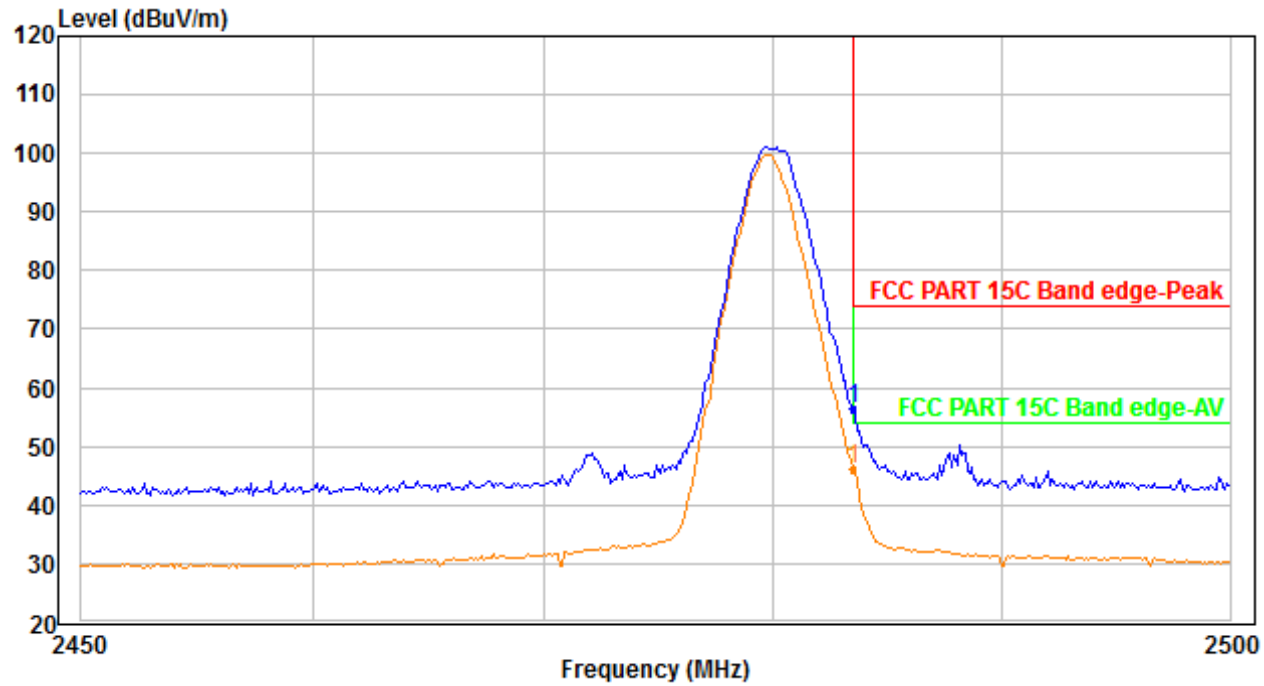
Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	48.25	74.00	29.85	54.00	Pass

Left Earbud

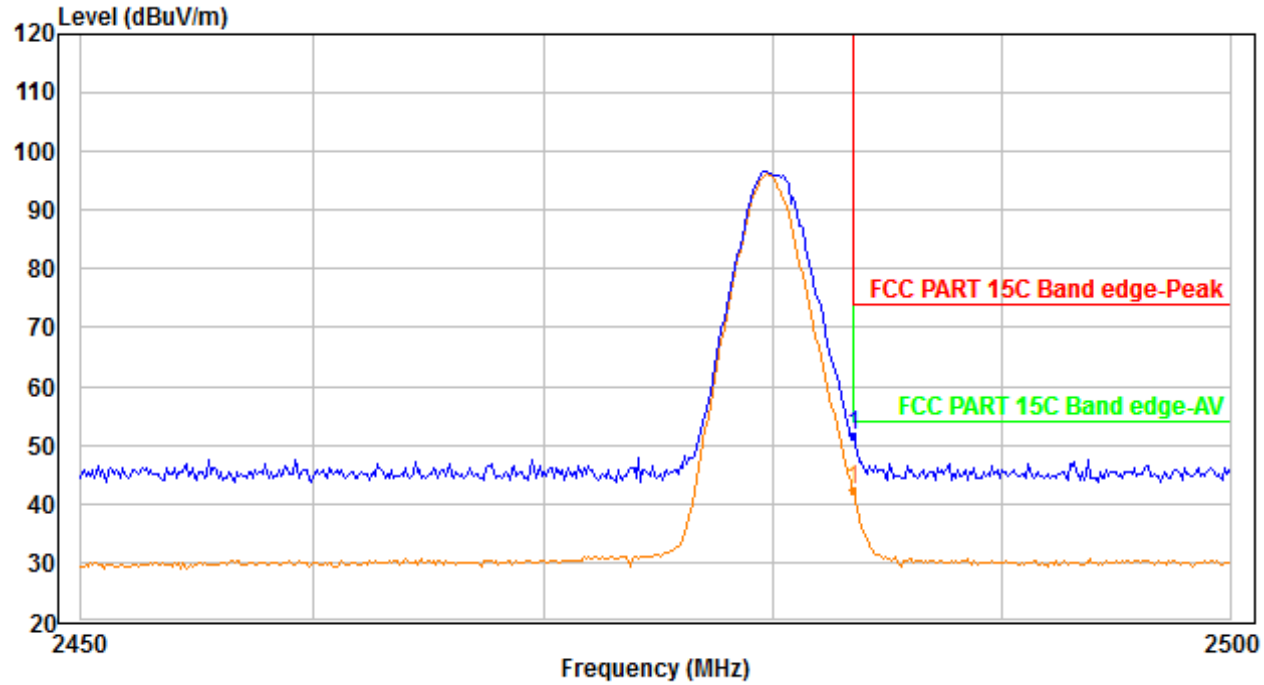
Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	56.40	74.00	46.17	54.00	Pass

Left Earbud

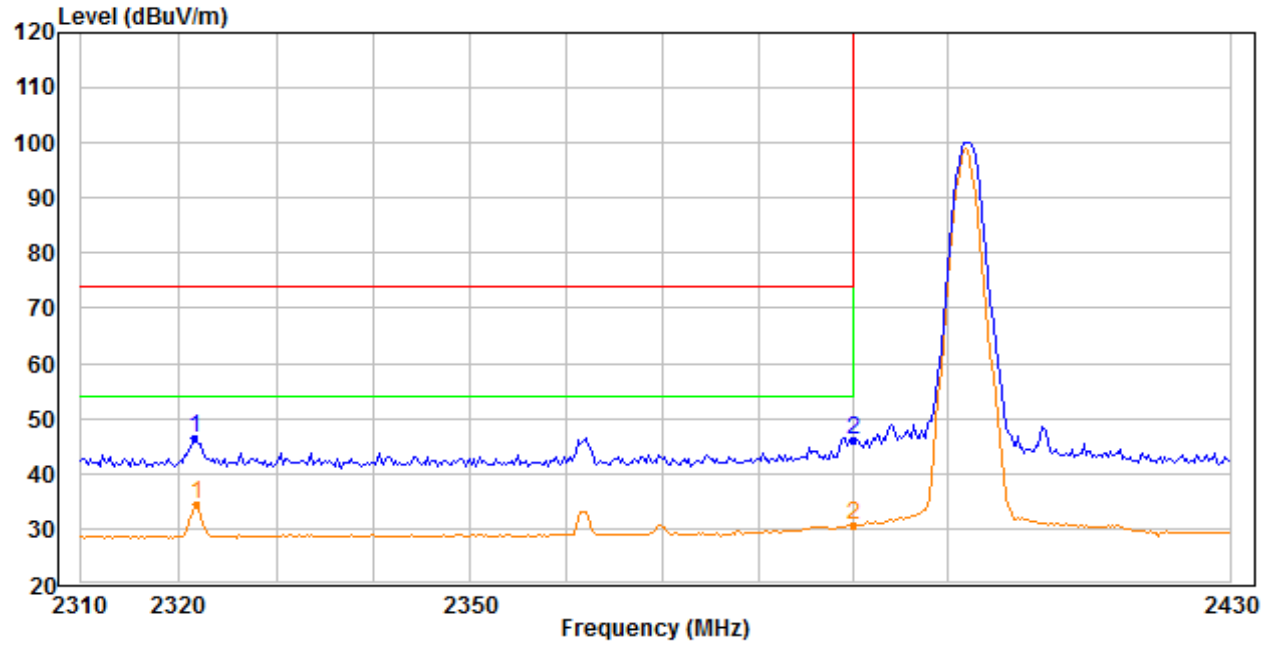
Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	51.45	74.00	42.30	54.00	Pass

Right Earbud

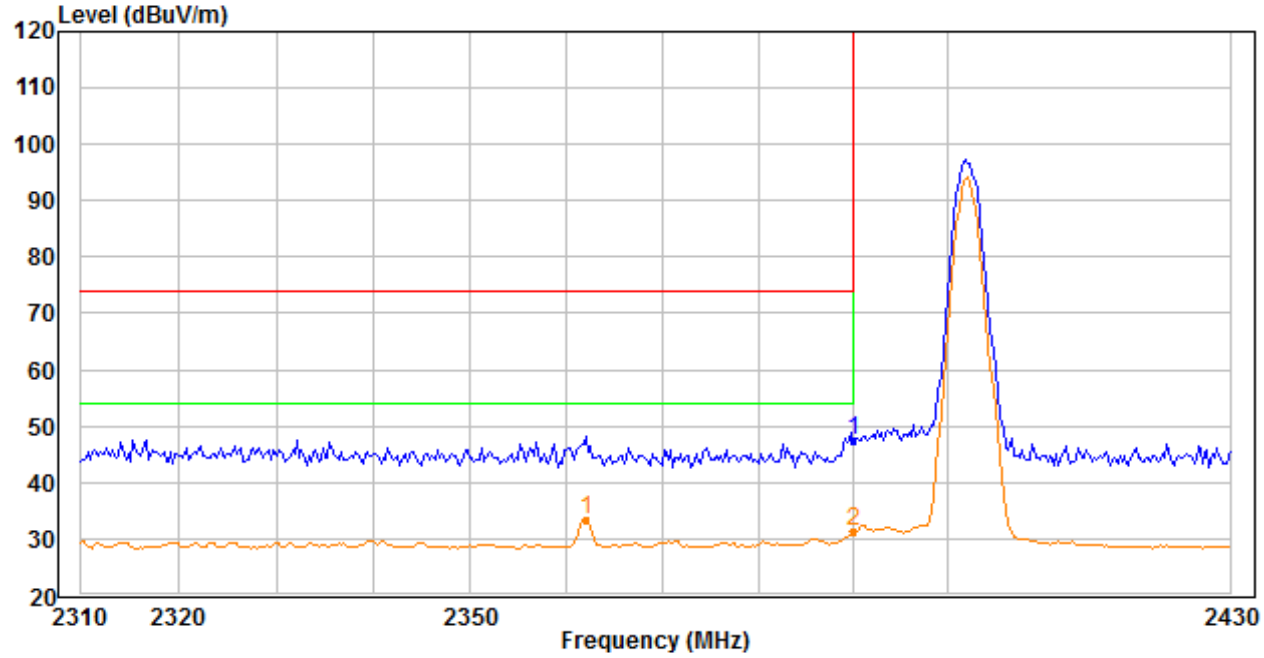
Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2321.5430	46.40	74.00	34.35	54.00	Pass
2390.0000	45.97	74.00	30.59	54.00	Pass

Right Earbud

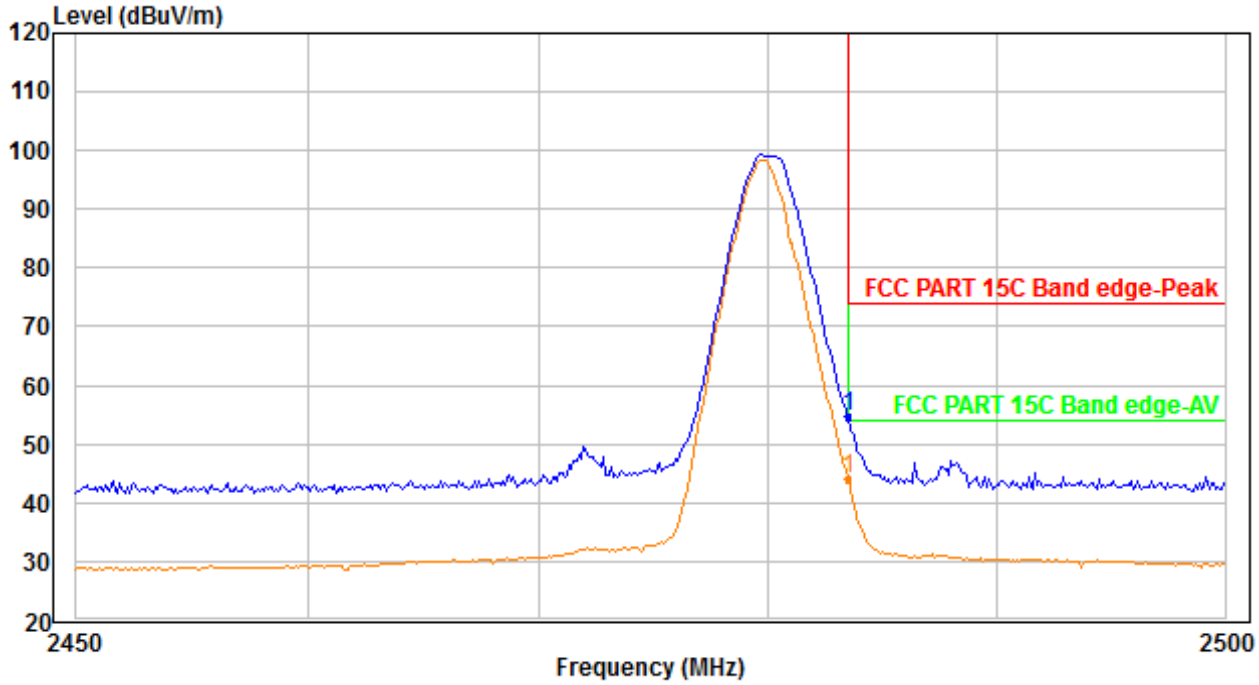
Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2361.9440	-	-	33.40	54.00	Pass
2390.0000	47.50	74.00	31.18	54.00	Pass

Right Earbud

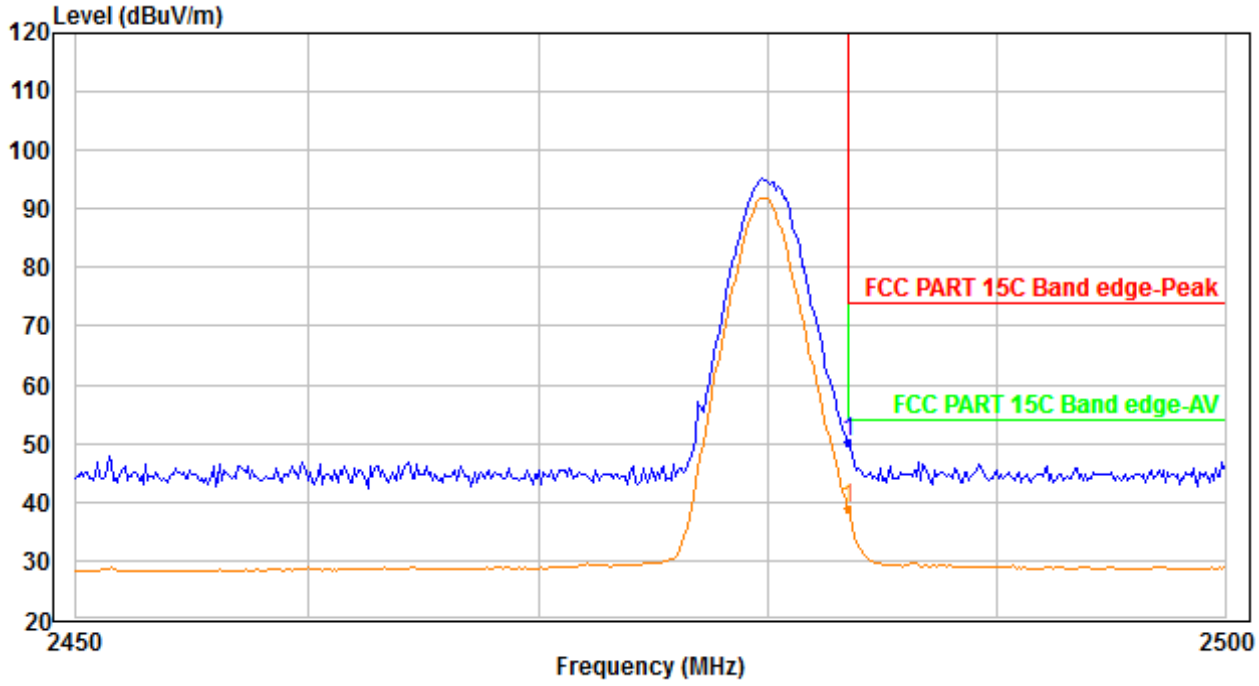
Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	54.66	74.00	44.09	54.00	Pass

Right Earbud

Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	50.16	74.00	38.79	54.00	Pass

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***