



MEASUREMENT REPORT

FCC ID : RWO-459
APPLICANT : Razer Inc.
Application Type : Certification
Product : Wireless Earphones
Model No. : 459
Serial No. : RC30-0459XXXX-XXXX (X can be 0-9 or A-Z)
Brand Name : RAZER
FCC Classification : (DSS) FCC Part 15 Spread Spectrum Transmitter
FCC Rule Part(s) : Part 15.247
Test Procedure(s) : ANSI C63.10-2013
Received Date : August 9, 2022
Test Date : August 12, 2022 ~ August 23, 2022
Tested By : *Peter Syu*
(Peter Syu)
Reviewed By : *Paddy Chen*
(Paddy Chen)
Approved By : *Chenz Ker*
(Chenz Ker)



The test results only relate to the tested sample.

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

The test report shall not be reproduced except in full without the written approval of MRT Technology (Taiwan) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2210TWE908-U1	1.0	Original Report	2022-10-25	

CONTENTS

Description	Page
1. INTRODUCTION	7
1.1. Scope	7
1.2. MRT Test Location	7
2. PRODUCT INFORMATION	8
2.1. Equipment Description	8
2.2. Product Specification Subjective to this Standard	9
2.3. Test Mode	9
2.4. Operation Frequency / Channel List	10
2.5. Test Configuration	11
2.6. Test Software	11
2.7. EMI Suppression Device(s)/Modifications	11
2.8. Labeling Requirements	11
2.9. Pseudorandom Frequency Hopping Sequence	12
3. DESCRIPTION of TEST	13
3.1. Evaluation Procedure	13
3.2. AC Line Conducted Emissions	13
3.3. Radiated Emissions	14
4. ANTENNA REQUIREMENTS	15
5. TEST EQUIPMENT CALIBRATION DATE	16
6. MEASUREMENT UNCERTAINTY	17
7. TEST RESULT	18
7.1. Summary	18
7.2. 20dB Bandwidth Measurement	19
7.2.1. Test Limit	19
7.2.2. Test Procedure used	19
7.2.3. Test Setting	19
7.2.4. Test Setup	19
7.2.5. Test Result	20
7.3. Output Power Measurement	24
7.3.1. Test Limit	24
7.3.2. Test Procedure Used	24
7.3.3. Test Setting	25

7.3.4.	Test Setup	25
7.3.5.	Test Result.....	26
7.4.	Carrier Frequency Separation Measurement	28
7.4.1.	Test Limit	28
7.4.2.	Test Procedure Used	28
7.4.3.	Test Setting.....	28
7.4.4.	Test Setup	28
7.4.5.	Test Result.....	29
7.5.	Number of Hopping Channels Measurement	33
7.5.1.	Test Limit	33
7.5.2.	Test Procedure Used	33
7.5.3.	Test Settintg.....	33
7.5.4.	Test Setup	33
7.5.5.	Test Result.....	34
7.6.	Time of Occupancy Measurement	37
7.6.1.	Test Limit	37
7.6.2.	Test Procedure Used	37
7.6.3.	Test Settintg.....	37
7.6.4.	Test Setup	37
7.6.5.	Test Result.....	38
7.7.	Out-of-Band Spurious Emissions Emissions Measurement	44
7.7.1.	Test Limit	44
7.7.2.	Test Procedure Used	44
7.7.3.	Test Setting.....	45
7.7.4.	Test Setup	45
7.7.5.	Test Result.....	46
7.8.	Radiated Spurious Emission Measurement	56
7.8.1.	Test Limit	56
7.8.2.	Test Procedure Used	56
7.8.3.	Test Setting.....	56
7.8.4.	Test Setup	58
7.8.5.	Test Result.....	60
7.9.	Radiated Restricted Band Edge Measurement	88
7.9.1.	Test Limit	88
7.9.2.	Test Procedure Used	88
7.9.3.	Test Setting.....	88
7.9.4.	Test Setup	90
7.9.5.	Test Result.....	91

7.10. AC Conducted Emissions Measurement	107
7.10.1. Test Limit	107
7.10.2. Test Setup	107
7.10.3. Test Result.....	108
8. CONCLUSION	112

§2.1033 General Information

Applicant	Razer Inc.
Applicant Address	9 Pasteur, Suite 100, Irvine, CA92618, USA
Manufacturer	Razer (Asia-Pacific) Pte.,Ltd
Manufacturer Address	1 one-north Crescent, #02-01 Singapore 138538
Test Site	MRT Technology (Taiwan) Co., Ltd
Test Site Address	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
MRT FCC Registration No.	291082
FCC Rule Part(s)	Part 15.247
Test Device Serial No.	#1-1 <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering

Test Facility / Accreditations

1. MRT facility is a FCC registered (Reg. No. 291082) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.
2. MRT facility is an IC registered (MRT Reg. No. 21723) test laboratory with the site description on file at Industry Canada.
3. MRT Lab is accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC (Designation Number: TW3261), Industry Taiwan, EU and TELEC Rules.

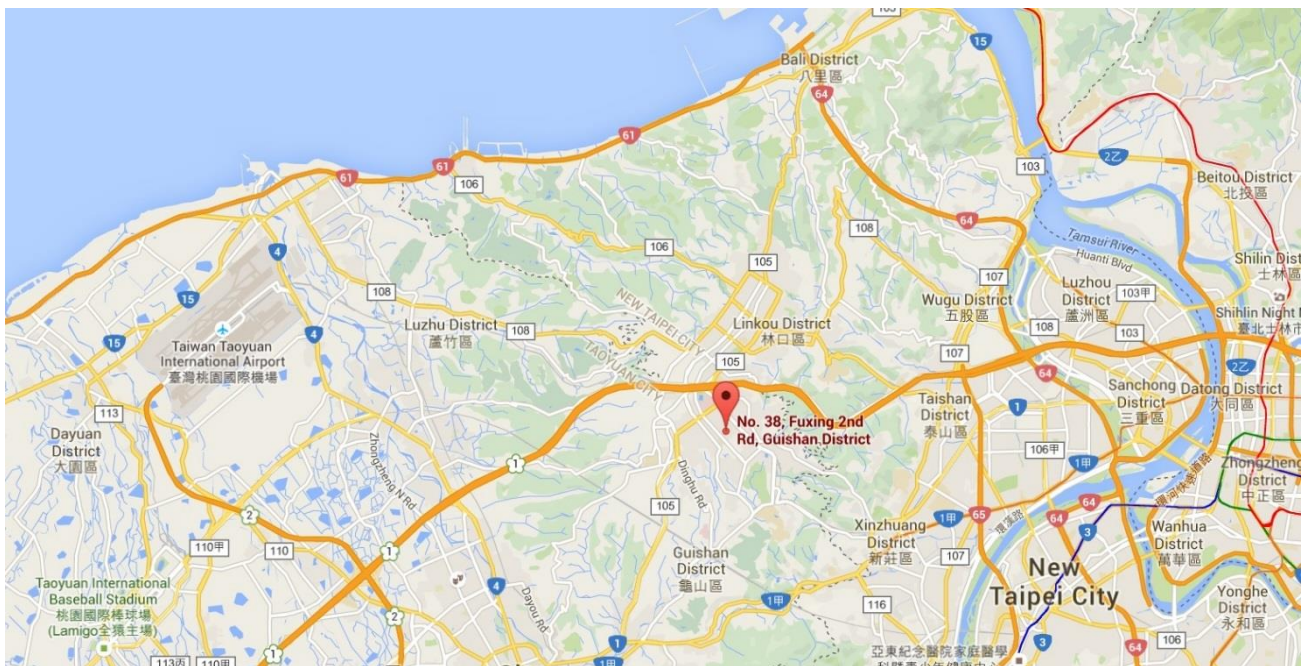
1. INTRODUCTION

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 Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	Wireless Earphones
Model No.	459
Serial No.	RC30-0459XXXX-XXXX (X can be 0-9 or A-Z)
Bluetooth Specification	Dual Mode
Maximum Output Power	Left Ear : 10.130dBm Right Ear : 11.170dBm
System's Accessories	
USB-A to USB-C adapter cable	Brand: RAZER Model No:459
USB-A to USB-C charging cable	Brand: RAZER Model No:459
Charging Case	Brand: RAZER Model No: 459C
USB WIRELESS TRANSCEIVER	Brand: RAZER Model No: RC30-0378
USB WIRELESS TRANSCEIVER	Brand: RAZER Model No: RC30-0403

Note 1: For more detailed features description, please refer to the manufacture's specifications of the users' manual.

Note 2: The system's model name is RZ12-0459XXXX-XXXX (X can be 0-9 or A-Z) (X can be 0-9 or A-Z), and the system contains Wireless Earphones (Model Name: 459) 、 USB-A to USB-C adapter cable (Model Name: 459) 、 USB-A to USB-C charging cable (Model Name: 459) 、 Charging Case (Model Name: 459C) and to USB Wireless Transceiver (Model Name: RC30-0378 or RC30-0403).

2.2. Product Specification Subjective to this Standard

Operating Frequency	2402~2480MHz
Type of modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Data Rate	1Mbps (GFSK), 2Mbps ($\pi/4$ DQPSK), 3Mbps (8DPSK)

2.3. Test Mode

Test Mode	Mode 1: Transmit - 1Mbps (GFSK) with Left Ear Mode 2: Transmit - 1Mbps (GFSK) with Right Ear Mode 3: Transmit - 3Mbps (8DPSK) with Left Ear Mode 4: Transmit - 3Mbps (8DPSK) with Right Ear
-----------	--

Note:

1. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
2. Bluetooth operation was evaluated at both 1Mbps and 3Mbps data rates. Through pre-testing 2Mbps data rate was found, to produce emissions like those for 3Mbps.

2.4. Operation Frequency / Channel List

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2403 MHz	02	2404 MHz
03	2405 MHz	04	2406 MHz	05	2407 MHz
06	2408 MHz	07	2409 MHz	08	2410 MHz
09	2411 MHz	10	2412 MHz	11	2413 MHz
12	2414 MHz	13	2415 MHz	14	2416 MHz
15	2417 MHz	16	2418 MHz	17	2419 MHz
18	2420 MHz	19	2421 MHz	20	2422 MHz
21	2423 MHz	22	2424 MHz	23	2425 MHz
24	2426 MHz	25	2427 MHz	26	2428 MHz
27	2429 MHz	28	2430 MHz	29	2431 MHz
30	2432 MHz	31	2433 MHz	32	2434 MHz
33	2435 MHz	34	2436 MHz	35	2437 MHz
36	2438 MHz	37	2439 MHz	38	2440 MHz
39	2441 MHz	40	2442 MHz	41	2443 MHz
42	2444 MHz	43	2445 MHz	44	2446 MHz
45	2447 MHz	46	2448 MHz	47	2449 MHz
48	2450 MHz	49	2451 MHz	50	2452 MHz
51	2453 MHz	52	2454 MHz	53	2455 MHz
54	2456 MHz	55	2457 MHz	56	2458 MHz
57	2459 MHz	58	2460 MHz	59	2461 MHz
60	2462 MHz	61	2463 MHz	62	2464 MHz
63	2465 MHz	64	2466 MHz	65	2467 MHz
66	2468 MHz	67	2469 MHz	68	2470 MHz
69	2471 MHz	70	2472 MHz	71	2473 MHz
72	2474 MHz	73	2475 MHz	74	2476 MHz
75	2477 MHz	76	2478 MHz	77	2479 MHz
78	2480 MHz	N/A	N/A	N/A	N/A

2.5. Test Configuration

This device was tested per the guidance of ANSI C63.10-2013. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.6. Test Software

The test utility software used during testing was “AWBTRDLAB v1.0.9.7”.

2.7. EMI Suppression Device(s)/Modifications

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

2.8. Labeling Requirements

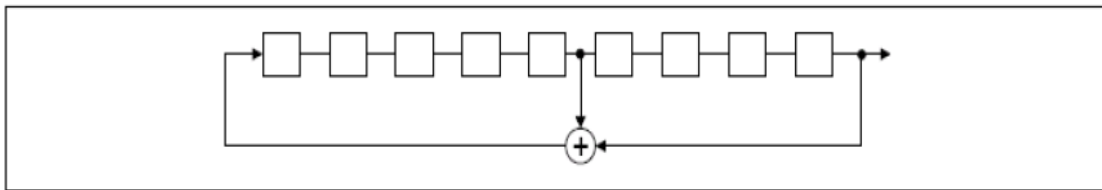
Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

2.9. Pseudorandom Frequency Hopping Sequence

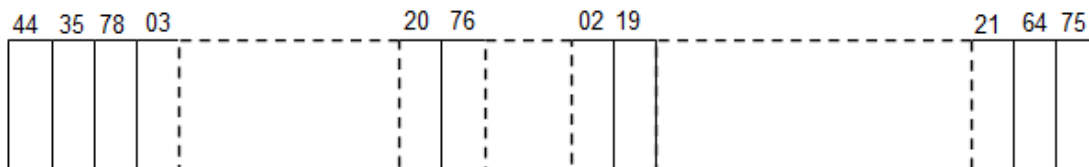
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their

Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

3. DESCRIPTION of TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) were used in the measurement of the **Wireless Earphones**.

Deviation from measurement procedure.....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 9'x4'x3' shielded enclosure. A 1m x 2m 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/50uH 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. 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. 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 receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions were 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.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

Line conducted emissions test results are shown in Section 7.10.

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. For measurements above 1GHz 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 below 1GHz, the absorbers are removed. An MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable. 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(b)(1) 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 for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 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, clock speed, mode of operation or video resolution, if applicable, 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. According to 3dB Beamwidth of horn antenna, the horn antenna should be always directed to the EUT when rising height.

Radiated emissions test results are shown in Section 7.8 & 7.9

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

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

- The antenna of the Wireless Earphones, is permanently attached.
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT unit complies with the requirement of §15.203.

Antenna List

No.	Brand	Part No.	Peak Gain
1	欣音	XY066(L)	-0.37dBi
2	欣音	XY066(R)	-0.39dBi

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions – SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2023/3/7
Cable	Rosnol	N1C50-RG400- B1C50-500CM	MRTTWE00013	1 year	2023/6/19
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2023/3/9

Radiated Emissions – AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2022/10/4
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2023/3/9
Active Loop Antenna	Schwarzbeck	FMZB 1519B	MRTTWA00002	1 year	2023/5/24
Broadband Horn antenna	SCHWARZBECK	BBHA 9120D	MRTTWA00003	1 year	2023/3/30
Breitband Hornantenna	Schwarzbeck	BBHA 9170	MRTTWA00004	1 year	2023/3/29
Broadband Amplifier	Schwarzbeck	BBV 9721	MRTTWA00006	1 year	2023/3/30
Broadband Preampfier	SCHWARZBECK	BBV 9718	MRTTWA00005	1 year	2023/3/30
Cable	HUBERSUHNER	SF106	MRTTWE00010	1 year	2023/5/23
Cable	Rosnol	K1K50-UP0264- K1K50-4M	MRTTWE00012	1 year	2023/6/19

Conducted Test Equipment – SR5

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2022/10/18
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2022/7/19
USB Wideband Power Sensor	KEYSIGHT	U2021XA	MRTTWA00015	1 year	2023/3/16

Test Software

Software	Version	Function
e3	9.160520a	EMI Test Software
EMI	V3	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT 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 $k = 2$.

Conducted Emission- Power Line
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 2.53\text{dB}$
Radiated Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 3.92\text{dB}$ (Below 30M)
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 4.25\text{dB}$ (30M~1G)
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 4.40\text{dB}$ (1G~18G)
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 4.45\text{dB}$ (18G~40G)
Frequency Error
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 78.4\text{Hz}$
Conducted Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 0.84\text{dB}$
Conducted Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 2.65\text{ dB}$
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 3.3\%$
Temp. / Humidity
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 0.82^\circ\text{C}/ \pm 3\%$
DC Voltage
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): $\pm 0.3\%$

7. TEST RESULT

7.1. Summary

Product Name: Wireless Earphones
FCC ID: RWO-459
FCC Classification: (DSS) FCC Part 15 Spread Spectrum Transmitter

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(1)	20dB Bandwidth	N/A	Conducted	PASS	Section 7.2
15.247(b)(1)	Output Power	<1 Watt if > 75 non-overlapping channels used		PASS	Section 7.3
15.247(a)(1)	Carrier Frequency Separation	25KHz or 20 dB BW for systems with Output Power < 125mW		PASS	Section 7.4
15.247(a)(1)(iii)	Number of Hopping Channels	> 15 Channels		PASS	Section 7.5
15.247(a)(1)(iii)	Time of Occupancy	< 0.4 sec in 31.6 sec period		PASS	Section 7.6
15.247(d)	Out-of-Band Emissions	Conducted \geq 20dBc		PASS	Section 7.7
15.205 15.209	Spurious Emission	< FCC 15.209 limits	Radiated	PASS	Section 7.8
15.205 15.209	Band Edge Measurement	\leq 74dBuV/m(Peak) \leq 54dBuV/m(Average)		PASS	Section 7.9
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.10

Note:

- Determining compliance is based on the test results met the regulation limits or requirements declared by clients, and the test results don't take into account the value of measurement uncertainty.
- All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. 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.

7.2. 20dB Bandwidth Measurement

7.2.1. Test Limit

N/A

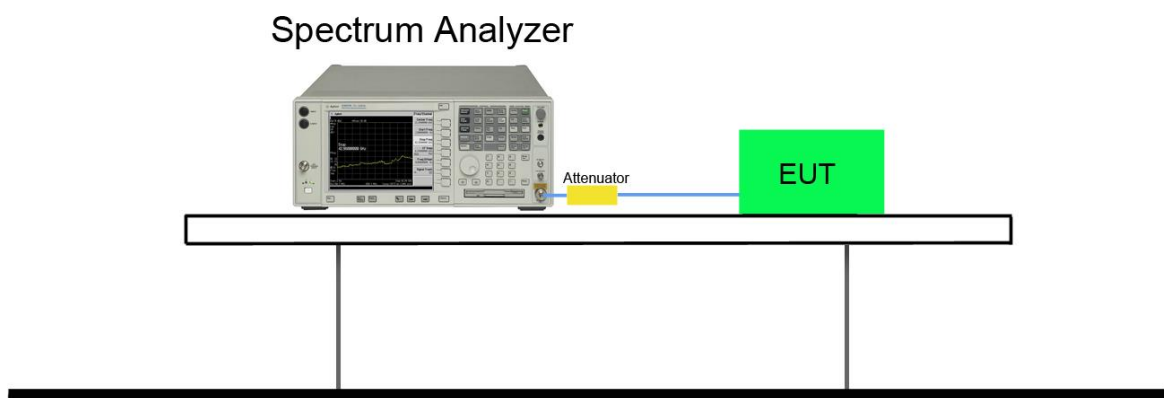
7.2.2. Test Procedure used

ANSI C63.10-2013 - Section 6.9.2

7.2.3. Test Setting

1. Set RBW $\geq 1\%$ of the 20dB bandwidth
2. VBW $\geq 3 \times$ RBW
3. Span = approximately 2 to 5 times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize
8. 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 20 dB relative to the maximum level measured in the fundamental emission.

7.2.4. Test Setup



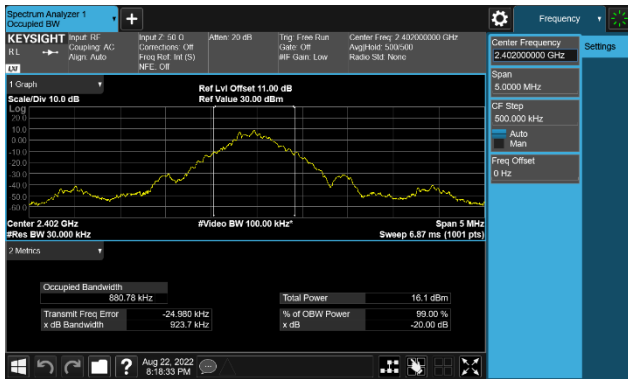
7.2.5. Test Result

Test Mode	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	Result
Left Ear				
DH5	00	2402	923.70	Pass
DH5	39	2441	924.20	Pass
DH5	78	2480	924.80	Pass
3-DH5	00	2402	1262.00	Pass
3-DH5	39	2441	1263.00	Pass
3-DH5	78	2480	1263.00	Pass

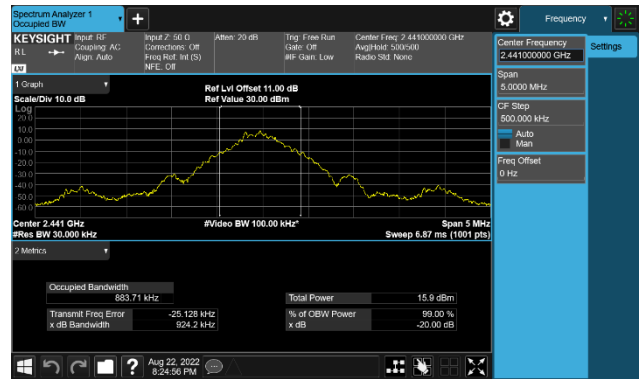
Test Mode	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	Result
Right Ear				
DH5	00	2402	917.10	Pass
DH5	39	2441	860.30	Pass
DH5	78	2480	919.20	Pass
3-DH5	00	2402	1262.00	Pass
3-DH5	39	2441	1263.00	Pass
3-DH5	78	2480	1263.00	Pass

Left Ear

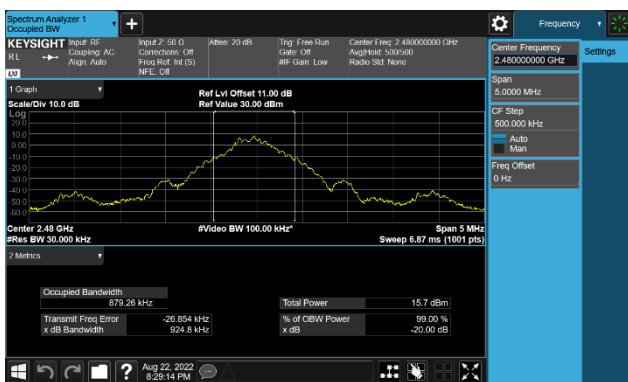
CH00 (2402MHz) DH5(1Mbps)



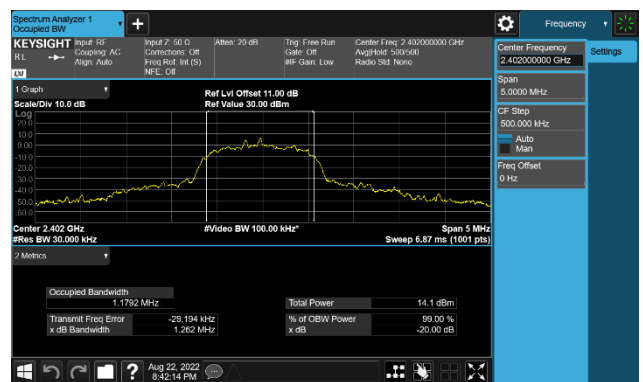
CH39 (2441MHz) DH5(1Mbps)



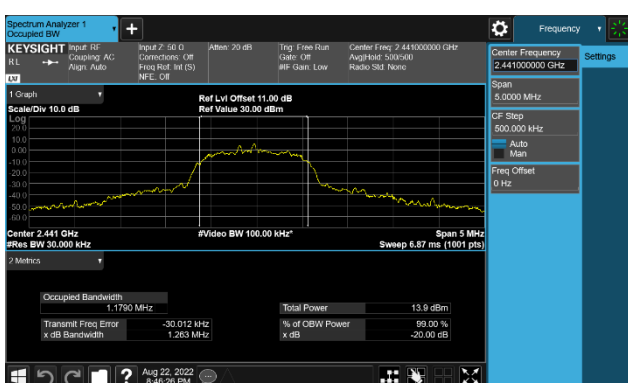
CH78 (2480MHz) DH5(1Mbps)



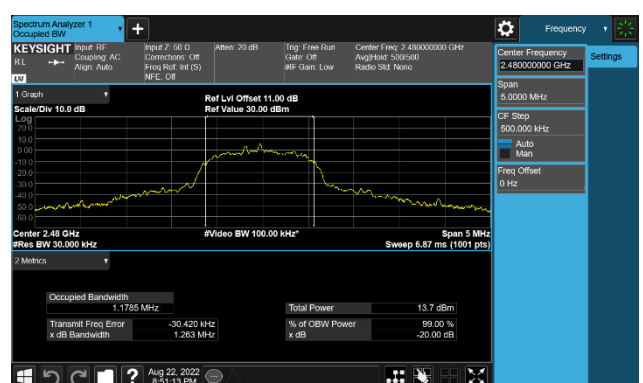
CH00 (2402MHz) 3-DH5(3Mbps)



CH39 (2441MHz) 3-DH5(3Mbps)

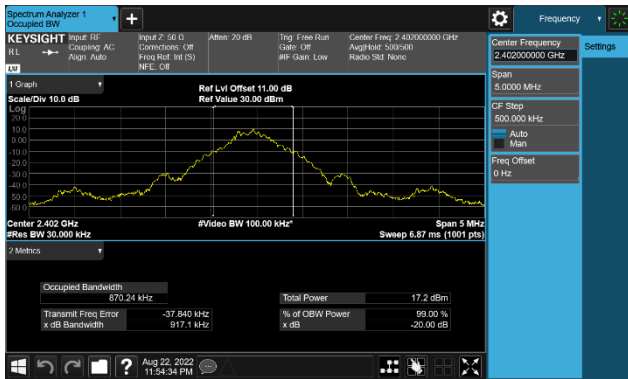


CH78 (2480MHz) 3-DH5(3Mbps)

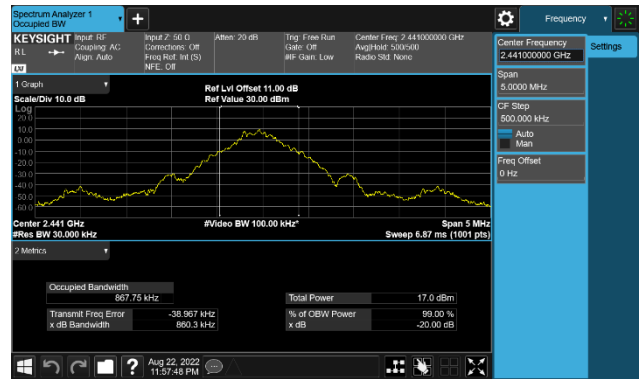


Right Ear

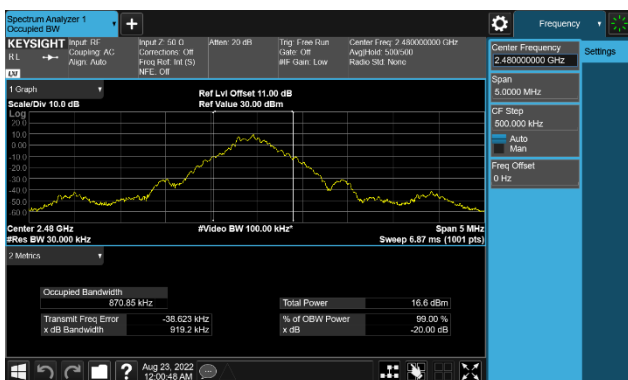
CH00 (2402MHz) DH5(1Mbps)



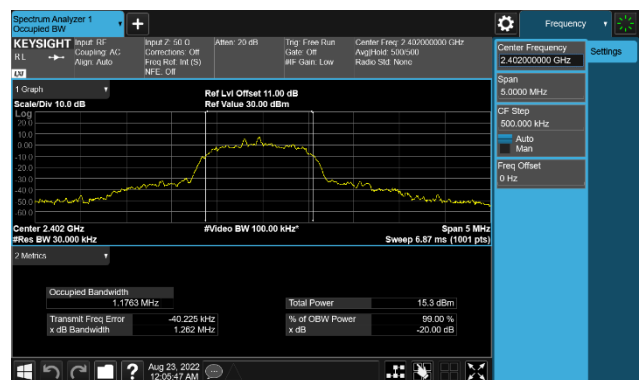
CH39 (2441MHz) DH5(1Mbps)



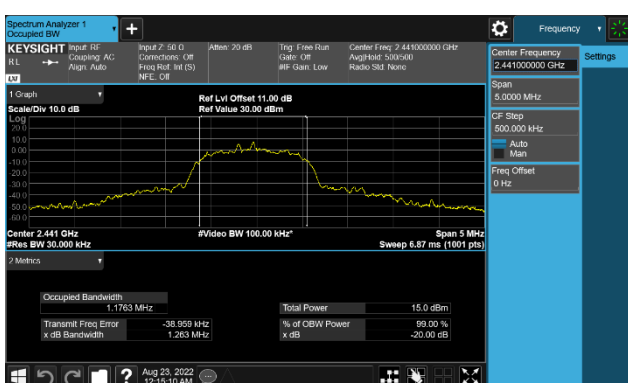
CH78 (2480MHz) DH5(1Mbps)



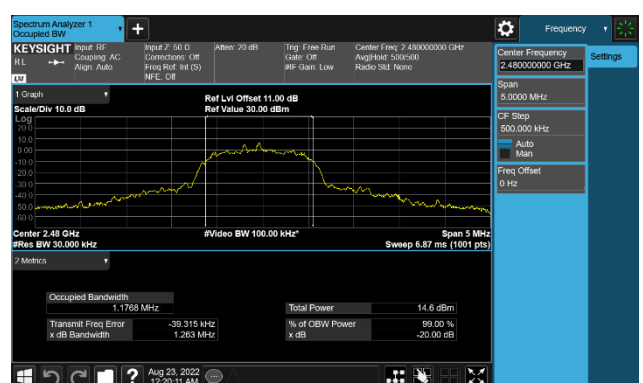
CH00 (2402MHz) 3-DH5(3Mbps)



CH39 (2441MHz) 3-DH5(3Mbps)



CH78 (2480MHz) 3-DH5(3Mbps)



7.3. Output Power Measurement

7.3.1. Test Limit

The maximum out power permissible output power is 1 Watt for all other frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels.

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels.

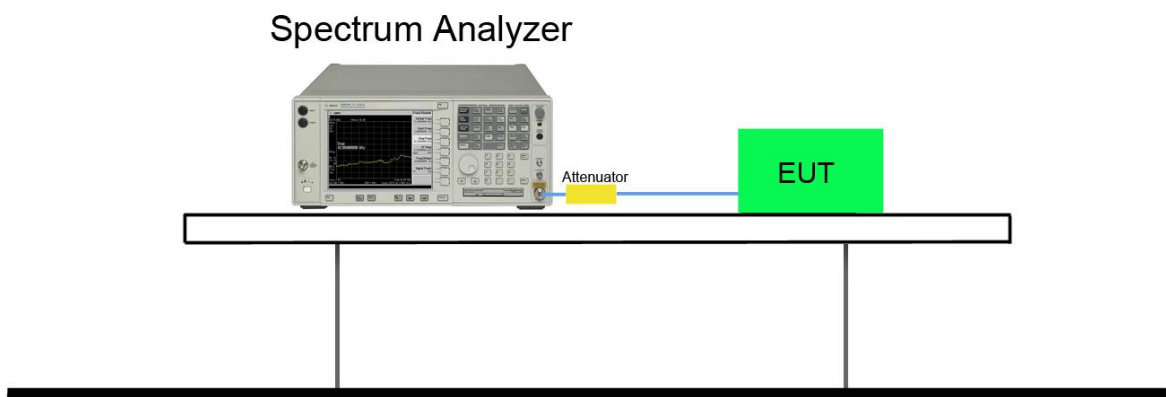
7.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.5

7.3.3. Test Setting

1. Set RBW \geq the 20 dB bandwidth of the emission being measured.
2. VBW $\geq 3 \times$ RBW
3. Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (don't forget added the external attenuation and cable loss)
8. Note: A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

7.3.4. Test Setup



7.3.5. Test Result

Test Mode	Channel No.	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)
Left Ear				
DH5	00	2402	9.100	< 30
DH5	39	2441	8.960	< 30
DH5	78	2480	8.670	< 30
2DH5	00	2402	9.290	< 30
2DH5	39	2441	9.210	< 30
2DH5	78	2480	8.930	< 30
3DH5	00	2402	10.130	< 30
3DH5	39	2441	10.060	< 30
3DH5	78	2480	9.820	< 30

Note:

1. The peak power of all test modes is less than 21dBm(125mW).
2. Peak Power Output Value =Reading value on power meter + cable loss.

Test Mode	Channel No.	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)
Right Ear				
DH5	00	2402	10.210	< 30
DH5	39	2441	10.010	< 30
DH5	78	2480	9.590	< 30
2DH5	00	2402	10.410	< 30
2DH5	39	2441	10.260	< 30
2DH5	78	2480	9.850	< 30
3DH5	00	2402	11.170	< 30
3DH5	39	2441	11.000	< 30
3DH5	78	2480	10.630	< 30

Note:

1. The peak power of all test modes is less than 21dBm(125mW).
2. Peak Power Output Value =Reading value on power meter + cable loss.

7.4. Carrier Frequency Separation Measurement

7.4.1. Test Limit

The minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.

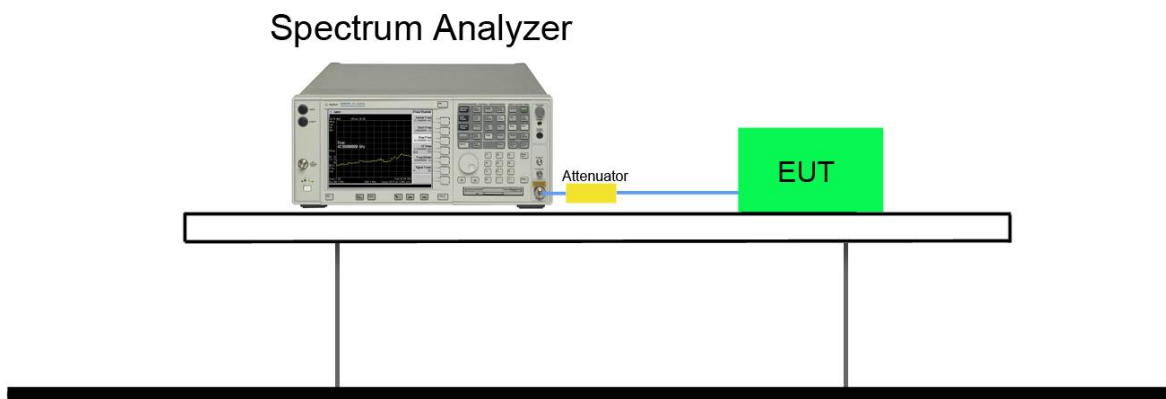
7.4.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.2

7.4.3. Test Setting

1. Span = wide enough to capture the peaks of two adjacent channels.
2. RBW \geq 1 % of the span
3. VBW \geq RBW
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

7.4.4. Test Setup



7.4.5. Test Result

Test Mode	Channel No.	Frequency (MHz)	Channel Separation (MHz)	Limit (kHz)	Limit of 2/3*20dB Bandwidth (kHz)	Result
Left Ear						
DH5	00	2402	1.00	25	615.80	Pass
DH5	39	2441	1.00	25	616.13	Pass
DH5	78	2480	1.00	25	616.53	Pass
3-DH5	00	2402	1.00	25	841.33	Pass
3-DH5	39	2441	1.00	25	842.00	Pass
3-DH5	78	2480	1.00	25	842.00	Pass

Note:

1. The limit is 25 kHz or 2/3 the value of the 20dB bandwidth of the hopping channel, whichever is greater.
2. The 20dB Bandwidth is refer to section 7.2.

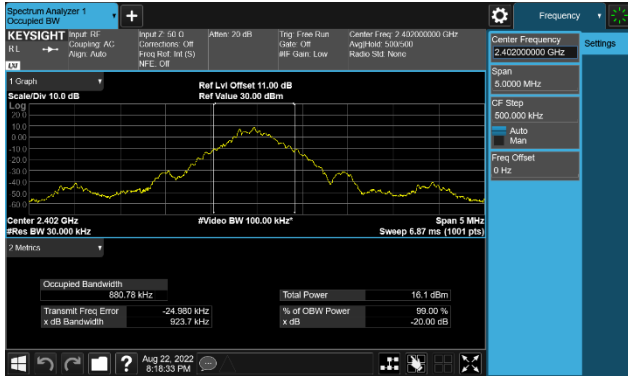
Test Mode	Channel No.	Frequency (MHz)	Channel Separation (MHz)	Limit (kHz)	Limit of 2/3*20dB Bandwidth (kHz)	Result
Right Ear						
DH5	00	2402	1.00	25	611.40	Pass
DH5	39	2441	1.00	25	573.53	Pass
DH5	78	2480	1.00	25	612.80	Pass
3-DH5	00	2402	1.00	25	841.33	Pass
3-DH5	39	2441	1.00	25	842.00	Pass
3-DH5	78	2480	1.00	25	842.00	Pass

Note:

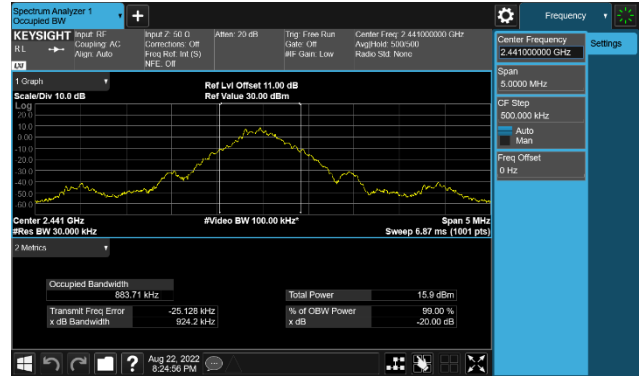
1. The limit is 25 kHz or 2/3 the value of the 20dB bandwidth of the hopping channel, whichever is greater.
2. The 20dB Bandwidth is refer to section 7.2.

Left Ear

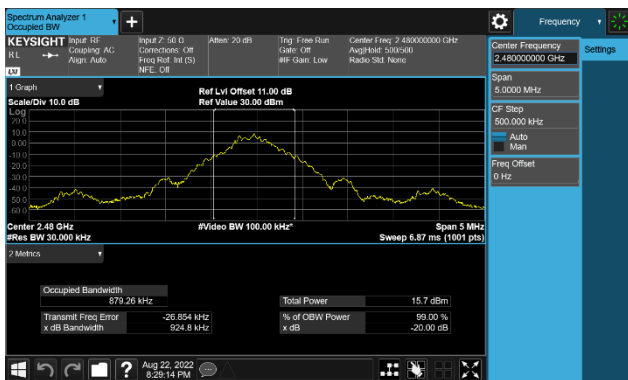
CH00 (2402MHz) DH5(1Mbps)



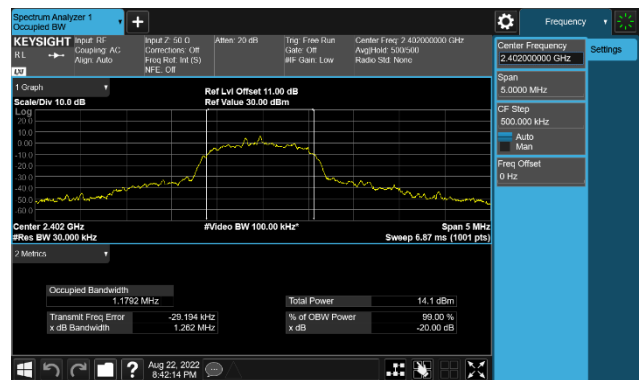
CH39 (2441MHz) DH5(1Mbps)



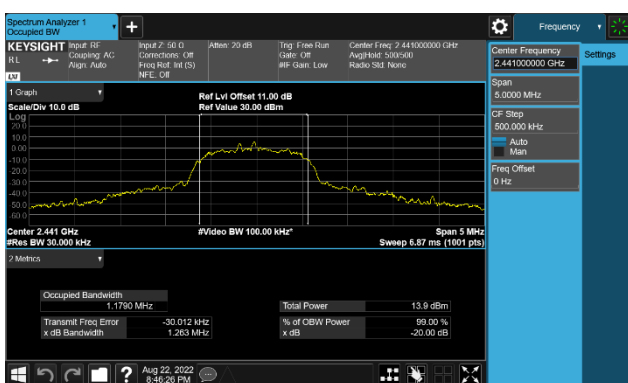
CH78 (2480MHz) DH5(1Mbps)



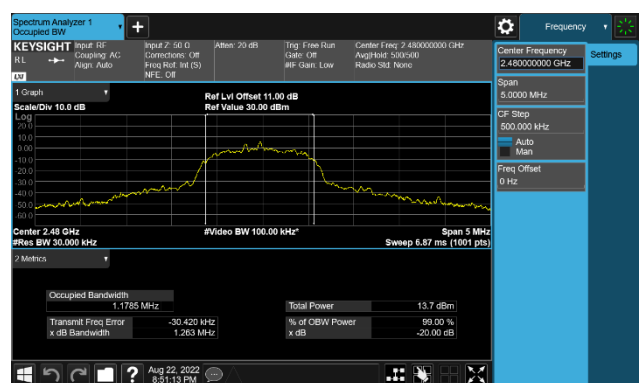
CH00 (2402MHz) 3-DH5(3Mbps)



CH39 (2441MHz) 3-DH5(3Mbps)

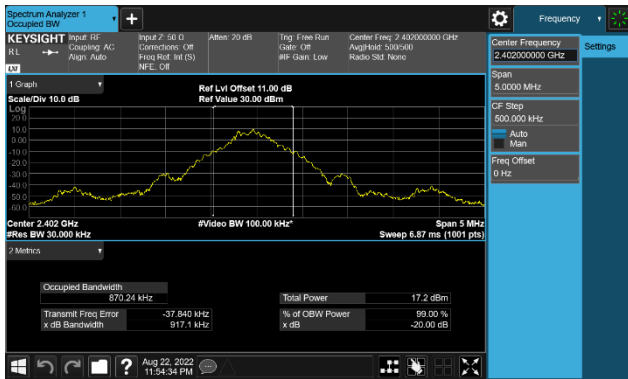


CH78 (2480MHz) 3-DH5(3Mbps)

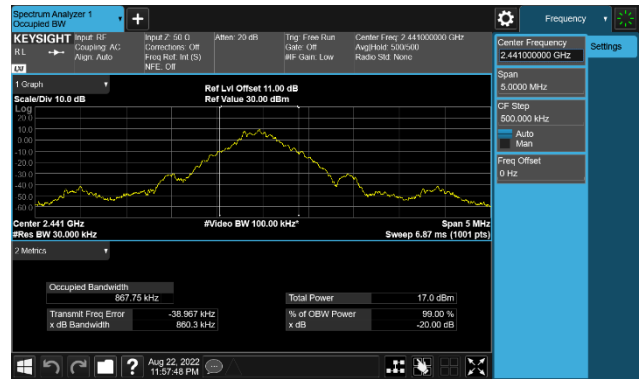


Right Ear

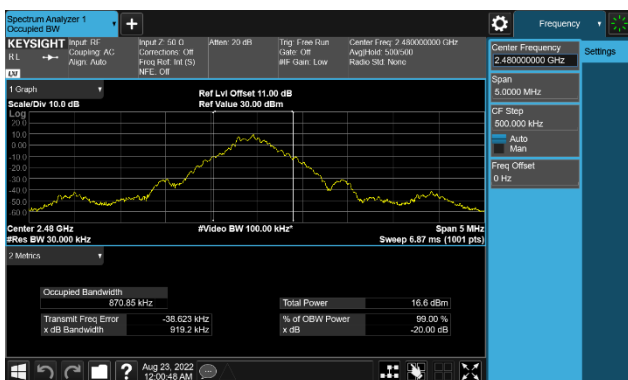
CH00 (2402MHz) DH5(1Mbps)



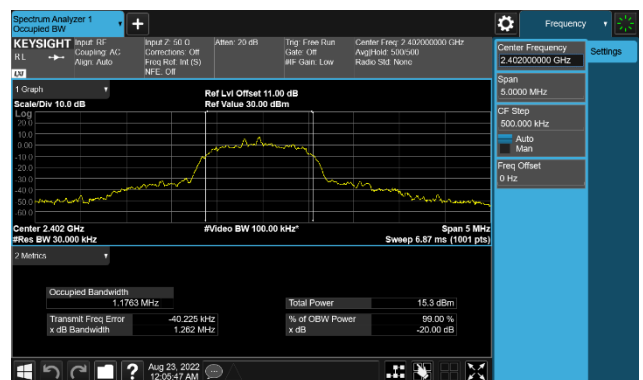
CH39 (2441MHz) DH5(1Mbps)



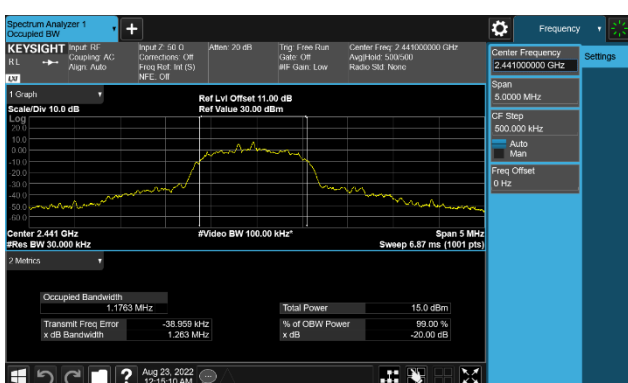
CH78 (2480MHz) DH5(1Mbps)



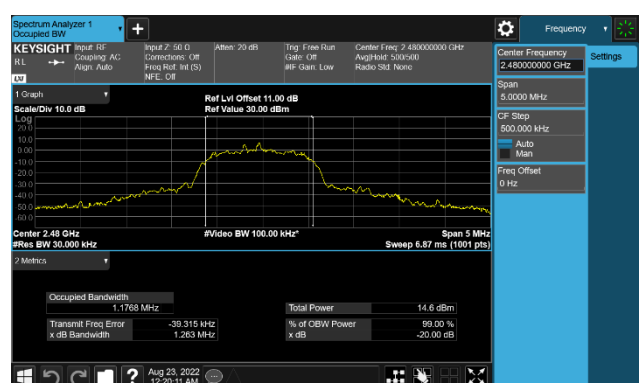
CH00 (2402MHz) 3-DH5(3Mbps)



CH39 (2441MHz) 3-DH5(3Mbps)



CH78 (2480MHz) 3-DH5(3Mbps)



7.5. Number of Hopping Channels Measurement

7.5.1. Test Limit

This frequency hopping system must employ a minimum of 15 hopping channels.

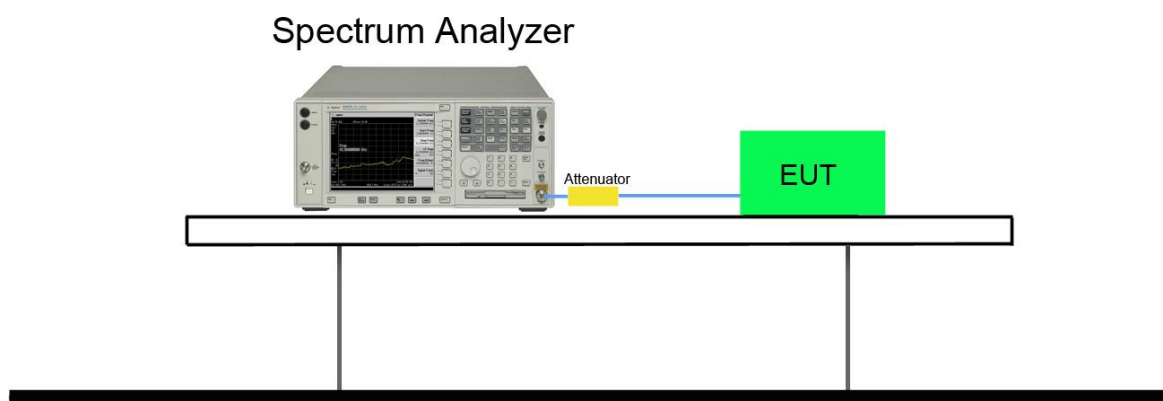
7.5.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.3

7.5.3. Test Setting

1. Span = the frequency band of operation.
2. RBW \geq 1 % of the span
3. VBW \geq RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

7.5.4. Test Setup



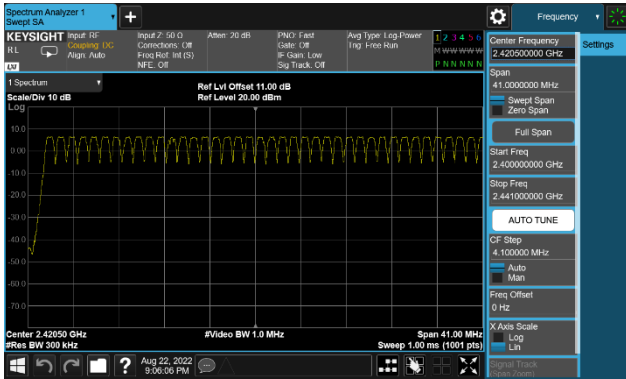
7.5.5. Test Result

Test Mode (Hopping)	Channel Numbers	Frequency (MHz)	Limit (Hopping Channels)	Result
Left Ear				
DH5	79	2402~2480	≥ 15	Pass
3DH5	79	2402~2480	≥ 15	Pass

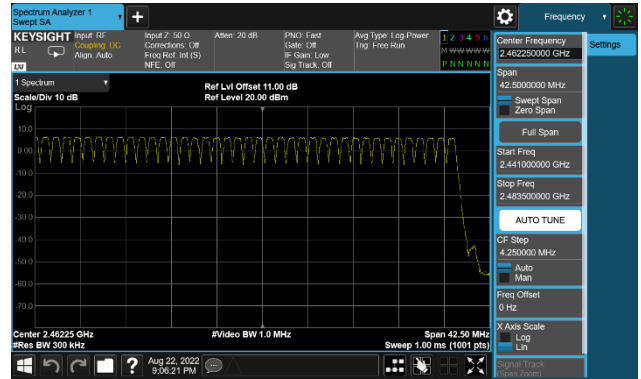
Test Mode (Hopping)	Channel Numbers	Frequency (MHz)	Limit (Hopping Channels)	Result
Right Ear				
DH5	79	2402~2480	≥ 15	Pass
3DH5	79	2402~2480	≥ 15	Pass

Left Ear

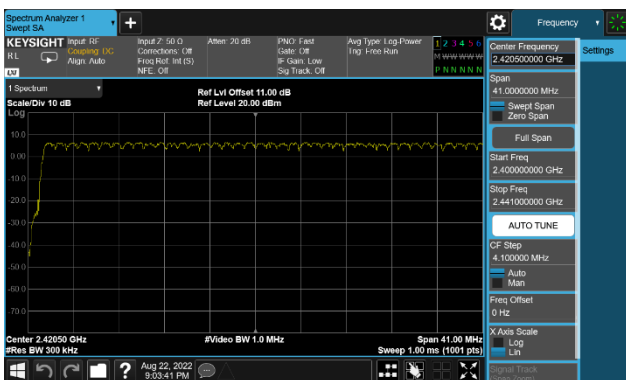
DH5(1Mbps)-2400 MHz ~2441MHz



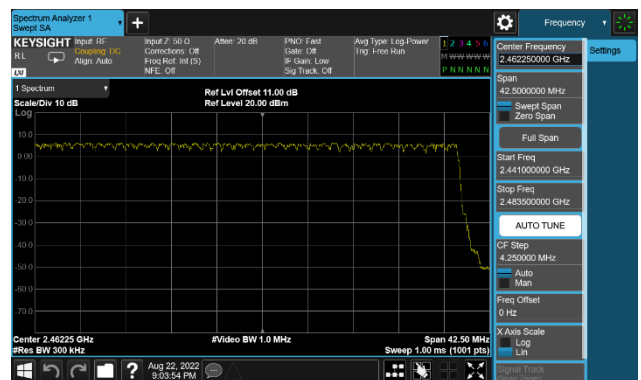
DH5(1Mbps)-2441 MHz ~2483.5MHz



3-DH5(3Mbps)- 2400 MHz ~2441MHz

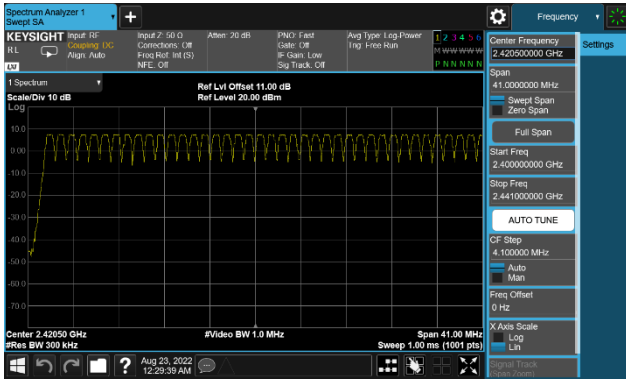


3-DH5(3Mbps)- 2441 MHz ~2483.5MHz

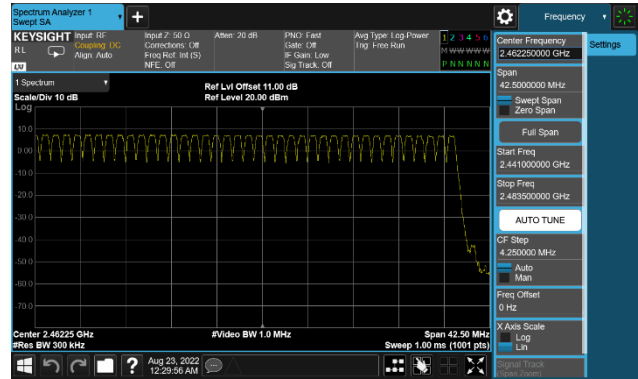


Right Ear

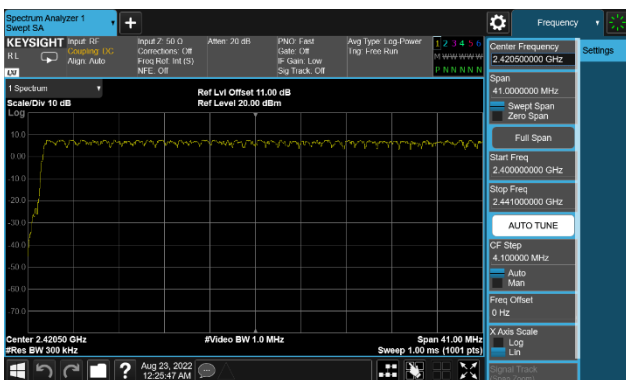
DH5(1Mbps)-2400 MHz ~2441MHz



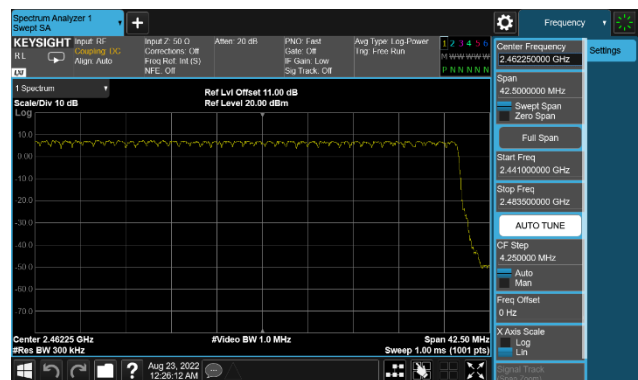
DH5(1Mbps)-2441 MHz ~2483.5MHz



3-DH5(3Mbps)- 2400 MHz ~2441MHz



3-DH5(3Mbps)- 2441 MHz ~2483.5MHz



7.6. Time of Occupancy Measurement

7.6.1. Test Limit

The maximum permissible time of occupancy is 400ms within a period of 400ms multiplied by the number of hopping channels employed.

7.6.2. Test Procedure Used

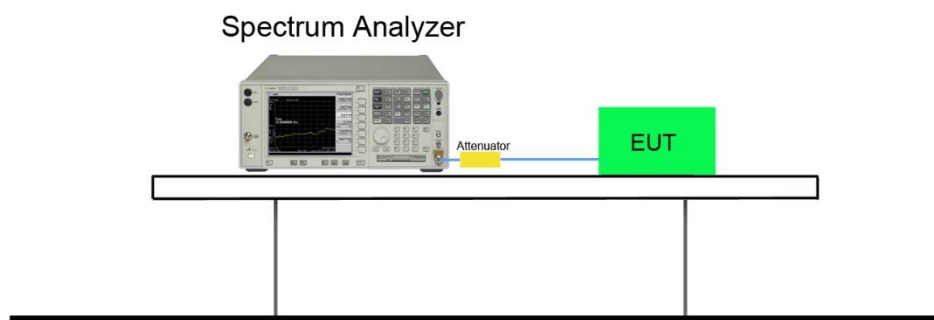
ANSI C63.10-2013 - Section 7.8.4

7.6.3. Test Setting

1. Span = zero span, centered on a hopping channel.
2. RBW = 1MHz
3. VBW \geq RBW
4. Sweep time = as necessary to capture the entire dwell time per hopping channel
5. Detector = Peak
6. Trace mode = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (data rate, modulation format, etc.), repeat this test for each variation. An oscilloscope may be used instead of a spectrum analyzer. The EUT shall show compliance with the appropriate regulatory limit for the number of hopping channels. A plot of the data shall be included in the test report.

7.6.4. Test Setup



7.6.5. Test Result

Test Mode	Frequency (MHz)	Time of Occupancy (ms)	Hopping of Numbers	Sweep time (ms)	Duty cycle	Dwell Time (Sec)	Limit (Sec)	Result
Left Ear								
DH5	2402	2.97	16.00	50	0.95	0.38	0.4	Pass
	2441	2.97	16.00	50	0.95	0.38	0.4	Pass
	2480	2.97	16.00	50	0.95	0.38	0.4	Pass
3-DH5	2402	2.98	16.00	50	0.95	0.38	0.4	Pass
	2441	2.98	16.00	50	0.95	0.38	0.4	Pass
	2480	2.97	16.00	50	0.95	0.38	0.4	Pass

Note:

1. Duty cycle = $((\text{Time slot length (ms)} * \text{Hopping of Number}) / \text{Sweep time (ms)})$ °
2. Dwell time = $((\text{Duty cycle} * (\text{Time Period} <0.4 * 79>)) / (\text{Total Hopping of Number} <79>))$ °
3. The dwell times of the packet type of DH1, DH3, and DH5 are tested. Only the worst case is shown on the report.

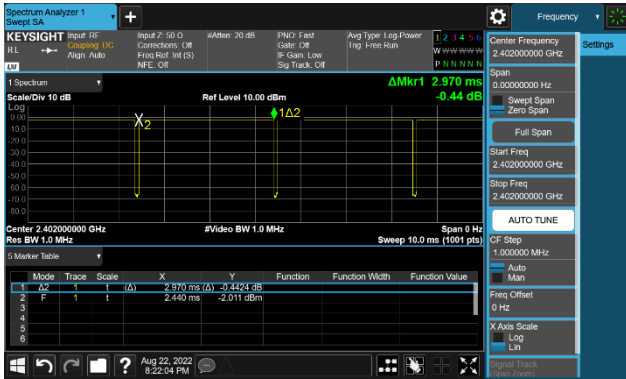
Test Mode	Frequency (MHz)	Time of Occupancy (ms)	Hopping of Numbers	Sweep time (ms)	Duty cycle	Dwell Time (Sec)	Limit (Sec)	Result
Right Ear								
DH5	2402	2.97	16.00	50	0.95	0.38	0.4	Pass
	2441	2.96	16.00	50	0.95	0.38	0.4	Pass
	2480	2.96	16.00	50	0.95	0.38	0.4	Pass
3-DH5	2402	2.98	16.00	50	0.95	0.38	0.4	Pass
	2441	2.98	16.00	50	0.95	0.38	0.4	Pass
	2480	2.98	16.00	50	0.95	0.38	0.4	Pass

Note:

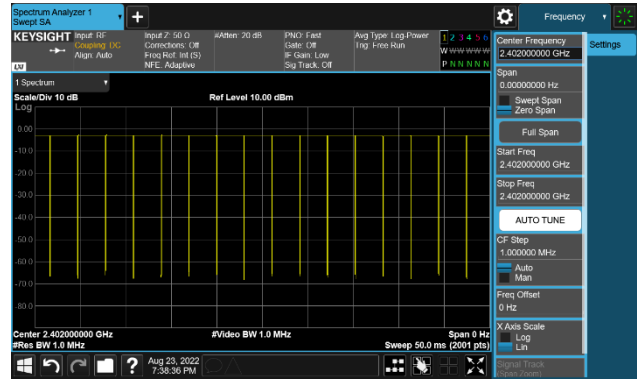
1. Duty cycle = ((Time slot length (ms)*Hopping of Number) / Sweep time (ms)) °
2. Dwell time = ((Duty cycle *(Time Period <0.4*79>)) / (Total Hopping of Number<79>)) °
3. The dwell times of the packet type of DH1, DH3, and DH5 are tested. Only the worst case is shown on the report.

Left Ear

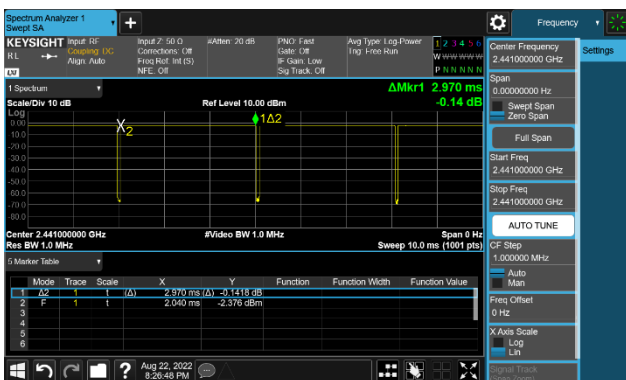
CH00 (2402MHz) DH5(1 Mbps)- Duty Cycle



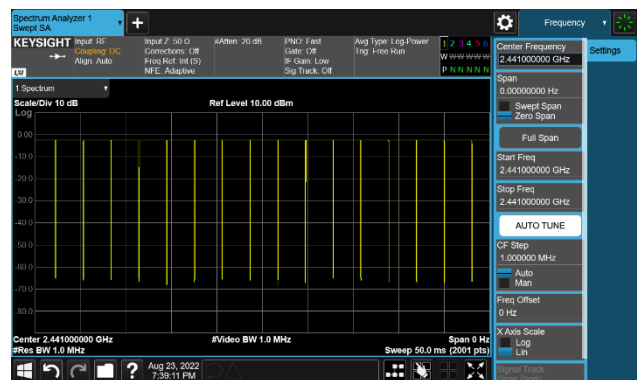
CH00 (2402MHz) DH5(1 Mbps)- Dwell time



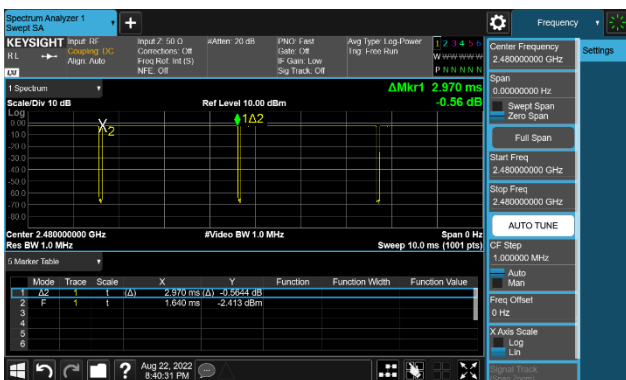
CH39 (2441MHz) DH5(1 Mbps)- Duty Cycle



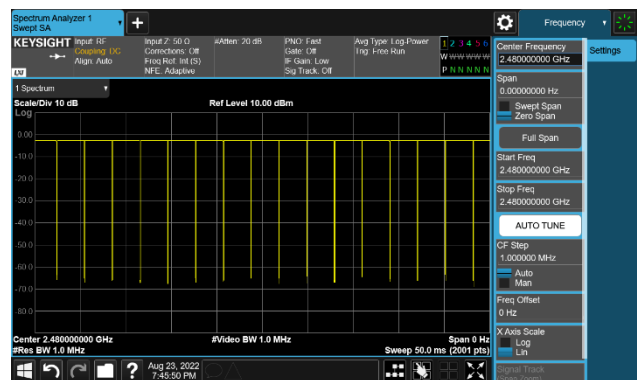
CH39 (2441MHz) DH5(1 Mbps)- Dwell time



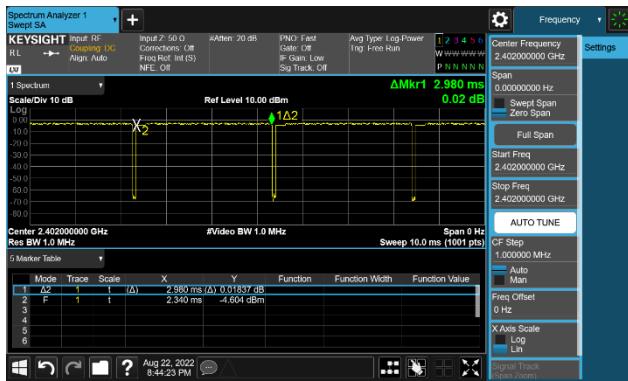
CH78 (2480MHz) DH5(1 Mbps)- Duty Cycle



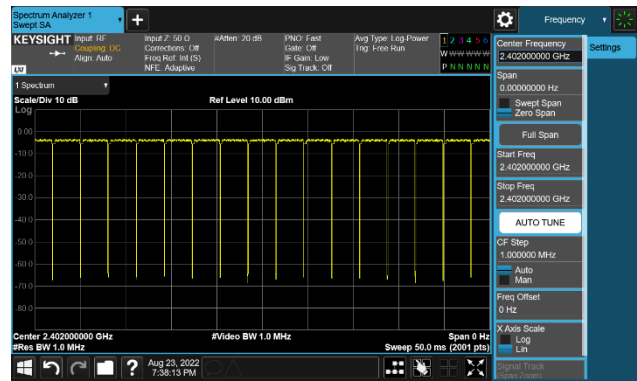
CH78 (2480MHz) DH5(1 Mbps)- Dwell time



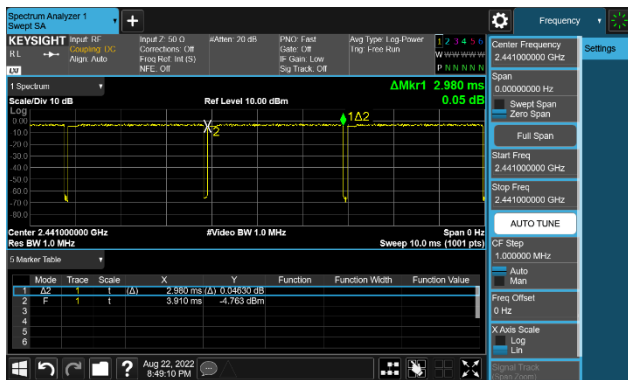
CH00 (2402MHz) 3-DH5(3 Mbps)- Duty Cycle



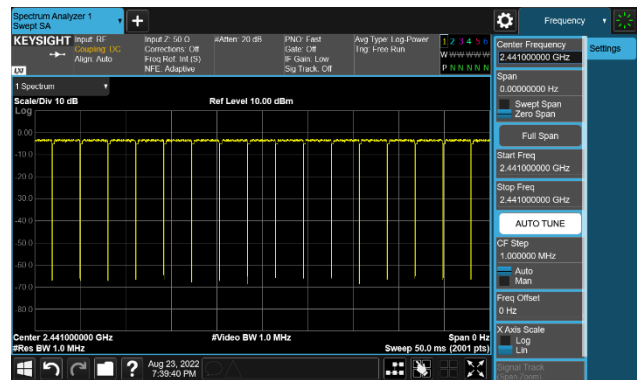
CH00 (2402MHz) 3-DH5(3 Mbps)- Dwell time



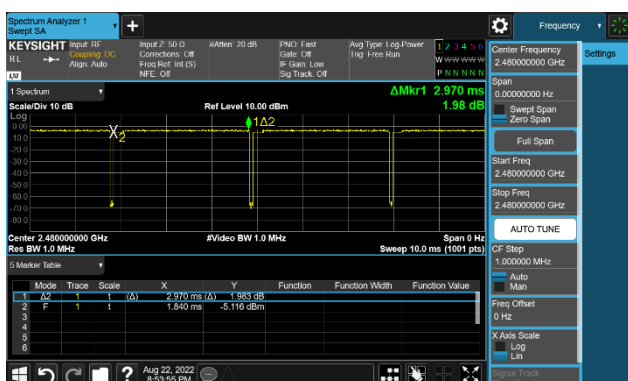
CH39 (2441MHz) 3-DH5(3 Mbps)- Duty Cycle



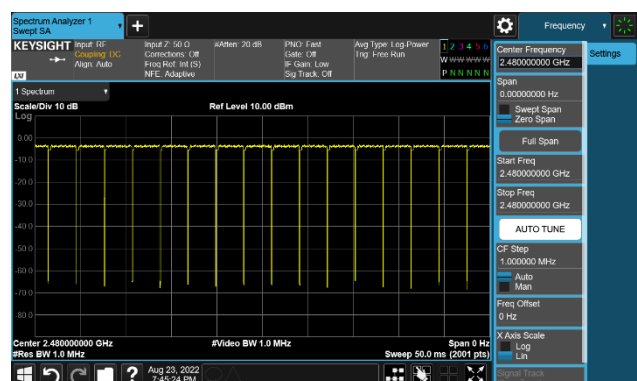
CH39 (2441MHz) 3-DH5(3 Mbps)- Dwell time



CH78 (2480MHz) 3-DH5(3 Mbps)- Duty Cycle

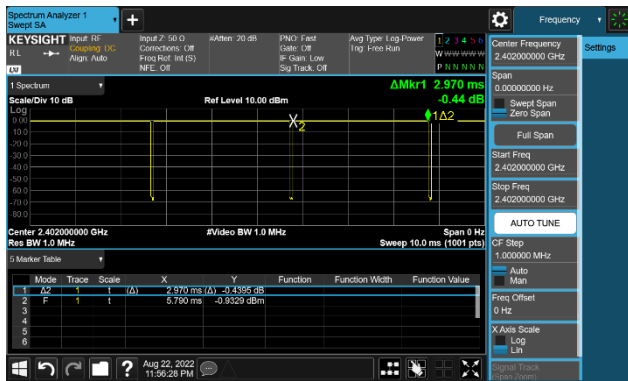


CH78 (2480MHz) 3-DH5(3 Mbps)- Dwell time

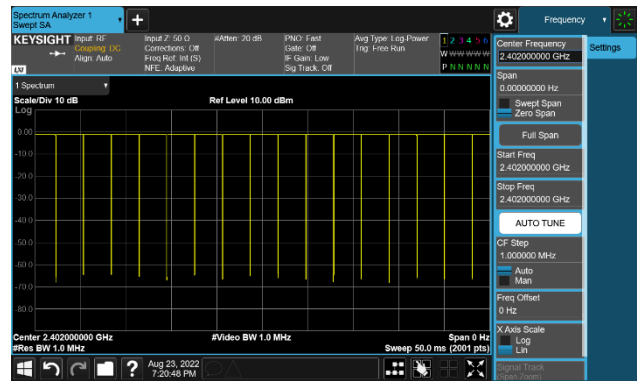


Right Ear

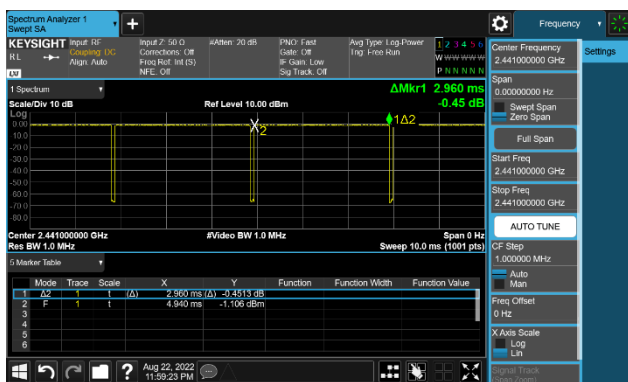
CH00 (2402MHz) DH5(1 Mbps)- Duty Cycle



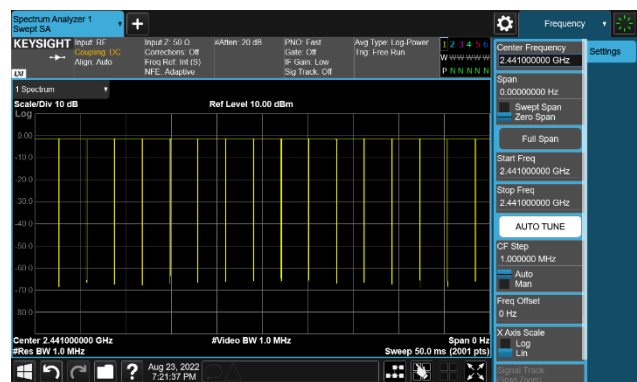
CH00 (2402MHz) DH5(1 Mbps)- Dwell time



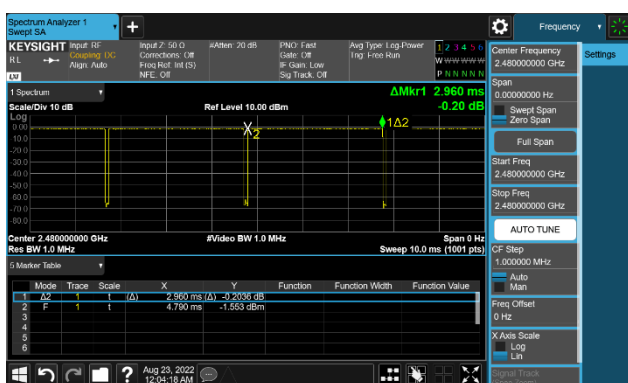
CH39 (2441MHz) DH5(1 Mbps)- Duty Cycle



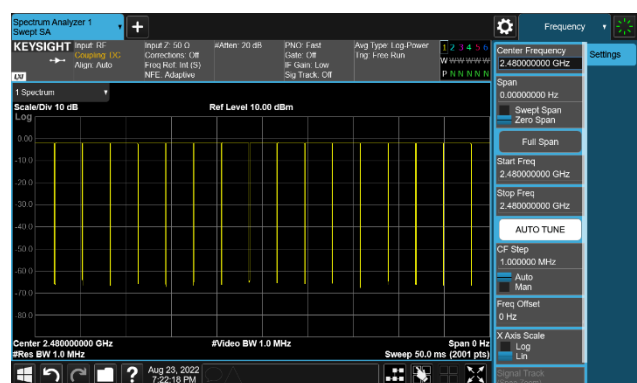
CH39 (2441MHz) DH5(1 Mbps)- Dwell time



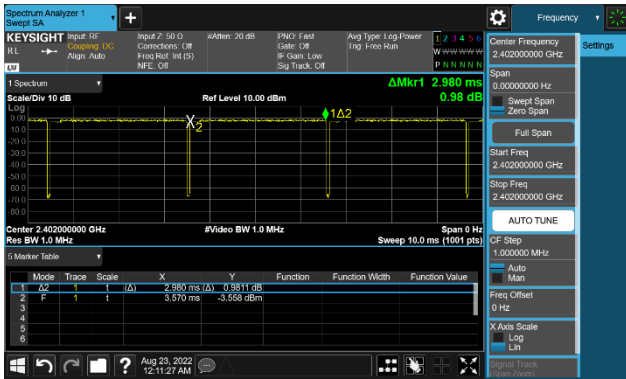
CH78 (2480MHz) DH5(1 Mbps)- Duty Cycle



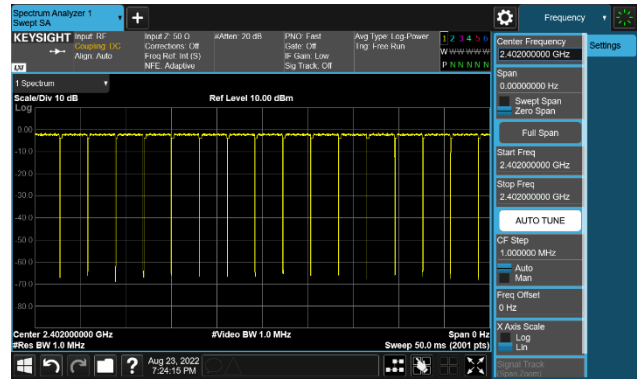
CH78 (2480MHz) DH5(1 Mbps)- Dwell time



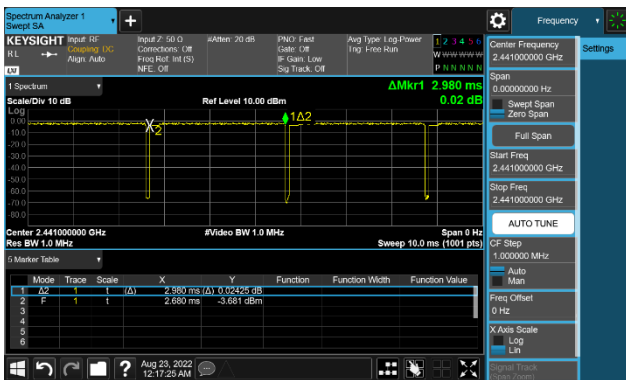
CH00 (2402MHz) 3-DH5(3 Mbps)- Duty Cycle



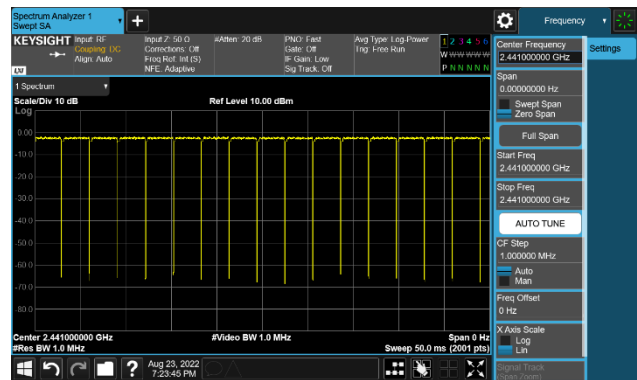
CH00 (2402MHz) 3-DH5(3 Mbps)- Dwell time



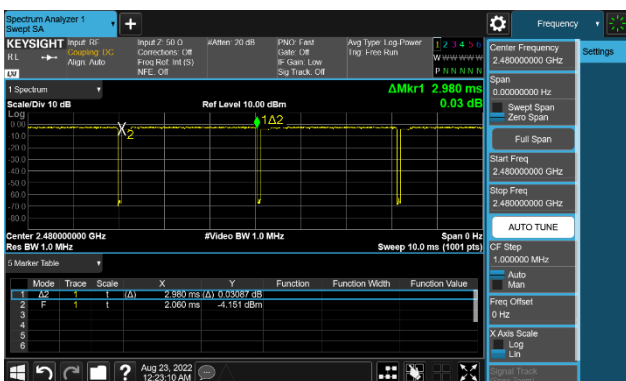
CH39 (2441MHz) 3-DH5(3 Mbps)- Duty Cycle



CH39 (2441MHz) 3-DH5(3 Mbps)- Dwell time



CH78 (2480MHz) 3-DH5(3 Mbps)- Duty Cycle



CH78 (2480MHz) 3-DH5(3 Mbps)- Dwell time

