MEASUREMENT REPORT

FCC ID	:	ACJ-EAH-AZ40M2
APPLICANT	:	Panasonic Corporation of North America
Application Type	:	Certification
Product	:	Digital Wireless Stereo Earphones
Model No.	:	EAH-AZ40M2
Brand Name	:	Technics
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	:	November 7, 2022
Test Date	:	December 27, 2022 ~ January 13, 2023

Tested By : (Fran Chen)

Reviewed By : (Paddy Chen)

Approved By : (Chenz Ker)

ilac-MRA

TAF Testing Laboratory 3261

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
2211TWE903-U1	1.0	Original Report	2023-01-16	

CONTENTS

§2.1033 General Information

Applicant	Panasonic Corporation of North America
Applicant Address	Two Riverfront Plaza, 9th Floor Newark, New Jersey 07102-5490 United States
Manufacturer	Panasonic Entertainment & Communication Co., Ltd.
Manufacturer Address	1-10-12 Yagumo-higashi-machi, Moriguchi City, Osaka 570-0021, Japan
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 ☐ Production ☒ Pre-Production ☐ 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.

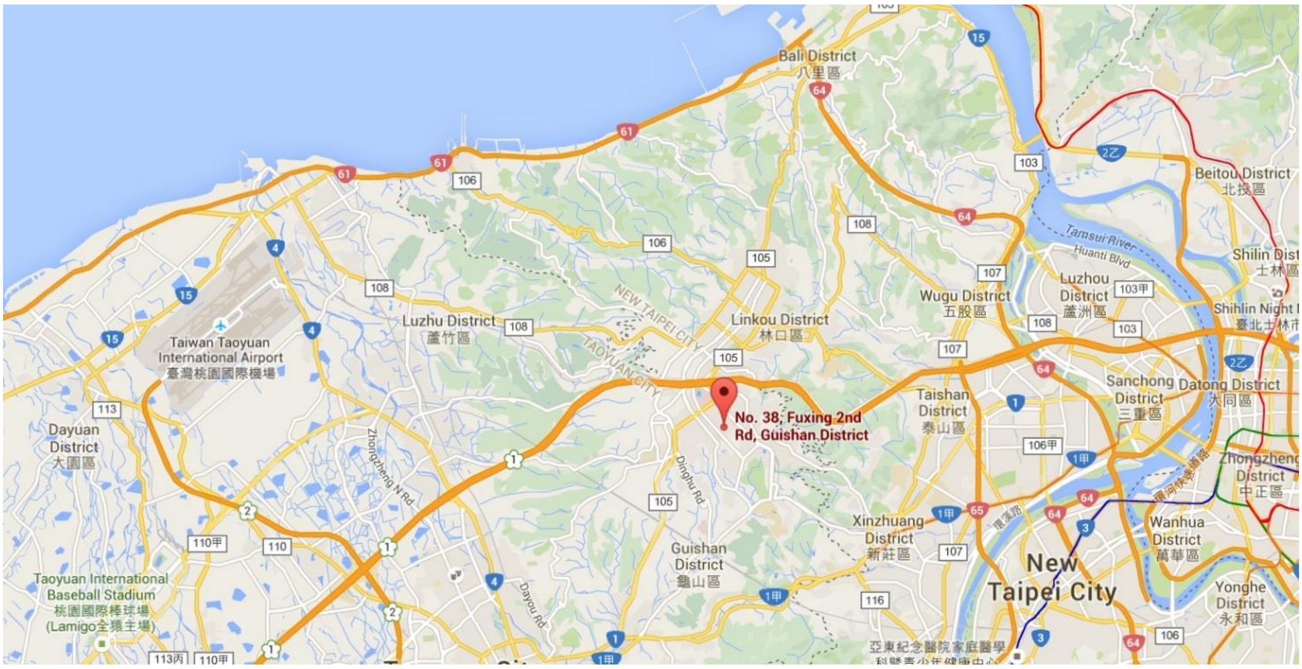
1. INTRODUCTION

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	Digital Wireless Stereo Earphones
Model No.	EAH-AZ40M2
Bluetooth Specification	Dual Mode
Maximum Output Power	Left Ear: 10.77dBm Right Ear: 10.60dBm
Accessory	
USB CABLE TYPE-C	Brand: LUXSHARE PRECISION INDUSTRY CO., LTD. Model No: RDS2204307-001 Length : 0.2m (Shielded)

2.2. Product Specification Subjective to this Standard

Operating Frequency	2402~2480MHz
Type of modulation	FHSS (GFSK, π/4 DQPSK,8DPSK)
Data Rate	1Mbps (GFSK), 2Mbps (π/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 “Airoha Tool Kit V2.9.2.1”.

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

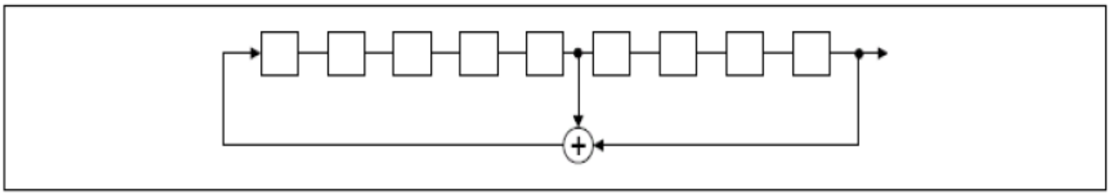
Per 2.1074 & 15.19; Docket 95-19

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

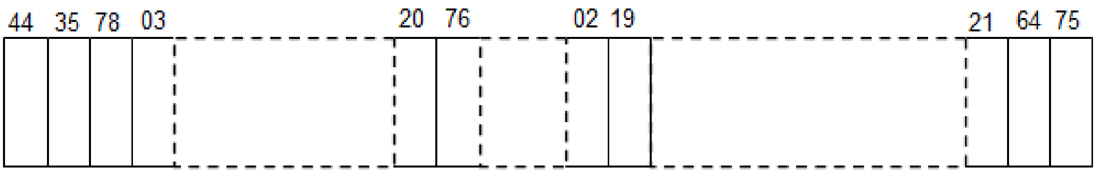
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized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

Note:

1. Output power and channel separation of a Bluetooth device in the different operating modes:

The different operating modes (data-mode, acquisition-mode) of a Bluetooth device has no influence on the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters. Only a different hopping sequence will be used. For this reason the check of these RF parameters in one op-mode is sufficient.

2. Frequency range of a Bluetooth device:

Hereby we declare that the maximum frequency of this device is: 2402 - 2480MHz. This is according to the Bluetooth Core Specification (+ critical errata) for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04-E). Other frequency ranges (e.g. for Spain, France, Japan) which are allowed according the Core Specification are not supported by this device.

3. Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters: Bluetooth units which want to communicate with other units must be organised in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from its BD address which is unique for each Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

4. Example of a hopping sequence in data mode:

Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04

5. Equally average use of frequencies in data mode and behaviour for short transmissions:

The generation of the hopping sequence in connection mode depends essentially on two input values:

a) LAP/UAP of the master of the connection.

b) Internal master clock.

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS.The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronisation with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 µs. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire.LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR- operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behaviour:

The first connection between the two devices is established, a hopping sequence was generated. For transmitting the wanted data the complete hopping sequence was not used. The connection ended.

The second connection will be established. A new hopping sequence is generated. Due to the fact that the

Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 μs). The hopping sequence will always differ from the first one.

6. Receiver input bandwidth and behaviour for repeated single or multiple packets:

The input bandwidth of the receiver is 1 MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multislot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings.Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

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 **Digital Wireless Stereo 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 Digital Wireless Stereo 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.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	Kinwong	Inverted-F	FPC	-5.9dBi

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 – AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2023/12/21
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2023/5/24
Broadband Hornantenna	RFSPIN	DRH18-E	MRTTWA00087	1 year	2023/5/10
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2023/3/29
Broadband Preamplifier	EMC Instruments corporation	EMC118A45SE	MRTTWA00088	1 year	2023/5/9
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2023/3/30
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2023/3/16
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2023/3/9
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2023/10/5
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2023/7/19
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00034	1 year	2023/6/27
Cable	HUBERSUHNER	EMC105-NM-NM-3000	MRTTWE00035	1 year	2023/6/27
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00032	1 year	2023/06/05

Conducted Test Equipment – SR5

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2023/10/5
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2023/7/19
Attenuator	Woken	WATT-218FS-20	MRTTWE00027	1 year	2023/6/15
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)): ± 2.53dB
Radiated Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 3.92dB (Below 30M) Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 4.25dB (30M~1G) Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 4.40dB (1G~18G) Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 4.45dB (18G~40G)
Frequency Error
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±78.4Hz
Conducted Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 0.84dB
Conducted Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):± 2.65 dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±3.3%
Temp. / Humidity
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±0.82°C/ ±3%
DC Voltage
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±0.3%

7. TEST RESULT

7.1. Summary

Product Name: **Digital Wireless Stereo Earphones**

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 ≥ 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	≦ 74dBuV/m(Peak) ≦ 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:

1) 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.
2) 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.
3) 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.
4) 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

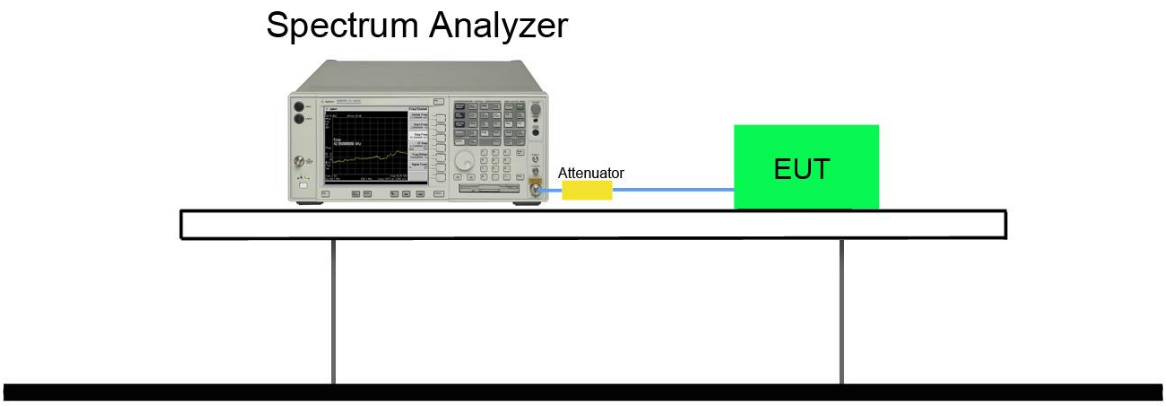
7.2.2. Test Procedure used

ANSI C63.10-2013 - Section 6.9.2

7.2.3. Test Setting

1. Set RBW ≥ 1% of the 20dB bandwidth
2. VBW ≥ 3 × 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



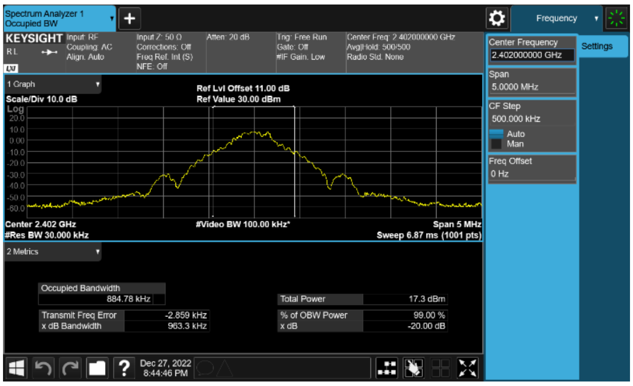
7.2.5. Test Result

Test Mode	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)	Result
Left Ear					
DH5	00	2402	963.30	884.78	Pass
DH5	39	2441	961.60	887.58	Pass
DH5	78	2480	960.30	886.94	Pass
3-DH5	00	2402	1274.00	1165.8	Pass
3-DH5	39	2441	1280.00	1164.9	Pass
3-DH5	78	2480	1276.00	1168.2	Pass

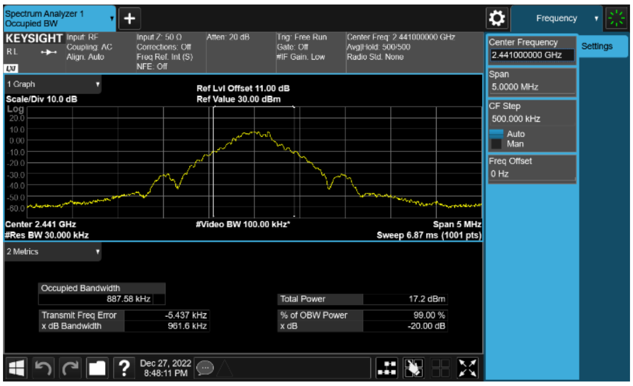
Test Mode	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)	Result
Right Ear					
DH5	00	2402	961.90	883.03	Pass
DH5	39	2441	963.50	886.33	Pass
DH5	78	2480	965.50	886.74	Pass
3-DH5	00	2402	1277.00	1167.7	Pass
3-DH5	39	2441	1276.00	1165.3	Pass
3-DH5	78	2480	1277.00	1167.7	Pass

Left Ear

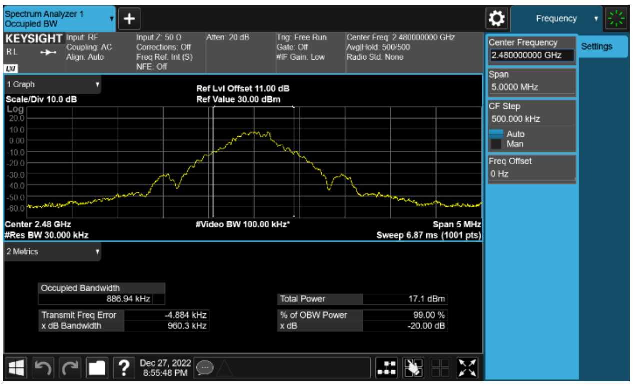
CH00 (2402MHz) DH5(1Mbps)



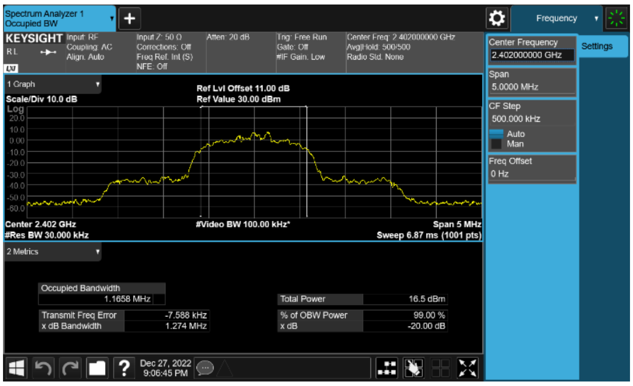
CH39 (2441MHz) DH5(1Mbps)



CH78 (2480MHz) DH5(1Mbps)



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

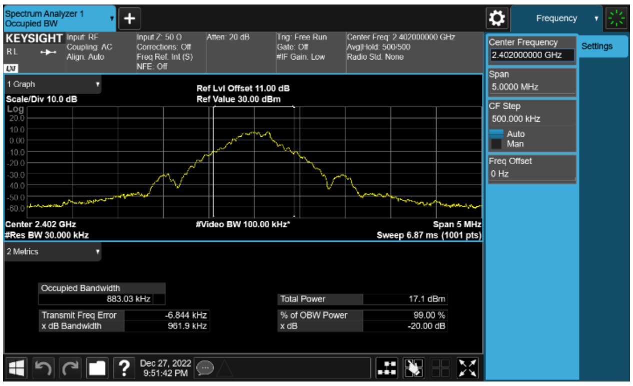


CH39 (2441MHz) 3-DH5(3Mbps)

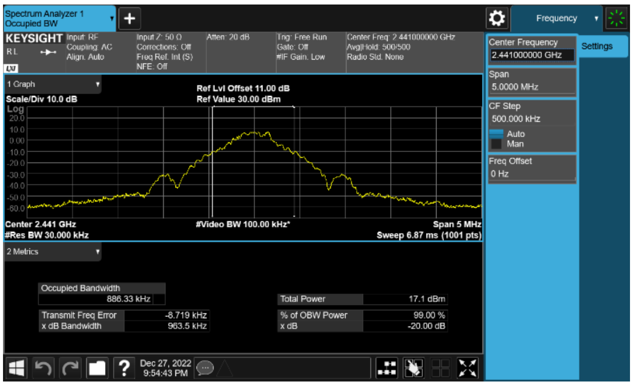
CH78 (2480MHz) 3-DH5(3Mbps)

Right Ear

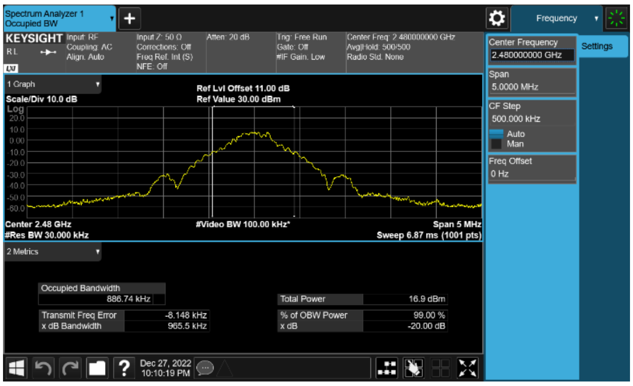
CH00 (2402MHz) DH5(1Mbps)



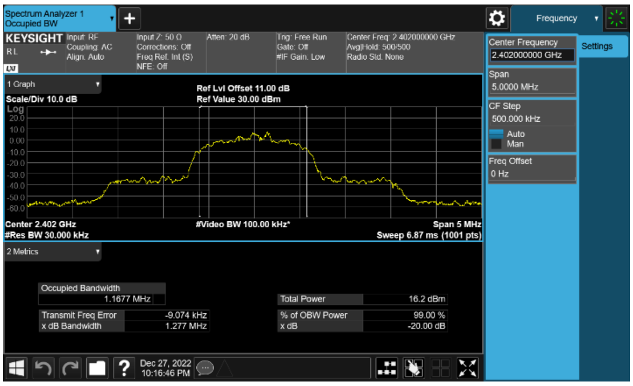
CH39 (2441MHz) DH5(1Mbps)



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.

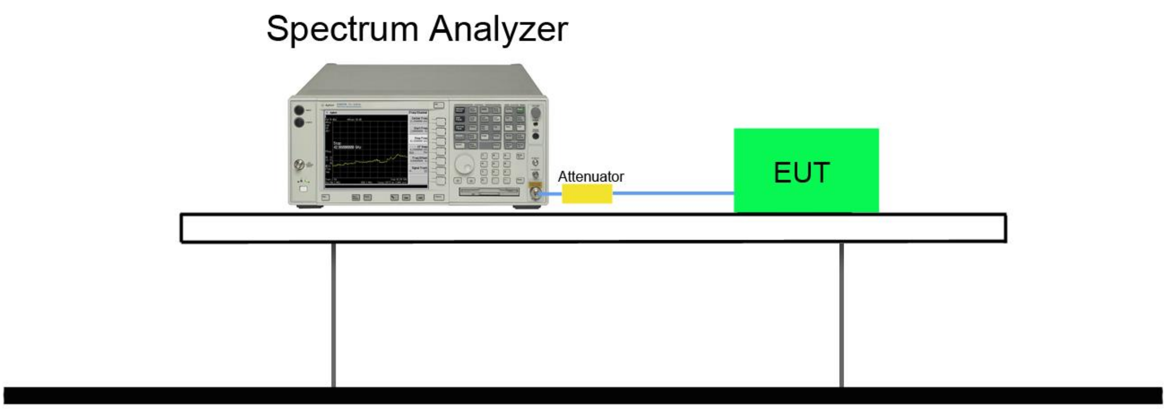
7.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.5

7.3.3. Test Setting

1. Set RBW ≥ the 20 dB bandwidth of the emission being measured.
2. VBW ≥ 3 × 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	10.700	< 30
DH5	39	2441	10.680	< 30
DH5	78	2480	10.550	< 30
2DH5	00	2402	10.640	< 30
2DH5	39	2441	10.660	< 30
2DH5	78	2480	10.520	< 30
3DH5	00	2402	10.730	< 30
3DH5	39	2441	10.770	< 30
3DH5	78	2480	10.630	< 30

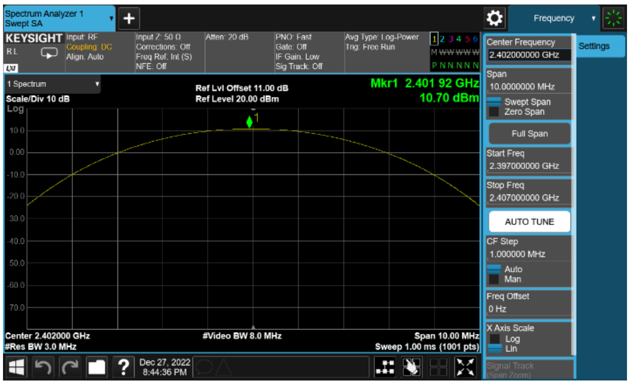
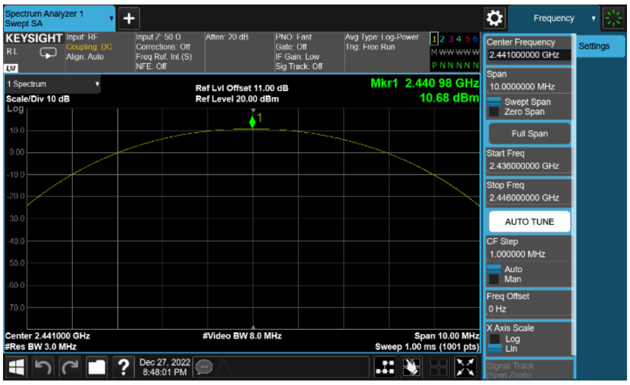
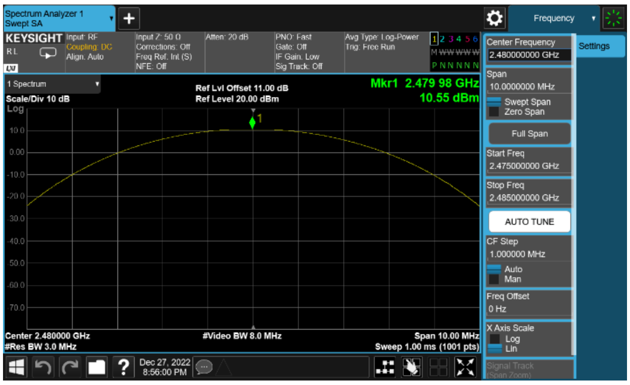
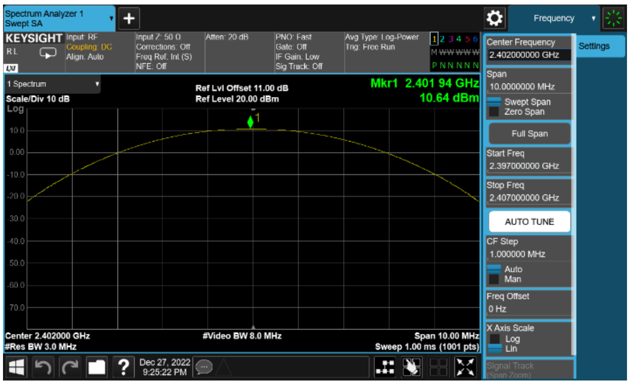
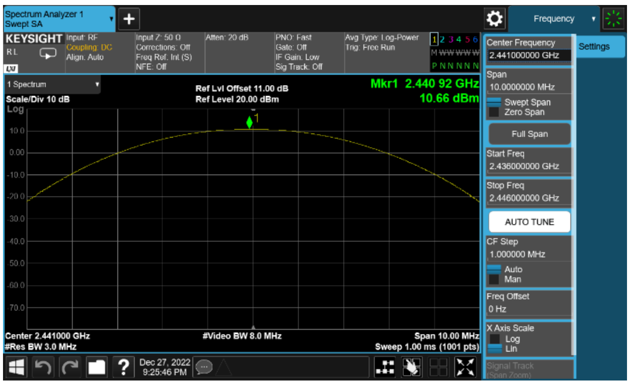
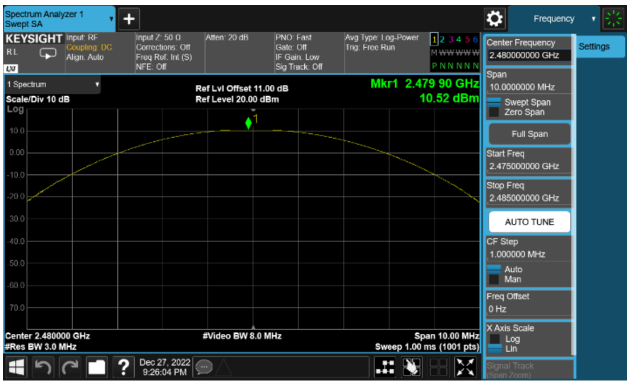
Note:

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.

Test Mode	Channel No.	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)
Right Ear				
DH5	00	2402	10.500	< 30
DH5	39	2441	10.490	< 30
DH5	78	2480	10.340	< 30
2DH5	00	2402	10.450	< 30
2DH5	39	2441	10.490	< 30
2DH5	78	2480	10.360	< 30
3DH5	00	2402	10.570	< 30
3DH5	39	2441	10.600	< 30
3DH5	78	2480	10.440	< 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.

Left Ear	
CH00 (2402MHz) DH5(1Mbps)	**CH39 (2441MHz) DH5(1Mbps)**
	
CH78 (2480MHz) DH5(1Mbps)	**CH00 (2402MHz) 2-DH5(2Mbps)**
	
CH39 (2441MHz) 2-DH5(2Mbps)	**CH78 (2480MHz) 2-DH5(2Mbps)**
	

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<tr><th>CH00 (2402MHz) 3-DH5(3Mbps)</th><th>CH39 (2441MHz) 3-DH5(3Mbps)</th></tr>
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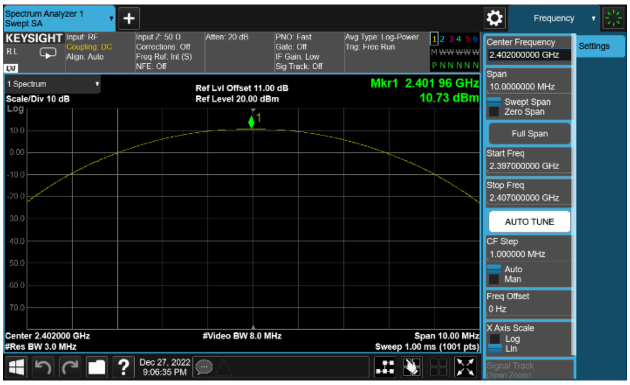

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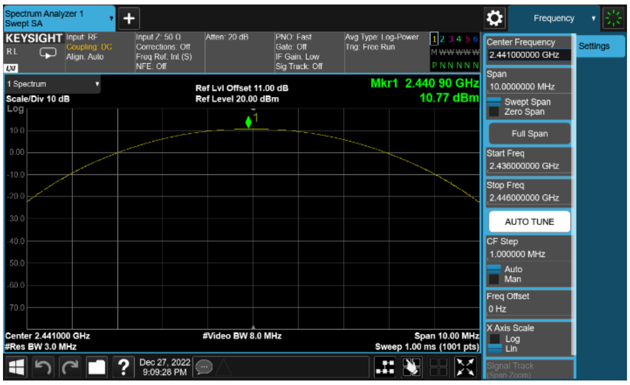

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<tr><th>CH78 (2480MHz) 3-DH5(3Mbps)</th><th></th></tr>
<tr><td>


</td><td></td></tr>
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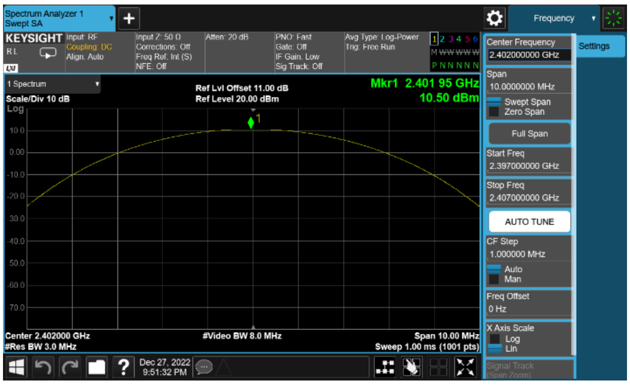
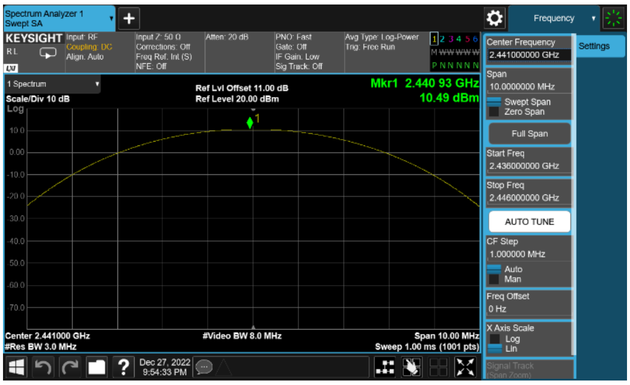
<table>
<tr><th colspan="2">Right Ear</th></tr>
<tr><th>CH00 (2402MHz) DH5(1Mbps)</th><th>CH39 (2441MHz) DH5(1Mbps)</th></tr>
<tr><td>
</td><td>
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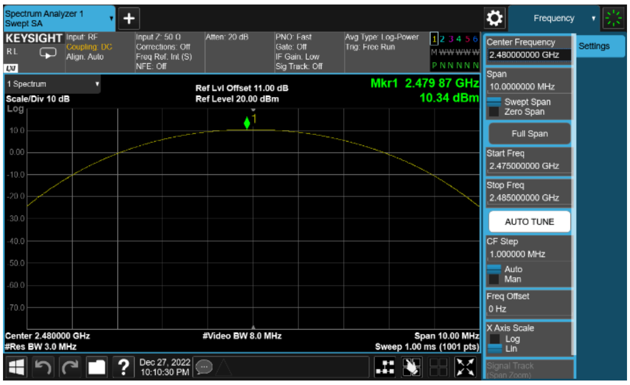
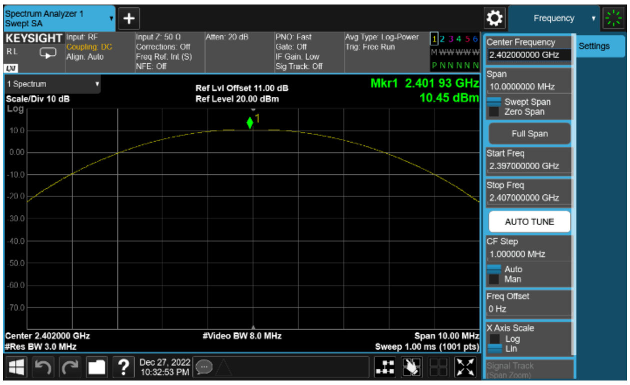
<tr><th>CH78 (2480MHz) DH5(1Mbps)</th><th>CH00 (2402MHz) 2-DH5(2Mbps)</th></tr>
<tr><td>
</td><td>
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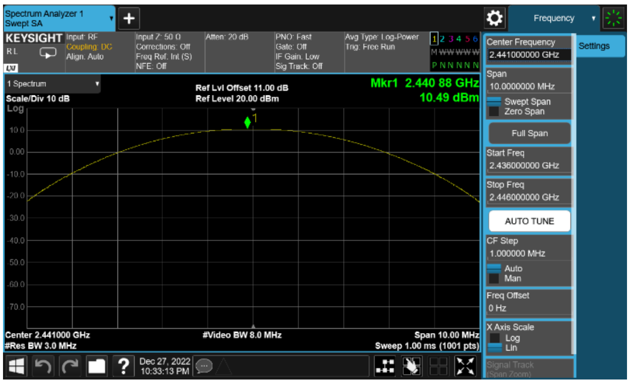
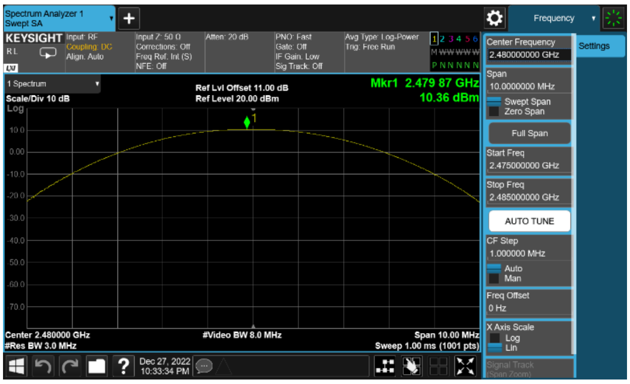
<tr><td>
</td><td>
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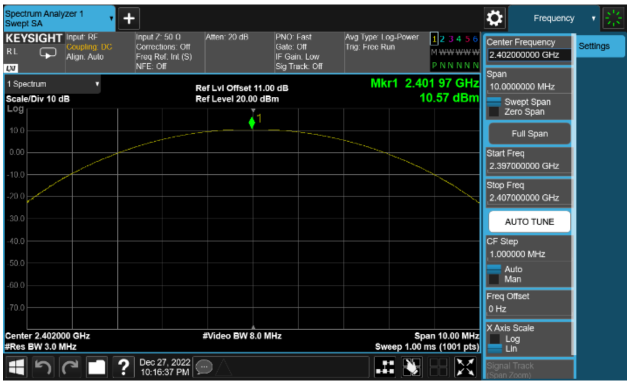
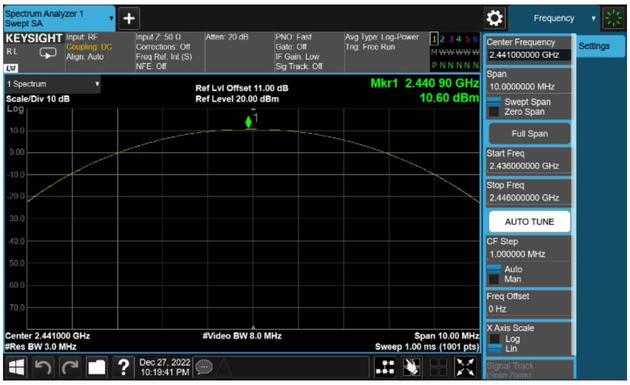
CH00 (2402MHz) 3-DH5(3Mbps)	CH39 (2441MHz) 3-DH5(3Mbps)
	
CH78 (2480MHz) 3-DH5(3Mbps)	
	

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.

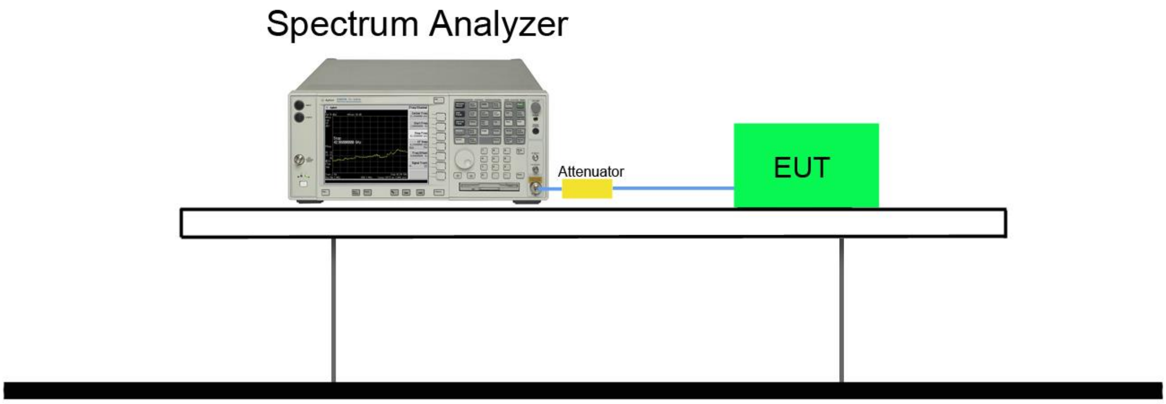
7.4.2. Test Procedure Used

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 ≥ 1 % of the span
3. VBW ≥ 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	642.20	Pass
DH5	39	2441	1.00	25	641.07	Pass
DH5	78	2480	1.00	25	640.20	Pass
3-DH5	00	2402	1.00	25	849.33	Pass
3-DH5	39	2441	1.00	25	853.33	Pass
3-DH5	78	2480	1.00	25	850.67	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.

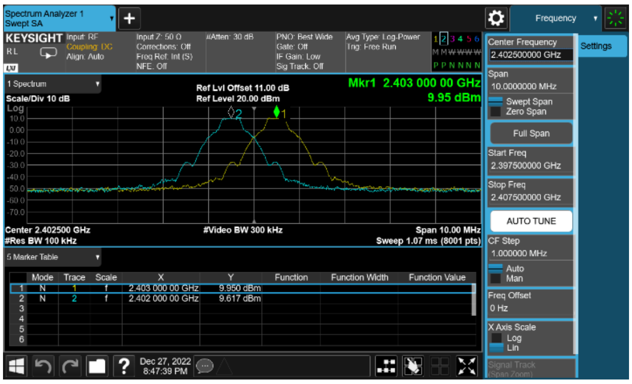
Test Mode	Channel No.	Frequency (MHz)	Channel Separation (MHz)	Limit (kHz)	Limit of 2/3*20dB Bandwidth (kHz)	Result
Right Ear						
DH5	00	2402	1.00	25	641.27	Pass
DH5	39	2441	1.00	25	642.33	Pass
DH5	78	2480	1.00	25	643.67	Pass
3-DH5	00	2402	1.00	25	851.33	Pass
3-DH5	39	2441	1.00	25	850.67	Pass
3-DH5	78	2480	1.00	25	851.33	Pass

Note:

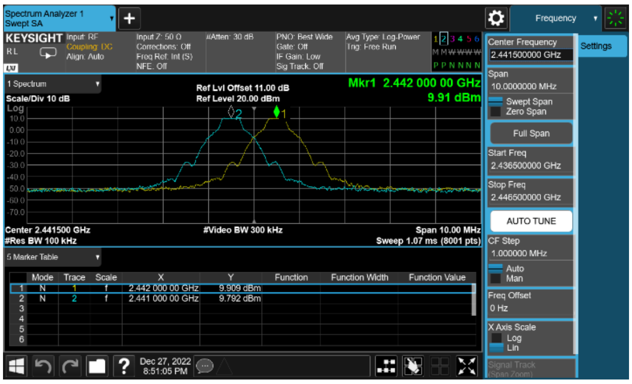
1. The limit is 25 kHz or 2/3 the value of the 20dB bandwidth of the hopping channel, whichever is greater.
2. The 20dB Bandwidth is refer to section 7.2.

Left Ear

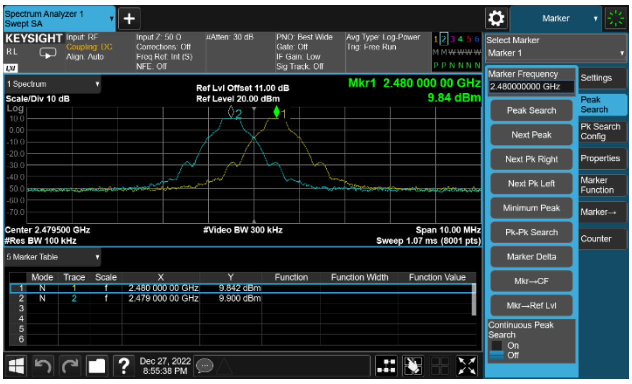
CH00 (2402MHz) DH5(1Mbps)



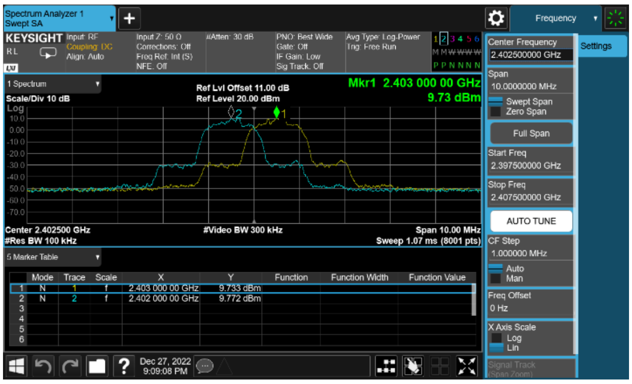
CH39 (2441MHz) DH5(1Mbps)



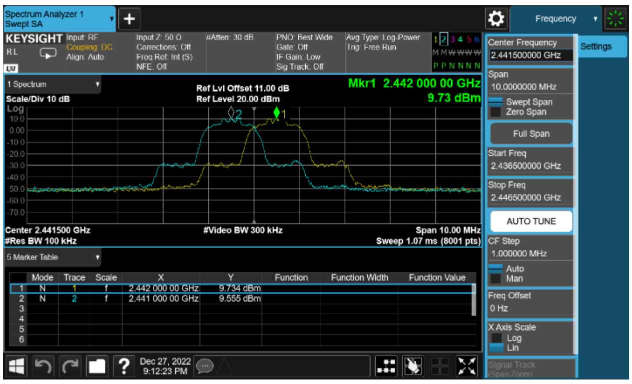
CH78 (2480MHz) DH5(1Mbps)



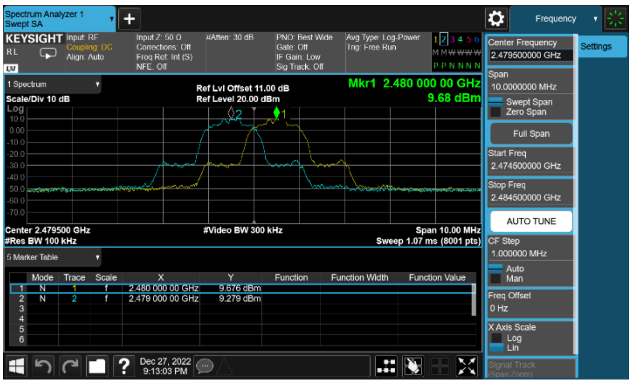
CH00 (2402MHz) 3-DH5(3Mbps)



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

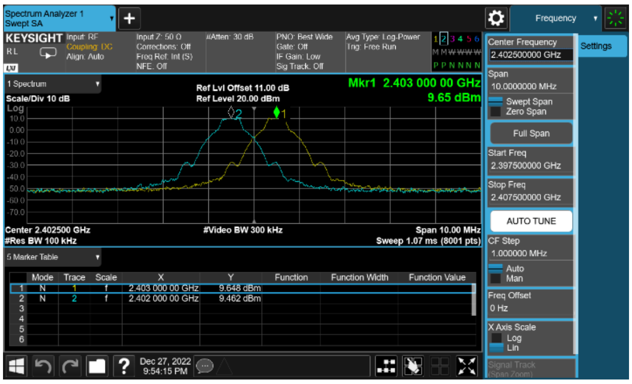


CH78 (2480MHz) 3-DH5(3Mbps)

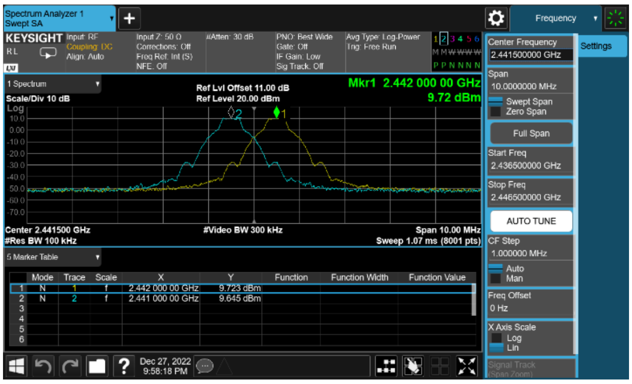


Right Ear

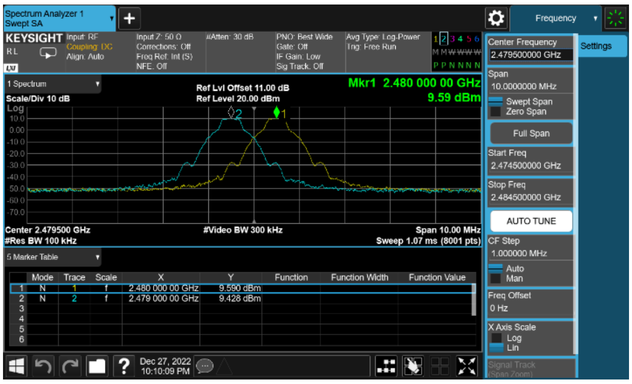
CH00 (2402MHz) DH5(1Mbps)



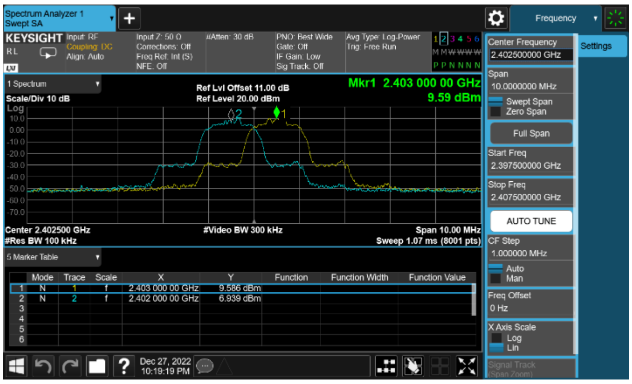
CH39 (2441MHz) DH5(1Mbps)



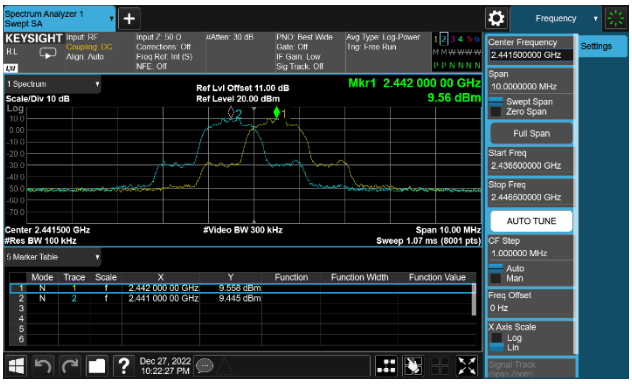
CH78 (2480MHz) DH5(1Mbps)



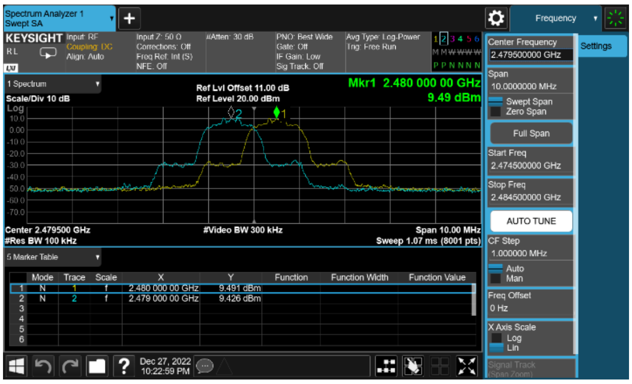
CH00 (2402MHz) 3-DH5(3Mbps)



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.

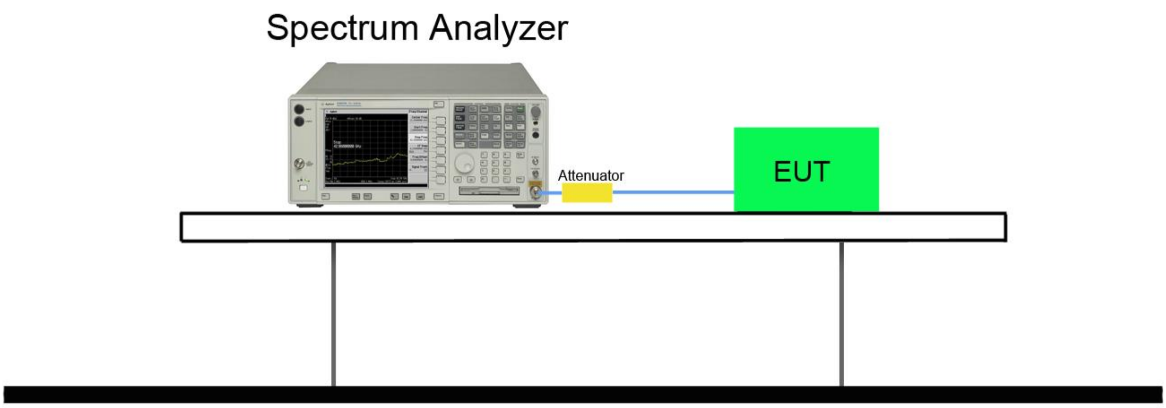
7.5.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.3

7.5.3. Test Settitng

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

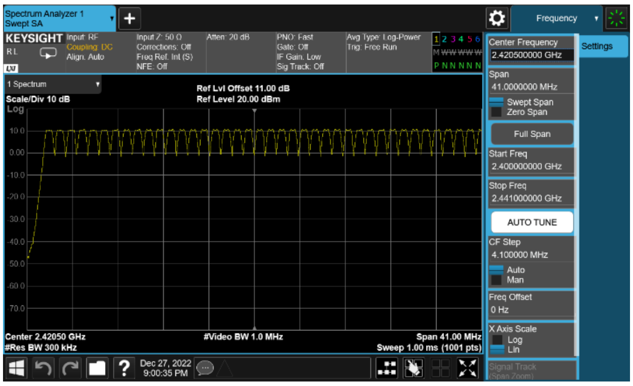
7.5.4. Test Setup



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

<table>
<tr><th colspan="2">Left Ear</th></tr>
<tr><th>DH5(1Mbps)-2400 MHz ~2441MHz</th><th>DH5(1Mbps)-2441 MHz ~2483.5MHz</th></tr>
<tr><td>


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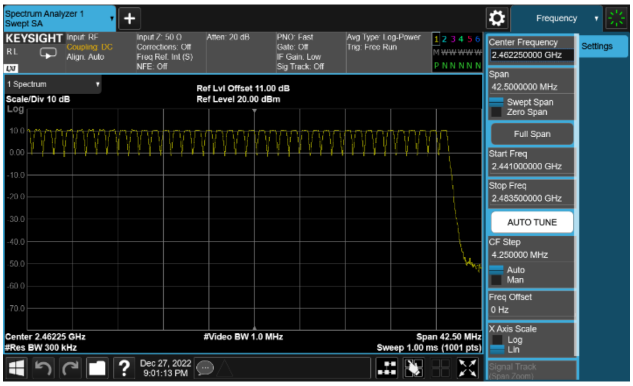

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<tr><th>3-DH5(3Mbps)- 2400 MHz ~2441MHz</th><th>3-DH5(3Mbps)- 2441 MHz ~2483.5MHz</th></tr>
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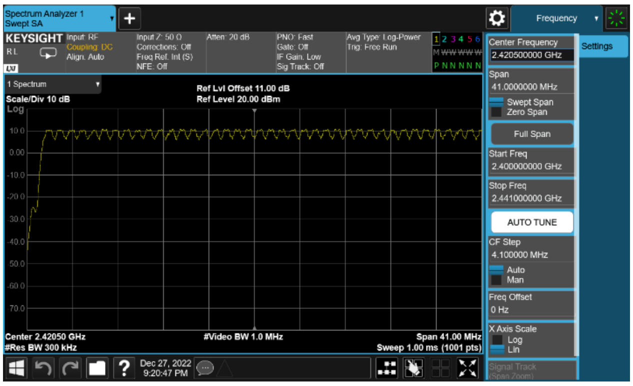

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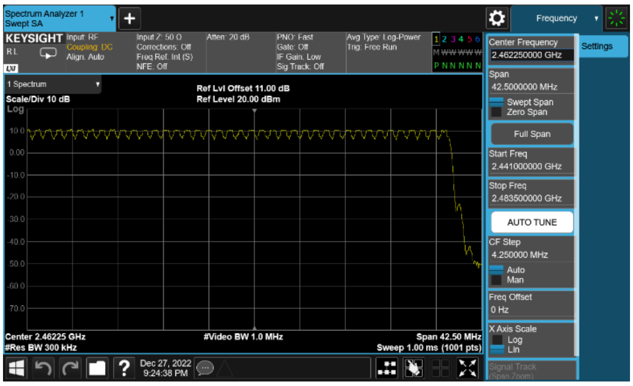

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<table>
<tr><th colspan="2">Right Ear</th></tr>
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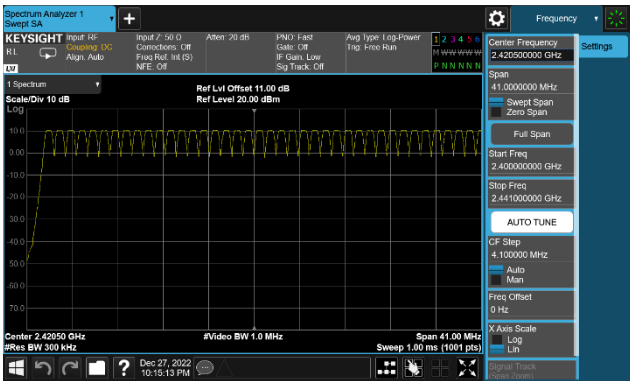
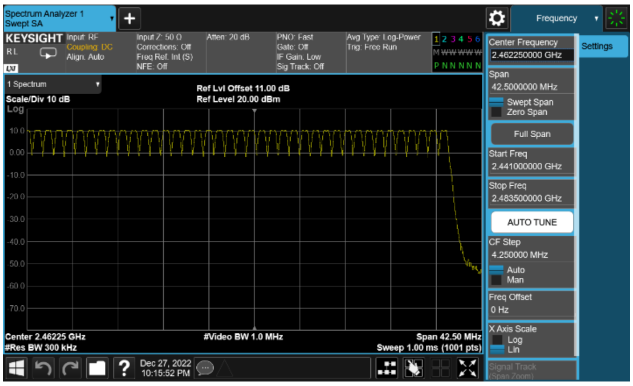
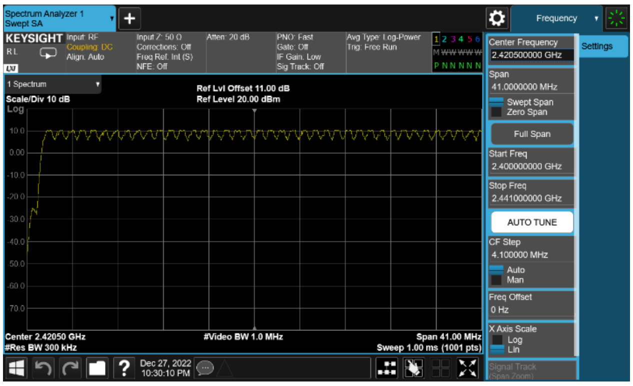
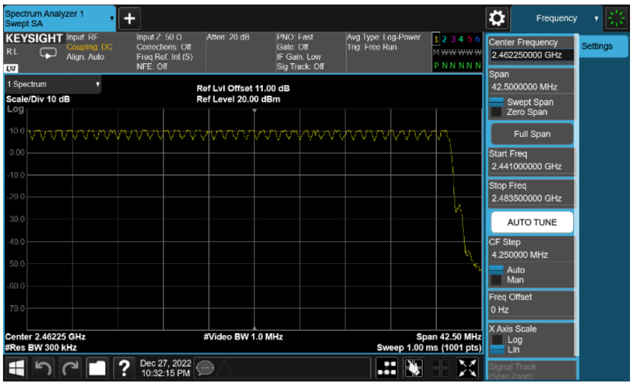
<tr><td>
</td><td>
</td></tr>
<tr><th>3-DH5(3Mbps)- 2400 MHz ~2441MHz</th><th>3-DH5(3Mbps)- 2441 MHz ~2483.5MHz</th></tr>
<tr><td>
</td><td>
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7.6. Time of Occupancy Measurement

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

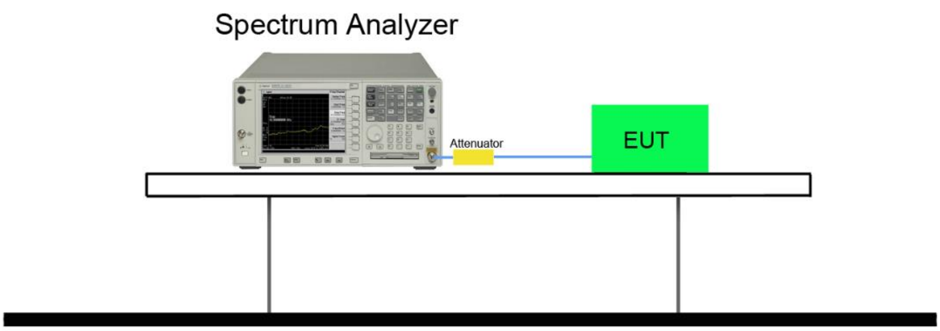
ANSI C63.10-2013 - Section 7.8.4

7.6.3. Test Settitng

1. Span = zero span, centered on a hopping channel.
2. RBW = 1MHz
3. VBW ≥ 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	2.869	13.00	50	0.75	0.30	0.4	Pass
	2441	2.873	13.00	50	0.75	0.30	0.4	Pass
	2480	2.865	13.00	50	0.74	0.30	0.4	Pass
3-DH5	2402	2.869	13.00	50	0.75	0.30	0.4	Pass
	2441	2.856	13.00	50	0.74	0.30	0.4	Pass
	2480	2.873	13.00	50	0.75	0.30	0.4	Pass

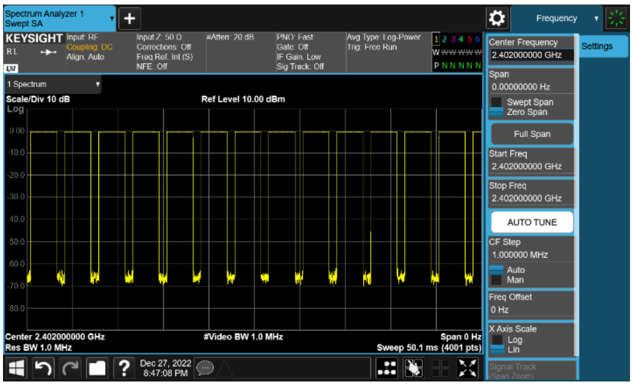
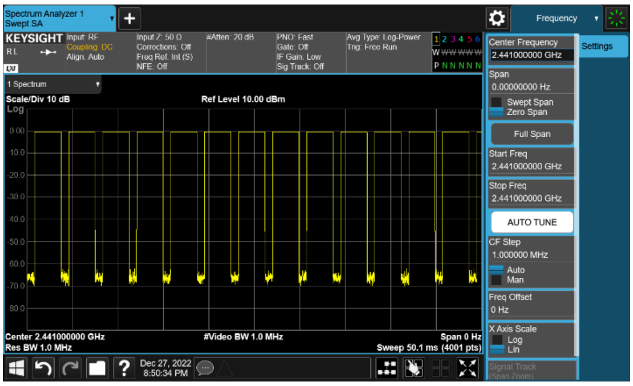
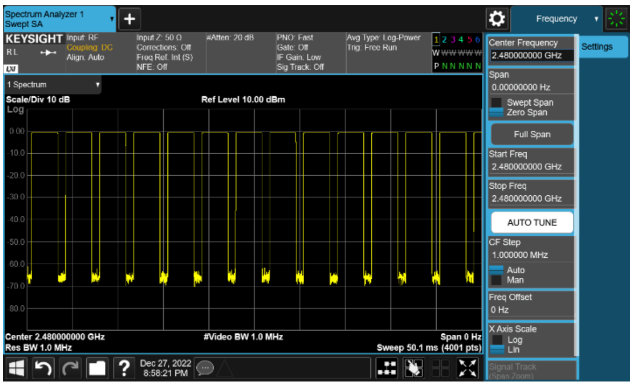
Note:

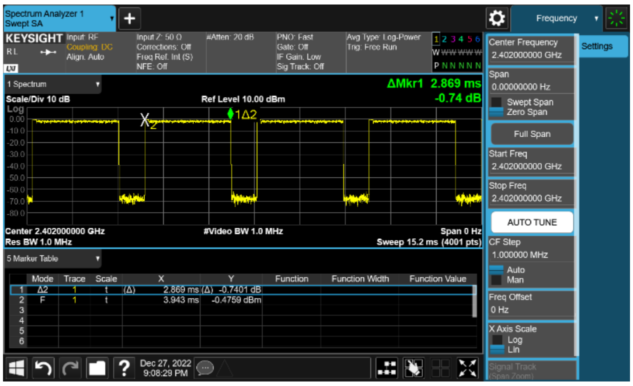
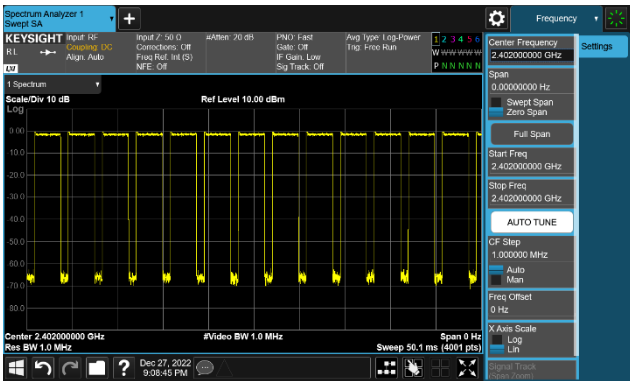
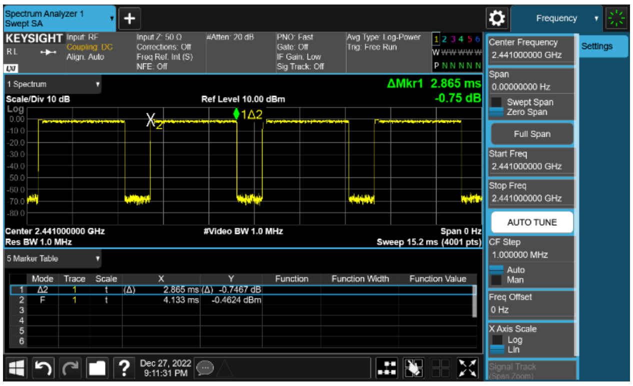
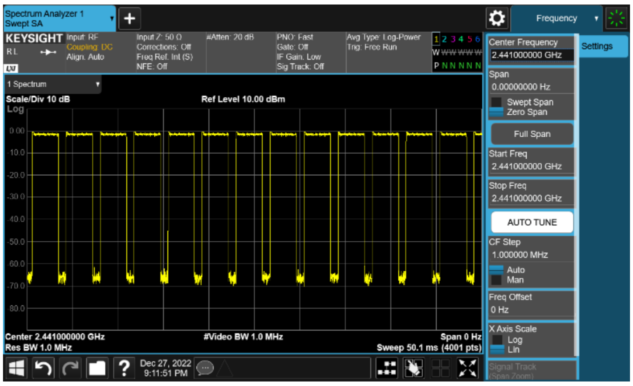
1. Duty cycle = ((Time slot length (ms)*Hopping of Number) / Sweep time (ms) 。
2. Dwell time = ((Duty cycle *(Time Period <0.4*79>)) / (Total Hopping of Number<79>)) 。
3. The dwell times of the packet type of DH1, DH3, and DH5 are tested. Only the worst case is shown on the report.
4. This product has the mode of BT AFH, which was considered during testing.800/20/X(X = 2 of DH1, X = 4 of DH3 or X = 6 of DH5) with 20, 10 or 6.67 hops per second in a channel, and then multiply 0.4*20 (20 # of hopping). But this mode is not the worst case mode as duration of the packet is same, and this report only shows the worst case mode.

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	2.877	13.00	50	0.75	0.30	0.4	Pass
	2441	2.869	13.00	50	0.75	0.30	0.4	Pass
	2480	2.877	13.00	50	0.75	0.30	0.4	Pass
3-DH5	2402	2.869	13.00	50	0.75	0.30	0.4	Pass
	2441	2.873	13.00	50	0.75	0.30	0.4	Pass
	2480	2.873	13.00	50	0.75	0.30	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.
4. This product has the mode of BT AFH, which was considered during testing.800/20/X(X = 2 of DH1, X = 4 of DH3 or X = 6 of DH5) with 20, 10 or 6.67 hops per second in a channel, and then multiply 0.4*20 (20 # of hopping). But this mode is not the worst case mode as duration of the packet is same, and this report only shows the worst case mode.

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**
	

Left Ear	
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