



MEASUREMENT REPORT

FCC PART 15.247 / Bluetooth

FCC ID: Z9G-EDF135

Applicant: Edifier International Limited

Application Type: Certification

Product: True Wireless Earbuds with Active Noise Cancellation

Model No.: EDF201005

Brand Name: EDIFIER

FCC Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)

FCC Rule Part(s): Part 15 Subpart C (Section 15.247)

Test Procedure(s): ANSI C63.10-2013

Test Date: February 23~ March 02, 2021

Reviewed By:

Jame Yuan

Jame Yuan

Approved By:

Robin Wu

Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. 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 (Shenzhen) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2102RSU037-U2	Rev. 01	Initial Report	03-07-2021	Valid

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1. General Information

1.1. Applicant

Edifier International Limited

P.O. Box 6264 General Post Office Hong Kong

1.2. Manufacturer

Beijing Edifier Technology Co., Ltd.

8th floor, ZuoAn Building, NO.68 BeiSiHuanXiLu, Haidian District, Beijing 100080, CHINA

1.3. Test Facility

☐	Test Site – MRT Suzhou Laboratory
	Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
	Laboratory Location (Suzhou - SIP) 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China
	Laboratory Accreditations
	A2LA: 3628.01 FCC: CN1166 VCCI: R-20025, G-20034, C-20020, T-20020
☒	Test Site – MRT Shenzhen Laboratory
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China
	Laboratory Accreditations
	A2LA: 3628.02 FCC: CN1284
☐	Test Site – MRT Taiwan Laboratory
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
	Laboratory Accreditations
	TAF: L3261-190725 FCC: 291082, TW3261

2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	True Wireless Earbuds with Active Noise Cancellation
Model No.	EDF201005
Test Device No.	20210204Sample#03 (Radiated Sample) 20210222Sample#01 (Conducted Sample)
Operating Temp.	0 ~ 45°C
Rated Input	5VDC 60mA (Earbuds) 5VDC 1A (Case)
Bluetooth Version	v5.0 dual mode

2.2. Product Specification Subjective to this Report

Operating Frequency	2402~2480MHz
Channel Number	79
Type of modulation	GFSK, Pi/4 DQPSK, 8DPSK
Data Rate	1Mbps (GFSK), 2Mbps (Pi/4 DQPSK), 3Mbps (8DPSK)
Antenna Type	LDS Antenna
Antenna Gain	Left Earbud: 0.74dBi Right Earbud: 1.38dBi

Note: For other features of this EUT, test report will be issued separately.

- 15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

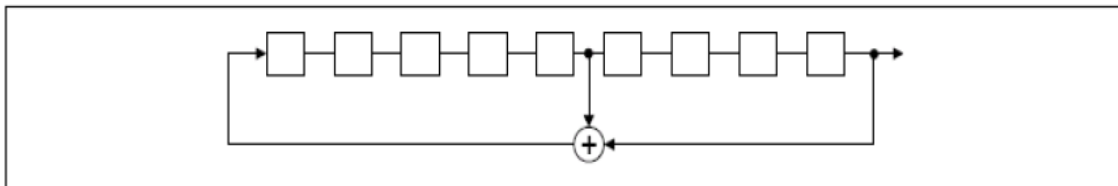
2.3. Working Frequencies

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	--	--	--	--

2.4. Pseudorandom Frequency Hopping Sequence

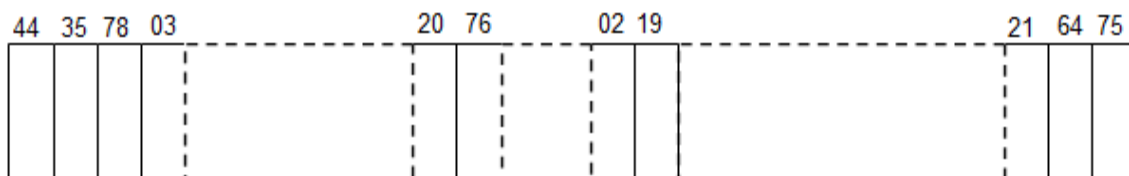
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES, i.e. the shift register is initialized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

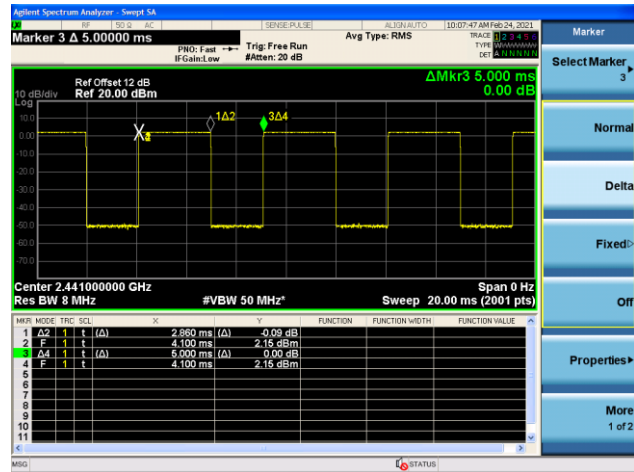
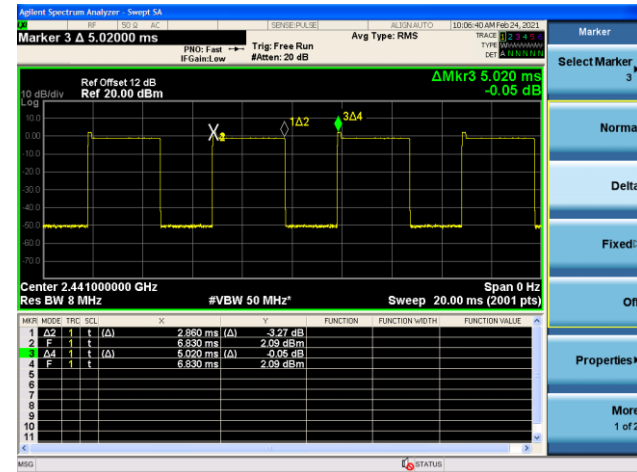
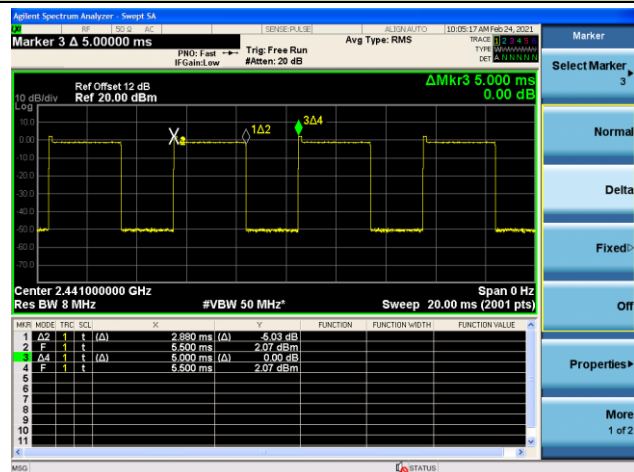


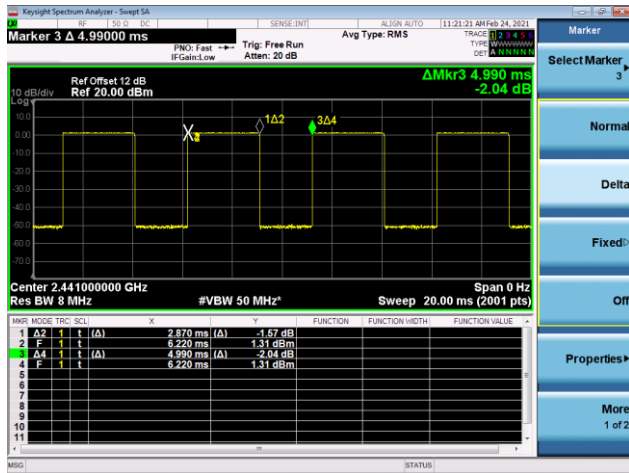
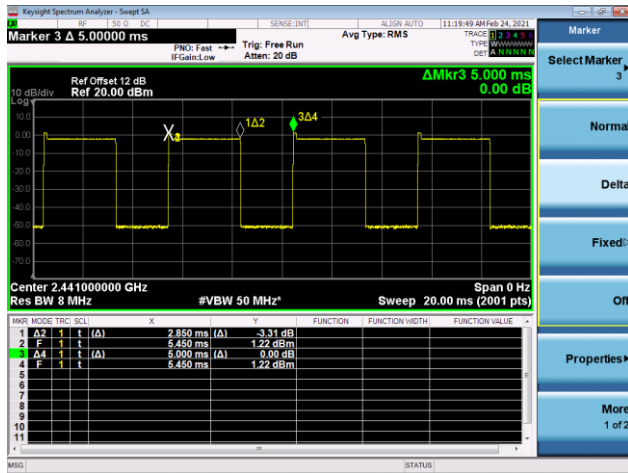
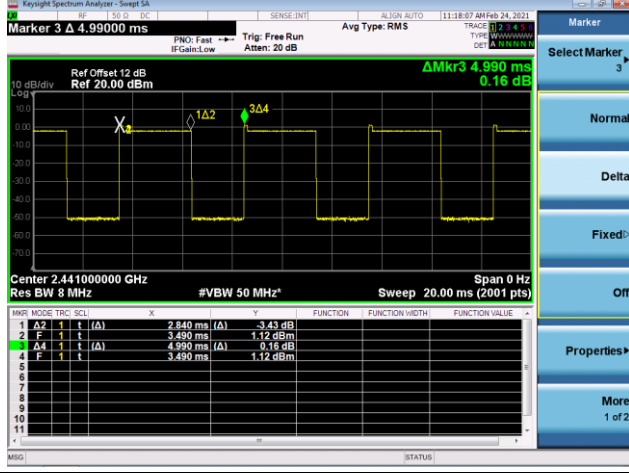
Each frequency used equally on the average by each transmitter.

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.

2.5. Duty Cycle

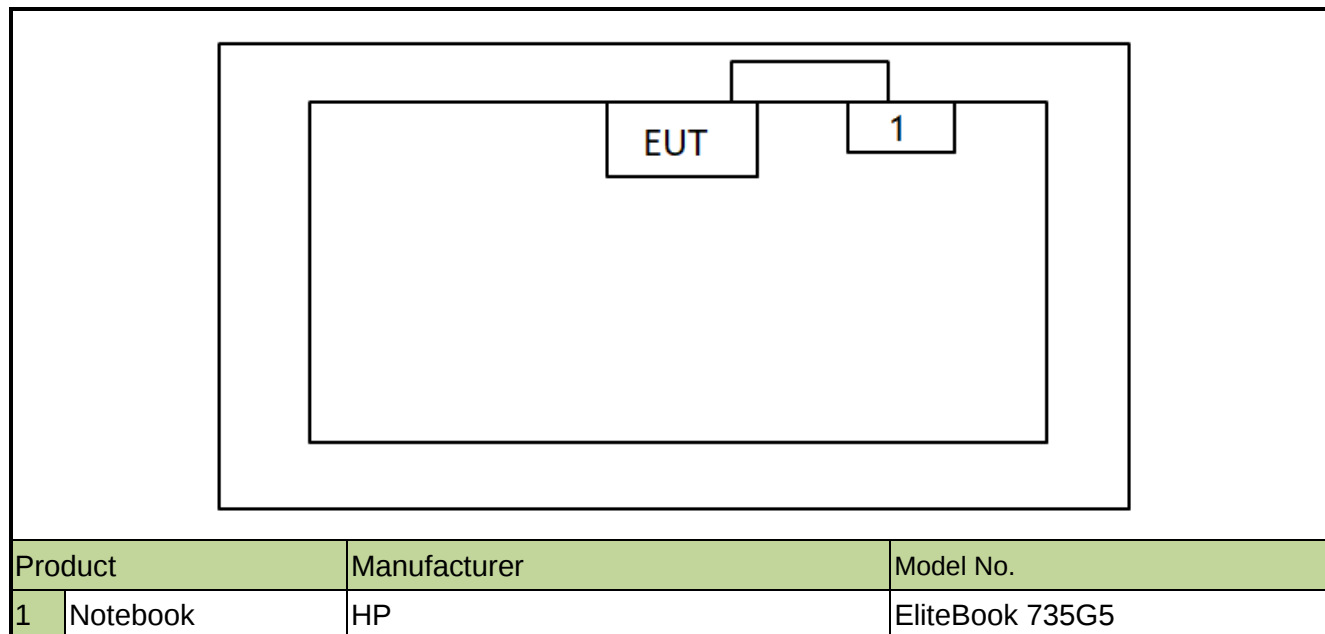
The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
Left Earbud	
DH5	57.20%
2DH5	56.97%
3DH5	57.60%
Test Plot (T = Transmission Duration)	
DH5 (T = 2.860ms)	2DH5 (T = 2.860ms)
	
3DH5 (T = 2.880ms)	
	

Test Mode	Duty Cycle
Right Earbud	
DH5	57.00%
2DH5	56.91%
3DH5	57.52%
Test Plot (T = Transmission Duration)	
DH5 (T = 2.870ms)	2DH5 (T = 2.850ms)
	
3DH5 (T = 2.840ms)	
	

2.6. Description of Test Configuration

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



Note 1: The test utility software used during testing was “BQB”.

Note 2: Detail power setting refer to operation description.

Note 3: This adapter is provided by test lab, the EUT will be sold without adapter.

2.7. EMI Suppression Device(s) / Modifications

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

2.8. Test Environment Condition

Ambient Temperature	15 ~ 35 °C
Relative Humidity	20 ~ 75 %RH

3. 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 device is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

4. TEST EQUIPMENT CALIBRATION DATE

Conducted Emission (NS-SR2)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESL3	MRTSUE06576	1 year	2021/07/09
ENV216-LV-NETZNACHB	R&S	ENV216	MRTSUE06577	1 year	2021/07/09
ENV216-LV-NETZNACHB	R&S	ENV216	MRTSUE06578	1 year	2021/07/09
Temperature/Humidity Meter	deli	NO.8813	MRTSUE06587	1 year	2021/07/08
Shielding Anechoic Chamber	BOOMWAVE	SR2	MRTSUE06551	5 year	2024/06/04

Radiated Emission (NS-AC1)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cal. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06575	1 year	2021/07/09
EXA Signal Analyzer	Keysight	N9010A	MRTSUE06195	1 year	2021/04/14
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2021/11/08
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06292	1 year	2021/10/24
Broad-Band Horn Antenna	Schwarzbeck	9120D	MRTSUE06572	1 year	2021/07/03
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06573	1 year	2021/07/03
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2021/06/11
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06574	1 year	2021/07/13
Anechoic Chamber	BOOMWAVE	AC1	MRTSUE06496	1 year	2021/07/25
Temperature/Humidity Meter	deli	NO.8813	MRTSUE06588	1 year	2021/07/08

Conducted Test Equipment (NS-TR2)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
electronic hygrothermograph	DELI	No.8813	MRTSUE06783	1 year	2021/05/13
USB wideband power sensor	Keysight	U2021XA	MRTSUE06581	1 year	2021/08/20
10dB Attenuator	MVE	10dB	N/A	1 year	2021/08/20
EXA Signal Analyzer	Keysight	N9010A	MRTSUE06195	1 year	2021/04/14

Software	Version	Function
EMI Software	V3	EMI Test Software

5. 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 $k = 2$.

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 0.78dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 1.13dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 0.28%

6. TEST RESULT

6.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(1)	20dB Bandwidth	N/A	Conducted	Pass	Section 6.2
15.247(b)(1)	Peak Transmitter Output Power	<1 Watt if > 75 non-overlapping channels used		Pass	Section 6.3
15.24207(a)(1)	Channel Separation	> 2/3 of 20 dB BW for systems with Output Power < 125mW		Pass	Section 6.4
15.247(a)(1)(iii)	Number of Channels	> 15 Channels		Pass	Section 6.5
15.247(a)(1)(iii)	Time of Occupancy	< 0.4 sec in 31.6 sec period		Pass	Section 6.6
15.247(d)	Band Edge / Out-of-Band Emissions	Conducted $\geq$ 20dBc		Pass	Section 6.7 Section 6.8
15.205, 15.209	General Field Strength (Restricted Bands and Radiated Emission)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 6.9 Section 6.10
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 6.11

Notes:

- 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 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.
- N/A means not applicable.

6.2. 20dB Bandwidth Measurement

6.2.1. Test Limit

N/A

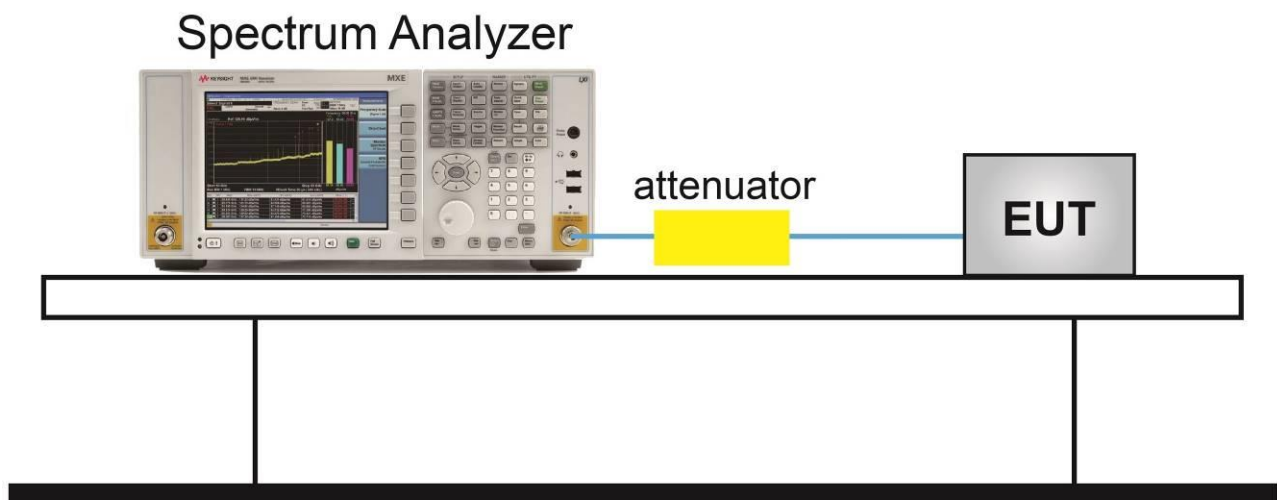
6.2.2. Test Procedure Used

ANSI C63.10-2013 - Section 6.9.2

6.2.3. Test Setting

1. Set RBW $\geq$ 1% to 5% of the OBW
2. VBW = Approximately three times RBW
3. Span = Approximately 2 to 5 times the OBW, 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.

6.2.4. Test Setup



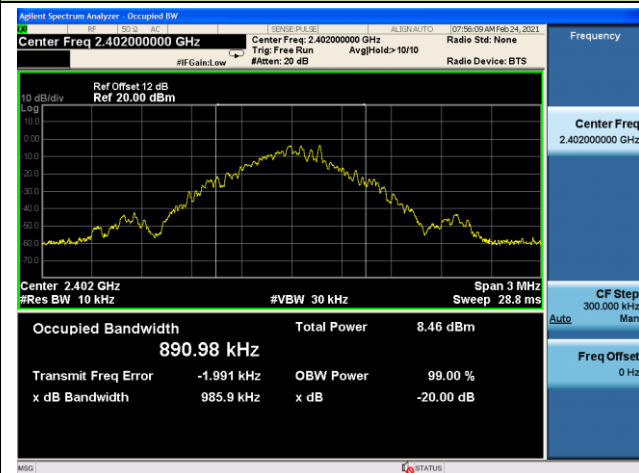
6.2.5. Test Result

Test Site	NS-TR2	Test Engineer	Selina Zhang
Test Date	2021/02/24		

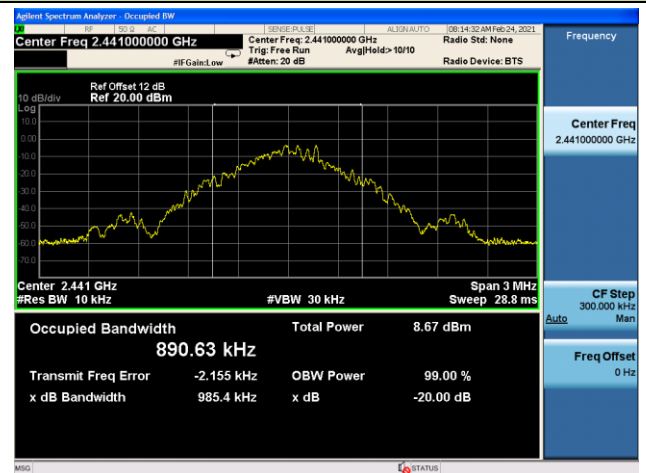
Test Mode	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)
Left Earbud			
DH5	00	2402	985.9
DH5	39	2441	985.4
DH5	78	2480	1006.0
2DH5	00	2402	1180.0
2DH5	39	2441	1178.0
2DH5	78	2480	1179.0
3DH5	00	2402	1179.0
3DH5	39	2441	1181.0
3DH5	78	2480	1178.0
Right Earbud			
DH5	00	2402	985.9
DH5	39	2441	1006.0
DH5	78	2480	1006.0
2DH5	00	2402	1178.0
2DH5	39	2441	1178.0
2DH5	78	2480	1178.0
3DH5	00	2402	1179.0
3DH5	39	2441	1178.0
3DH5	78	2480	1175.0

DH5 20dB Bandwidth – Left Earbud

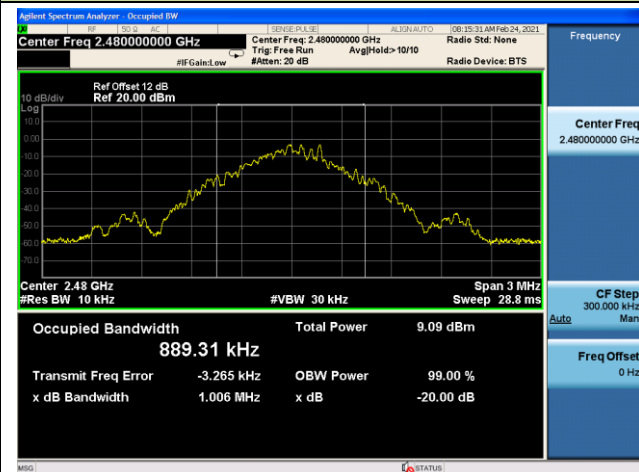
Channel 00 (2402MHz)



Channel 39 (2441MHz)

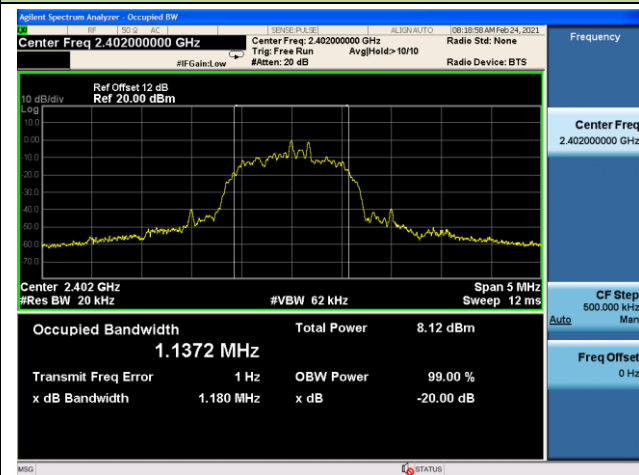


Channel 78 (2480MHz)

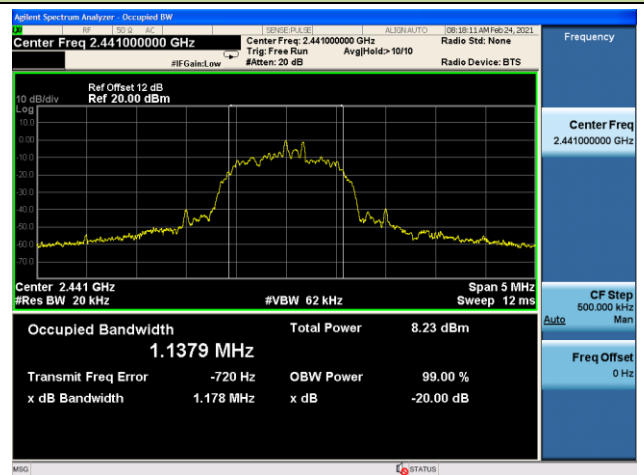


2DH5 20dB Bandwidth - Left Earbud

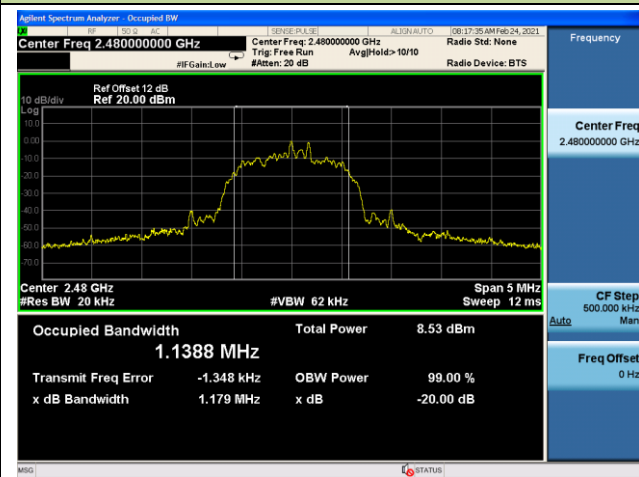
Channel 00 (2402MHz)



Channel 39 (2441MHz)

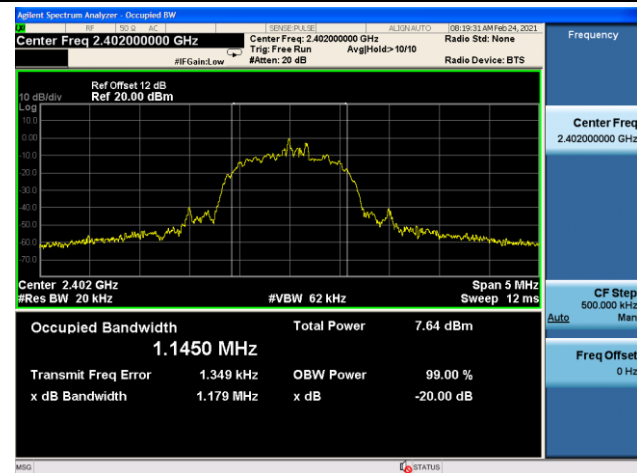


Channel 78 (2480MHz)

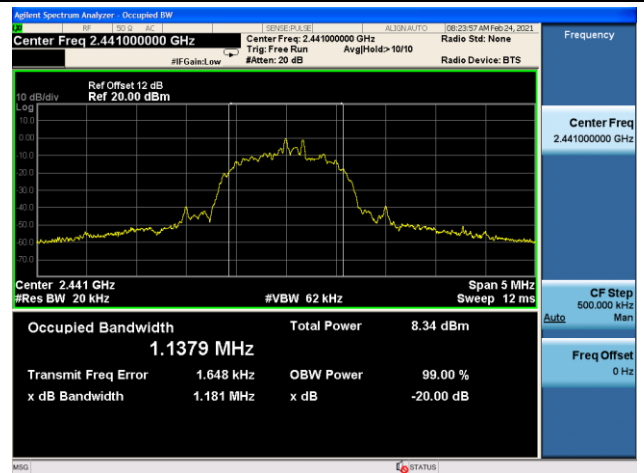


3DH5 20dB Bandwidth - Left Earbud

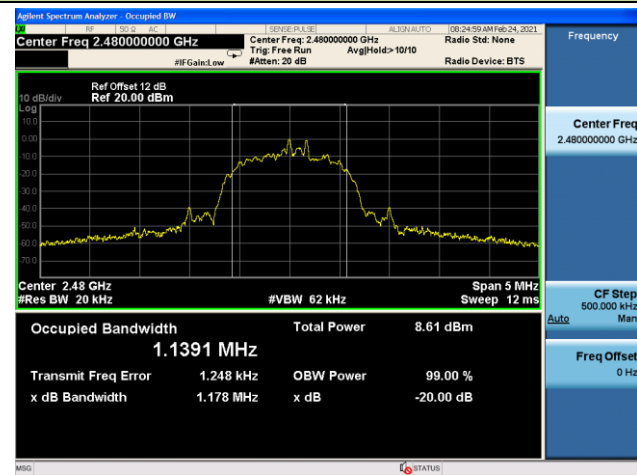
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)

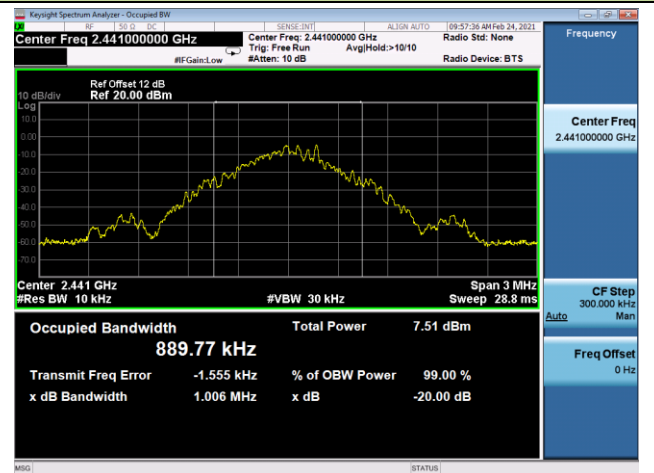


DH5 20dB Bandwidth - Right Earbud

Channel 00 (2402MHz)



Channel 39 (2441MHz)

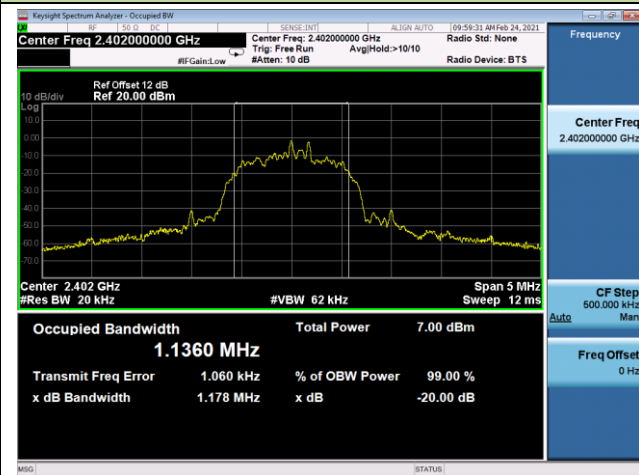


Channel 78 (2480MHz)



2DH5 20dB Bandwidth - Right Earbud

Channel 00 (2402MHz)



Channel 39 (2441MHz)

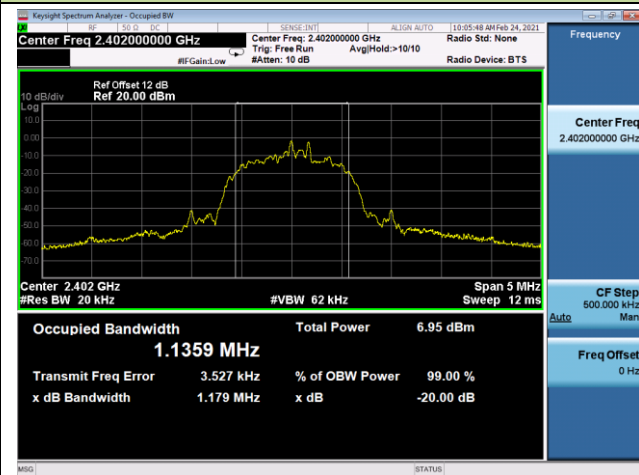


Channel 78 (2480MHz)

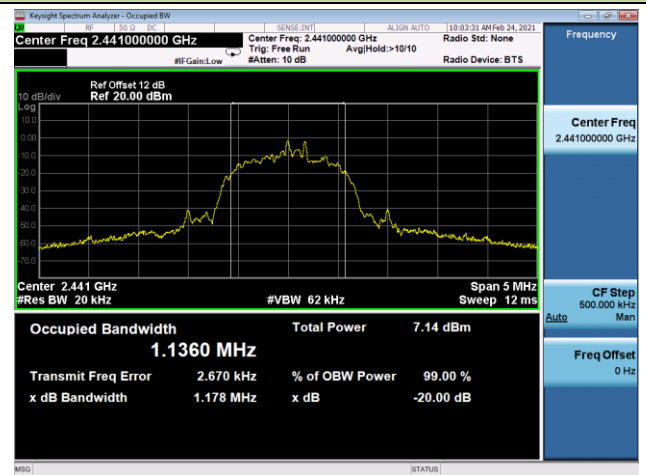


3DH5 20dB Bandwidth - Right Earbud

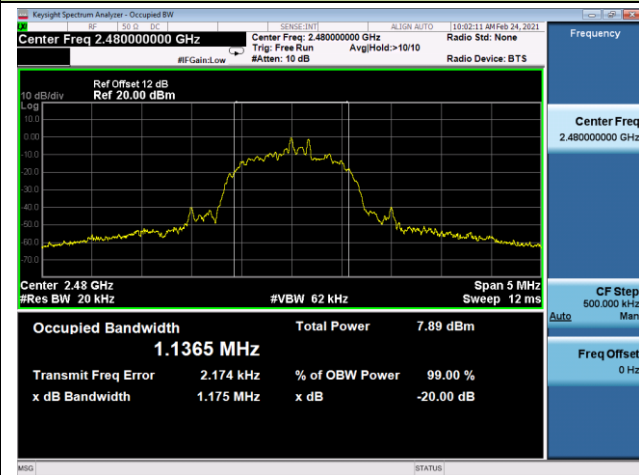
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



6.3. Output Power Measurement

6.3.1. Test Limit

The maximum out power permissible output power is 1 Watt for all frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

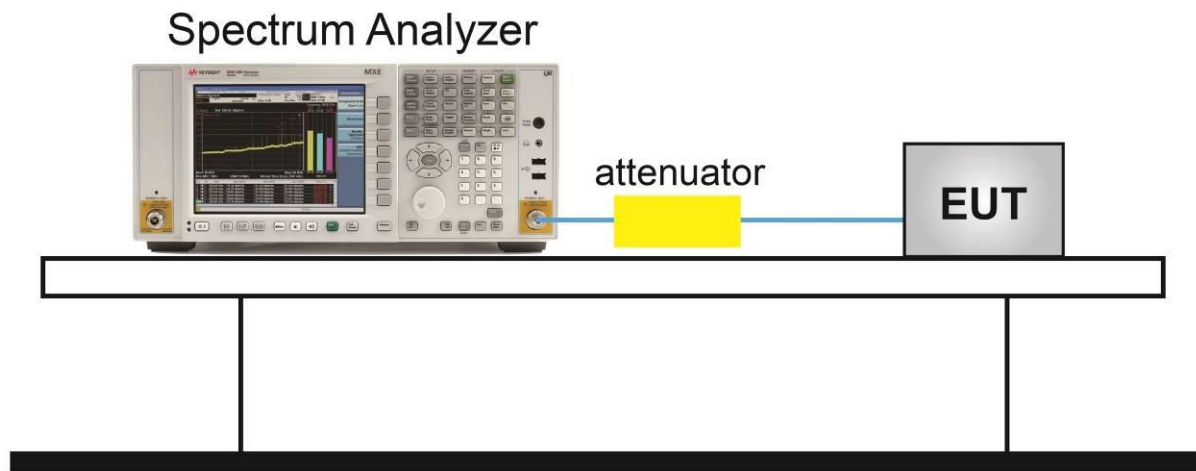
6.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.5

6.3.3. Test Setting

1. Set RBW $\geq$ the 20 dB bandwidth of the emission being measured.
2. VBW $\geq$ RBW
3. Span = approximately five 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)

6.3.4. Test Setup



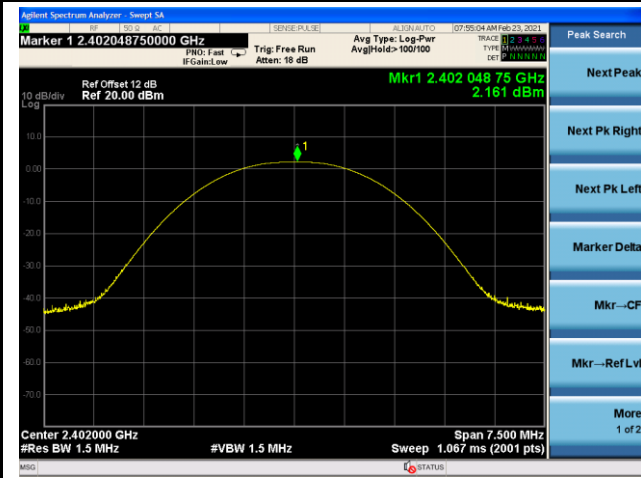
6.3.5. Test Result

Test Site	NS-TR2	Test Engineer	Sakura Chen
Test Date	2021/02/23		

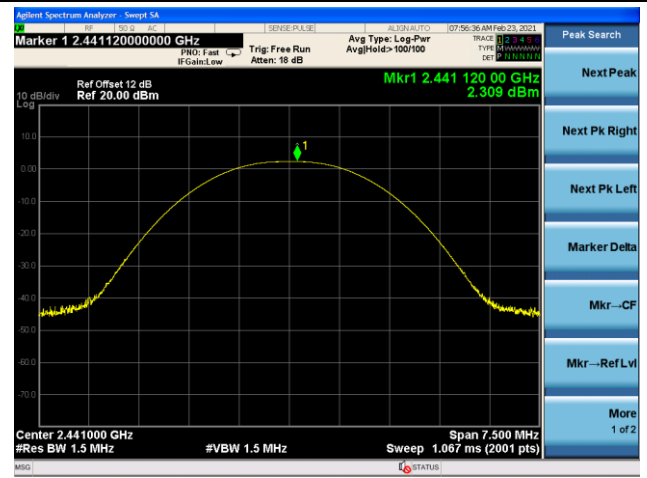
Test Mode	Channel No.	Frequency (MHz)	Peak Power (dBm)	Power Limit (dBm)
Left Earbud				
DH5	00	2402	2.16	≤ 20.97
DH5	39	2441	2.31	≤ 20.97
DH5	78	2480	2.73	≤ 20.97
2DH5	00	2402	2.10	≤ 20.97
2DH5	39	2441	2.27	≤ 20.97
2DH5	78	2480	2.66	≤ 20.97
3DH5	00	2402	2.11	≤ 20.97
3DH5	39	2441	2.28	≤ 20.97
3DH5	78	2480	2.65	≤ 20.97
Right Earbud				
DH5	00	2402	0.85	≤ 20.97
DH5	39	2441	1.05	≤ 20.97
DH5	78	2480	1.90	≤ 20.97
2DH5	00	2402	0.83	≤ 20.97
2DH5	39	2441	1.03	≤ 20.97
2DH5	78	2480	1.89	≤ 20.97
3DH5	00	2402	0.85	≤ 20.97
3DH5	39	2441	1.04	≤ 20.97
3DH5	78	2480	1.90	≤ 20.97

DH5 Output Power - Left Earbud

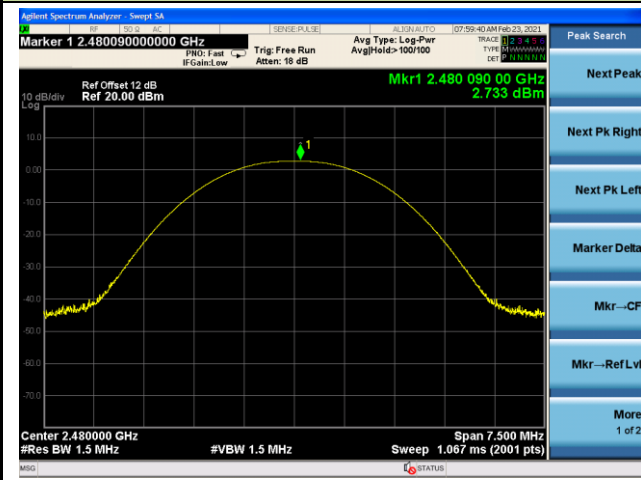
Channel 00 (2402MHz)



Channel 39 (2441MHz)

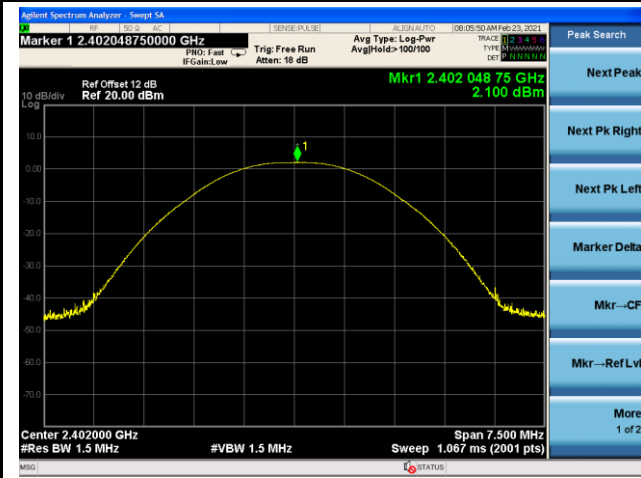


Channel 78 (2480MHz)

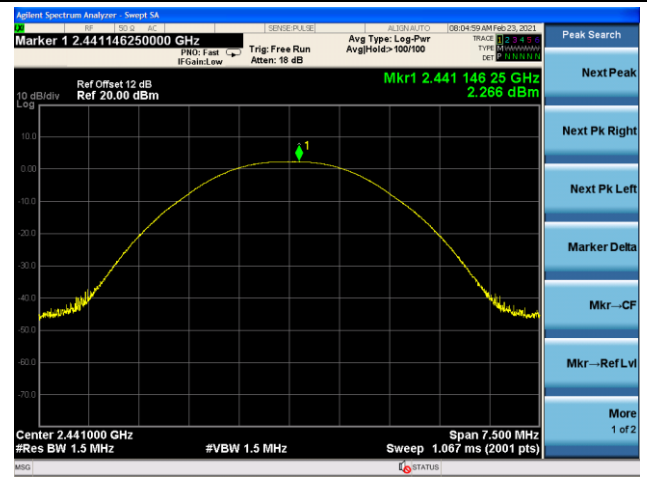


2DH5 Output Power - Left Earbud

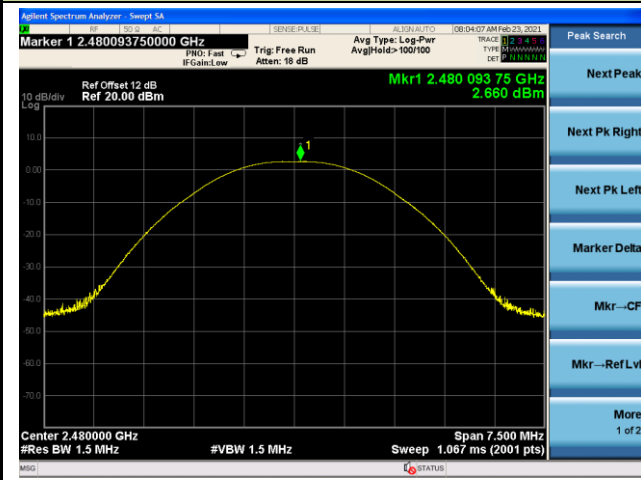
Channel 00 (2402MHz)



Channel 39 (2441MHz)

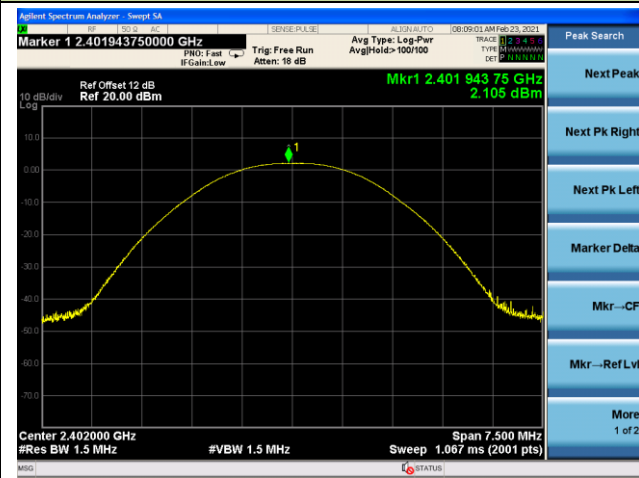


Channel 78 (2480MHz)

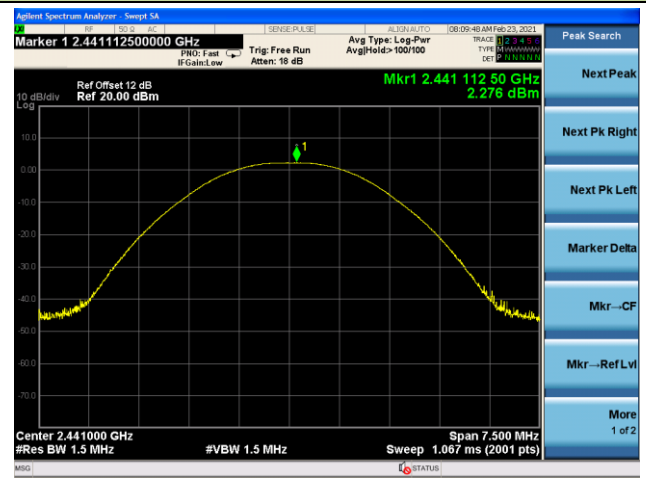


3DH5 Output Power - Left Earbud

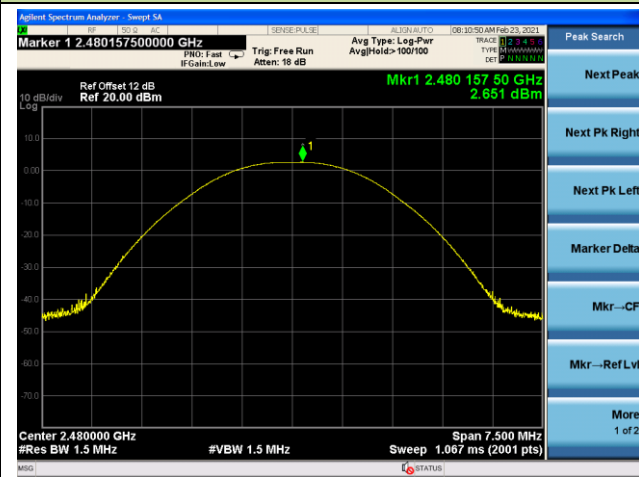
Channel 00 (2402MHz)



Channel 39 (2441MHz)

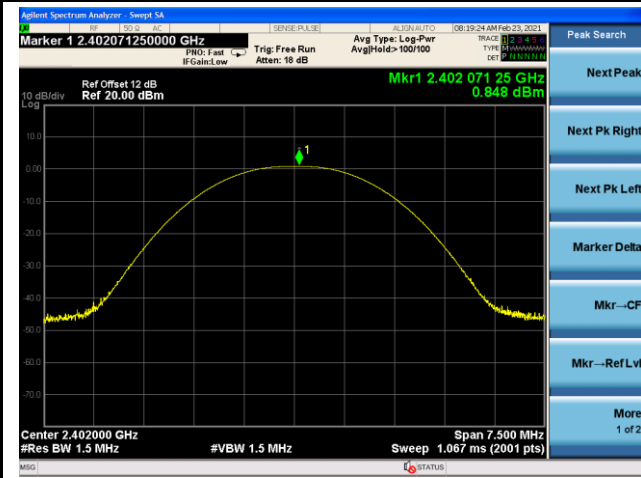


Channel 78 (2480MHz)

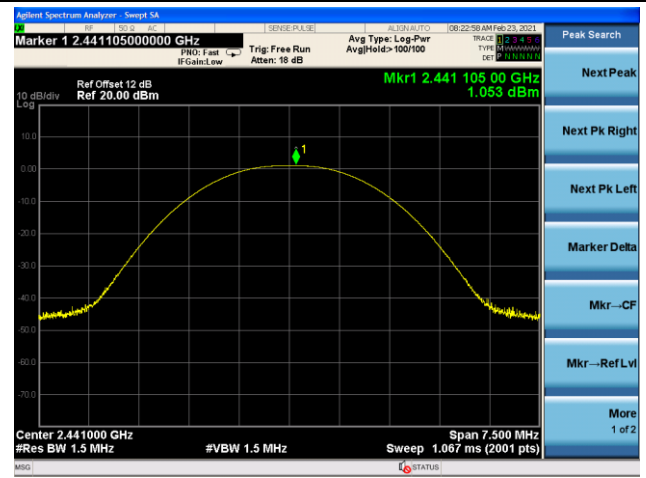


DH5 Output Power - Right Earbud

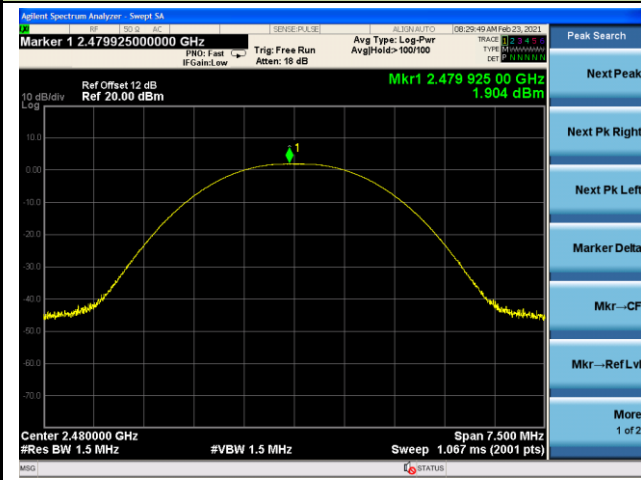
Channel 00 (2402MHz)



Channel 39 (2441MHz)

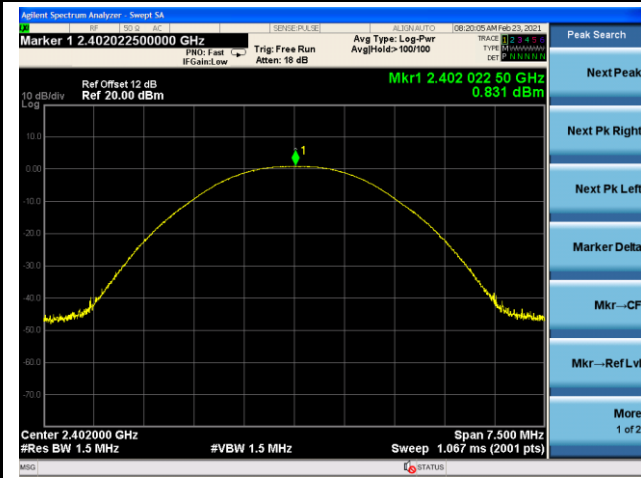


Channel 78 (2480MHz)

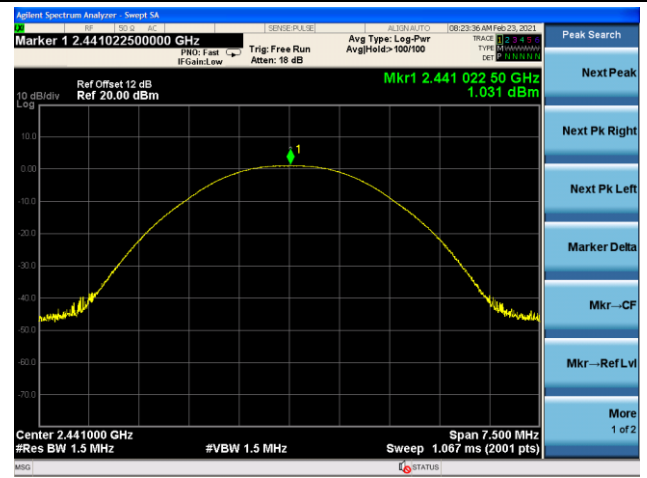


2DH5 Output Power - Left Earbud

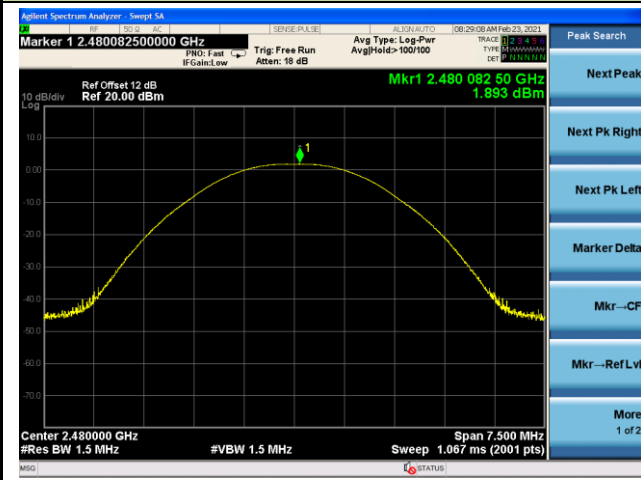
Channel 00 (2402MHz)



Channel 39 (2441MHz)

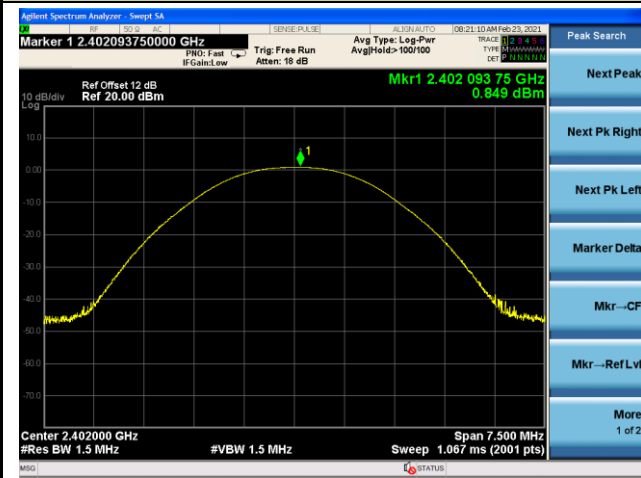


Channel 78 (2480MHz)

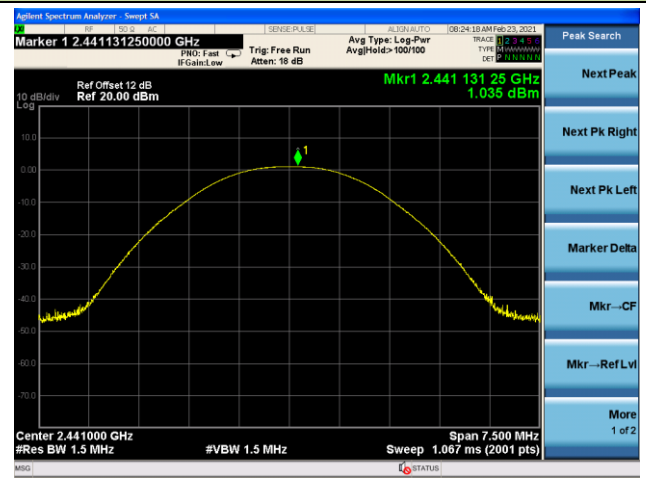


3DH5 Output Power - Left Earbud

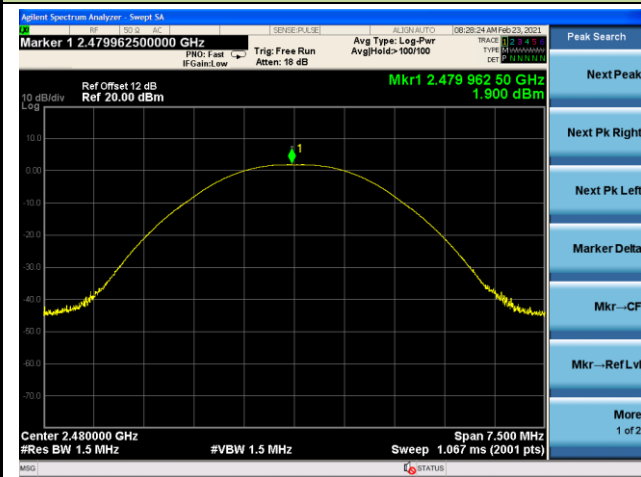
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)



6.4. Carrier Frequency Separation Measurement

6.4.1. Test Limit

The minimum permissible channel separation for this system is $\frac{2}{3}$ the value of the 20dB BW.

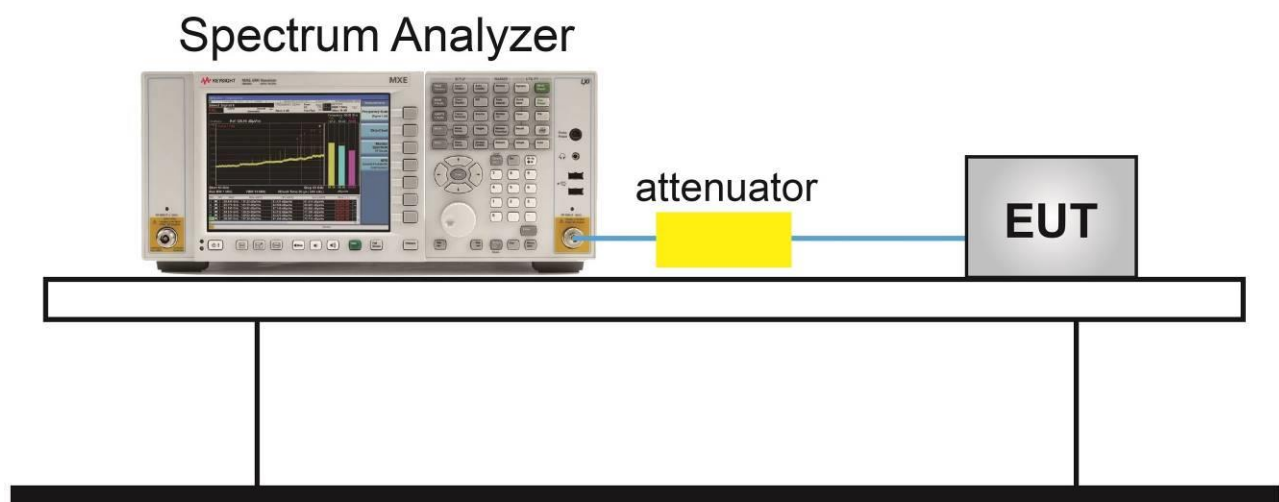
6.4.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.2

6.4.3. Test Setting

1. Span = Wide enough to capture the peaks of two adjacent channels.
2. Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. VBW $\geq$ RBW
4. Sweep time = Auto couple
5. Detector = Peak
6. Trace mode = Max hold
7. Allowed the trace to stabilize
8. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

6.4.4. Test Setup



6.4.5. Test Result

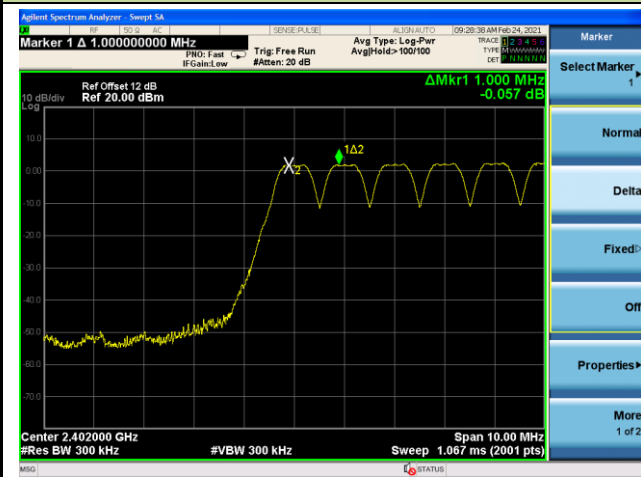
Test Site	NS-TR2	Test Engineer	Selina Zhang
Test Date	2021/02/24		

Test Mode	Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
Left Earbud					
DH5	00	2402	1000	≥ 657.3	Pass
DH5	39	2441	1000	≥ 656.9	Pass
DH5	78	2480	1000	≥ 667.1	Pass
2DH5	00	2402	1000	≥ 786.7	Pass
2DH5	39	2441	1000	≥ 785.3	Pass
2DH5	78	2480	1000	≥ 786.0	Pass
3DH5	00	2402	1000	≥ 786.0	Pass
3DH5	39	2441	1000	≥ 787.3	Pass
3DH5	78	2480	1000	≥ 785.3	Pass
Right Earbud					
DH5	00	2402	1000	≥ 657.3	Pass
DH5	39	2441	1000	≥ 670.7	Pass
DH5	78	2480	1000	≥ 670.7	Pass
2DH5	00	2402	1000	≥ 785.3	Pass
2DH5	39	2441	1000	≥ 785.3	Pass
2DH5	78	2480	1000	≥ 785.3	Pass
3DH5	00	2402	1000	≥ 786.0	Pass
3DH5	39	2441	1000	≥ 785.3	Pass
3DH5	78	2480	1000	≥ 783.3	Pass

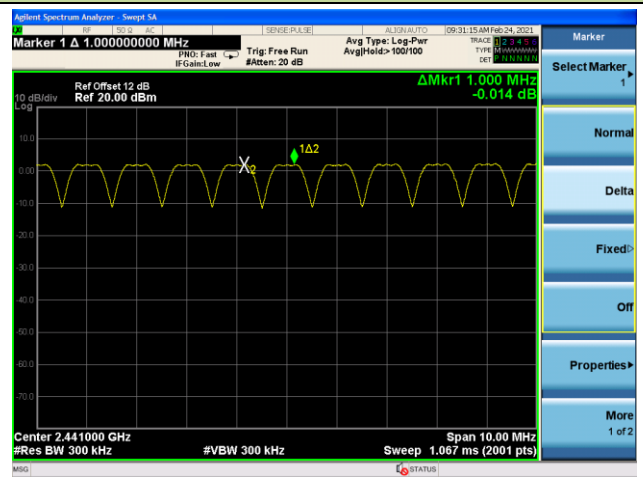
Note: The Limit is 2/3 the value of the 20dB BW.

DH5 Carrier Frequency Separation - Left Earbud

Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)

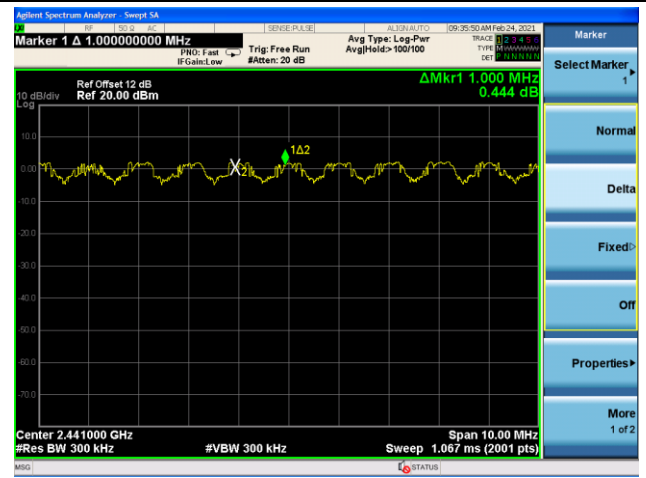


2DH5 Carrier Frequency Separation - Left Earbud

Channel 00 (2402MHz)



Channel 39 (2441MHz)

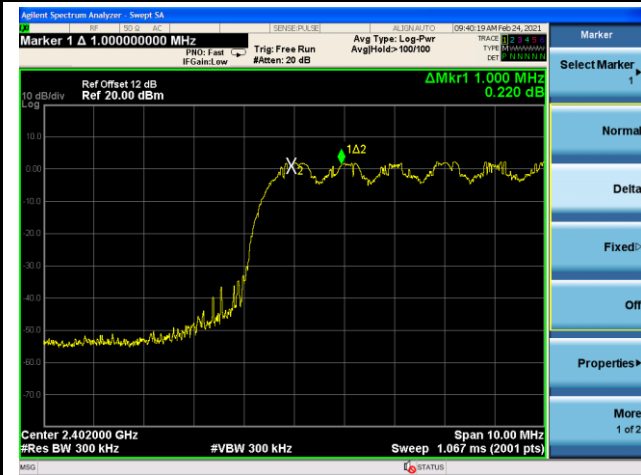


Channel 78 (2480MHz)

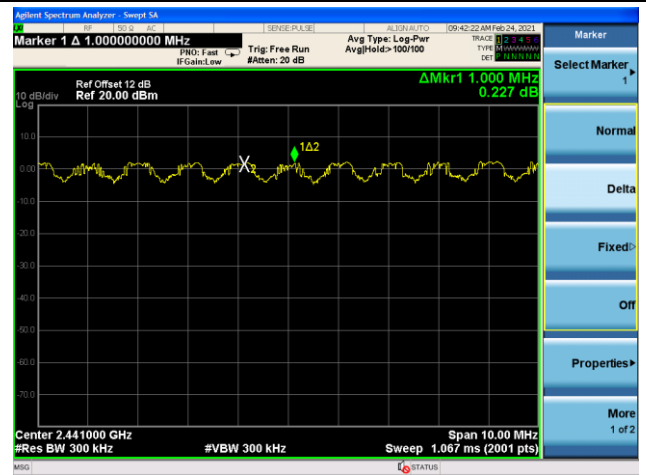


3DH5 Carrier Frequency Separation - Left Earbud

Channel 00 (2402MHz)



Channel 39 (2441MHz)

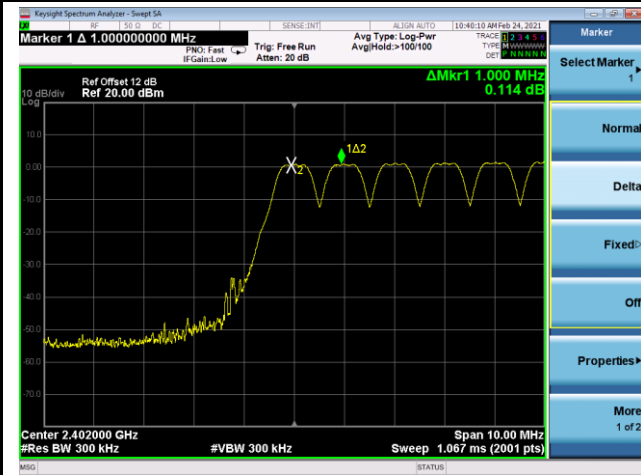


Channel 78 (2480MHz)

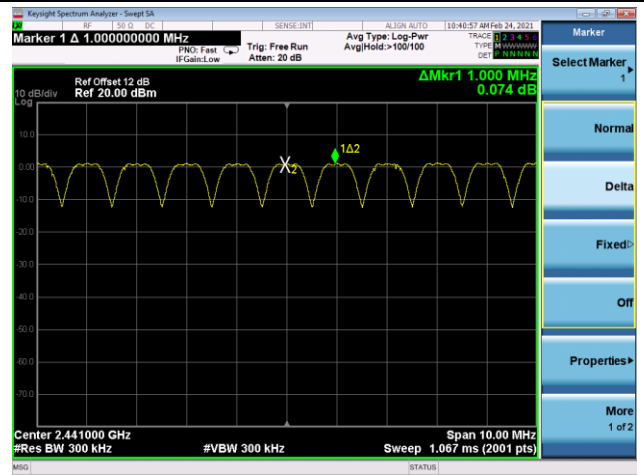


DH5 Carrier Frequency Separation - Right Earbud

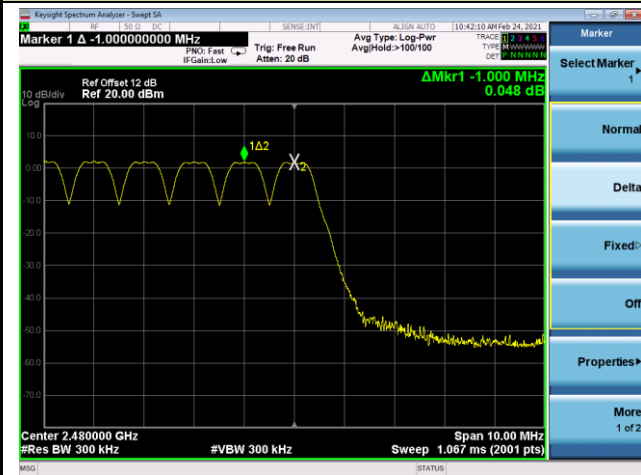
Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)

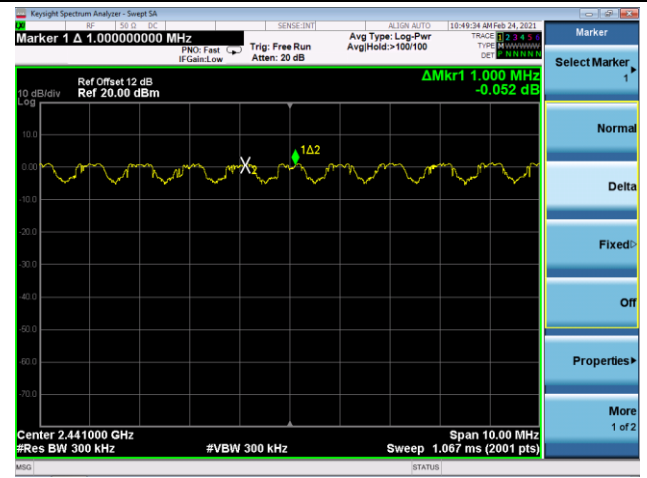


2DH5 Carrier Frequency Separation - Right Earbud

Channel 00 (2402MHz)



Channel 39 (2441MHz)



Channel 78 (2480MHz)

