

TEST REPORT

Applicant:	Huizhou Jinghao Medical Technology Co.,Ltd
Address of Applicant:	Floor 6, Huicheng Industry Building, No.9 Huifeng Dong'er Road, ZhongKai High tech Zone, Huizhou City, Guangdong Province, 516000, P.R.China
Manufacturer:	Huizhou Jinghao Medical Technology Co.,Ltd
Address of Manufacturer:	Floor 6, Huicheng Industry Building, No.9 Huifeng Dong'er Road, ZhongKai High tech Zone, Huizhou City, Guangdong Province, 516000, P.R.China
Product name:	HEARING AIDS/ hearing amplifier
Model:	JH-A61HT, JH-DW2AT, JH-AW2B, JH-AW2BT, JH-D59FT, JH-DW1A, JH-DW3A, JH-DW3E, JH-DW3F, JH-DW3FT, JH-DW4AT, JH-DW5A, JH-TW4AT, JH-TW4A, JH-D59ET, JH-DW1AT, JH-A32D, JH-A32E, JH-A32F, JH-A32G, HNB-4/0143
Rating(s):	Input: DC 5V, 1A Output: DC 4.2V 0.05A
Trademark:	JINGHAO
Standards:	47 CFR PART 15 Subpart C section 15.247
FCC ID:	2A39M-JH22A61H
Data of Receipt:	2022-10-26
Date of Test:	2022-10-26~2022-11-17
Date of Issue:	2022-11-17
Test Result	Pass*

* In the configuration tested, the test item complied with the standards specified above.

Authorized for issue by:

Test by:

Nov.17, 2022 Chivas Tsang

Project Engineer

Date

Name/Position

Signature

Reviewed by:

Nov.17, 2022

Victor Meng

Project Manager

Date

Name/Position

Signature

Possible test case verdicts:

test case does not apply to the test object...: N/A
test object does meet the requirement.....: P (Pass)
test object does not meet the requirement...: F (Fail)

Testing Laboratory information:

Testing Laboratory Name: ITL Co., Ltd
Address.....: No. 8 Jinqianling Street 5, Huangjiang Town, Dongguan,
Guangdong, 523757 P.R.C.
Testing location : Same as above
Tel : 0086-769-39001678
Fax : 0086-20-62824387
E-mail : itl@i-testlab.com

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report would be invalid test report without all the signatures of testing technician and approver.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

General product information:

The left and right ears are symmetrical in structure, basically the same in design, slightly different in layout and wiring, and will not affect the RF performance.

All models are identical to each other except the model name.

All tests were performed on the model JH-A61HT as representative.

1 Test Summary

Test	Test Requirement	Test method	Result
Antenna Requirement	FCC PART 15 C section 15.247 (c) and Section 15.203	FCC PART 15 C section 15.247 (c) and Section 15.203	PASS
Occupied Bandwidth (-20dB)	FCC PART 15 C section 15.247 (a)(1);	ANSI C63.10:2013	PASS
Carrier Frequencies Separated	FCC PART 15 C section 15.247(a)(1);	ANSI C63.10:2013	PASS
Hopping Channel Number	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10:2013	PASS
Dwell Time	FCC PART 15 C section 15.247(a)(1)(iii);	ANSI C63.10:2013	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(1);	ANSI C63.10:2013	PASS
Conducted Spurious Emission (30 MHz to 25 GHz)	FCC PART 15 C section 15.247(d);	ANSI C63.10:2013	PASS
Radiated Spurious Emission (9 kHz to 25 GHz)	FCC PART 15 C section 15.247(d);	ANSI C63.10:2013	PASS
Band Edges Measurement	FCC PART 15 C section 15.247 (d) &15.205	ANSI C63.10:2013	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207;	ANSI C63.10:2013	PASS
Radiated Emissions which fall in the restricted bands	FCC PART 15 C section 15.209	ANSI C63.10:2013	PASS
Pseudorandom Frequency Hopping Sequence	47 CFR Part 15, Subpart C Section 15.247(b)(4)&TCB Exclusion List	ANSI C63.10:2013	PASS

Remark:

N/A: not applicable. Refer to the relative section for the details.
 EUT: In this whole report EUT means Equipment Under Test.
 Tx: In this whole report Tx (or tx) means Transmitter.
 Rx: In this whole report Rx (or rx) means Receiver.
 RF: In this whole report RF means Radio Frequency.
 ANSI C63.10:2013 the detail version is ANSI C63.10:2013 in the whole report.

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3 General Information

3.1 Client Information

Applicant: Huizhou Jinghao Medical Technology Co.,Ltd
Address of Applicant: Floor 6, Huicheng Industry Building, No.9 Huifeng Dong'er Road, ZhongKai High tech Zone, Huizhou City, Guangdong Province, 516000, P.R.China

3.2 General Description of E.U.T.

Name: HEARING AIDS
Model No.: JH-A61HT
Trade Mark: JINGHAO
Operating Frequency: 2402 MHz to 2480 MHz for Bluetooth.
Channels: 79 channels with 1MHz step for Bluetooth
Bluetooth Version: 5.0
Bluetooth Version: This report is for classic mode.
Modulation Technique: Frequency Hopping Spread Spectrum (FHSS)
Type of Modulation: GFSK, ($\pi/4$) DQPSK for Bluetooth
Dwell time: Per channel is less than 0.4s.
Antenna Type: FPC Antenna
Antenna gain: 0.5 dBi
Function: HEARING AIDS/ hearing amplifier

3.3 Details of E.U.T.

EUT Power Supply: 300mAh battery
Test mode: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2402MHz), middle (2441MHz) and highest (2480MHz) are chosen for Bluetooth full testing.
Normal mode: the Bluetooth has been tested on the Modulation of GFSK;
EDR mode: the Bluetooth has been tested on the Modulation of ($\pi/4$)DQPSK, compliance test and record the worst case on ($\pi/4$)DQPSK
Power cord: /

3.4 Description of Support Units

The EUT has been tested as an independent unit for fixed frequency by testing lab.

Details of Support Equipment(s)

Description	Manufacturer	Model No.	Connection	Working state
/	/	/	/	/

3.5 Test Location

All tests were performed at:

ITL Co., Ltd

No. 8 Jinqianling Street 5, Huangjiang Town, Dongguan, Guangdong, 523757 P.R.C.

0086-769-39001678

itl@i-testlab.com

No tests were sub-contracted.

3.6 Deviation from Standards

None.

3.7 Abnormalities from Standard Conditions

None.

3.8 Other Information Requested by the Customer

None.

3.9 Test Facility

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

- **CNAS Lab code:L9342**
- **FCC Designation No.:CN5035**
- **IC Registration NO.: 12593A**
- **NVLAP LAB CODE: 600199-0**

3.10 Measurement Uncertainty

The below measurement uncertainties given below are based on a 95% confidence level (base on a coverage factor (k=2).)

Parameter	Uncertainty
Radio frequency	2.25%
total RF power, conducted	±1.34 dB
RF power density , conducted	±1.49 dB
All emissions, radiated	±2.72 dB
Temperature	±5.02 dB
Humidity	±0.8°C
DC and low frequency voltages	±1.5 %

4 Instruments Used during Test

No.	Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
ITL-114	Spectrum Analyzer	Agilent	N9010A	MY51250936	2022/01/14	2023/01/13
ITL-154	EMI test receiver 9kHz to 26.5GHz	R&S	ESR26	101257	2022/01/14	2023/01/13
ITL-116	Pre Amplifier	HP	8447F	3113A05905	2022/01/14	2023/01/13
ITL-117	Wideband Amplifier Super Ultra	Mini-circuits	ZVA-183- S+	469101134	2022/01/14	2023/01/13
ITL-180	Trilog-Broadband Antenna	Schwarzbeck	VULB 9164	005	2021/01/31	2023/01/30
ITL-110	Horn Antenna	A-INFOMW	JXTXLB- 10180-N	J2031090612 133	2022/01/14	2023/01/13
ITL-103	Two-line v- network	R&S	ENV216	100120	2022/06/17	2024/06/16
ITL-115	50 Ω Coaxial Cable	Mini-circuits	CBL	C001	2022/06/15	2024/06/14
ITL-100	Semi-Anechoic chamber	ETS•Lindgren	FACT3 2.0	CT09015	2022/10/14	2025/10/13
ITL-145	Loop Antenna	ZHINAN	Z30900A	002489	2022/01/16	2024/01/15
ITL-101	Shielded Room	ETS•Lindgren	8*4*3	CT09010	2021/01/22	2024/01/21
ITL-165	Power Meter	R&S	NRVS	838246/026	2022/10/16	2023/10/15
ITL-166	Power Sensor	Agilent	U2021XA	MY5365004	2022/01/20	2023/01/19

5 Test Results

5.1 E.U.T. test conditions

Test Voltage: 300mAh battery

Temperature: 20.0 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

Test frequencies and frequency range: According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz,
At or above 10 GHz to below	5th harmonic of highest fundamental frequency or to 100 GHz,
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz,

EUT channels and frequencies list for Bluetooth:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	11	2413	22	2424
1	2403	12	2414	23	2425
2	2404	13	2415	24	2426
3	2405	14	2416	25	2427
4	2406	15	2417	26	2428
5	2407	16	2418	27	2429
6	2408	17	2419	28	2430
7	2409	18	2420	29	2431
8	2410	19	2421	30	2432
9	2411	20	2422	31	2433
10	2412	21	2423	32	2434
33	2435	49	2451	65	2467
34	2436	50	2452	66	2468
35	2437	51	2453	67	2469
36	2438	52	2454	68	2470
37	2439	53	2455	69	2471
38	2440	54	2456	70	2472
39	2441	55	2457	71	2473
40	2442	56	2458	72	2474
41	2443	57	2459	73	2475
42	2444	58	2460	74	2476
43	2445	59	2461	75	2477
44	2446	60	2462	76	2478
45	2447	61	2463	77	2479
46	2448	62	2464	78	2480
47	2449	63	2465		
48	2450	64	2466		

Test frequencies are the lowest channel: 0 channel (2402 MHz), middle channel: 39 channel (2441 MHz) and highest channel: 78 channel (2480 MHz)

5.2 Antenna requirement

Standard requirement

15.203 requirement:

For intentional device. According to 15.203. an intentional radiator shall be designed to Ensure that no antenna other than that furnished by the responsible party shall be used with the device.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz bands that are used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna

The antenna is an Internal Antenna and no consideration of replacement. The best case gain of the antenna is 0.5dBi.

Test result: The unit does meet the FCC requirements.

5.3 Occupied Bandwidth

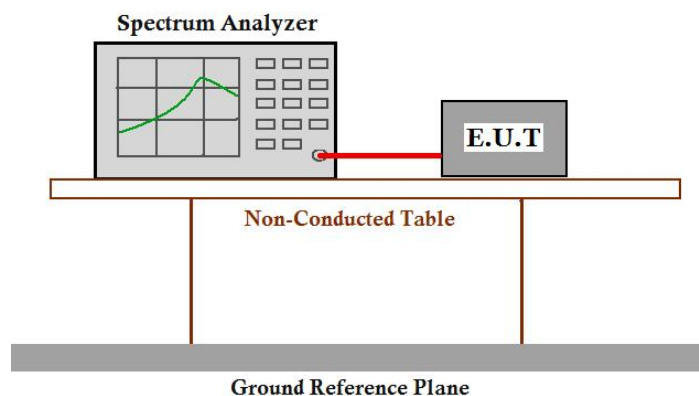
Test Requirement: FCC Part 15 C section 15.247

(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Method: ANSI C63.10:2013

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest, middle and highest channel with different data package. Compliance test in normal mode (DH5), EDR mode (2DH5) as the worst case was found.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centring on a hopping channel;
3. Set the spectrum analyzer: RBW \geq 1% of the 20dB bandwidth VBW \geq RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20dB points bandwidth.

Test result (-20dB bandwidth), For Bluetooth**Normal mode (DH5):**

Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	0.941	0.627
Middle	0.930	0.620
Highest	0.948	0.632

EDR mode (2DH5):

Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.305	0.870
Middle	1.307	0.871
Highest	1.333	0.889

For Bluetooth

Result plot as follows:

DH5:

Lowest Channel:



Middle Channel:

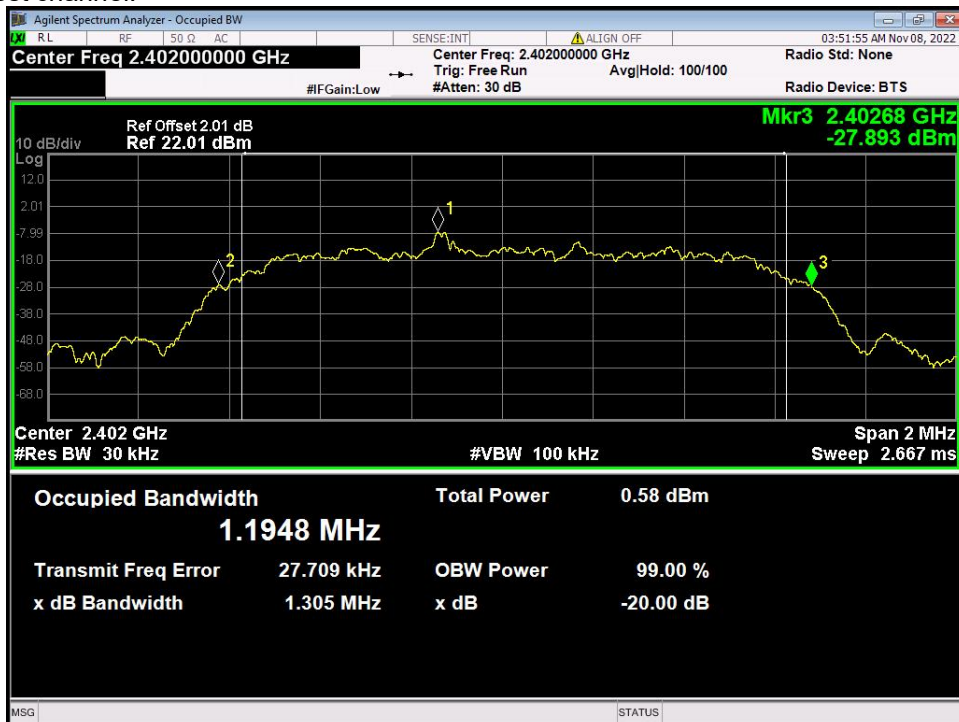


Highest Channel:

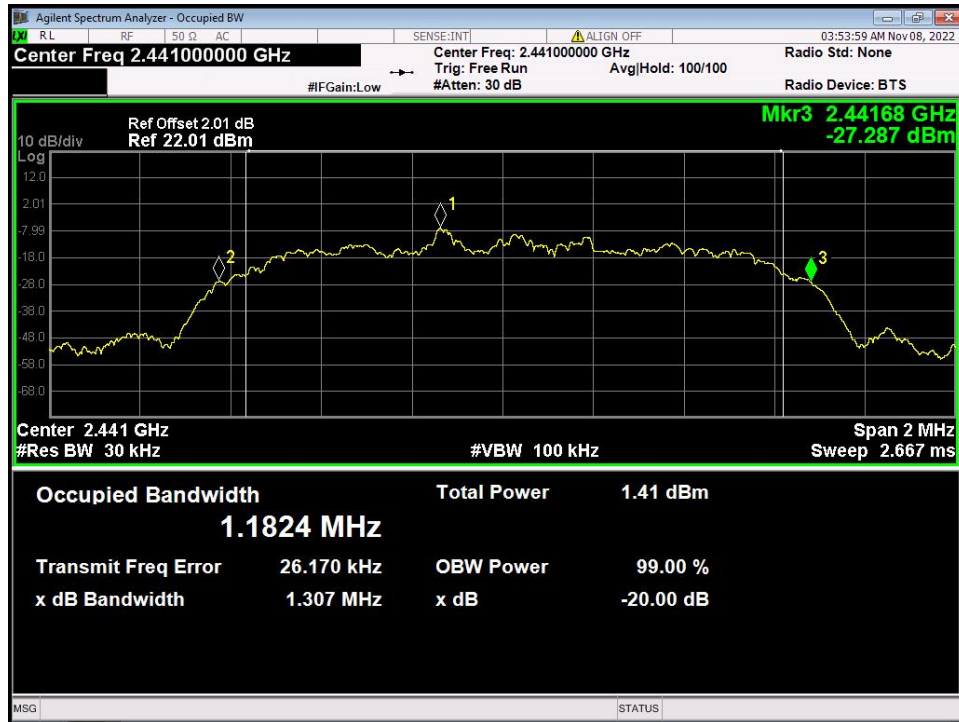


2DH5:

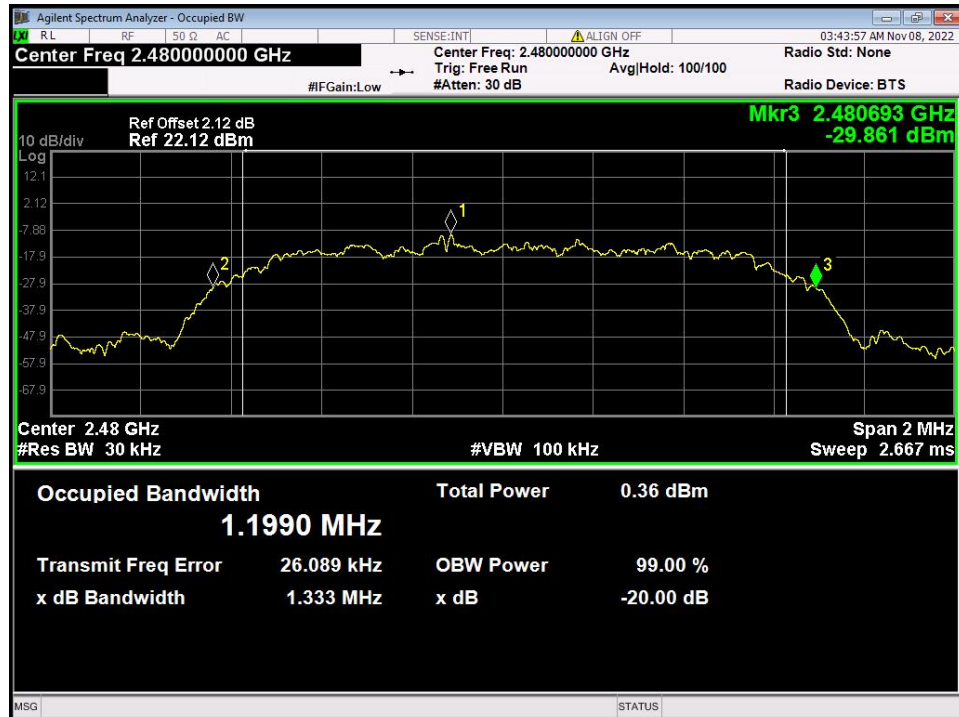
Lowest channel:



Middle channel:



Highest channel:



5.4 Carrier Frequencies Separated

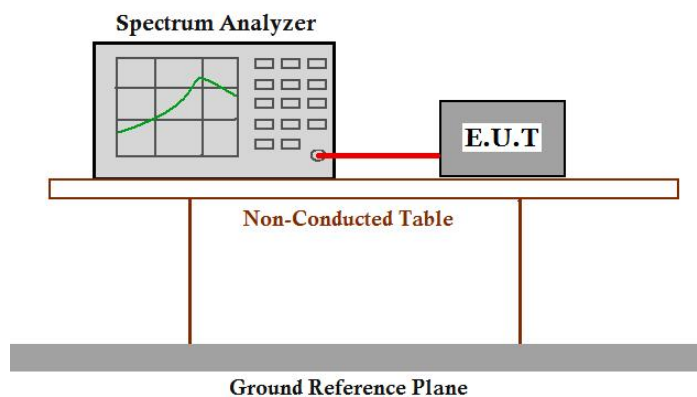
Test Requirement: FCC Part 15 C section 15.247

(a),(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Method: ANSI C63.10:2013

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest, middle and highest channel with different data package. Compliance test in normal mode (DH5), EDR mode (2DH5) as the worst case was found.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW \geq 1% of the span, VBW \geq RBW, Sweep = auto; Detector Function = Peak. Trace = Max, hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

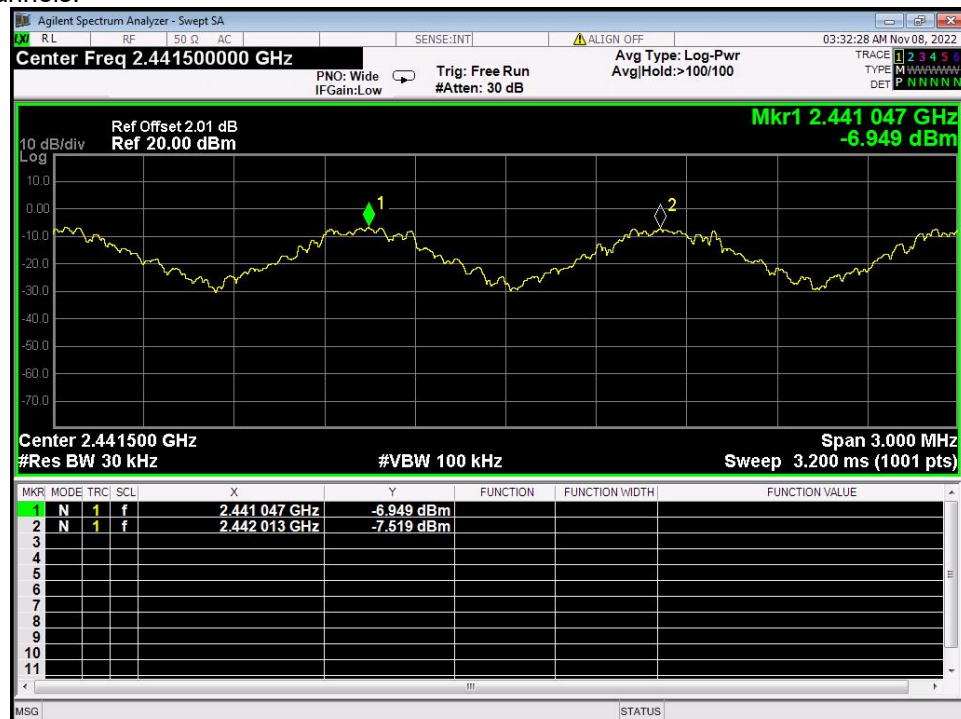
Test result:**For Bluetooth****DH5**

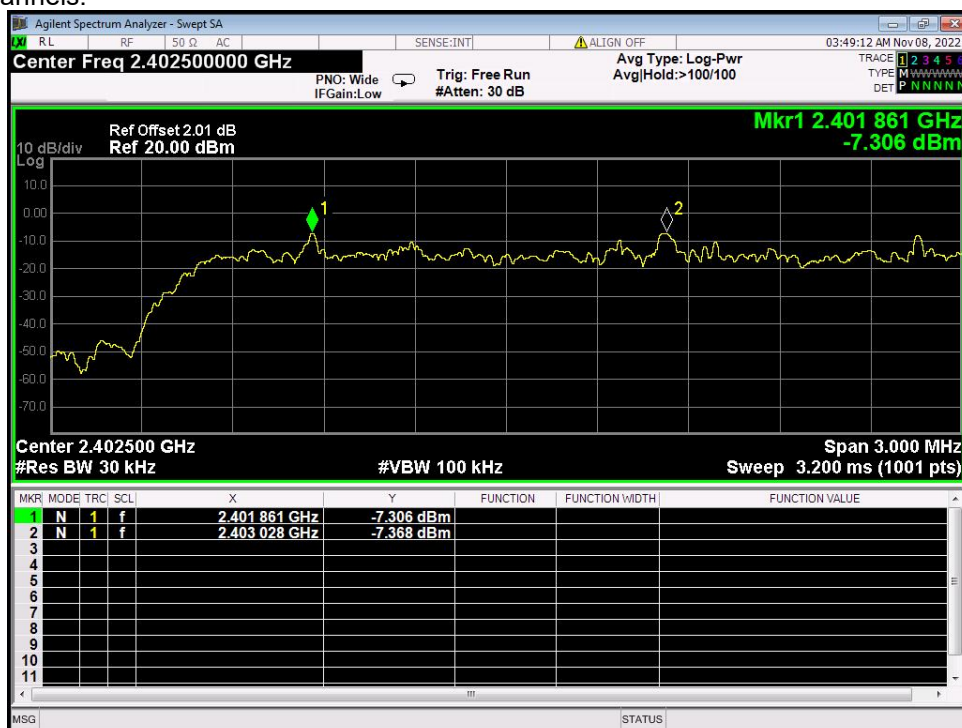
Test Channel	Carrier Frequencies Separated	Pass/Fail
Lower Channels (channel 0 and channel 1)	0.865MHz	Pass
Middle Channels (channel 39 and channel 40)	0.855MHz	Pass
Upper Channels (channel 77 and channel 78)	0.868MHz	Pass
Remark: The limit is maximum two-thirds of the 20 dB bandwidth: 0.632 MHz		

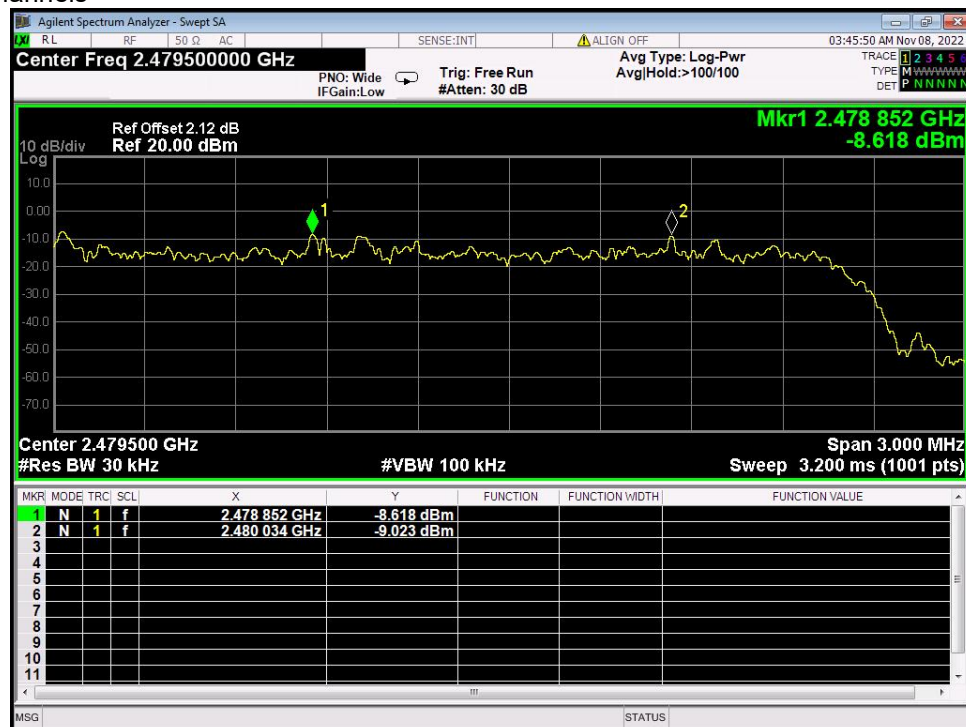
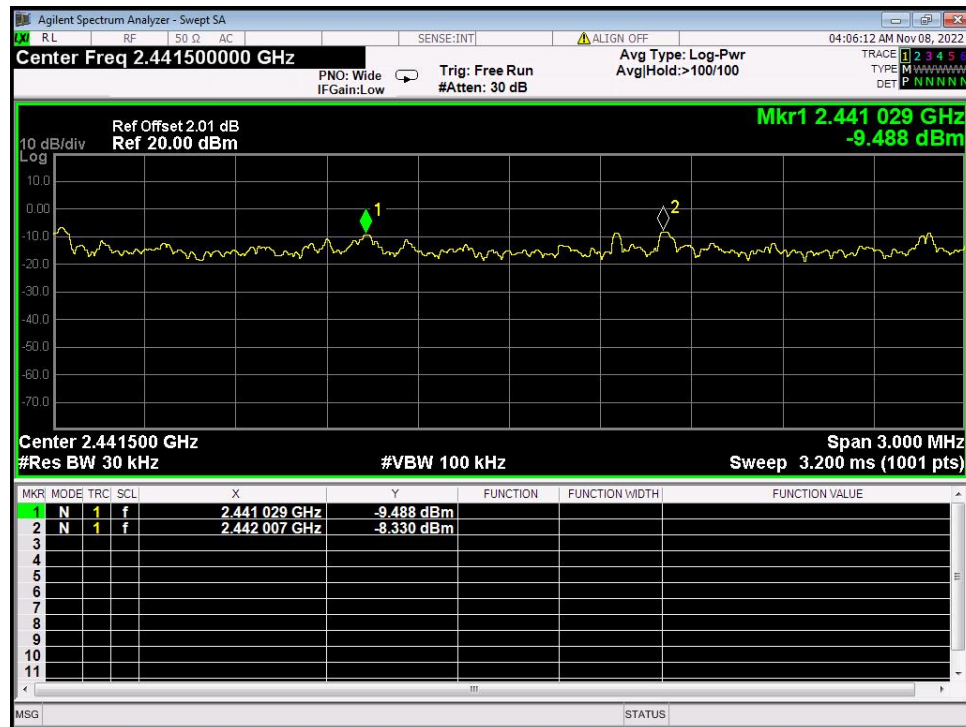
2DH5

Test Channel	Carrier Frequencies Separated	Pass/Fail
Lower Channels (channel 0 and channel 1)	1.175MHz	Pass
Middle Channels (channel 39 and channel 40)	1.177MHz	Pass
Upper Channels (channel 77 and channel 78)	1.179MHz	Pass
Remark: The limit is maximum two-thirds of the 20 dB bandwidth: 0.889 MHz		

1. Lowest Channels:







5.5 Hopping Channel Number

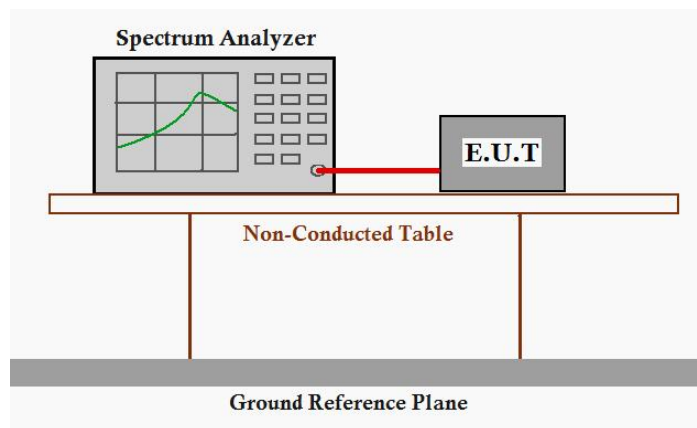
Test Requirement: FCC Part15 C section 15.247

(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test Method: ANSI C63.10:2013

Test Status: Pre-test the EUT in hopping mode with different data packet. Compliance test in hopping with normal mode (DH5), EDR mode (2DH5) as the worst case was found.

Test Configuration:



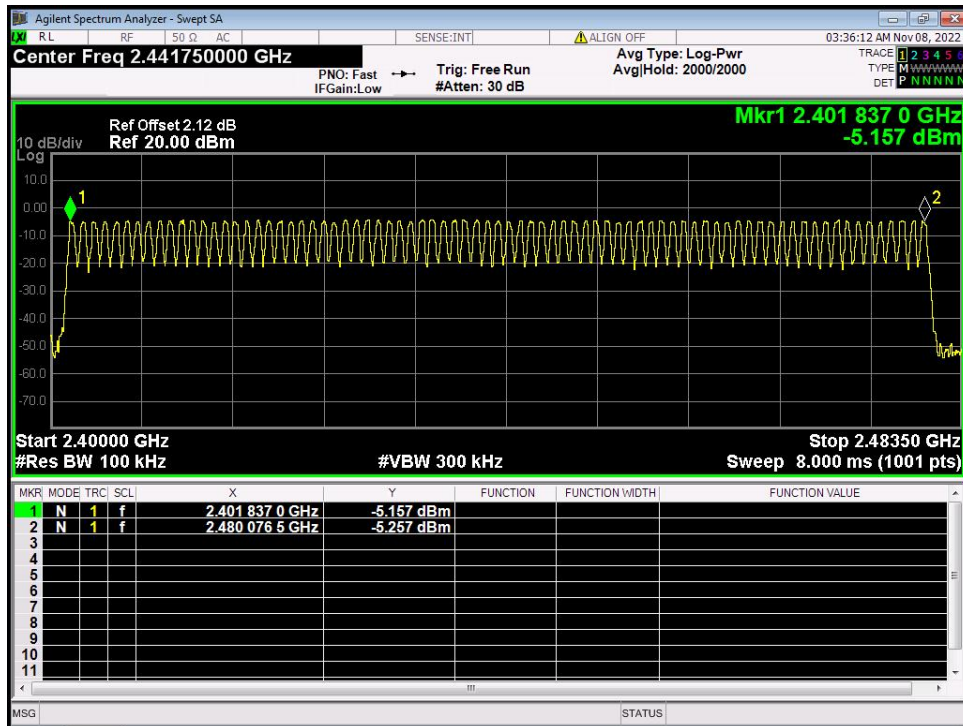
Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 300 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: start frequency = 2400 MHz. stop frequency = 2483.5 MHz. Submit the test result graph.

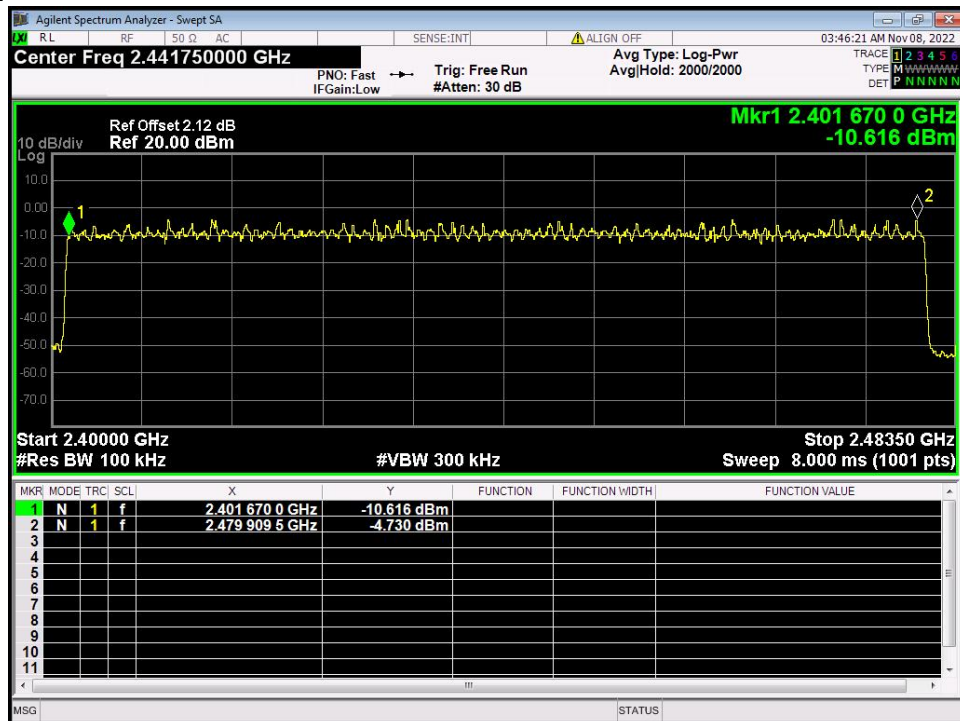
For Bluetooth

Test result: Total channels are 79 channels.

DH5:



2DH5:



Test result: The unit does meet the FCC requirements.

5.6 Dwell Time

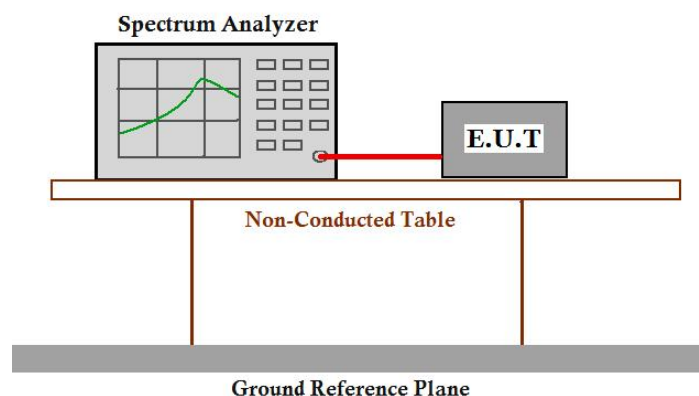
Test Requirement: FCC Part 15 C section 15.247

(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Method: ANSI C63.10:2013

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest, middle and highest channel with different data packet. Compliance test in hopping with Normal mode (DH1, DH3 and DH5) and EDR mode (2DH1, 2DH3 and 2DH5) as the worst case was found.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
 2. Set spectrum analyzer span = 0. centered on a hopping channel;
 3. Set RBW = 1 MHz and VBW = 3 MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Detector Function = Peak. Trace = View;
 4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.). Repeat this test for each variation.
- The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

Test Result:**For Bluetooth**

The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

1. Channel 0: 2.402GHz

DH1 time slot = $0.371(\text{ms}) \times (1600/(2 \times 79)) \times 31.6 = 118.72\text{ms}$

DH3 time slot = $1.627(\text{ms}) \times (1600/(4 \times 79)) \times 31.6 = 260.32\text{ms}$

DH5 time slot = $2.876(\text{ms}) \times (1600/(6 \times 79)) \times 31.6 = 306.77\text{ms}$

2. Channel 39: 2.441GHz

DH1 time slot = $0.371(\text{ms}) \times (1600/(2 \times 79)) \times 31.6 = 118.72\text{ms}$

DH3 time slot = $1.628(\text{ms}) \times (1600/(4 \times 79)) \times 31.6 = 260.48\text{ms}$

DH5 time slot = $2.876(\text{ms}) \times (1600/(6 \times 79)) \times 31.6 = 306.77\text{ms}$

3. Channel 78: 2.480GHz

DH1 time slot = $0.371(\text{ms}) \times (1600/(2 \times 79)) \times 31.6 = 118.72\text{ms}$

DH3 time slot = $1.627(\text{ms}) \times (1600/(4 \times 79)) \times 31.6 = 260.32\text{ms}$

DH5 time slot = $2.876(\text{ms}) \times (1600/(6 \times 79)) \times 31.6 = 306.77 \text{ ms}$

4. Channel 0: 2.402GHz

2DH1 time slot = $0.381(\text{ms}) \times (1600/(2 \times 79)) \times 31.6 = 121.92 \text{ ms}$

2DH3 time slot = $1.625(\text{ms}) \times (1600/(4 \times 79)) \times 31.6 = 260.00\text{ms}$

2DH5 time slot = $2.881(\text{ms}) \times (1600/(6 \times 79)) \times 31.6 = 307.31\text{ms}$

5. Channel 39: 2.441GHz

2DH1 time slot = $0.381(\text{ms}) \times (1600/(2 \times 79)) \times 31.6 = 121.92\text{ms}$

2DH3 time slot = $1.626(\text{ms}) \times (1600/(4 \times 79)) \times 31.6 = 260.16\text{ms}$

2DH5 time slot = $2.881(\text{ms}) \times (1600/(6 \times 79)) \times 31.6 = 307.31\text{ms}$

6. Channel 78: 2.480GHz

2DH1 time slot = $0.381(\text{ms}) \times (1600/(2 \times 79)) \times 31.6 = 121.92\text{ms}$

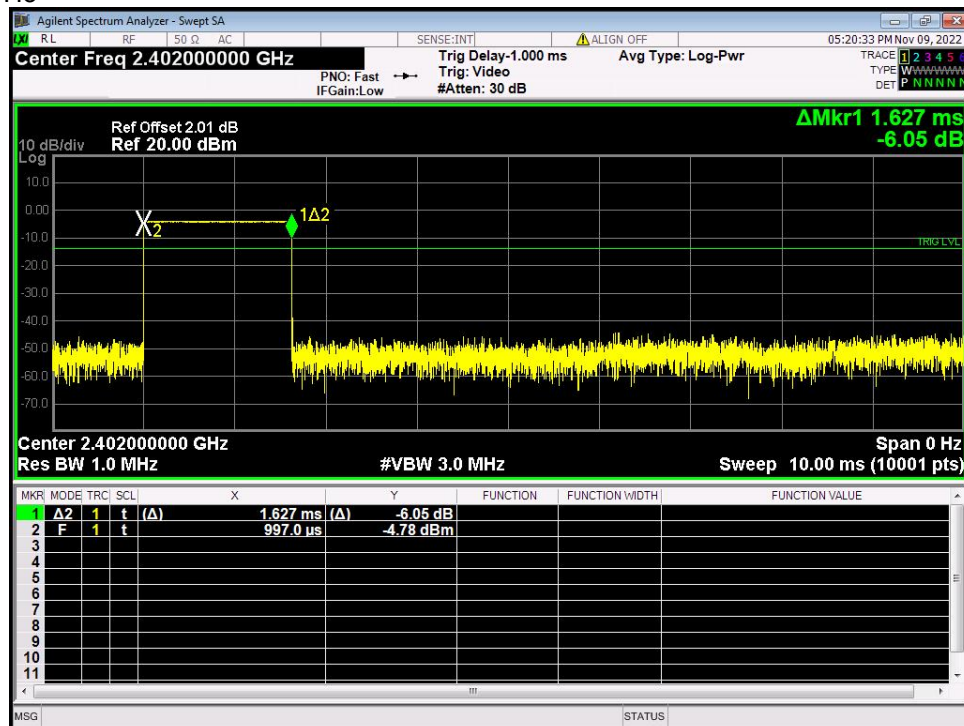
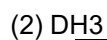
2DH3 time slot = $1.663(\text{ms}) \times (1600/(4 \times 79)) \times 31.6 = 266.08\text{ms}$

2DH5 time slot = $2.881(\text{ms}) \times (1600/(6 \times 79)) \times 31.6 = 307.31\text{ms}$

The results are not greater than 0.4 seconds

The unit does meet the FCC requirements.

(1) DH1



[illegible]

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.441000000 GHz PNO: Fast → IF Gain: Low Trig Delay-1.000 ms Trig: Video #Atten: 30 dB Avg Type: Log-Pwr

Ref Offset 2.01 dB Ref 20.00 dBm ΔMkr1 371.0 μs 2.45 dB

10 dB/div
Log

X2

ΔA2

TRIG LVL

Center 2.441000000 GHz Span 0 Hz
Res BW 1.0 MHz #VBW 3.0 MHz Sweep 10.00 ms (10001 pts)

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	A2	1	t	(Δ)	371.0 μs (Δ) 2.45 dB			
2	F	1	t		876.0 μs -22.02 dBm			
3								
4								
5								
6								
7								
8								
9								
10								
11								

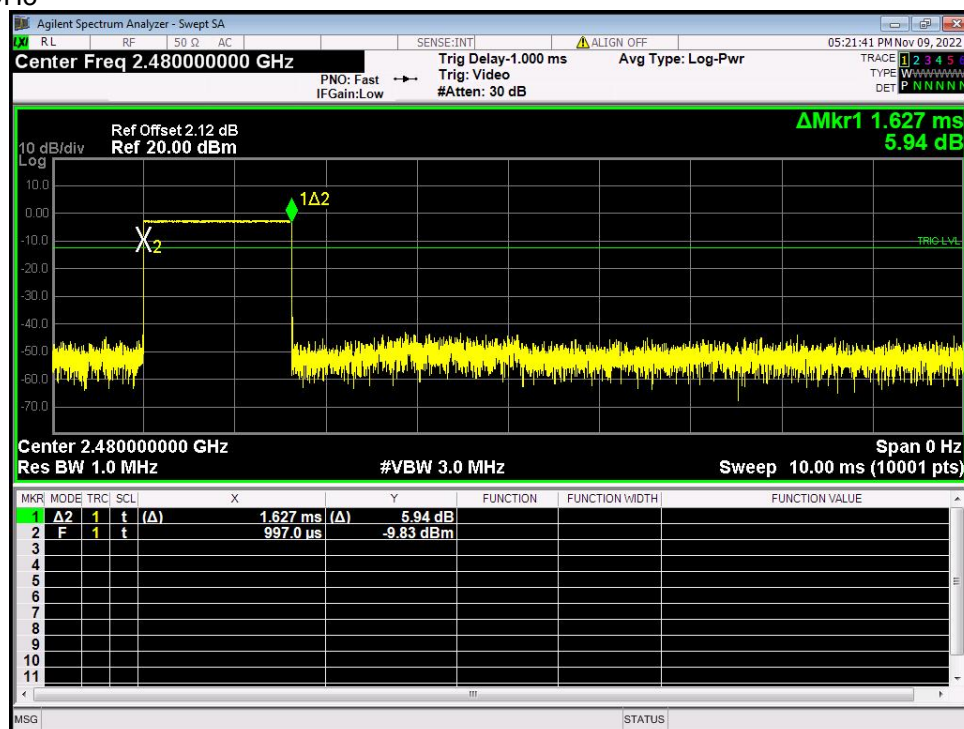
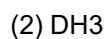
MSG STATUS

[illegible]

Center Freq 2.44100000 GHz
PNO: Fast IFGain:Low →
Trig Delay-1.000 ms
Trig: Video #Atten: 30 dB
Avg Type: Log-Pwr
Ref Offset 2.01 dB
Ref 20.00 dBm
ΔMkr1 2.876 ms
6.45 dB

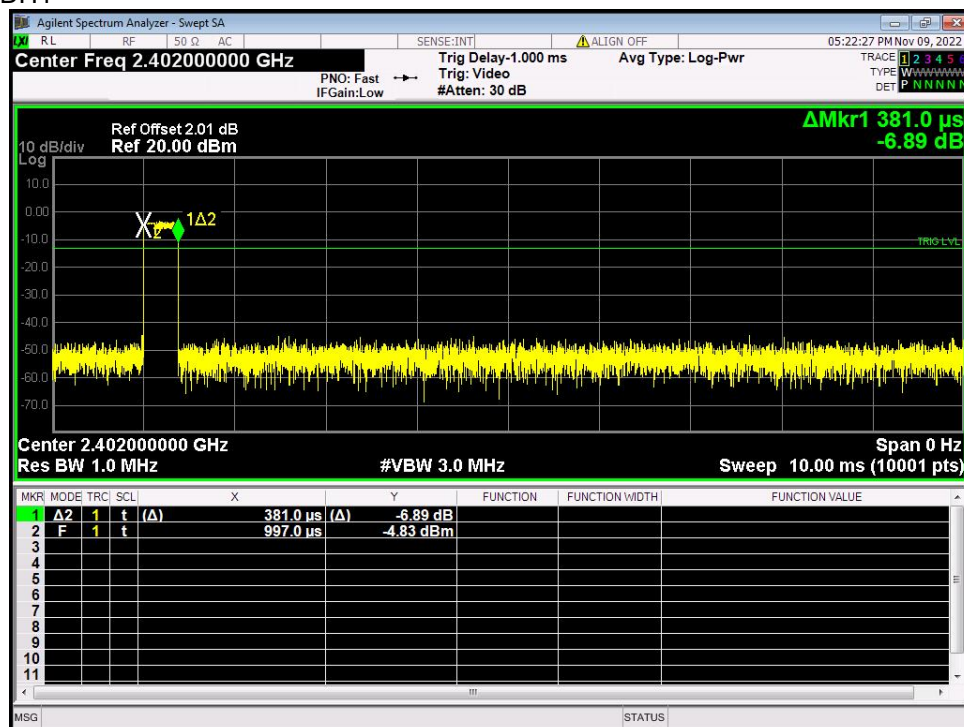
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	Δ2	1	t	(Δ)	2.876 ms	(Δ)	6.45 dB	
2	F	1	t		997.0 μs		-11.81 dBm	

(1) DH1



[illegible]

(1) 2DH1



Agilent Spectrum Analyzer - Swept SA

Center Freq 2.402000000 GHz

PNO: Fast IF Gain: Low

Trig Delay-1.000 ms

Trig: Video

#Atten: 30 dB

Avg Type: Log-Pwr

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Ref Offset 2.01 dB

Ref 20.00 dBm

ΔMkr1 1.625 ms

-2.27 dB

Center 2.402000000 GHz

Res BW 1.0 MHz

#VBW 3.0 MHz

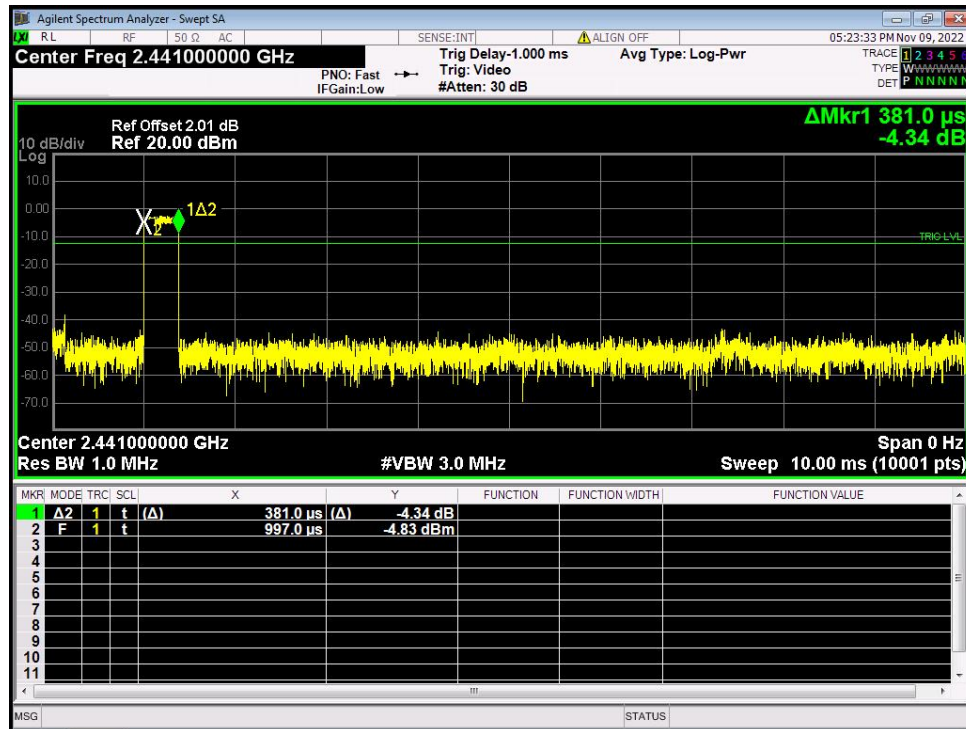
Span 0 Hz

Sweep 10.00 ms (10001 pts)

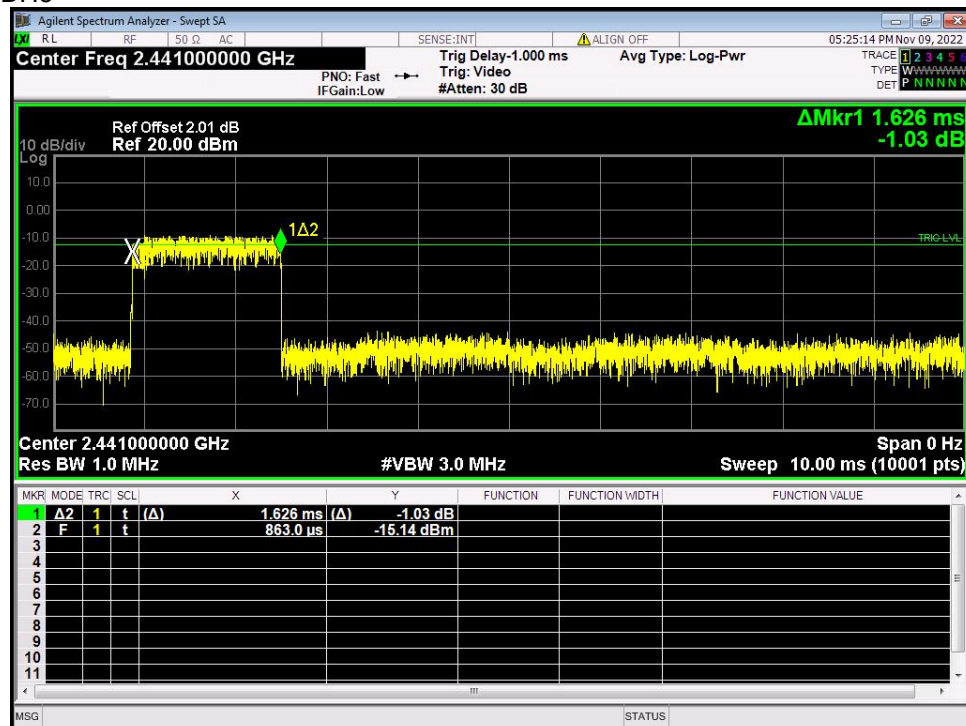
[illegible]

5. Middle channel (2.441 GHz):

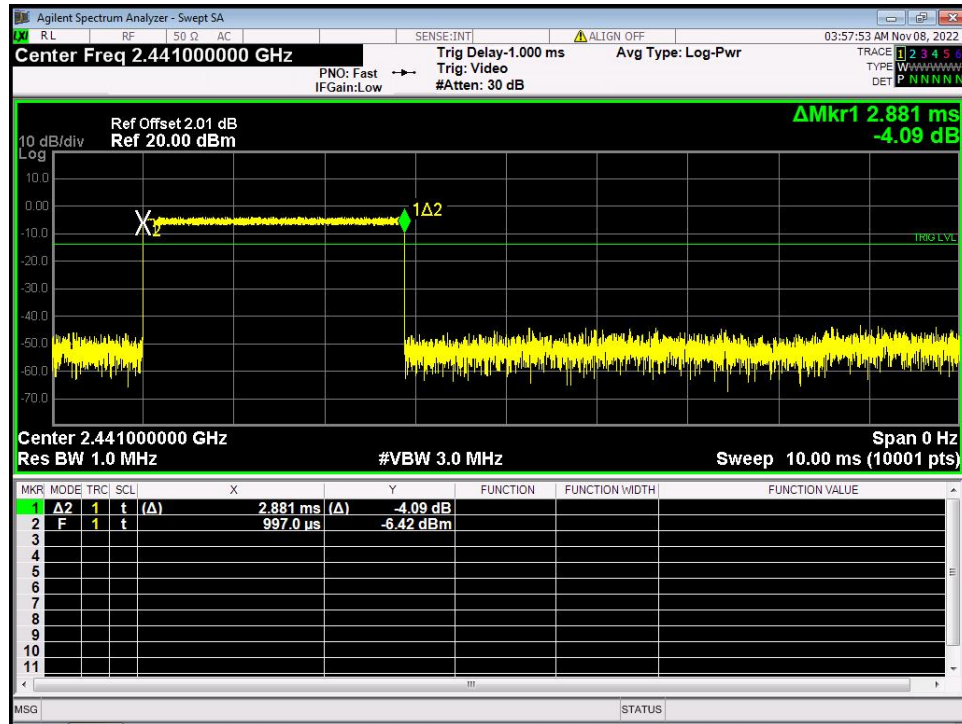
(1) 2DH1



(2) 2DH3

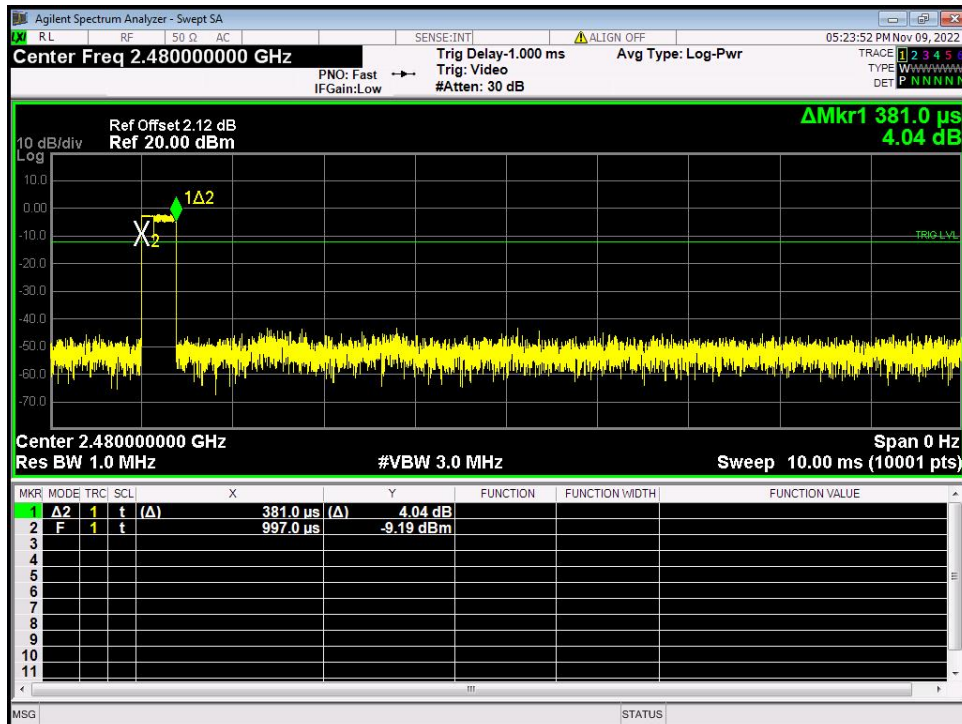


(3) 2DH5

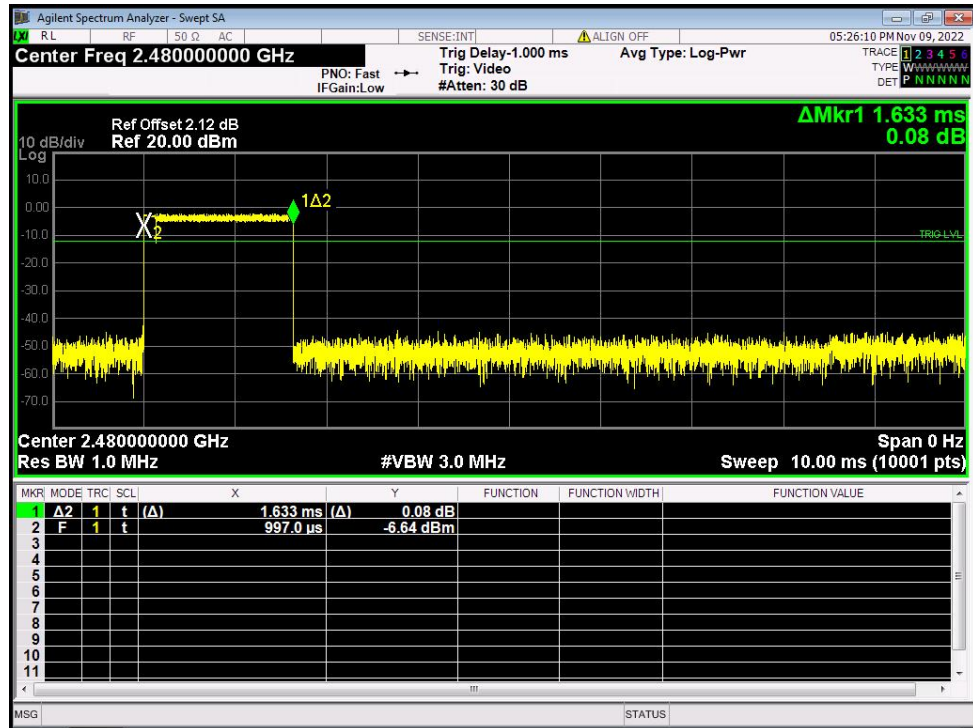


6. Highest channel (2.480 GHz):

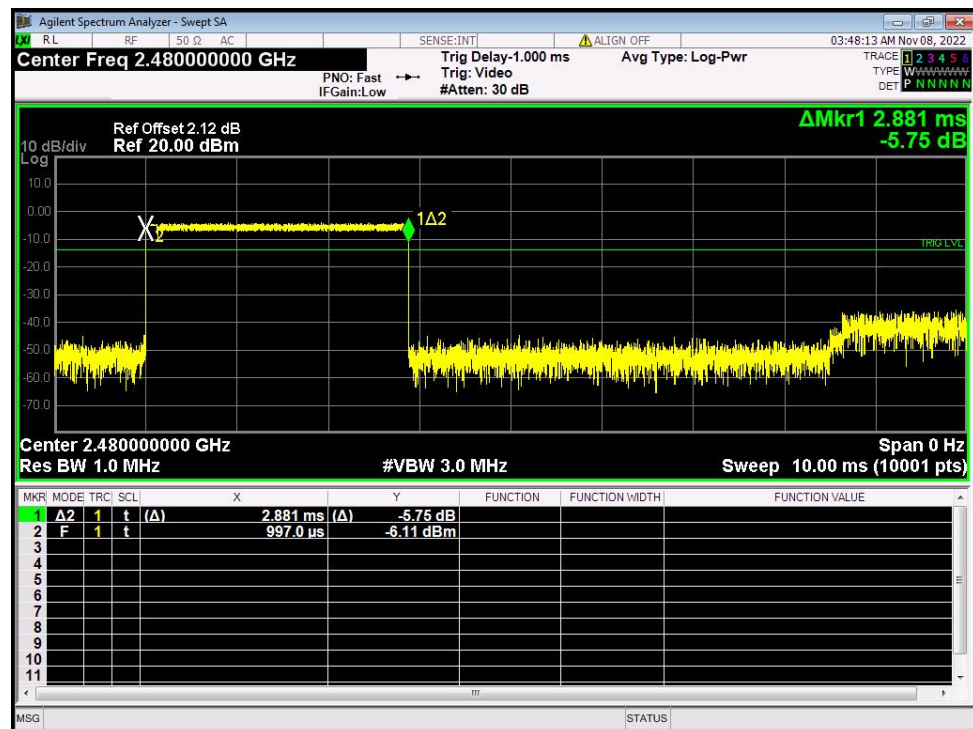
(1) 2DH1



(2) 2DH3



(3) 2DH5



Remark:

In communication data link mode (except inquiry or page mode) the hopping rate is 1600 per second, the 79 channels will be randomly selected for RF channel, and each channel have equal probability to be selected. The hop selection scheme is defined in Clause 2.6 of Part B of Volume 2 of core specification of Bluetooth.

The Dwell time must be calculated via following formula:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds

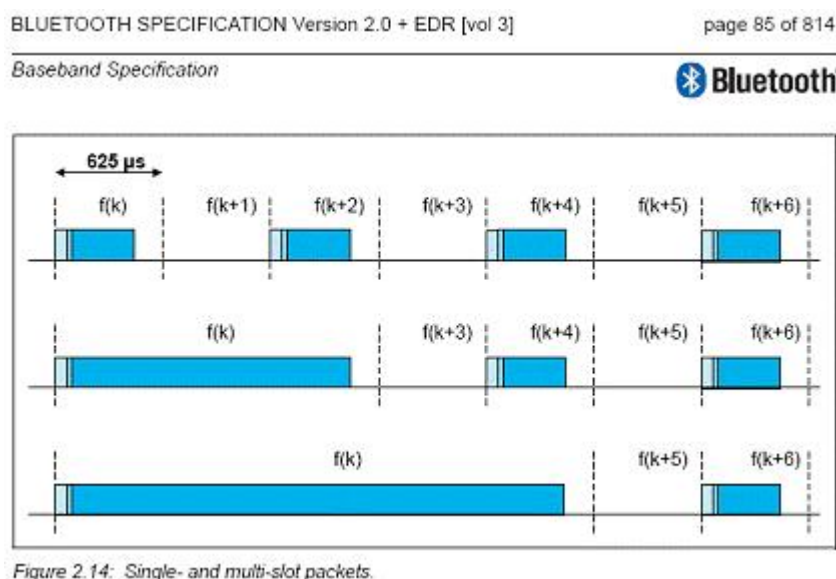
So

Dwell time DH1= slot time * (1600/2/79) * 31.6

Dwell time DH3= slot time * (1600/4/79) * 31.6

Dwell time DH5= slot time * (1600/6/79) * 31.6

The RF channel will remain fixed for duration of a packet, that means for DH3 packet the RF frequency will remain unchanged during 3 slots (1 slot=1/1600=625us), and for DH5 packet the RF frequency will remain unchanged during 5 slots, illustrated the principle as below:



Therefore, in a certain period for different packet types, the quantities of hops (not hopping rate 1600) are different, accurately, the quantity of hops for DH1 is double of DH3's and triple of DH5's. "for DH1 packet, 1 hop in 1 slot; for DH3 packet, 1/2 hop in 1 slot; for DH5 packet, 1/3 hop in 1 slot.", explained as below:

From the illustrated hopping scheme:

For DH1, in two slots, there are two hops, i.e. $f(k)$ in Slot(k), $f(k+1)$ in Slot(k+1), means DH1 1 hop in 1 slot;

For DH3, in four slots, there are two hops, i.e. $f(k)$ in Slot(k) & Slot(k+1) & Slot(k+2), $f(k+3)$ in

Slot(k+3), means DH3 2 hops in four slots -> $\frac{1}{2}$ hop in 1 slot;

For DH5, in six slots, there are two hops, i.e. f(k) in Slot(k) & Slot(k+1) & Slot(k+2) & Slot(k+3) & Slot(k+4), f(k+5) in Slot(k+5), means DH3 2 hops in six slots -> $\frac{1}{3}$ hop in 1 slot.

The Hopping rate in the formula should not be fixed value, for DH1, it is $1600/2$; for DH3, it is $1600/4$; for DH5, it is $1600/6$.

To calculate Dwell time of data transmission of Bluetooth system, the worst case is for Bluetooth PICONET that contains two devices only (although Bluetooth PICONET can support up to eight devices), and for Bluetooth data transmission, after device A sending a packet to device B, device A must get response packet from device B to continue data transmission;

For DH1 packet: assume device A is EUT, the worst case is after device A sending a DH1 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 1 time slot for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is half of 1600, i.e. 800 hops per second for EUT;

For DH3 packet: assume device A is EUT, the worst case is after device A sending a DH3 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 3 time slots for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is quarter of 1600, i.e. 400 hops per second for EUT;

For DH5 packet: assume device A is EUT, the worst case is after device A sending a DH5 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 5 time slots for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is sixth of 1600, i.e. $1600/6=266.7$ hops per second for EUT;

5.7 Maximum Peak Output Power

Test Requirement: FCC Part 15 C section 15.247

(b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125W

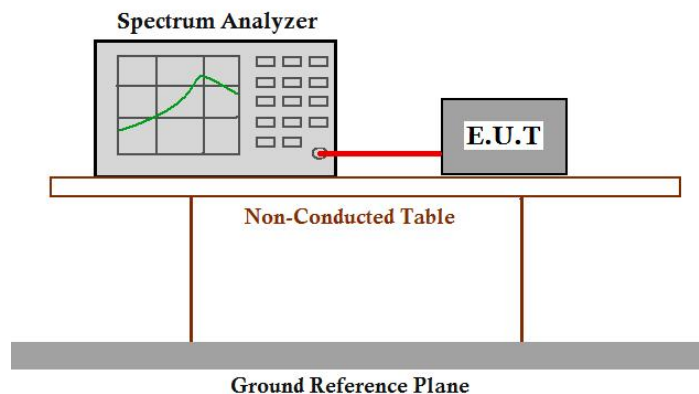
Refer to the result "Hopping channel number" of this document. The 1 watt (30.0 dBm) limit applies.

Test Method: ANSI C63.10:2013

Test Limit:

Test mode: Pre-test the EUT in continuous transmitting mode at the lowest, middle and highest channel with different data packet. Compliance test in continuous transmitting mode with normal (DH5) and EDR mode (2DH5) as the worst case was found.

Test Configuration:



Test Procedure:

- 1 . Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
- 2 . Set the spectrum analyzer : RBW > 20 db bandwidth VBW 2 RBW . Sweepauto : Detector Function = Peak
- 3 . Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

Test Result: (For Bluetooth)				
Normal mode(DH5):				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	-4.628	21.0	Pass
Middle	2441	-4.368	21.0	Pass
Highest	2480	-4.627	21.0	Pass
EDR mode(2DH5):				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	-3.892	21.0	Pass
Middle	2441	-3.598	21.0	Pass
Highest	2480	-3.785	21.0	Pass
Remark: cable lose=2.01dB				
Test result: The unit does meet the FCC requirements.				
Test result plot as follows:				