RF Test Report

For

Applicant Name:	Shenzhen Xinlongwei intelligent Technology Co., LTD
Address:	4 / F, Building E, Xingguang Industrial Park, Shilong Community, Shiyan Street, Baoan District, Shenzhen
EUT Name:	wristband
Brand Name:	N/A
Model Number:	LH10
Series Model Number:	LH8, LH9, LH17, LH18, LH19, LH20, LH21, LH22, LH23, LH25, LH26, LH28, LH29

Issued By

Company Name:	**BTF Testing Lab (Shenzhen) Co., Ltd.**
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Report Number:	BTF230703R00501
Test Standards:	47 CFR Part 15 Subpart C Section 15.247
FCC ID:	2BBTT-LH10
Test Conclusion:	Pass
Test Date:	2023-06-26 to 2023-07-05
Date of Issue:	2023-07-05
Prepared By:	Elma.Kang
	Elma.yang / Project Engineer
Date:	2023-07-05
Approved By:	Ryan
	Ryan.CJ / Project Manager
Date:	2023-07-05

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Revision History		
Version	Issue Date	Revisions Content
R_V0	July 05th 2023	Original
Note:	*Once the revision has been made, then previous versions reports are invalid.*	

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Table of Contents

1. Introduction 4
1.1 Identification of Testing Laboratory 4
1.2 Identification of the Responsible Testing Location 4
1.3 Laboratory Condition 4
1.4 Announcement 4
2. Product Information 5
2.1 Application Information 5
2.2 Manufacturer Information 5
2.3 Factory Information 5
2.4 General Description of Equipment under Test (EUT) 5
2.5 Technical Information 6
3. Summary of Test Results 8
3.1 Test Standards 8
3.2 Summary of Test Result 9
3.3 Uncertainty of Test 10
4. Test Configuration 11
4.1 Environment Condition 11
4.2 Test Equipment List 11
4.3 Test Auxiliary Equipment 12
4.4 Test Setup 13
5. Test Items 16
5.1 Antenna Requirements 16
5.2 Frequency Hopping System 17
5.3 Number of Hopping Frequencies 18
5.4 Peak Output Power 19
5.5 Occupied Bandwidth 20
5.6 Carrier Frequency Separation 21
5.7 Time of Occupied (Dwell time) 22
5.8 Conducted Spurious Emission & Authorized-band band-edge 24
5.9 Conducted Emission 25
5.10 Radiated Spurious Emission 26
5.11 Band Edge (Restricted-band-edge) 28
ANNEX A Test Results 29
A.1 Number of Hopping Frequency 29
A.2 Peak Output Power 31
A.3 20 dB and 99% Bandwidth 36
A.4 Hopping Frequency Separation 41
A.5 Average time of Occupancy 46
A.6 Conducted Spurious Emissions & Authorized-band band-edge 48
A.7 Conducted Emission 63
A.8 Radiated Spurious Emission 65
A.9 Band Edge (Restricted-band-edge) 69
ANNEX BTEST SETUP PHOTOS 71
ANNEX CEUT EXTERNAL PHOTOS 71
ANNEX DEUT INTERNAL PHOTOS 71

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1. Introduction

1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130

1.2 Identification of the Responsible Testing Location

Test Location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Description:	All measurement facilities used to collect the measurement data are located at F101,201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
FCC Registration Number:	518915
Designation Number:	CN1330

1.3 Laboratory Condition

Ambient Temperature:	20℃ to 25℃
Ambient Relative Humidity:	45% to 55%
Ambient Pressure:	100 kPa to 102 kPa

1.4 Announcement

(1) The test report reference to the report template version v0.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

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2. Product Information

2.1 Application Information

Company Name:	Shenzhen Xinlongwei intelligent Technology Co., LTD
Address:	4 / F, Building E, Xingguang Industrial Park, Shilong Community, Shiyan Street, Baoan District, Shenzhen

2.2 Manufacturer Information

Company Name:	Shenzhen Xinlongwei intelligent Technology Co., LTD
Address:	4 / F, Building E, Xingguang Industrial Park, Shilong Community, Shiyan Street, Baoan District, Shenzhen

2.3 Factory Information

Company Name:	Shenzhen Xinlongwei intelligent Technology Co., LTD
Address:	4 / F, Building E, Xingguang Industrial Park, Shilong Community, Shiyan Street, Baoan District, Shenzhen

2.4 General Description of Equipment under Test (EUT)

EUT Name	wristband
Under Test Model Name	LH10
Series Model Name	LH8, LH9, LH17, LH18, LH19, LH20, LH21, LH22, LH23, LH25, LH26, LH28, LH29
Description of Model name differentiation	All the same except model number
Hardware Version	V1.0
Software and Firmware Version	V1.0

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2.5 Technical Information

Modulation Technology	FHSS
Modulation Type	GFSK, π/4-DQPSK, 8-DPSK
Product Type	☐ Mobile ☒ Portable ☐ Fixed Location
Transfer Rate	DH5: 1 Mbps 2DH5: 2 Mbps 3DH5: 3 Mbps
Frequency Range	The frequency range used is 2402 MHz – 2480 MHz; The frequency block is 2400 MHz to 2483.5 MHz.
Number of Channel	79 (at intervals of 1 MHz)
Tested Channel	0 (2402 MHz), 39 (2441 MHz), 78 (2480 MHz)
Antenna Type	Internal Antenna
Antenna Gain#	0.5 dBi
Antenna Impedance	50Ω
Antenna System (MIMO Smart Antenna)	N/A

Note:

#: The antenna gain provided by the applicant, and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.

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All channel was listed on the following table:

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

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3. Summary of Test Results

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C Section 15.247	Intentional Radiators
2	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
3	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules

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3.2 Summary of Test Result

No.	Description	FCC Part No.	Channel	Test Result	Verdict	Remark
1	Antenna Requirement	15.203	N/A	--	Pass	--
2	Number of Hopping Frequencies	15.247(a)	Hopping Mode	ANNEX A.1	Pass	--
3	Peak Output Power	15.247(b)	Low/Middle/High	ANNEX A.2	Pass	--
4	Occupied Bandwidth	15.247(a)	Low/Middle/High	ANNEX A.3	Pass	--
5	Carrier Frequency Separation	15.247(a)	Hopping Mode	ANNEX A.4	Pass	--
6	Time of Occupancy (Dwell time)	15.247(a)	Hopping Mode	ANNEX A.5	Pass	--
7	Conducted Spurious Emission & Authorized-band band-edge	15.247(d)	Low/High	ANNEX A.6	Pass	--
8	Conducted Emission	15.207	Low/Middle/High	ANNEX A.7	Pass	--
9	Radiated Spurious Emission	15.209 15.247(d)	Low/Middle/High	ANNEX A.8	Pass	--
10	Band Edge (Restricted-band band-edge)	15.209 15.247(d)	Low/High	ANNEX A.9	Pass	--

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3.3 Uncertainty of Test

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2 and TR100 028-1/-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Occupied Channel Bandwidth	69 KHz
RF output power, conducted	0.87 dB
Unwanted Emissions, conducted	0.94 dB
All emissions, radiated(<1GHz)	4.12 dB
All emissions, radiated(>1GHz)	4.16 dB
Temperature	0.82 °C
Humidity	4.1 %

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4. Test Configuration

4.1 Environment Condition

Environment Parameter	Selected Values During Tests			
	Temperature	Voltage	Relative Humidity	Ambient Pressure
Normal Temperature, Normal Voltage (NTNV)	20°C to 25°C	DC 3.7V from battery	30% to 60%	100 kPa to 102 kPa

4.2 Test Equipment List

Conducted Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022.11.24	2023.11.23	☒
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022.11.24	2023.11.23	☒
ESG VECTOR SIGNAL GENERATOR	Agilent	E4438C	MY45094854	2022.11.24	2023.11.23	☒
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2022.11.24	2023.11.23	☒
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022.11.25	2023.11.24	☒
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022.11.24	2023.11.23	☒
RF Control Unit	TST	TST-Full	S01	/	/	☒
RF Test software	TST	V2.0	/	/	/	☒

Radiated Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2022.11.24	2023.11.23	☒
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2022.11.24	2023.11.23	☒
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2021.11.28	2023.11.27	☒
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2021.11.28	2023.11.27	☒
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/	☒
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022.11.24	2023.11.23	☒
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2022.11.24	2023.11.23	☒

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RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2022.11.24	2023.11.23	☒
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023.3.24	2024.3.23	☒
RE Cable	Talent Microwave	A40-2.92M2.92 M-14M	22080539	2022.11.24	2023.11.23	☒
RE Cable	Talent Microwave	A81-SMAMNM-14M	22080538	2022.11.24	2023.11.23	☒
Preamplifier	SCHWARZBECK	BBV9744	00246	2022.11.24	2023.11.23	☒
Horn Antenna	Schwarzbeck	BBHA9120D	2597	2022.5.22	2024.5.21	☒
Broadband Preamplilifier	Schwarzbeck	BBV9718D	00008	2023.3.24	2024.3.23	☒

Conducted disturbance Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESCI3	101422	2022.11.24	2023.11.23	☒
V-LISN	SCHWARZBECK	NSLK 8127	01073	2022.11.24	2023.11.23	☒
LISN	AFJ	LS16/110VAC	16010020076	2022.11.24	2023.11.23	☒
Coaxial Switcher	SCHWARZBECK	CX210	CX210	2022.11.24	2023.11.23	☒
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	00953	2022.11.24	2023.11.23	☒
EZ_EMC	Frad	EMC-CON 3A1.1+	/	/	/	☒

4.3 Test Auxiliary Equipment

Description	Manufacturer	Model	Serial No.	Length	Description	Use
N/A	N/A	N/A	N/A	N/A	N/A	☒

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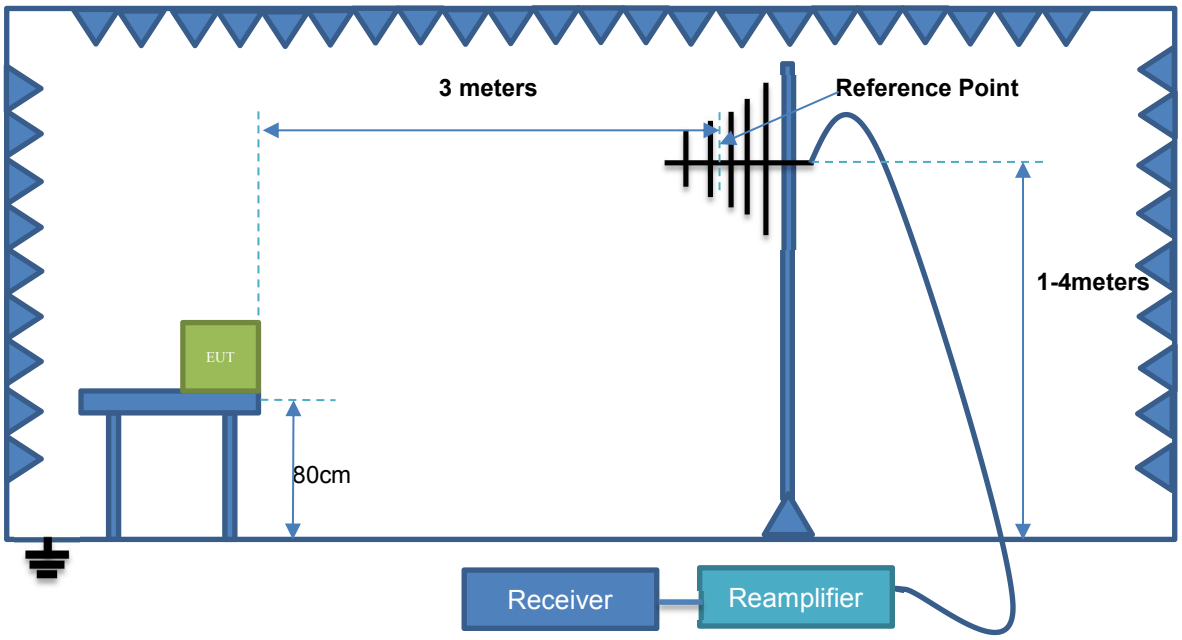
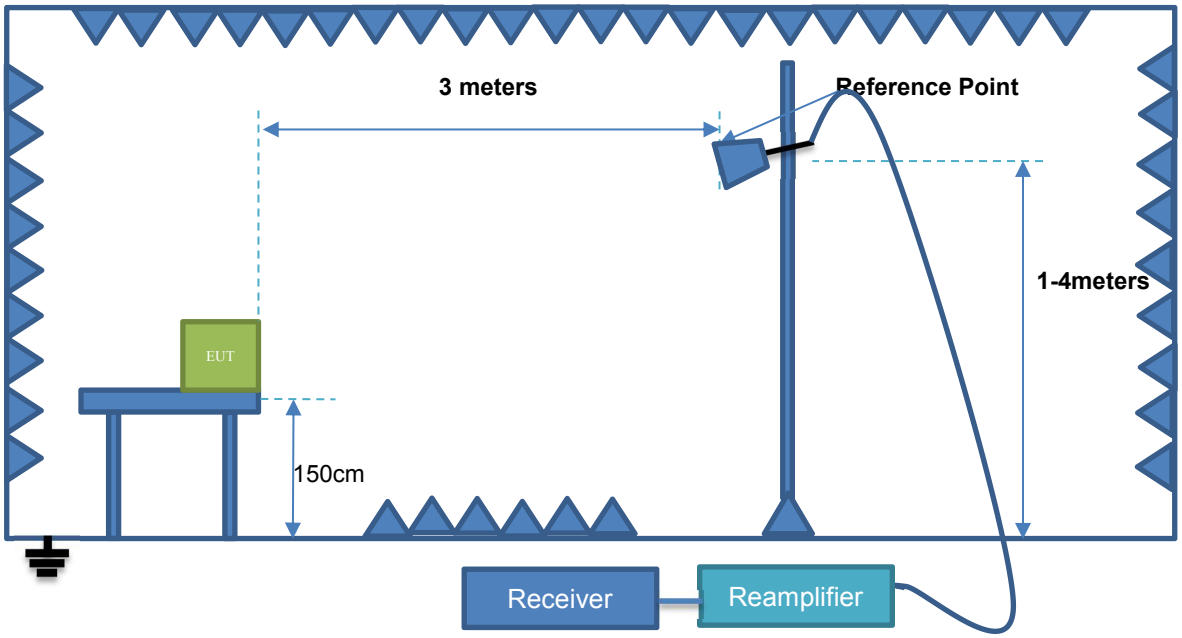
4.4 Test Setup

Test Setup 1



Radiation Test (30MHz – 1GHz)



Radiation Test (Above 1GHz)

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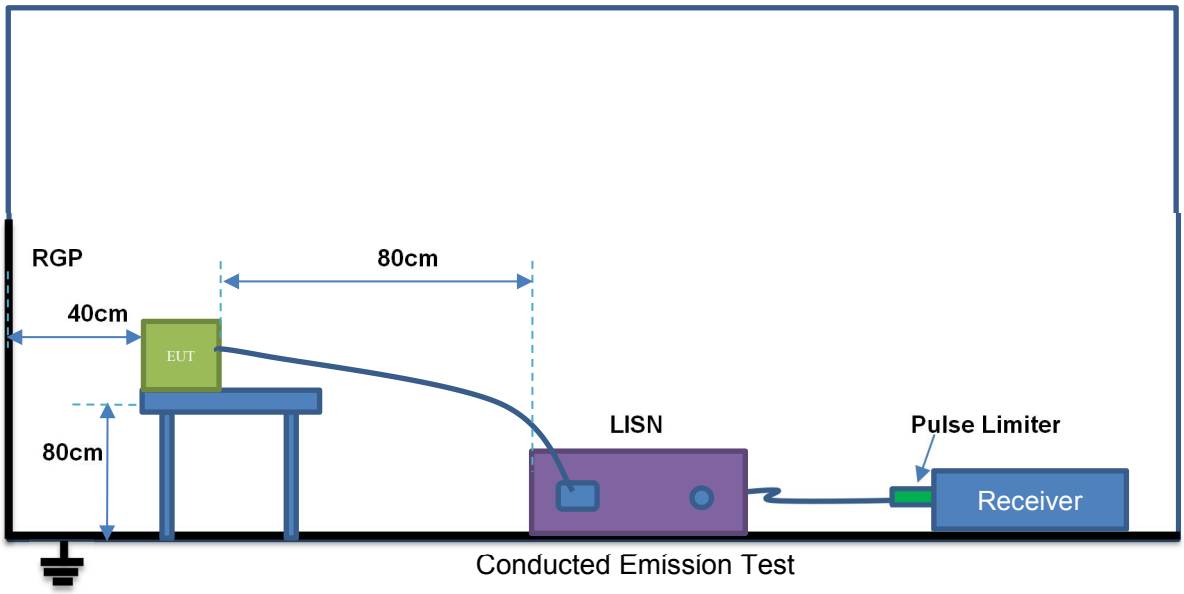
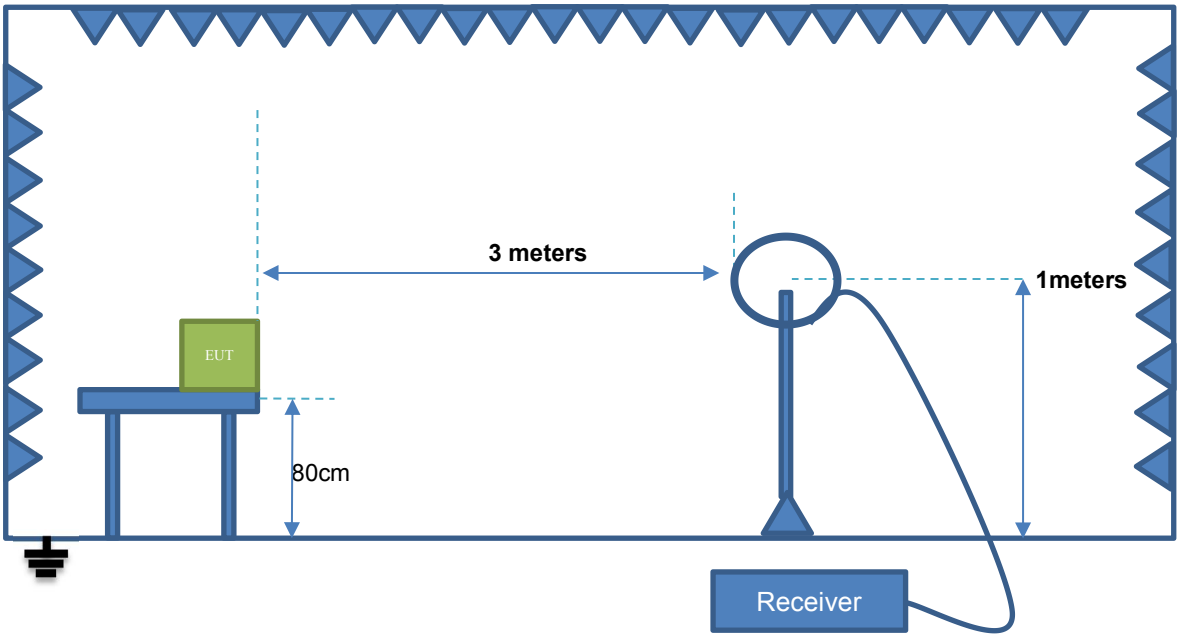
Test Setup 2



Conducted Emission Test

Test Setup 3



Radiation Test (9k - 30MHz)

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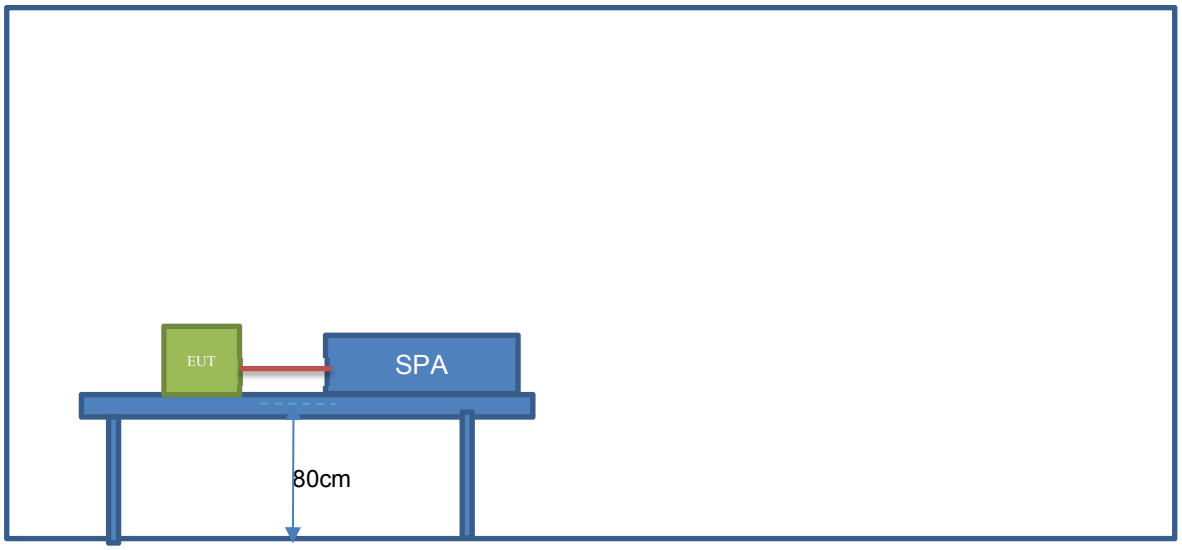
Test Setup 4



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5. Test Items

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203 & §15.247, RSS-247, 5.4(f)
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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 FCC rule.

5.1.2 Antenna Anti-Replacement Construction

Protected Method	Description
The antenna is embedded in the product.	An embedded in antenna design is used.

Reference Documents	Item
Photo	Please refer to the EUT Photo documents.

5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

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5.2 Frequency Hopping System

5.2.1 Relevant Standards

FCC §15.247(a) (1) (i) (ii) (iii) (iv); FCC §15.247(g); FCC §15.247(h)

Describe how the hopping sequence is generated. Provide an example of the hopping sequence channels, to demonstrate that the sequence meets the requirement specified in the definition of an FHSS system. Per the definition in Section 2.1(c), the hop set shall appear as random in the near term, shall appear as evenly distributed in the long term, and sequential hops shall be randomly distributed in both direction and magnitude of change.
Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (e.g., that each new transmission event begins on the next channel in the hopping sequence after the final channel used in the previous transmission event).
Describe how the associated receiver(s) complies with the requirement that the input bandwidth (either RF or IF) matches the bandwidth of the transmitted signal.
Describe how the associated receiver(s) has the ability to shift frequencies in synchronization with the transmitted signals.
For short burst systems, describe how the EUT complies with the requirement that it be designed to be capable of operating as a true frequency hopping system. Specifically, the device shall comply with the equal frequency use and pseudorandom hopping sequence requirement when transmitting in short bursts, and shall be designed to comply when presented with continuous data (or information) stream.
Describe how the EUT complies with the requirement that it not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

5.2.2 Description of the systems

1. According to the preset procedure of the whole network, all the stations in the automatic control network synchronously change the frequency multiple times within one second, and temporarily stay on each frequency hopping channel. Periodic synchronization signaling is sent from the primary station, instructing all slaves to simultaneously change the operating frequency, then the hopping sequence is generated.
2. The hop set shall appear as random in the near term, shall appear as evenly distributed in the long term, and sequential hops shall be randomly distributed in both direction and magnitude of change.
3. Channels are classified into two categories, used and unused, where used channels are part of the hopping sequence and unused channels are replaced in the hopping sequence by used channels in a pseudo- random way. Make each individual EUT meets the requirement that each of its hopping channels is used equally on average.
4. The input bandwidth and transmitted bandwith are both 1MHz, the associated receiver(s) complies with the requirement that the input bandwidth matches the bandwidth of the transmitted signal.
5. Connected devices communicate on the same physical channel by synchronizing with a common clock and hopping sequence.
6. EUT isn’t short burst systems.
7. EUT can’t have the ability to be coordinated with other FHSS systems in an effort.

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5.3 Number of Hopping Frequencies

5.3.1 Limit

FCC §15.247(a) (1) (iii); RSS-247, 5.1(d)

Frequency hopping systems operating in the 2400 MHz to 2483.5 MHz bands shall use at least 15 hopping frequencies.

5.3.2 Test Setup

See section 4.5 for test setup description for antenna port The photo of test setup please refer to ANNEX B

5.3.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = The frequency band of operation
RBW = To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
VBW ≥ RBW
Sweep = auto
Detector function = peak Trace = max hold
Allow the trace to stabilize

5.3.4 Test Result

Please refer to ANNEX A.1

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5.4 Peak Output Power

5.4.1 Limit

FCC § 15.247(b)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247, 5.4(b)
For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

5.4.2 Test Setup

See section 4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B

5.4.3 Test Procedure

The Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.
Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured
VBW ≥ RBW

Sweep = auto

Detector function = peak Trace = max hold
Allow the trace to stabilize.

5.4.4 Test Result

Please refer to ANNEX A.2

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5.5 Occupied Bandwidth

5.5.1 Limit

FCC §15.247(a)l; RSS-247, 5.1(a)

Measurement of the 20dB bandwidth of the modulated signal.

5.5.2 Test Setup

See section 4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B

5.5.3 Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel RBW = in the range of 1% to 5% of the OBW
VBW ≥ RBW

Sweep = auto

Detector function = peak Trace = max hold
The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

5.5.4 Test Result

Please refer to ANNEX A.3

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5.6 Carrier Frequency Separation

5.6.1 Limit

FCC §15.247(a); RSS-247, 5.1(b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 2/3 of the 20 dB bandwidth of the hopping channel, whichever is greater.

5.6.2 Test Setup

See section 4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B

5.6.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = auto

Detector function = peak Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

5.6.4 Test Result

Please refer to ANNEX A.4

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5.7 Time of Occupied (Dwell time)

5.7.1 Limit

FCC §15.247(a); RSS-247, 5.1(d)

Frequency hopping systems in the 2400 MHz - 2483.5 MHz band shall use at least 15 non-overlapping 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.

5.7.2 Test Setup

See section 4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B

5.7.3 Test Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: Span: Zero span, centered on a hopping channel

RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel

Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel

Detector function: Peak Trace: Max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

The average time of occupancy on any channel within the Period can be calculated with formulas: For GFSK and 8-DPSK:

For DH1 package type

{Total of Dwell} = {Pulse Time} * (1600 / 2) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

For DH3 package type

{Total of Dwell} = {Pulse Time} * (1600 / 4) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

For DH5 package type

{Total of Dwell} = {Pulse Time} * (1600 / 6) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

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For AFH Mode:

For DH1 package type

{Total of Dwell} = {Pulse Time} * (800 / 2) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

For DH3 package type

{Total of Dwell} = {Pulse Time} * (800 / 4) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

For DH5 package type

{Total of Dwell} = {Pulse Time} * (800 / 6) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4 s * {Number of Hopping Frequency}

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

5.7.4 Test Result

Please refer to ANNEX A.5

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5.8 Conducted Spurious Emission & Authorized-band band-edge

5.8.1 Limit

FCC §15.247(d); RSS-247, 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

5.8.2 Test Setup

See section 4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B

5.8.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz VBW = 300 kHz
Sweep = auto
Detector function = peak Trace = max hold
Allow the trace to stabilize

5.8.4 Test Result

Please refer to ANNEX A.6

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5.9 Conducted Emission

5.9.1 Limit

FCC §15.207; RSS-Gen, 8.8

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.9.2 Test Setup

See section 4.5 for test setup description for setup 2. The photo of test setup please refer to ANNEX B

5.9.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

5.9.4 Test Result

Please refer to ANNEX A.7

NOTE:

1. Results (dBuV) = Reading (dBuV) + Factor (dB)

The reading level is calculated by software which is not shown in the sheet

2. Factor = Insertion loss + Cable loss
3. Over limit = Results – Limit.

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5.10 Radiated Spurious Emission

5.10.1 Limit

FCC §15.209&15.247(d); RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a). According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

1. Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

5.10.2 Test Setup

See section 4.5 for test setup description for setup 1 and 3. The photo of test setup please refer to ANNEX B

5.10.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.
Use the following spectrum analyzer settings:

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Span = wide enough to fully capture the emission being measured RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak Trace = max hold
For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.10.4 Test Result

Please refer to ANNEX A.8

NOTE:
1. Results (dBuV) = Reading (dBuV) + Factor (dB)
The reading level is calculated by software which is not shown in the sheet
2. Factor = Insertion loss + Cable loss
3. Over limit = Results – Limit.

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5.11 Band Edge (Restricted-band-edge)

5.11.1 Limit

FCC §15.209&15.247(d); RSS-Gen 8.10; RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

5.11.2 Test Setup

See section 4.5 for test setup description for antenna port. The photo of test setup please refer to ANNEX B

5.11.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.
Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.11.4 Test Result

Please refer to ANNEX A.9

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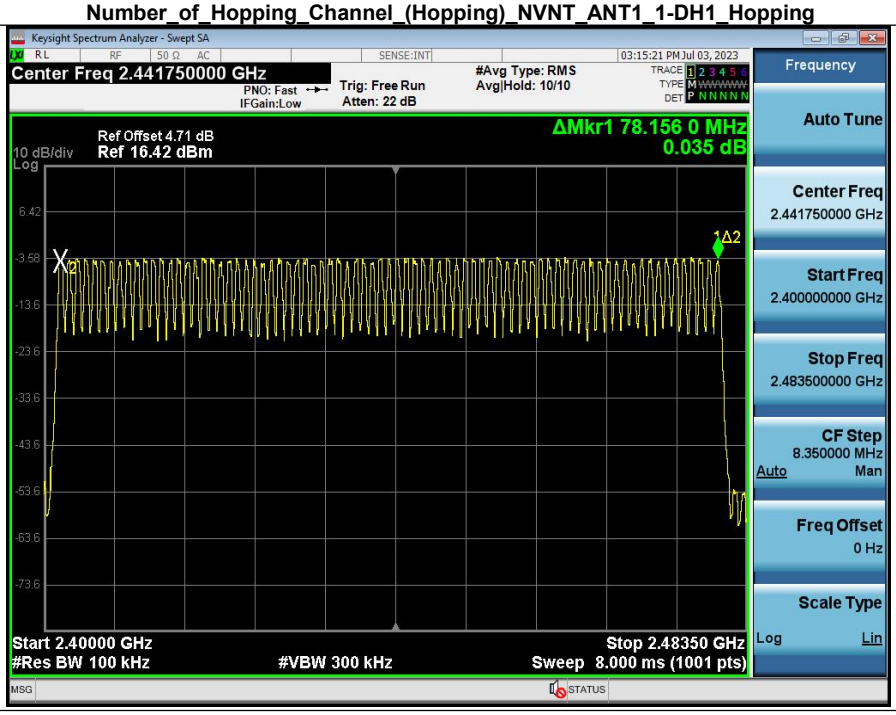
ANNEX A Test Results

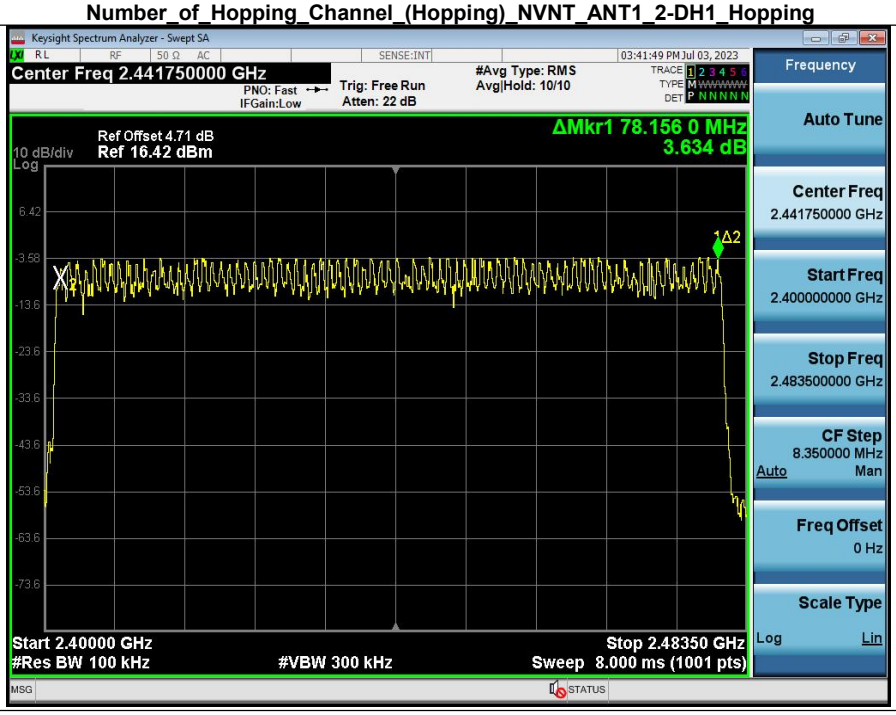
A.1 Number of Hopping Frequency

Antenna	Modulation	Hopping Num	Limit	Result
ANT1	1-DH1	79	15	Pass
ANT1	2-DH1	79	15	Pass
ANT1	3-DH1	79	15	Pass

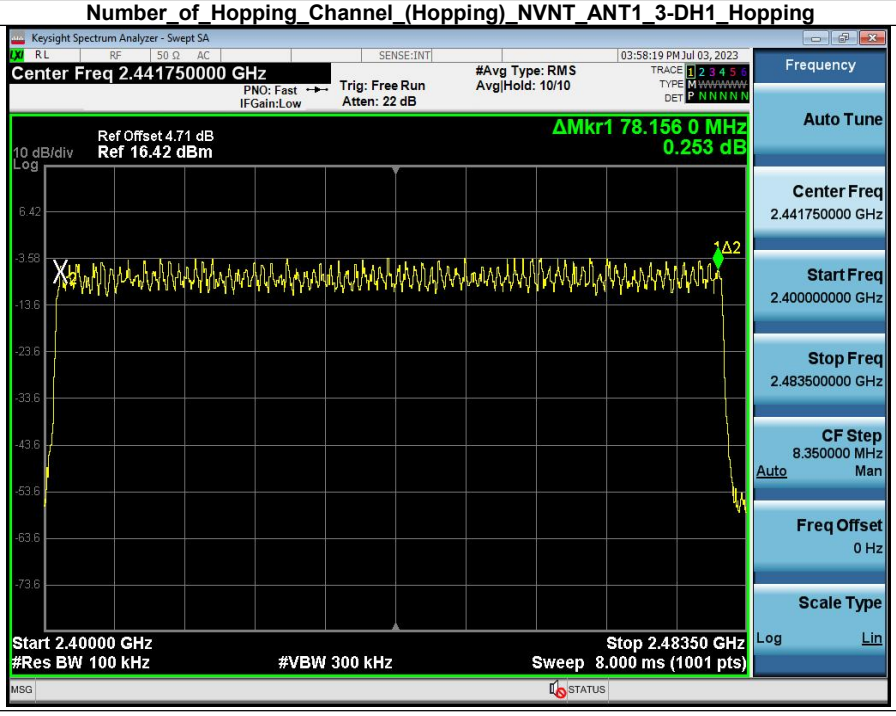
Number_of_Hopping_Channel_(Hopping)_NVNT_ANT1_1-DH1_Hopping



Number_of_Hopping_Channel_(Hopping)_NVNT_ANT1_2-DH1_Hopping



Number_of_Hopping_Channel_(Hopping)_NVNT_ANT1_3-DH1_Hopping



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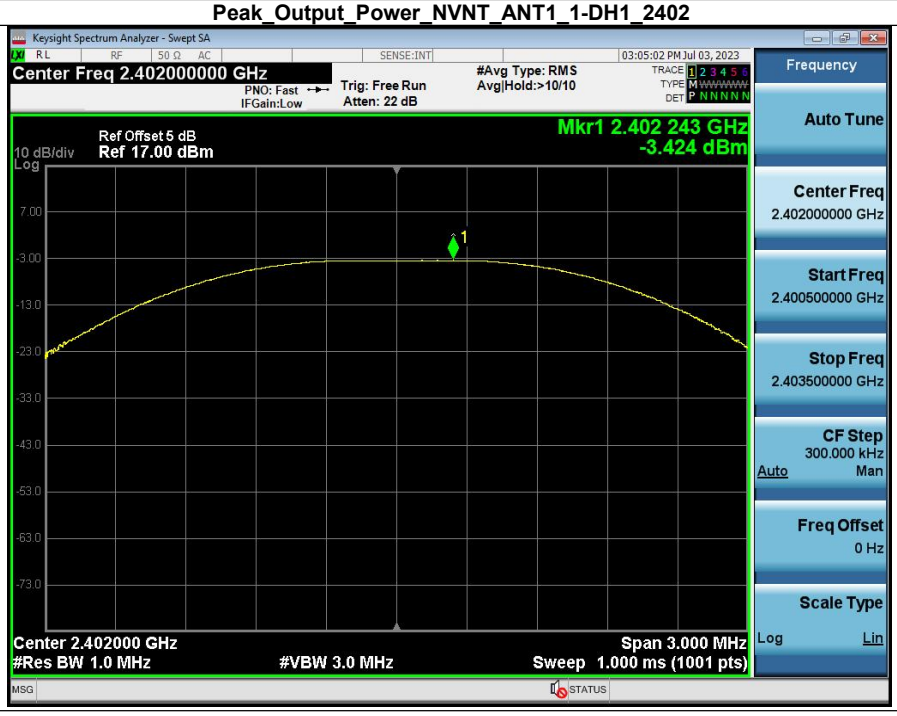
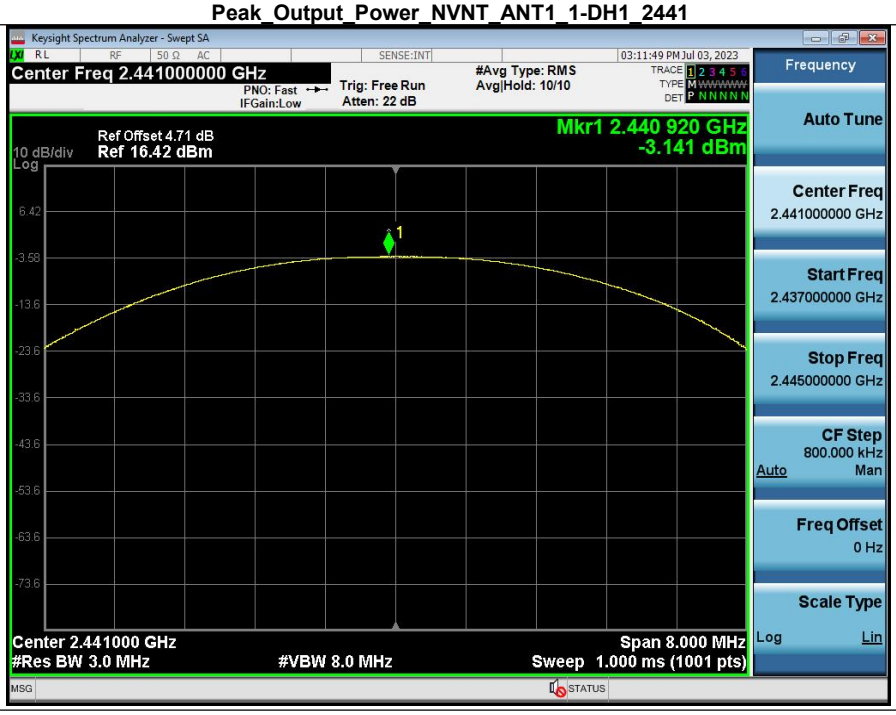
A.2 Peak Output Power

Modulation	Frequency (MHz)	Max. Conducted Power(dBm)	Max. Conducted Power(mW)	Limit(mW)	Result
1-DH1	2402.00	-3.42	0.45	1000	Pass
1-DH1	2441.00	-3.14	0.49	125	Pass
1-DH1	2480.00	-3.35	0.46	125	Pass
2-DH1	2402.00	-2.58	0.55	125	Pass
2-DH1	2441.00	-2.43	0.57	125	Pass
2-DH1	2480.00	-2.51	0.56	125	Pass
3-DH1	2402.00	-2.14	0.61	125	Pass
3-DH1	2441.00	-2.07	0.62	125	Pass
3-DH1	2480.00	-2.17	0.61	125	Pass

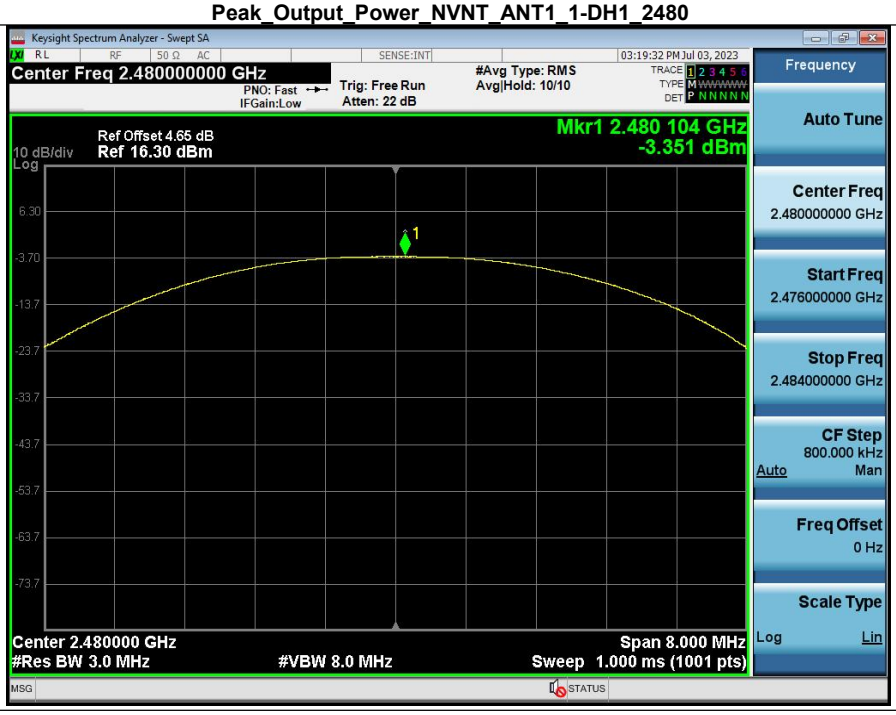
Peak_Output_Power_NVNT_ANT1_1-DH1_2402



Peak_Output_Power_NVNT_ANT1_1-DH1_2441



Peak_Output_Power_NVNT_ANT1_1-DH1_2480



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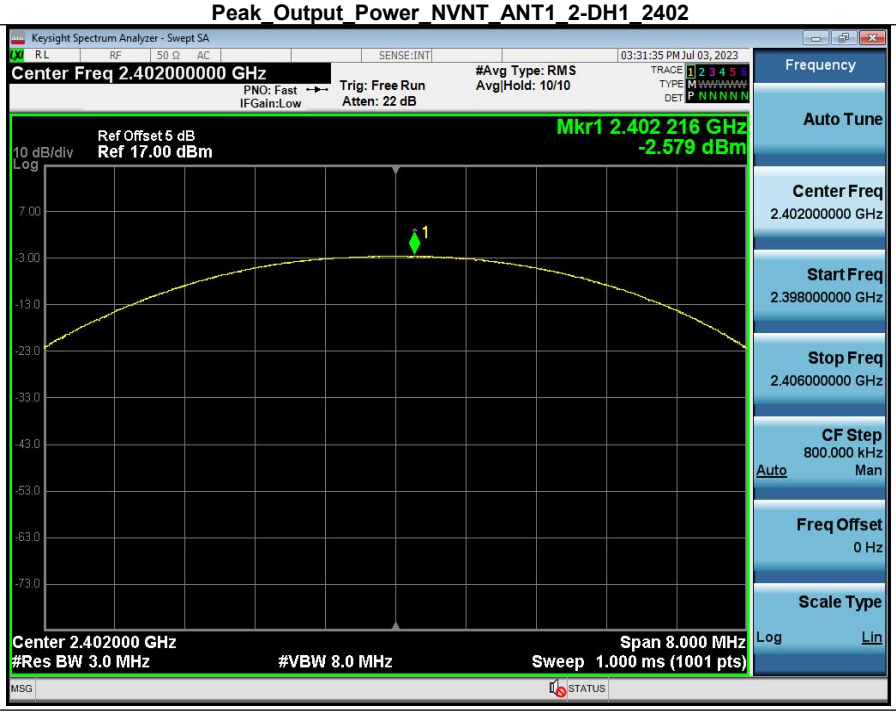
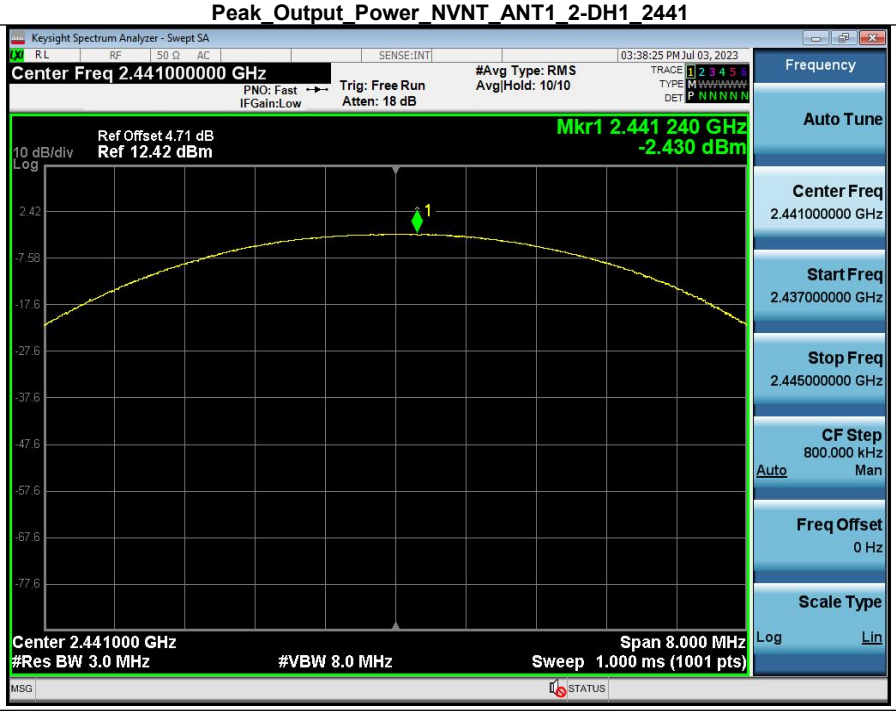
Peak_Output_Power_NVNT_ANT1_2-DH1_2402



Peak_Output_Power_NVNT_ANT1_2-DH1_2441



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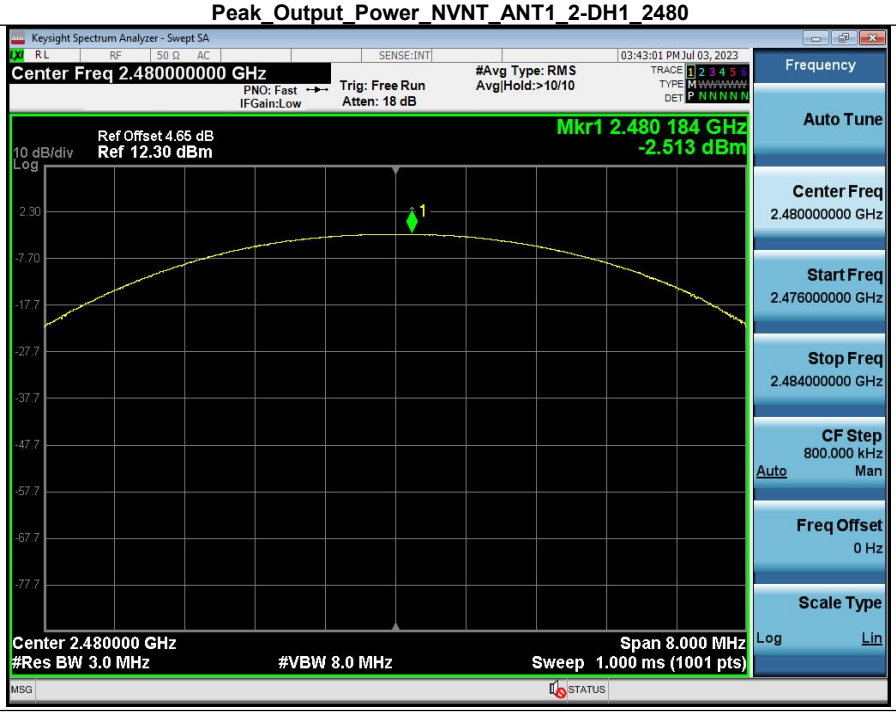
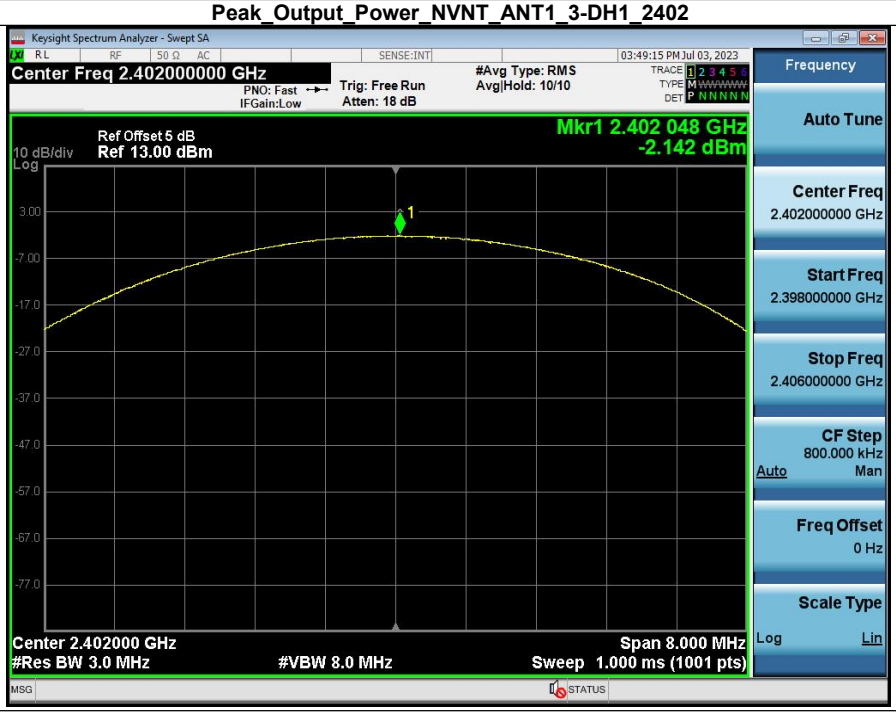
Peak_Output_Power_NVNT_ANT1_2-DH1_2480



Peak_Output_Power_NVNT_ANT1_3-DH1_2402



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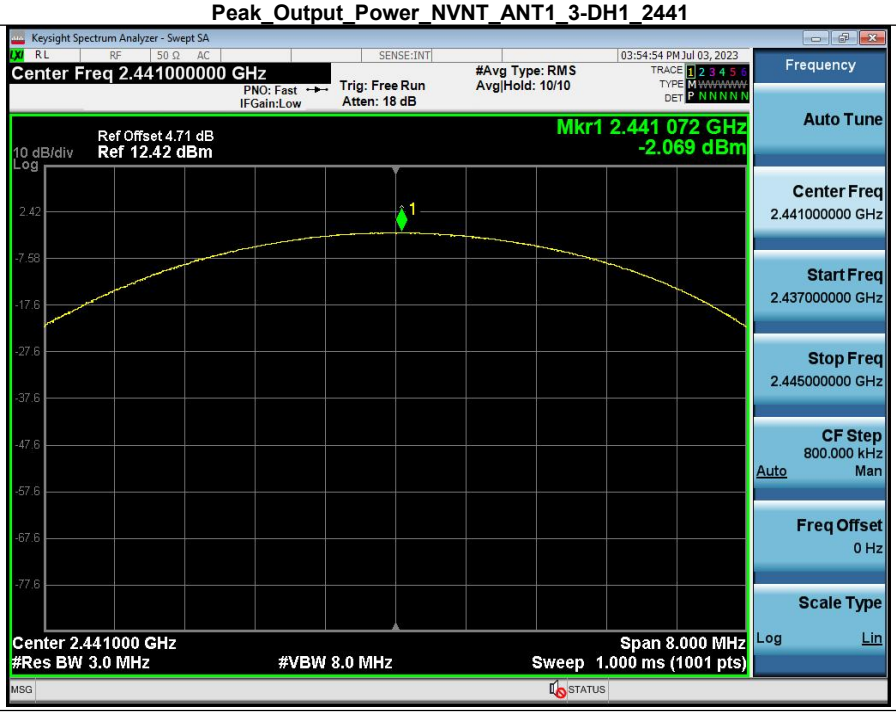
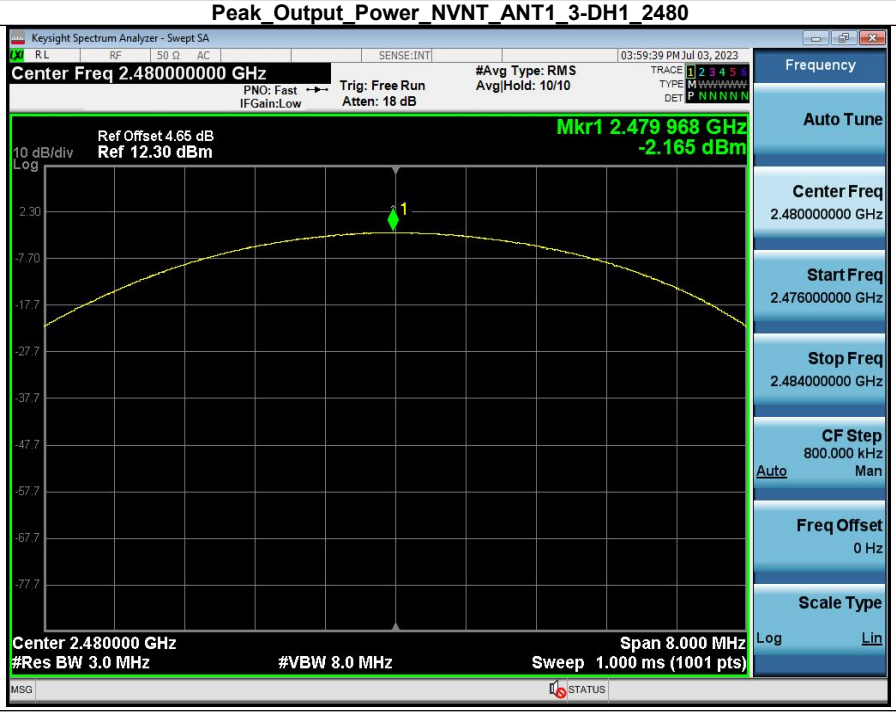
Peak_Output_Power_NVNT_ANT1_3-DH1_2441



Peak_Output_Power_NVNT_ANT1_3-DH1_2480



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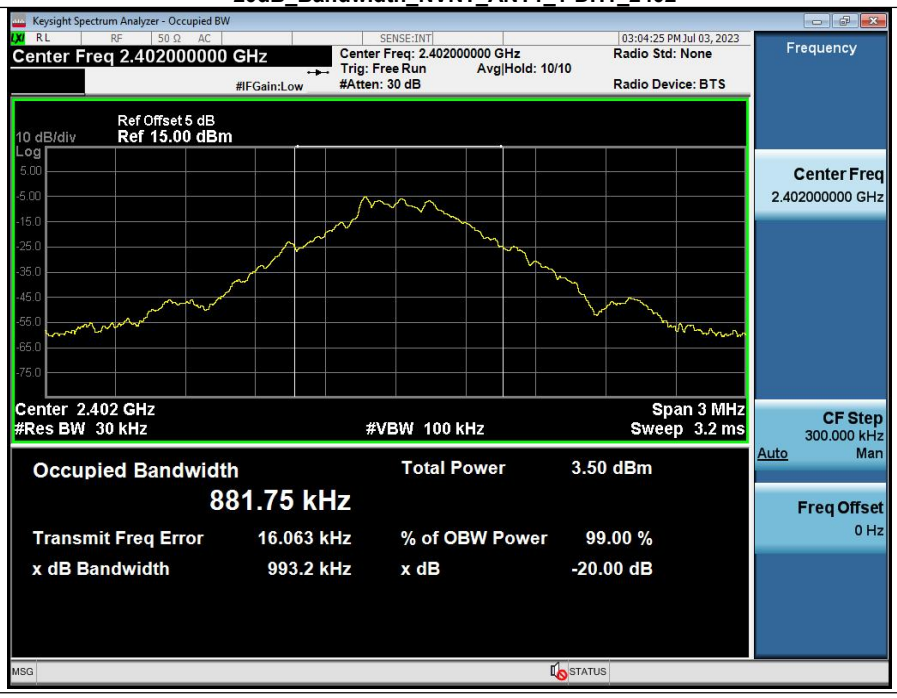
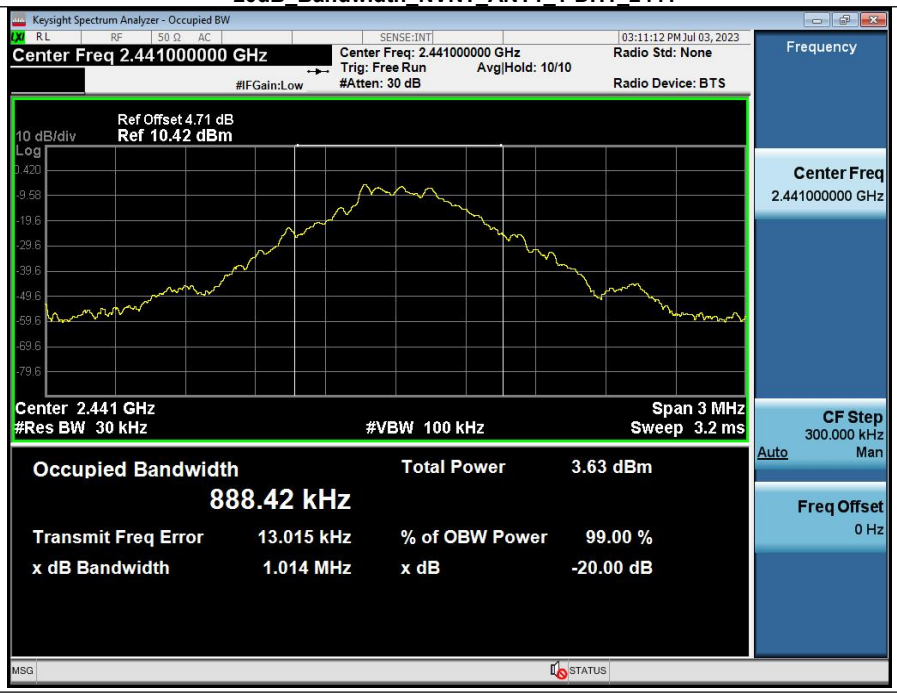
A.3 20 dB and 99% Bandwidth

Modulation	Frequency (MHz)	-20dB BW(MHz)	Result
1-DH1	2402.00	0.993	Pass
1-DH1	2441.00	1.014	Pass
1-DH1	2480.00	1.026	Pass
2-DH1	2402.00	1.292	Pass
2-DH1	2441.00	1.291	Pass
2-DH1	2480.00	1.288	Pass
3-DH1	2402.00	1.306	Pass
3-DH1	2441.00	1.321	Pass
3-DH1	2480.00	1.320	Pass

-20dB_Bandwidth_NVNT_ANT1_1-DH1_2402



-20dB_Bandwidth_NVNT_ANT1_1-DH1_2441



-20dB_Bandwidth_NVNT_ANT1_1-DH1_2480

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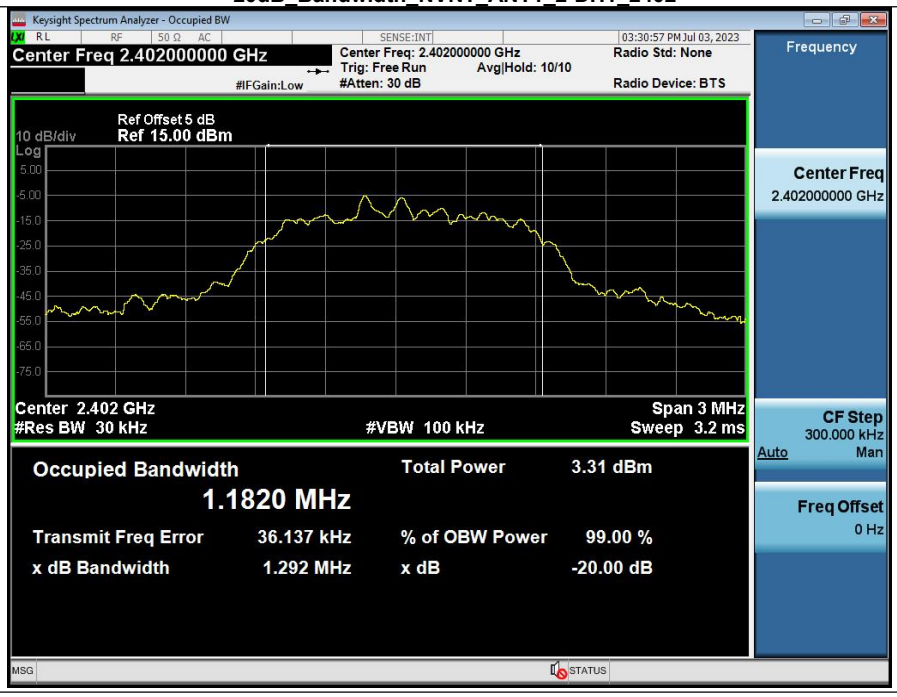
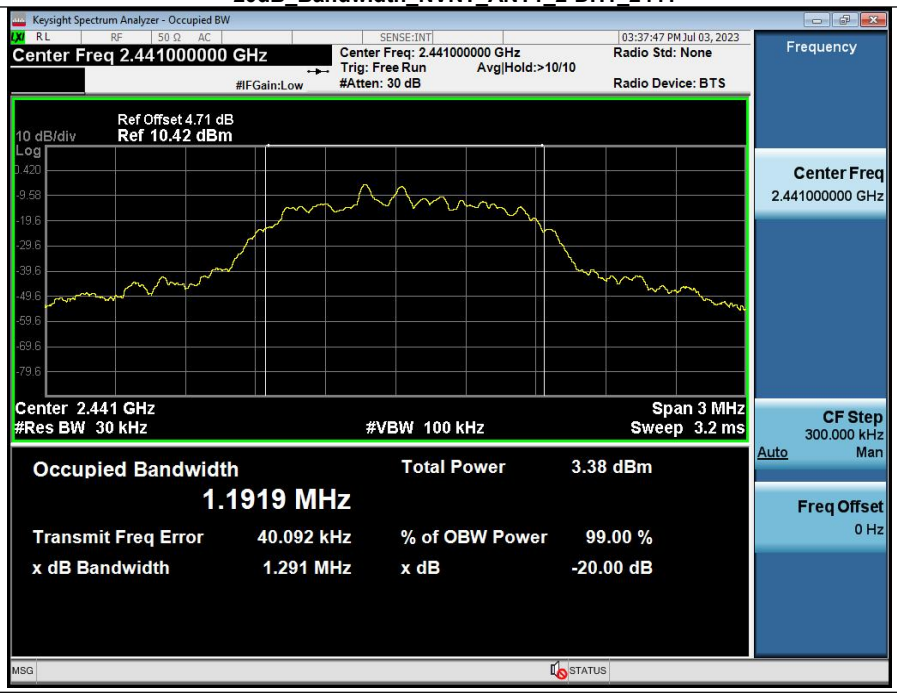
-20dB_Bandwidth_NVNT_ANT1_2-DH1_2402



-20dB_Bandwidth_NVNT_ANT1_2-DH1_2441



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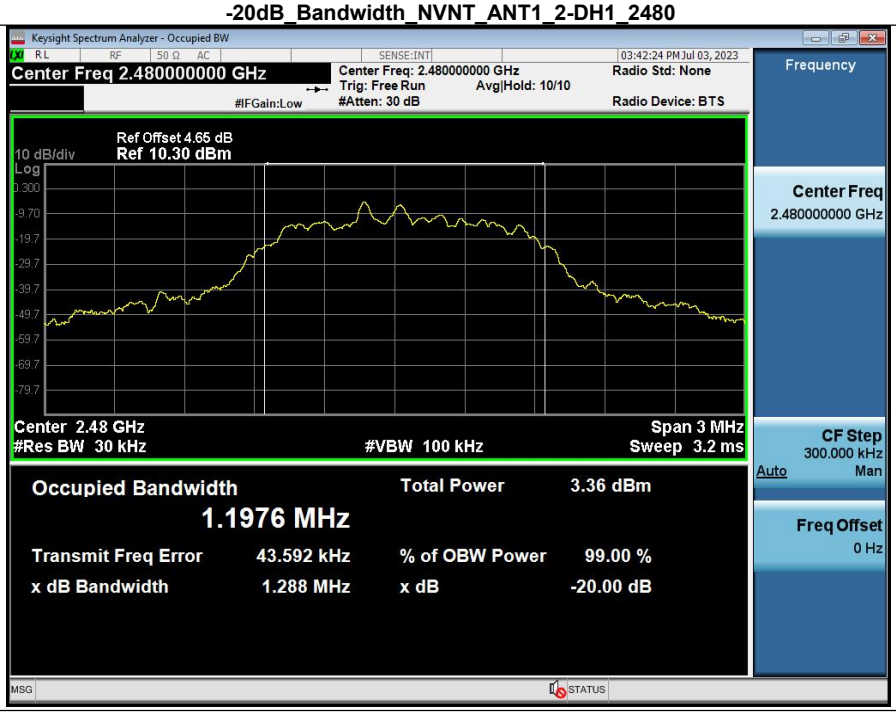
-20dB_Bandwidth_NVNT_ANT1_2-DH1_2480



-20dB_Bandwidth_NVNT_ANT1_3-DH1_2402

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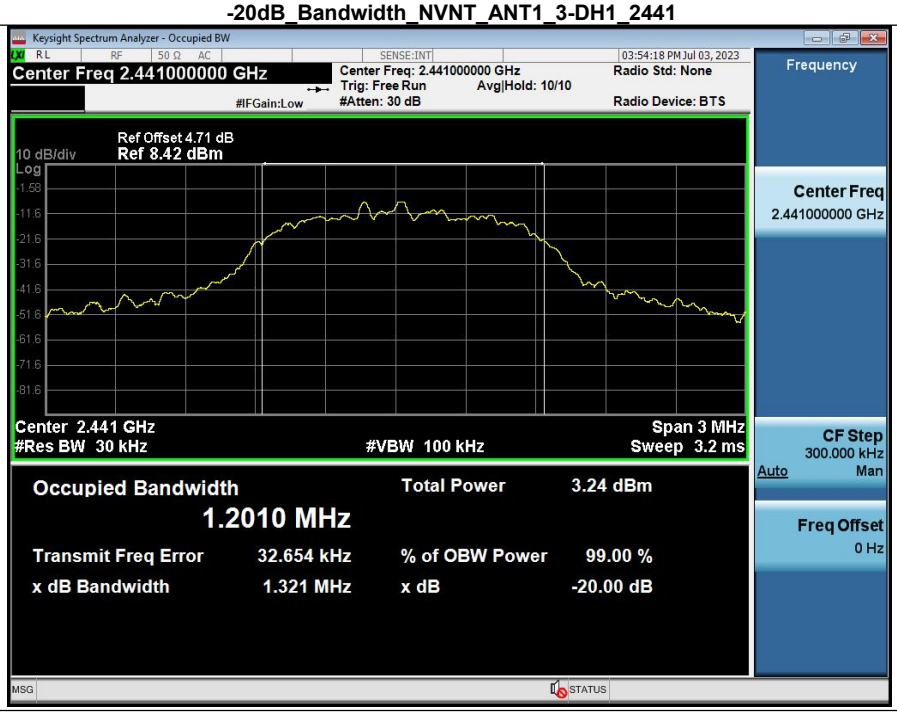
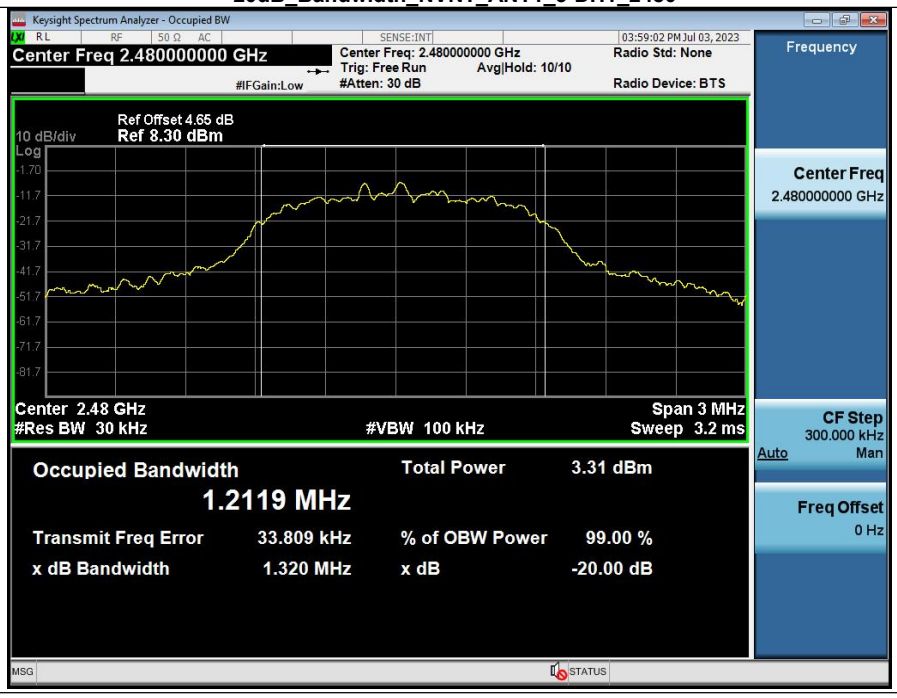
-20dB_Bandwidth_NVNT_ANT1_3-DH1_2441



-20dB_Bandwidth_NVNT_ANT1_3-DH1_2480



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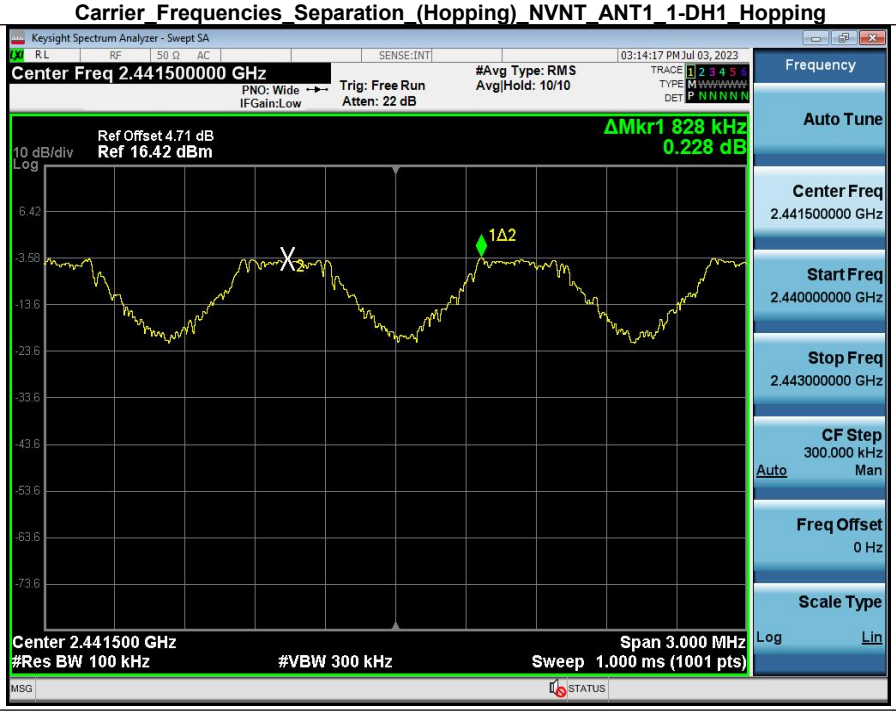
A.4 Hopping Frequency Separation

Modulation	Frequency(MHz)	Hopping NO.0 (MHz)	Hopping NO.1 (MHz)	Carrier Frequencies Separation(MHz)	Limit(MHz)	Result
1-DH1	2402.00	2401.867	2402.872	1.00	0.662	Pass
1-DH1	2441.00	2441.038	2441.866	0.83	0.676	Pass
1-DH1	2480.00	2478.879	2479.863	0.98	0.684	Pass
2-DH1	2402.00	2401.873	2402.875	1.00	0.861	Pass
2-DH1	2441.00	2440.876	2441.887	1.01	0.861	Pass
2-DH1	2480.00	2478.879	2479.878	1.00	0.859	Pass
3-DH1	2402.00	2402.008	2403.028	1.02	0.871	Pass
3-DH1	2441.00	2440.864	2442.139	1.27	0.881	Pass
3-DH1	2480.00	2478.876	2479.878	1.00	0.880	Pass

Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_1-DH1_Hopping

Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_1-DH1_Hopping



Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_1-DH1_Hopping

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Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_2-DH1_Hopping

Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_2-DH1_Hopping

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Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_2-DH1_Hopping

Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_3-DH1_Hopping

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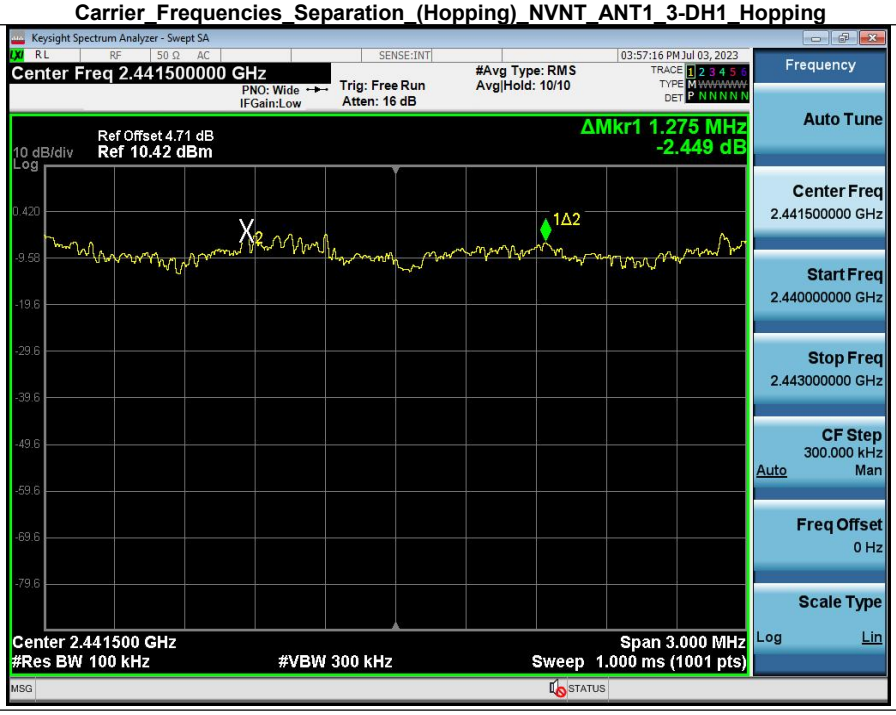
Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_3-DH1_Hopping



Carrier_Frequencies_Separation_(Hopping)_NVNT_ANT1_3-DH1_Hopping

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