Radio Test Report

Report No.: STS2512372W02

Issued for

Hebei Haifa Toy Co., Ltd

No. 61-1-1 Jinbao Highway, Wangjiaying Village, Xiong'an New District, Rongcheng County, Hebei Province, China

Product Name:	AIPals
Brand Name:	HAI FA TOY
Model Name:	HF-Y01
Series Model(s):	HF-Y02, HF-Y03, HF-Y04, HF-Y05, HF-Y06, HF-Y07, HF-Y08
FCC ID:	2BS5Q-HF-Y01
Test Standards:	FCC Part15.247

The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Shenzhen STS Test Services Co., Ltd.

TEST REPORT

Applicant's Name..... : Hebei Haifa Toy Co., Ltd

Address ..... : No. 61-1-1 Jinbao Highway, Wangjiaying Village, Xiong'an New District, Rongcheng County, Hebei Province, China

Manufacturer's Name ..... : Hebei Haifa Toy Co., Ltd

Address ..... : No. 61-1-1 Jinbao Highway, Wangjiaying Village, Xiong'an New District, Rongcheng County, Hebei Province, China

Product Description

Product Name..... : AIPals

Brand Name ..... : HAI FA TOY

Model Name ..... : HF-Y01

Series Model(s) ..... : HF-Y02, HF-Y03, HF-Y04, HF-Y05, HF-Y06, HF-Y07, HF-Y08

Standards..... : FCC Part15.247

Test Procedure ..... : ANSI C63.10-2020

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Shenzhen STS Test Services Co., Ltd.

Date of Test.....:

Date of receipt of test item .....: 13 Dec. 2025

Date (s) of performance of tests.: 13 Dec. 2025 to 20 Dec. 2025

Date of Issue.....: 20 Dec. 2025

Test Result.....: **Pass**

Testing Engineer : Aaron Bu

(Aaron Bu)

Technical Manager : Skylar. Li

(Skylar Li)

Authorized Signatory : Bovey Yang

(Bovey Yang)

SHENZHEN STS TEST SERVICES CO., LTD. TESTING APPROVAL

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Revision History

Rev.	Issue Date	Report No.	Effect Page	Contents
00	20 Dec. 2025	STS2512372W02	ALL	Initial Issue

101, Building B, Zhuoke Science Park, No. 190 Chongqing Road, Zhancheng Shequ, Fuhai Sub-District, Bao'an District, Shenzhen, Guangdong, China
Tel: +86-755 3688 6288 Fax: +86-755 3688 6277 Http://www.stsapp.com E-mail:sts@stsapp.com

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r02.

FCC Part 15.247,Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	--
15.247(a)(1)	Hopping Channel Separation	PASS	--
15.247(a)(1)&(b)(1)	Output Power	PASS	--
15.209	Radiated Spurious Emission	PASS	--
15.247(d)	Conducted Spurious & Band Edge Emission	PASS	--
15.247(a)(1)(iii)	Number of Hopping Frequency	PASS	--
15.247(a)(1)(iii)	Dwell Time	PASS	--
15.247(a)(1)	Bandwidth	PASS	--
15.205	Restricted bands of operation	PASS	--
Part 15.247(d)/part 15.209(a)	Band Edge Emission	PASS	--
15.203	Antenna Requirement	PASS	--

Note:

(1) 'N/A' denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2020.

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD

Add. : 101, Building B, Zhuoke Science Park, No.190 Chongqing Road, ZhanChengShequ, Fuhai Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y ±U**, where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately **95** %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.751dB
2	Unwanted Emissions, conducted	±2.888dB
3	All emissions, radiated 9K-30MHz	±2.48dB
4	All emissions, radiated 30M-1GHz	±2.52dB
5	All emissions, radiated 1G-18GHz	±3.48dB
6	All emissions, radiated>18GHz	±4.18dB
7	Conducted Emission (9KHz-150KHz)	±2.48dB
8	Conducted Emission (150KHz-30MHz)	±2.52dB
9	Occupied Channel Bandwidth	±3.6%
10	Duty Cycle	±3.2%

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	AIPals
Brand Name	HAI FA TOY
Model Name	HF-Y01
Series Model(s)	HF-Y02, HF-Y03, HF-Y04, HF-Y05, HF-Y06, HF-Y07, HF-Y08
Model Difference	All the models are the same circuit and RF module, except model names, color and appearance.
Channel List	Please refer to the Note 3.
Operation Frequency	2402 – 2480 MHz
Modulation Type	GFSK, π/4-DQPSK, 8DPSK
Number Of Channel	79
Antenna Type	Internal antenna
Antenna Gain(dBi)	1.18
Power Rating	DC 5V from adapter or DC 3.7V from Battery
Adapter	N/A
Battery	DC 3.7V
Hardware version number	N/A
Software version number	N/A
Connecting I/O Port(s)	Please refer to the Note 1.

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.
2. The antenna details in this report are based on the manufacturer provided antenna specification documents and apply only to the tested sample identified herein.
   Any discrepancies in the antenna information may affect the accuracy of the test results, and the customer assumes responsibility for any related issues.

3.

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

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Data Rate/Modulation
Mode 1	TX CH00	1Mbps/GFSK
Mode 2	TX CH39	1Mbps/GFSK
Mode 3	TX CH78	1Mbps/GFSK
Mode 4	TX CH00	2 Mbps/π/4-DQPSK
Mode 5	TX CH39	2 Mbps/π/4-DQPSK
Mode 6	TX CH78	2 Mbps/π/4-DQPSK
Mode7	TX CH00	3 Mbps/8DPSK
Mode 8	TX CH39	3 Mbps/8DPSK
Mode 9	TX CH78	3 Mbps/8DPSK
Mode 10	Hopping	GFSK
Mode 11	Hopping	π/4-DQPSK
Mode 12	Hopping	8DPSK

Note:
(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.
(2) We tested for all available U.S. voltage and frequencies (For 120V, 50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V/ 60Hz is shown in the report.
(3) The battery is fully-charged during the radiated and RF conducted test.

For AC Conducted Emission

Test Case	
AC Conducted Emission	Mode 13 : Keeping BT TX

2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS

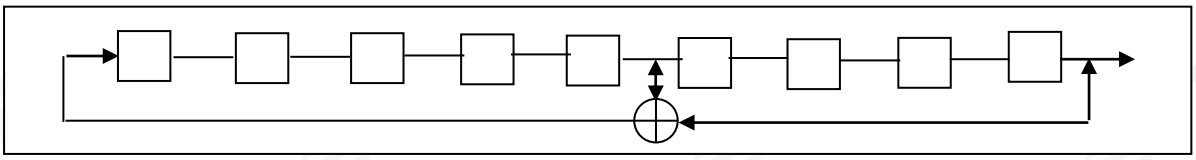
(1)Standard and Limit

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

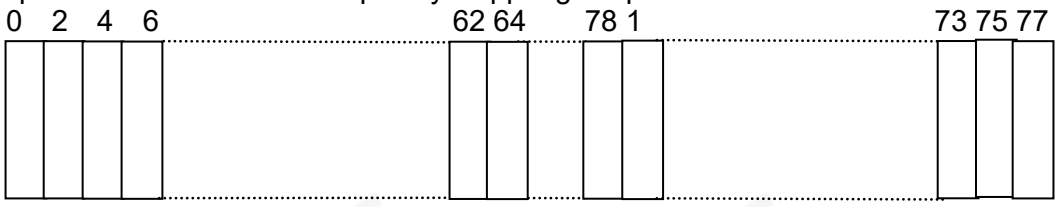
The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

(2)The Pseudorandom sequence may be generated in a nin-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.
Numver of shift register stages:9
Length of pseudo-random sequence:2^9-1=511bits
Longest sequence of zeros: 8(non-inverted signal)



Liner Feedback Shift Register for Generator of the PRBS sequence

An example of Pseudorandom Frequency Hoppong Sequence as follow:



Each frequency used equally on th average by each transmitter.
The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies ini synchronization with the transmitted signals.

(3)Frequency Hopping System
This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with a bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements FCC Part 15.247 rule.

2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

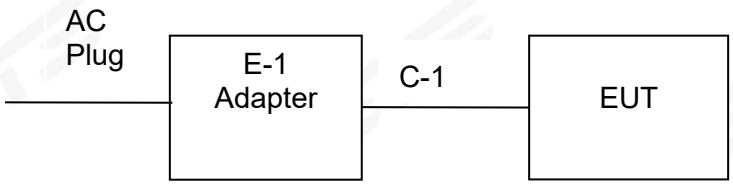
During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

(Control software) Parameters(1/2/3Mbps)	Test program: Bluetooth		
	Packet type: DH1:4:27 2DH1:20:54 3DH1:24:83	Packet type: DH3:11:183 2DH3:26:367 3DH3:27:552	Packet type: DH5:15:339 2DH5:30:679 3DH5:31:1021

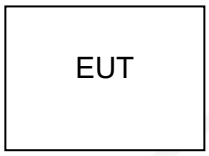
RF Function	Type	Mode or Modulation type	Power Class	Software for Testing
BT	BR+EDR	GFSK	Default	FCC_Assist_V1.0.2.2
		π/4-DQPSK	Default	
		8DPSK	Default	

2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

CONDUCTED EMISSION TEST



RADIATED SPURIOUS EMISSION TEST



2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment

Item	Equipment	Mfr/Brand	Model/Type No.	Note
E-1	Adapter	ZTC	NB-A515A	EUT
C-1	DC Cable	N/A	N/A	Auxiliary

Line

Item	Equipment	Mfr/Brand	Length	Note
C-1	Shielded	NO	80cm	N/A

Note:

(1) For detachable type I/O cable should be specified the length in cm in『Length』column.
(2) “YES” is means “with core”; “NO” is means “without core”.

2.7 EQUIPMENTS LIST

RF Radiation Test Equipment					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Temperature & Humidity	SW-108	SuWei	N/A	2025.02.24	2026.02.23
Pre-Amplifier(0.1 M-3GHz)	EM	EM330	060665	2025.02.22	2026.02.21
Pre-Amplifier(1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2025.09.25	2026.09.24
Pre-Amplifier(18G -40GHz)	SKET	LNPA_1840-50	SK2018101801	2025.02.22	2026.02.21
Active loop Antenna	ZHINAN	ZN30900C	16035	2025.02.25	2027.02.24
Bilog Antenna	TESEQ	CBL6111D	34678	2025.09.27	2027.09.26
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2025.09.27	2027.09.26
Horn Antenna	A-INFOMW	LB-180400-KF	J211020657	2025.09.27	2027.09.26
Positioning Controller	MF	MF-7802	MF-780208587	N/A	N/A
Signal Analyzer	R&S	FSV 40-N	101823	2025.09.26	2026.09.25
Switch Control Box	N/A	N/A	N/A	N/A	N/A
Filter Box	BALUN Technology	SU319E	BL-SZ1530051	N/A	N/A
Antenna Mast	MF	MFA-440H	N/A	N/A	N/A
Turn Table	MF	SC100_1	60531	N/A	N/A
AC Power Source	APC	KDF-11010G	F214050035	N/A	N/A
DC power supply	HONGSHENGFENG	DPS-305AF	17064939	2025.09.22	2026.09.21
Test SW	EZ-EMC	Ver.STSLAB-03A1 RE			
Conduction Test Equipment					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2025.09.25	2026.09.24
Limiter	CYBERTEK	EM5010	N/A	2025.09.25	2026.09.24
LISN	R&S	ENV216	101242	2025.09.25	2026.09.24
LISN	EMCO	3810/2NM	23625	2025.09.25	2026.09.24
Temperature & Humidity	SW-108	SuWei	N/A	2025.02.24	2026.02.23
Test SW	EZ-EMC	Ver.STSLAB-03A1 CE			
RF Connected Test					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Signal Analyzer	Agilent	N9020A	MY51510623	2025.02.22	2026.02.21
Pulse Power Sensor	Anritsu	MA2411B	917389	2025.09.23	2026.09.22
Power Meter	Anritsu	ML2480	1005127	2025.09.23	2026.09.22
Power detector group	Keysight	NW2021031	N/A	2025.09.23	2026.09.22
Switch control box	MW	MW100-RFCB	N/A	N/A	N/A
Temperature& Humidity test chamber	Safety test	AG80L	171200018	2025.02.22	2026.02.21
Temperature & Humidity	SW-108	SuWei	N/A	2025.02.24	2026.02.23
Test SW	MW	MTS 8310_2.0.0.0			

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

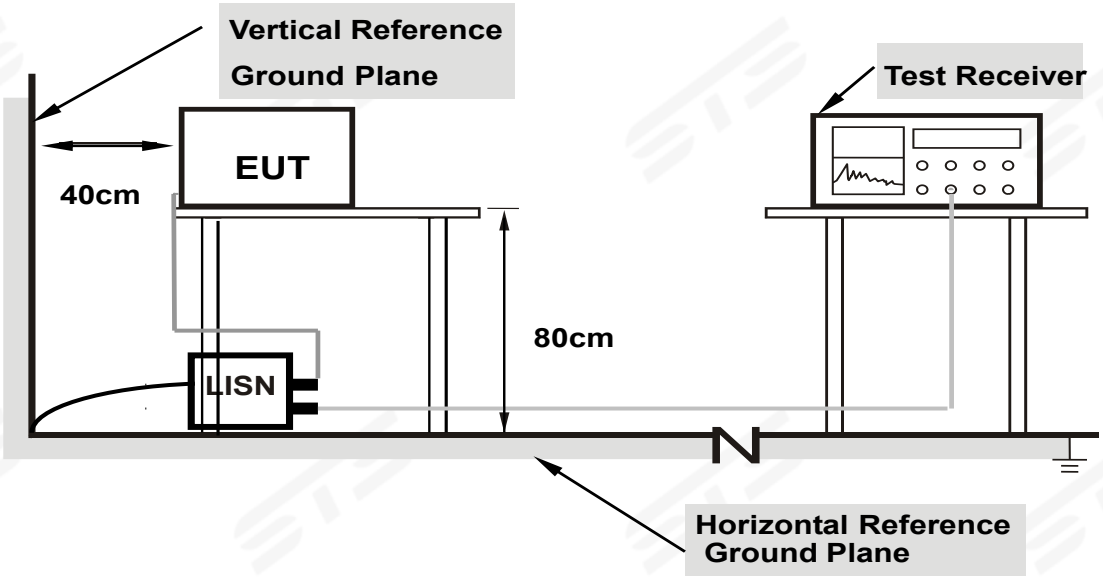
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.1.2 TEST PROCEDURE

a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN is at least 80 cm from the nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 TEST SETUP



Note: 1. Support units were connected to second LISN.

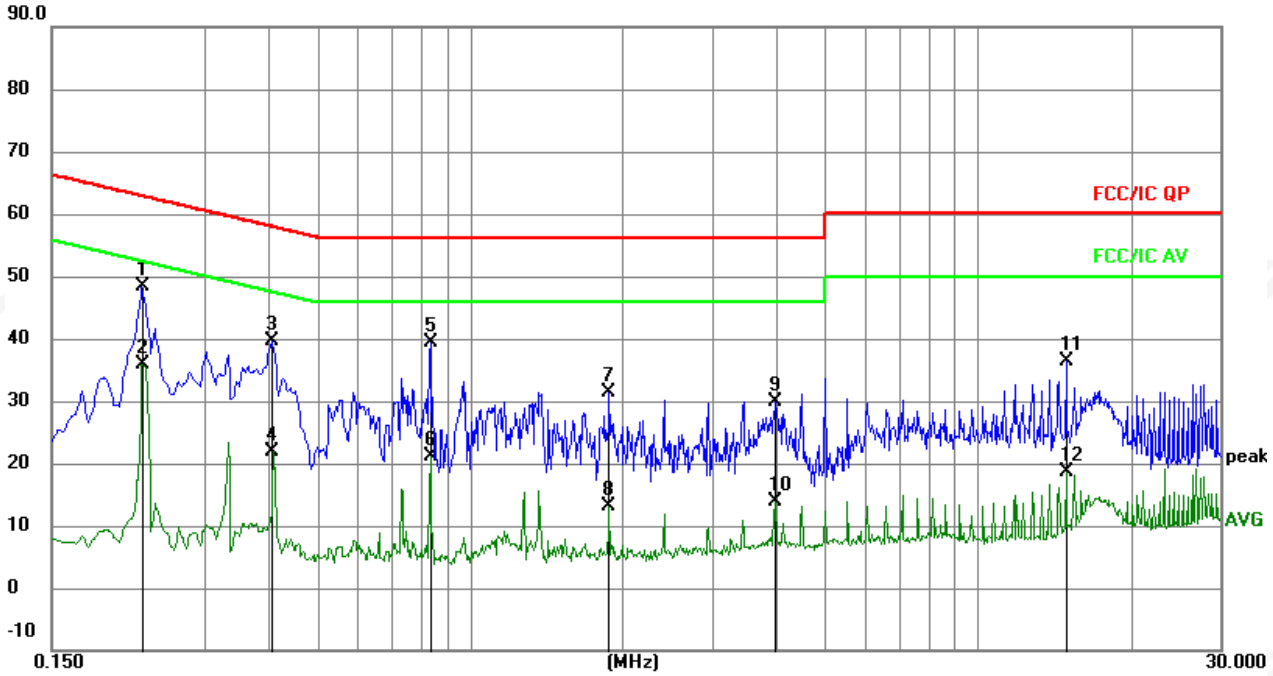
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

3.1.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

3.1.5 TEST RESULT

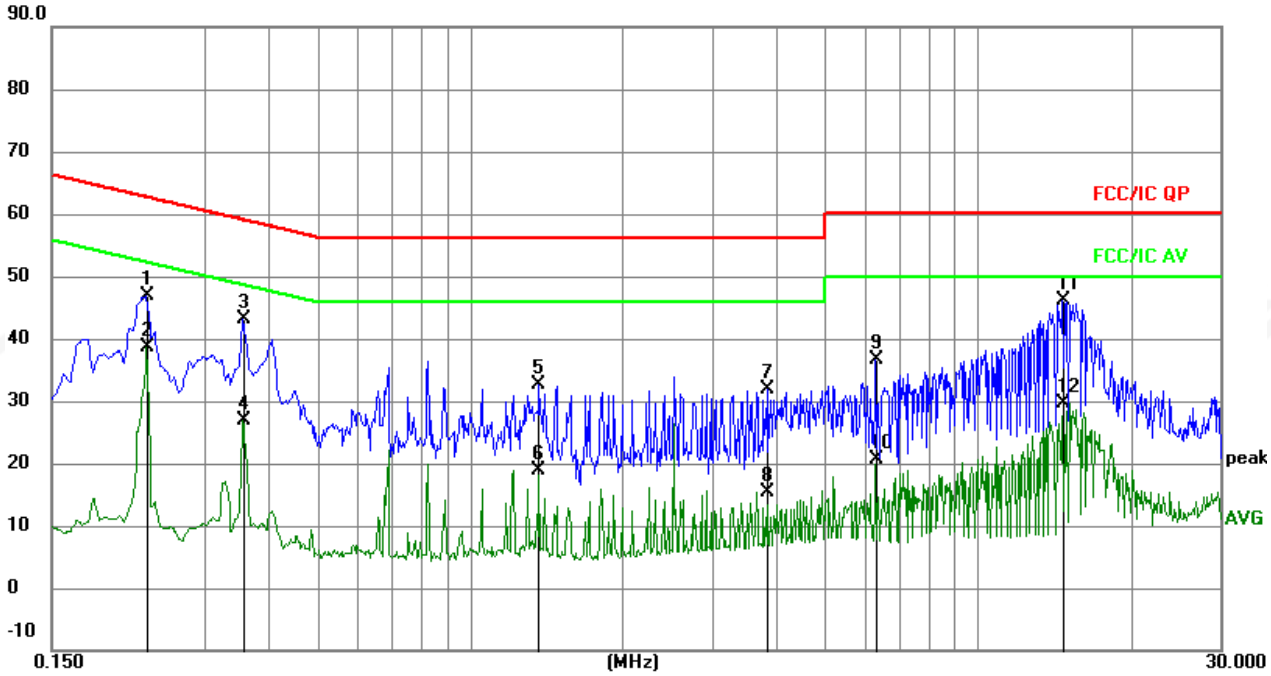
Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 13		



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. Measurement = Reading Level + Correct Factor
4. Over = Measurement – Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1	*	0.2256	28.33	20.04	48.37	62.61	-14.24	QP
2		0.2256	15.77	20.04	35.81	52.61	-16.80	AVG
3		0.4061	19.60	20.05	39.65	57.73	-18.08	QP
4		0.4061	1.82	20.05	21.87	47.73	-25.86	AVG
5		0.8349	19.02	20.26	39.28	56.00	-16.72	QP
6		0.8349	0.80	20.26	21.06	46.00	-24.94	AVG
7		1.8779	11.27	20.19	31.46	56.00	-24.54	QP
8		1.8779	-7.04	20.19	13.15	46.00	-32.85	AVG
9		3.9850	9.26	20.61	29.87	56.00	-26.13	QP
10		3.9850	-6.75	20.61	13.86	46.00	-32.14	AVG
11		14.9068	13.82	22.46	36.28	60.00	-23.72	QP
12		14.9068	-3.80	22.46	18.66	50.00	-31.34	AVG

Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 13		



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. Measurement = Reading Level + Correct Factor
4. Over = Measurement – Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.2304	26.93	20.04	46.97	62.44	-15.47	QP
2		0.2304	18.47	20.04	38.51	52.44	-13.93	AVG
3		0.3558	22.99	20.05	43.04	58.83	-15.79	QP
4		0.3558	6.72	20.05	26.77	48.83	-22.06	AVG
5		1.3665	12.50	20.24	32.74	56.00	-23.26	QP
6		1.3665	-1.47	20.24	18.77	46.00	-27.23	AVG
7		3.8399	11.21	20.58	31.79	56.00	-24.21	QP
8		3.8399	-5.25	20.58	15.33	46.00	-30.67	AVG
9		6.2852	15.83	20.85	36.68	60.00	-23.32	QP
10		6.2852	-0.23	20.85	20.62	50.00	-29.38	AVG
11	*	14.6718	23.79	22.41	46.20	60.00	-13.80	QP
12		14.6718	7.14	22.41	29.55	50.00	-20.45	AVG

3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2020 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
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

LIMITS OF RADIATED EMISSION MEASUREMENT (1000MHz-25GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RESTRICTED FREQUENCY BANDS

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP/AV
Start Frequency	9 KHz/150KHz(Peak/QP/AV)
Stop Frequency	150KHz/30MHz(Peak/QP/AV)
RB / VB (emission in restricted band)	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz); 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP
Start Frequency	30 MHz(Peak/QP)
Stop Frequency	1000 MHz (Peak/QP)
RB / VB (emission in restricted band)	120 KHz / 300 KHz

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

For Restricted band

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 2310 to 2410 MHz Upper Band Edge: 2476 to 2500 MHz
RB / VB	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

a. The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and QuasiPeak detector mode will be re-measured.
e. If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

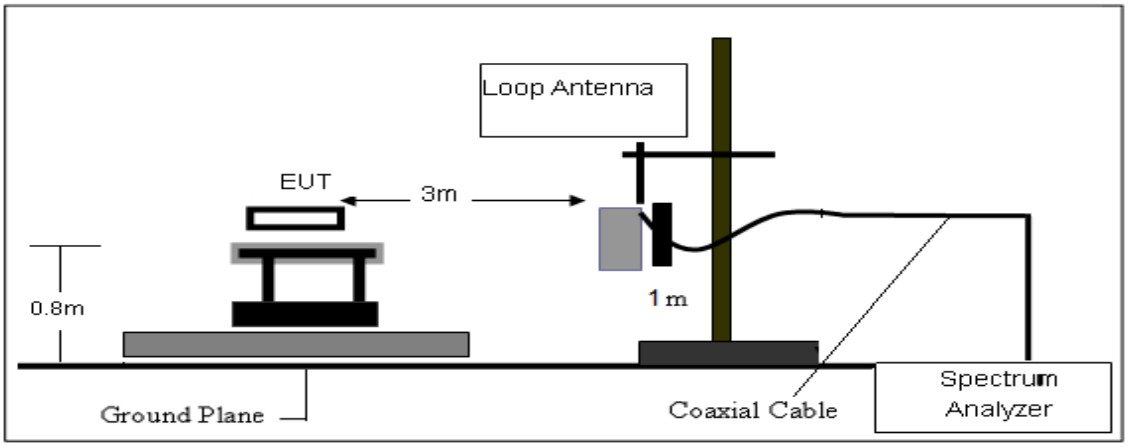
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

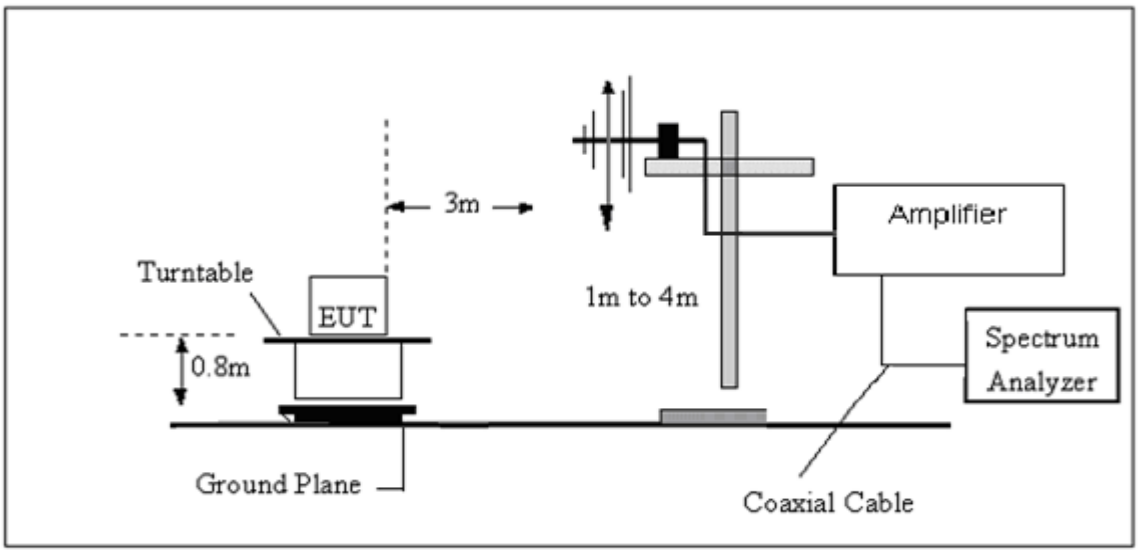
No deviation.

3.2.4 TESTSETUP

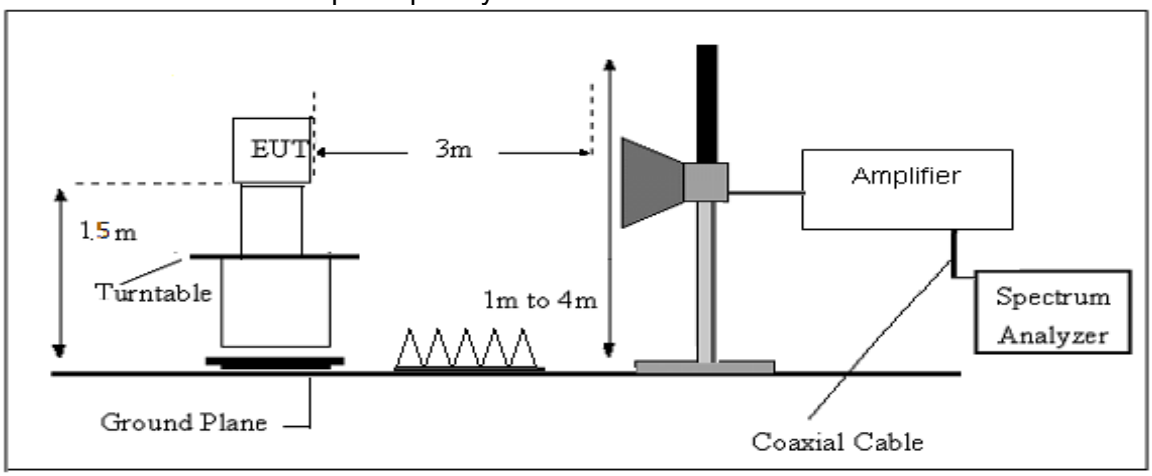
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 EUT OPERATING CONDITIONS

Please refer to section 3.1.4 of this report.

3.2.6 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG

3.2.7 TEST RESULTS

(Between 9KHz – 30 MHz)

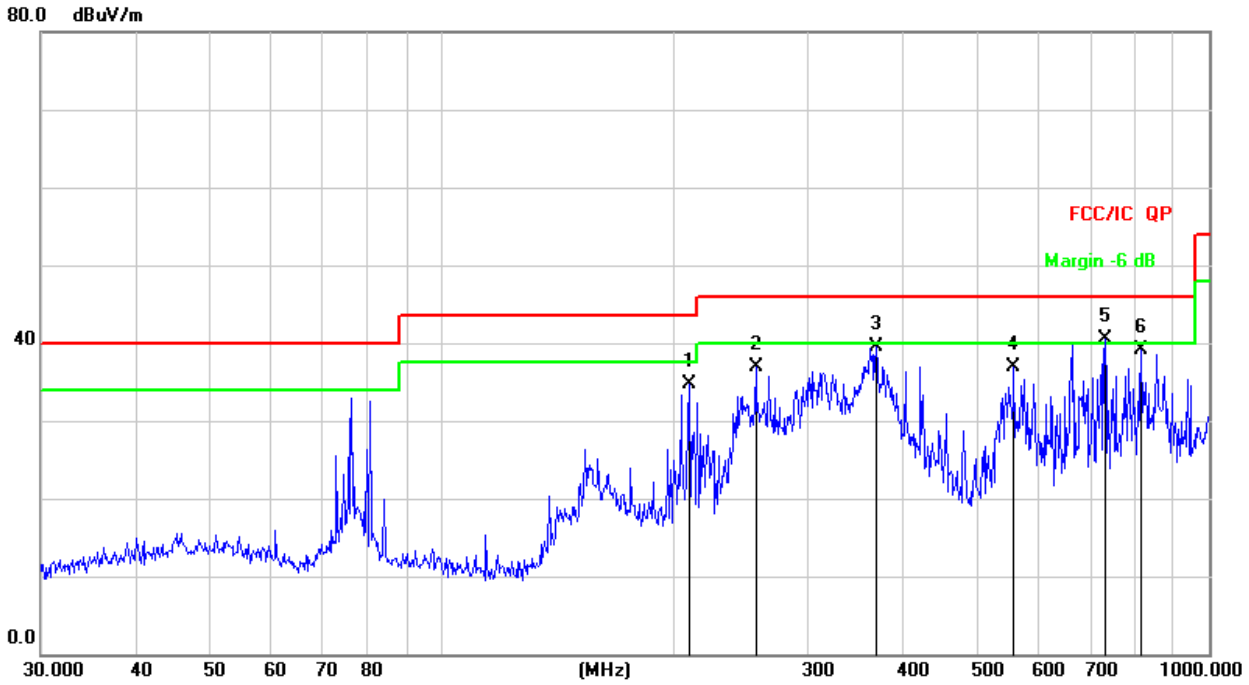
Temperature:	26℃	Relative Humidtity:	54%
Test Voltage:	AC 120V/60Hz	Polarization:	--
Test Mode:	TX Mode		

Freq.	Reading	Limit	Margin	State	Test Result
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	
--	--	--	--	--	PASS
--	--	--	--	--	PASS

Note:
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits (dBuv) + distance extrapolation factor.

(30MHz-1000MHz)

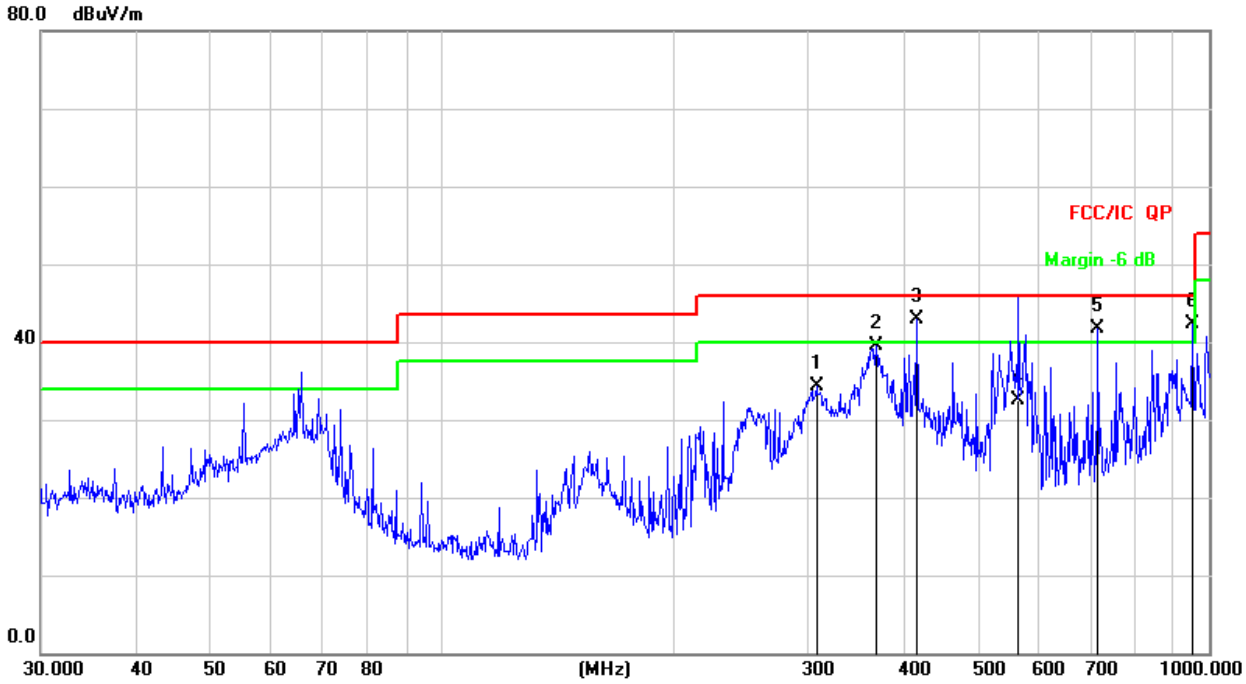
Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	AC 120V/60Hz	Phase:	Horizontal
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 3 worst mode)		



Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Measurement = Reading Level + Correct Factor
3. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		210.0482	46.61	-11.84	34.77	43.50	-8.73	QP
2		256.5211	48.00	-11.16	36.84	46.00	-9.16	QP
3		368.1116	47.77	-8.33	39.44	46.00	-6.56	QP
4		556.7744	41.82	-4.93	36.89	46.00	-9.11	QP
5	*	731.9203	43.15	-2.64	40.51	46.00	-5.49	QP
6		815.9678	40.43	-1.28	39.15	46.00	-6.85	QP

Temperature:	26℃	Relative Humidity:	54%
Test Voltage:	AC 120V/60Hz	Phase:	Vertical
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 3 worst mode)		



Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Measurement = Reading Level + Correct Factor
3. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		307.8313	44.44	-10.13	34.31	46.00	-11.69	QP
2		368.1116	47.88	-8.33	39.55	46.00	-6.45	QP
3	*	416.1791	49.97	-7.14	42.83	46.00	-3.17	QP
4		564.6389	37.26	-4.78	32.48	46.00	-13.52	QP
5	!	716.6820	44.57	-2.88	41.69	46.00	-4.31	QP
6	!	952.0937	41.62	0.63	42.25	46.00	-3.75	QP

(1GHz~25GHz) Spurious emission Requirements

Frequency (MHz)	Meter (dBμV)	Amplifier (dB)	Loss (dB)	Antenna (dB/m)	Correcte d (dB)	Emissio n (dBμV/m	Limits (dBμV/m	Margin (dB)	Dete Type	Comment
Low Channel (8DPSK/2402 MHz)										
3264.80	61.83	44.70	6.70	28.20	-9.80	52.03	74.00	-21.97	PK	Vertical
3264.80	50.75	44.70	6.70	28.20	-9.80	40.95	54.00	-13.05	AV	Vertical
3264.68	61.01	44.70	6.70	28.20	-9.80	51.21	74.00	-22.79	PK	Horizontal
3264.68	51.05	44.70	6.70	28.20	-9.80	41.25	54.00	-12.75	AV	Horizontal
4804.48	58.11	44.20	9.04	31.60	-3.56	54.55	74.00	-19.45	PK	Vertical
4804.48	50.33	44.20	9.04	31.60	-3.56	46.77	54.00	-7.23	AV	Vertical
4804.60	58.22	44.20	9.04	31.60	-3.56	54.66	74.00	-19.34	PK	Horizontal
4804.60	50.01	44.20	9.04	31.60	-3.56	46.45	54.00	-7.55	AV	Horizontal
5359.86	48.85	44.20	9.86	32.00	-2.34	46.51	74.00	-27.49	PK	Vertical
5359.86	39.21	44.20	9.86	32.00	-2.34	36.87	54.00	-17.13	AV	Vertical
5359.69	47.40	44.20	9.86	32.00	-2.34	45.06	74.00	-28.94	PK	Horizontal
5359.69	38.24	44.20	9.86	32.00	-2.34	35.90	54.00	-18.10	AV	Horizontal
7205.86	54.03	43.50	11.40	35.50	3.40	57.43	74.00	-16.57	PK	Vertical
7205.86	44.43	43.50	11.40	35.50	3.40	47.83	54.00	-6.17	AV	Vertical
7205.92	54.32	43.50	11.40	35.50	3.40	57.72	74.00	-16.28	PK	Horizontal
7205.92	43.92	43.50	11.40	35.50	3.40	47.32	54.00	-6.68	AV	Horizontal
Middle Channel (8DPSK/2441 MHz)										
3264.76	60.96	44.70	6.70	28.20	-9.80	51.16	74.00	-22.84	PK	Vertical
3264.76	50.92	44.70	6.70	28.20	-9.80	41.12	54.00	-12.88	AV	Vertical
3264.71	61.80	44.70	6.70	28.20	-9.80	52.00	74.00	-22.00	PK	Horizontal
3264.71	50.98	44.70	6.70	28.20	-9.80	41.18	54.00	-12.82	AV	Horizontal
4882.47	59.30	44.20	9.04	31.60	-3.56	55.74	74.00	-18.26	PK	Vertical
4882.47	50.41	44.20	9.04	31.60	-3.56	46.85	54.00	-7.15	AV	Vertical
4882.53	58.69	44.20	9.04	31.60	-3.56	55.13	74.00	-18.87	PK	Horizontal
4882.53	50.46	44.20	9.04	31.60	-3.56	46.90	54.00	-7.10	AV	Horizontal
5359.61	48.44	44.20	9.86	32.00	-2.34	46.10	74.00	-27.90	PK	Vertical
5359.61	39.48	44.20	9.86	32.00	-2.34	37.14	54.00	-16.86	AV	Vertical
5359.83	48.51	44.20	9.86	32.00	-2.34	46.17	74.00	-27.83	PK	Horizontal
5359.83	39.10	44.20	9.86	32.00	-2.34	36.76	54.00	-17.24	AV	Horizontal
7323.69	54.09	43.50	11.40	35.50	3.40	57.49	74.00	-16.51	PK	Vertical
7323.69	44.61	43.50	11.40	35.50	3.40	48.01	54.00	-5.99	AV	Vertical
7323.95	53.54	43.50	11.40	35.50	3.40	56.94	74.00	-17.06	PK	Horizontal
7323.95	44.45	43.50	11.40	35.50	3.40	47.85	54.00	-6.15	AV	Horizontal

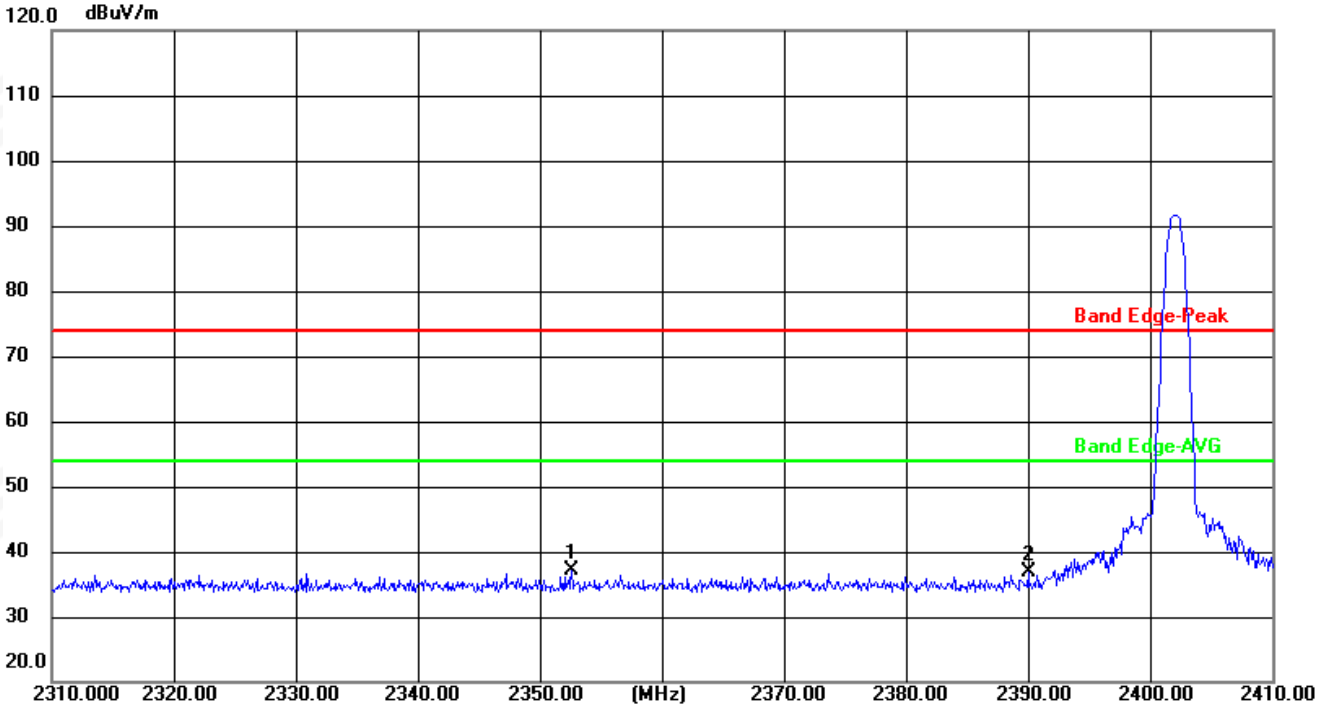
High Channel (8DPSK/2480 MHz)										
3264.87	61.77	44.70	6.70	28.20	-9.80	51.97	74.00	-22.03	PK	Vertical
3264.87	51.02	44.70	6.70	28.20	-9.80	41.22	54.00	-12.78	AV	Vertical
3264.59	61.94	44.70	6.70	28.20	-9.80	52.14	74.00	-21.86	PK	Horizontal
3264.59	50.80	44.70	6.70	28.20	-9.80	41.00	54.00	-13.00	AV	Horizontal
4960.37	58.54	44.20	9.04	31.60	-3.56	54.98	74.00	-19.02	PK	Vertical
4960.37	49.78	44.20	9.04	31.60	-3.56	46.22	54.00	-7.78	AV	Vertical
4960.36	58.30	44.20	9.04	31.60	-3.56	54.74	74.00	-19.26	PK	Horizontal
4960.36	49.78	44.20	9.04	31.60	-3.56	46.22	54.00	-7.78	AV	Horizontal
5359.78	49.21	44.20	9.86	32.00	-2.34	46.87	74.00	-27.13	PK	Vertical
5359.78	38.99	44.20	9.86	32.00	-2.34	36.65	54.00	-17.35	AV	Vertical
5359.59	47.66	44.20	9.86	32.00	-2.34	45.32	74.00	-28.68	PK	Horizontal
5359.59	38.79	44.20	9.86	32.00	-2.34	36.45	54.00	-17.55	AV	Horizontal
7439.77	54.32	43.50	11.40	35.50	3.40	57.72	74.00	-16.28	PK	Vertical
7439.77	44.30	43.50	11.40	35.50	3.40	47.70	54.00	-6.30	AV	Vertical
7439.76	54.89	43.50	11.40	35.50	3.40	58.29	74.00	-15.71	PK	Horizontal
7439.76	43.61	43.50	11.40	35.50	3.40	47.01	54.00	-6.99	AV	Horizontal

Note:

1) All modes have been measurement, only worst mode was reported.
2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.
   Emission Level = Reading + Factor
3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

Restricted band Requirements

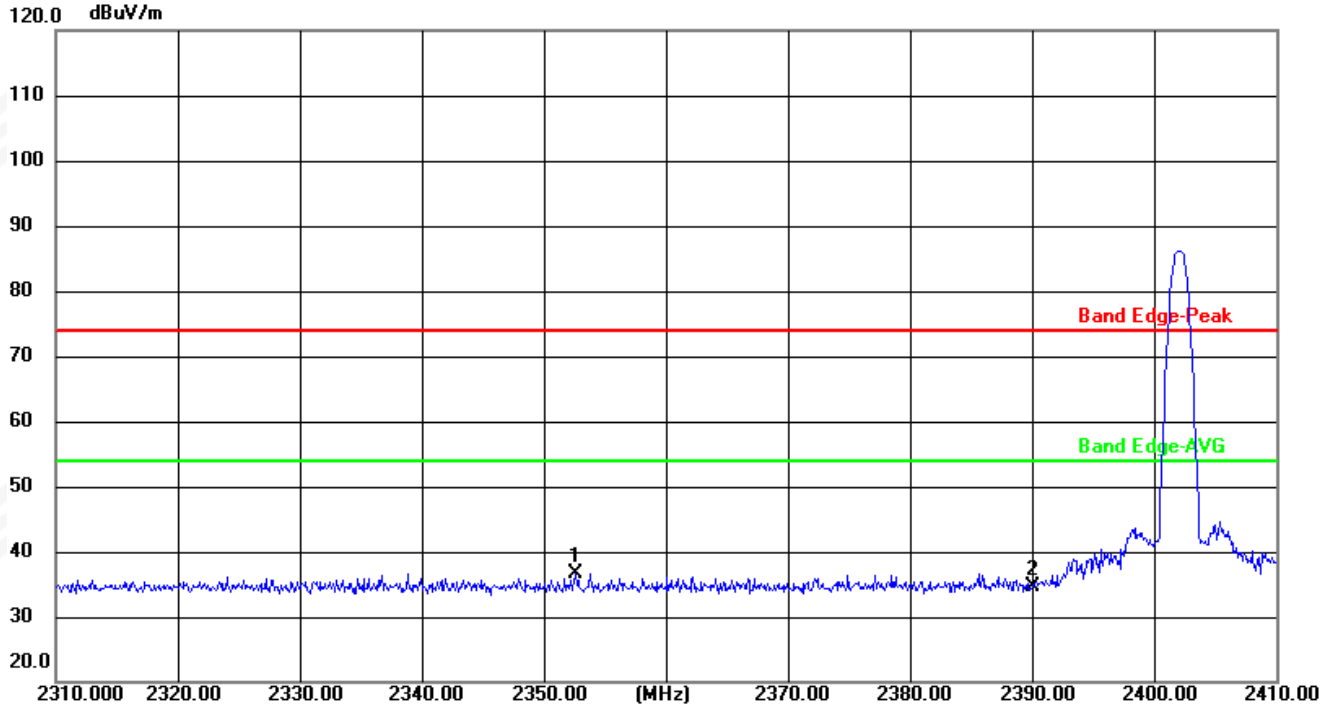
GFSK-Low
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2352.600	62.94	-25.89	37.05	74.00	-36.95	peak
2	2390.000	62.69	-25.82	36.87	74.00	-37.13	peak

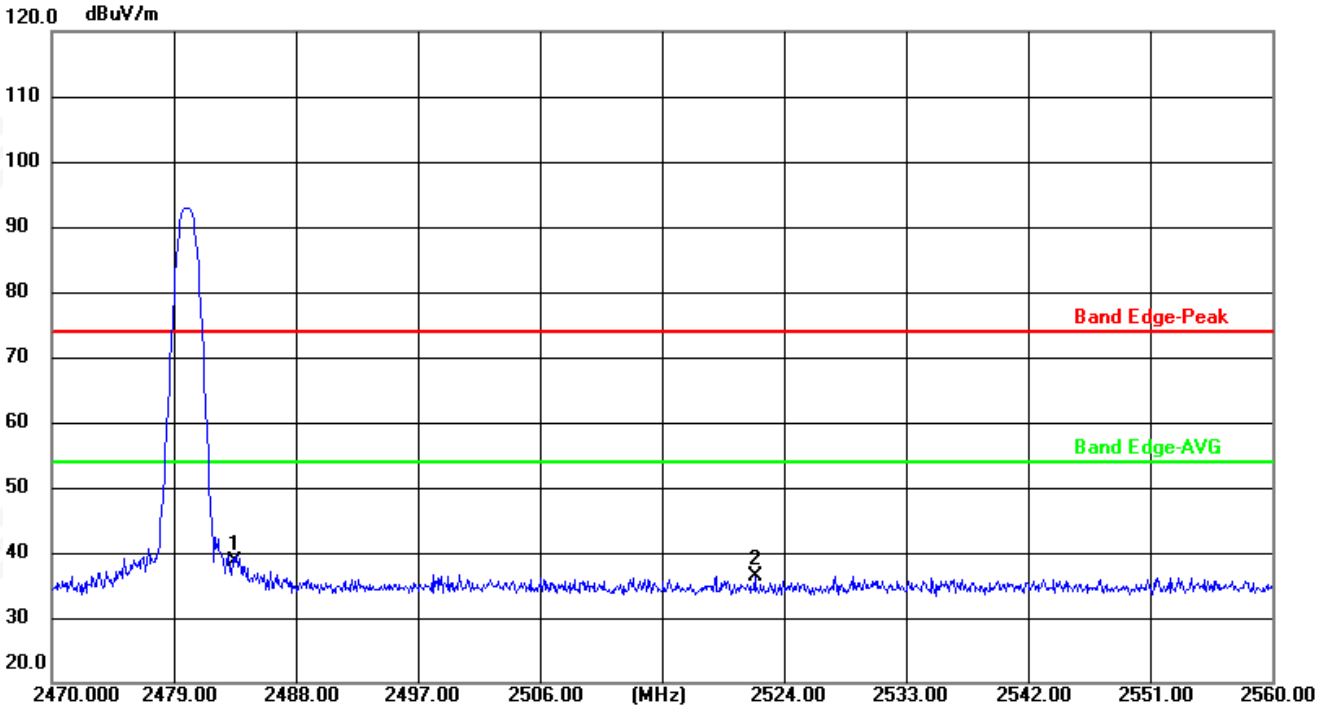
GFSK-Low

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2352.600	62.44	-25.89	36.55	74.00	-37.45	peak
2	2390.000	60.45	-25.82	34.63	74.00	-39.37	peak

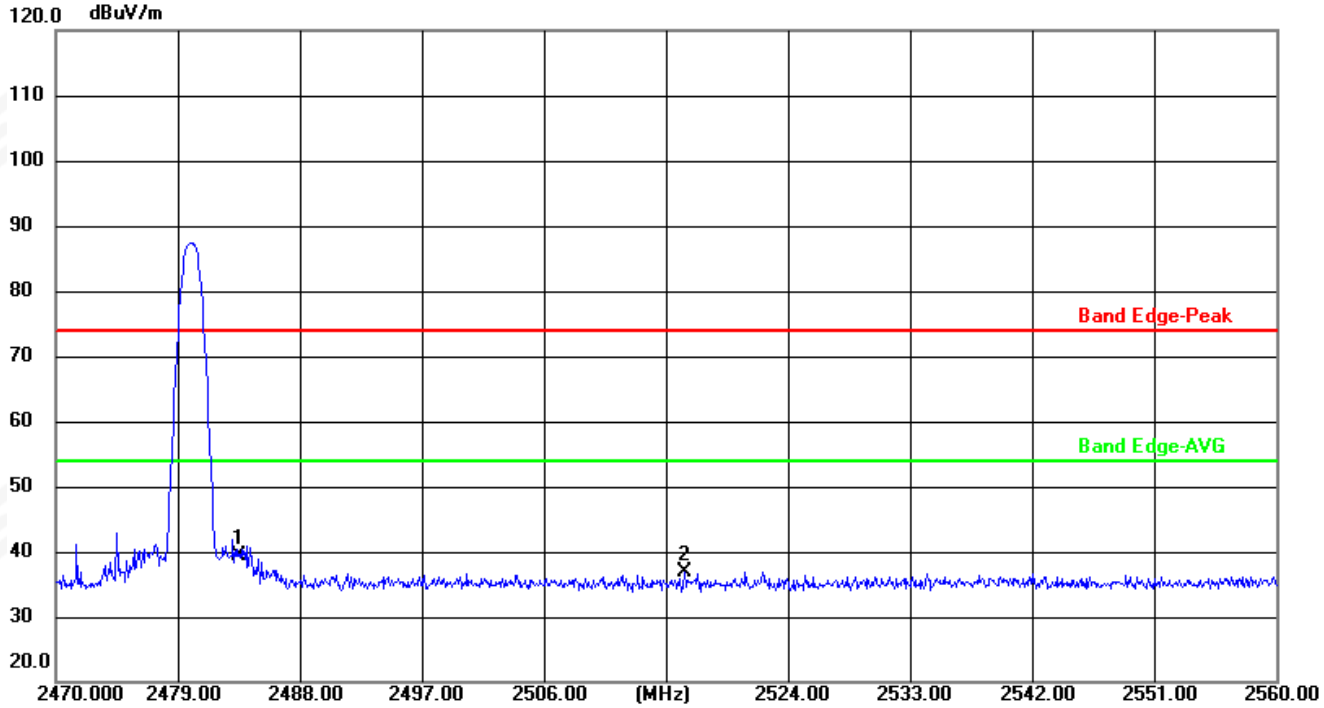
GFSK- High
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2483.500	64.26	-25.63	38.63	74.00	-35.37	peak
2	2521.840	61.94	-25.57	36.37	74.00	-37.63	peak

GFSK- High

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2483.500	65.09	-25.63	39.46	74.00	-34.54	peak
2	2516.350	62.56	-25.58	36.98	74.00	-37.02	peak

Note: All modes have been measurement, only worst mode was reported.

4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

4.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Hopping Band edge

For Hopping Band edge	For Hopping Band edge
Detector	Peak
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

4.3 TEST SETUP

The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Tune the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, the span is set to be greater than RBW.

4.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

4.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1)(iii)	Number of Hopping Channel	≥15	2400-2483.5	PASS

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	100KHz
VB	300KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. Spectrum Setting: RBW= 100KHz, VBW=300KHz, Sweep time = Auto.

5.3 TEST SETUP

5.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

5.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

6. AVERAGE TIME OF OCCUPANCY

6.1 LIMIT

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1)(iii)	Average Time of Occupancy	0.4sec	2400-2483.5	PASS

6.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyzer.
b. Set RBW =1MHz/VBW =3MHz.
c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
d. Sweep Time is more than once pulse time.
e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
f. Measure the maximum time duration of one single pulse.
The Dwell Time=Burst Width*Total Hops.The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4[s]*hopping number=0.4[s]*79[ch)=31.6[s*ch];
Dwell Time Calculate formula:
Dwell time = pulse time (ms) x pulse number in 31.6s

6.3 TEST SETUP

6.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

6.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

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.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> 20 dB Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 300 kHz (Channel Separation)
VB	≥ 3*RB kHz (20dB Bandwidth) / 300 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

7.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
b. The resolution bandwidth of 30 kHz and the video bandwidth of be equal or greater than 3*RB kHz were utilised for 20 dB bandwidth measurement.
c. The resolution bandwidth of 300 kHz and the video bandwidth of 300 kHz were utilised for channel separation measurement.

7.3 TEST SETUP

7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

7.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

8. BANDWIDTH TEST

8.1 LIMIT

FCC Part15 15.247,Subpart C				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1)	Bandwidth	N/A	2400-2483.5	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 300 kHz (Channel Separation)
VB	≥ 3*RB kHz (20dB Bandwidth) / 300 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. Spectrum Setting: RBW= 30KHz, VBW≥ 3*RB KHz, Sweep time = Auto.

8.3 TEST SETUP

8.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

8.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

9. OUTPUT POWER TEST

9.1 LIMIT

FCC Part 15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (a)(1)&(b)(1)	Output Power	1 W or 0.125W	2400-2483.5	PASS
		if channel separation > 2/3 bandwidthprovided thesystems operatewith an output power no greater than125 mW(20.97dBm)		

9.2 TEST PROCEDURE

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
2) RBW > 20 dB bandwidth of the emission being measured.
3) VBW ≥ RBW.
4) Sweep: Auto.
5) Detector function: Peak.
6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

e) A plot of the test results and setup description shall be included in the test report.

Note—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

9.3 TEST SETUP

9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

9.5 TEST RESULTS

Note: The test data please refer to APPENDIX 1.

10. ANTENNA REQUIREMENT

10.1 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.

10.2 EUT ANTENNA

The EUT antenna is Internal Antenna. It comply with the standard requirement.

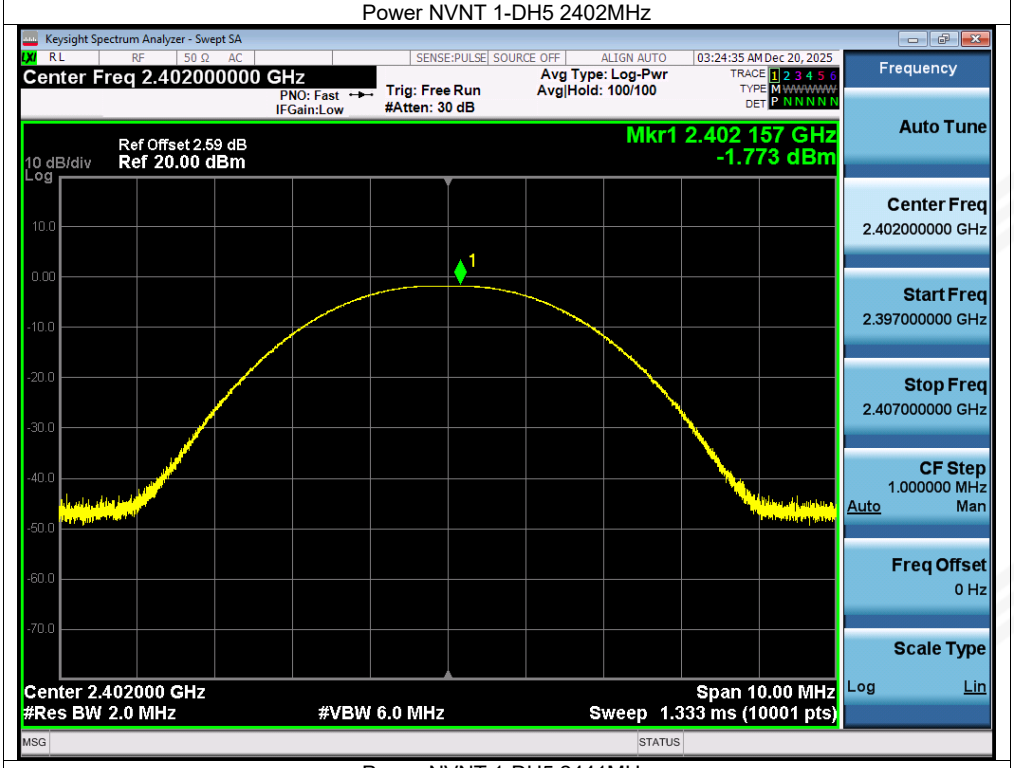
APPENDIX 1-TEST DATA

Maximum Conducted Output Power

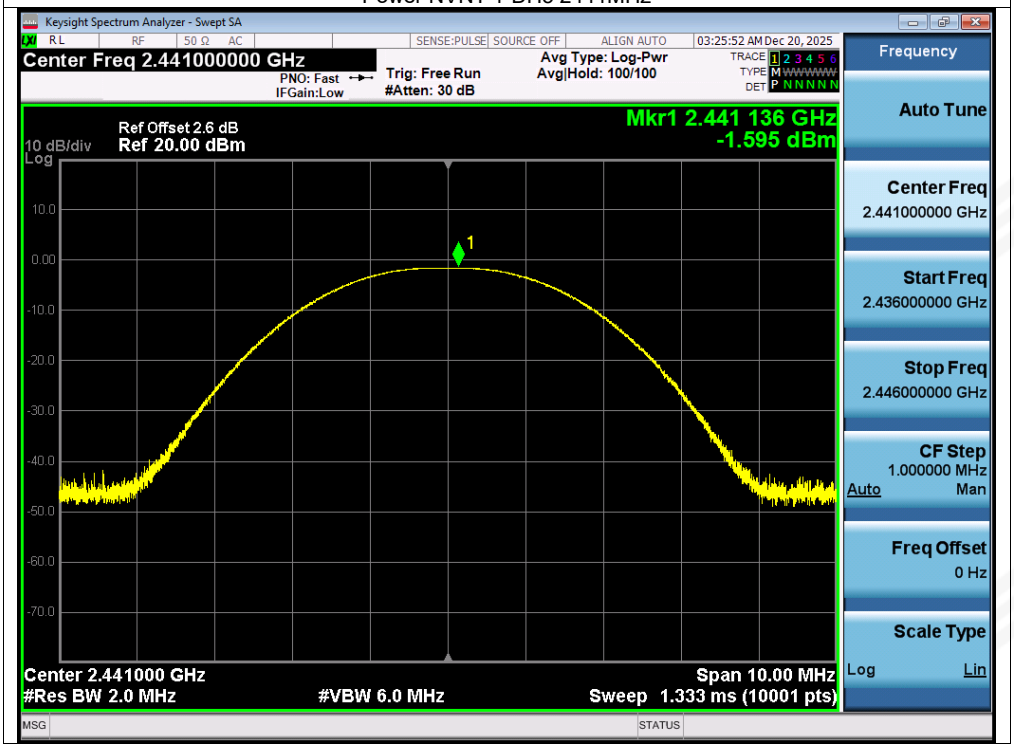
Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	1-DH1	2402	-1.77	21	Pass
NVNT	1-DH1	2441	-1.6	21	Pass
NVNT	1-DH1	2480	-1.36	21	Pass
NVNT	2-DH1	2402	-0.94	21	Pass
NVNT	2-DH1	2441	-0.79	21	Pass
NVNT	2-DH1	2480	-0.54	21	Pass
NVNT	3-DH1	2402	-0.55	21	Pass
NVNT	3-DH1	2441	-0.4	21	Pass
NVNT	3-DH1	2480	-0.17	21	Pass

Test Graphs

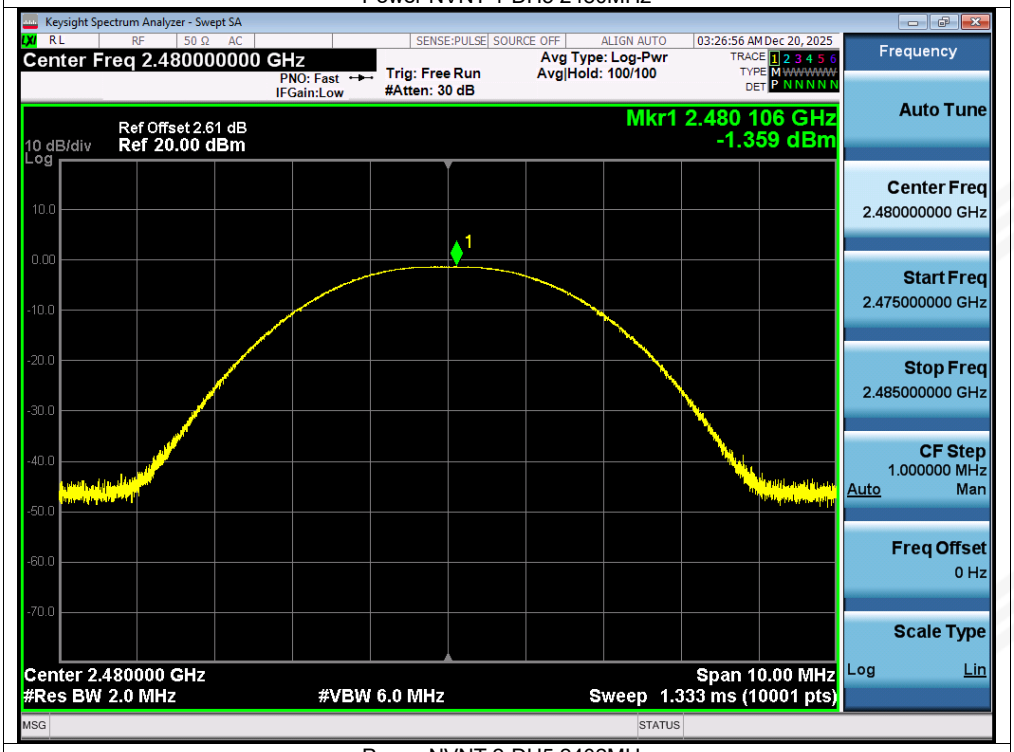
Power NVNT 1-DH5 2402MHz



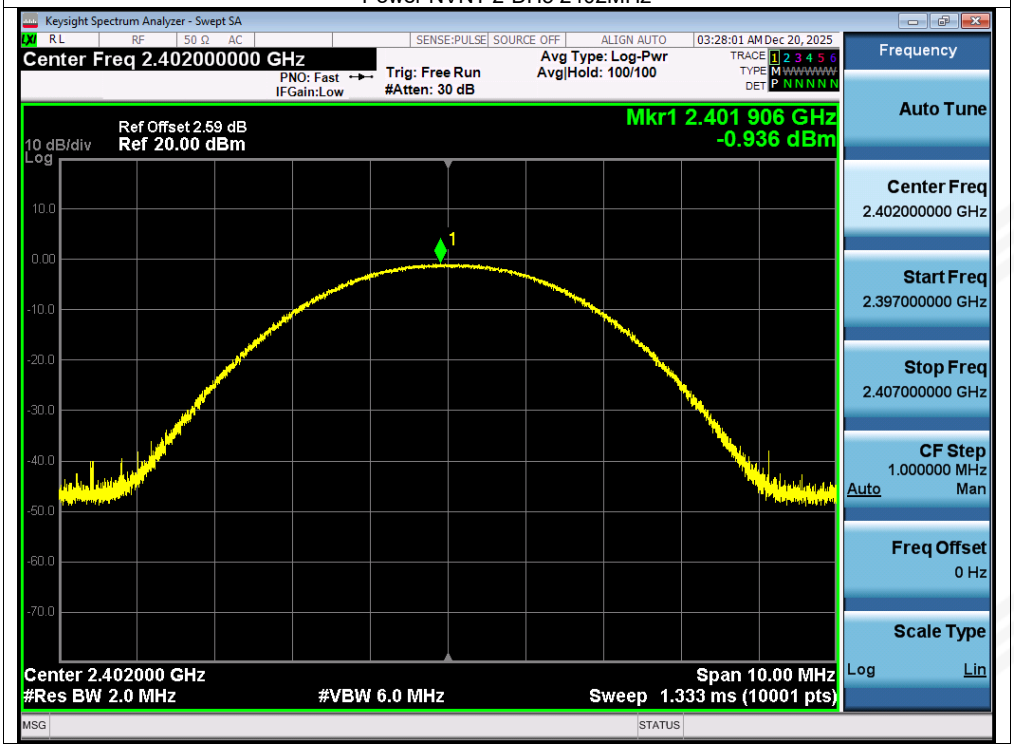
Power NVNT 1-DH5 2441MHz



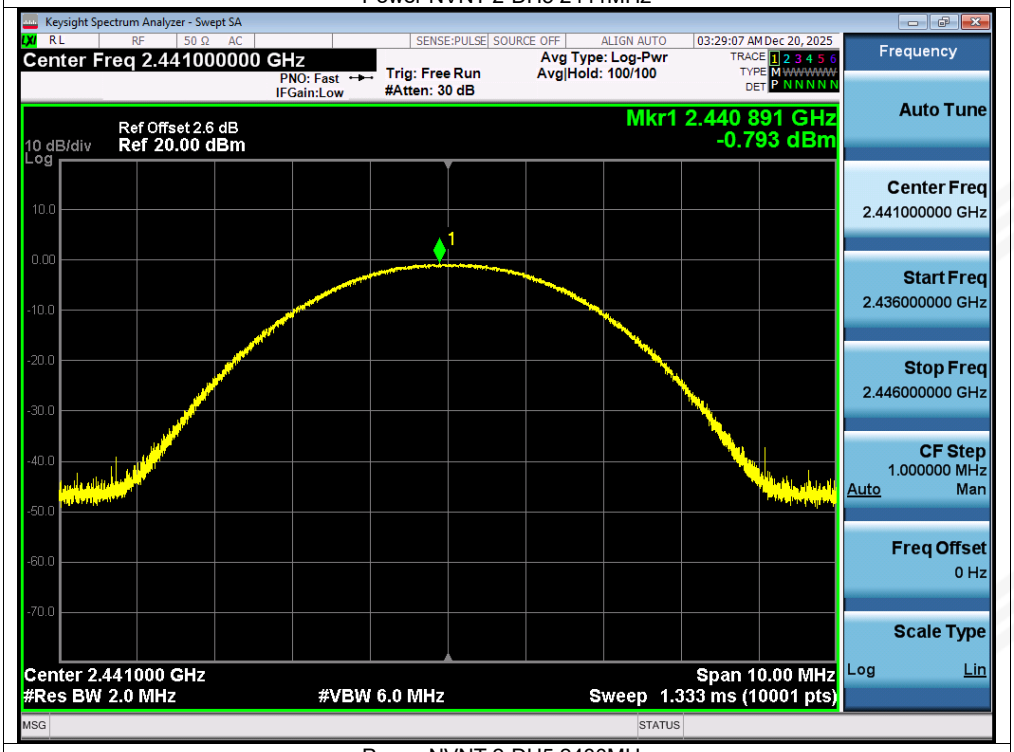
Power NVNT 1-DH5 2480MHz



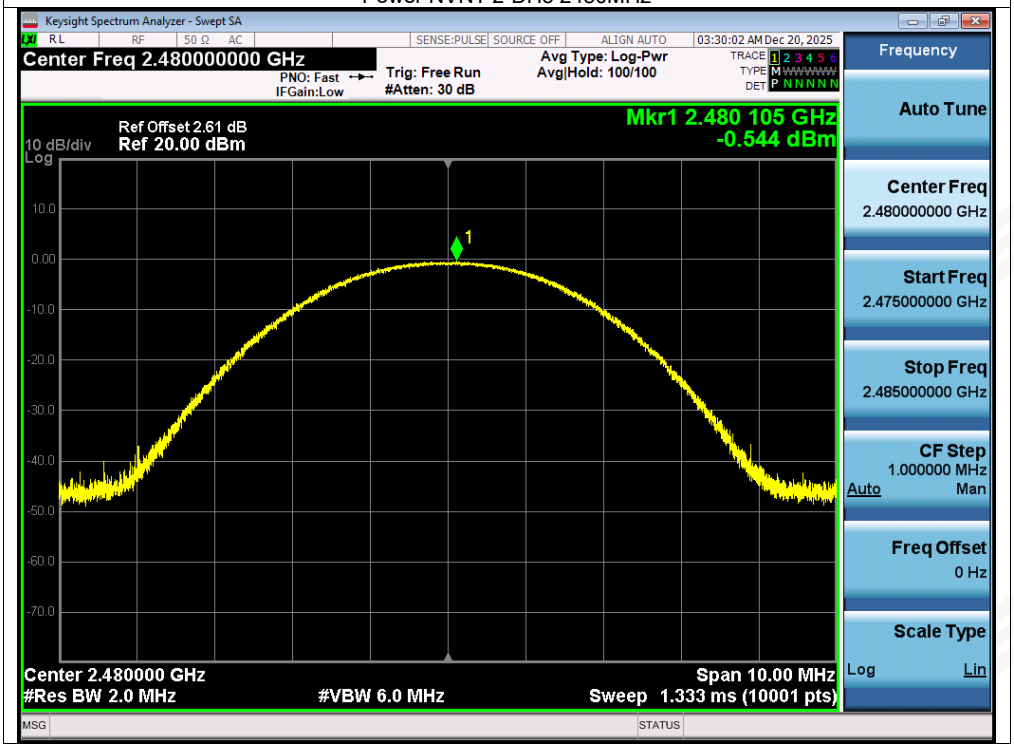
Power NVNT 2-DH5 2402MHz



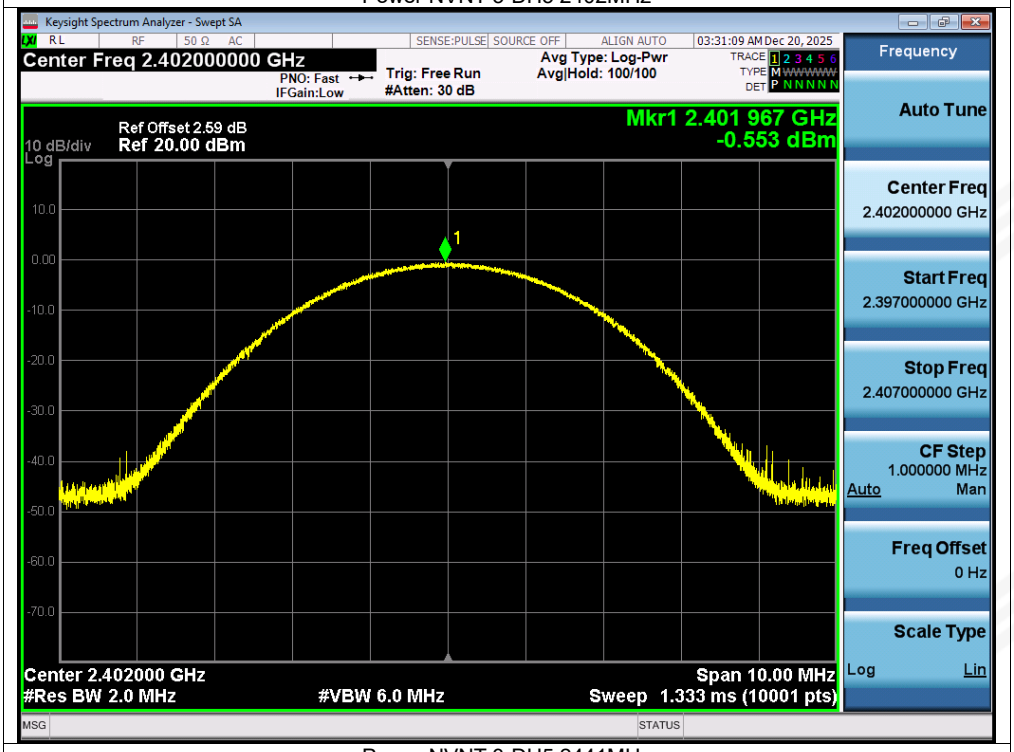
Power NVNT 2-DH5 2441MHz



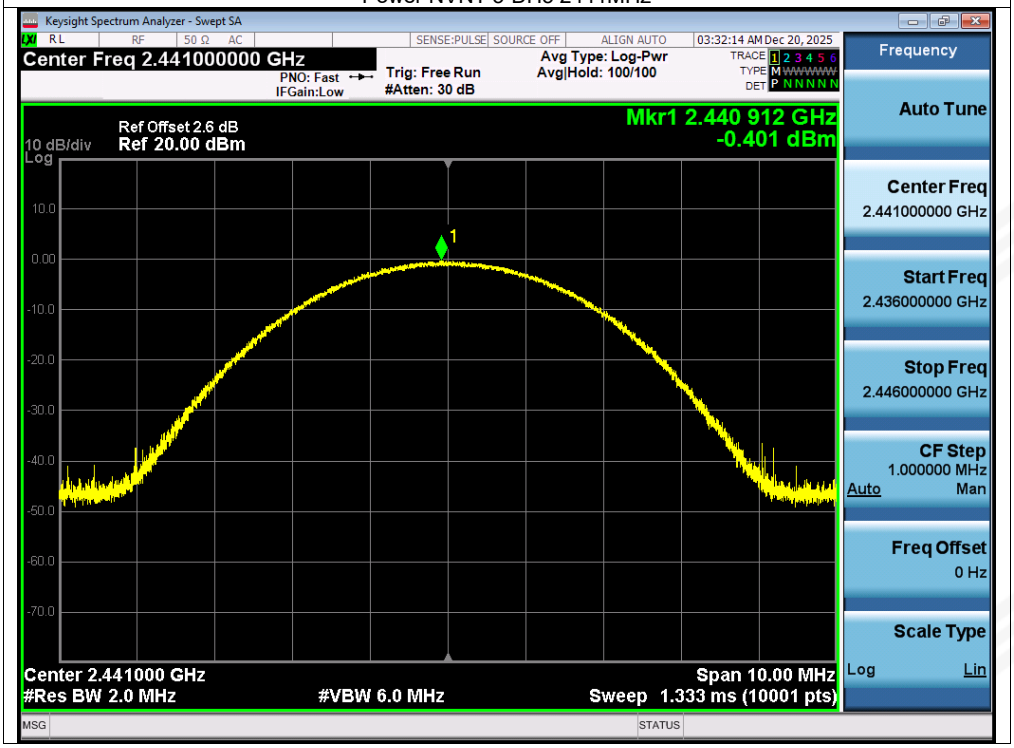
Power NVNT 2-DH5 2480MHz



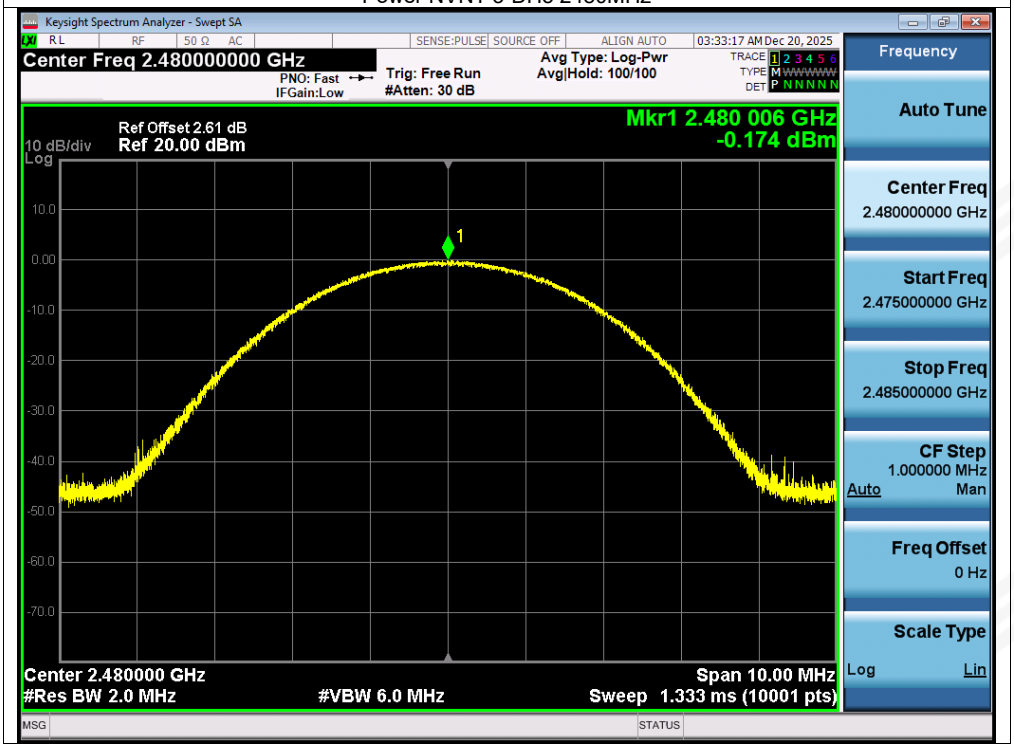
Power NVNT 3-DH5 2402MHz



Power NVNT 3-DH5 2441MHz



Power NVNT 3-DH5 2480MHz



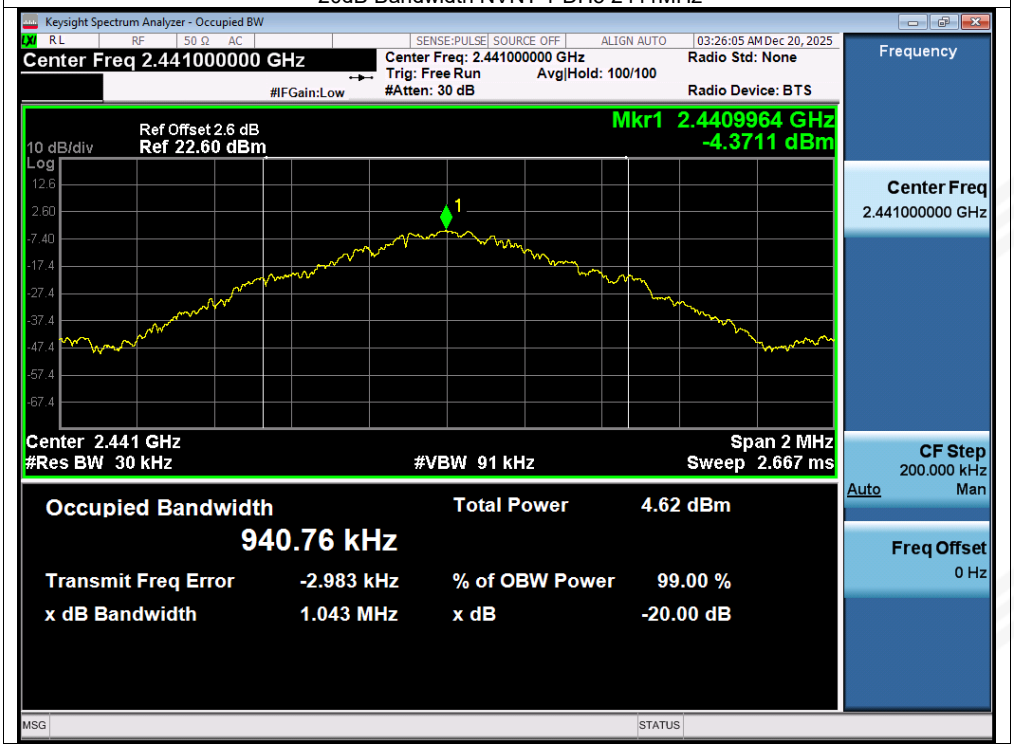
-20dB Bandwidth

Condition	Mode	Frequency (MHz)	-20 dB Bandwidth (MHz)	Limit -20 dB Bandwidth (MHz)	Verdict
NVNT	1-DH1	2402	1.019	0	Pass
NVNT	1-DH1	2441	1.043	0	Pass
NVNT	1-DH1	2480	1.042	0	Pass
NVNT	2-DH1	2402	1.32	0	Pass
NVNT	2-DH1	2441	1.304	0	Pass
NVNT	2-DH1	2480	1.328	0	Pass
NVNT	3-DH1	2402	1.306	0	Pass
NVNT	3-DH1	2441	1.299	0	Pass
NVNT	3-DH1	2480	1.283	0	Pass

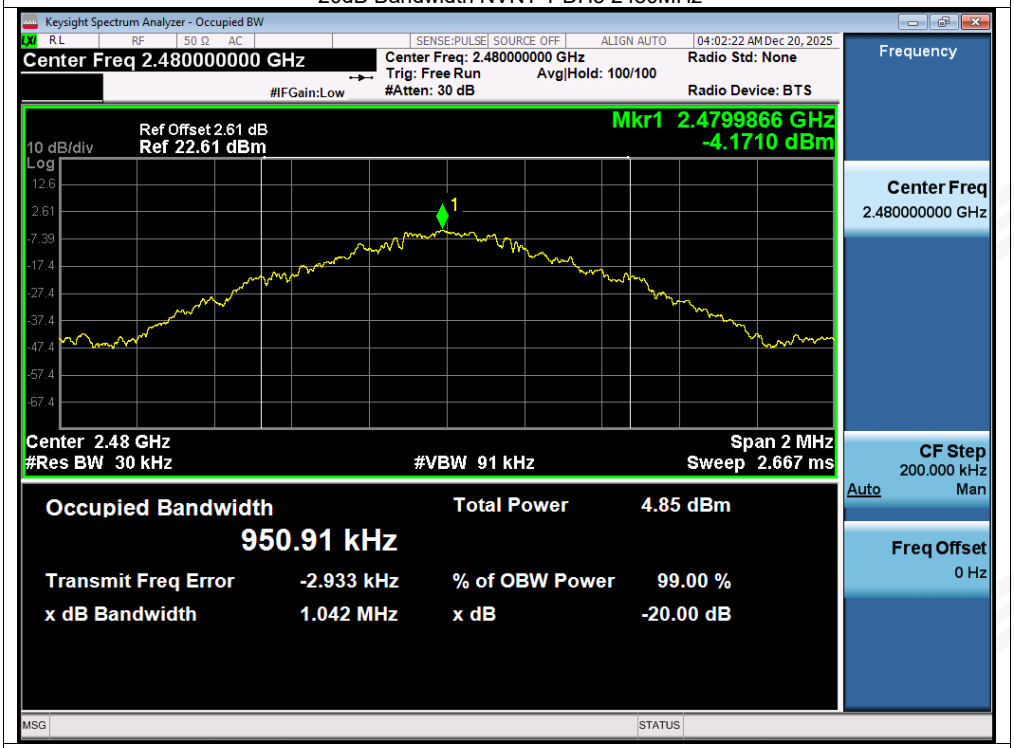
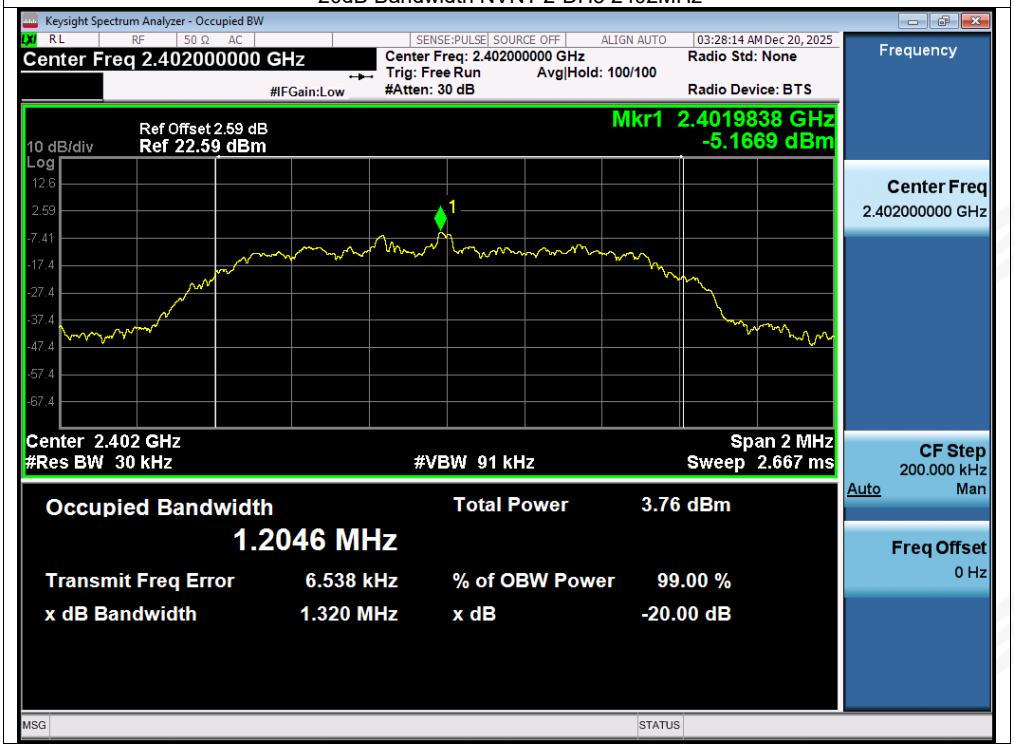
Test Graphs

-20dB Bandwidth NVNT 1-DH5 2402MHz

-20dB Bandwidth NVNT 1-DH5 2441MHz



-20dB Bandwidth NVNT 1-DH5 2480MHz



-20dB Bandwidth NVNT 2-DH5 2402MHz