RF TEST REPORT

Product Name: Keyboard

Model Name: ZH980

FCC ID: 2BLF3-ZH980

Issued For : Dongguan Zornher electronics Co., LTD

Room 204, Building 1, No.91 Shipai Avenue West, Shipai Town, Dongguan City, Guangdong Province

Issued By : Shenzhen LGT Test Service Co., Ltd.

Room 205, Building 13, Zone B, Zhenxiong Industrial Park, No.177, Renmin West Road, Jinsha, Kengzi Street, Pingshan District, Shenzhen, Guangdong, China

Report Number:	LGT24I070RF02
Sample Received Date:	Sep. 11, 2024
Date of Test:	Sep. 11, 2024 – Sep. 26, 2024
Date of Issue:	Sep. 26, 2024

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TEST REPORT CERTIFICATION

Applicant:	Dongguan Zornher electronics Co., LTD
Address:	Room 204, Building 1, No.91 Shipai Avenue West, Shipai Town, Dongguan City, Guangdong Province
Manufacturer:	Dongguan Zornher electronics Co., LTD
Address:	Room 204, Building 1, No.91 Shipai Avenue West, Shipai Town, Dongguan City, Guangdong Province
Product Name:	Keyboard
Trademark:	Zornher
Model Name:	ZH980
Sample Status:	Normal

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC Part 15.247, Subpart C ANSI C63.10-2013	PASS

Prepared by:

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Approved by:

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Technical Director

SHENZHEN LGT TEST SERVICE CO., LTD.
LGT
领冠检测

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Revision History

Rev.	Issue Date	Revisions
00	Sep. 26, 2024	Initial Issue

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 C63.10-2013.

1.1 TEST FACTORY

Company Name:	Shenzhen LGT Test Service Co., Ltd.
Address:	Room 205, Building 13, Zone B, Zhenxiong Industrial Park, No.177, Renmin West Road, Jinsha, Kengzi Street, Pingshan District, Shenzhen, Guangdong, China
Accreditation Certificate	A2LA Certificate No.: 6727.01
	FCC Registration No.: 746540
	CAB ID: CN0136

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	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 9K-30MHz	±2.84dB
4	All emissions, radiated 30M-1GHz	±4.39dB
5	All emissions, radiated 1G-6GHz	±5.10dB
6	All emissions, radiated>6G	±5.48dB
7	Conducted Emission (9KHz-150KHz)	±2.79dB
8	Conducted Emission (150KHz-30MHz)	±2.80dB

Note: The measurement uncertainty is not included in the test result.

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name:	Keyboard
Trademark:	Zornher
Model Name:	ZH980
Series Model:	N/A
Model Difference:	N/A
Channel List:	Please refer to the Note 3.
Frequency:	2402 – 2480 MHz
Modulation:	GFSK
Antenna Type:	PCB
Antenna Gain:	0.34
Rating:	Input: DC 5V 1A
Battery:	Capacity: 6000mAh Rated Voltage: DC 3.7V
Hardware Version:	N/A
Software Version:	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 information refers to the manufacturer provide report, applicable only to the tested sample identified in the report. Due to the incorrect antenna information, a series of problems such as the accuracy of the test results will be borne by the customer.

3.

2.4G 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	GFSK
Mode 2	TX CH38	GFSK
Mode 3	TX CH78	GFSK

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 : Keeping TX

2.3 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.

Test software Version	Test program: 2.4G	
Engineering Mode	Mode Or Modulation type	Power setting
	GFSK	Default

2.4 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.

Accessories Equipment

Description	Manufacturer	Model	S/N	Rating
USB-A to USB-C Cable	N/A	N/A	N/A	1.8m

Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating
Adapter	Tenpao	S005CAU0500100	N/A	Input: 100-240V ~ 50/60Hz 0.2A Output: 5V, 1A

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”.

2.5 EQUIPMENTS LIST

Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Until**
EMI Test Receiver	R&S	ESU8	100372	2024.03.09	2025.03.08
LISN	COM-POWER	LI-115	02032	2024.03.09	2025.03.08
LISN	SCHWARZBECK	NNLK 8122	00160	2024.03.09	2025.03.08
Transient Limiter	CYBERTEK	EM5010A	E2250100049	2024.03.09	2025.03.08
Temperature & Humidity	KTJ	TA218B	N.A	2024.03.09	2025.03.08
Testing Software	EMC-I_V1.4.0.3_SKET				

Radiated Test equipment					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Until**
EMI Test Receiver	R&S	ESU8	100372	2024.03.09	2025.03.08
Active loop Antenna	ETS	6502	00049544	2023.10.13	2025.10.12
Spectrum Analyzer	Keysight	N9010B	MY60242508	2024.08.05	2025.08.04
Bilog Antenna(30M-1G)	SCHWARZBECK	VULB 9168	2705	2022.12.12	2025.12.11
Horn Antenna(1-18G)	SCHWARZBECK	3115	10SL0060	2022.06.02	2025.06.01
Horn Antenna(18-40G)	A-INFO	LB-180400-KF	J211060273	2022.06.08	2025.06.07
Pre-amplifier(30M-1G)	EMtrace	RP01A	02019	2024.03.09	2025.03.08
Pre-amplifier(1-26.5G)	Agilent	8449B	3008A4722	2024.03.09	2025.03.08
Pre-amplifier(18-40G)	com-mw	LNPA_18-40-01	18050003	2024.03.09	2025.03.08
Wireless Communications Test Set	R&S	CMW 500	137737	2024.03.09	2025.03.08
Antenna Tower	SAEMC	BK-4AT-BS-D	SK2021093008	N.A	N.A
Temperature & Humidity	JINGCHUANG	BT-3	N.A	2024.03.11	2025.03.10
Testing Software	EMC-I_V1.4.0.3_SKET				

RF Conducted Test equipment					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Until**
Signal Analyzer	Keysight	N9010B	MY60242508	2024.08.05	2025.08.04
Signal Analyzer	Keysight	N9020A	MY50530994	2024.03.09	2025.03.08
RF Automatic Test system	MW	MW100-RFCB	MW220322LG-033	2024.03.09	2025.03.08
MXG Vector Signal Generator	Keysight	N5182B	MY59100717	2024.03.09	2025.03.08
Power Sensor	Keysight	U2021XA	MY5563043	2024.04.12	2025.04.11
Temperature& Humidity test chamber	AISRY	LX-1000L	171200018	2024.03.09	2025.03.08
Attenuator	eastsheep	90db	N.A	2024.03.09	2025.03.08
Temperature & Humidity	JINGCHUANG	BT-3	N.A	2024.03.11	2025.03.10
Digital multimeter	MASTECH	MS8261	MBGBC83053	2024.03.09	2025.03.08
Testing Software	MTS8310_V2.0.0.0_MW				

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.

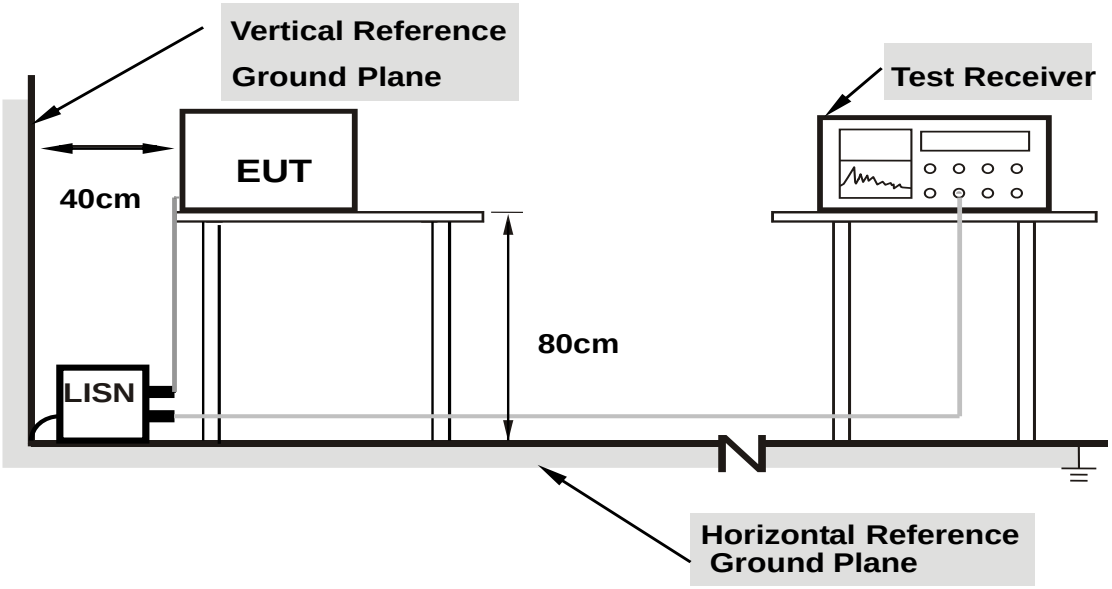
The following table is the setting of the receiver

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.

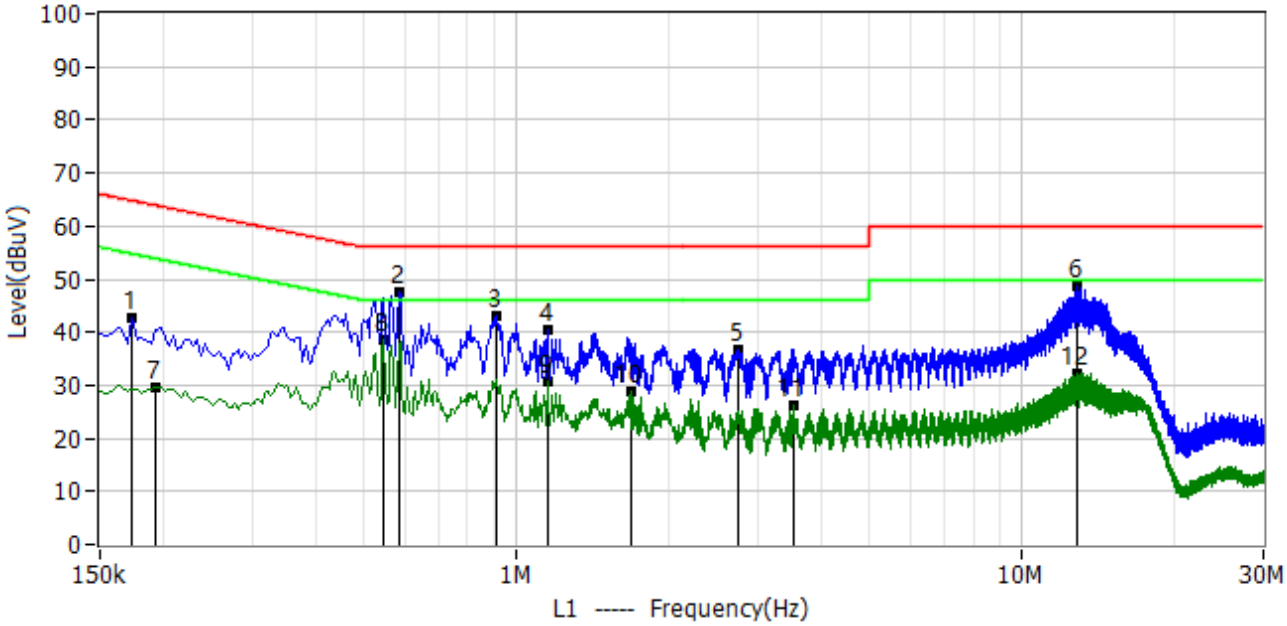
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

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.

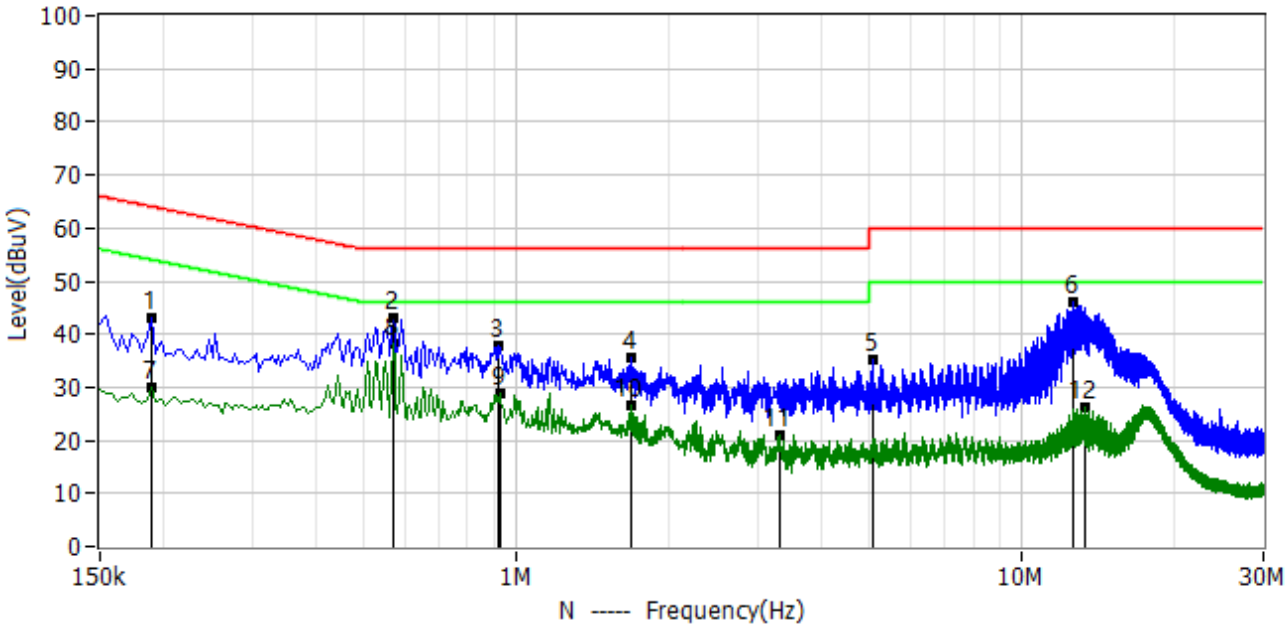
3.1.5 TEST RESULT

Project: LGT24I070	Test Engineer: LiuH
EUT: Keyboard	Temperature: 28.1℃
M/N: ZH980	Humidity: 48%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-09-12
Test Mode: TX 2.4G	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Detector	Polar
1*	0.174	31.96	10.60	42.56	64.77	-22.20	QP	L1
2*	0.586	37.16	10.57	47.73	56.00	-8.27	QP	L1
3*	0.914	32.41	10.65	43.06	56.00	-12.94	QP	L1
4*	1.154	29.89	10.74	40.63	56.00	-15.37	QP	L1
5*	2.734	25.73	11.14	36.87	56.00	-19.13	QP	L1
6*	12.858	37.35	11.23	48.58	60.00	-11.42	QP	L1
7*	0.194	19.07	10.62	29.69	53.86	-24.18	AV	L1
8*	0.546	27.96	10.57	38.53	46.00	-7.47	AV	L1
9*	1.154	19.82	10.74	30.56	46.00	-15.44	AV	L1
10*	1.678	17.99	10.89	28.88	46.00	-17.12	AV	L1
11*	3.522	15.05	11.16	26.21	46.00	-19.79	AV	L1
12*	12.842	21.09	11.23	32.32	50.00	-17.68	AV	L1

Project: LGT24I070	Test Engineer: LiuH
EUT: Keyboard	Temperature: 28.1℃
M/N: ZH980	Humidity: 48%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-09-12
Test Mode: TX 2.4G	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Detector	Polar
1*	0.190	32.68	10.56	43.24	64.04	-20.80	QP	N
2*	0.570	32.52	10.55	43.07	56.00	-12.93	QP	N
3*	0.918	27.30	10.55	37.85	56.00	-18.15	QP	N
4*	1.690	25.00	10.69	35.69	56.00	-20.31	QP	N
5*	5.062	24.22	10.84	35.06	60.00	-24.94	QP	N
6*	12.578	35.03	11.19	46.22	60.00	-13.78	QP	N
7*	0.190	19.23	10.56	29.79	54.04	-24.25	AV	N
8*	0.570	27.57	10.55	38.12	46.00	-7.88	AV	N
9*	0.926	18.45	10.55	29.00	46.00	-17.00	AV	N
10*	1.690	15.73	10.69	26.42	46.00	-19.58	AV	N
11*	3.310	10.37	10.79	21.16	46.00	-24.84	AV	N
12*	13.350	14.84	11.25	26.09	50.00	-23.91	AV	N

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 C63.10-2013 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 (1GHz-25 GHz)

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
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
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:

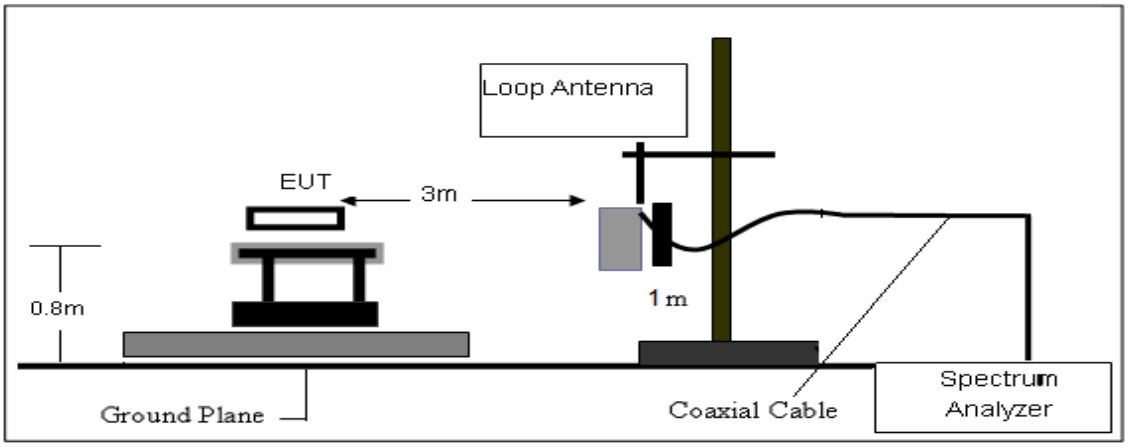
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

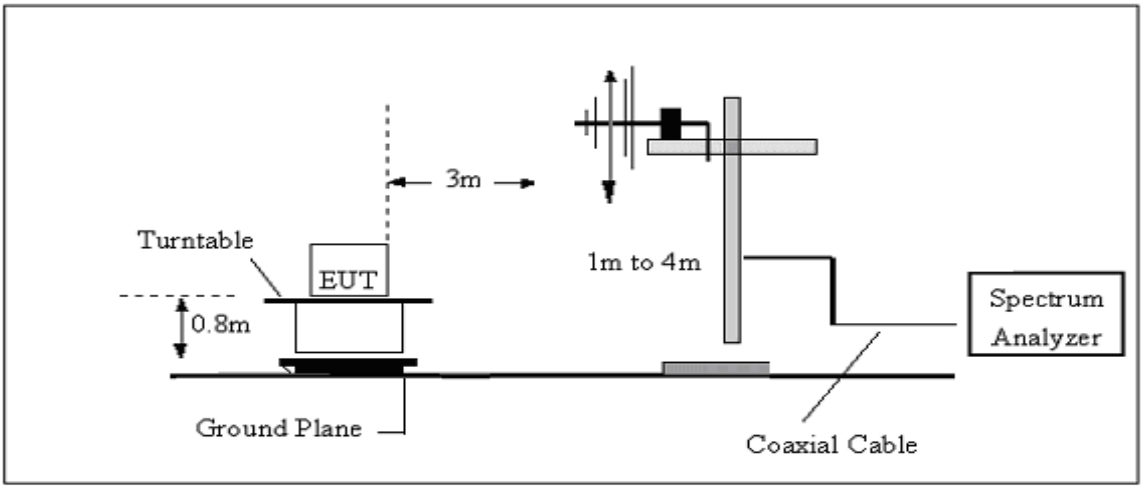
No deviation.

3.2.4 TESTSETUP

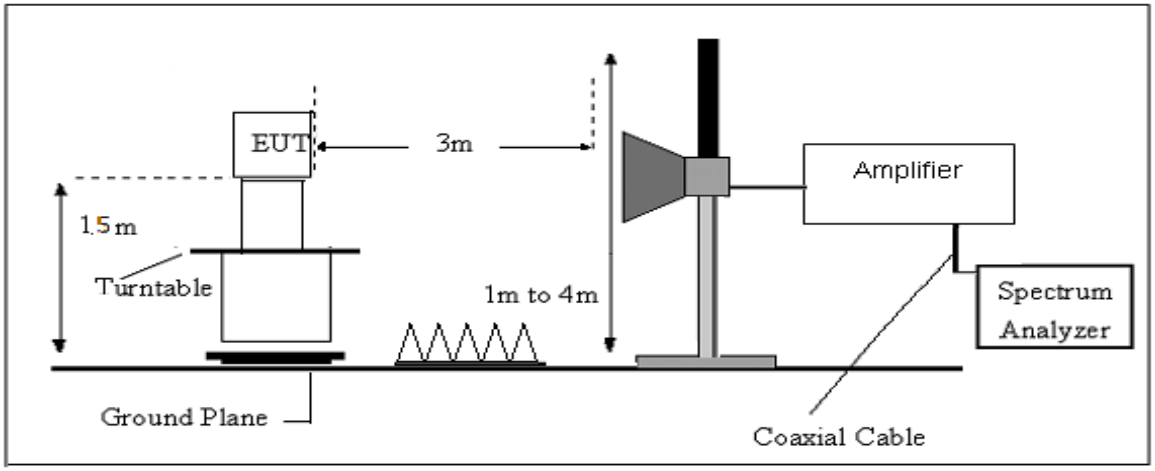
(A) Radiated Emission Test-Up Frequency Below 30MHz



(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

Results of Radiated Emissions (9 KHz~30MHz)

No.	Frequency	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Remark
1*	-	-	-	-	-	-	-	See Note

Note:

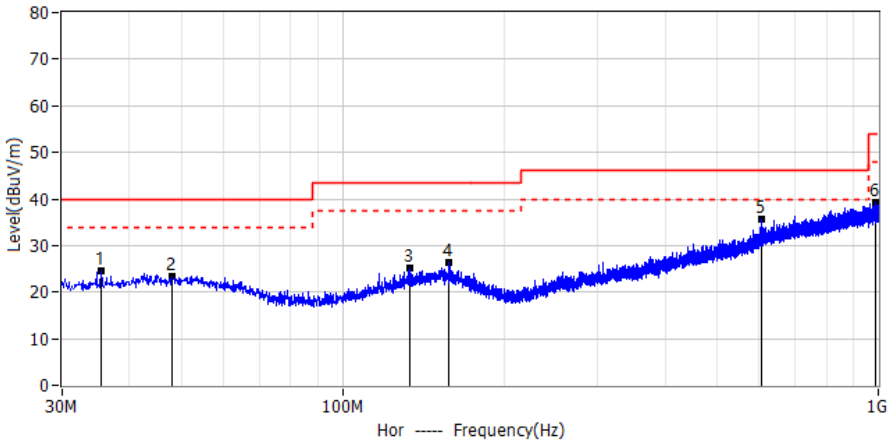
The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

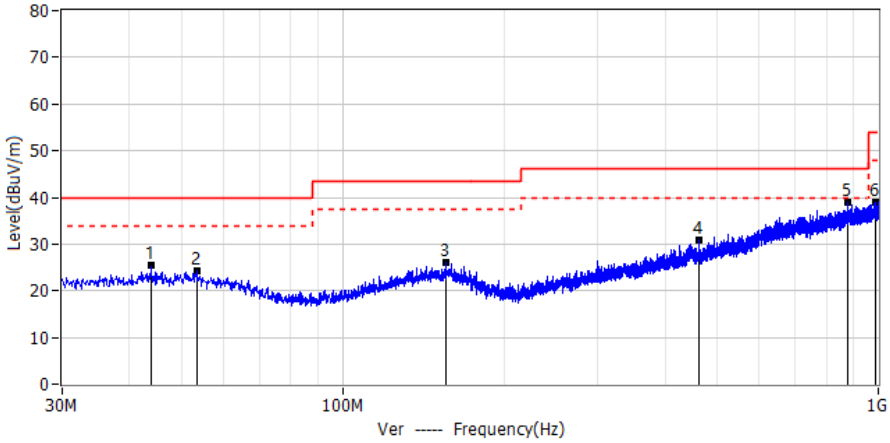
Limit line = specific limits (dBuV) + distance extrapolation factor.

Results of Radiated Emissions (30MHz~1000MHz)

Project: LGT24I070	Test Engineer: LiuH
EUT: Keyboard	Temperature: 25.5℃
M/N: ZH980	Humidity: 52%RH
Test Voltage: Battery	Test Data: 2024-09-14
Test Mode: TX 2.4G	
Note:	



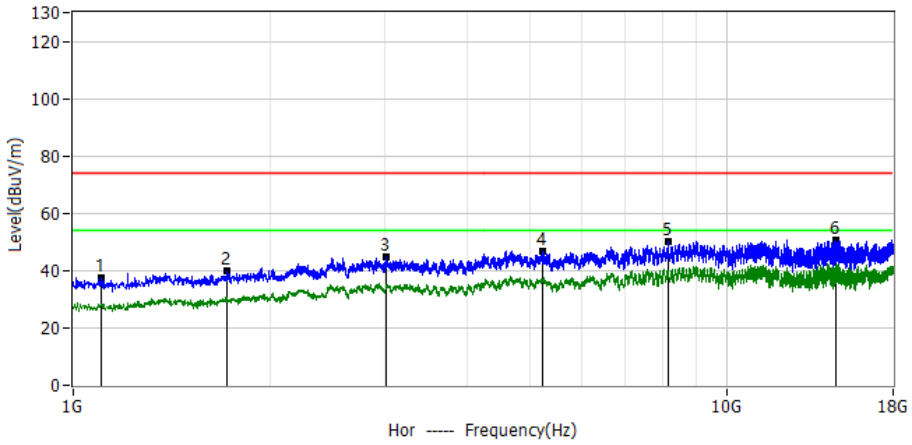
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	35.456	5.06	19.62	24.68	40.00	-15.30	QP	Hor
2*	48.066	3.20	20.28	23.48	40.00	-16.50	QP	Hor
3*	133.669	4.64	20.58	25.22	43.50	-18.30	QP	Hor
4*	158.283	4.71	21.66	26.37	43.50	-17.10	QP	Hor
5*	606.423	6.98	28.75	35.73	46.00	-10.30	QP	Hor
6*	987.875	5.21	33.98	39.19	54.00	-14.80	QP	Hor



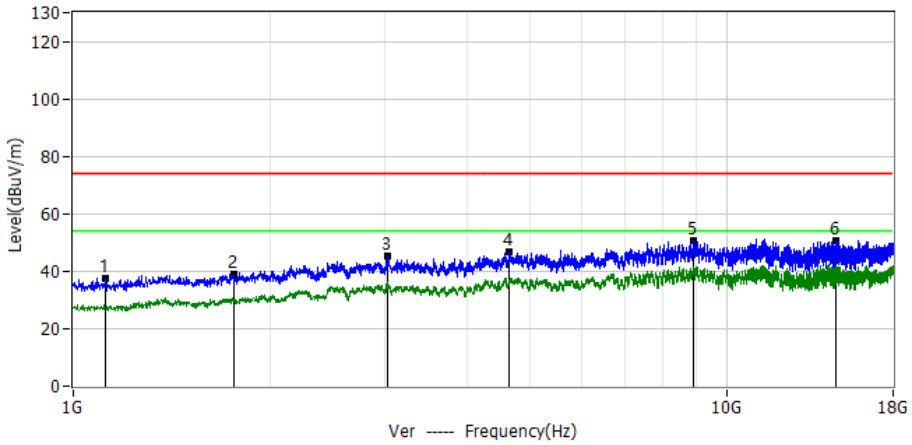
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	43.944	4.60	20.72	25.32	40.00	-14.70	QP	Ver
2*	53.401	3.66	20.53	24.19	40.00	-15.80	QP	Ver
3*	155.979	4.34	21.71	26.05	43.50	-17.40	QP	Ver
4*	461.771	5.05	25.80	30.85	46.00	-15.10	QP	Ver
5*	877.295	6.12	32.89	39.01	46.00	-7.00	QP	Ver
6*	986.056	4.81	34.16	38.97	54.00	-15.00	QP	Ver

Results of Radiated Emissions (Above 1000MHz)

Project: LGT24I070	Test Engineer: LiuH
EUT: Keyboard	Temperature: 26℃
M/N: ZH980	Humidity: 67%RH
Test Voltage: Battery	Test Data: 2024-09-24
Test Mode: L	
Note:	

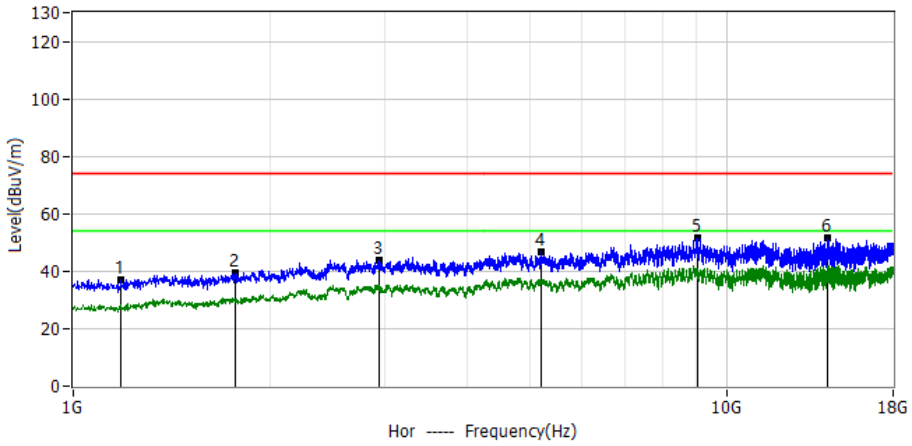


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1104.1000	61.35	-23.84	37.51	74.00	-36.49	PK	Hor
2*	1718.2000	59.05	-19.19	39.86	74.00	-34.14	PK	Hor
3*	3006.0000	53.36	-8.77	44.59	74.00	-29.41	PK	Hor
4*	5233.0000	54.42	-7.79	46.63	74.00	-27.37	PK	Hor
5*	8146.4000	55.57	-5.23	50.34	74.00	-23.66	PK	Hor
6*	14714.7000	50.10	0.58	50.68	74.00	-23.32	PK	Hor

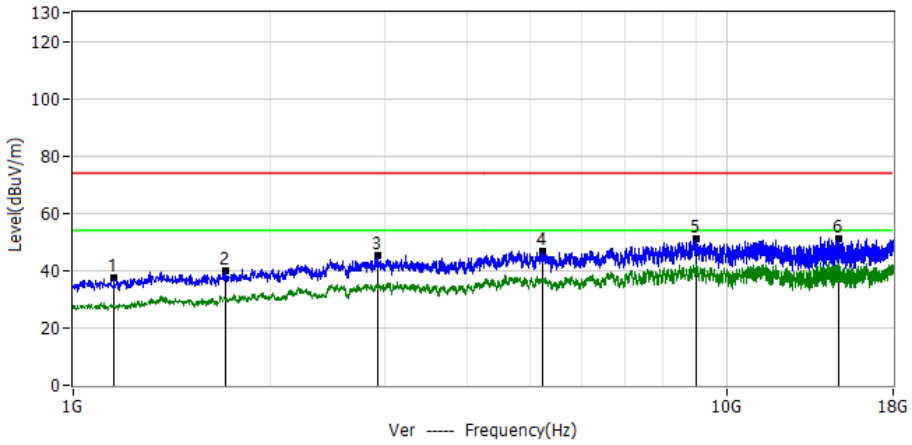


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1121.1000	60.97	-23.70	37.27	74.00	-36.73	PK	Ver
2*	1762.9000	57.79	-18.77	39.02	74.00	-34.98	PK	Ver
3*	3020.9000	53.85	-8.78	45.07	74.00	-28.93	PK	Ver
4*	4650.7000	53.17	-6.65	46.52	74.00	-27.48	PK	Ver
5*	8915.6000	54.66	-3.82	50.84	74.00	-23.16	PK	Ver
6*	14706.2000	50.05	0.58	50.63	74.00	-23.37	PK	Ver

Project: LGT24I070	Test Engineer: LiuH
EUT: Keyboard	Temperature: 26℃
M/N: ZH980	Humidity: 67%RH
Test Voltage: Battery	Test Data: 2024-09-24
Test Mode: M	
Note:	

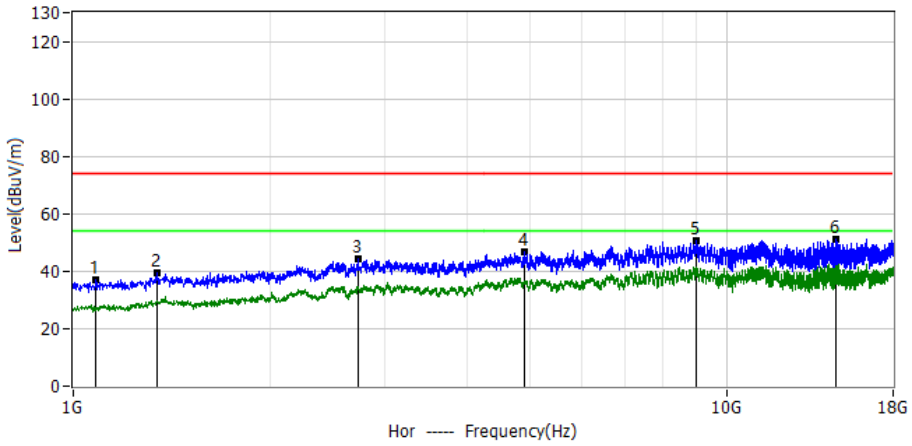


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1182.7000	60.30	-23.16	37.14	74.00	-36.86	PK	Hor
2*	1767.1000	58.13	-18.73	39.40	74.00	-34.60	PK	Hor
3*	2935.9000	53.13	-9.09	44.04	74.00	-29.96	PK	Hor
4*	5209.6000	54.29	-7.71	46.58	74.00	-27.42	PK	Hor
5*	9026.1000	55.43	-3.68	51.75	74.00	-22.25	PK	Hor
6*	14249.4000	50.73	0.77	51.50	74.00	-22.50	PK	Hor

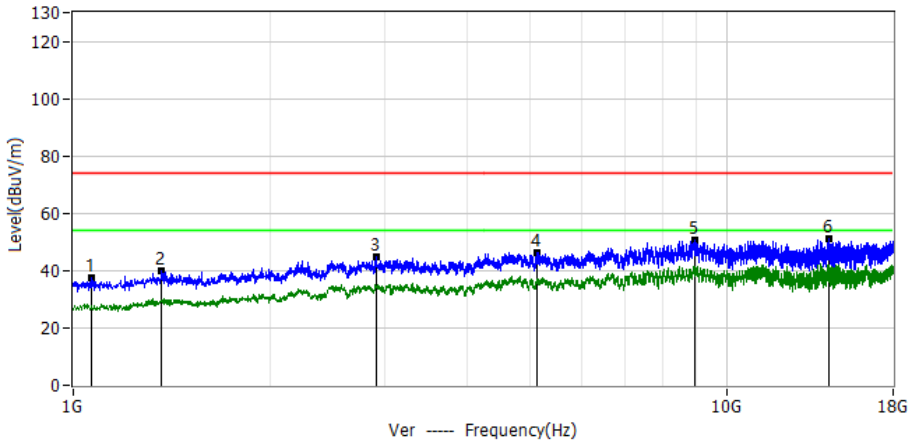


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1153.0000	60.78	-23.42	37.36	74.00	-36.64	PK	Ver
2*	1707.6000	59.11	-19.29	39.82	74.00	-34.18	PK	Ver
3*	2931.6000	54.48	-9.12	45.36	74.00	-28.64	PK	Ver
4*	5228.7000	54.70	-7.78	46.92	74.00	-27.08	PK	Ver
5*	9009.1000	54.78	-3.67	51.11	74.00	-22.89	PK	Ver
6*	14818.9000	50.80	0.53	51.33	74.00	-22.67	PK	Ver

Project: LGT24I070	Test Engineer: LiuH
EUT: Keyboard	Temperature: 26℃
M/N: ZH980	Humidity: 67%RH
Test Voltage: Battery	Test Data: 2024-09-24
Test Mode: H	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1082.9000	61.09	-24.03	37.06	74.00	-36.94	PK	Hor
2*	1342.1000	61.40	-21.91	39.49	74.00	-34.51	PK	Hor
3*	2734.0000	54.48	-10.12	44.36	74.00	-29.64	PK	Hor
4*	4901.5000	53.82	-6.90	46.92	74.00	-27.08	PK	Hor
5*	9004.9000	54.33	-3.67	50.66	74.00	-23.34	PK	Hor
6*	14695.6000	50.41	0.58	50.99	74.00	-23.01	PK	Hor

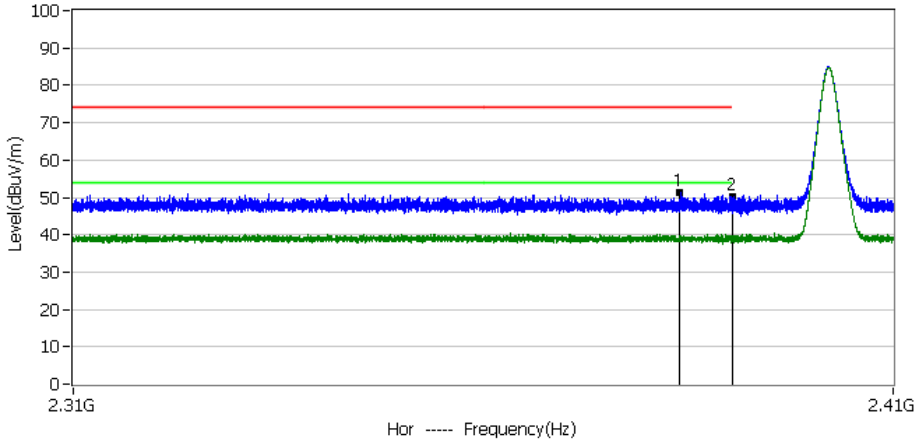


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1063.7000	61.51	-24.20	37.31	74.00	-36.69	PK	Ver
2*	1363.4000	61.65	-21.75	39.90	74.00	-34.10	PK	Ver
3*	2910.4000	53.79	-9.22	44.57	74.00	-29.43	PK	Ver
4*	5124.6000	53.81	-7.42	46.39	74.00	-27.61	PK	Ver
5*	8928.4000	54.50	-3.80	50.70	74.00	-23.30	PK	Ver
6*	14370.5000	50.23	0.72	50.95	74.00	-23.05	PK	Ver

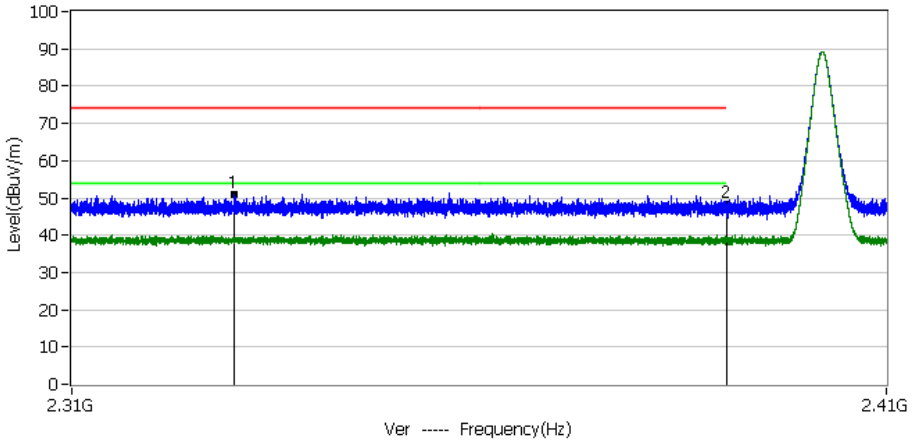
Remark:
In frequency ranges 18~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

3.2.8 TEST RESULTS (BAND EDGE REQUIREMENTS)

Project: LGT24I070	Test Engineer: LiuH
EUT: Keyboard	Temperature: 25.9℃
M/N: ZH980	Humidity: 48%RH
Test Voltage: Battery	Test Data: 2024-09-24
Test Mode: L	
Note:	

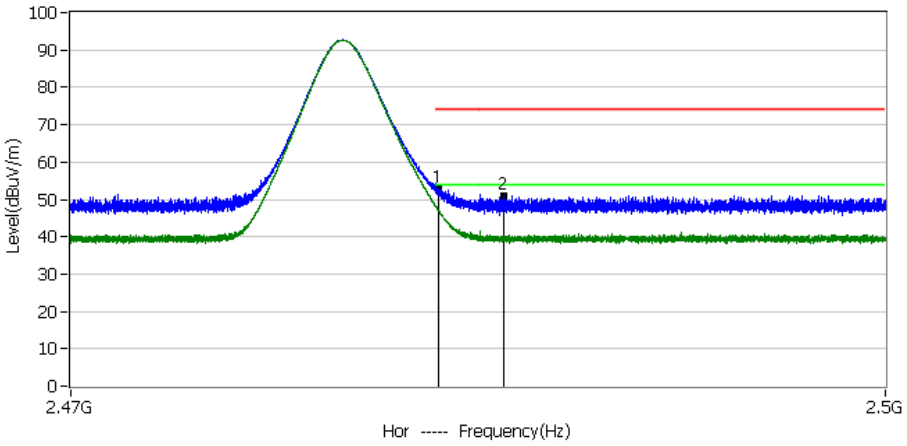


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2383.6000	17.06	34.11	51.17	74.00	-22.83	PK	Hor
2*	2390.0000	16.27	34.10	50.37	74.00	-23.63	PK	Hor

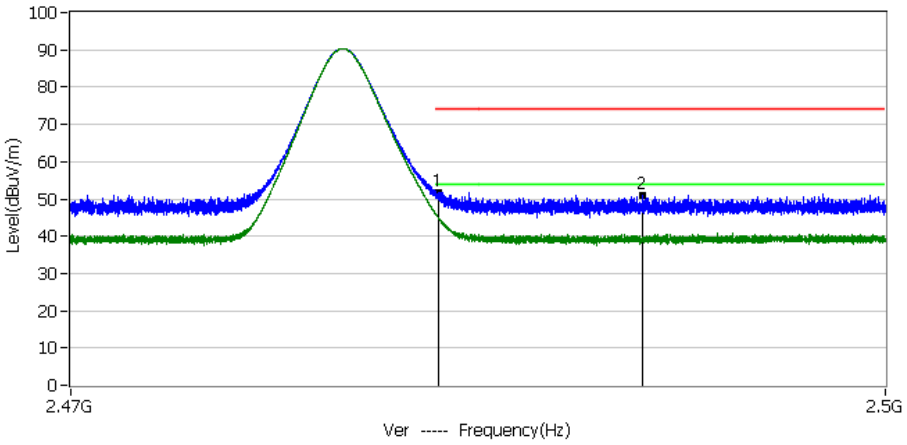


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2329.6000	16.71	34.16	50.87	74.00	-23.13	PK	Ver
2*	2390.0000	14.29	34.10	48.39	74.00	-25.61	PK	Ver

Project: LGT24I070	Test Engineer: LiuH
EUT: Keyboard	Temperature: 25.9℃
M/N: ZH980	Humidity: 48%RH
Test Voltage: Battery	Test Data: 2024-09-24
Test Mode: H	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2483.5000	18.25	34.44	52.69	74.00	-21.31	PK	Hor
2*	2485.9000	16.60	34.44	51.04	74.00	-22.96	PK	Hor



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2483.5000	17.32	34.44	51.76	74.00	-22.24	PK	Ver
2*	2491.0000	16.39	34.45	50.84	74.00	-23.16	PK	Ver

Note:

Average measurement was not performed if peak level lower than average limit. No any other emissions level which are attenuated less than 20dB below the limit. The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this Part. Hence there no other emissions have been 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
Start/Stop Frequency	Lower Band Edge: 2300 – 2407 MHz Upper Band Edge: 2475 – 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Hopping Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300– 2403 MHz Upper Band Edge: 2479 – 2500 MHz
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

For the measurement records, refer to the appendix I.

Note: Not recorded emission from 9 KHz to 30 MHz as emission level at least 20dBc lower than emission limit.

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	300KHz
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= 300KHz, 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

For the measurement records, refer to the appendix I.

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.
g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
h. Measure the maximum time duration of one single pulse.
i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 3.37 x 31.6 = 106.6.
j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 5.06 x 31.6 = 160.
k. DH1 Packet permit maximum 1600 / 79 / 2 = 10.12 hops per second in each channel (1 time slot RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 10.12 x 31.6 = 320.

6.3 TEST SETUP

6.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

6.5 TEST RESULTS

For the measurement records, refer to the appendix I.

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) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 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 100 kHz were utilised for 20 dB bandwidth measurement.
c. The resolution bandwidth of 30 kHz and the video bandwidth of 100 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

For the measurement records, refer to the appendix I.

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) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 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=100KHz, 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

For the measurement records, refer to the appendix I.

9. OUTPUT POWER TEST

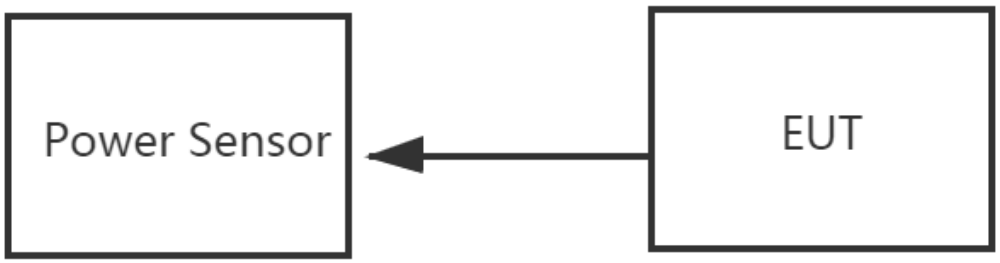
9.1 LIMIT

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 if channel separation > 2/3 bandwidthprovided thesystems operatewith an output power no greater than125 mW(20.97dBm)	2400-2483.5	PASS

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.
PKPM1 Peak power meter method:
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DSS bandwidth and shall use a fast-responding diode detector.

9.3 TEST SETUP



9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

9.5 TEST RESULTS

For the measurement records, refer to the appendix I.

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 PCB Antenna. It comply with the standard requirement.

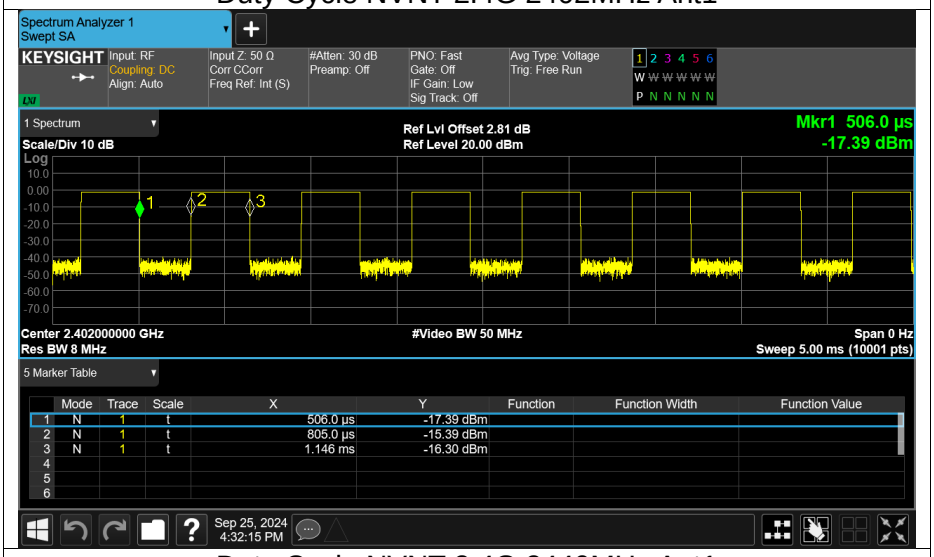
APPENDIX I - TEST RESULTS

Duty Cycle

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	2.4G	2402	Ant1	53.28	2.73	2.93
NVNT	2.4G	2440	Ant1	53.28	2.73	2.93
NVNT	2.4G	2480	Ant1	53.28	2.73	2.93

Test Graphs

Duty Cycle NVNT 2.4G 2402MHz Ant1



Duty Cycle NVNT 2.4G 2440MHz Ant1

Duty Cycle NVNT 2.4G 2480MHz Ant1

Maximum Peak Conducted Output Power

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	2.4G	2402	Ant1	-1.23	21	Pass
NVNT	2.4G	2440	Ant1	-2.08	21	Pass
NVNT	2.4G	2480	Ant1	-3.06	21	Pass

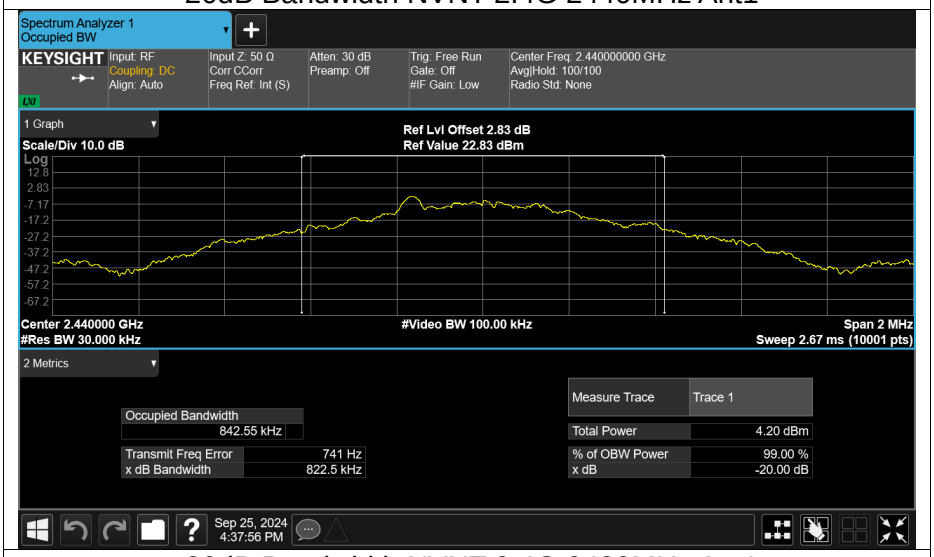
-20dB Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	-20 dB Bandwidth (MHz)	Verdict
NVNT	2.4G	2402	Ant1	0.836	Pass
NVNT	2.4G	2440	Ant1	0.822	Pass
NVNT	2.4G	2480	Ant1	0.832	Pass

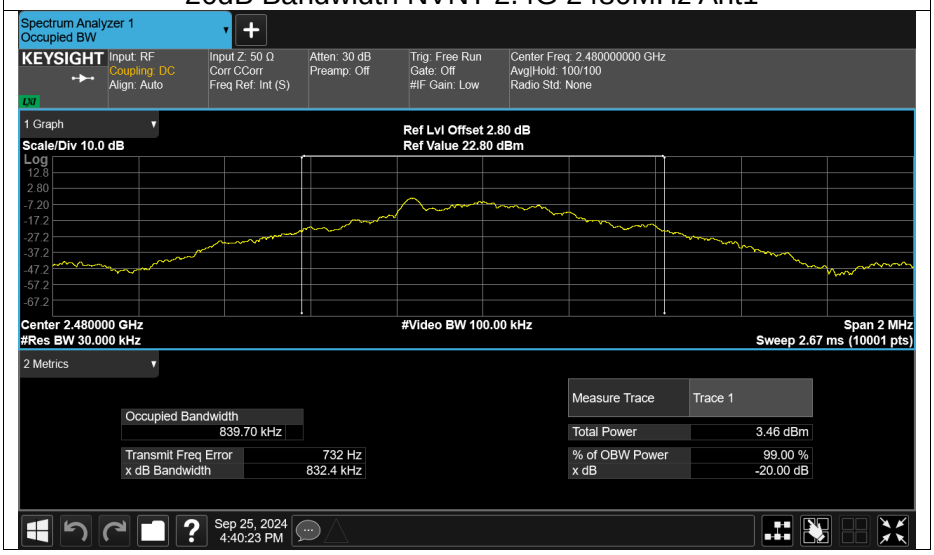
Test Graphs

-20dB Bandwidth NVNT 2.4G 2402MHz Ant1

-20dB Bandwidth NVNT 2.4G 2440MHz Ant1



-20dB Bandwidth NVNT 2.4G 2480MHz Ant1

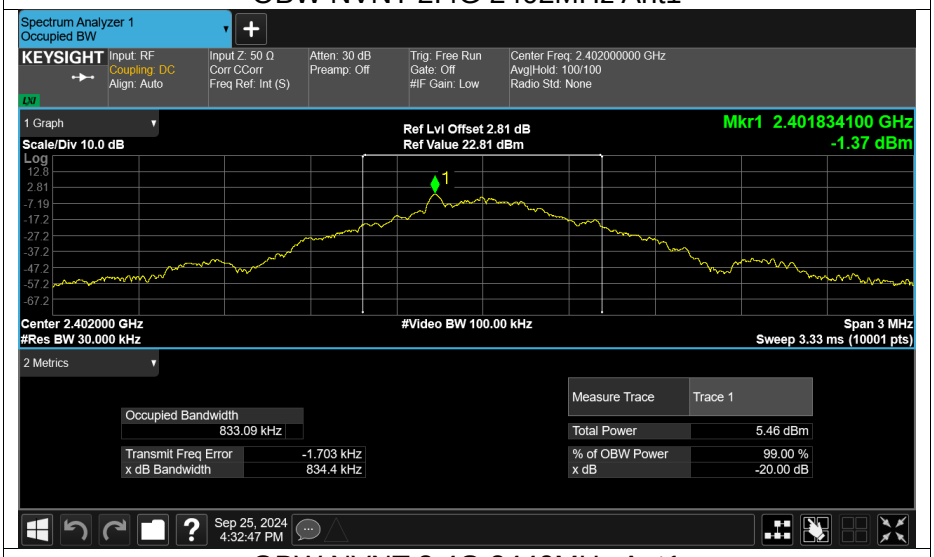


Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	2.4G	2402	Ant1	0.833
NVNT	2.4G	2440	Ant1	0.842
NVNT	2.4G	2480	Ant1	0.842

Test Graphs

OBW NVNT 2.4G 2402MHz Ant1



OBW NVNT 2.4G 2440MHz Ant1

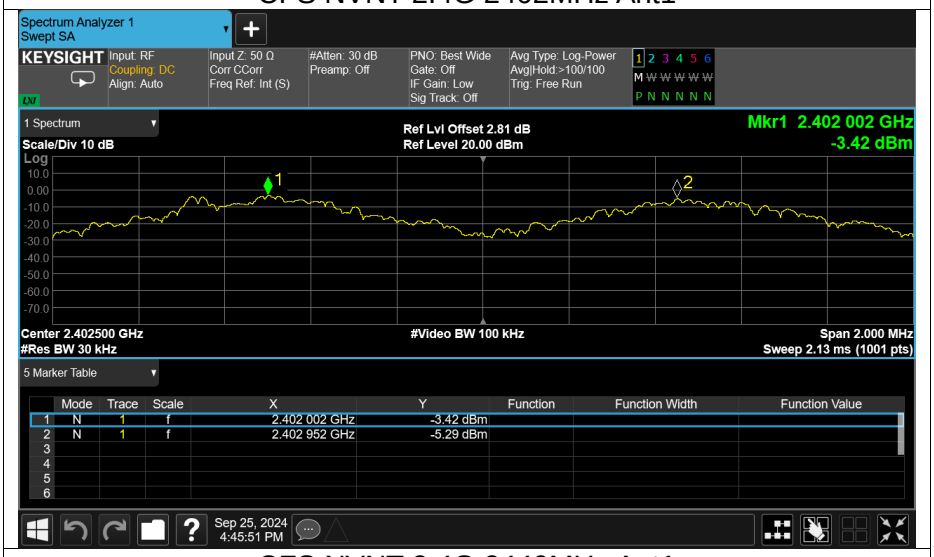
OBW NVNT 2.4G 2480MHz Ant1

Carrier Frequencies Separation

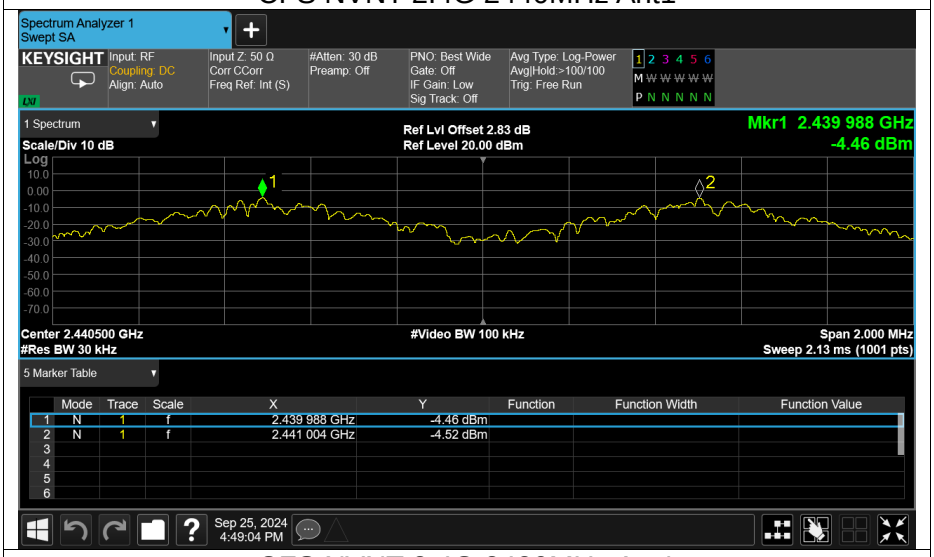
Condition	Mode	Antenna	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	2.4G	Ant1	2402.002	2402.952	0.95	0.557	Pass
NVNT	2.4G	Ant1	2439.988	2441.004	1.016	0.548	Pass
NVNT	2.4G	Ant1	2479.002	2479.996	0.994	0.555	Pass

Test Graphs

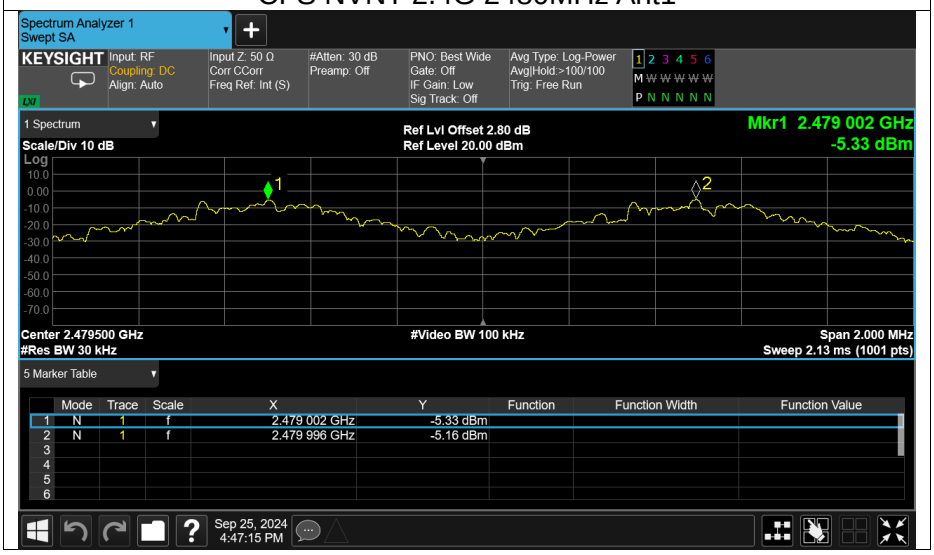
CFS NVNT 2.4G 2402MHz Ant1



CFS NVNT 2.4G 2440MHz Ant1



CFS NVNT 2.4G 2480MHz Ant1

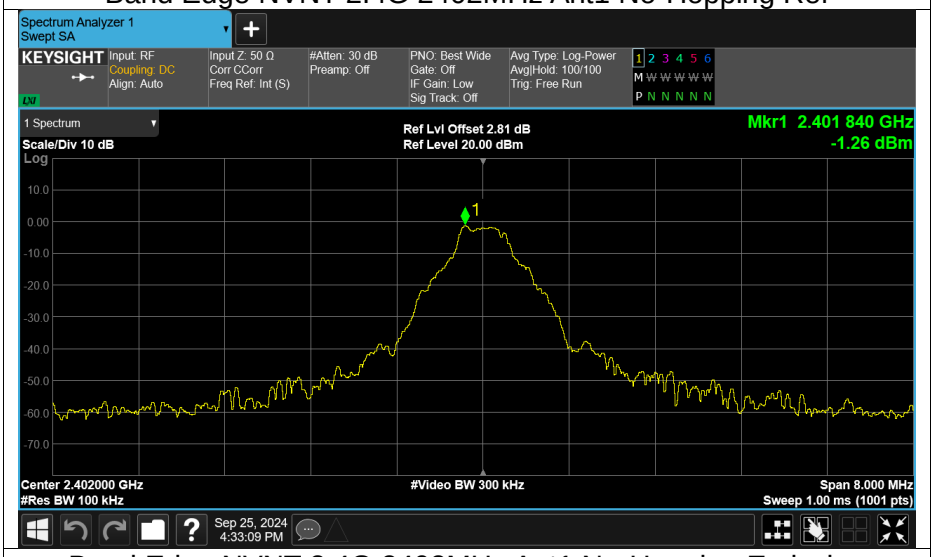


Band Edge

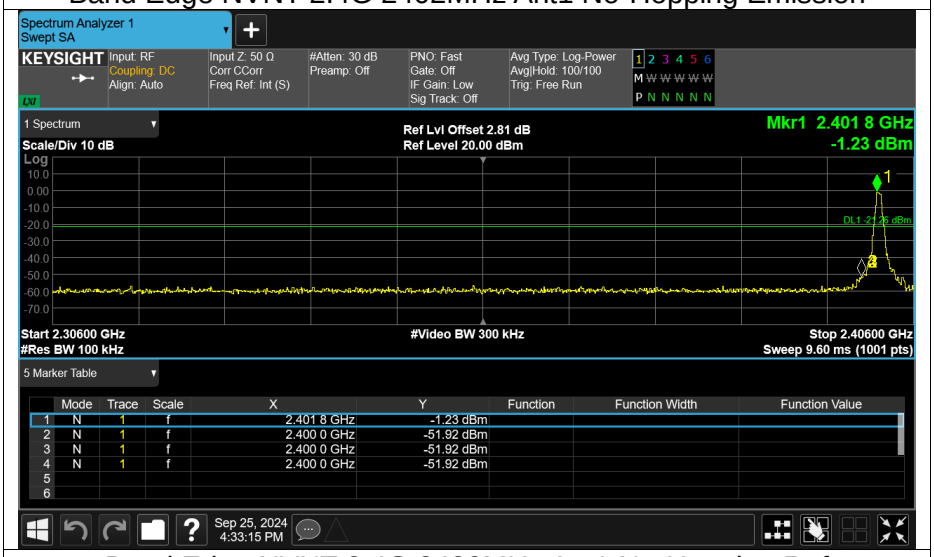
Condition	Mode	Frequency (MHz)	Antenna	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	2.4G	2402	Ant1	No-Hopping	-50.66	-20	Pass
NVNT	2.4G	2480	Ant1	No-Hopping	-53.07	-20	Pass

Test Graphs

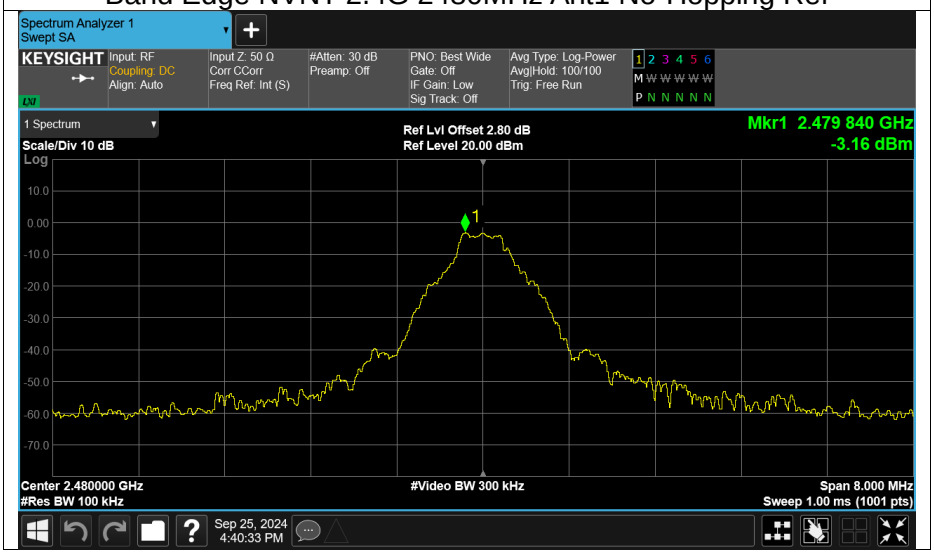
Band Edge NVNT 2.4G 2402MHz Ant1 No-Hopping Ref



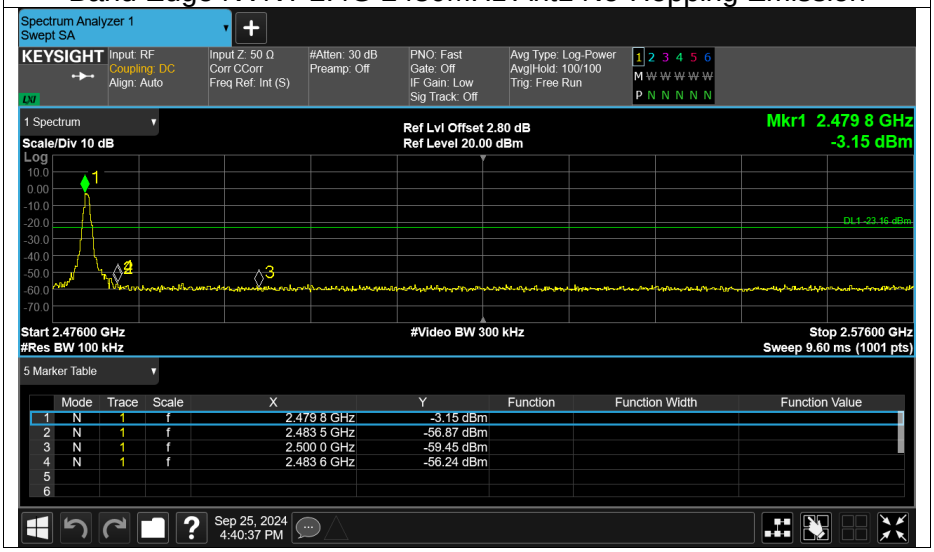
Band Edge NVNT 2.4G 2402MHz Ant1 No-Hopping Emission



Band Edge NVNT 2.4G 2480MHz Ant1 No-Hopping Ref



Band Edge NVNT 2.4G 2480MHz Ant1 No-Hopping Emission

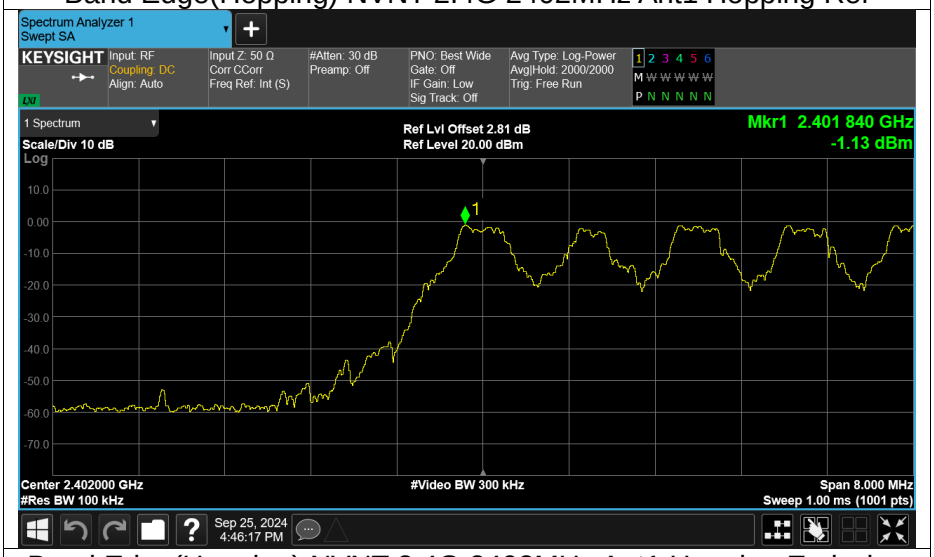


Band Edge(Hopping)

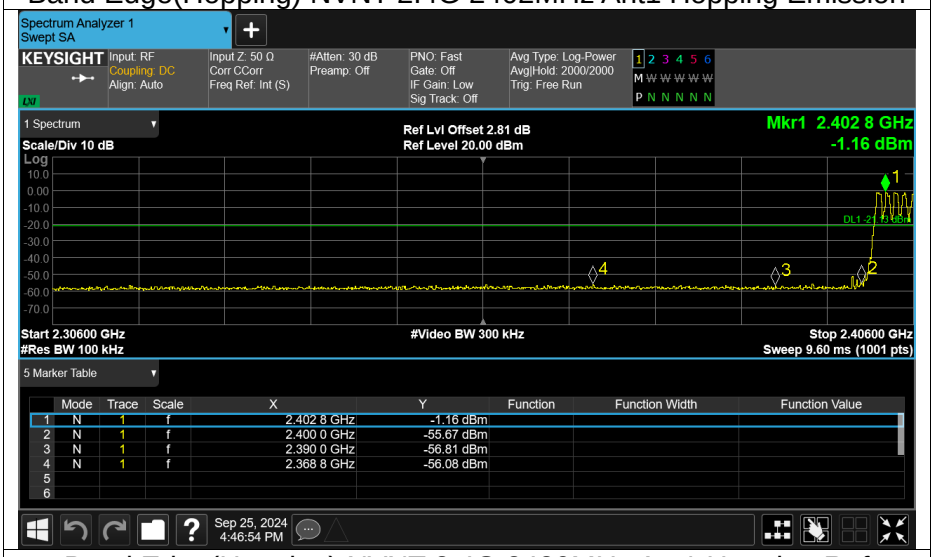
Condition	Mode	Frequency (MHz)	Antenna	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	2.4G	2402	Ant1	Hopping	-54.95	-20	Pass
NVNT	2.4G	2480	Ant1	Hopping	-53.18	-20	Pass

Test Graphs

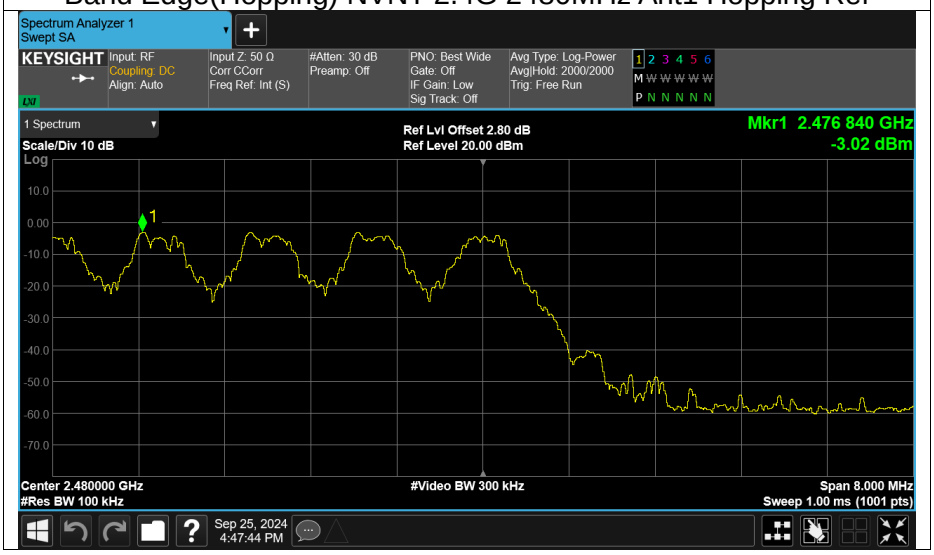
Band Edge(Hopping) NVNT 2.4G 2402MHz Ant1 Hopping Ref



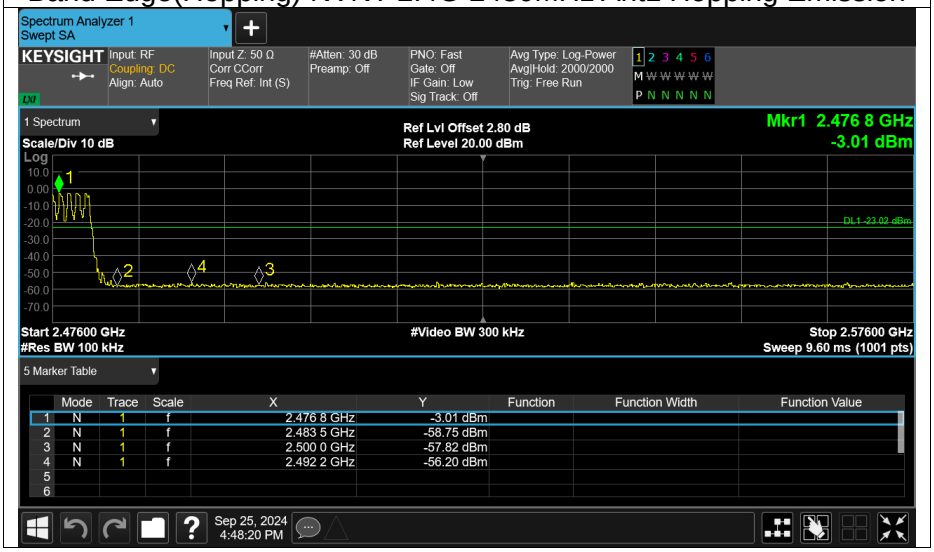
Band Edge(Hopping) NVNT 2.4G 2402MHz Ant1 Hopping Emission



Band Edge(Hopping) NVNT 2.4G 2480MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 2.4G 2480MHz Ant1 Hopping Emission

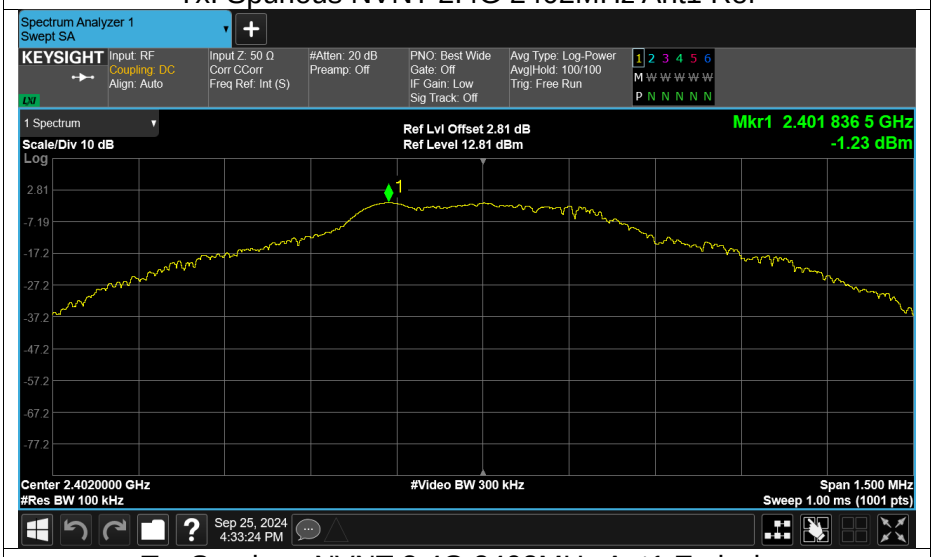


Conducted RF Spurious Emission

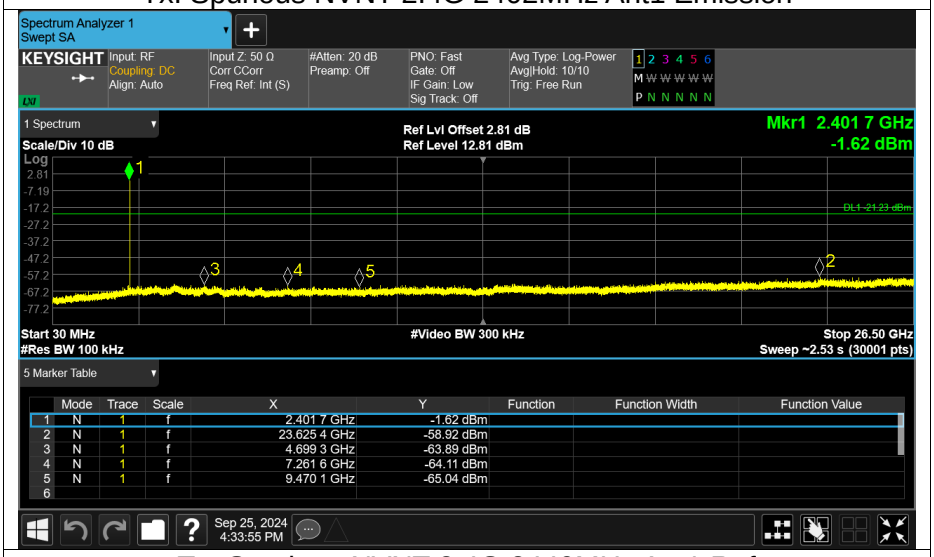
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	2.4G	2402	Ant1	-57.68	-20	Pass
NVNT	2.4G	2440	Ant1	-54.68	-20	Pass
NVNT	2.4G	2480	Ant1	-55.57	-20	Pass

Test Graphs

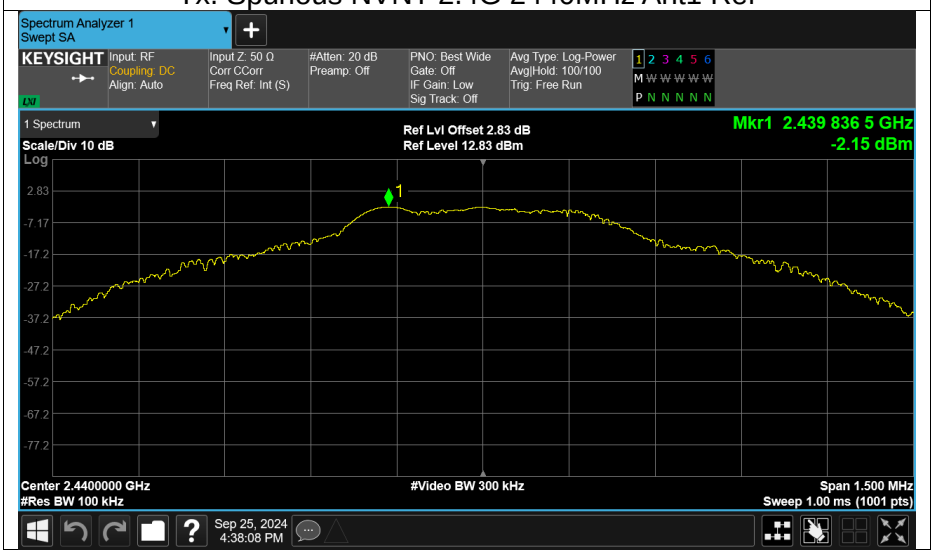
Tx. Spurious NVNT 2.4G 2402MHz Ant1 Ref



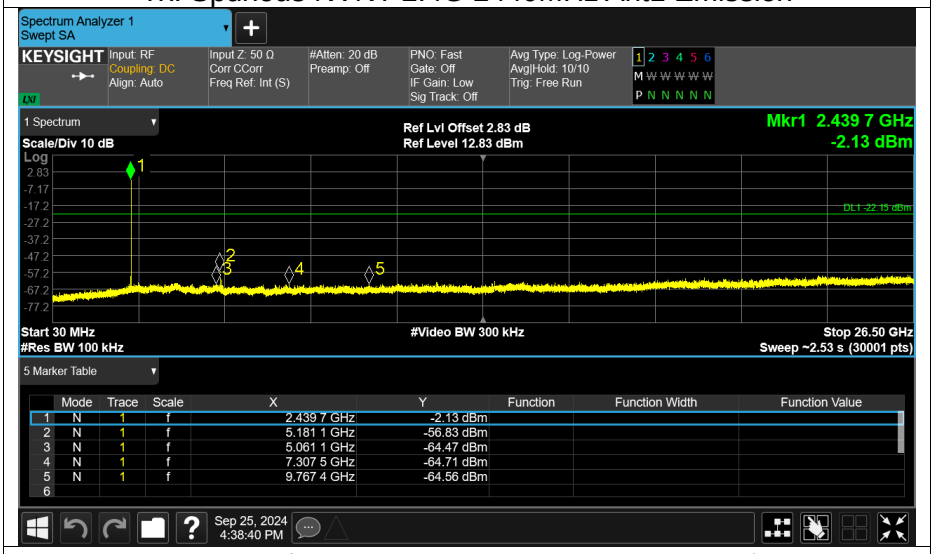
Tx. Spurious NVNT 2.4G 2402MHz Ant1 Emission



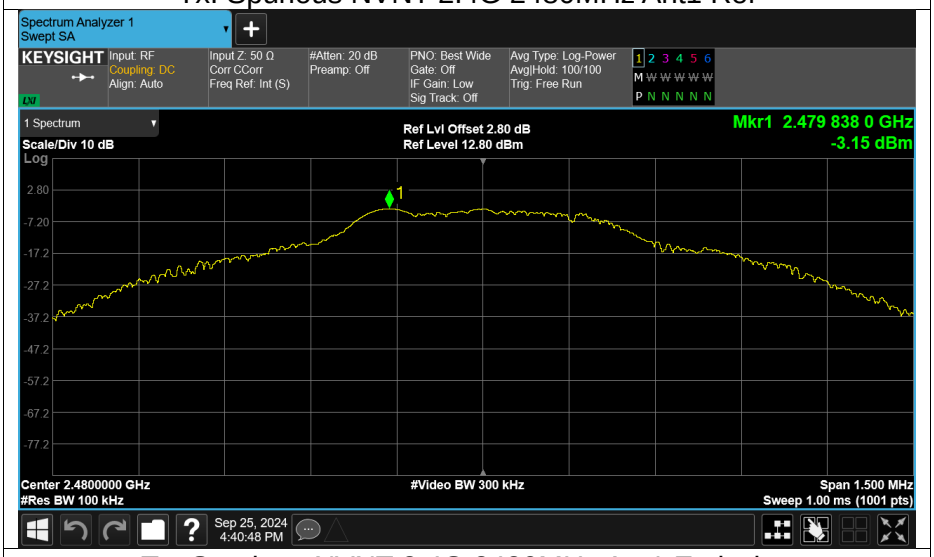
Tx. Spurious NVNT 2.4G 2440MHz Ant1 Ref



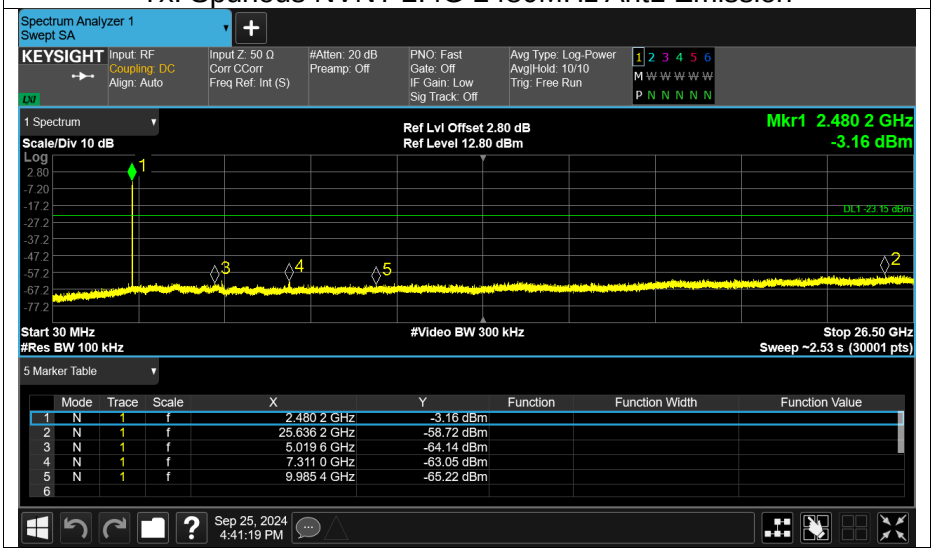
Tx. Spurious NVNT 2.4G 2440MHz Ant1 Emission



Tx. Spurious NVNT 2.4G 2480MHz Ant1 Ref



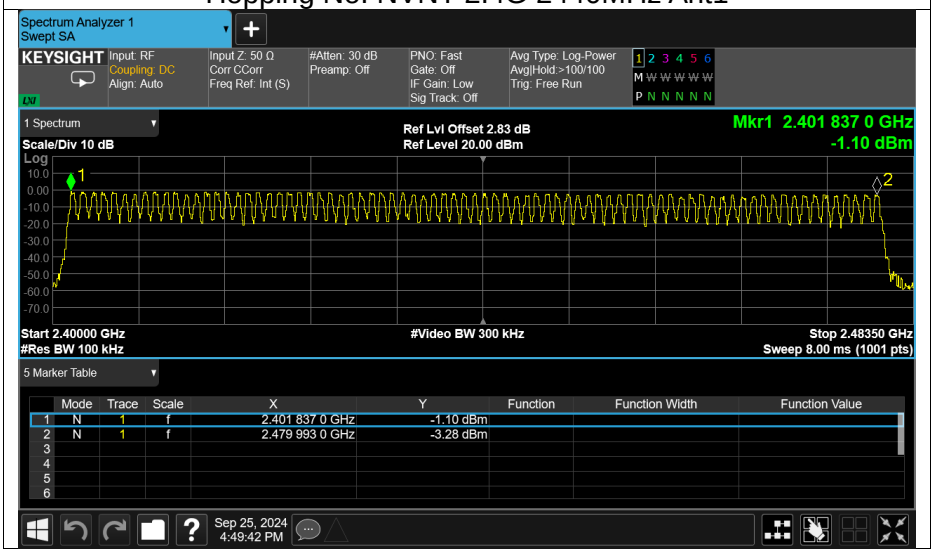
Tx. Spurious NVNT 2.4G 2480MHz Ant1 Emission



Number of Hopping Channel

Condition	Mode	Antenna	Hopping Number	Limit	Verdict
NVNT	2.4G	Ant1	79	15	Pass

Test Graphs
Hopping No. NVNT 2.4G 2440MHz Ant1

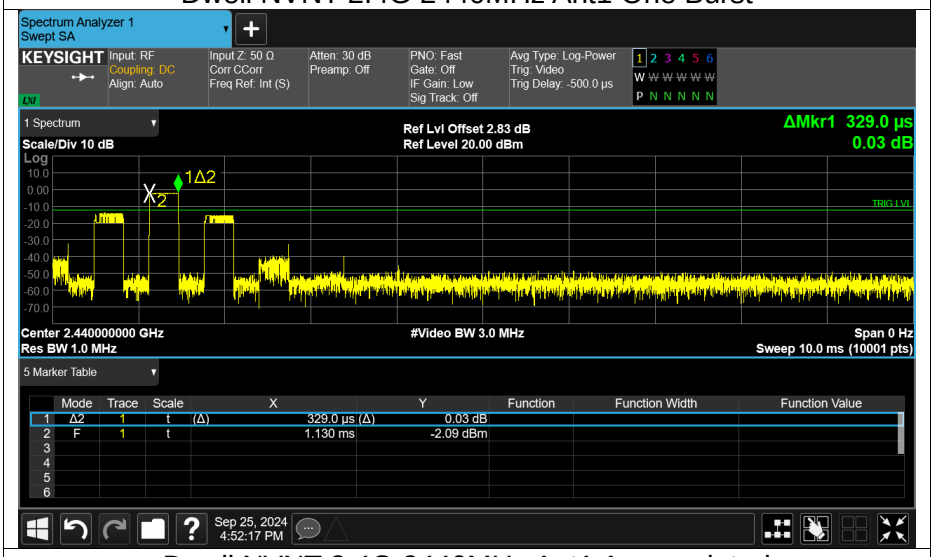


Dwell Time

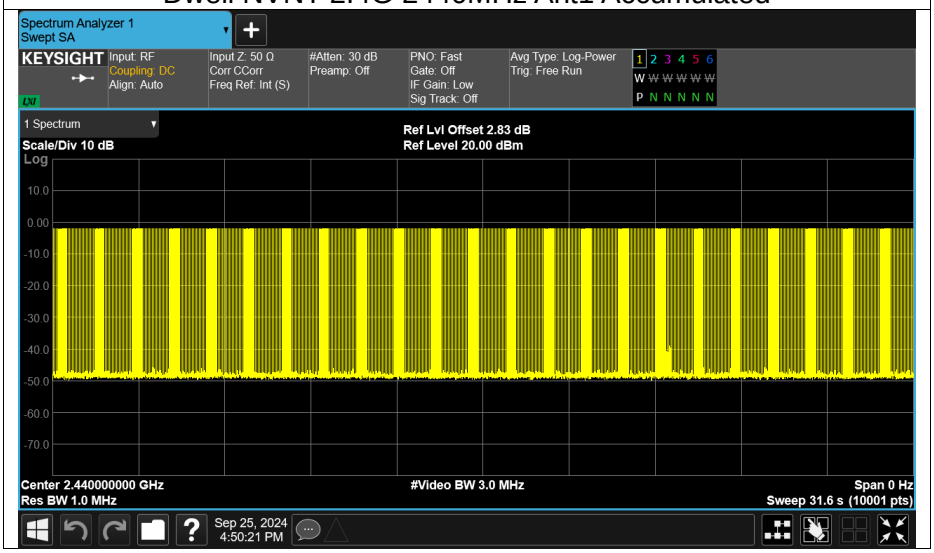
Condition	Mode	Frequency (MHz)	Antenna	Pulse Time (ms)	Total Dwell Time (ms)	Burst Count	Period Time (ms)	Limit (ms)	Verdict
NVNT	2.4G	2440	Ant1	0.32	160.32	501	31600	400	Pass

Test Graphs

Dwell NVNT 2.4G 2440MHz Ant1 One Burst



Dwell NVNT 2.4G 2440MHz Ant1 Accumulated



APPENDIX II - MEASUREMENT PHOTOS

Note: Please see the attached RF_Test Setup photos for FCC ID.

APPENDIX III - PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS

Note: Please see the attached ZH980_External Photos and ZH980_Internal Photos.

※※※※※END OF THE REPORT※※※※※