



FCC TEST REPORT

FCC ID: SY4- M12PRO

On Behalf of

Shanghai Huace Navigation Technology Ltd.

Remote Controller

Model No.: M12 Pro

Prepared for : Shanghai Huace Navigation Technology Ltd.
Address : Building D, 599 Gaojing Road, Qingpu District, Shanghai, China

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.
Address : Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103,
Shenzhen, Guangdong, China

Report Number : A2109129-C01-R01
Date of Receipt : September 16, 2021
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TEST REPORT DECLARATION

Applicant : Shanghai Huace Navigation Technology Ltd.
Address : Building D, 599 Gaojing Road, Qingpu District, Shanghai, China
Manufacturer : Shanghai Huace Navigation Technology Ltd.
Address : Building D, 599 Gaojing Road, Qingpu District, Shanghai, China
EUT Description : Remote Controller
(A) Model No. : M12 Pro
(B) Trademark : 

Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.247

ANSI C63.10:2013

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....: Yannis Wen
Project Engineer


.....

Approved by (name + signature).....: Simple Guan
Project Manager


.....

Date of issue..... : September 30, 2021

Revision History

Revision	Issue Date	Revisions	Revised By
V0	September 30, 2021	Initial released Issue	Yannis Wen

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

Test Item	Standards Paragraph	Result
Maximum Peak Output Power	FCC Part 15: 15.247(b)(1) ANSI C63.10 :2013	P
Power Spectral Density	FCC PART 15:15.247(e) RSS-247(5.2 b) ANSI C63.10 :2013	P
Bandwidth	FCC Part 15: 15.215 ANSI C63.10 :2013	P
Radiated Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10 :2013	P
Band Edge Compliance	FCC Part 15: 15.247(d) ANSI C63.10 :2013	P
Power Line Conducted Emissions	FCC Part 15: 15.207 ANSI C63.10 :2013	P
Antenna requirement	FCC Part 15: 15.203	P
Note:	1. P is an abbreviation for Pass. 2. F is an abbreviation for Fail. 3. N/A is an abbreviation for Not Applicable.	

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

Description : Remote Controller

Trademark : 

Model Number : M12 Pro

DIFF. : N/A

Test Voltage : DC 3.7V from battery, DC 5V from adapter

Radio Technology : 2.4G

Operation frequency : 2402-2480MHz

Channel No. : 79 channels

Modulation type : GFSK

Antenna Type : External antenna, Maximum Gain is 2dBi(This value is supplied by applicant).

Software version : V1.0

Hardware version : V1.0

Connector cable loss : 0.5dB (This value is supplied by applicant).

Remark: There are two 2.4G modules, both two modules have been tested, and the report only reflects the worst data.

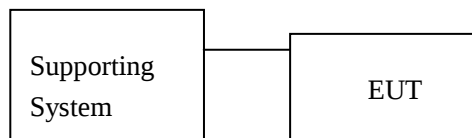
2.2.Accessories of Device (EUT)

Accessories1 : /
 Manufacturer : /
 Model : /
 Ratings : /

2.3.Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification
1.	Notebook PC	Lenovo	ThinkPad E14	N/A	SDOC
2	AC/DC ADAPTER	Shenzhen Jiuzhou Power Technology Co.,Ltd	JZB110-050200W U	N/A	N/A

2.4.Block Diagram of connection between EUT and simulators



2.5.Test Mode Description

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
GFSK	Low :CH1	2402
	Middle: CH40	2441
	High: CH79	2480

Channel list:

CH	Frequency	CH	Frequency	CH	Frequency	CH	Frequency
1	2402	21	2422	41	2442	61	2462
2	2403	22	2423	42	2443	62	2463
3	2404	23	2424	43	2444	63	2464
4	2405	24	2425	44	2445	64	2465
5	2406	25	2426	45	2446	65	2466
6	2407	26	2427	46	2447	66	2467
7	2408	27	2428	47	2448	67	2468
8	2409	28	2429	48	2449	68	2469
9	2410	29	2430	49	2450	69	2470
10	2411	30	2431	50	2451	70	2471
11	2412	31	2432	51	2452	71	2472
12	2413	32	2433	52	2453	72	2473
13	2414	33	2434	53	2454	73	2474
14	2415	34	2435	54	2455	74	2475
15	2416	35	2436	55	2456	75	2476
16	2417	36	2437	56	2457	76	2477
17	2418	37	2438	57	2458	77	2478
18	2419	38	2439	58	2459	78	2479
19	2420	39	2440	59	2460	79	2480
19	2421	40	2441	60	2461		

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	24℃
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	98kPa

2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd

Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103,
Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission

Registration Number: 293961

July 15, 2019 Certificated by IC

Registration Number: CN0085

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

Item	Uncertainty
Uncertainty for Power point Conducted Emissions Test	2.74dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB(Polarize: V)
	2.57dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.13dB(Polarize: H)
	4.16dB(Polarize: V)
Uncertainty for radio frequency	5.4×10^{-8}
Uncertainty for conducted RF Power	0.37dB
Uncertainty for temperature	0.2°C
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.9. Test Equipment List

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	N/A	2020.09.02	3Year
Spectrum analyzer	ROHDE&SCHWARZ	FSV40-N	102137	2021.08.25	1Year
Spectrum analyzer	Agilent	N9020A	MY499100060	2021.08.25	1Year
Receiver	ROHDE&SCHWARZ	ESR	1316.3003K03-10208 2-Wa	2021.08.25	1Year
Receiver	R&S	ESCI	101165	2021.08.25	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2020.04.12	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D(1201)	2020.04.12	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00059	2021.08.30	2Year
RF Cable	Resenberger	Cable 1	RE1	2021.08.25	1Year
RF Cable	Resenberger	Cable 2	RE2	2021.08.25	1Year
RF Cable	Resenberger	Cable 3	CE1	2021.08.25	1Year
Pre-amplifier	HP	HP8347A	2834A00455	2021.08.25	1Year
Pre-amplifier	Agilent	8449B	3008A02664	2021.08.25	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126-466	2021.08.25	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2021.08.25	1 Year
Horn Antenna	SCHWARZBECK	BBHA9170	00946	2021.08.30	2 Year
Preamplifier	SKET	LNPA_1840 -50	SK2018101801	2021.08.25	1 Year
Power Meter	Agilent	E9300A	MY41496628	2021.08.25	1 Year
Power Sensor	DARE	RPR3006W	15100041SNO91	2021.08.25	1 Year
Temp. & Humid. Chamber	Wei Huang	WHTH-1000 -40-880	100631	2021.04.21	1 Year
Switching Mode Power Supply	JUNKE	JK12010S	20140927-6	2021.08.25	1 Year
Adjustable attenuator	MWRFtest	N/A	N/A	N/A	N/A
10dB Attenuator	Mini-Circuits	DC-6G	N/A	N/A	N/A

Software Information			
Test Item	Software Name	Manufacturer	Version
RE	EZ-EMC	EZ	Alpha-3A1
CE	EZ-EMC	EZ	Alpha-3A1
RF-CE	MTS 8310	MW	V2.0.0.0

3. MAXIMUM PEAK OUTPUT POWER

3.1.Limit

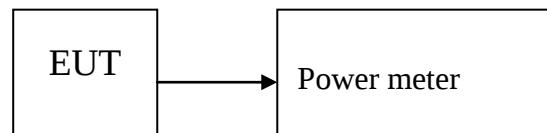
Please refer section15.247.

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W

3.2.Test Procedure

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the average power detection.

3.3.Test Setup



3.4.Test Result

Mode	Freq (MHz)	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	2402	-0.693	30	Pass
	2441	2.167	30	Pass
	2480	3.662	30	Pass
Conclusion: PASS				

4. POWER SPECTRAL DENSITY

4.1.Limit

4.1.1 Please refer section RSS-247 & 15.247.

4.1.2 For direct sequence systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

4.1.3 The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

4.2.Test Procedure

Details see the KDB558074 D01 Meas Guidance V05

4.2.1 Place the EUT on the table and set it in transmitting mode.

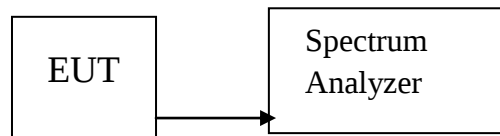
4.2.2 Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

4.2.3 Detector = RMS. Set the spectrum analyzer as RBW = 3kHz(Set the RBW to: $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$.), VBW = 10kHz(Set the VBW $\geq 3 \times \text{RBW}$), span= $1.5 \times \text{DTS bandwidth}$., detail see the test plot.

4.2.4 Record the max reading.

4.2.5 Repeat the above procedure until the measurements for all frequencies are completed.

4.3.Test Setup



4.4.Test Results

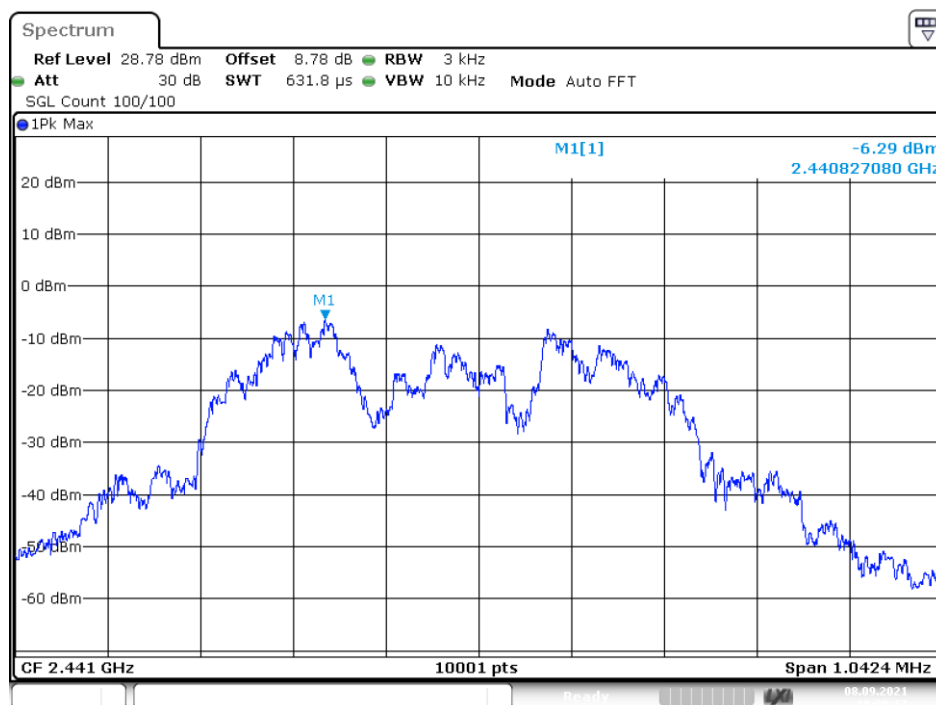
Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm)	Result
CH1	2402	-8.48	8	PASS
CH39	2441	-6.294	8	PASS
CH69	2480	-4.899	8	PASS
Conclusion: PASS				

PSD NVNT user 2402MHz Ant1



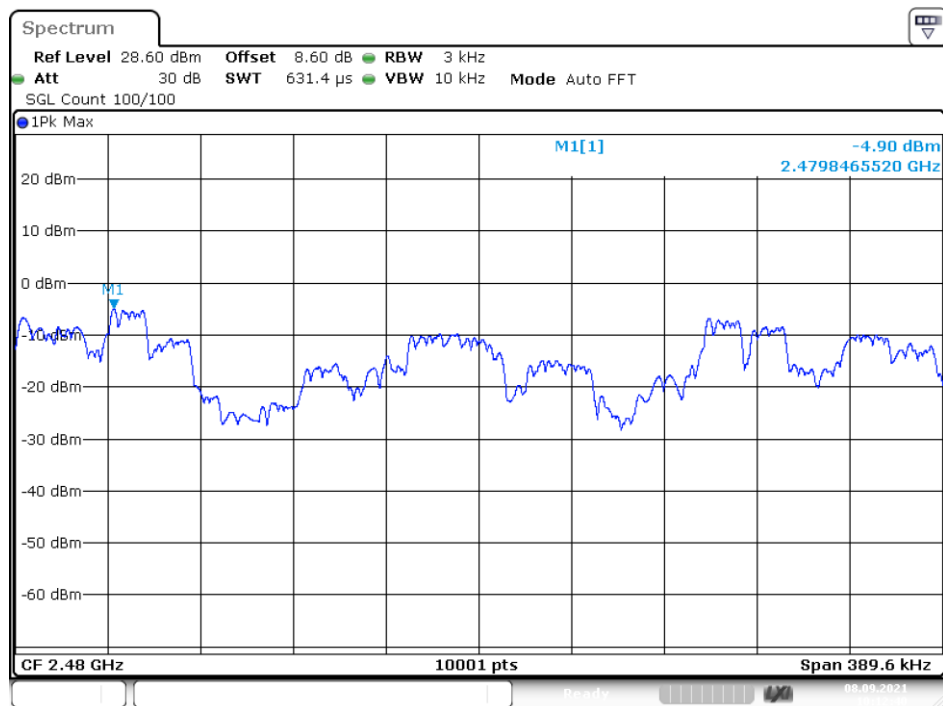
Date: 8.SEP.2021 10:01:58

PSD NVNT user 2441MHz Ant1



Date: 8.SEP.2021 10:08:17

PSD NVNT user 2480MHz Ant1



Date: 8.SEP.2021 10:12:40

5. BANDWIDTH

5.1.Limit

Please refer section RSS-247 & 15.247

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500 kHz.

5.2.Test Procedure

Details see the KDB558074 D01 Meas Guidance v05r02

a) The bandwidth is measured at an amplitude level reduced 6dB from the reference level.

The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

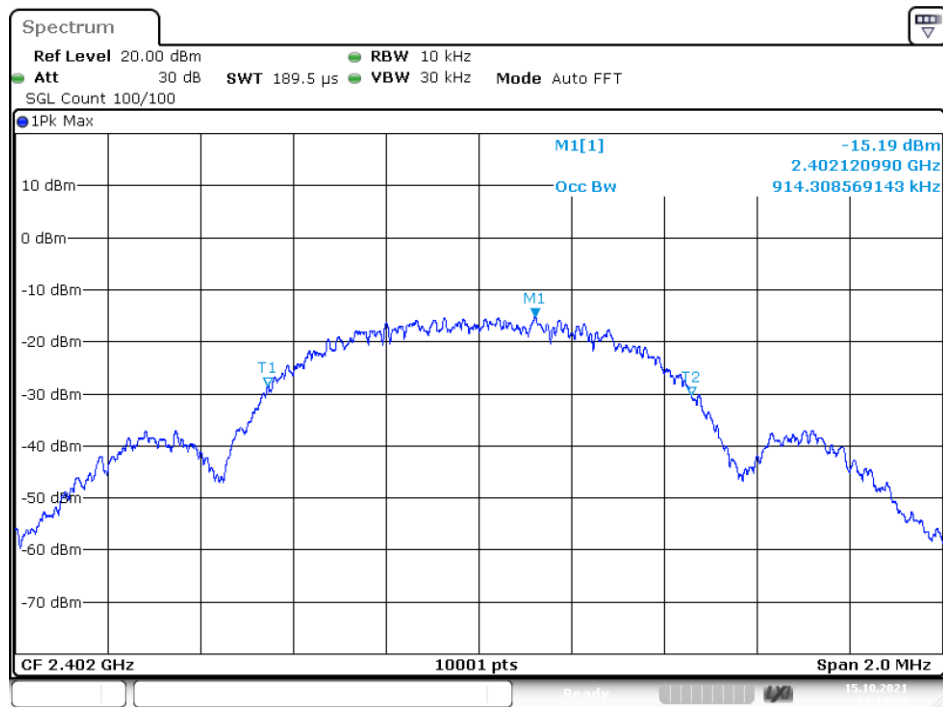
b) The test receiver set $RBW = 100\text{kHz}$, $VBW \geq 3 * RBW = 300\text{kHz}$, Sweep time set auto, detail see the test plot.

5.3.Test Result

For RF module 1

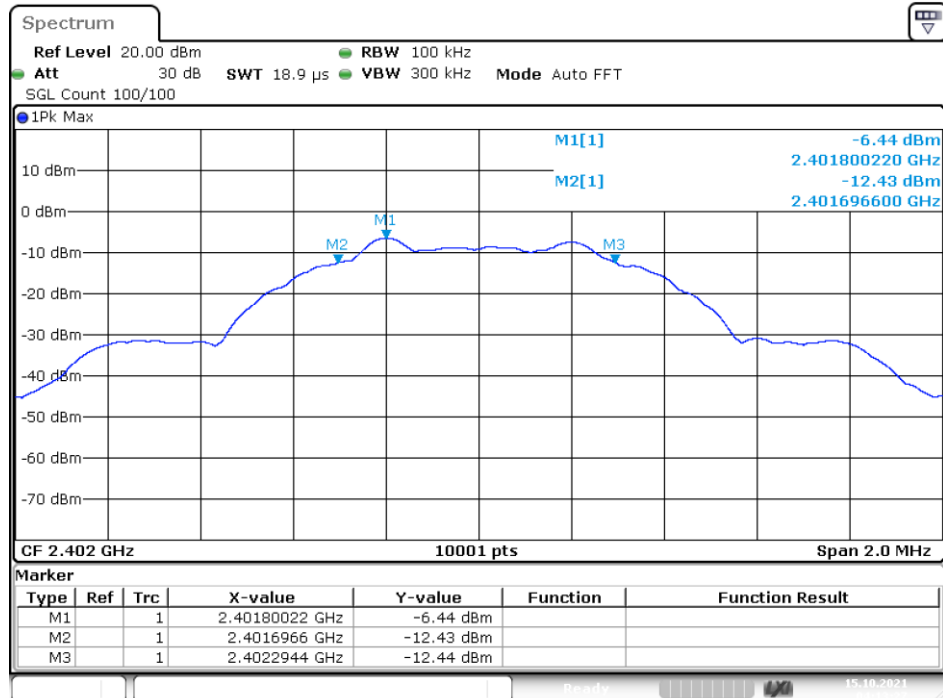
Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	user	2402	Ant 1	0.9143	0.5978	0.5	Pass
NVNT	user	2441	Ant 1	0.9161	0.6272	0.5	Pass
NVNT	user	2480	Ant 1	0.9243	0.6388	0.5	Pass

OBW NVNT user 2402MHz Ant1



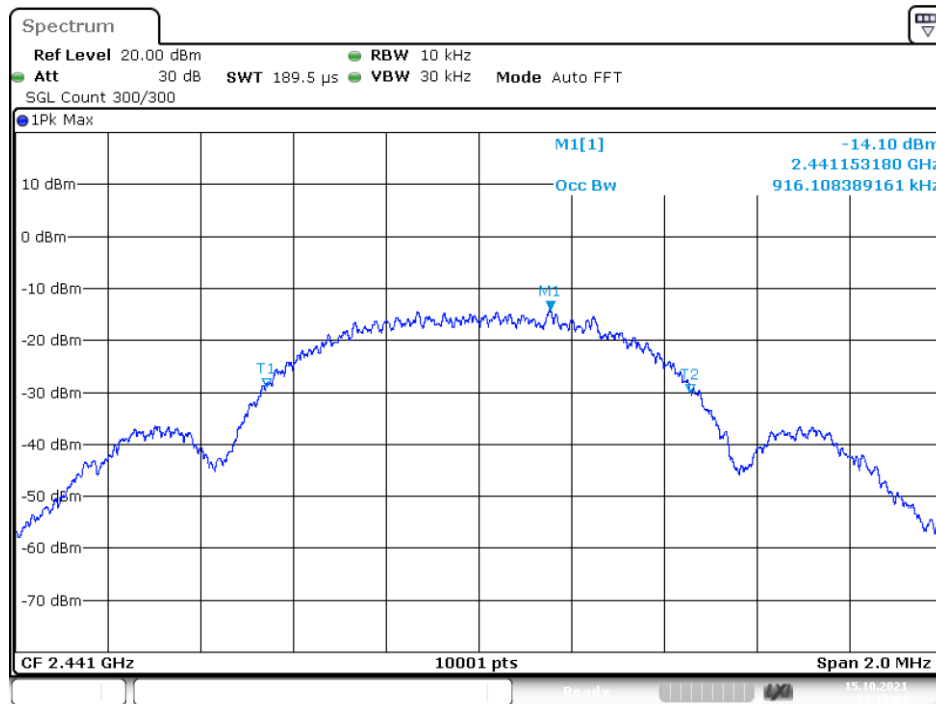
Date: 15.OCT.2021 04:13:24

-6 dB BW NVNT user 2402MHz Ant1



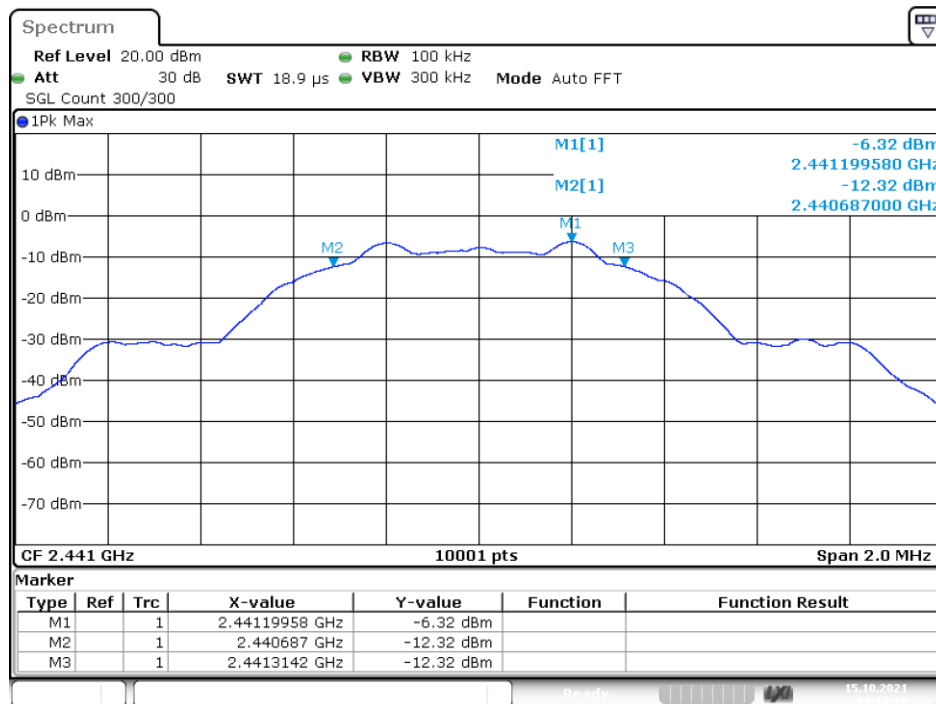
Date: 15.OCT.2021 04:13:27

OBW NVNT user 2441MHz Ant1



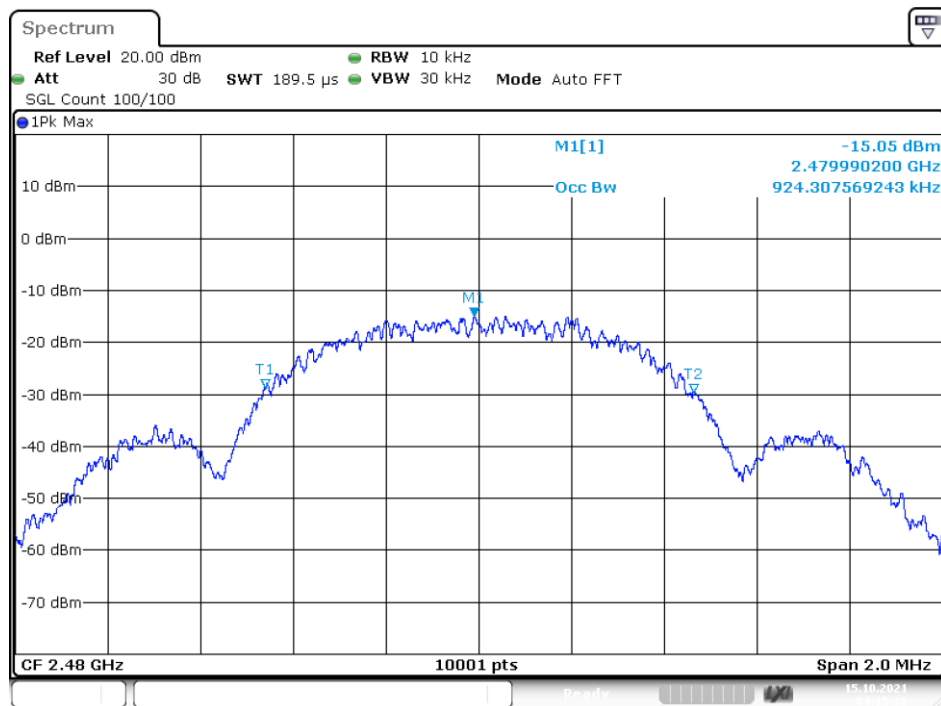
Date: 15.OCT.2021 04:15:04

-6 dB BW NVNT user 2441MHz Ant1



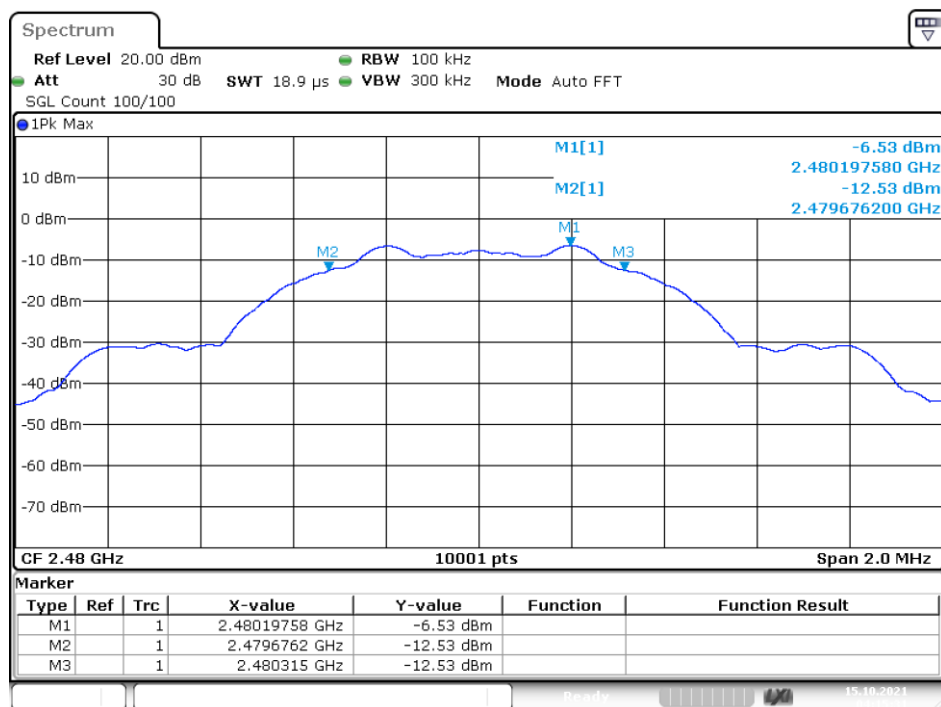
Date: 15.OCT.2021 04:15:09

OBW NVNT user 2480MHz Ant1



Date: 15.OCT.2021 04:15:27

-6 dB BW NVNT user 2480MHz Ant1

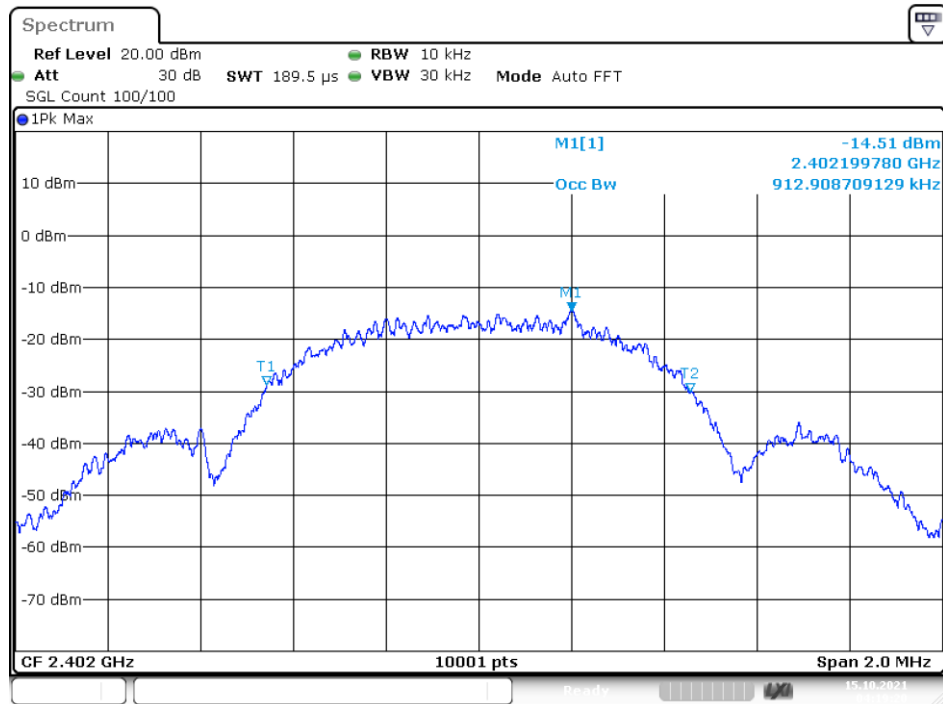


Date: 15.OCT.2021 04:15:31

For RF module 2

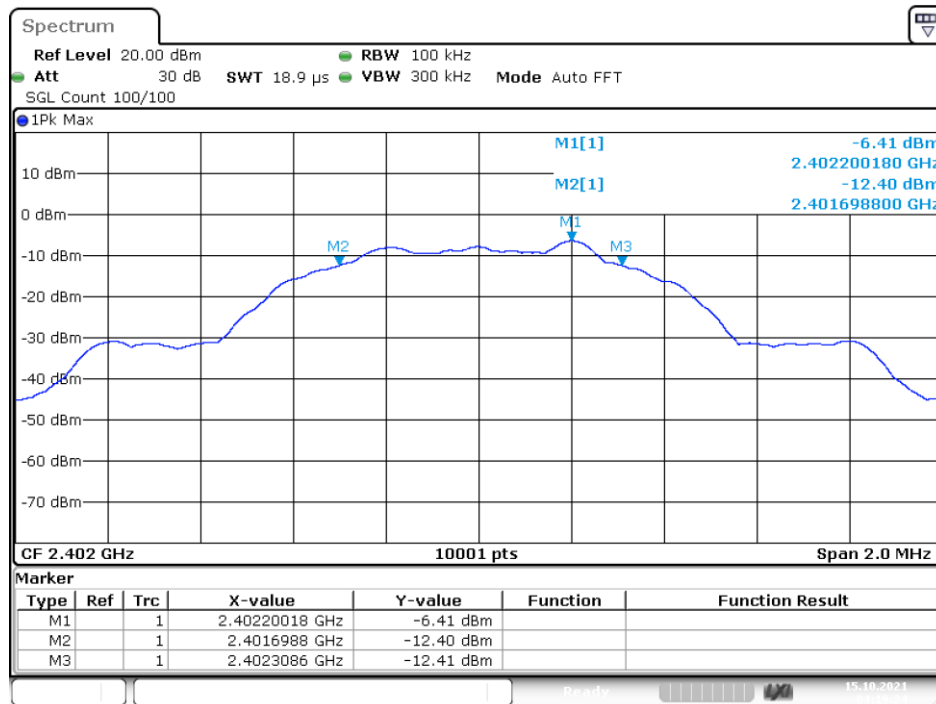
Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	user	2402	Ant 1	0.9129	0.6098	0.5	Pass
NVNT	user	2441	Ant 1	0.9157	0.6276	0.5	Pass
NVNT	user	2480	Ant 1	0.9133	0.6116	0.5	Pass

OBW NVNT user 2402MHz Ant1



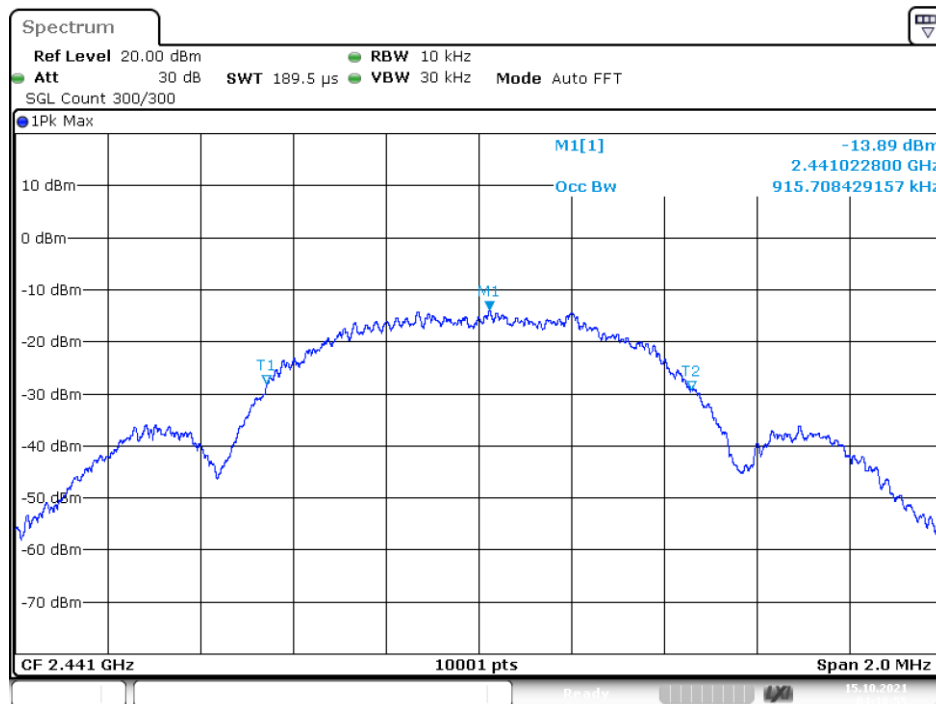
Date: 15.OCT.2021 04:19:20

-6 dB BW NVNT user 2402MHz Ant1



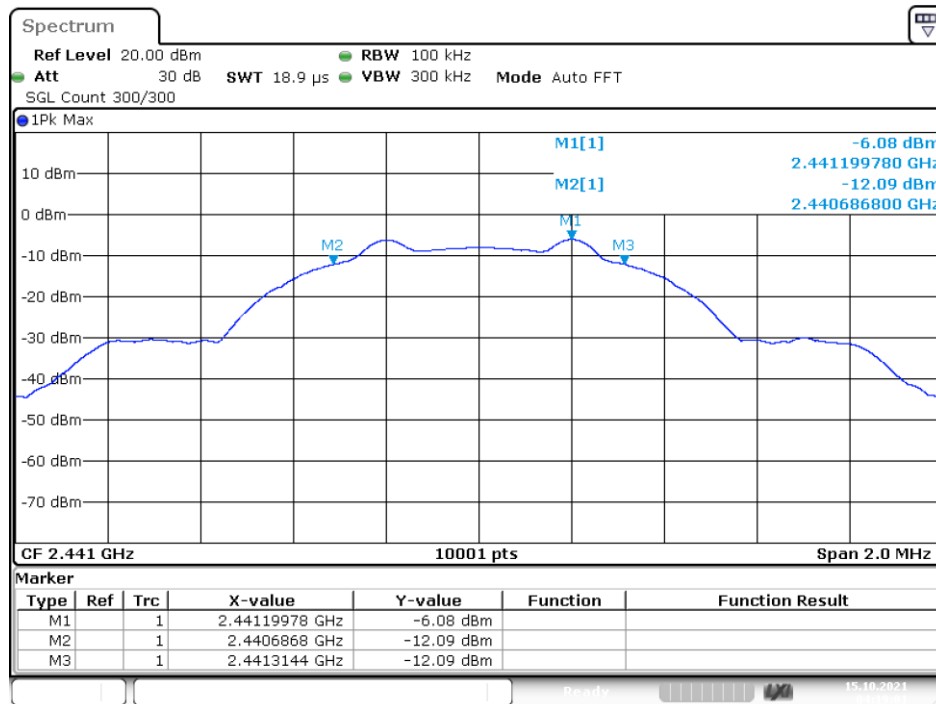
Date: 15.OCT.2021 04:19:24

OBW NVNT user 2441MHz Ant1



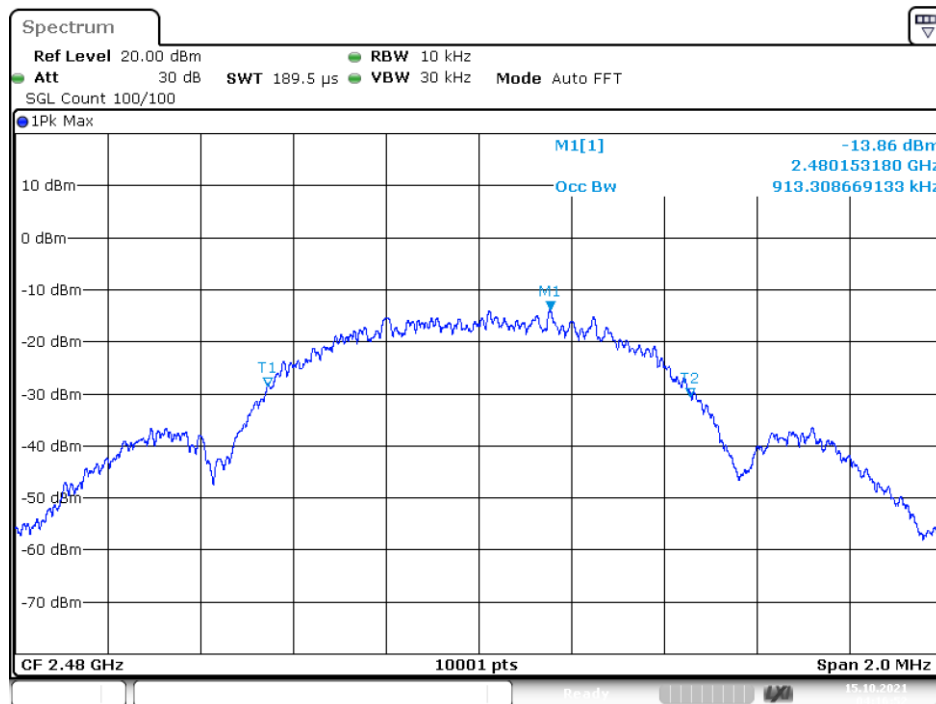
Date: 15.OCT.2021 04:18:56

-6 dB BW NVNT user 2441MHz Ant1



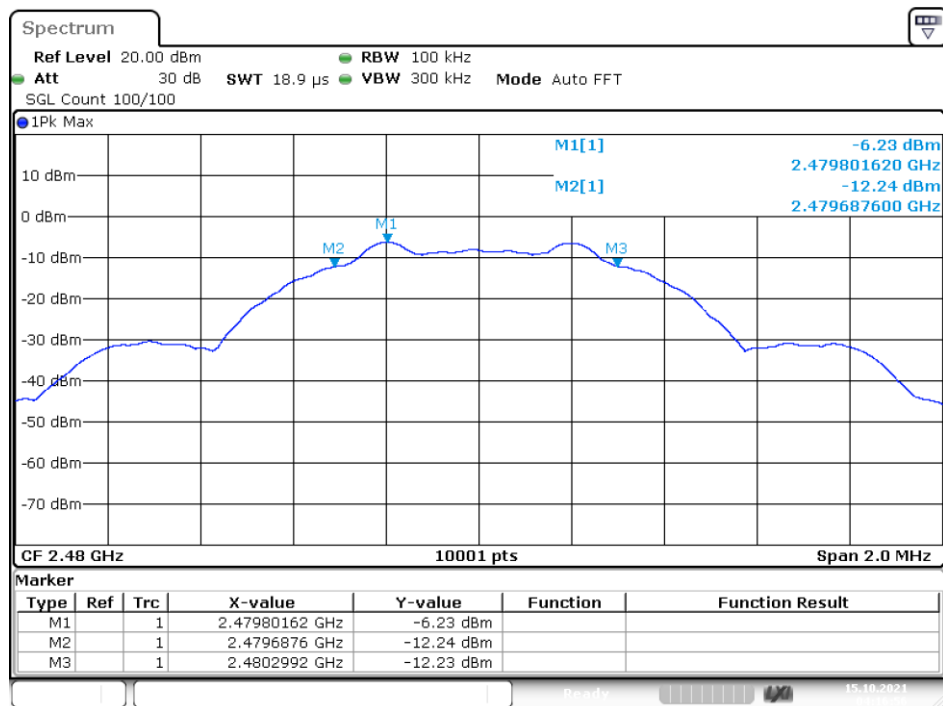
Date: 15.OCT.2021 04:19:01

OBW NVNT user 2480MHz Ant1



Date: 15.OCT.2021 04:16:52

-6 dB BW NVNT user 2480MHz Ant1



Date: 15.OCT.2021 04:16:56

6. RADIATED EMISSIONS

6.1.Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

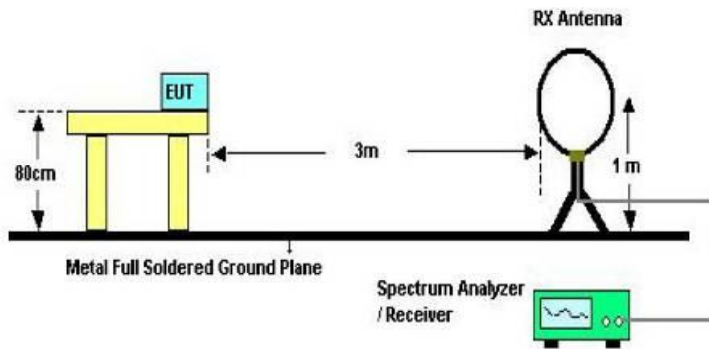
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 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	(²)

15.209 Limit

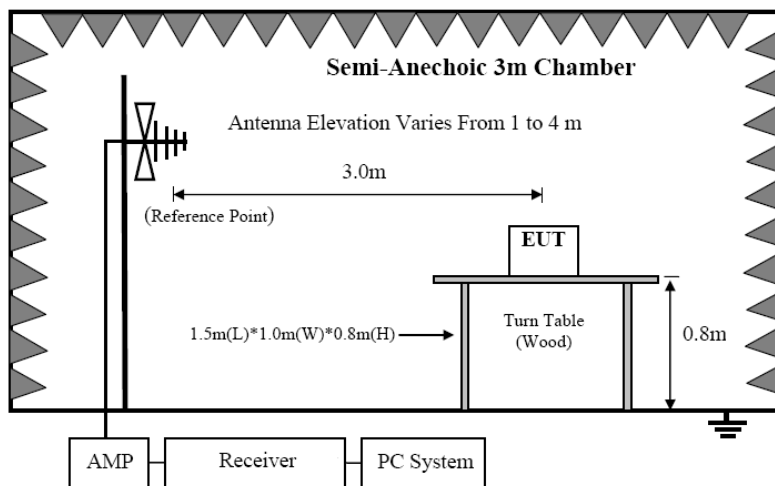
FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009-0.490	300	2400/F(KHz)	/
0.490-1.705	30	24000/F(KHz)	/
1.705-30	30	30	29.5
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

6.2. Block Diagram of Test setup

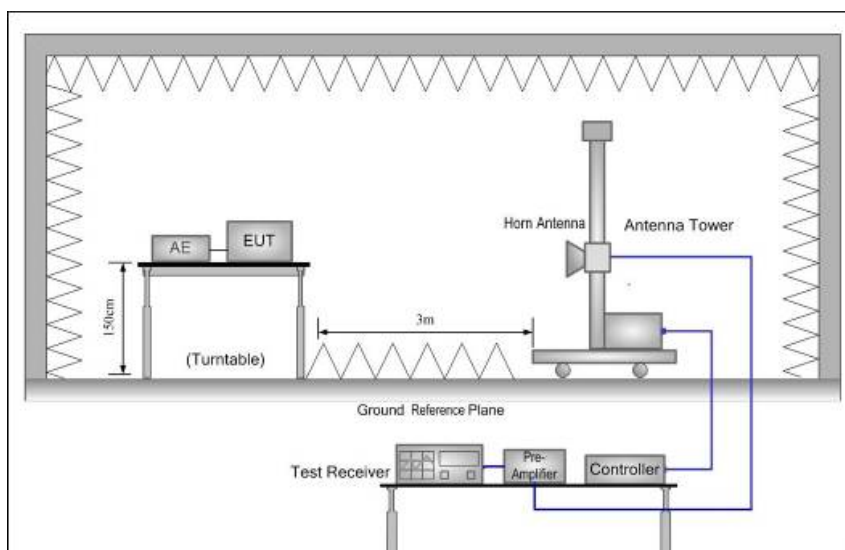
8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 30MHz



8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



8.2.2 In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

6.3. Test Procedure

- (1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.
- (2) Setup EUT and simulator as shown in section 1.4 and 6.1
- (3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
 - (a) Change work frequency or channel of device if practicable.
 - (b) Change modulation type of device if practicable.
- (c) Rotated EUT through three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions
- (4) Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated
- (5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 :2013 on Radiated Emission test.
- (6) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure.

6.4. Test Result

We have scanned the 10th harmonic from 9KHz to the EUT's highest frequency..
Detailed information please see the following page.

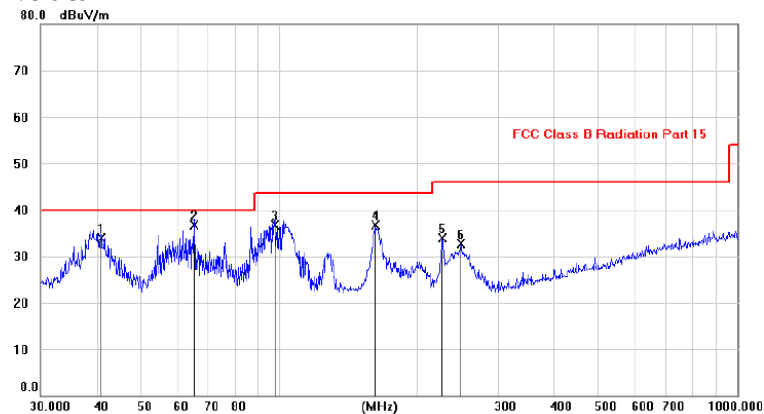
From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

From 30MHz to 1000MHz: Conclusion: PASS

Pol

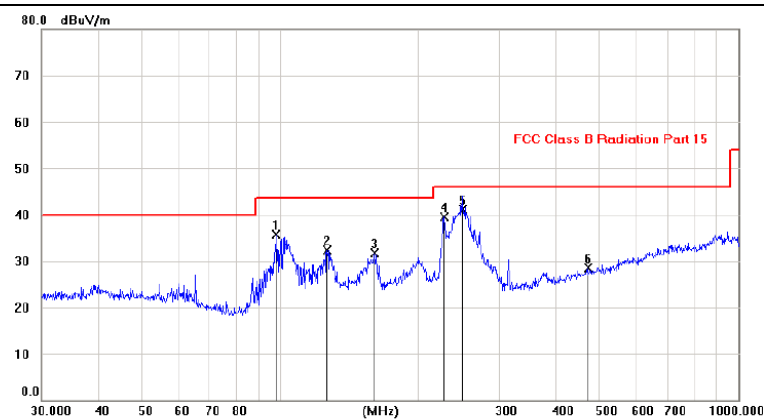
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		40.8064	19.52	14.37	33.89	40.00	-6.11	QP		
2	*	65.1689	24.65	12.14	36.79	40.00	-3.21	QP		
3		97.6042	25.97	10.69	36.66	43.50	-6.84	QP		
4		162.3827	21.80	14.81	36.61	43.50	-6.89	peak		
5		227.6108	21.74	12.17	33.91	46.00	-12.09	peak		
6		249.1045	19.98	12.75	32.73	46.00	-13.27	peak		

Pol

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		97.8212	25.03	10.69	35.72	43.50	-7.78	peak		
2		126.7279	18.87	13.41	32.28	43.50	-11.22	peak		
3		160.8524	16.82	14.96	31.78	43.50	-11.72	peak		
4		228.2235	27.23	12.21	39.44	46.00	-6.56	peak		
5	*	249.8627	28.32	12.77	41.09	46.00	-4.91	QP		
6		469.3697	10.82	17.74	28.56	46.00	-17.44	peak		

*:Maximum data x:Over limit !:over margin

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Remark: All modes have been tested, and only worst data of (GFSK) was listed in this report.

Test Mode: GFSK TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	42.89	V	33.95	10.18	34.26	52.76	74	-21.24	PK
4804	38.09	V	33.95	10.18	34.26	47.96	54	-6.04	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4824	44.26	H	33.95	10.18	34.26	54.13	74	-19.87	PK
4824	35.79	H	33.95	10.18	34.26	45.66	54	-8.34	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: GFSK TX Mid									
4882	43.83	V	33.93	10.2	34.29	53.67	74	-20.33	PK
4882	36.57	V	33.93	10.2	34.29	46.41	54	-7.59	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
4882	45.14	H	33.93	10.2	34.29	54.98	74	-19.02	PK
4882	34.42	H	33.93	10.2	34.29	44.26	54	-9.74	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
Test Mode: GFSK TX High									
4960	43.83	V	33.98	10.22	34.25	53.78	74	-20.22	PK
4960	33.72	V	33.98	10.22	34.25	43.67	54	-10.33	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	42.06	H	33.98	10.22	34.25	52.01	74	-21.99	PK
4960	35.23	H	33.98	10.22	34.25	45.18	54	-8.82	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
Note:									
1, Result = Read level + Antenna factor + cable loss-Amp factor									
2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.									

Conducted method

EUT Description	Remote Controller	Model No.	PT1933
Temperature	24°C	Humidity	56%
Test mode	GFSK(2402MHz)	Test mode	GFSK(2441MHz)

Spectrum

Ref Level 8.62 dBm Offset 8.62 dB RBW 100 kHz
Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep
SGL Count 100/100

1Pk Max

0 dBm

M1

M1[1]

-0.77 dBm

2.4120 GHz

-41.19 dBm

16.8948 GHz

-20 dBm

D1 -20.986 dBm

M2

M2[1]

-40 dBm

M3

M4

M5

M2

-50 dBm

-60 dBm

-70 dBm

-80 dBm

Start 30.0 MHz 1001 pts Stop 25.0 GHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		2.412 GHz	-0.77 dBm		
M2	1		16.8948 GHz	-41.19 dBm		
M3	1		4.6994 GHz	-46.49 dBm		
M4	1		7.0715 GHz	-45.23 dBm		
M5	1		9.6185 GHz	-45.43 dBm		

Date: 8.SEP.2021 10:04:44

Spectrum

Ref Level 8.78 dBm Offset 8.78 dB RBW 100 kHz
Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep
SGL Count 10/10

1Pk Max

0 dBm

M1

M1[1]

2.08 dBm

2.4370 GHz

-41.44 dBm

15.8610 GHz

-20 dBm

D1 -18.953 dBm

M2

M2[1]

-40 dBm

M3

M4

M5

M2

-50 dBm

-60 dBm

-70 dBm

-80 dBm

Start 30.0 MHz 1001 pts Stop 25.0 GHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		2.437 GHz	2.08 dBm		
M2	1		15.861 GHz	-41.44 dBm		
M3	1		4.9741 GHz	-45.99 dBm		
M4	1		7.2963 GHz	-46.52 dBm		
M5	1		9.8932 GHz	-44.93 dBm		

Date: 8.SEP.2021 10:07:01

Test mode	GFSK(2480MHz)
-----------	---------------

Spectrum

Ref Level 8.60 dBm Offset 8.60 dB RBW 100 kHz
Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep
SGL Count 10/10

1Pk Max

0 dBm

M1

M1[1]

2.78 dBm

2.4870 GHz

-41.52 dBm

16.1856 GHz

-20 dBm

D1 -16.520 dBm

M2

M2[1]

-40 dBm

M3

M4

M5

M2

-50 dBm

-60 dBm

-70 dBm

-80 dBm

Start 30.0 MHz 1001 pts Stop 25.0 GHz

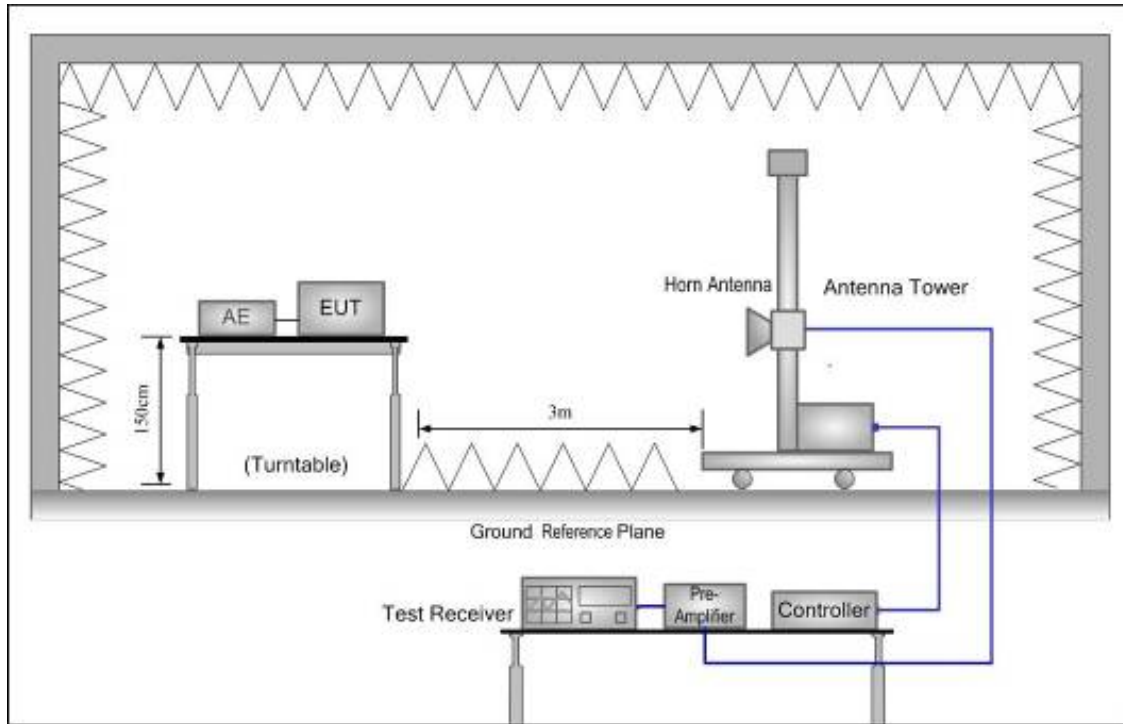
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		2.487 GHz	2.78 dBm		
M2	1		16.1856 GHz	-41.52 dBm		
M3	1		5.1239 GHz	-46.91 dBm		
M4	1		7.4461 GHz	-46.56 dBm		
M5	1		9.9681 GHz	-45.47 dBm		

Date: 8.SEP.2021 10:12:09

7. BAND EDGE COMPLIANCE

7.1. Block Diagram of Test Setup



7.2. Limit

All the lower and upper band-edges emissions appearing within restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

7.3. Test Procedure

All restriction band and non- restriction band have been tested, only worse case is reported.

7.4. Test Result

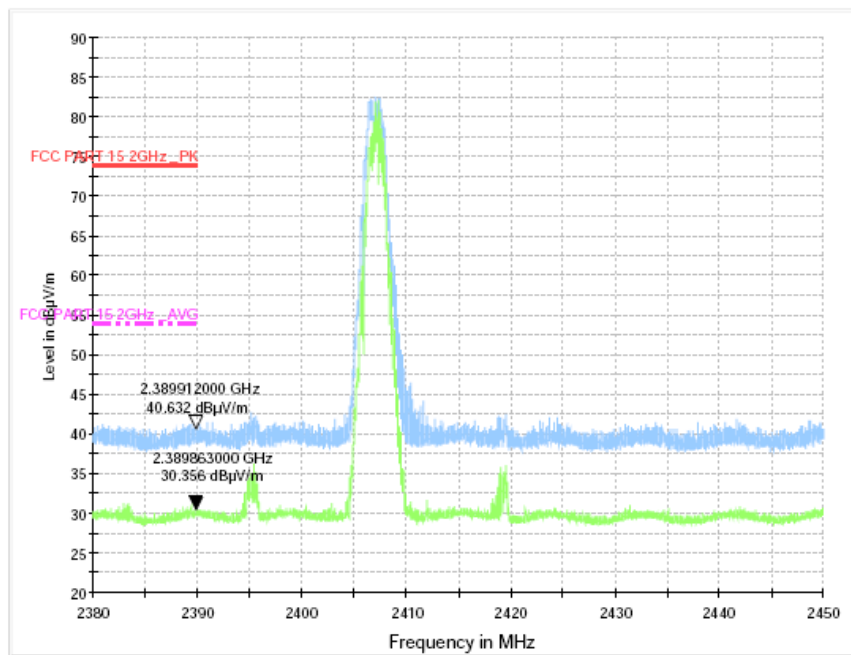
PASS. (See below detailed test data)

Radiated Method:

Hopping-off

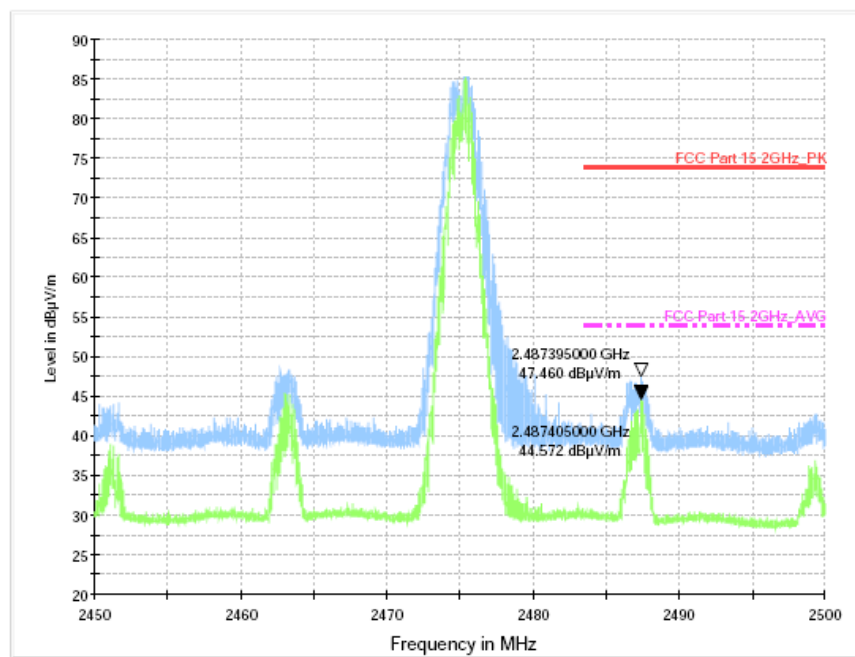
Test Mode:

GFSK-Low



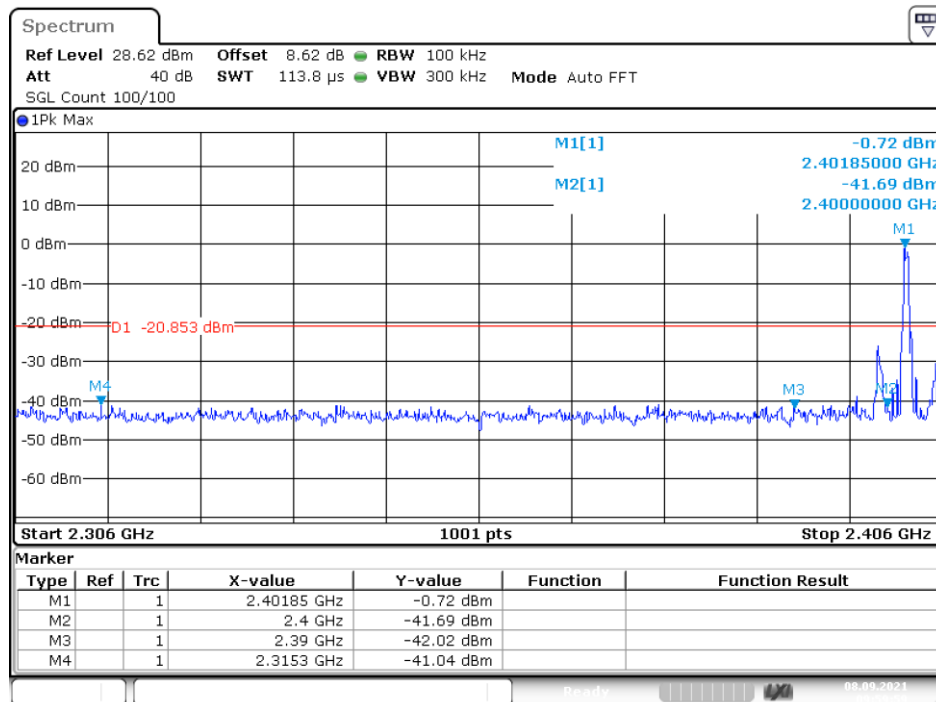
Test Mode:

GFSK-High



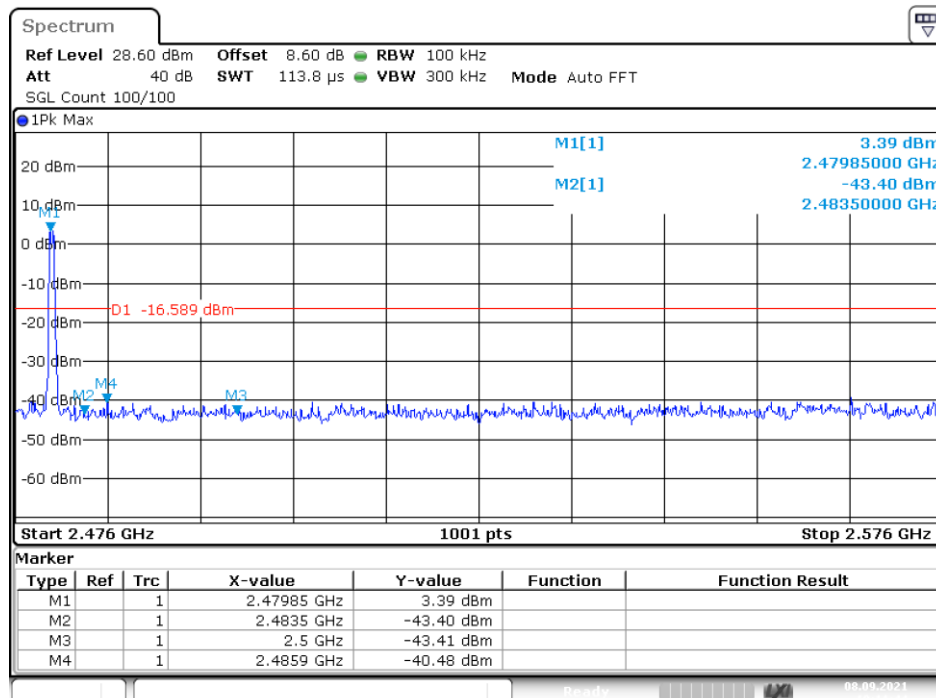
Conducted Method

Band Edge NVNT 1-DH1 2402MHz Ant1 Emission



Date: 8.SEP.2021 09:59:59

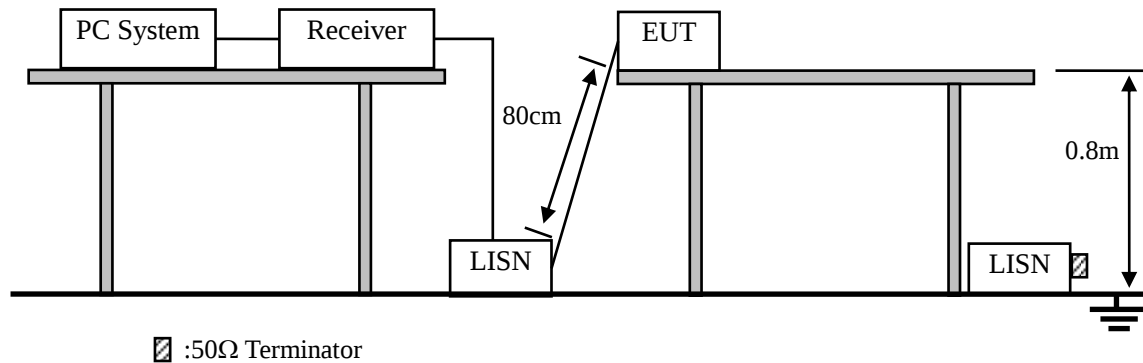
Band Edge NVNT 1-DH1 2480MHz Ant1 Emission



Date: 8.SEP.2021 10:11:44

8. POWER LINE CONDUCTED EMISSIONS

8.1. Block Diagram of Test Setup



□ :50Ω Terminator

8.2. Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

8.3. Test Procedure

- (1) The EUT was placed on a non-metallic table, 80cm above the ground plane.
- (2) Setup the EUT and simulator as shown in 10.1
- (3) The EUT Power connected to the power mains through a power adapter and a line impedance stabilization network (L.I.S.N1). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N2), this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 :2013on conducted Emission test.
- (4) The bandwidth of test receiver is set at 10KHz.
- (5) The frequency range from 150 KHz to 30MHz is checked.

8.4. Test Result

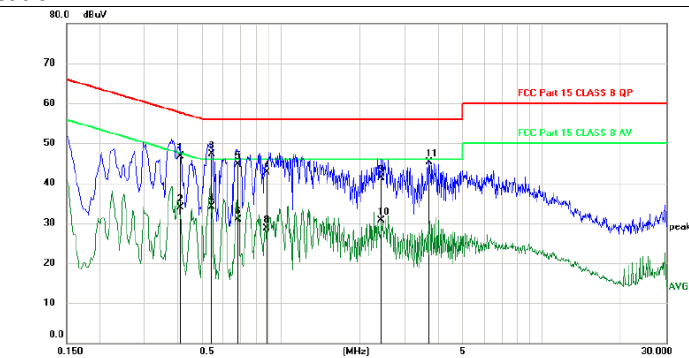
PASS.

See below original test data.

From 0.15MHz to 30MHz: Conclusion: PASS

Pol

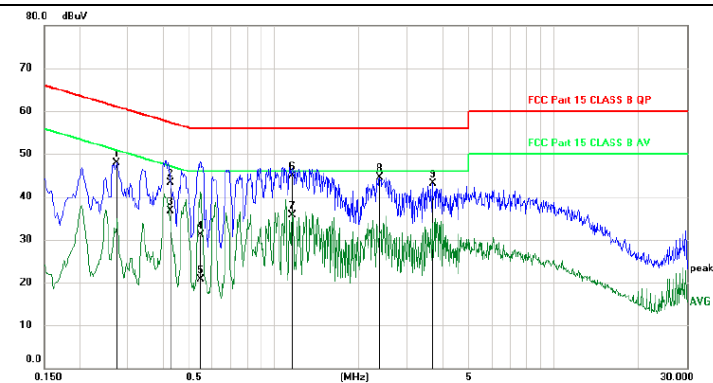
Neutra



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.4107	36.85	9.94	46.79	57.63	-10.84	QP	
2		0.4107	23.93	9.94	33.87	47.63	-13.76	AVG	
3	*	0.5432	37.40	9.94	47.34	56.00	-8.66	QP	
4		0.5432	24.26	9.94	34.20	46.00	-11.80	AVG	
5		0.6851	34.72	9.93	44.65	56.00	-11.35	QP	
6		0.6851	21.01	9.93	30.94	46.00	-15.06	AVG	
7		0.8830	32.70	9.96	42.66	56.00	-13.34	QP	
8		0.8830	18.78	9.96	28.74	46.00	-17.26	AVG	
9		2.4106	31.50	9.90	41.40	56.00	-14.60	QP	
10		2.4106	20.73	9.90	30.63	46.00	-15.37	AVG	
11		3.7170	35.29	9.97	45.26	56.00	-10.74	peak	

Pol

Line



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.2730	37.97	9.95	47.92	61.03	-13.11	peak	
2		0.4238	33.44	9.94	43.38	57.37	-13.99	QP	
3		0.4238	26.86	9.94	36.80	47.37	-10.57	AVG	
4		0.5460	21.20	9.94	31.14	56.00	-24.86	QP	
5		0.5460	10.79	9.94	20.73	46.00	-25.27	AVG	
6		1.1643	34.98	9.89	44.87	56.00	-11.13	QP	
7	*	1.1643	25.74	9.89	35.63	46.00	-10.37	AVG	
8		2.3940	34.63	9.90	44.53	56.00	-11.47	peak	
9		3.6960	33.05	9.97	43.02	56.00	-12.98	peak	

*:Maximum data x:Over limit !:over margin

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Remark: All modes have been tested, and only worst data of (GFSK) was listed in this report.

9. ANTENNA REQUIREMENTS

9.1.Limit

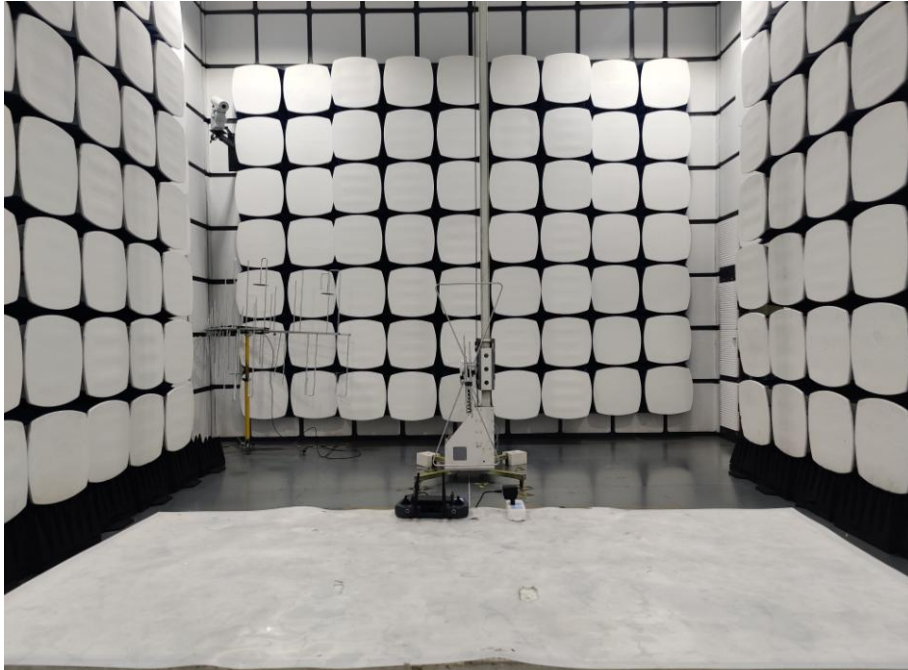
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

9.2.Result

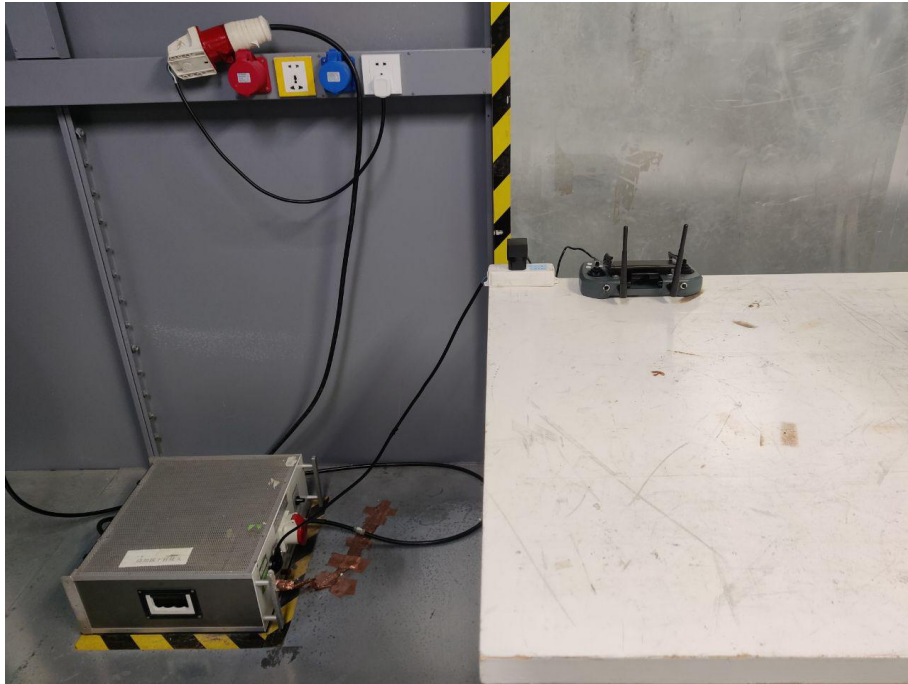
The EUT antenna is internal antenna. It complies with the standard requirement.

10. TEST SETUP PHOTO

10.1. Photos of Radiated emission



10.2.Photos of Power Line Conducted Emission Test



11. PHOTOS OF EUT

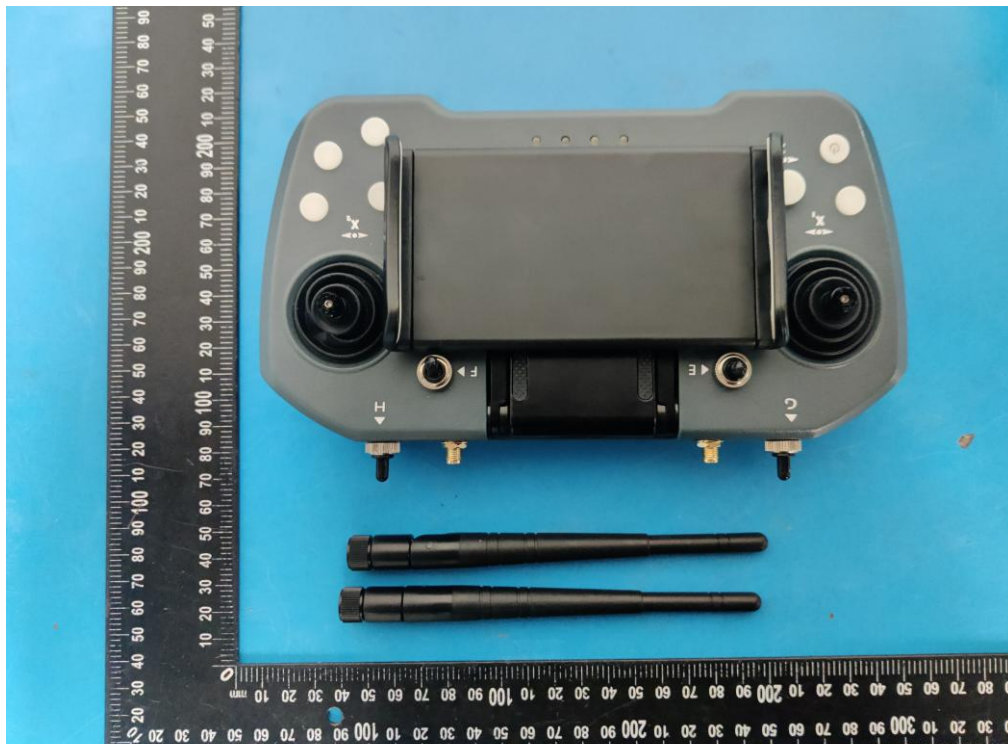


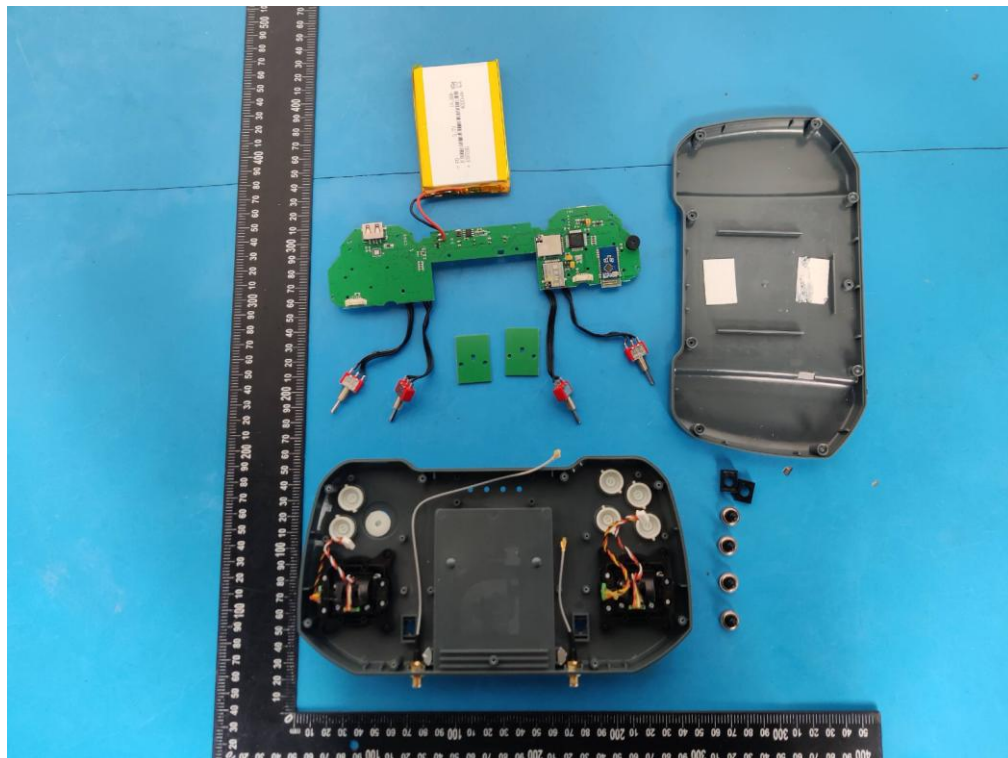
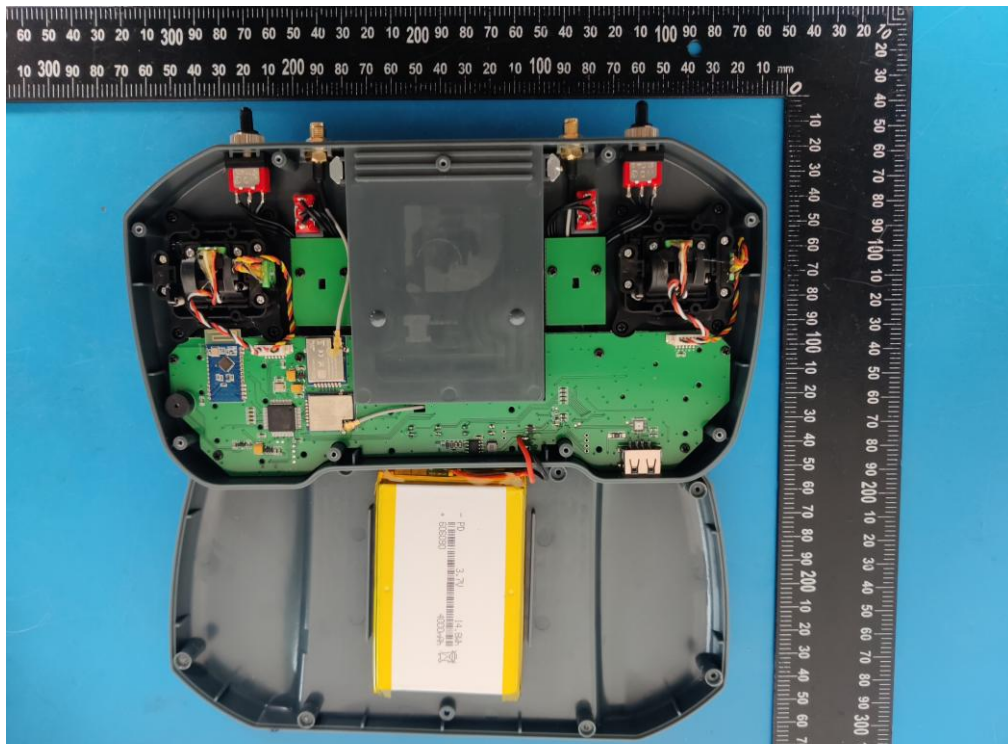


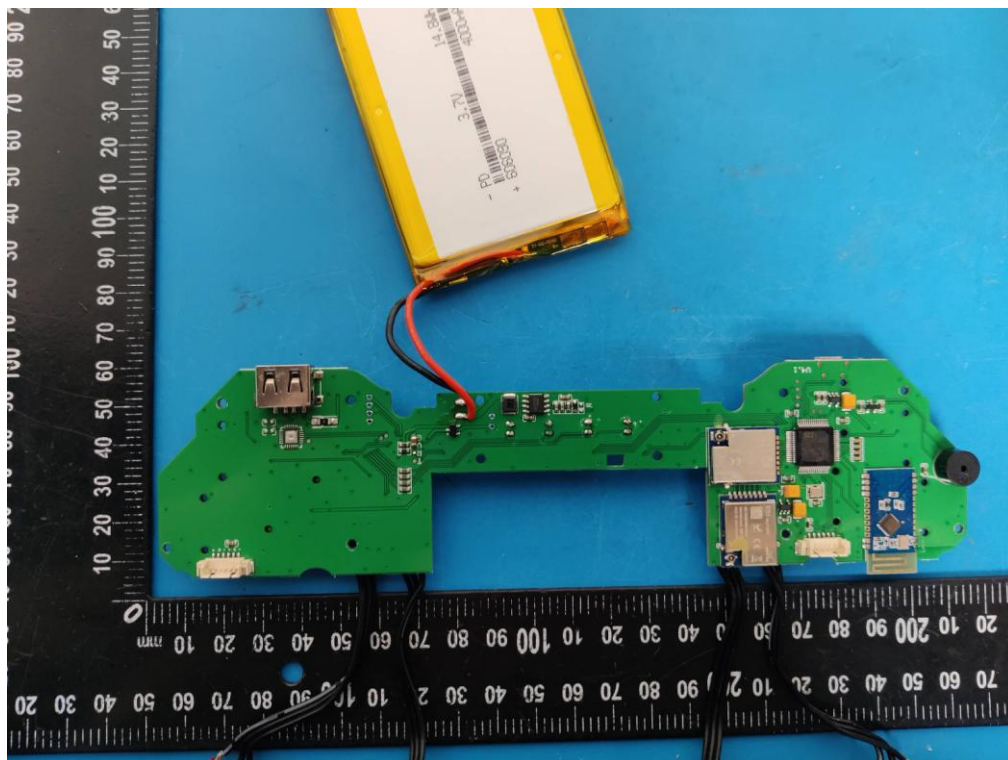
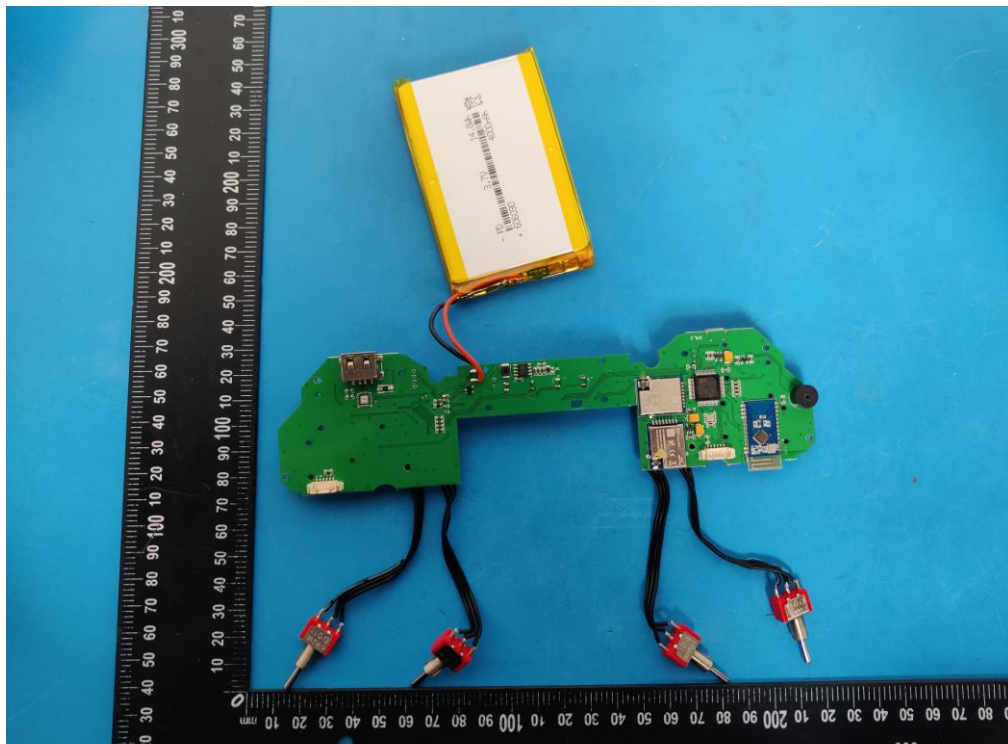


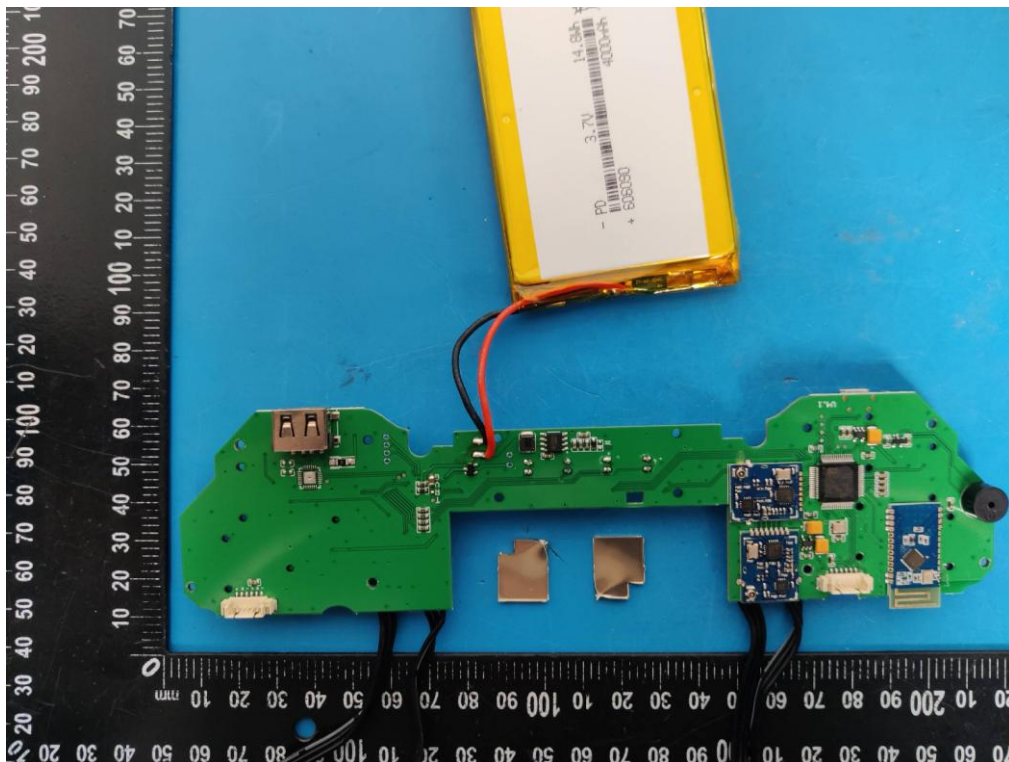


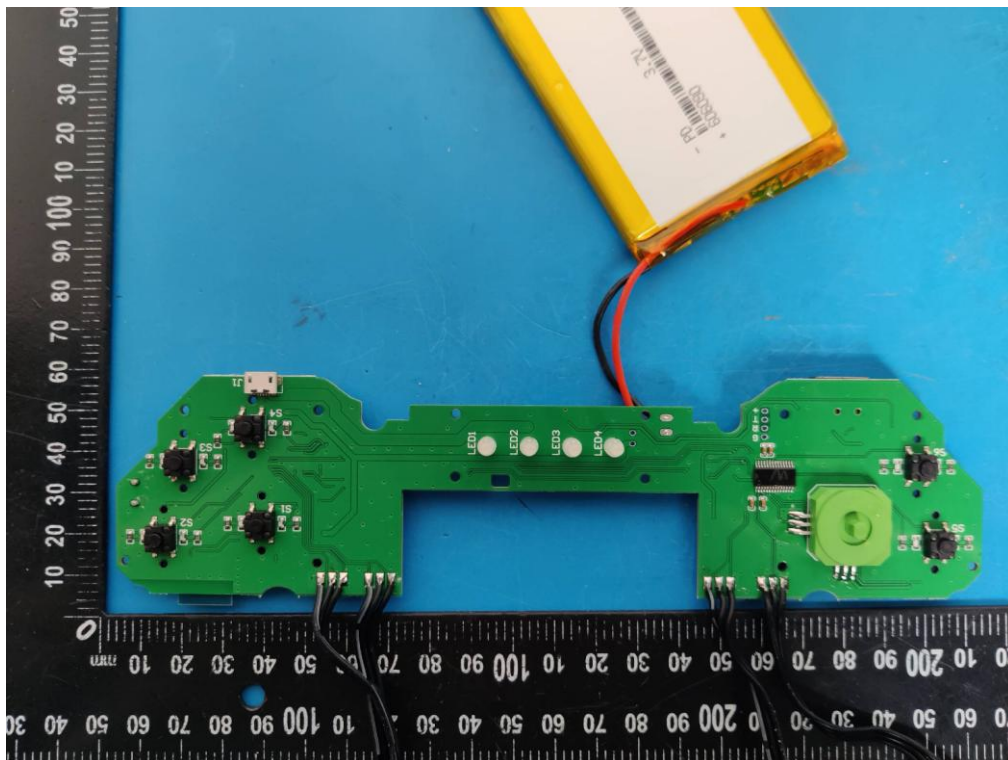
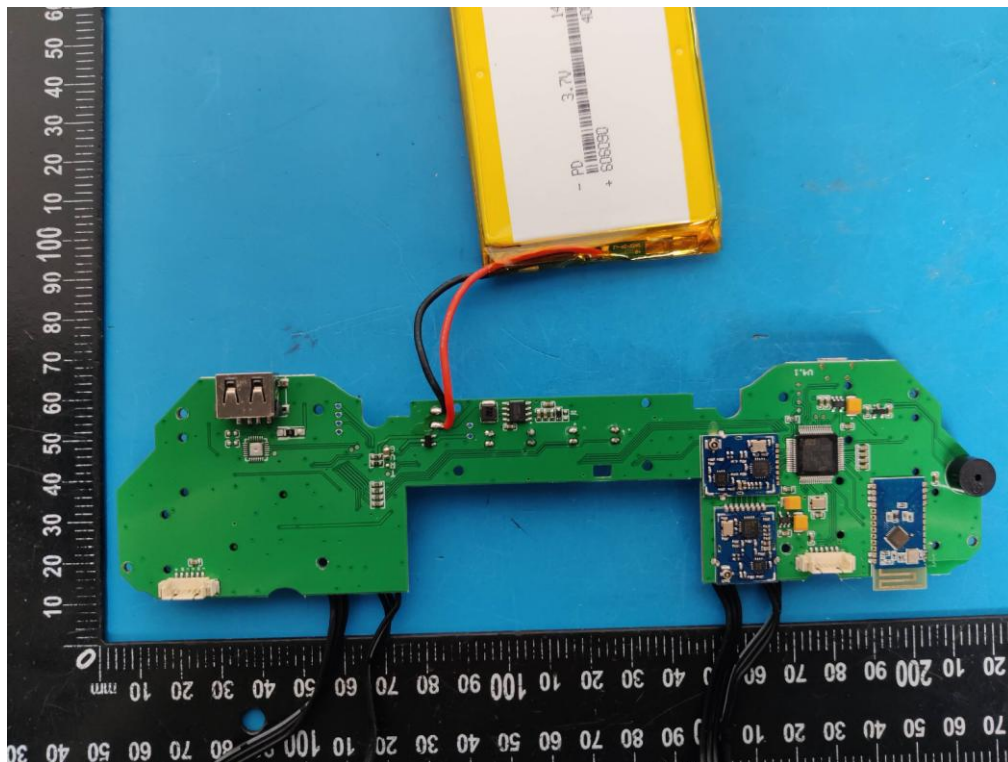


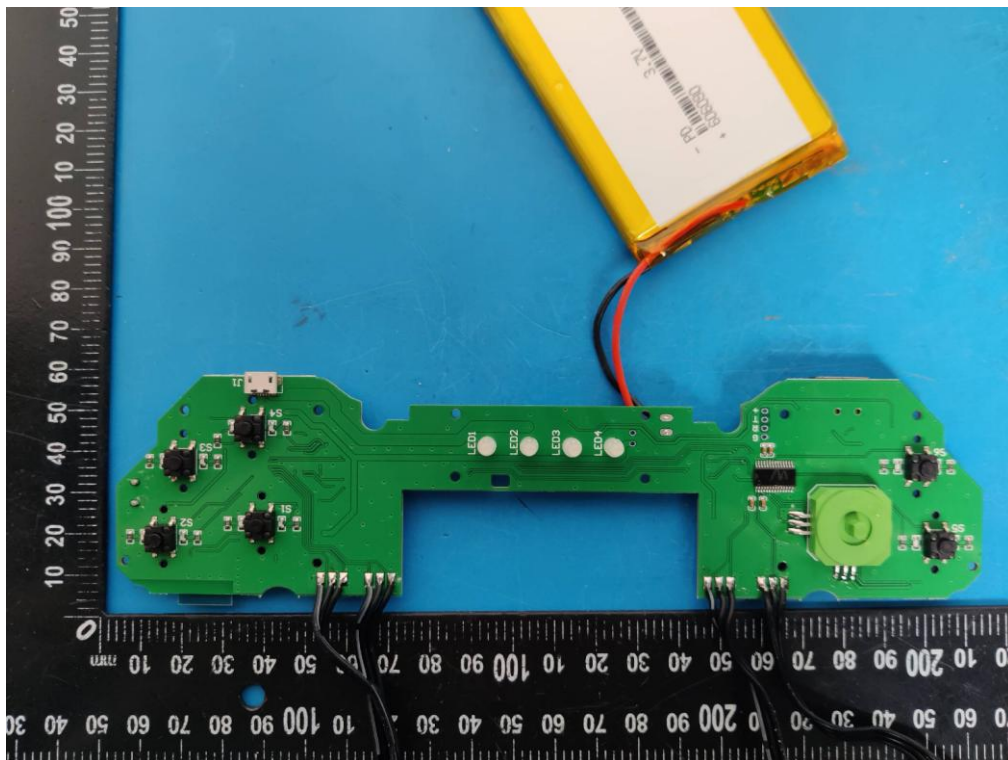
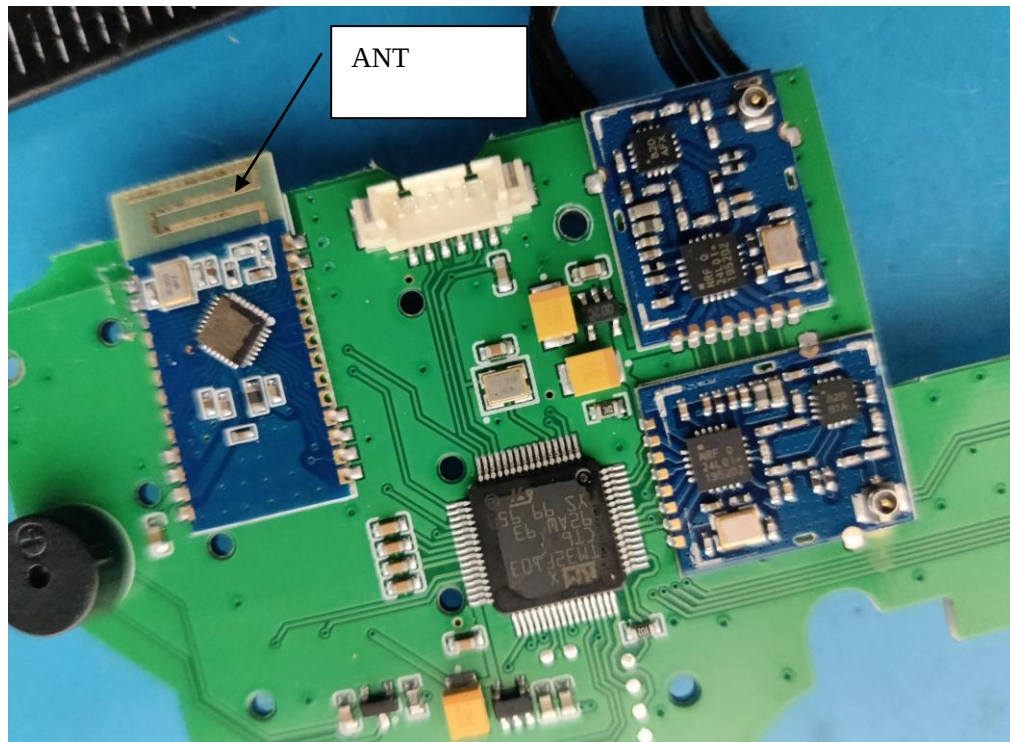












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