CFR 47 FCC PART 15 SUBPART C(DTS)

TEST REPORT

For

2.4G Remote control

MODEL NUMBER: 12 Key position 2.4GRemote control

REPORT NUMBER: E04A24080285F00101

ISSUE DATE: October 15, 2024

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Prepared for

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Prepared by

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This report is based on a single evaluation of the submitted sample(s) of the above mentioned product, it does not imply an assessment of the production of the products. This report shall not be reproduced, except in full, without the written approval of Guangdong Global Testing Technology Co., Ltd.

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	October 15, 2024	Initial Issue	

Summary of Test Results

Test Item	Clause	Limit/Requirement	Result
Antenna Requirement	N/A	FCC Part 15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	ANSI C63.10-2013, Clause 6.2	FCC Part 15.207	N/A
Conducted Output Power	ANSI C63.10-2013, Clause 11.9.1.3	FCC Part 15.247 (b)(3)	Pass
6dB Bandwidth and 99% Occupied Bandwidth	ANSI C63.10-2013, Clause 11.8.1	FCC Part 15.247 (a)(2)	Pass
Power Spectral Density	ANSI C63.10-2013, Clause 11.10.2	FCC Part 15.247 (e)	Pass
Conducted Band edge and spurious emission	ANSI C63.10-2013, Clause 11.11	FCC Part 15.247(d)	Pass
Radiated Band edge and Spurious Emission	ANSI C63.10-2013, Clause 11.11 & Clause 11.12	FCC Part 15.205/15.209	Pass
Duty Cycle	ANSI C63.10-2013, Clause 11.6	None; for reporting purposes only.	Pass

*This test report is only published to and used by the applicant, and it is not for evidence purpose in China.
*The measurement result for the sample received is <Pass> according to <CFR 47 FCC PART 15 SUBPART C(DTS)> when <Accuracy Method> decision rule is applied.

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	Zhaoqing Chendong Optoelectronic Technology Co., Ltd.
Address:	Building 2, Block 2, Guangdong-Guangxi Cooperation Zone, Pingfeng Town, Fengkai County, Zhaoqing City, Guangdong Province

Manufacturer Information

Company Name:	Zhaoqing Chendong Optoelectronic Technology Co., Ltd.
Address:	Building 2, Block 2, Guangdong-Guangxi Cooperation Zone, Pingfeng Town, Fengkai County, Zhaoqing City, Guangdong Province

EUT Information

Product Description:	2.4G Remote control
Model:	12 Key position 2.4GRemote control
Brand:	/
Sample Received Date:	August 19, 2024
Sample Status:	Normal
Sample ID:	A24080285 001
Date of Tested:	August 19, 2024 to October 12, 2024

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 FCC PART 15 SUBPART C(DTS)	**Pass**

Prepared By:

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2. TEST METHODOLOGY

All tests were performed in accordance with the standard CFR 47 FCC PART 15 SUBPART C(DTS)

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 6947.01)** Guangdong Global Testing Technology Co., Ltd. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1343)** Guangdong Global Testing Technology Co., Ltd. has been recognized to perform compliance testing on equipment subject to Supplier's Declaration of Conformity (SDoC) and Certification rules **ISED (Company No.: 30714)** Guangdong Global Testing Technology Co., Ltd. has been registered and fully described in a report filed with ISED. The Company Number is 30714 and the test lab Conformity Assessment Body Identifier (CABID) is CN0148.

Note: All tests measurement facilities use to collect the measurement data are located at Room 101-105, 203-210, Building 1, No.2, Keji 8 Road, Songshan Lake Park, Dongguan city, Guangdong, People’s Republic of China, 523808

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Items	k	Uncertainty
DTS Bandwidth	1.96	±9.2 PPM
20dB Emission Bandwidth	1.96	±9.2 PPM
Carrier Frequency Separation	1.96	±9.2 PPM
Time of Occupancy	1.96	±0.57%
Conducted Output Power	1.96	±1.5 dB
Power Spectral Density Level	1.96	±1.9 dB
Conducted Spurious Emission	1.96	9 kHz-30 MHz: ± 0.95 dB 30 MHz-1 GHz: ± 1.5 dB 1GHz-12.75GHz: ± 1.8 dB 12.75 GHz-26.5 GHz: ± 2.1dB
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.		

Test Item	Measurement Frequency Range	K	U(dB)
Conducted emissions from the AC mains power ports (AMN)	150 kHz ~ 30 MHz	2	3.37
Radiated emissions	9 kHz ~ 30 MHz	2	4.16
Radiated emissions	30 MHz ~ 1 GHz	2	3.79
Radiated emissions	1 GHz ~ 18 GHz	2	5.62
Radiated emissions	18 GHz ~ 40 GHz	2	5.54
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.			

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name		2.4G Remote control
Model		12 Key position 2.4GRemote control
Hardware Version		YK-SXW-12K
Software Version		GY2275_V03
Ratings		Battery 3V
Power Supply	Battery	3V

Frequency Band:	2400 MHz to 2483.5 MHz
Frequency Range:	2402 MHz to 2480 MHz
Type of Modulation:	GFSK
Number of Channels:	3
Maximum Peak Power:	-16.58 dBm
Antenna Type:	Internal antenna
Antenna Gain:	0 dBi
EUT Test software:	/
Note:	The Antenna Gain was provided by customer, and this information may affect the validity of the results, customer should be responsible for this.

5.2. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	2	2440	3	2480	/	/

5.3. MAXIMUM PEAK OUTPUT POWER

Test Mode	Frequency (MHz)	Channel Number	Maximum Peak Output Power (dBm)
GFSK	2402 ~ 2480	1-3[3]	-16.58

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
GFSK	CH 1(Low Channel), CH 2(MID Channel), CH 3(High Channel)	2402 MHz, 2440 MHz, 2480 MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software Version		/		
Modulation Type	Transmit Antenna Number	Test Software setting value		
		CH 1	CH 2	CH 3
GFSK(1Mbps)	1	default	default	default

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	2402-2480	Internal antenna	0

Test Mode	Transmit and Receive Mode	Description
GFSK	☒1TX	Antenna 1 can be used as transmitting antenna.

5.7. SUPPORT UNITS FOR SYSTEM TEST

The EUT has been tested as an independent unit

5.8. SETUP DIAGRAM

Radiated Emission:

EUT

RF conducted:

EUT

6. MEASURING EQUIPMENT AND SOFTWARE USED

Test Equipment of Conducted RF					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
Spectrum Analyzer	Rohde & Schwarz	FSV40	102257	2024/09/14	2025/09/13
Spectrum Analyzer	KEYSIGHT	N9020A	MY51285127	2024/09/14	2025/09/13
EXG Analog Signal Generator	KEYSIGHT	N5173B	MY61253075	2024/09/14	2025/09/13
Vector Signal Generator	Rohde & Schwarz	SMM100A	101899	2024/09/14	2025/09/13
RF Control box	MWRF-test	MW100-RFCB	MW220926GTG	2024/09/14	2025/09/13
Wideband Radio Communication Tester	Rohde & Schwarz	CMW270	102792	2024/09/14	2025/09/13
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	103235	2024/09/14	2025/09/13
temperature humidity chamber	Espec	SH-241	SH-241-2014	2024/09/14	2025/09/13
RF Test Software	MWRF-test	MTS8310E (Ver. V2/0)	N/A	N/A	N/A

Test Equipment of Radiated emissions below 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
3m Semi-anechoic Chamber	ETS	9m*6m*6m	Q2146	2022/08/30	2025/08/29
EMI Test Receiver	Rohde & Schwarz	ESCI3	101409	2024/09/14	2025/09/13
Spectrum Analyzer	KEYSIGHT	N9020A	MY51283932	2024/09/14	2025/09/13
Pre-Amplifier	HzEMC	HPA-9K0130	HYPA21001	2024/09/14	2025/09/13
Biconilog Antenna	Schwarzbeck	VULB 9168	01315	2022/10/10	2025/10/09
Biconilog Antenna	ETS	3142E	00243646	2022/03/23	2025/03/22
Loop Antenna	ETS	6502	243668	2022/03/30	2025/03/29
Test Software	Farad	EZ-EMC (Ver.FA-03A2 RE)	N/A	N/A	N/A

Test Equipment of Radiated emissions above 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
3m Semi-anechoic Chamber	ETS	9m*6m*6m	Q2149	2022/08/30	2025/08/29
Spectrum Analyzer	Rohde & Schwarz	FSV40	101413	2024/09/14	2025/09/13
Spectrum Analyzer	KEYSIGHT	N9020A	MY51283932	2024/09/14	2025/09/13
Pre-Amplifier	A-INFO	HPA-1G1850	HYPA21003	2024/09/14	2025/09/13
Horn antenna	A-INFO	3117	246069	2022/03/11	2025/03/10
Pre-Amplifier	ZKJC	HPA-184057	HYPA21004	2024/09/14	2025/09/13

Horn antenna	ZKJC	3116C	246265	2022/03/29	2025/03/28
Test Software	Farad	EZ-EMC (Ver.FA-03A2 RE+)	N/A	N/A	N/A

7. ANTENNA PORT TEST RESULTS

7.1. CONDUCTED OUTPUT POWER

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(b)(3)	Peak Conduct Output Power	1 watt or 30 dBm	2400-2483.5

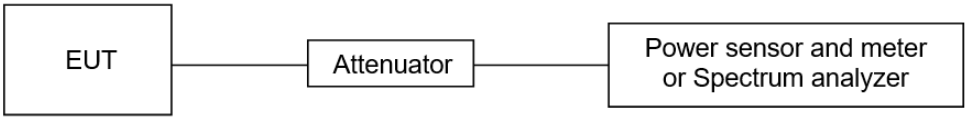
TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.9.1.
Connect the EUT to the spectrum Analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	≥DTS bandwidth
VBW	≥3×RBW
Span	≥3×RBW
Trace	Max hold
Sweep time	Auto

Allow trace to stabilize.
Use the marker-to-peak function to set the marker to the peak of the emission.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.7℃	Relative Humidity	51%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.2. 6DB BANDWIDTH AND 99% OCCUPIED BANDWIDTH

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C ISED RSS-247 ISSUE 3			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(a)(2) ISED RSS-247 5.2 (a)	6 dB Bandwidth	≥ 500 kHz	2400-2483.5
ISED RSS-Gen Clause 6.7	99 % Occupied Bandwidth	For reporting purposes only.	2400-2483.5

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.8 for DTS bandwidth and clause 6.9 for Occupied Bandwidth.

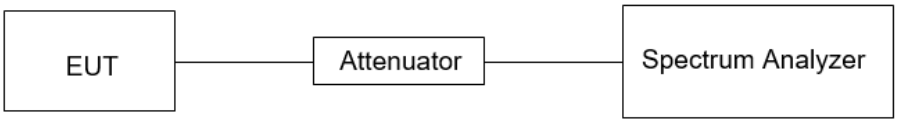
Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Frequency Span	For 6 dB Bandwidth: Enough to capture all products of the modulation carrier emission For 99 % Occupied Bandwidth: Between 1.5 times and 5.0 times the OBW
Detector	Peak
RBW	For 6 dB Bandwidth: 100 kHz For 99 % Occupied Bandwidth: 1 % to 5 % of the occupied bandwidth
VBW	For 6 dB Bandwidth: ≥3 × RBW For 99 % Occupied Bandwidth: ≥3 × RBW
Trace	Max hold
Sweep	Auto couple

a) Use the 99 % power bandwidth function of the instrument, allow the trace to stabilize and report the measured bandwidth.

b) Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.7℃	Relative Humidity	51%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.3. POWER SPECTRAL DENSITY

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C ISED RSS-247 ISSUE 3			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC §15.247 (e) ISED RSS-247 5.2 (b)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

TEST PROCEDURE

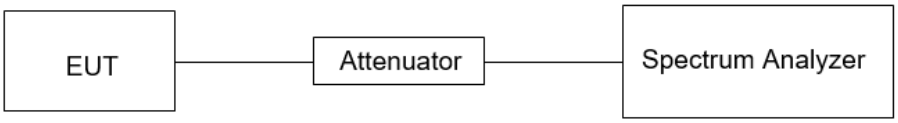
Refer to ANSI C63.10-2013 clause 11.10.

Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	PEAK
RBW	3 kHz ≤ RBW ≤ 100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.7℃	Relative Humidity	51%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.4. CONDUCTED BAND EDGE AND SPURIOUS EMISSION

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C ISED RSS-247 ISSUE 3		
Section	Test Item	Limit
CFR 47 FCC §15.247 (d) ISED RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.11 and 11.13.

Connect the EUT to the spectrum analyser and use the following settings for reference level measurement:

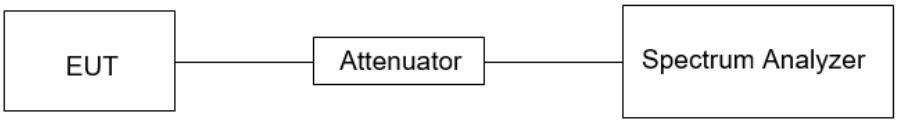
Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level.
Change the settings for emission level measurement:

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100 kHz
VBW	≥3 × RBW
measurement points	≥span/RBW
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.7℃	Relative Humidity	51%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.5. DUTY CYCLE

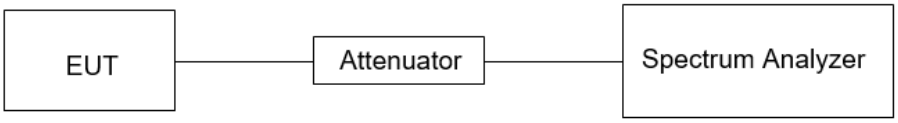
LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.6 Zero – Span Spectrum Analyzer method.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.7℃	Relative Humidity	51%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

8. RADIATED TEST RESULTS

LIMITS

Please refer to CFR 47 FCC §15.205 and §15.209.

Please refer to ISED RSS-GEN Clause 8.9 and Clause 8.10.

Radiation Disturbance Test Limit for FCC (Class B) (9 kHz ~ 1 GHz)

Emissions radiated outside of the specified frequency bands above 30 MHz			
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m	
		Quasi-Peak	
30 - 88	100	40	
88 - 216	150	43.5	
216 - 960	200	46	
Above 960	500	54	
Above 1000	500	Peak	Average
		74	54

FCC Emissions radiated outside of the specified frequency bands below 30 MHz		
Frequency (MHz)	Field strength (microvolts/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

ISED General field strength limits at frequencies below 30 MHz

Table 6 – General field strength limits at frequencies below 30 MHz		
Frequency	**Magnetic field strength (H-Field) (µA/m)**	**Measurement distance (m)**
9 - 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

ISED Restricted bands please refer to ISED RSS-GEN Clause 8.10

Table 7 – Restricted frequency bands[Note 1]		
MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

FCC Restricted bands of operation refer to FCC §15.205 (a):

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])
13.36-13.41			

Note: [1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2]Above 38.6c

TEST PROCEDURE

Below 30 MHz

The setting of the spectrum analyser

RBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
VBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
Sweep	Auto

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.4.

2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1 m height antenna tower.

5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

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

7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.

8. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Below 1 GHz and above 30 MHz

The setting of the spectrum analyser

RBW	120 kHz
VBW	300 kHz
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.5.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high

pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

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

Above 1G

The setting of the spectrum analyser

RBW	1 MHz
VBW	PEAK: 3 MHz AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.6.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

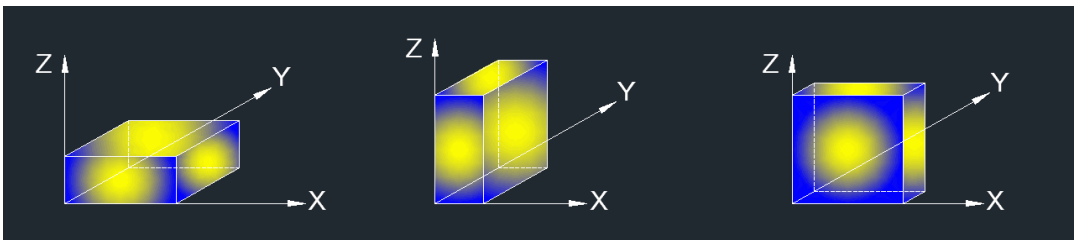
3. The EUT was placed on a turntable with 1.5 m above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement above 1 GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.

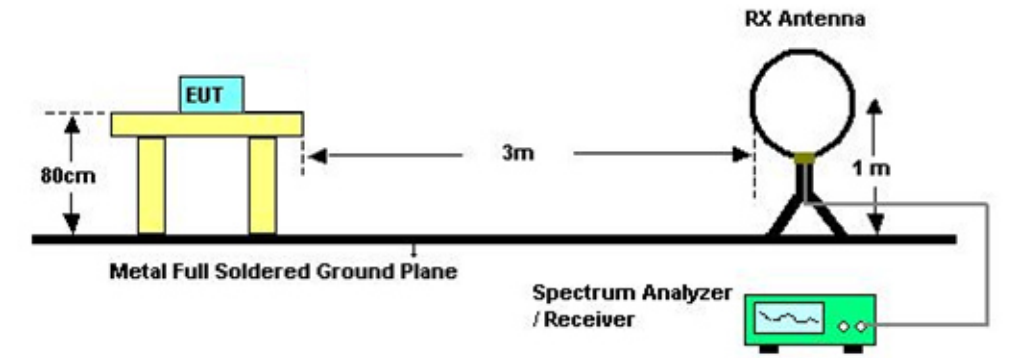
6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 7.1.ON TIME AND DUTY CYCLE.

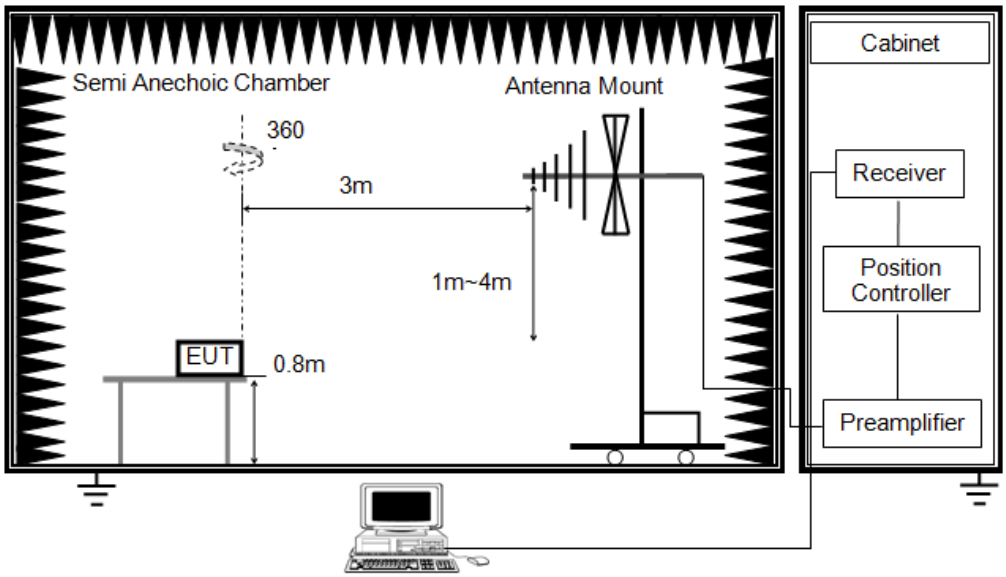
X axis, Y axis, Z axis positions:

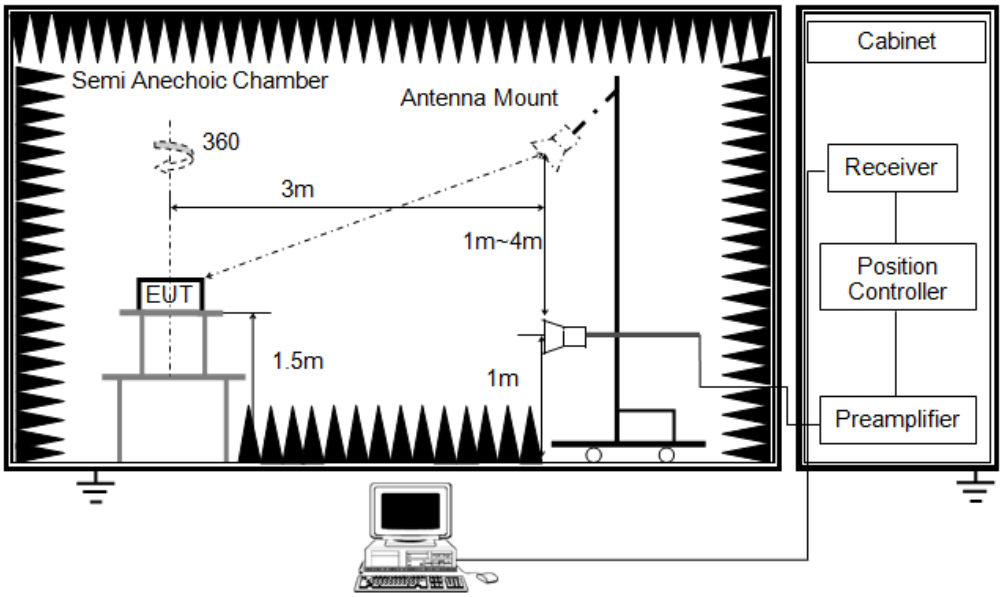


Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

TEST SETUP







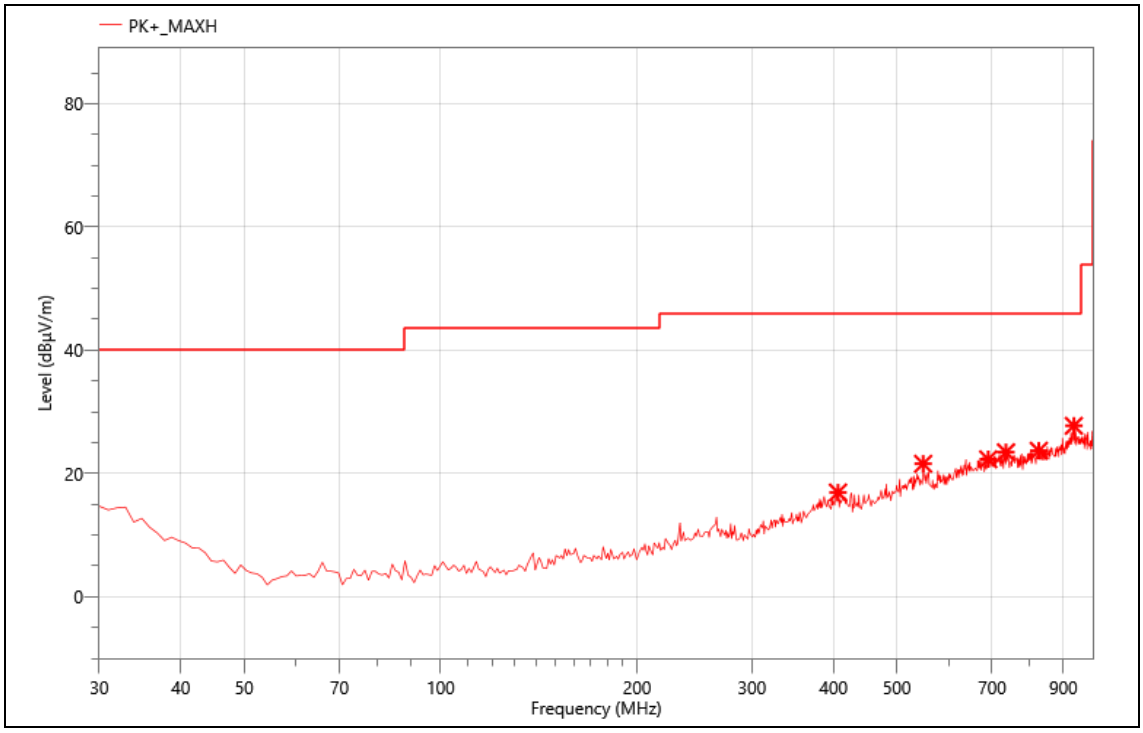
TEST ENVIRONMENT

Temperature	23.7℃	Relative Humidity	51%
Atmosphere Pressure	101kPa		

TEST RESULTS

8.1. RADIATED BAND EDGE AND SPURIOUS EMISSION

Mode:	2402MHz
Power:	Battery 3V
TE:	Berny
Date	2024/8/21
T/A/P	23.7℃/51%/101Kpa

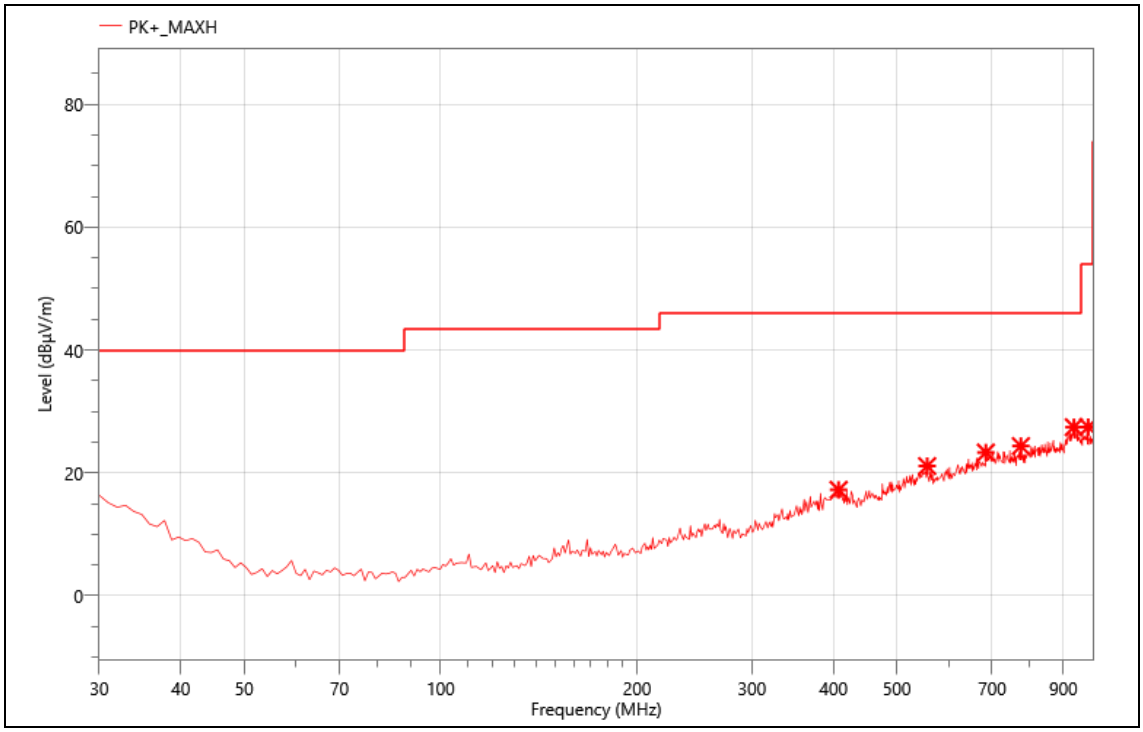


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	406.360	30.63	-13.73	16.90	46.00	29.10	PK+	V
2	548.950	31.35	-9.79	21.56	46.00	24.44	PK+	V
3	690.570	29.97	-7.68	22.29	46.00	23.71	PK+	V
4	735.190	30.49	-7.05	23.44	46.00	22.56	PK+	V
5	825.400	29.66	-5.99	23.67	46.00	22.33	PK+	V
6	934.040	30.78	-3.05	27.73	46.00	18.27	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2402MHz
Power:	Battery 3V
TE:	Berny
Date	2024/8/21
T/A/P	23.7℃/51%/101Kpa



Critical_Freqs

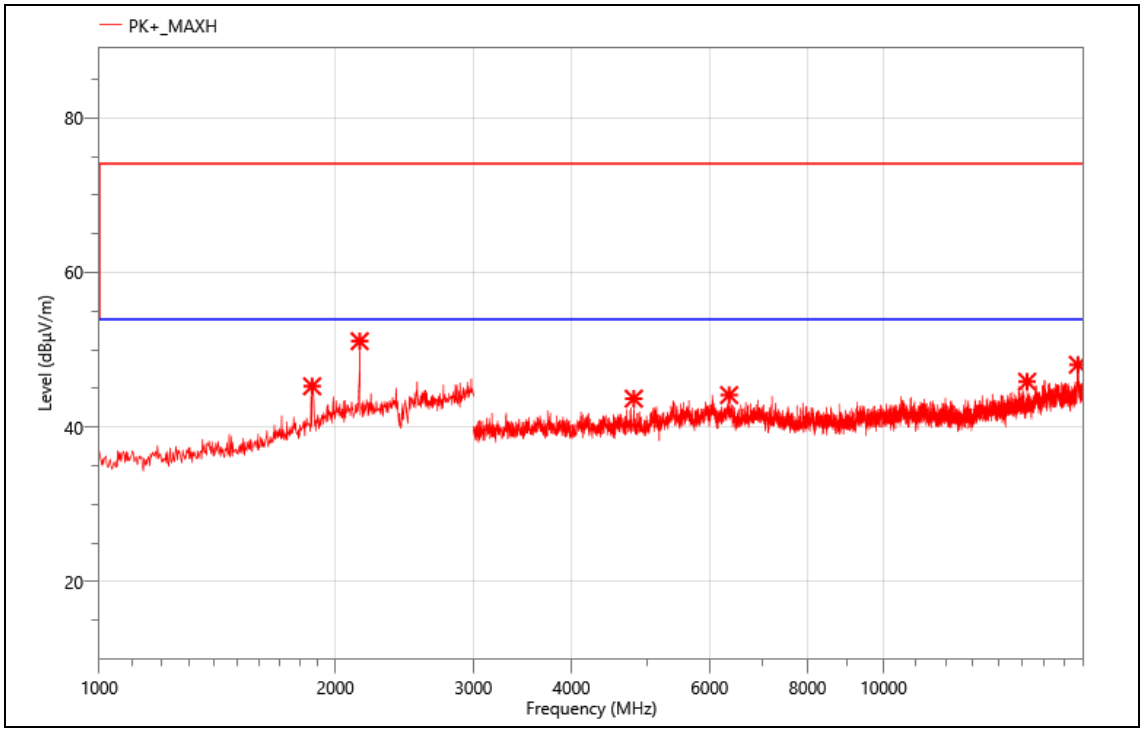
No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	407.330	30.99	-13.75	17.24	46.00	28.76	PK+	H
2	556.710	31.20	-10.09	21.11	46.00	24.89	PK+	H
3	684.750	31.03	-7.71	23.32	46.00	22.68	PK+	H
4	774.960	31.34	-6.97	24.37	46.00	21.63	PK+	H
5	934.040	30.49	-3.05	27.44	46.00	18.56	PK+	H
6	982.540	31.17	-3.7	27.47	53.90	26.43	PK+	H

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Peak: Peak detector.
4. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

Mode:	2402MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa

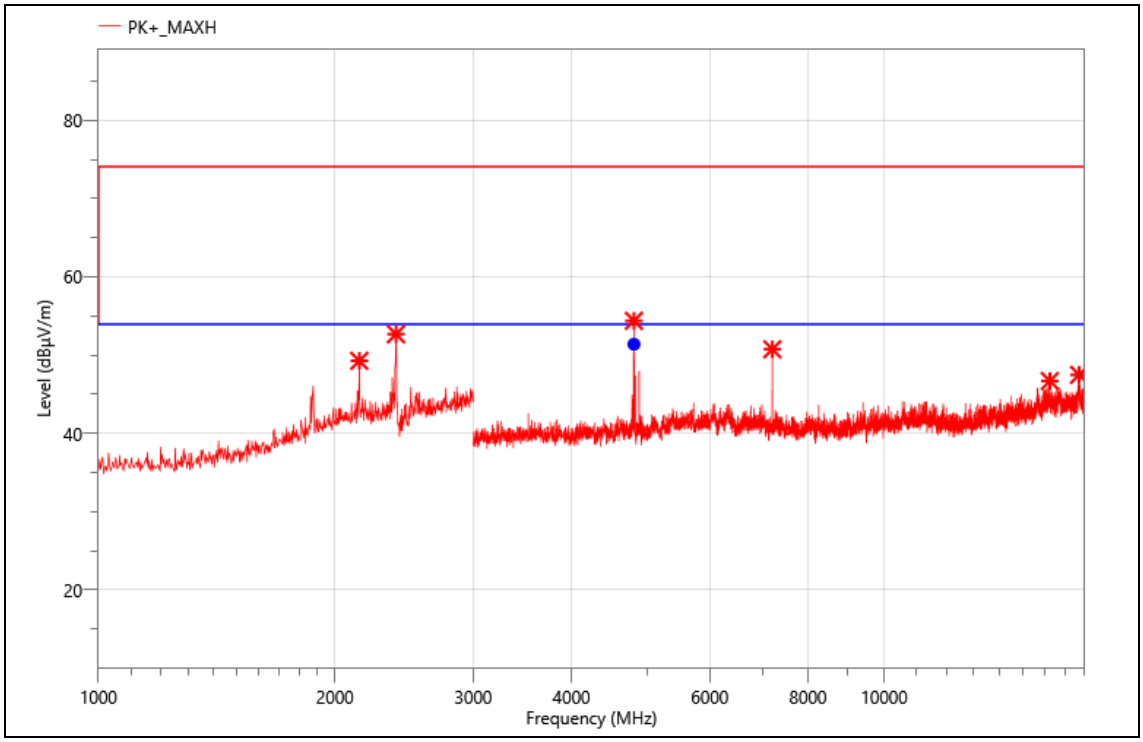


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	1868.000	55.67	-10.38	45.29	74.00	28.71	PK+	V
2	2148.000	60.17	-9.05	51.12	74.00	22.88	PK+	V
3	4803.000	55.03	-11.34	43.69	74.00	30.31	PK+	V
4	6354.000	52.08	-7.93	44.15	74.00	29.85	PK+	V
5	15244.500	48.68	-2.8	45.88	74.00	28.12	PK+	V
6	17692.500	47.85	0.22	48.07	74.00	25.93	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2402MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa



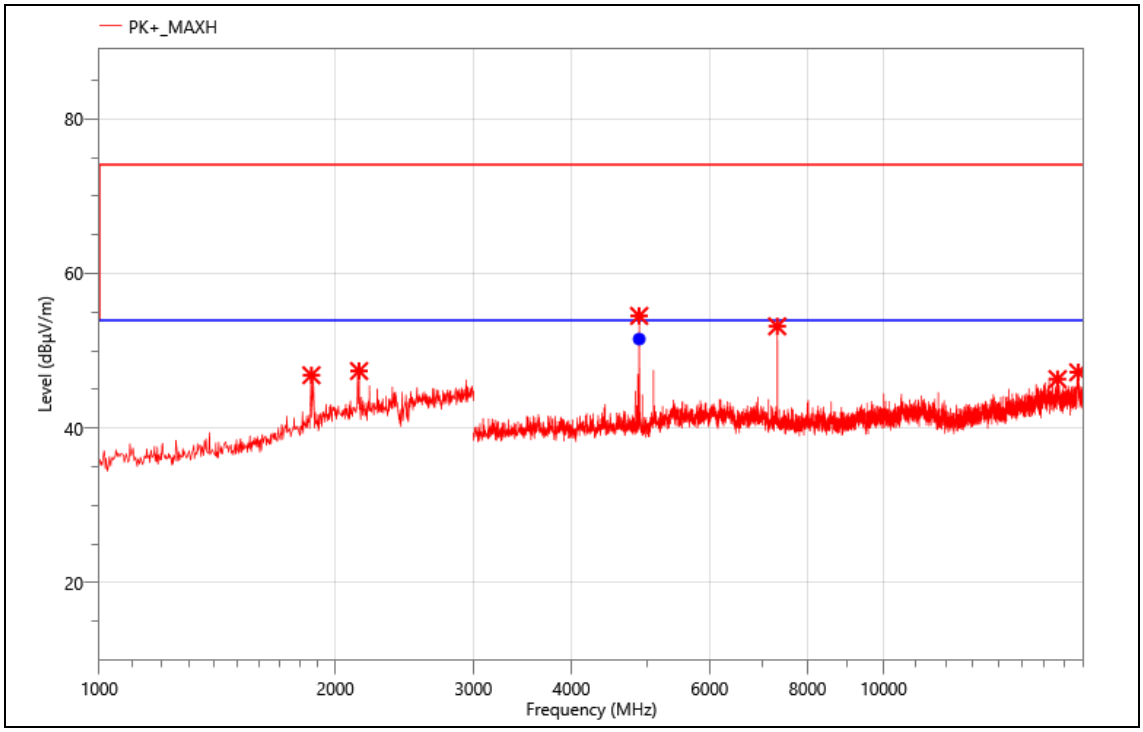
Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2148.000	58.33	-9.05	49.28	74.00	24.72	PK+	H
2	2392.000	61.20	-8.53	52.67	74.00	21.33	PK+	H
3	4803.000	65.73	-11.34	54.39	74.00	19.61	PK+	H
4	7206.000	58.75	-8	50.75	74.00	23.25	PK+	H
5	16249.500	47.26	-0.56	46.70	74.00	27.30	PK+	H
6	17706.000	47.43	0.05	47.48	74.00	26.52	PK+	H

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.	Verdict
1	4803.000	62.73	-11.34	51.39	53.90	2.51	AVG	H	PASS

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2440MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa



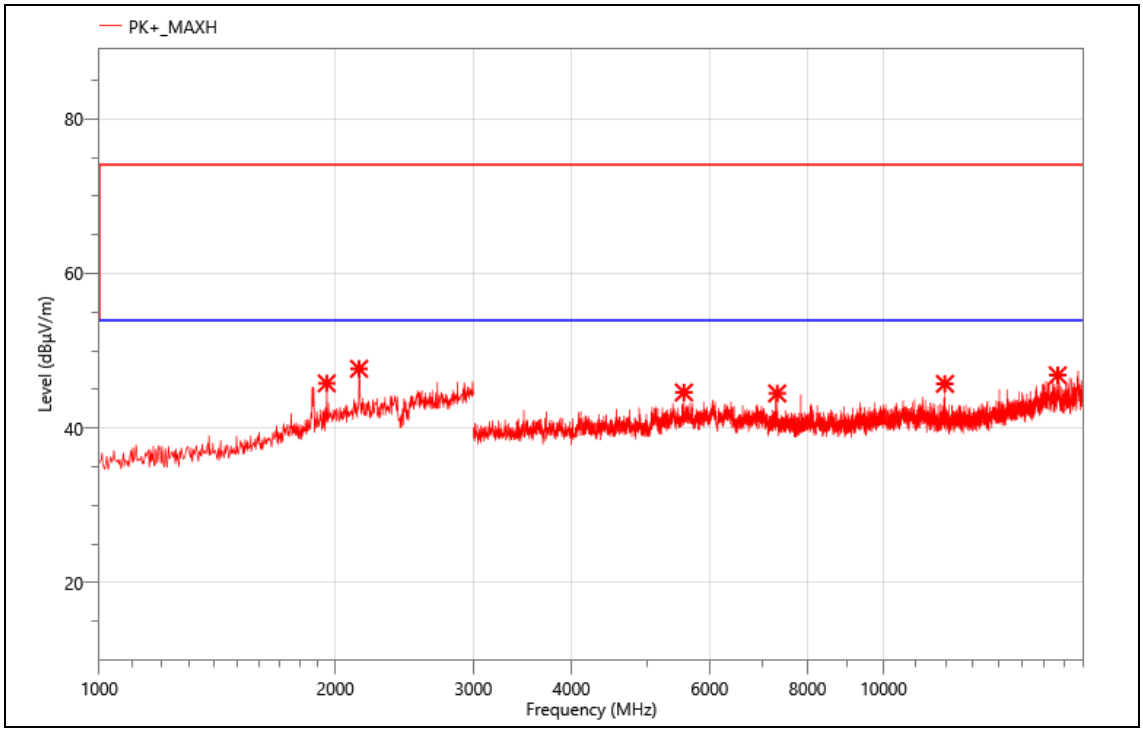
Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	1864.000	57.24	-10.4	46.84	74.00	27.16	PK+	H
2	2144.000	56.44	-9.05	47.39	74.00	26.61	PK+	H
3	4879.500	65.66	-11.14	54.52	74.00	19.48	PK+	H
4	7318.500	60.99	-7.82	53.17	74.00	20.83	PK+	H
5	16669.500	46.88	-0.54	46.34	74.00	27.66	PK+	H
6	17712.000	47.31	-0.08	47.23	74.00	26.77	PK+	H

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.	Verdict
1	4879.500	62.66	-11.14	51.52	53.90	2.38	AVG	H	PASS

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2440MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa

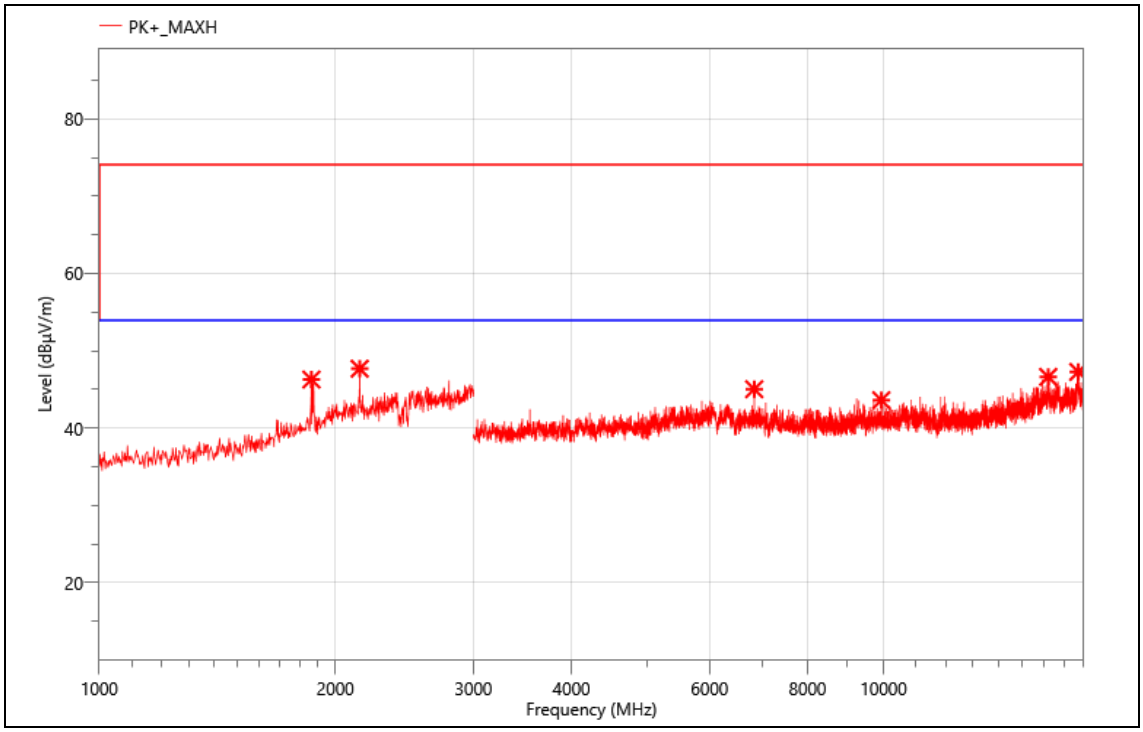


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	1950.000	55.39	-9.59	45.80	74.00	28.20	PK+	V
2	2144.000	56.73	-9.05	47.68	74.00	26.32	PK+	V
3	5565.000	53.96	-9.34	44.62	74.00	29.38	PK+	V
4	7318.500	52.31	-7.82	44.49	74.00	29.51	PK+	V
5	11974.500	50.35	-4.62	45.73	74.00	28.27	PK+	V
6	16674.000	47.34	-0.49	46.85	74.00	27.15	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2480MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa

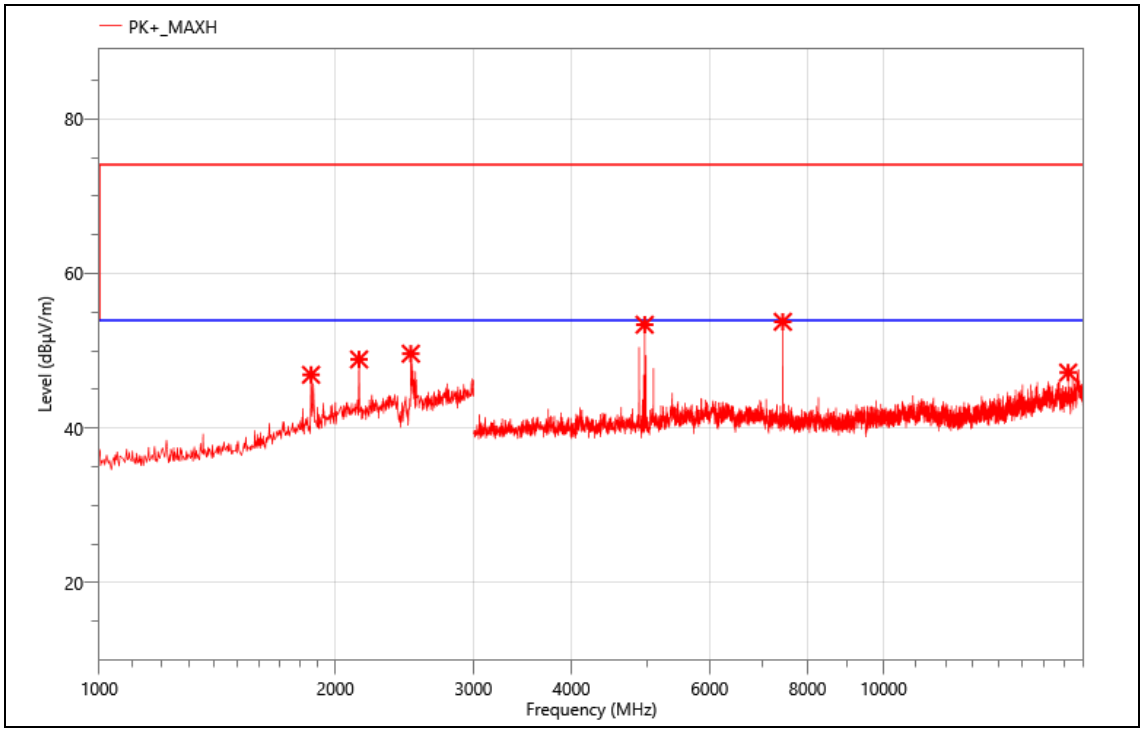


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	1864.000	56.69	-10.4	46.29	74.00	27.71	PK+	V
2	2148.000	56.74	-9.05	47.69	74.00	26.31	PK+	V
3	6841.500	53.18	-8.14	45.04	74.00	28.96	PK+	V
4	9936.000	49.90	-6.28	43.62	74.00	30.38	PK+	V
5	16216.500	47.84	-1.21	46.63	74.00	27.37	PK+	V
6	17715.000	47.41	-0.14	47.27	74.00	26.73	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2480MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	1862.000	57.31	-10.41	46.90	74.00	27.10	PK+	H
2	2144.000	57.94	-9.05	48.89	74.00	25.11	PK+	H
3	2496.000	58.04	-8.41	49.63	74.00	24.37	PK+	H
4	4959.000	64.73	-11.35	53.38	74.00	20.62	PK+	H
5	7438.500	61.71	-7.95	53.76	74.00	20.24	PK+	H
6	17196.000	48.23	-1.04	47.19	74.00	26.81	PK+	H

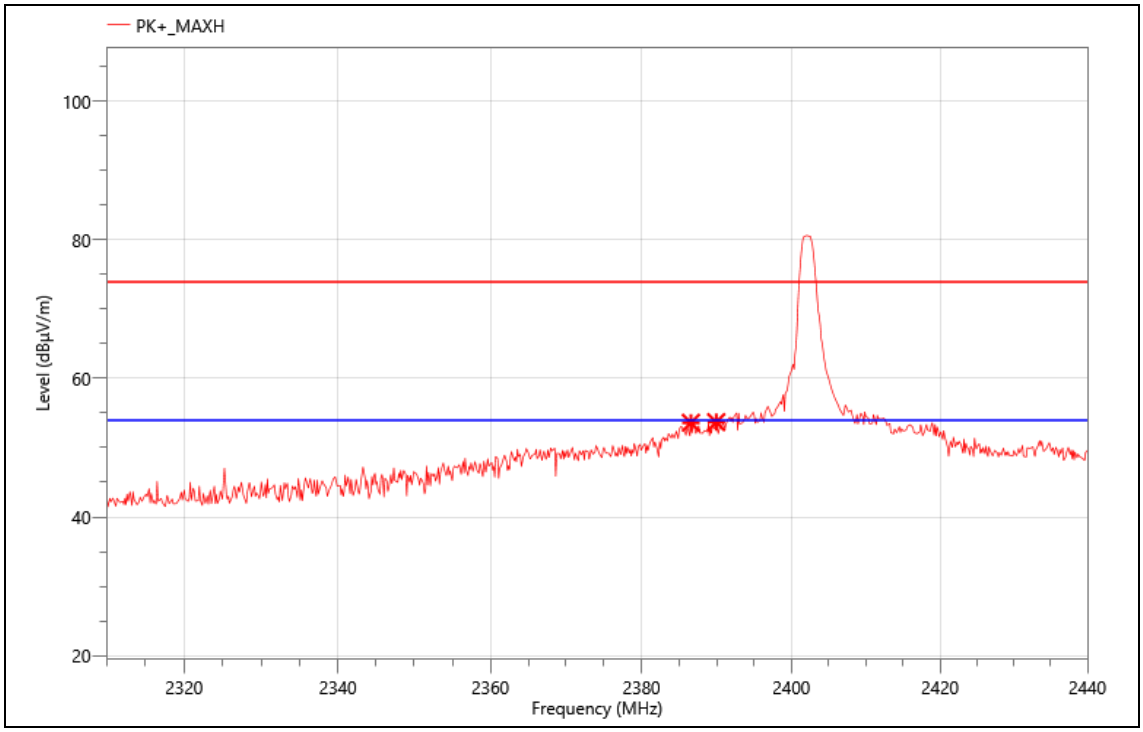
Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

For the frequency above 18 GHz, a pre-scan was performed, and the result was 20 dB lower than the limit line, the test data was not shown in the report.

Mode:	2402MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa

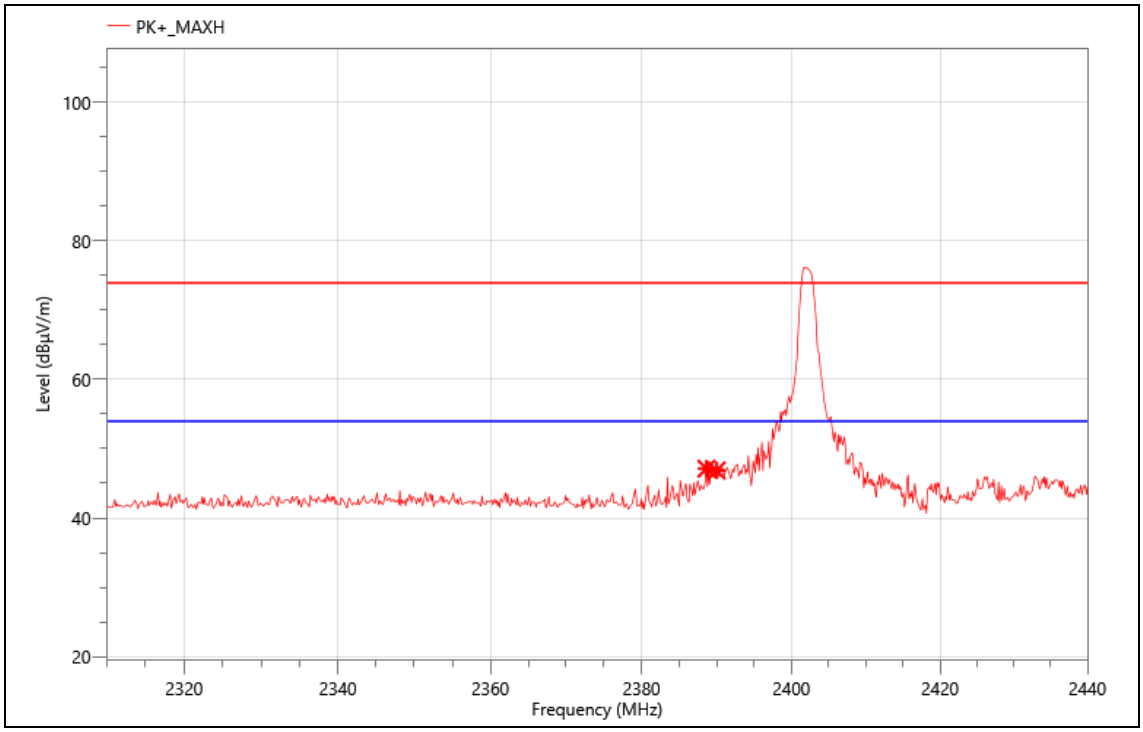


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2386.570	30.96	22.65	53.61	74.00	20.39	PK+	H
2	2390.000	30.98	22.72	53.70	74.00	20.30	PK+	H

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2402MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa

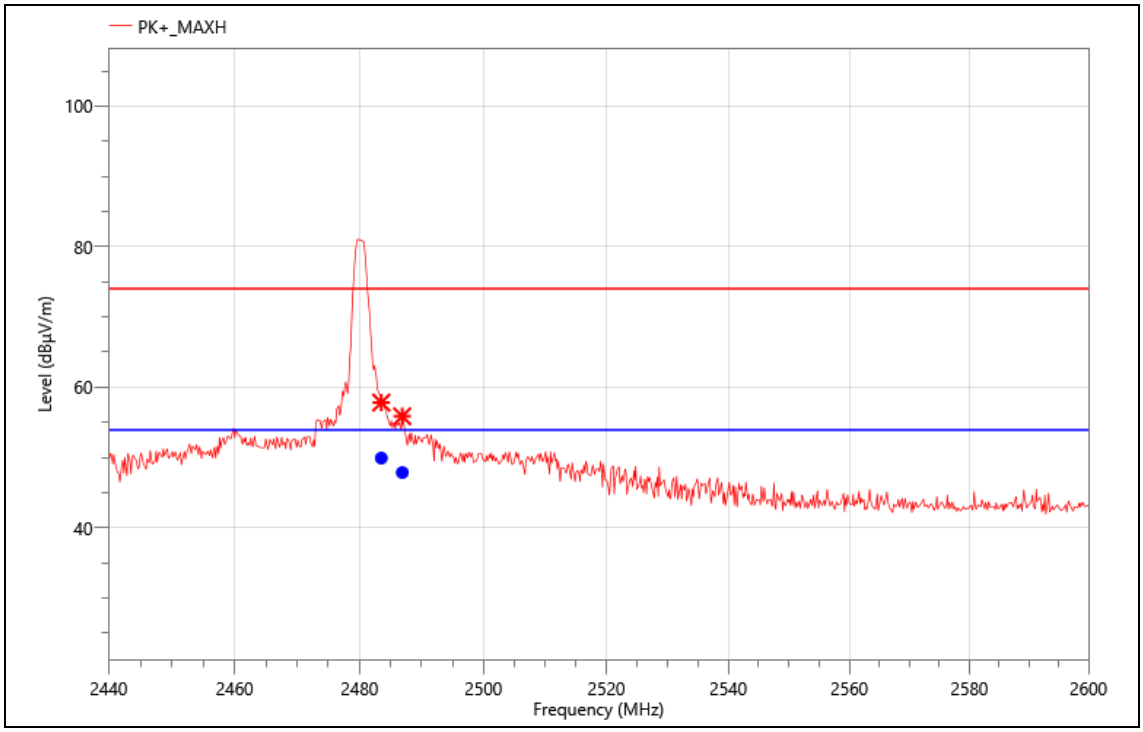


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2388.650	24.44	22.69	47.13	74.00	26.87	PK+	V
2	2390.000	24.14	22.72	46.86	74.00	27.14	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2480MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa



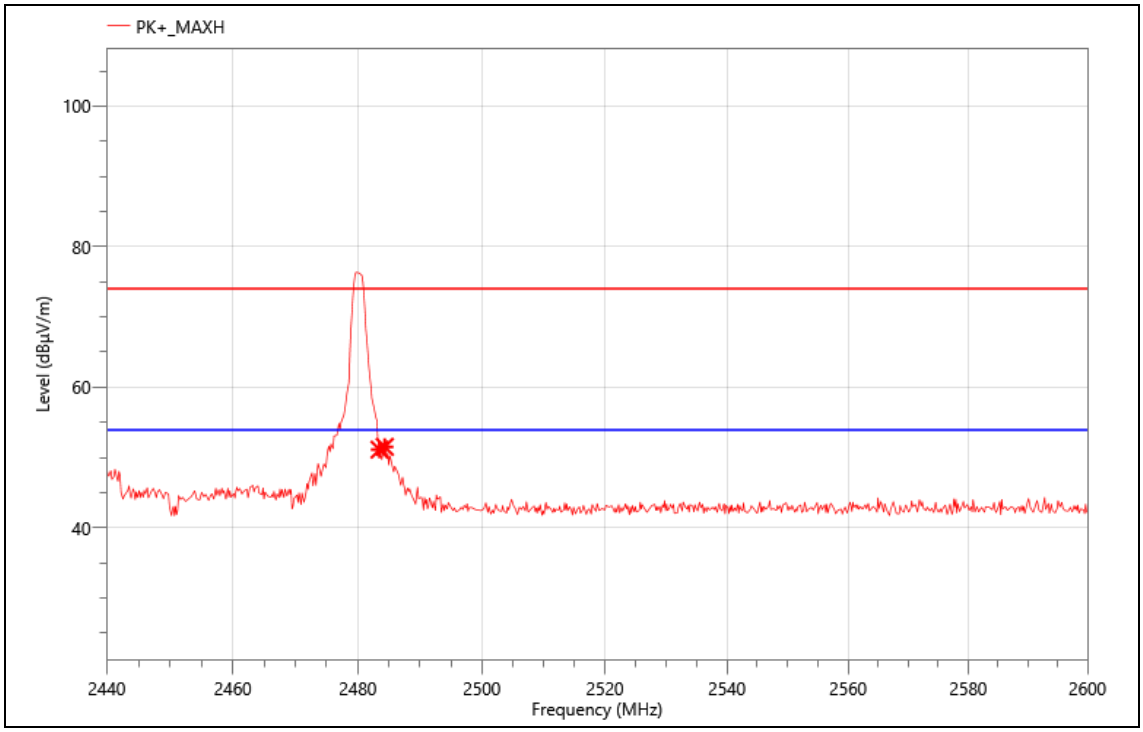
Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2483.500	34.68	23.15	57.83	74.00	16.17	PK+	H
2	2486.880	32.73	23.14	55.87	74.00	18.13	PK+	H

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.	Verdict
1	2483.500	26.78	23.15	49.93	53.90	3.97	AVG	H	PASS
2	2486.880	24.73	23.14	47.87	53.90	6.03	AVG	H	PASS

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	2480MHz
Power:	Battery 3V
TE:	Berny
Date	2024/09/30
T/A/P	22.8℃/53%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2483.500	27.98	23.15	51.13	74.00	22.87	PK+	V
2	2484.320	28.38	23.15	51.53	74.00	22.47	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Note:

1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

9. ANTENNA REQUIREMENT

REQUIREMENT

Please refer to FCC §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Please refer to FCC §15.247(b)(4)
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DESCRIPTION

Pass

10. AC POWER LINE CONDUCTED EMISSION

LIMITS

Please refer to CFR 47 FCC §15.207 (a)

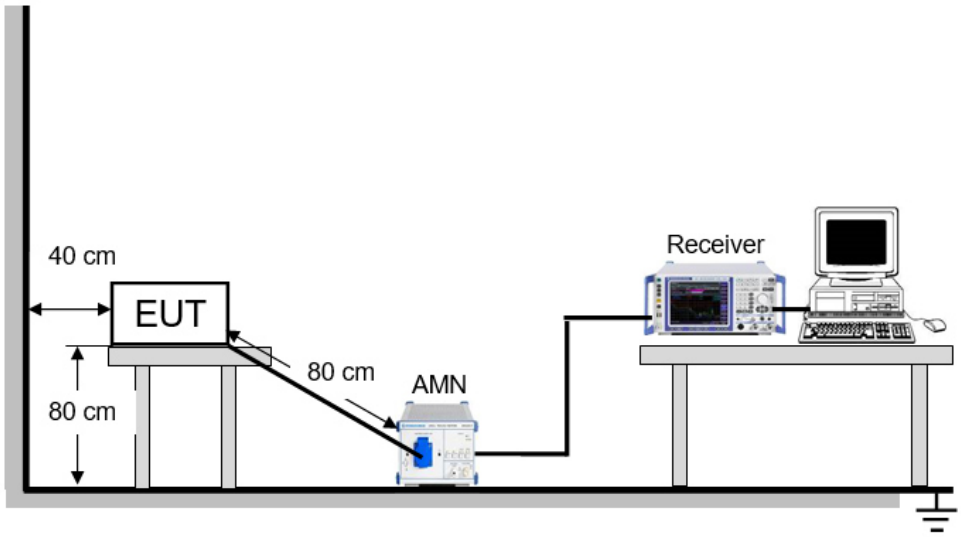
FREQUENCY (MHz)	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

TEST PROCEDURE

The EUT is put on a table of non-conducting material that is 80 cm high. The vertical conducting wall of shielding is located 40 cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10-2013.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9 kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

TEST SETUP



TEST ENVIRONMENT

N/A

TEST RESULTS

N/A

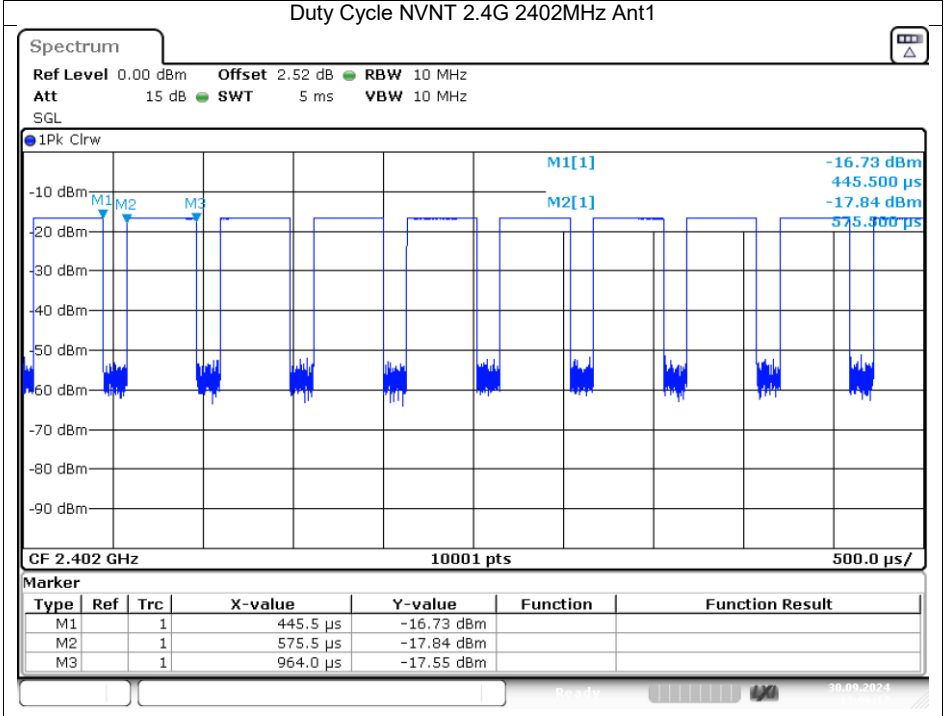
11. TEST DATA - Appendix A

Duty Cycle

Condition	Mode	Frequency (MHz)	Antenna	On Time (ms)	Period (ms)	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	2.4G	2402	Ant1	0.39	0.52	75	1.25	2.57
NVNT	2.4G	2440	Ant1	0.39	0.52	75	1.25	2.58
NVNT	2.4G	2480	Ant1	0.39	0.52	75	1.25	2.58

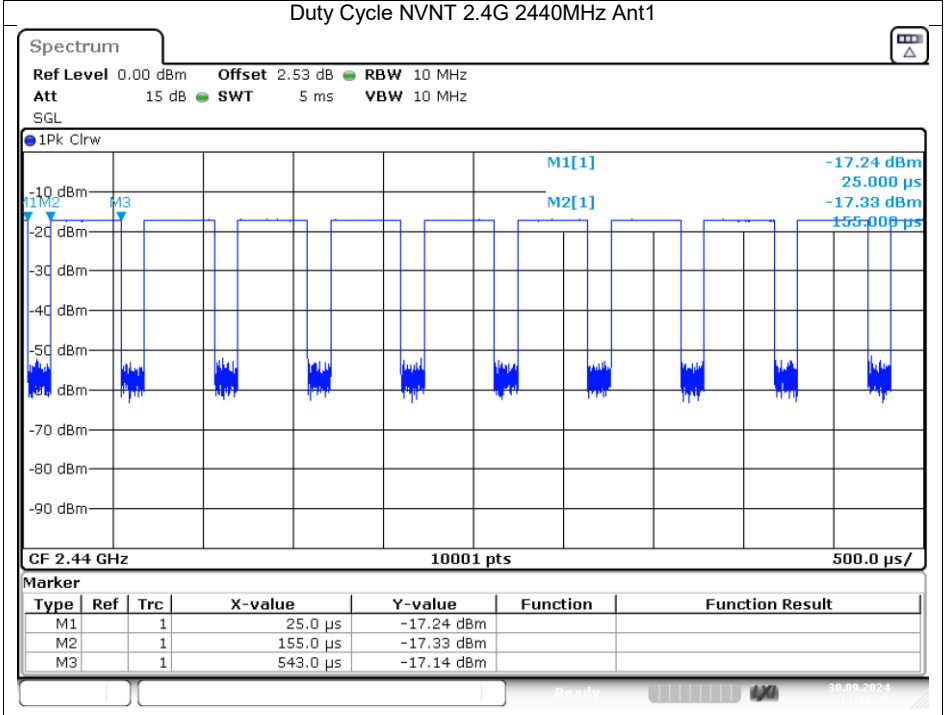
Test Graphs

Duty Cycle NVNT 2.4G 2402MHz Ant1



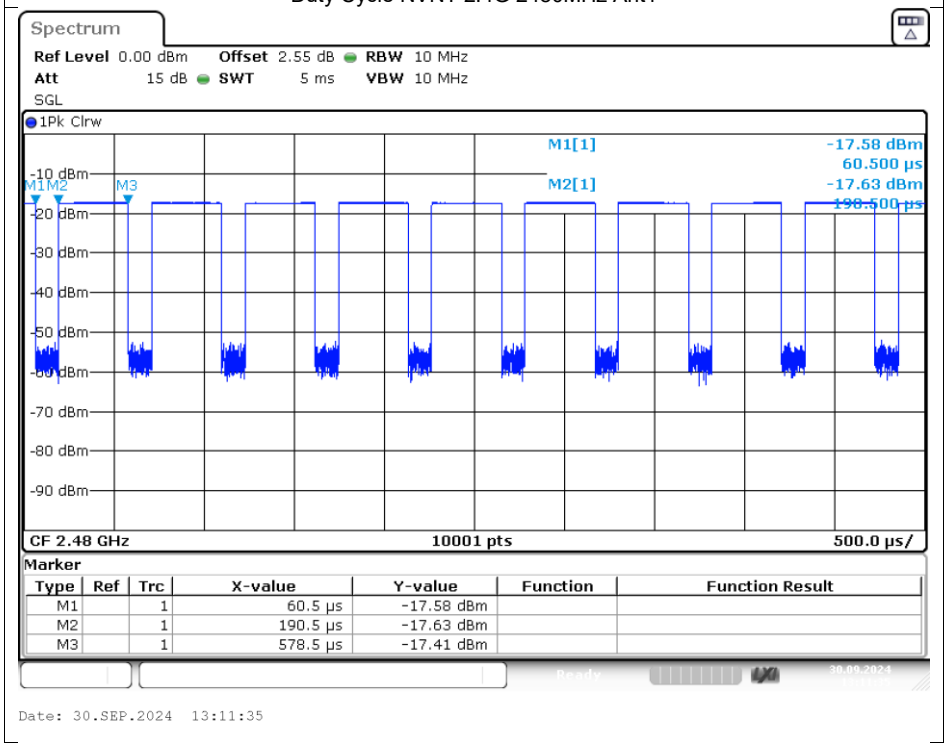
Date: 30.SEP.2024 13:06:17

Duty Cycle NVNT 2.4G 2440MHz Ant1



Date: 30.SEP.2024 13:10:21

Duty Cycle NVNT 2.4G 2480MHz Ant1

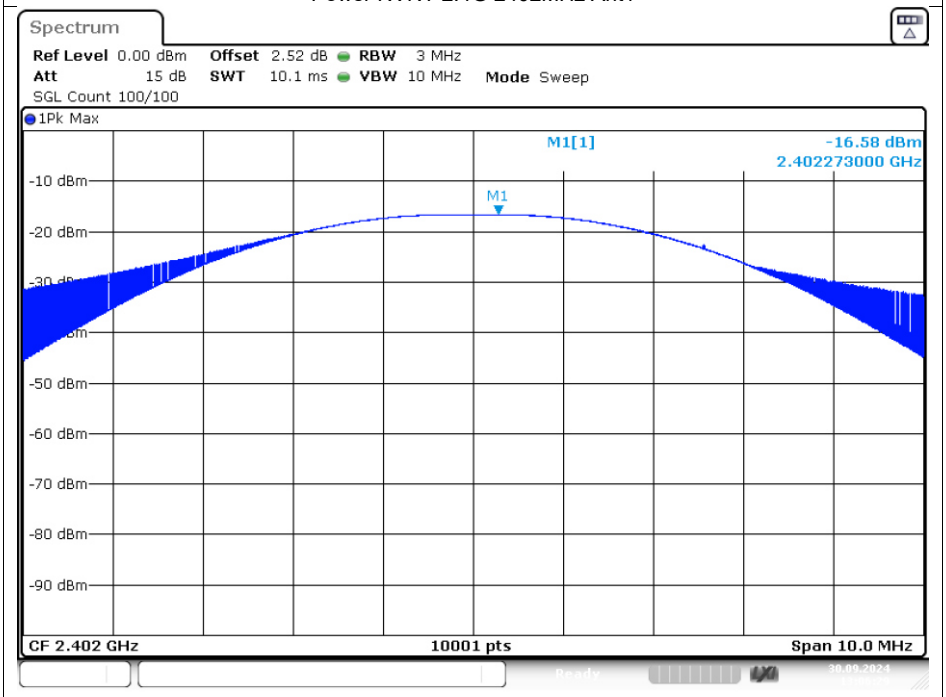


Maximum Conducted Output Power

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	2.4G	2402	Ant1	-16.58	30	Pass
NVNT	2.4G	2440	Ant1	-17.14	30	Pass
NVNT	2.4G	2480	Ant1	-17.35	30	Pass

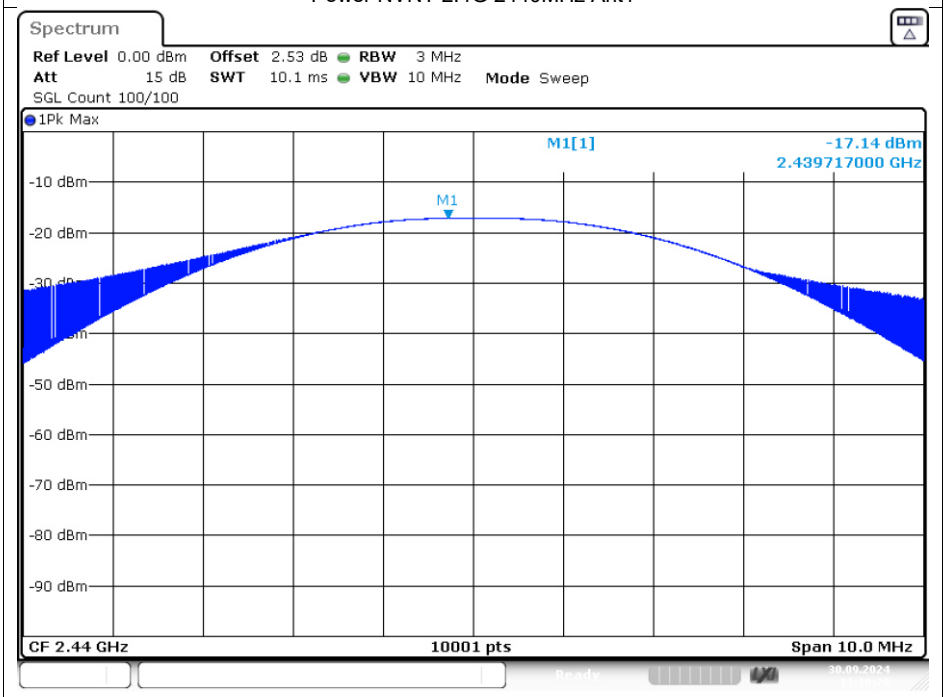
Test Graphs

Power NVNT 2.4G 2402MHz Ant1



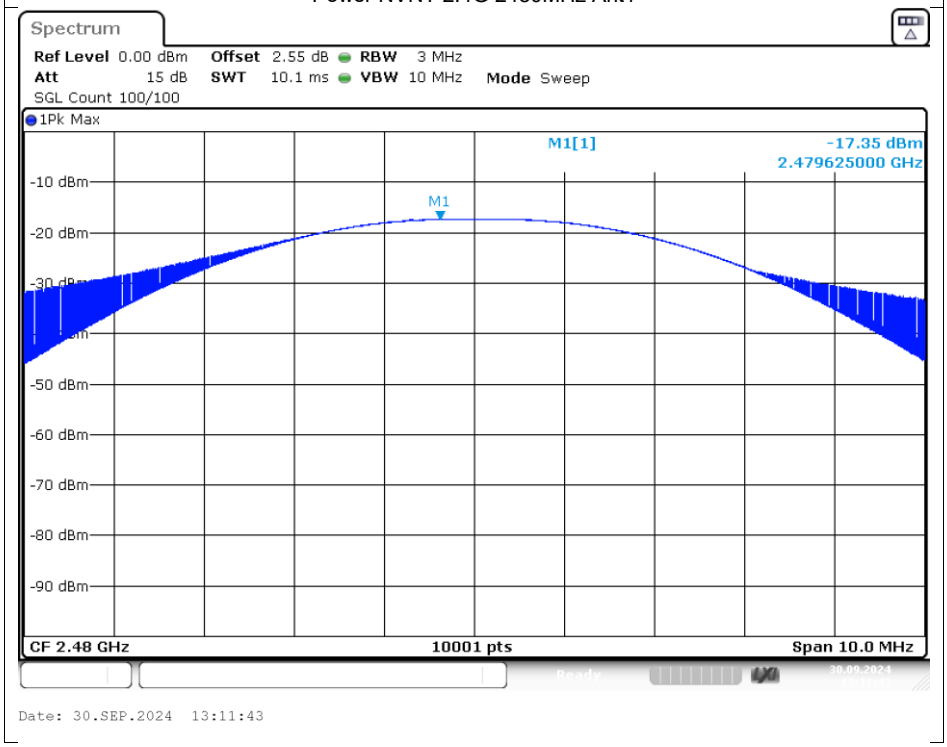
Date: 30.SEP.2024 13:06:29

Power NVNT 2.4G 2440MHz Ant1



Date: 30.SEP.2024 13:10:28

Power NVNT 2.4G 2480MHz Ant1

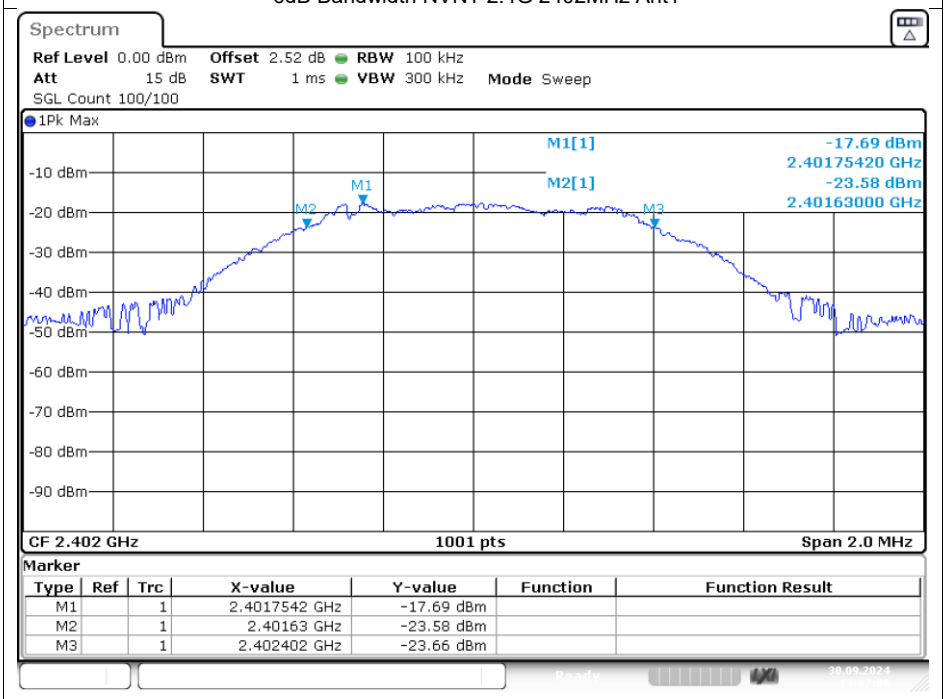


-6dB Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	2.4G	2402	Ant1	0.77	0.5	Pass
NVNT	2.4G	2440	Ant1	0.78	0.5	Pass
NVNT	2.4G	2480	Ant1	0.82	0.5	Pass

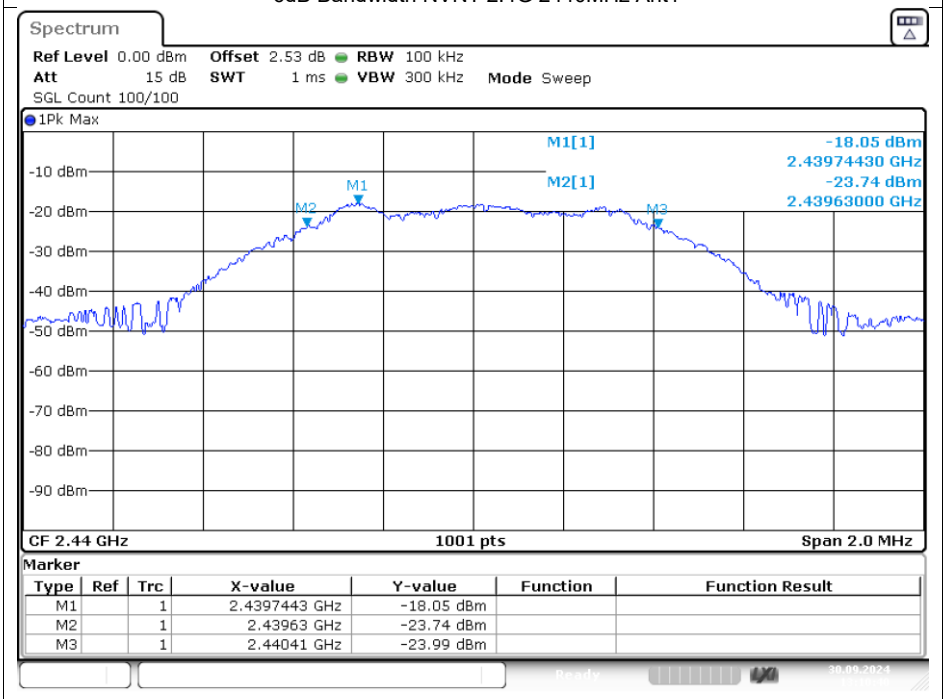
Test Graphs

-6dB Bandwidth NVNT 2.4G 2402MHz Ant1



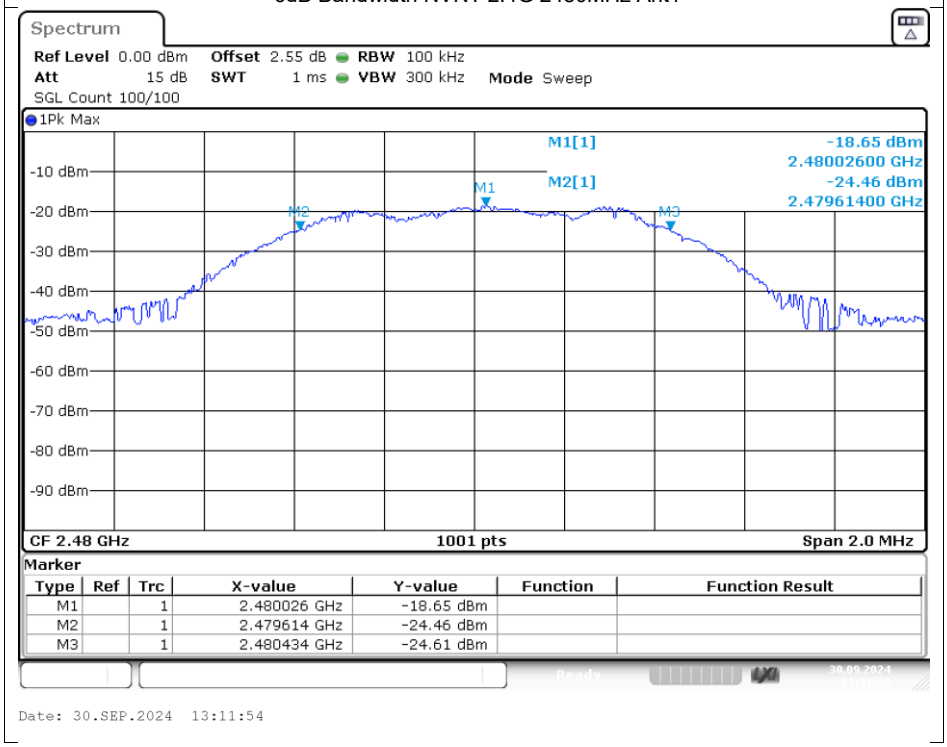
Date: 30.SEP.2024 13:06:59

-6dB Bandwidth NVNT 2.4G 2440MHz Ant1



Date: 30.SEP.2024 13:10:40

-6dB Bandwidth NVNT 2.4G 2480MHz Ant1

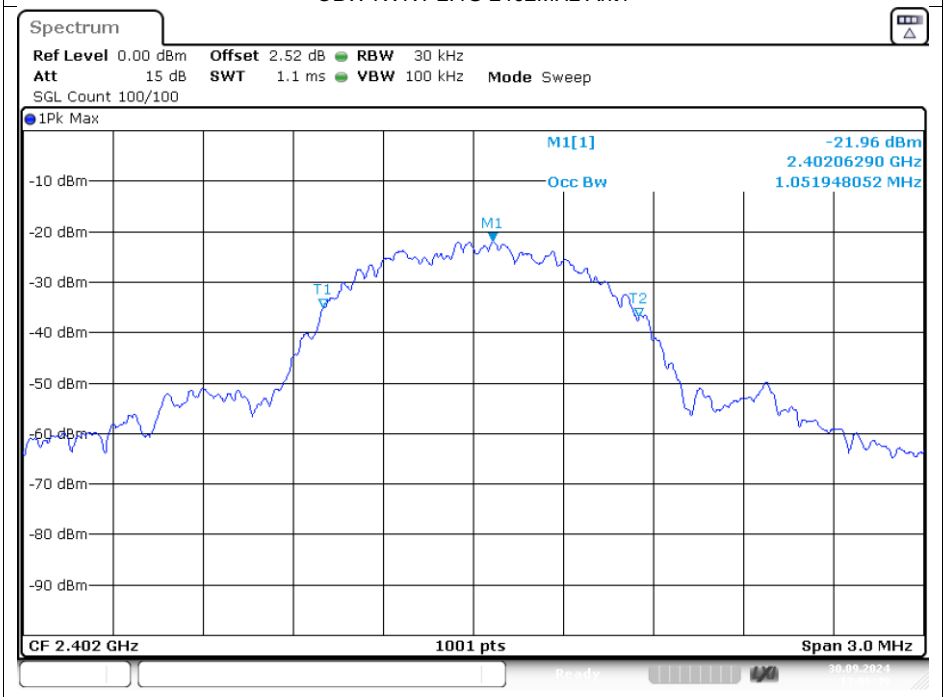


Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	2.4G	2402	Ant1	1.052
NVNT	2.4G	2440	Ant1	1.057
NVNT	2.4G	2480	Ant1	1.079

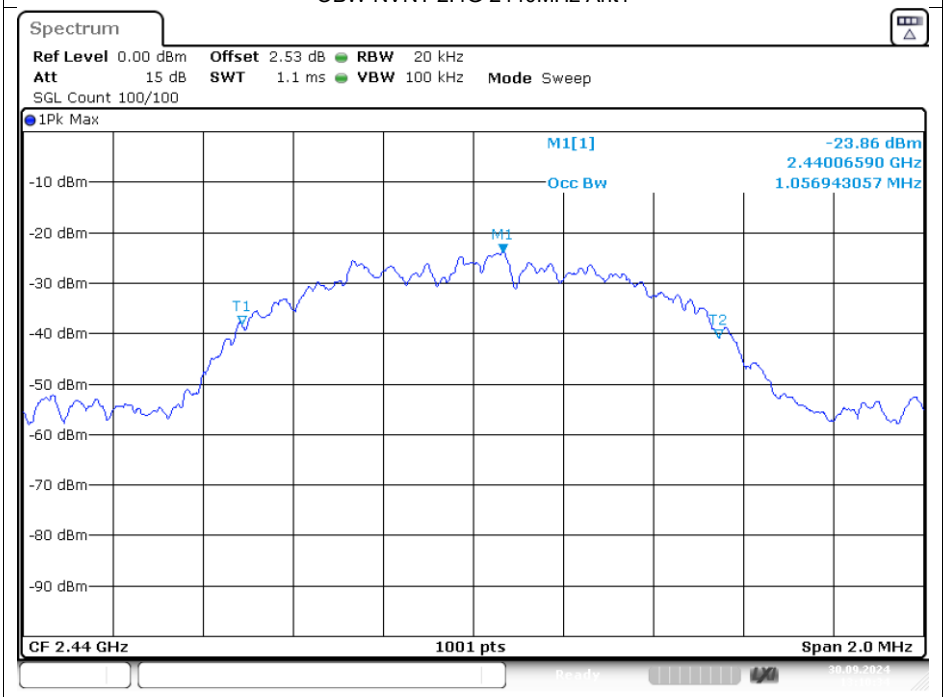
Test Graphs

OBW NVNT 2.4G 2402MHz Ant1



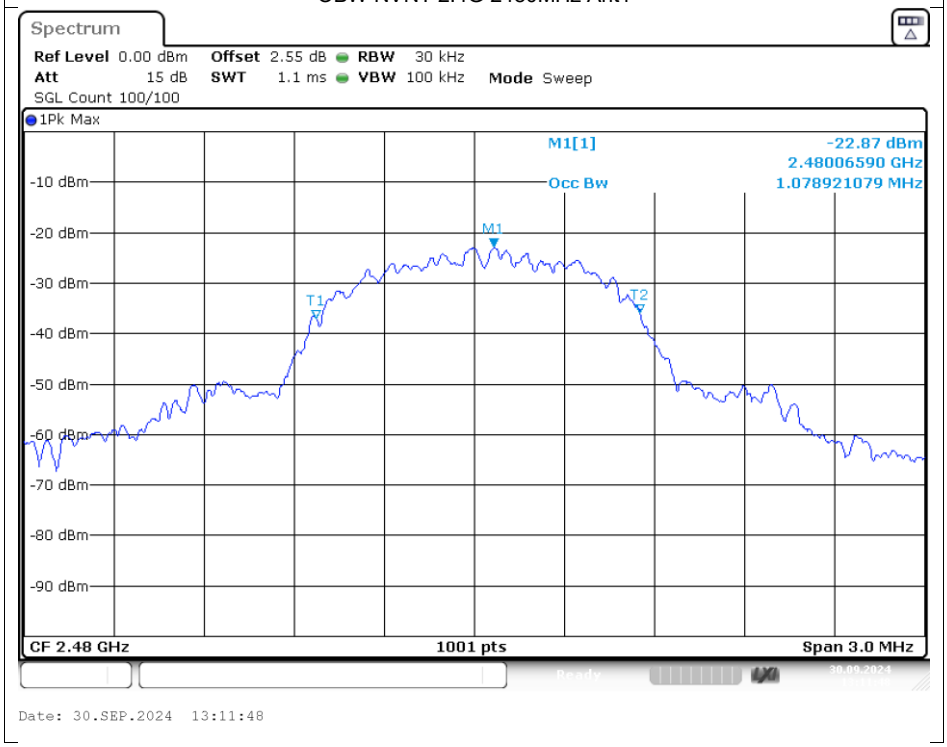
Date: 30.SEP.2024 13:06:50

OBW NVNT 2.4G 2440MHz Ant1



Date: 30.SEP.2024 13:10:34

OBW NVNT 2.4G 2480MHz Ant1

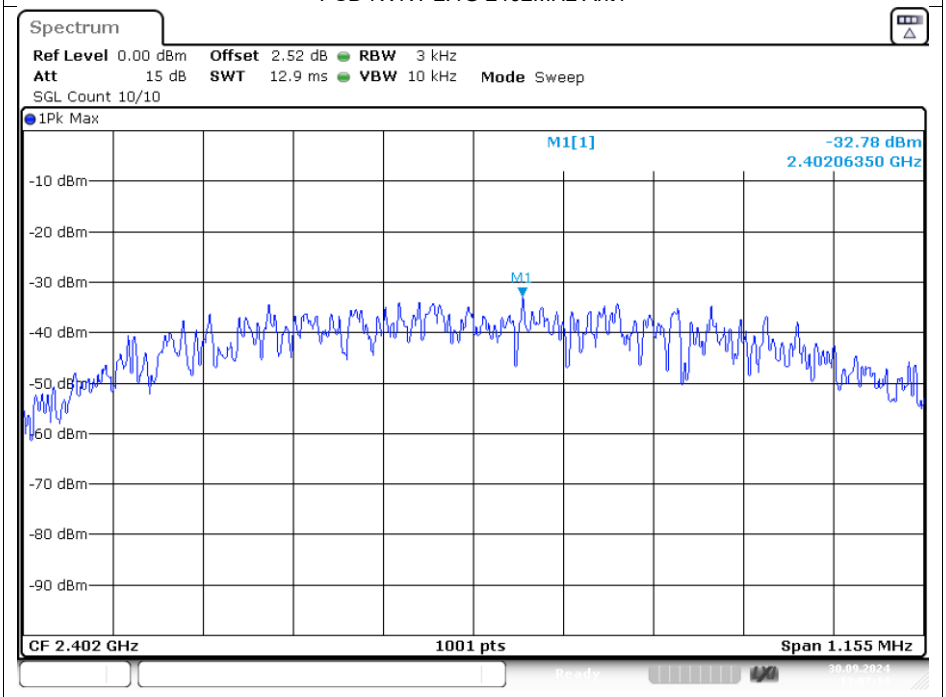


Maximum Power Spectral Density Level

Condition	Mode	Frequency (MHz)	Antenna	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
NVNT	2.4G	2402	Ant1	-32.78	8	Pass
NVNT	2.4G	2440	Ant1	-32.75	8	Pass
NVNT	2.4G	2480	Ant1	-33.96	8	Pass

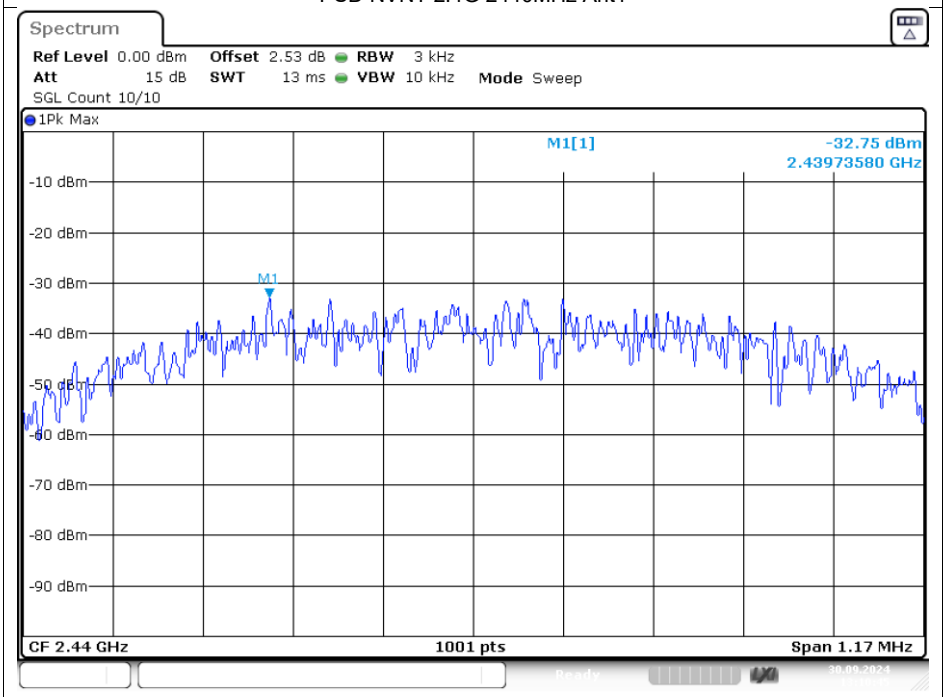
Test Graphs

PSD NVNT 2.4G 2402MHz Ant1



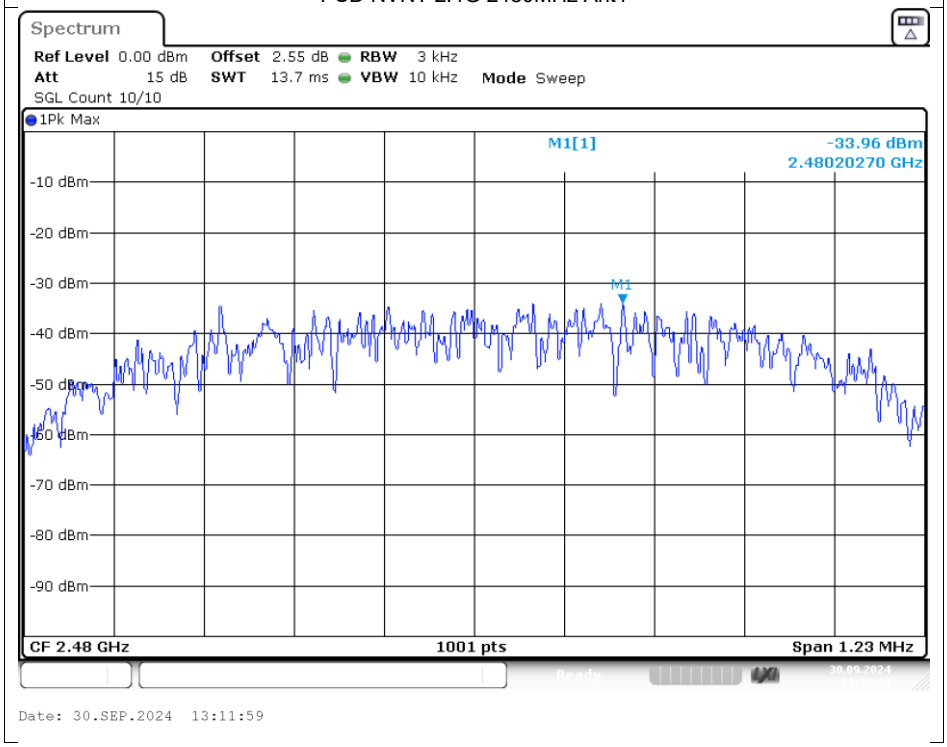
Date: 30.SEP.2024 13:07:14

PSD NVNT 2.4G 2440MHz Ant1



Date: 30.SEP.2024 13:10:45

PSD NVNT 2.4G 2480MHz Ant1

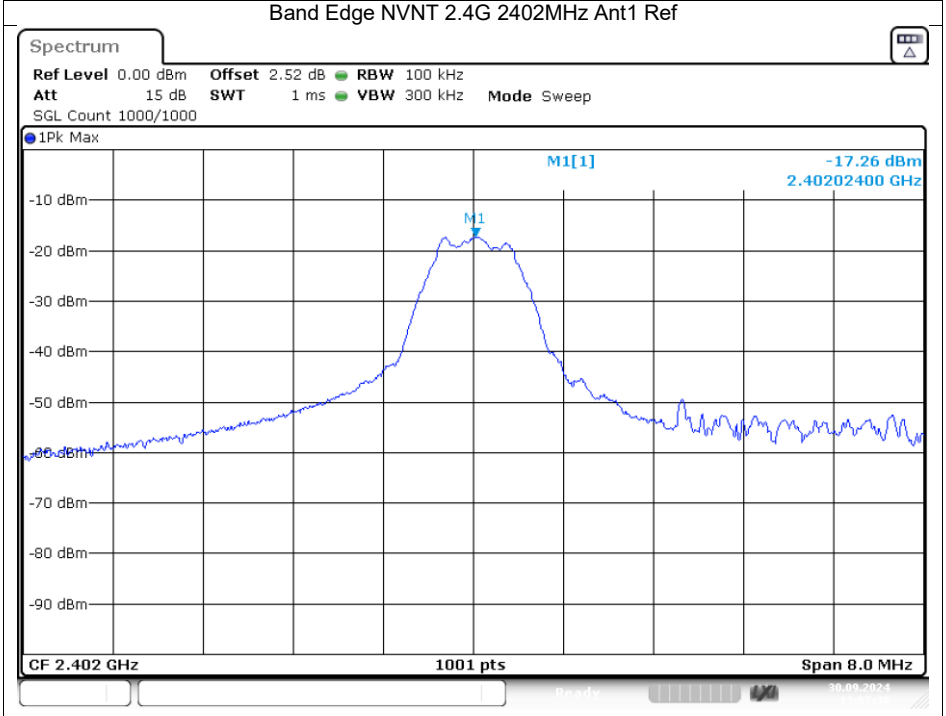


Band Edge

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	2.4G	2402	Ant1	-36.32	-20	Pass
NVNT	2.4G	2480	Ant1	-41.58	-20	Pass

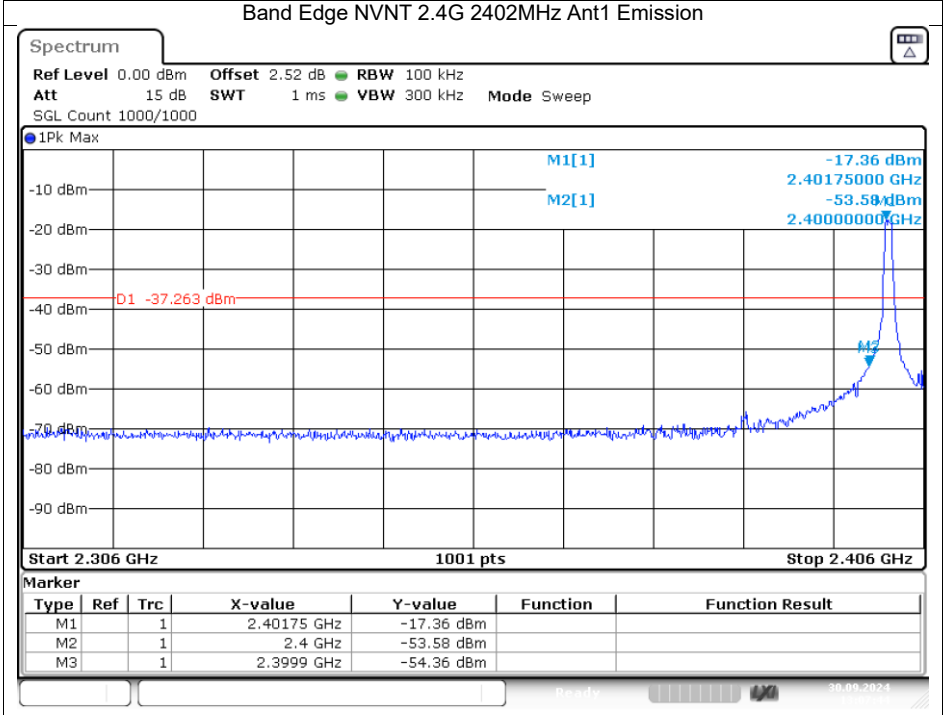
Test Graphs

Band Edge NVNT 2.4G 2402MHz Ant1 Ref



Date: 30.SEP.2024 13:07:30

Band Edge NVNT 2.4G 2402MHz Ant1 Emission

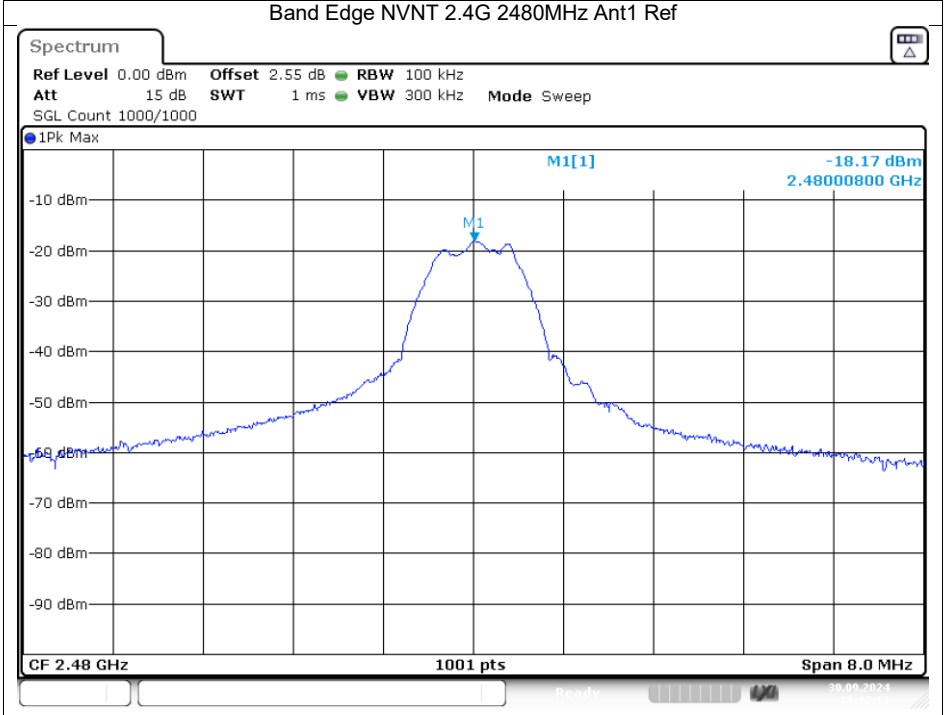


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40175 GHz	-17.36 dBm		
M2		1	2.4 GHz	-53.58 dBm		
M3		1	2.3999 GHz	-54.36 dBm		

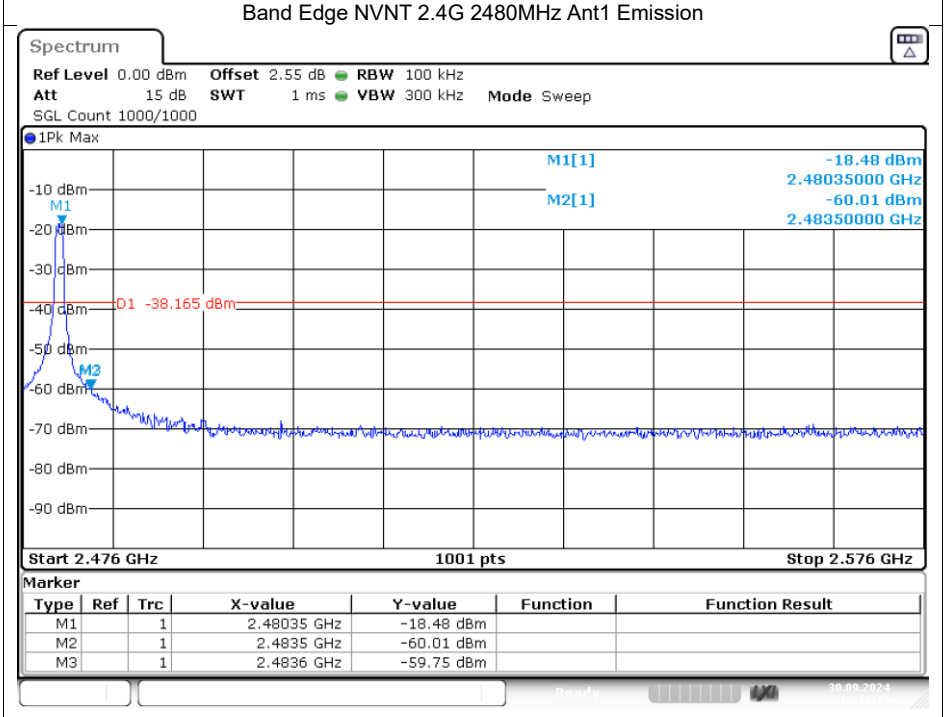
Date: 30.SEP.2024 13:07:43

Band Edge NVNT 2.4G 2480MHz Ant1 Ref



Date: 30.SEP.2024 13:12:10

Band Edge NVNT 2.4G 2480MHz Ant1 Emission



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48035 GHz	-18.48 dBm		
M2		1	2.4835 GHz	-60.01 dBm		
M3		1	2.4836 GHz	-59.75 dBm		

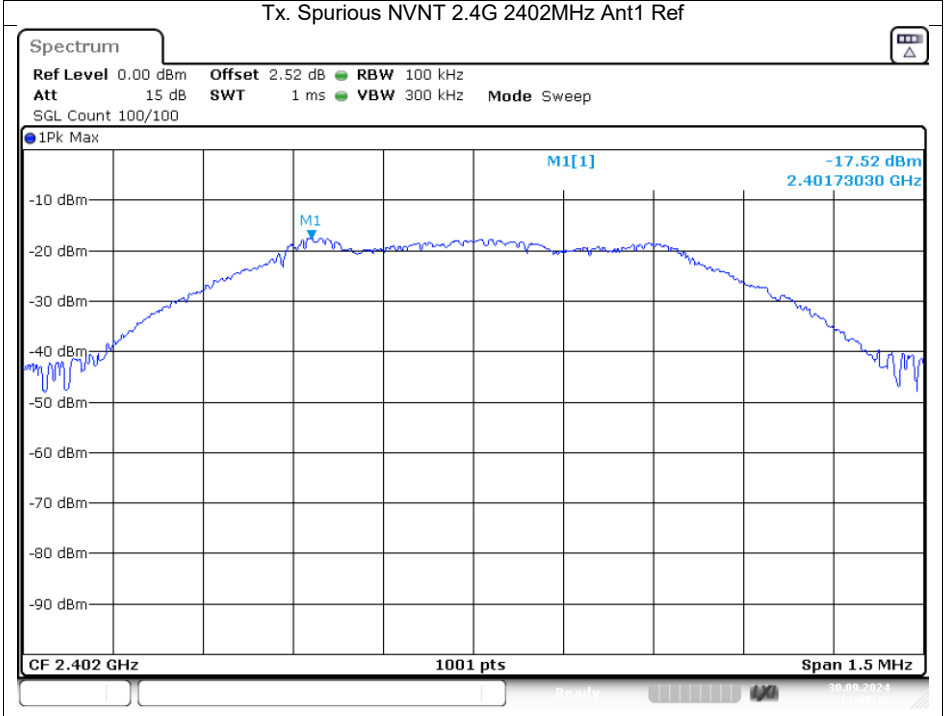
Date: 30.SEP.2024 13:12:19

Conducted RF Spurious Emission

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	2.4G	2402	Ant1	-29.89	-20	Pass
NVNT	2.4G	2440	Ant1	-31.51	-20	Pass
NVNT	2.4G	2480	Ant1	-31.63	-20	Pass

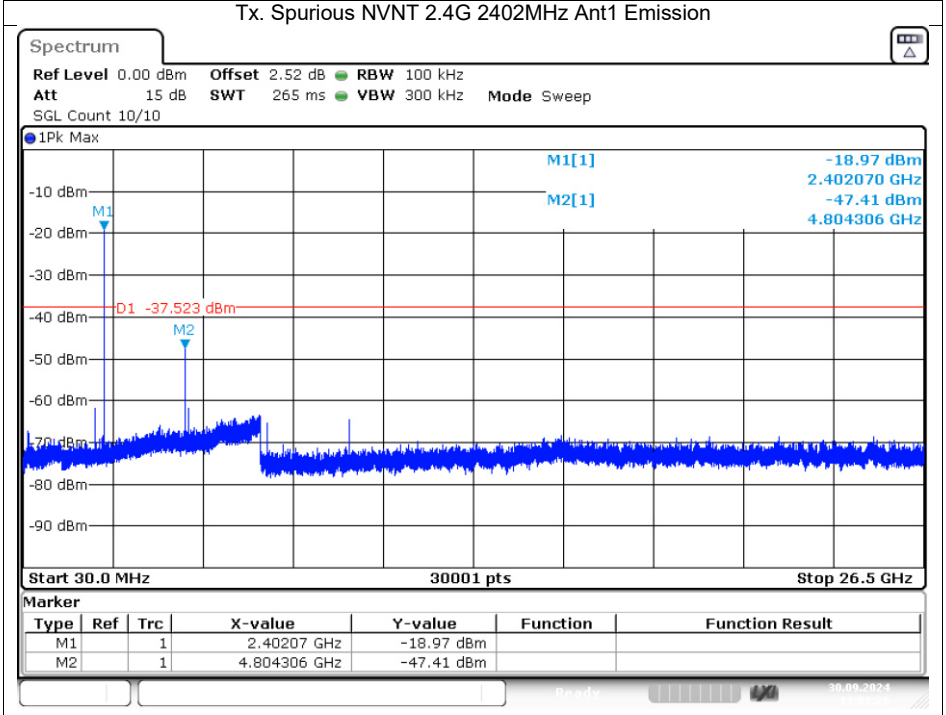
Test Graphs

Tx. Spurious NVNT 2.4G 2402MHz Ant1 Ref



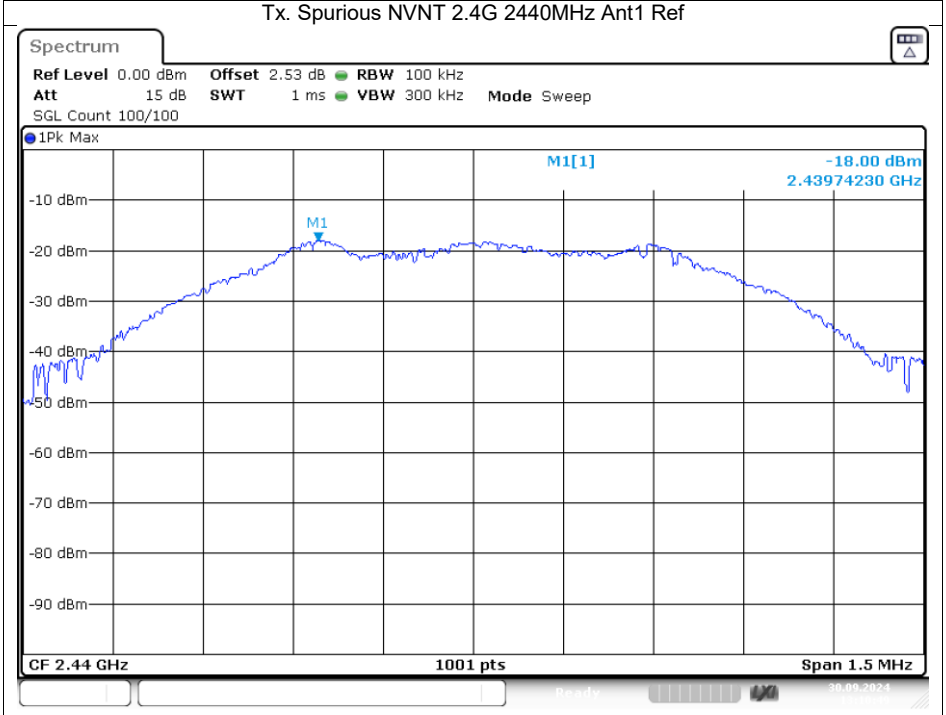
Date: 30.SEP.2024 13:08:10

Tx. Spurious NVNT 2.4G 2402MHz Ant1 Emission



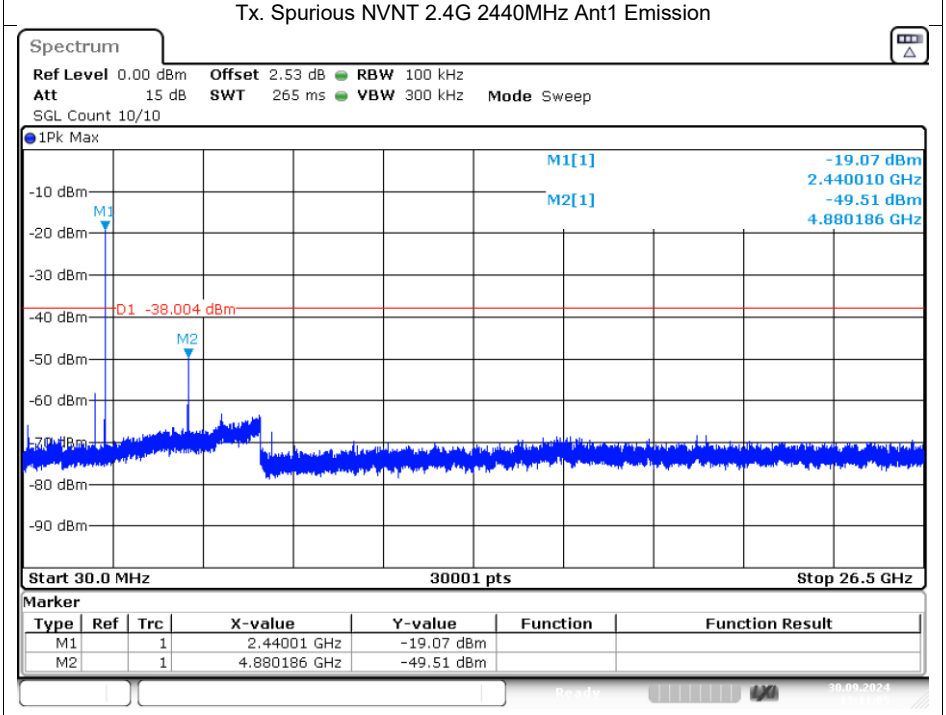
Date: 30.SEP.2024 13:08:26

Tx. Spurious NVNT 2.4G 2440MHz Ant1 Ref



Date: 30.SEP.2024 13:10:49

Tx. Spurious NVNT 2.4G 2440MHz Ant1 Emission

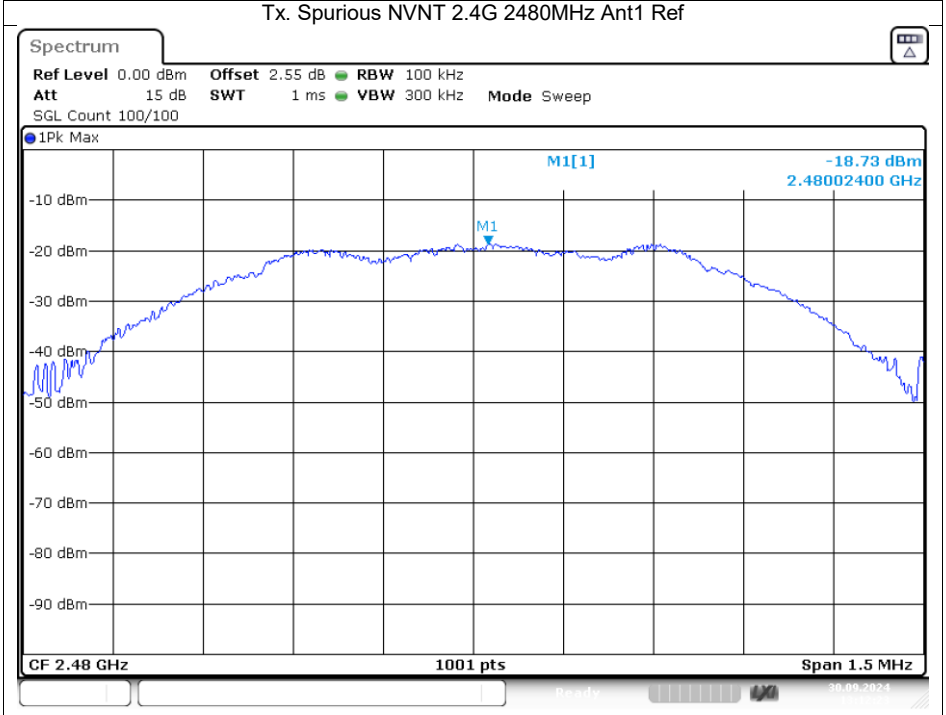


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44001 GHz	-19.07 dBm		
M2		1	4.880186 GHz	-49.51 dBm		

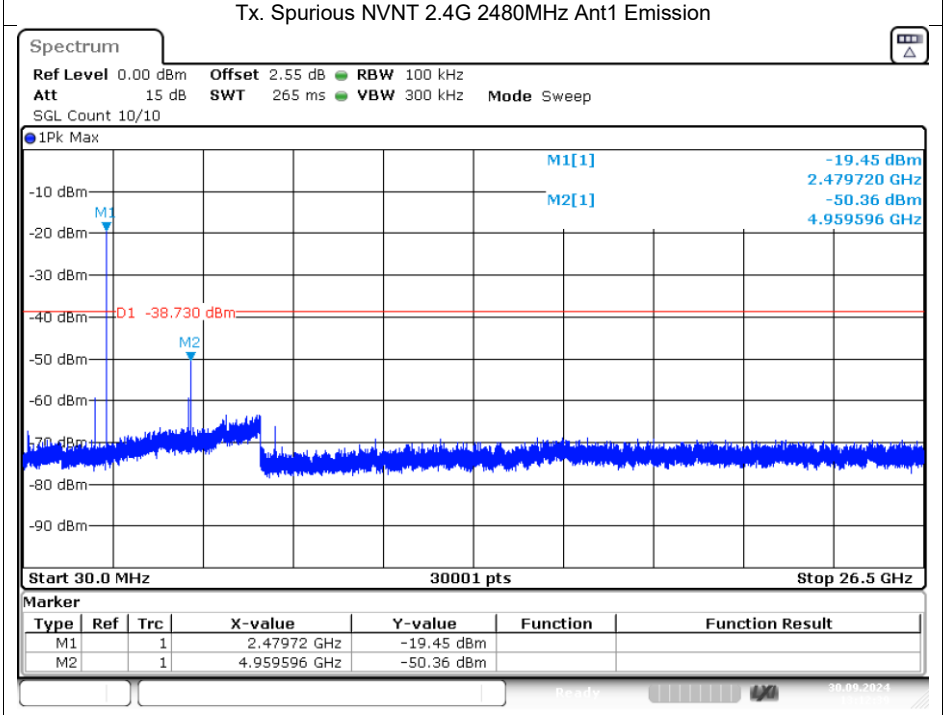
Date: 30.SEP.2024 13:11:05

Tx. Spurious NVNT 2.4G 2480MHz Ant1 Ref



Date: 30.SEP.2024 13:12:24

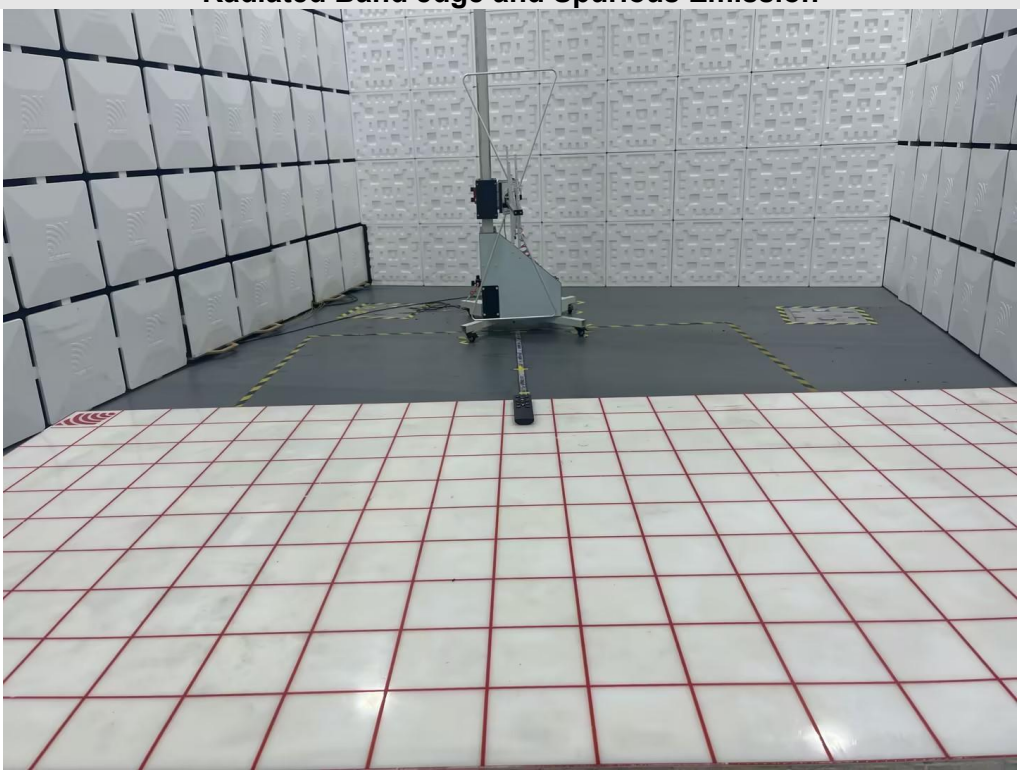
Tx. Spurious NVNT 2.4G 2480MHz Ant1 Emission

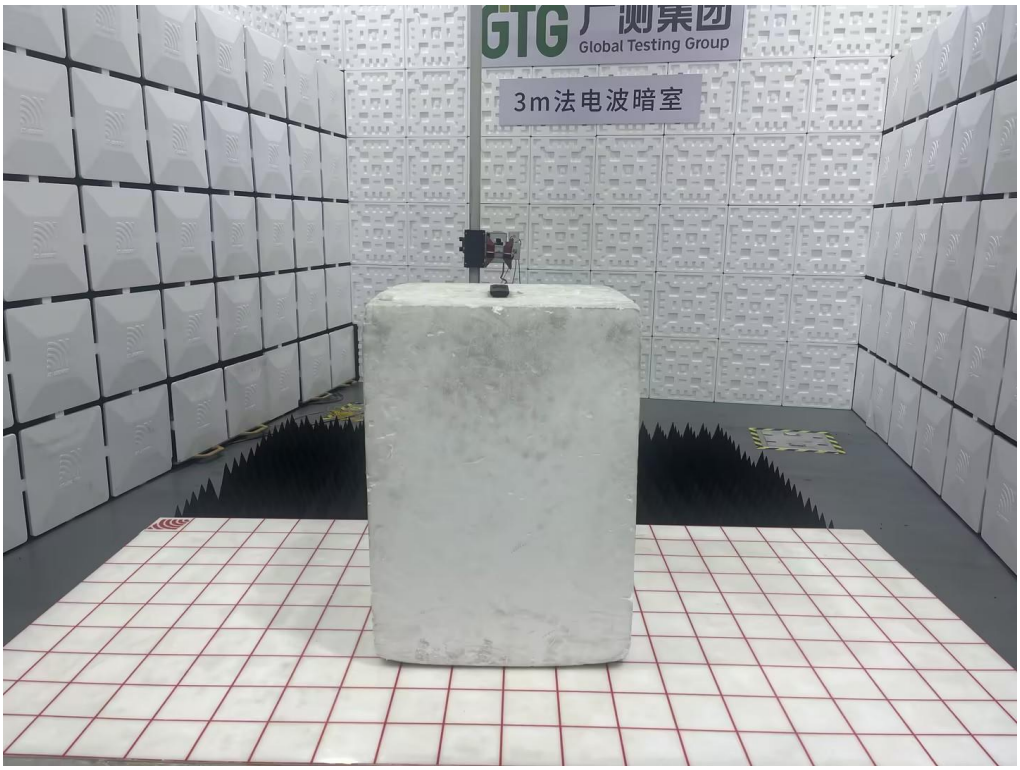


Date: 30.SEP.2024 13:12:39

APPENDIX: PHOTOGRAPHS OF TEST CONFIGURATION

Radiated Band edge and Spurious Emission





END OF REPORT