



## SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.

SHEM-TRF-001 Rev. 02 Sep01, 2023

Report No.: SHCR250100008703

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# TEST REPORT

<b>Application No.:</b>	SHCR2501000087AT
<b>FCC ID:</b>	2AJONSEED060A06G2
<b>Applicant:</b>	Shanghai Rising Digital Co., Ltd.
<b>Address of Applicant:</b>	No. 318, Chuanda Road, Pudong New District, Shanghai, China
<b>Manufacturer:</b>	Shanghai Rising Digital Co., Ltd.
<b>Address of Manufacturer:</b>	No. 318, Chuanda Road, Pudong New District, Shanghai, China
<b>Factory:</b>	Shanghai Rising Digital Co., Ltd.
<b>Address of Factory:</b>	No. 318, Chuanda Road, Pudong New District, Shanghai, China
<b>Equipment Under Test (EUT):</b>	
<b>EUT Name:</b>	Controller
<b>Model No.:</b>	SEED-060A-06(G2),SEED-060A-06(E2),SEED-060A-06(D2), SEED-060B-06(E2),SEED-060B-06(G2),SEED-060B-06(D2),SEED-060A-06(S2) ♣
♣	Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
<b>Standard(s) :</b>	47 CFR Part 15, Subpart C 15.247
<b>Date of Receipt:</b>	2025-01-10
<b>Date of Test:</b>	2025-02-24 to 2025-03-14
<b>Date of Issue:</b>	2025-03-17
<b>Test Result:</b>	<b>Pass*</b>

\* In the configuration tested, the EUT complied with the standards specified above.

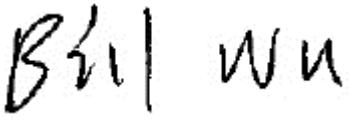
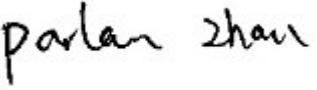
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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

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<b>Revision Record</b>			
<b>Version</b>	<b>Description</b>	<b>Date</b>	<b>Remark</b>
00	Original	2025-03-17	/

<b>Authorized for issue by:</b>			
<b>Tested By</b>	 Bill Wu	Bill Wu	
		Bill Wu/Project Engineer	
<b>Approved By</b>	 Parlam Zhan	Parlam Zhan	
		Parlam Zhan/Reviewer	

## 2 Test Summary

<b>Radio Spectrum Technical Requirement</b>				
<b>Item</b>	<b>Standard</b>	<b>Method</b>	<b>Requirement</b>	<b>Result</b>
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass

<b>Radio Spectrum Matter Part</b>				
<b>Item</b>	<b>Standard</b>	<b>Method</b>	<b>Requirement</b>	<b>Result</b>
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Below 1GHz		ANSI C63.10 (2013) Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Above 1GHz		ANSI C63.10 (2013) Section 6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Conducted Peak Output Power		ANSI C63.10 (2013) Section 11.9.1	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Minimum 6dB Bandwidth		ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Power Spectrum Density		ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass

### Declaration of EUT Family Grouping:

Note: There are series models mentioned in this report, and they are identical in electrical and electronic characters. Only the model SEED-060A-06(G2) was tested since their differences were the model number and appearance.

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## 4 General Information

### 4.1 Details of E.U.T.

Power supply:	DC 24V,3A
Operation Frequency:	2402MHz to 2480MHz
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	External Antenna
Antenna Gain:	2.5dBi (Provided by the manufacturer)

### 4.2 Power level setting using in test

Channel	BLE 1M
	Ant 1
0	Default
19	Default
39	Default

### 4.3 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Notebook	Lenovo	A1402	/
DC power supply	Agilent	/	/

### 4.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$8.4 \times 10^{-8}$
2	Timeout	2s
3	Duty Cycle	0.37%
4	Occupied Bandwidth	3%
5	RF Conducted Power	0.6dB
6	RF Power Density	2.9dB
7	Conducted Spurious Emissions	0.75dB
8	RF Radiated Power	5.2dB (Below 1GHz) 5.9dB (Above 1GHz)
9	Radiated Spurious Emission Test	4.2dB (Below 30MHz) 4.5dB (30MHz-1GHz) 5.1dB (1GHz-18GHz) 5.4dB (Above 18GHz)
10	Temperature Test	1°C
11	Humidity Test	3%
12	Supply Voltages	1.5%
13	Time	3%

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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### 4.5 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888 Fax: +86 512 5737 0818

Note:

1. SGS is not responsible for wrong test results due to incorrect information (e.g., max. internal working frequency, antenna gain, cable loss, etc) is provided by the applicant. (If applicable).
2. SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (If applicable).
3. Sample source: sent by customer.

### 4.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **A2LA**

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

- **FCC**

Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory. Designation Number: CN1172.

- **ISED**

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory.

Company Number: 2324E; CAB Identifier: CN0072.

- **VCCI**

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, R-11600, C-11707, T-11499, G-10216 respectively.

### 4.7 Deviation from Standards

None

### 4.8 Abnormalities from Standard Conditions

None

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## 5 Equipment List

Item	Equipment	Manufacturer	Model	Inventory No	Cal Date	Cal. Due Date
<b>Conducted Emission at Mains Terminals</b>						
1	EMI Test Receive	R&S	ESCI	KS301101	03/19/2024	03/18/2025
2	LISN	R&S	ENV216	KS301197	01/15/2025	01/14/2026
3	LISN	Schwarzbeck	NNLK 8129	KS301091	01/15/2025	01/14/2026
4	Pulse Limiter	R&S	ESH3-Z2	KUS1902E001	12/05/2024	12/04/2025
5	CE test Cable	Thermax	/	CZ301102	01/14/2025	01/13/2026
6	Test Software	ESE	E3_V 6.111221a	/	N.C.R	N.C.R
<b>RF Conducted Test</b>						
1	Spectrum Analyzer	Keysight	N9020A	KUS1911E004-2	08/01/2024	07/31/2025
2	Spectrum Analyzer	Keysight	N9020A	KUS2001M001-2	08/01/2024	07/31/2025
3	Spectrum Analyzer	Keysight	N9030B	KSEM021-1	01/15/2025	01/14/2026
4	Signal Generator	R&S	SMBV100B	KSEM032	03/19/2024	03/18/2025
5	Signal Generator	R&S	SMW200A	KSEM020-1	08/02/2024	08/01/2025
6	Signal Generator	Agilent	N5182A	KUS2001M001-1	08/01/2024	07/31/2025
7	Radio Communication Test Station	Anritsu	MT8000A	KSEM001-1	08/01/2024	07/31/2025
8	Radio Communication Analyzer	Anritsu	MT8821C	KSEM002-1	03/19/2024	03/18/2025
9	Universal Radio Communication Tester	R&S	CMW500	KUS1911E004-1	08/13/2024	08/12/2025
10	Switcher	TST	FY562	KUS2001M001-4	01/15/2025	01/14/2026
11	AC Power Source	EXTECH	6605	KS301178	N.C.R	N.C.R
12	DC Power Supply	Agilent	E3632A	KS301180	N.C.R	N.C.R
13	Conducted Test Cable	Thermax	RF01-RF04	CZ301111-CZ301120	01/14/2025	01/13/2026
14	Temp. / Humidity Chamber	TERCHY	MHK-120AK	KS301190	08/26/2024	08/25/2025
15	Temperature & Humidity Recorder	Renke Control	RS-WS-N01-6J	KSEM024-5	03/19/2024	03/18/2025
16	Software	BST	TST-PASS	/	NCR	NCR
<b>RF Radiated Test</b>						
1	Spectrum Analyzer	R&S	FSV40	KUS1806E003	08/06/2024	08/05/2025
2	Universal Radio Communication Tester	R&S	CMW500	KSEM009-1	03/19/2024	03/18/2025
3	Signal Generator	Agilent	E8257C	KS301066	08/06/2024	08/05/2025
4	Loop Antenna	COM-POWER	AL-130R	KUS1806E001	03/18/2023	03/17/2025
5	Bilog Antenna	TESEQ	CBL 6112D	KUS1806E005	06/29/2023	06/28/2025
6	Bilog Antenna	TESEQ	CBL 6112D	KUS1806E006	03/19/2024	03/18/2025
7	Horn-antenna(1-18GHz)	Schwarzbeck	BBHA9120D	KS301079	03/23/2024	03/22/2025
8	Horn-antenna(1-18GHz)	ETS-LINDGREN	3117	KS301186	04/07/2023	04/06/2025
9	Horn Antenna(18-40GHz)	Schwarzbeck	BBHA9170	CZ301058	01/07/2024	01/06/2026
10	Amplifier(30MHz~18GHz)	PANSHAN TECHNOLOGY	LNA:1~18G	KSEM010-1	01/15/2025	01/14/2026
11	Amplifier(18~40GHz)	PANSHAN TECHNOLOGY	LNA180400G40	KSEM038	08/12/2024	08/11/2025
12	RE Test Cable	REBES MICROWAVE	/	CZ301097	08/23/2024	08/22/2025
13	Temperature & Humidity Recorder	Renke Control	RS-WS-N01-6J	KSEM024-4	03/19/2024	03/18/2025
14	Software	Faratronic	EZ_EMC-v 3A1	/	NCR	NCR
15	Software	ESE	E3_V 6.111221a	/	NCR	NCR

## 6 Radio Spectrum Technical Requirement

### 6.1 Antenna Requirement

#### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

#### 6.1.2 Conclusion

Standard Requirement:

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, 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.

15.247(b) (4) requirement:

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.

EUT Antenna:

The antenna is External Antenna and no consideration of replacement. The best case gain of the antenna is 2.5dBi.

Antenna location: Refer to internal photo.

## 7 Radio Spectrum Matter Test Results

### 7.1 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 &amp; 15.209

Test Method: ANSI C63.10 (2013) Section 6.10.5

Measurement Distance: 3M

Limit:

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
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

#### 7.1.1 E.U.T. Operation

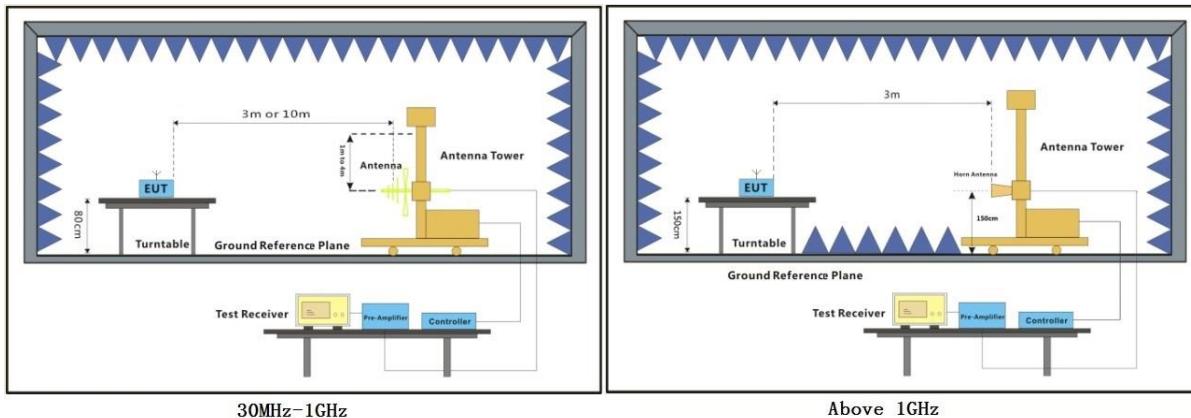
Operating Environment:

Temperature: 23.3 °C      Humidity: 45.2 % RH      Atmospheric Pressure: 1010 mbar

#### 7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.1.3 Test Setup Diagram



### 7.1.4 Measurement Procedure and Data

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- Test the EUT in the lowest channel, the middle channel, the Highest channel.
- The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Remark 3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for Peak detection (PK) and Average detection (AV) at frequency above 1GHz.

Remark 4: For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle  $< 98\%$ ) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.

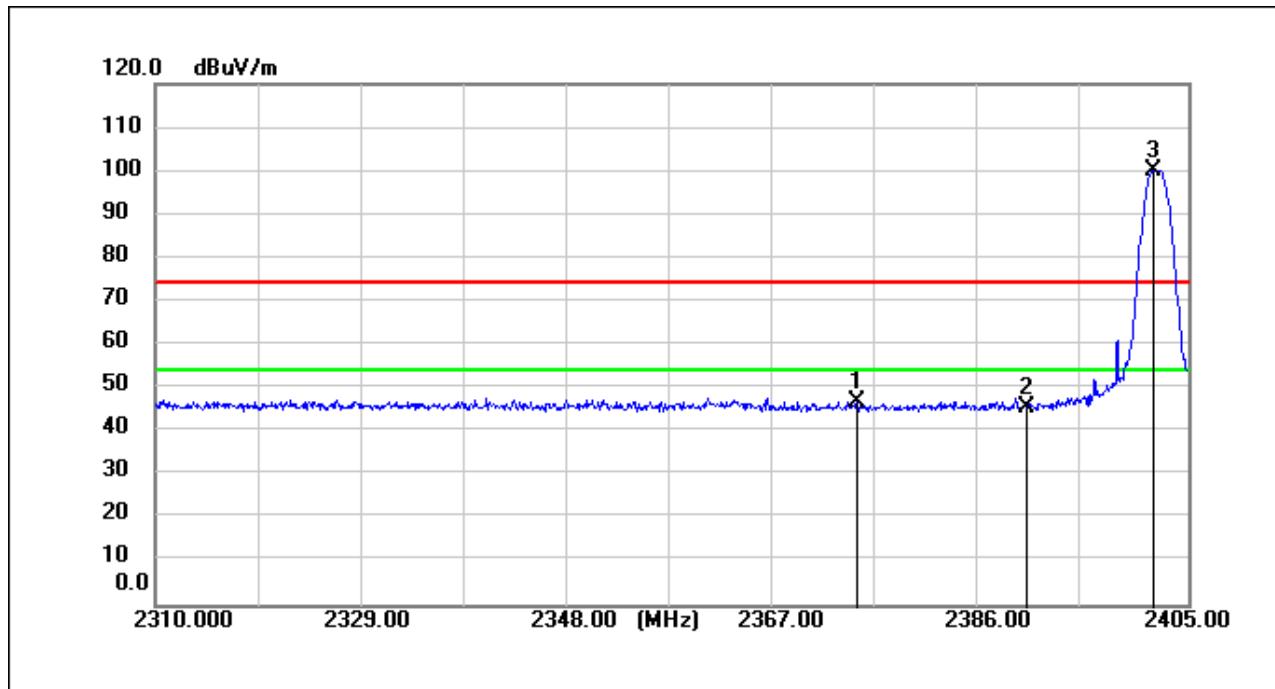
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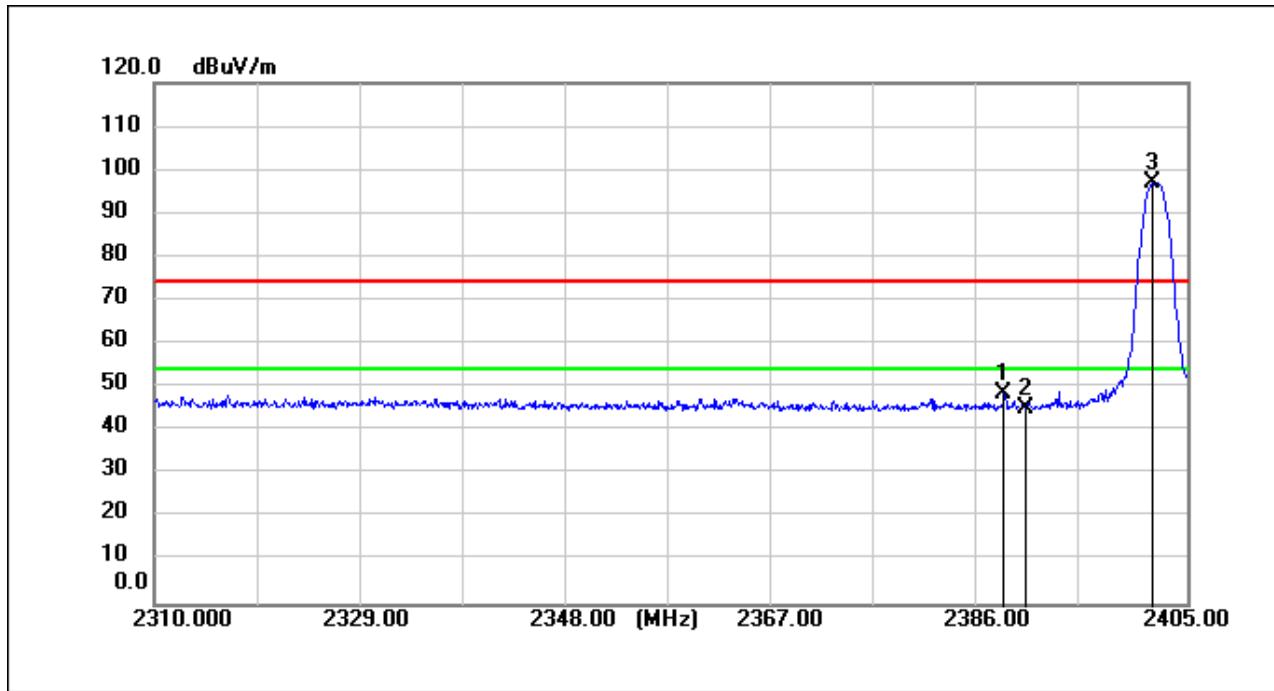
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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:Low



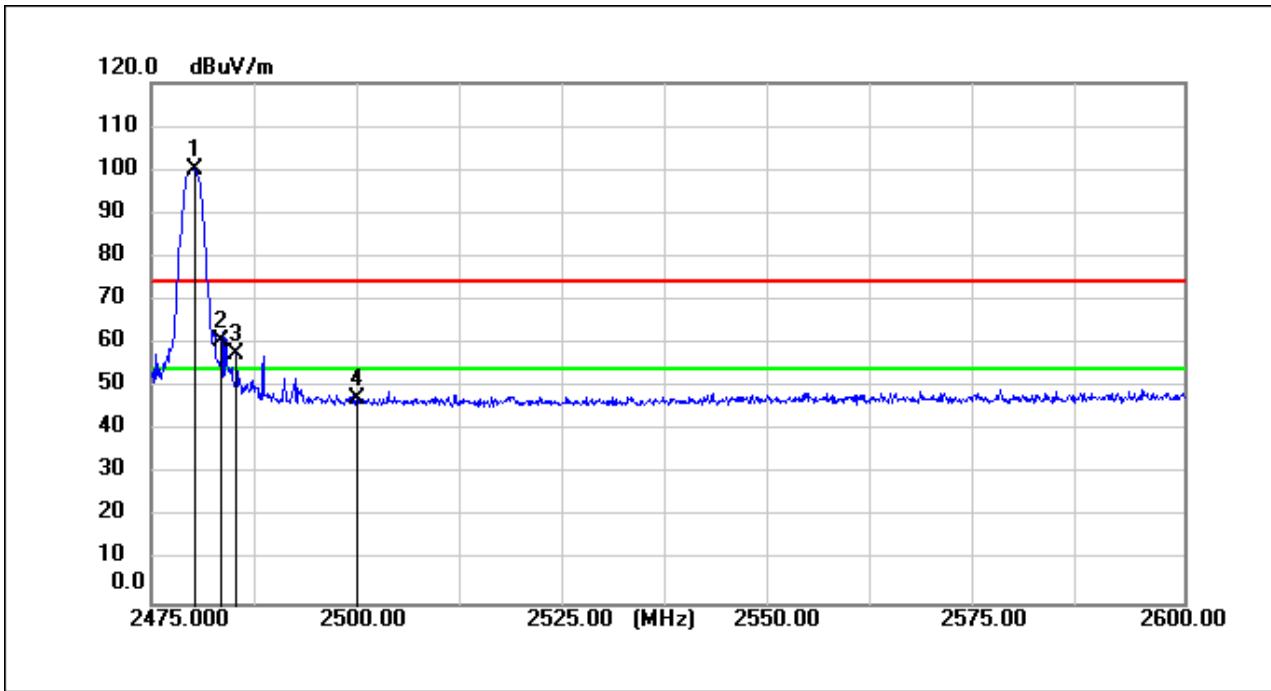
No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2374.505	47.97	-0.87	47.10	74.00	-26.90	peak
2	2390.000	46.57	-0.79	45.78	74.00	-28.22	peak
3	2401.865	100.81	-0.73	100.08	74.00	26.08	peak

Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



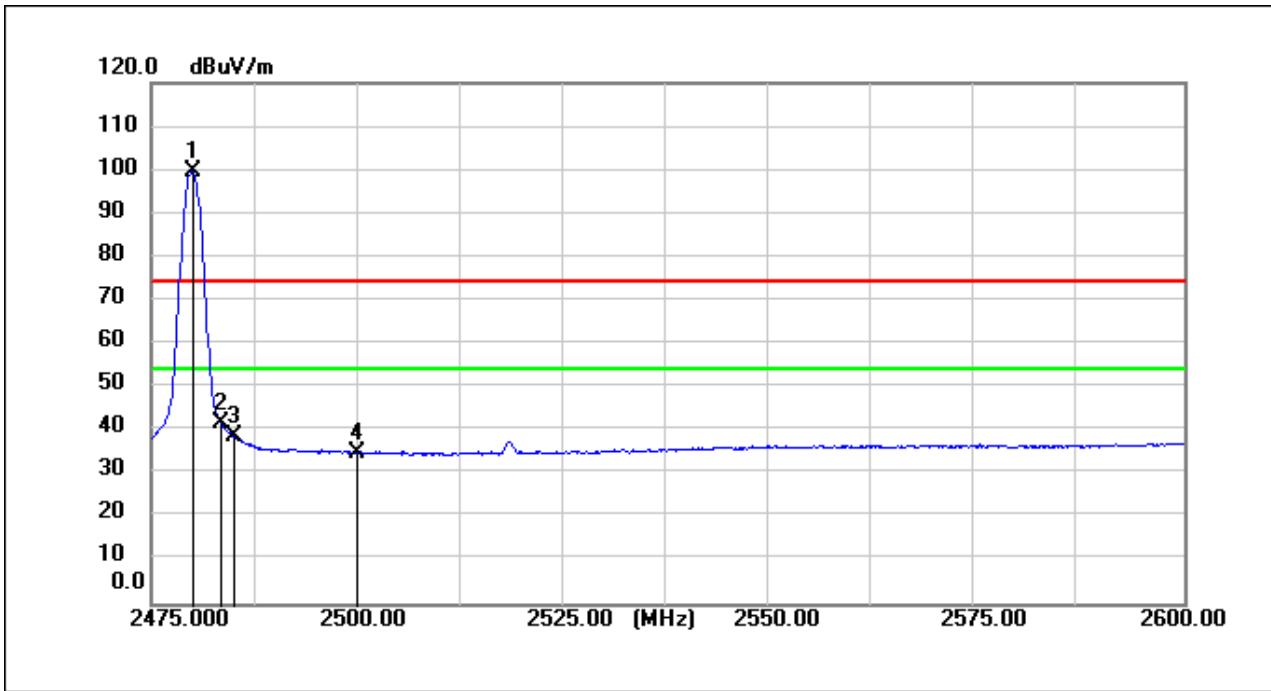
No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2388.185	49.53	-0.80	48.73	74.00	-25.27	peak
2	2390.000	46.14	-0.79	45.35	74.00	-28.65	peak
3	2401.865	97.64	-0.73	96.91	74.00	22.91	peak

Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:High



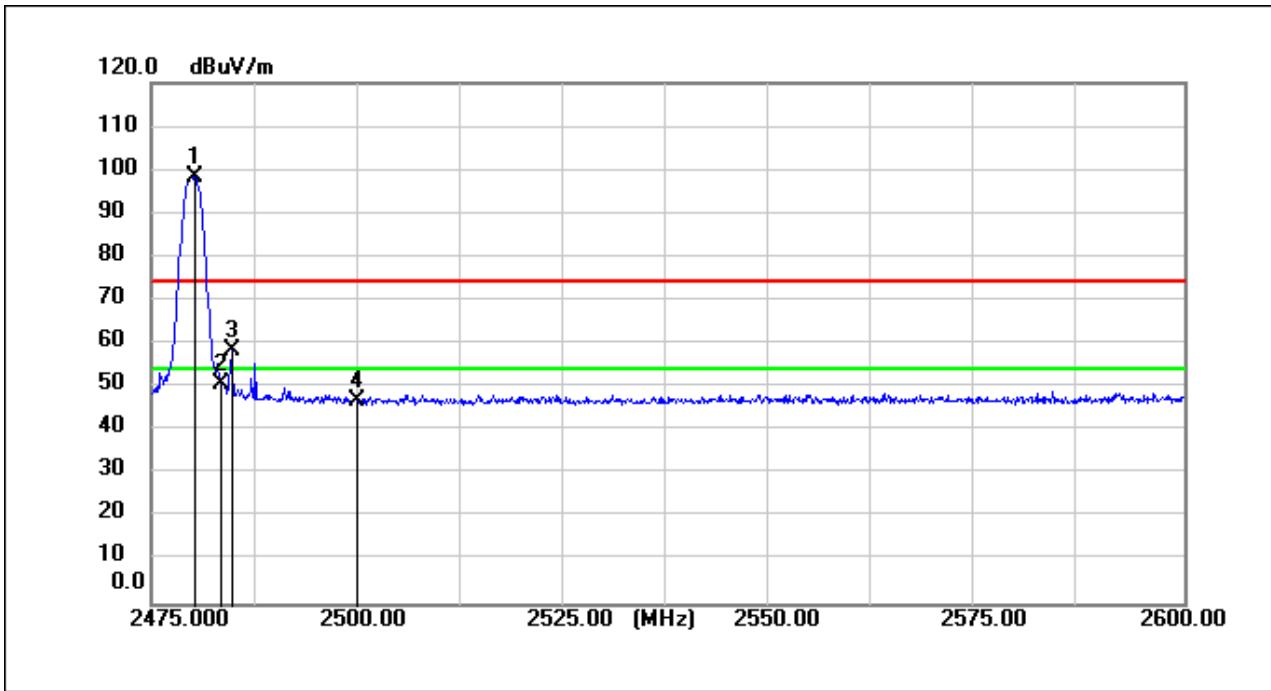
No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.250	100.44	-0.34	100.10	74.00	26.10	peak
2	2483.500	61.17	-0.33	60.84	74.00	-13.16	peak
3	2485.375	57.96	-0.31	57.65	74.00	-16.35	peak
4	2500.000	47.42	-0.24	47.18	74.00	-26.82	peak

Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:High



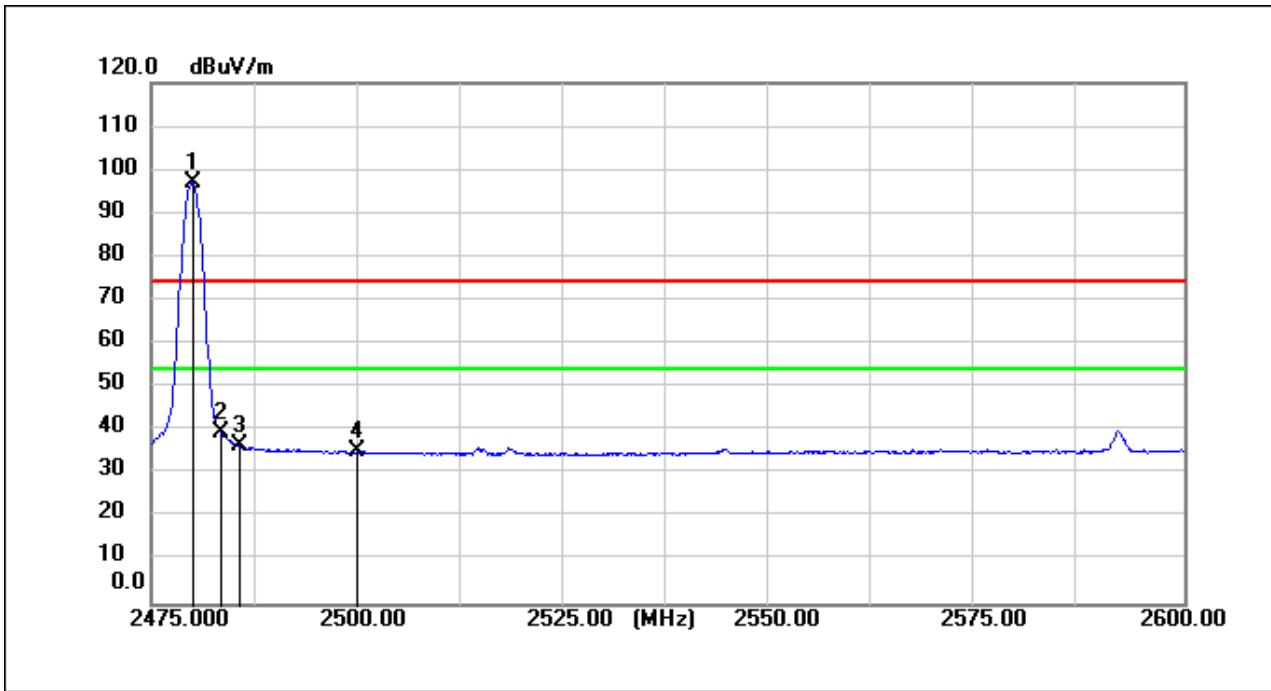
No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.000	99.91	-0.34	99.57	54.00	45.57	AVG
2	2483.500	42.13	-0.33	41.80	54.00	-12.20	AVG
3	2485.000	39.09	-0.32	38.77	54.00	-15.23	AVG
4	2500.000	35.19	-0.24	34.95	54.00	-19.05	AVG

Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.250	98.56	-0.34	98.22	74.00	24.22	peak
2	2483.500	51.03	-0.33	50.70	74.00	-23.30	peak
3	2484.750	58.72	-0.32	58.40	74.00	-15.60	peak
4	2500.000	47.29	-0.24	47.05	74.00	-26.95	peak

Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.000	97.31	-0.34	96.97	54.00	42.97	AVG
2	2483.500	39.83	-0.33	39.50	54.00	-14.50	AVG
3	2485.750	36.76	-0.31	36.45	54.00	-17.55	AVG
4	2500.000	35.39	-0.24	35.15	54.00	-18.85	AVG

### 7.2 Radiated Spurious Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.4,6.5

Measurement Distance: 3M

Limit:

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
30-88	100	3
88-216	150	3
216-960	200	3
960-1000	500	3

#### 7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23.3 °C

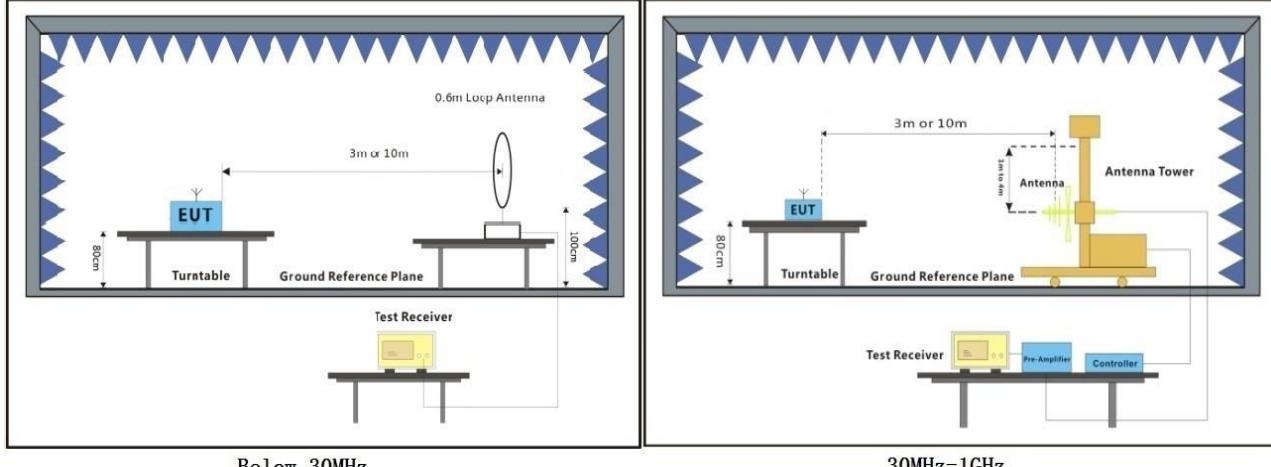
Humidity: 45.2 % RH

Atmospheric Pressure: 1010 mbar

#### 7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

#### 7.2.3 Test Setup Diagram



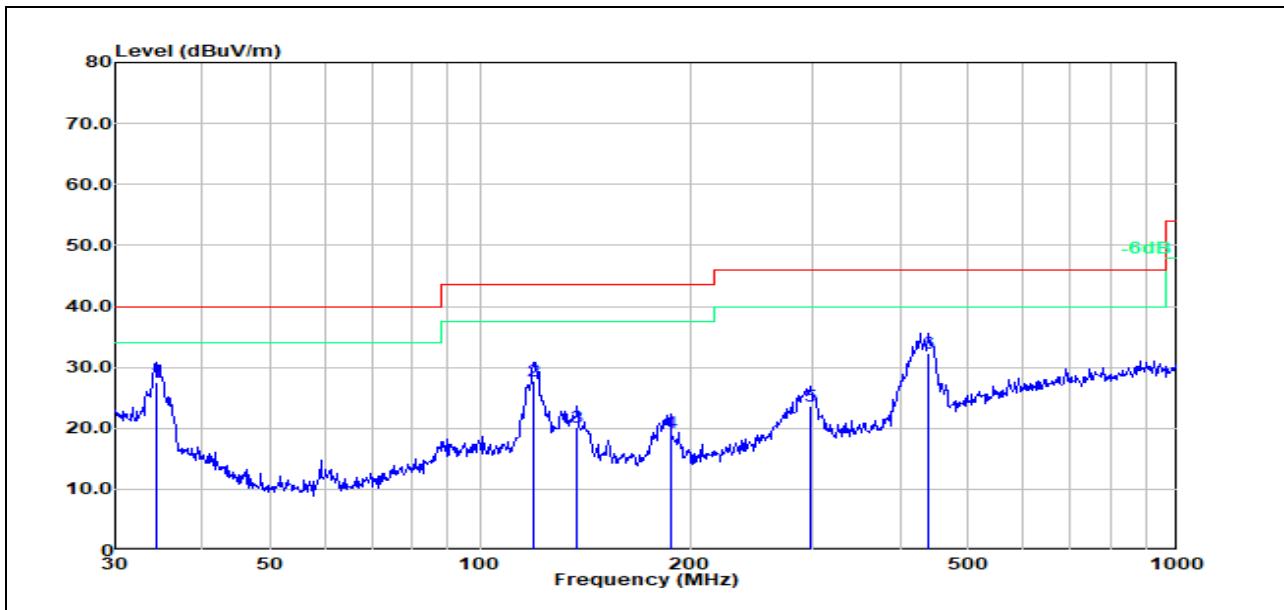
**7.2.4 Measurement Procedure and Data**

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using quasi-peak method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

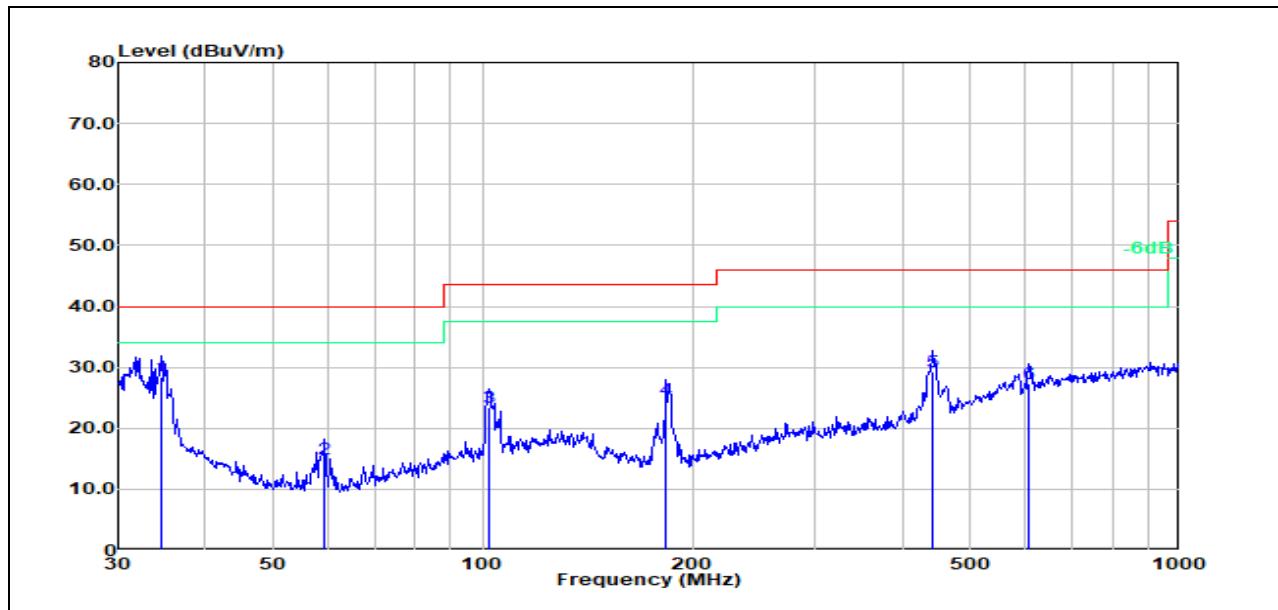
1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

Test Mode: 02; Polarity: Horizontal

**Test Data :**

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	34.2760	11.06	16.53	27.59	40.00	-12.41	100	13	QP
2	119.4360	13.21	14.55	27.76	43.50	-15.74	200	155	QP
3	137.9030	5.41	14.85	20.26	43.50	-23.24	200	349	QP
4	187.7530	6.95	12.26	19.21	43.50	-24.29	100	360	QP
5	297.2240	7.79	15.83	23.62	46.00	-22.38	200	222	QP
6	440.1960	13.11	19.20	32.31	46.00	-13.69	100	2	QP

Test Mode: 02; Polarity: Vertical

**Test Data :**

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	34.5170	12.01	16.34	28.35	40.00	-11.65	100	302	QP
2	59.4410	9.11	5.94	15.05	40.00	-24.95	100	359	QP
3	102.0014	10.45	12.86	23.31	43.50	-20.19	100	18	QP
4	183.2005	12.14	12.50	24.64	43.50	-18.86	100	335	QP
5	443.2943	10.29	19.07	29.36	46.00	-16.64	100	11	QP
6	607.7867	4.49	22.93	27.42	46.00	-18.58	100	160	QP

### 7.3 Radiated Spurious Emissions Above 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.6

Measurement Distance: 3M

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
Above 1000	500	3

#### 7.3.1 E.U.T. Operation

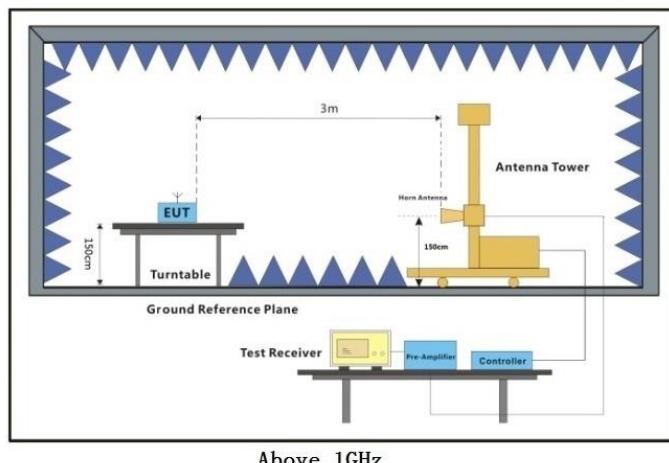
Operating Environment:

Temperature: 23.3 °C      Humidity: 45.2 % RH      Atmospheric Pressure: 1010 mbar

#### 7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

#### 7.3.3 Test Setup Diagram



**7.3.4 Measurement Procedure and Data**

- a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
3. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.
- 4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for Peak detection (PK) and Average detection (AV) at frequency above 1GHz.
- 5:For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle  $< 98\%$ ) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.

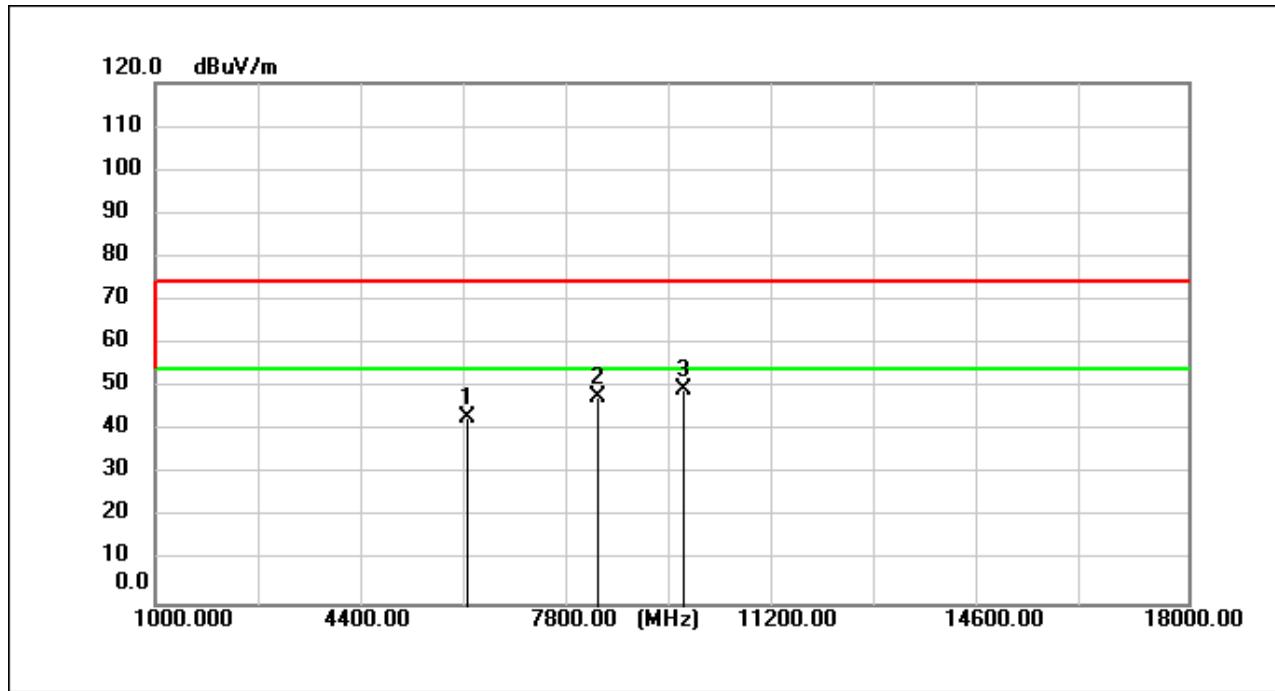
**SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.**

SHEM-TRF-001 Rev. 02 Sep01, 2023

Report No.: SHCR250100008703

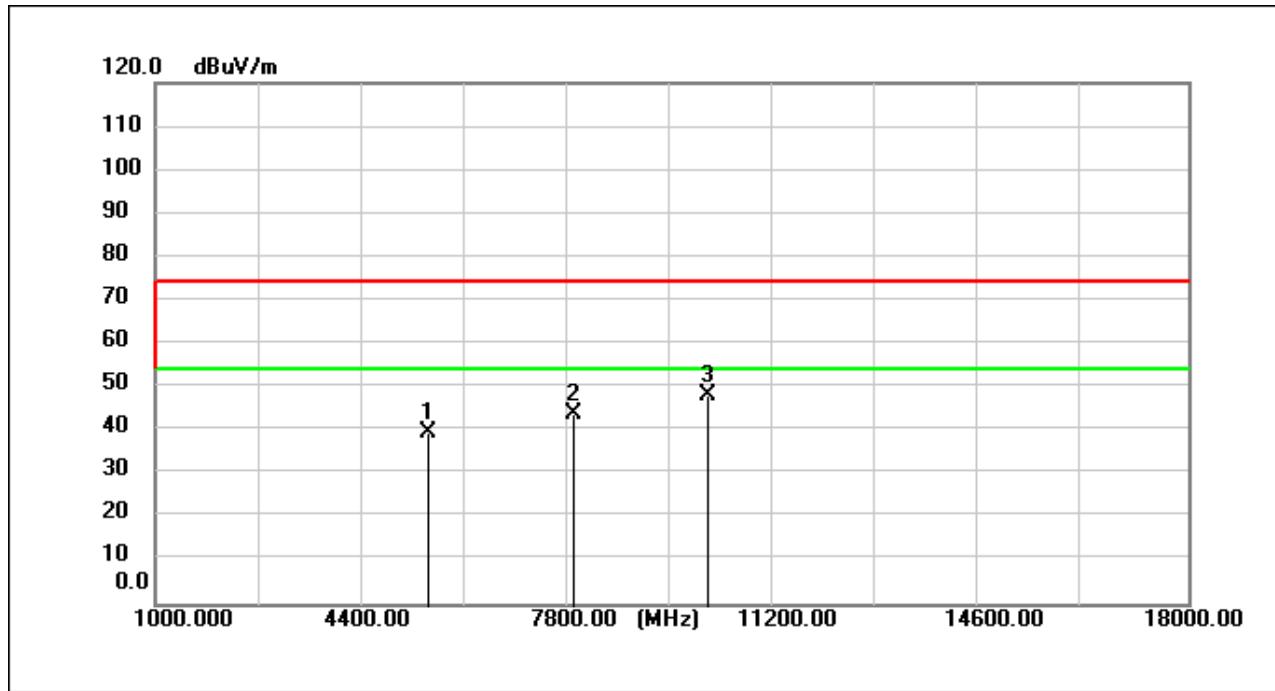
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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	6134.020	56.26	-13.21	43.05	74.00	-30.95	peak
2	8276.300	56.72	-8.88	47.84	74.00	-26.16	peak
3	9687.450	55.48	-6.05	49.43	74.00	-24.57	peak

Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5488.360	55.40	-15.82	39.58	74.00	-34.42	peak
2	7868.210	53.50	-9.45	44.05	74.00	-29.95	peak
3	10095.040	53.98	-5.66	48.32	74.00	-25.68	peak

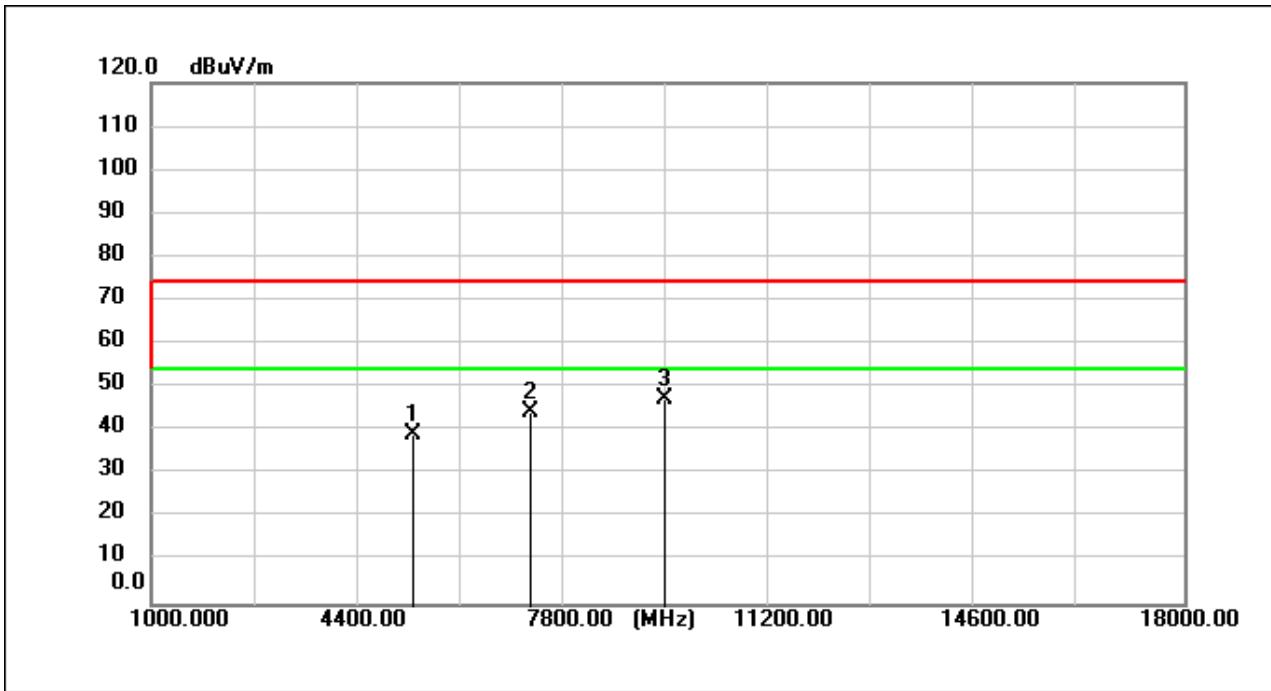
**SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.**

SHEM-TRF-001 Rev. 02 Sep01, 2023

Report No.: SHCR250100008703

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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:middle



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5301.360	55.45	-16.13	39.32	74.00	-34.68	peak
2	7222.050	54.27	-10.03	44.24	74.00	-29.76	peak
3	9449.700	53.81	-6.65	47.16	74.00	-26.84	peak

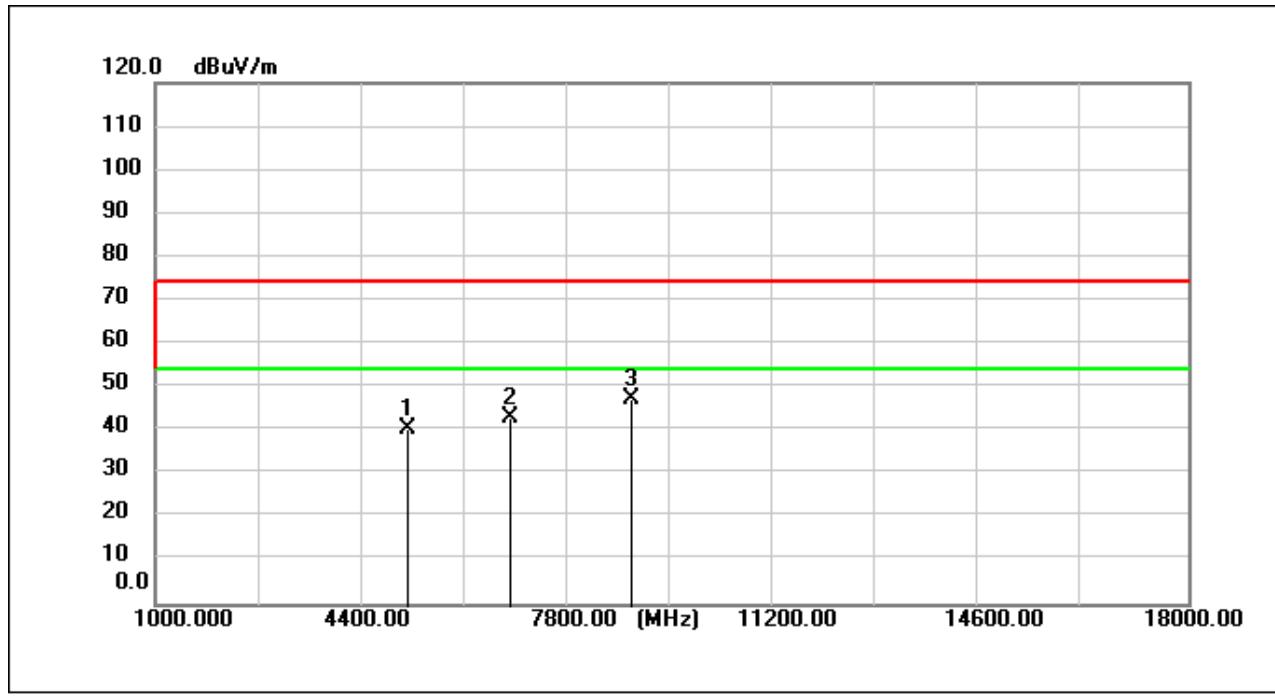
**SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.**

SHEM-TRF-001 Rev. 02 Sep01, 2023

Report No.: SHCR250100008703

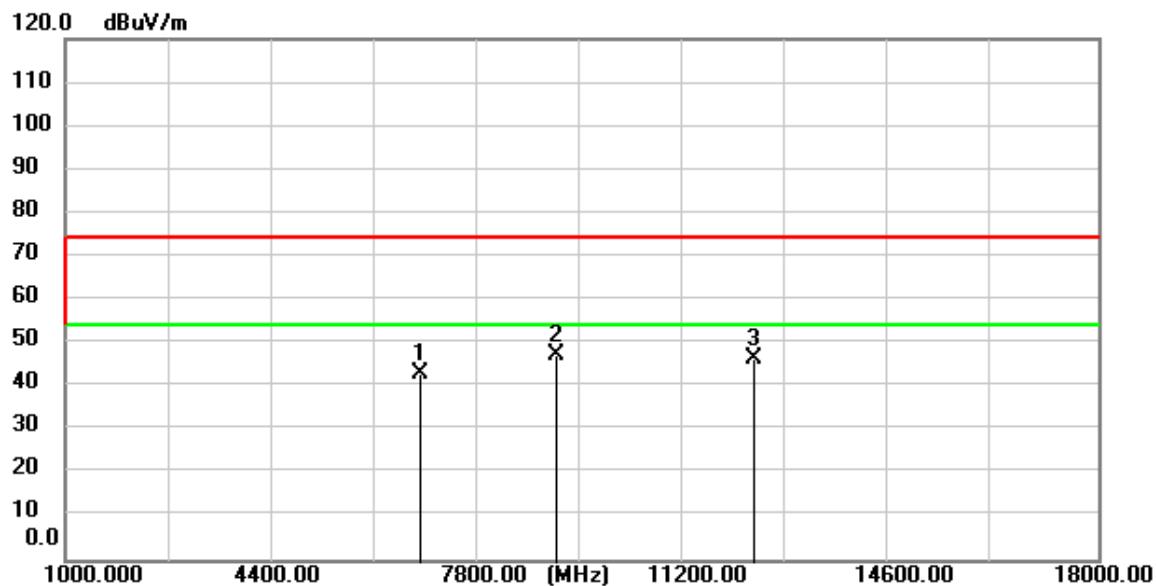
Page: 26 of 54

Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:middle



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5148.500	56.86	-16.39	40.47	74.00	-33.53	peak
2	6831.680	53.53	-10.30	43.23	74.00	-30.77	peak
3	8837.520	55.45	-8.06	47.39	74.00	-26.61	peak

Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	6831.600	53.41	-10.30	43.11	74.00	-30.89	peak
2	9075.900	55.06	-7.60	47.46	74.00	-26.54	peak
3	12322.540	52.92	-6.25	46.67	74.00	-27.33	peak

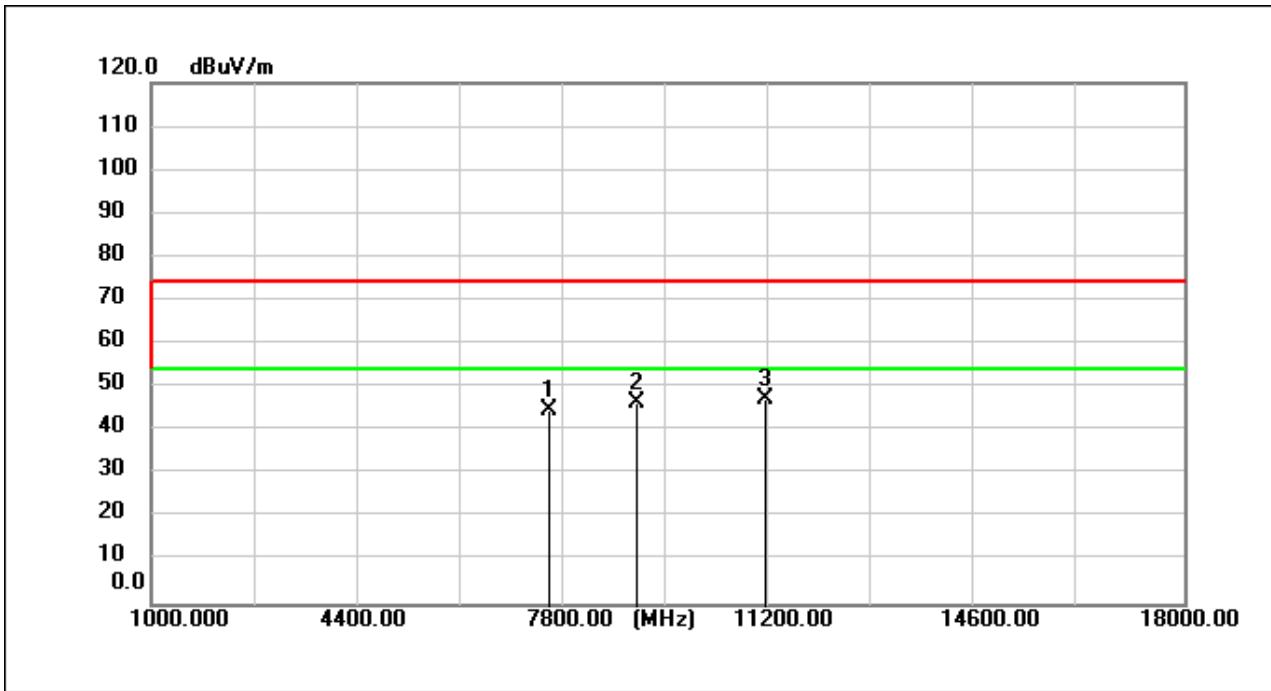
**SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.**

SHEM-TRF-001 Rev. 02 Sep01, 2023

Report No.: SHCR250100008703

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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	7545.200	54.63	-9.82	44.81	74.00	-29.19	peak
2	8973.980	54.52	-7.84	46.68	74.00	-27.32	peak
3	11098.060	53.85	-6.43	47.42	74.00	-26.58	peak

## 7.4 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)

Test Method: ANSI C63.10 (2013) Section 11.9.1

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for $\geq 50$ hopping channels
	0.25 for $25 \leq$ hopping channels $< 50$
	1 for digital modulation
2400-2483.5	1 for $\geq 75$ non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

### 7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 20.5 °C

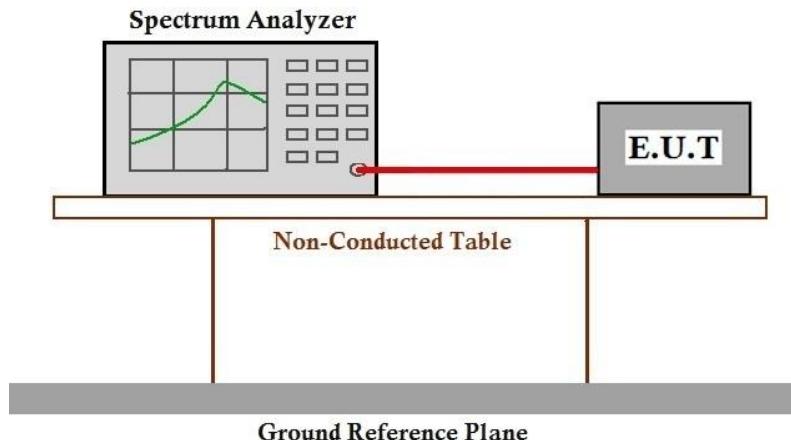
Humidity: 50.5 % RH

Atmospheric Pressure: 1010 mbar

### 7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.4.3 Test Setup Diagram



### 7.4.4 Measurement Procedure and Data

Note: Since the verify power the same operating range bandwidth and smaller power can be covered by the higher power.

Please Refer to Appendix for Details

**7.5 Minimum 6dB Bandwidth**

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)

Test Method: ANSI C63.10 (2013) Section 11.8.1

Limit:

≥500 kHz

**7.5.1 E.U.T. Operation**

Operating Environment:

Temperature: 20.5 °C      Humidity: 50.5 % RH      Atmospheric Pressure: 1010 mbar

**7.5.2 Test Mode Description**

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

**7.5.3 Measurement Procedure and Data**

Please Refer to Appendix for Details

## 7.6 Power Spectrum Density

Test Requirement 47 CFR Part 15, Subpart C 15.247(e)

Test Method: ANSI C63.10 (2013) Section 11.10.2

Limit:

≤8dBm in any 3 kHz band during any time interval of continuous transmission

### 7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 20.5 °C      Humidity: 50.5 % RH      Atmospheric Pressure: 1010 mbar

### 7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.6.3 Measurement Procedure and Data

Please Refer to Appendix for Details

## 7.7 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.13.3.2

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### 7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 20.5 °C      Humidity: 50.5 % RH      Atmospheric Pressure: 1010 mbar

### 7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.7.3 Measurement Procedure and Data

Please Refer to Appendix for Details

## 7.8 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.11

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### 7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 20.5 °C      Humidity: 50.5 % RH      Atmospheric Pressure: 1010 mbar

### 7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.8.3 Measurement Procedure and Data

Please Refer to Appendix for Details

## 8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SHCR2501000087AT

## 9 EUT Constructional Details (EUT Photos)

Refer to Appendix\_Photos of EUT Constructional Details for SHCR2501000087AT

## 10 Appendix

### 1. Duty Cycle

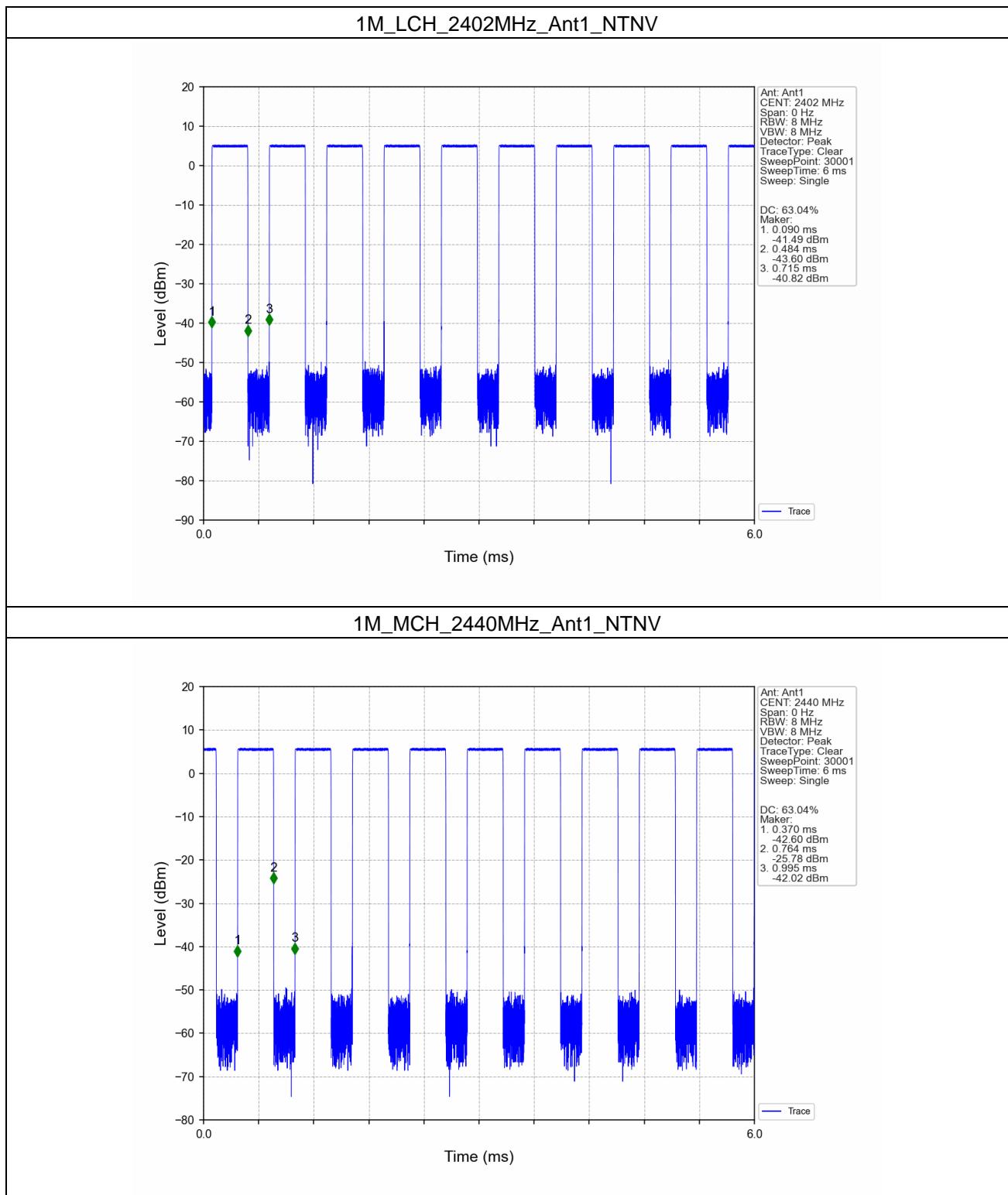
#### 1.1 Test Result

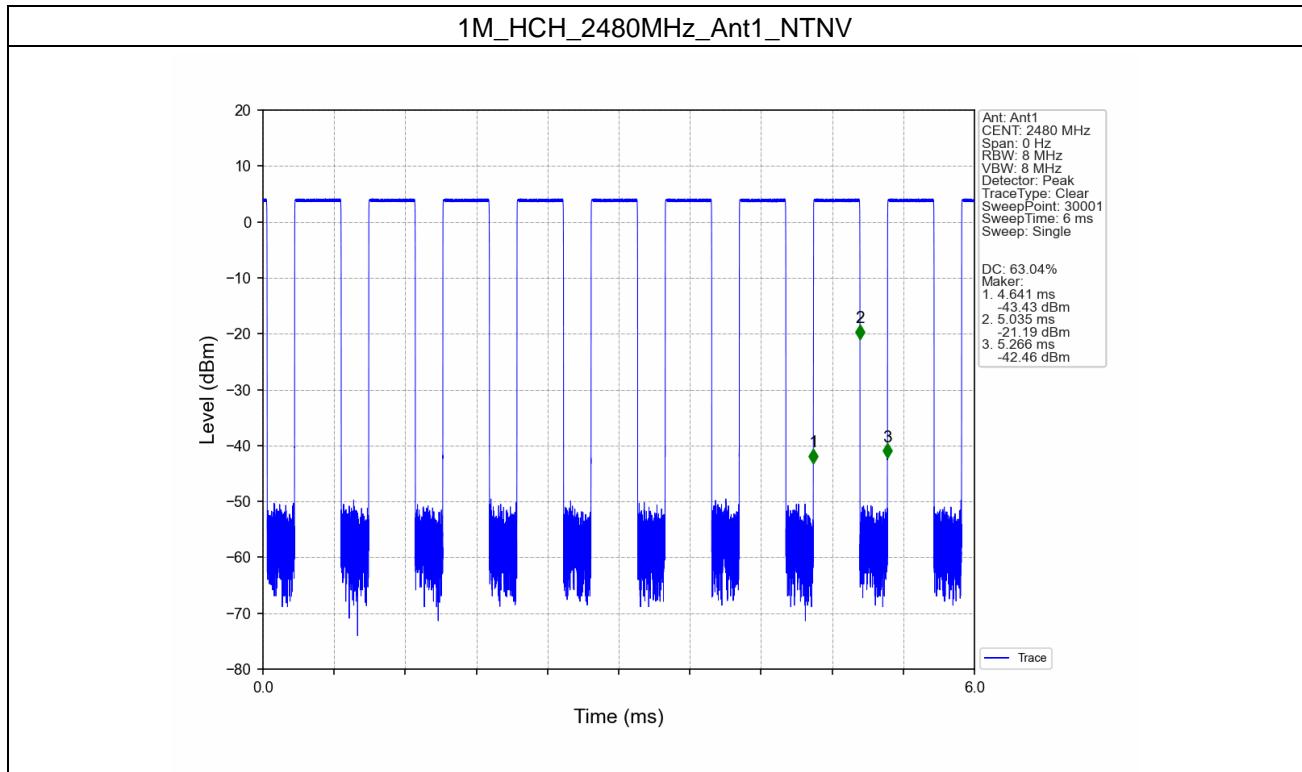
##### 1.1.1 Ant1

Ant1							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
1M	SISO	2402	0.394	0.625	63.04	2.00	0.03
		2440	0.394	0.625	63.04	2.00	0.03
		2480	0.394	0.625	63.04	2.00	0.03

## 1.2 Test Graph

### 1.2.1 Ant1





## 2. Bandwidth

### 2.1 Test Result

#### 2.1.1 OBW

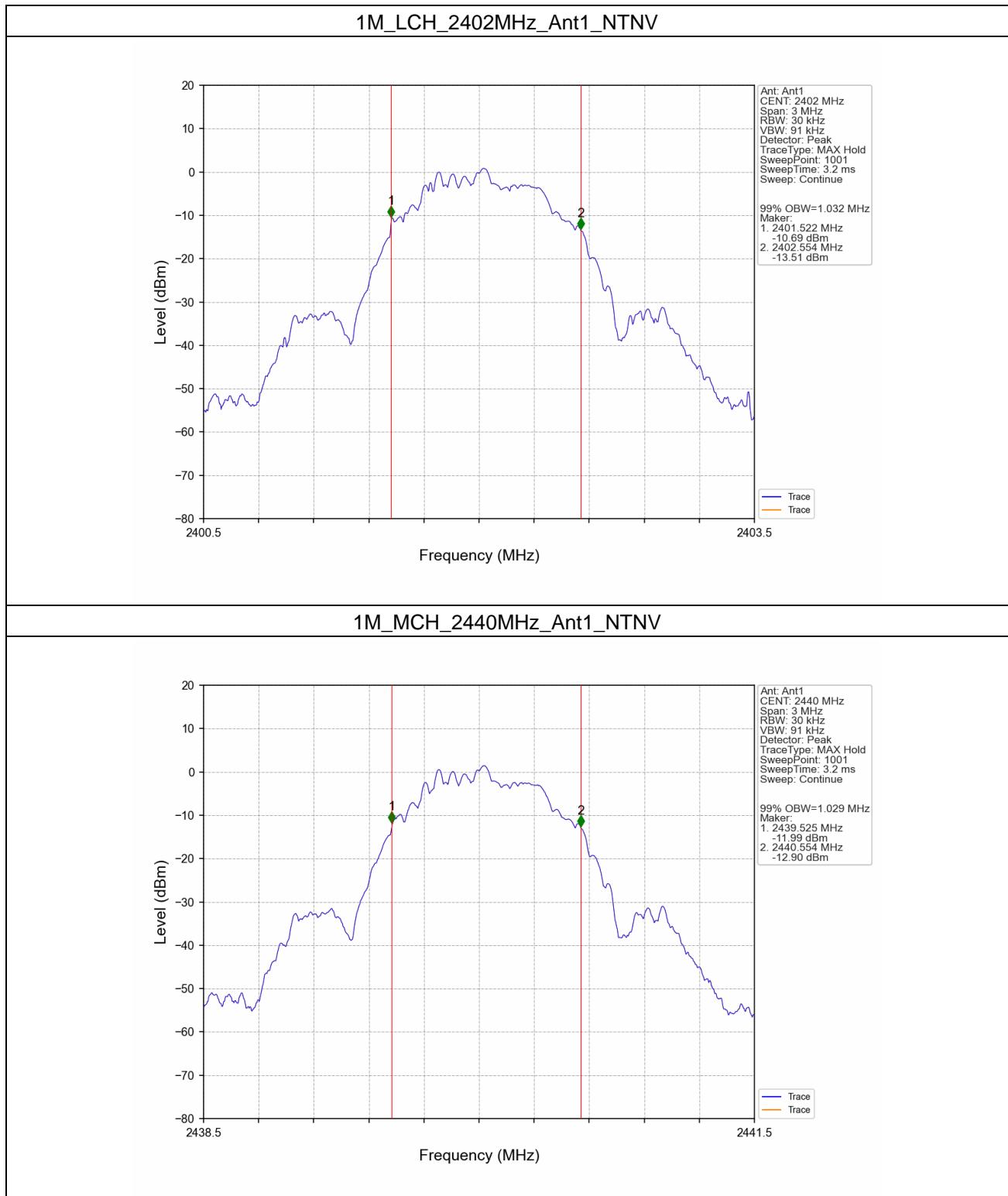
Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	1	1.032	/	Pass
		2440	1	1.029	/	Pass
		2480	1	1.028	/	Pass

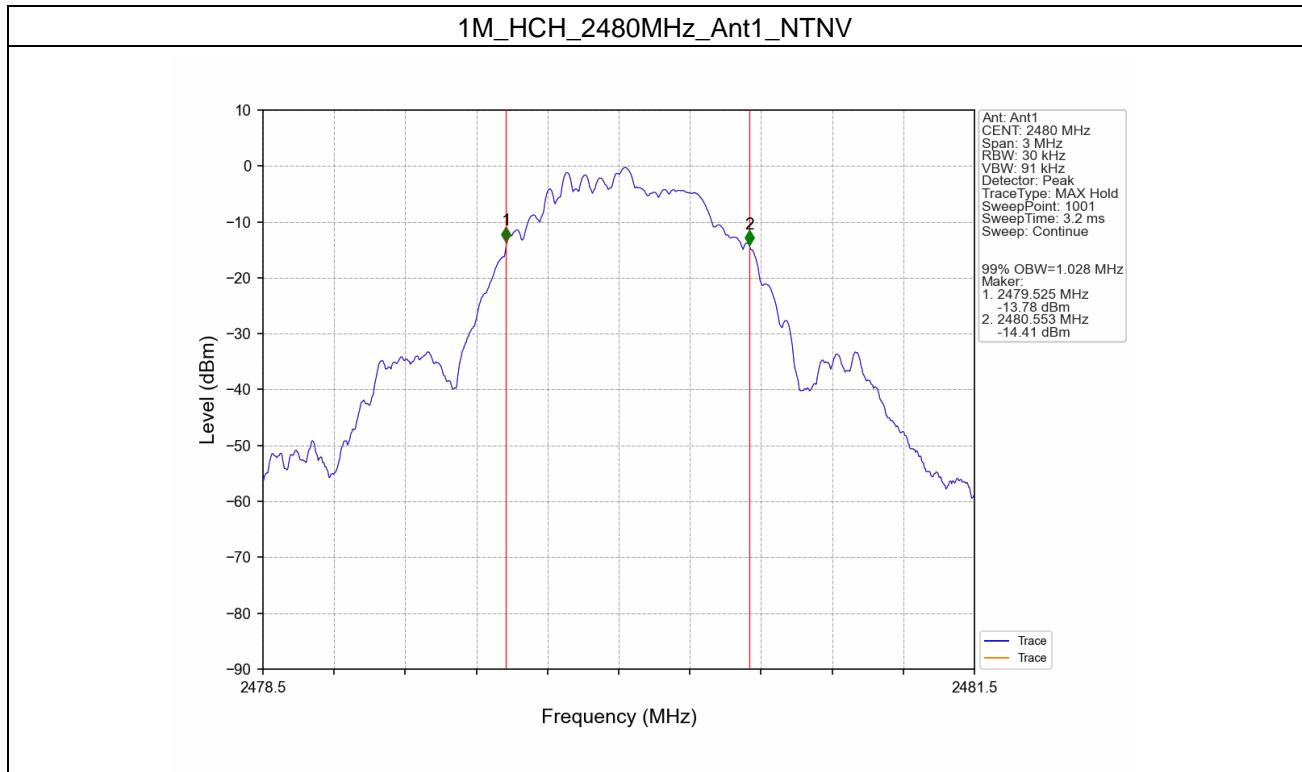
#### 2.1.2 6dB BW

Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	1	0.671	>=0.5	Pass
		2440	1	0.674	>=0.5	Pass
		2480	1	0.671	>=0.5	Pass

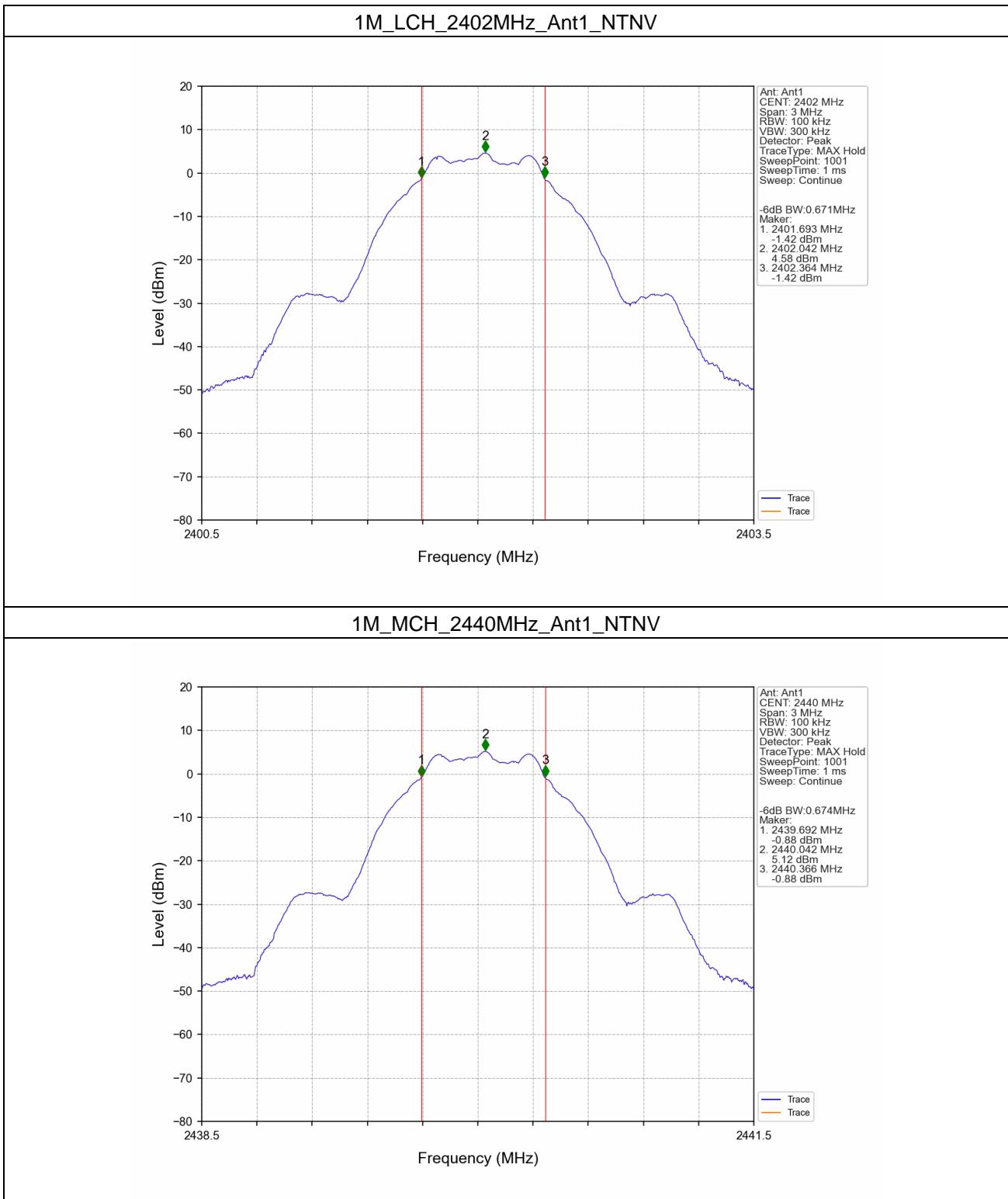
## 2.2 Test Graph

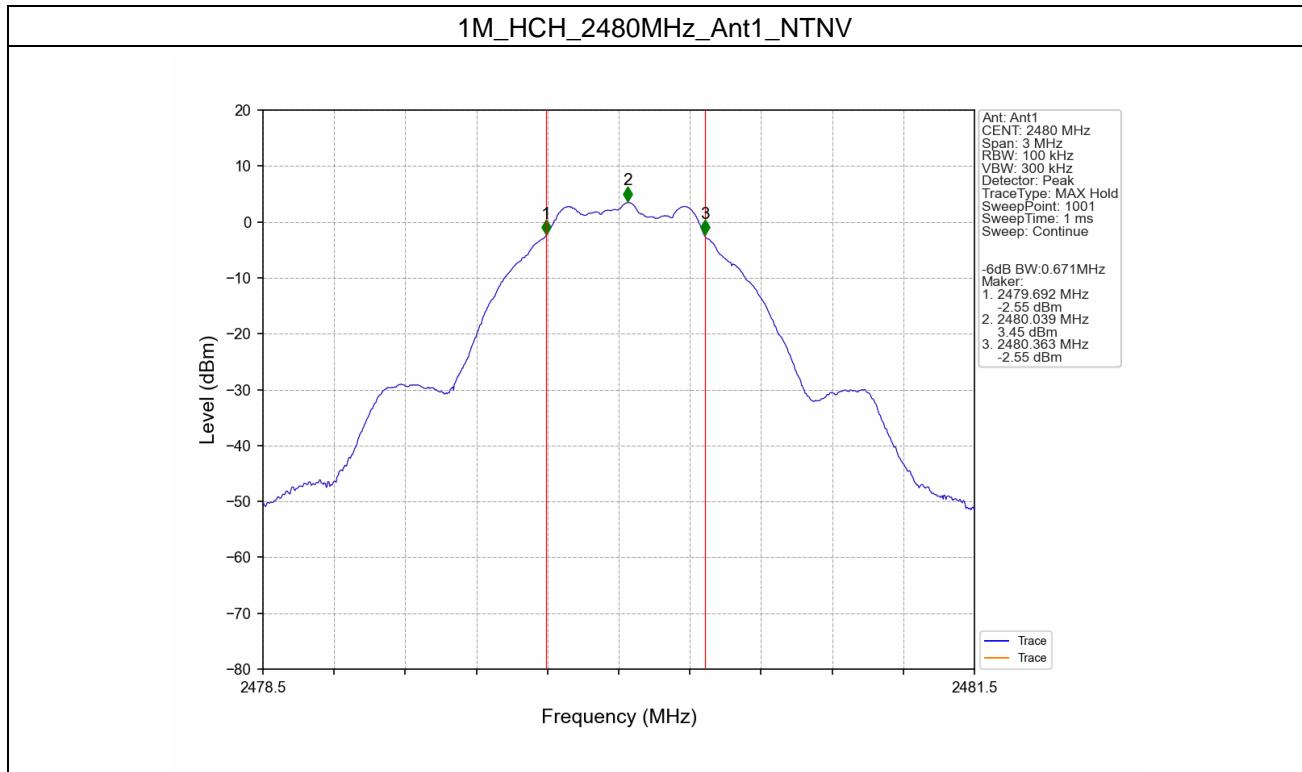
### 2.2.1 OBW





### 2.2.2 6dB BW





### 3. Maximum Conducted Output Power

#### 3.1 Test Result

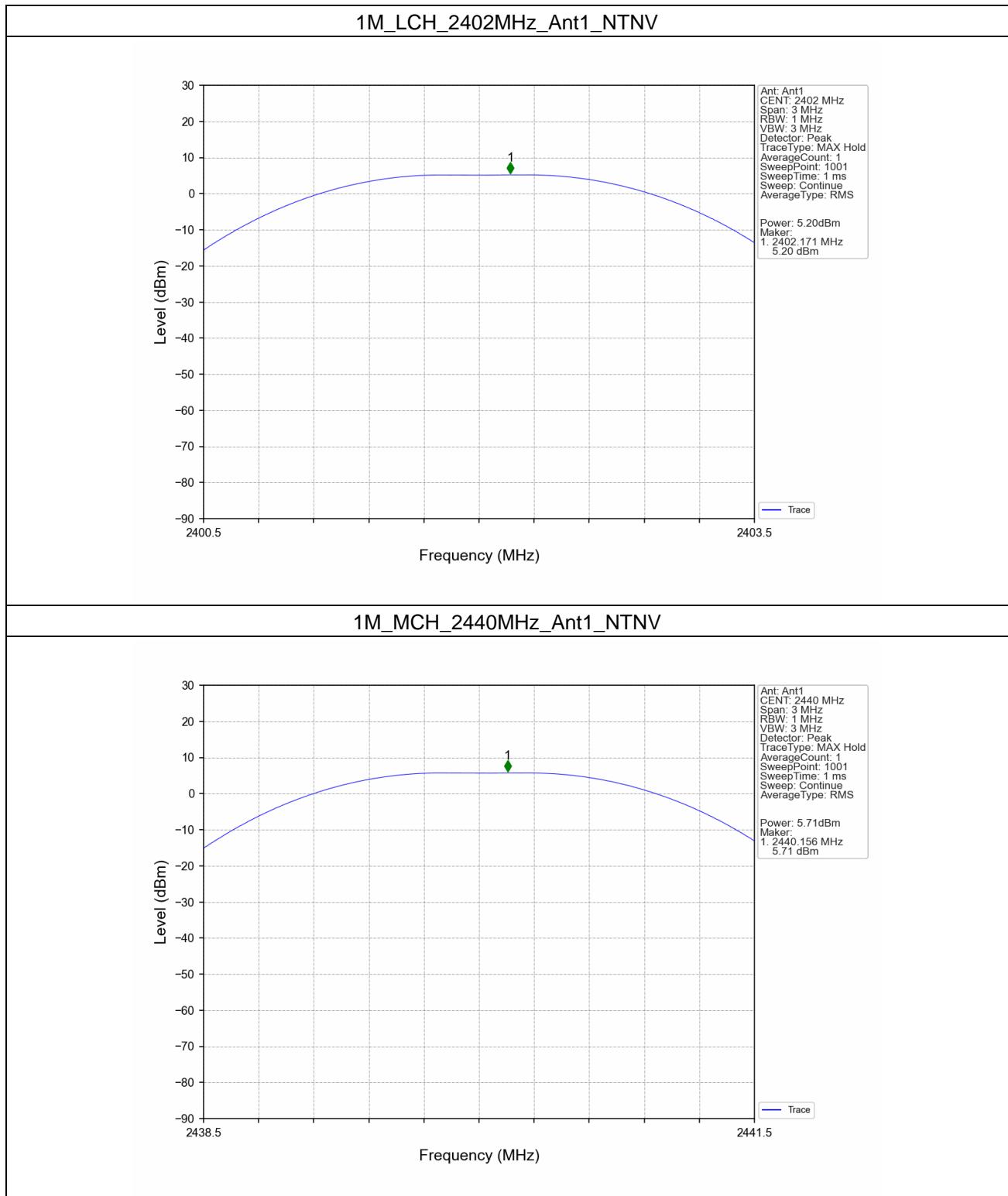
##### 3.1.1 Power

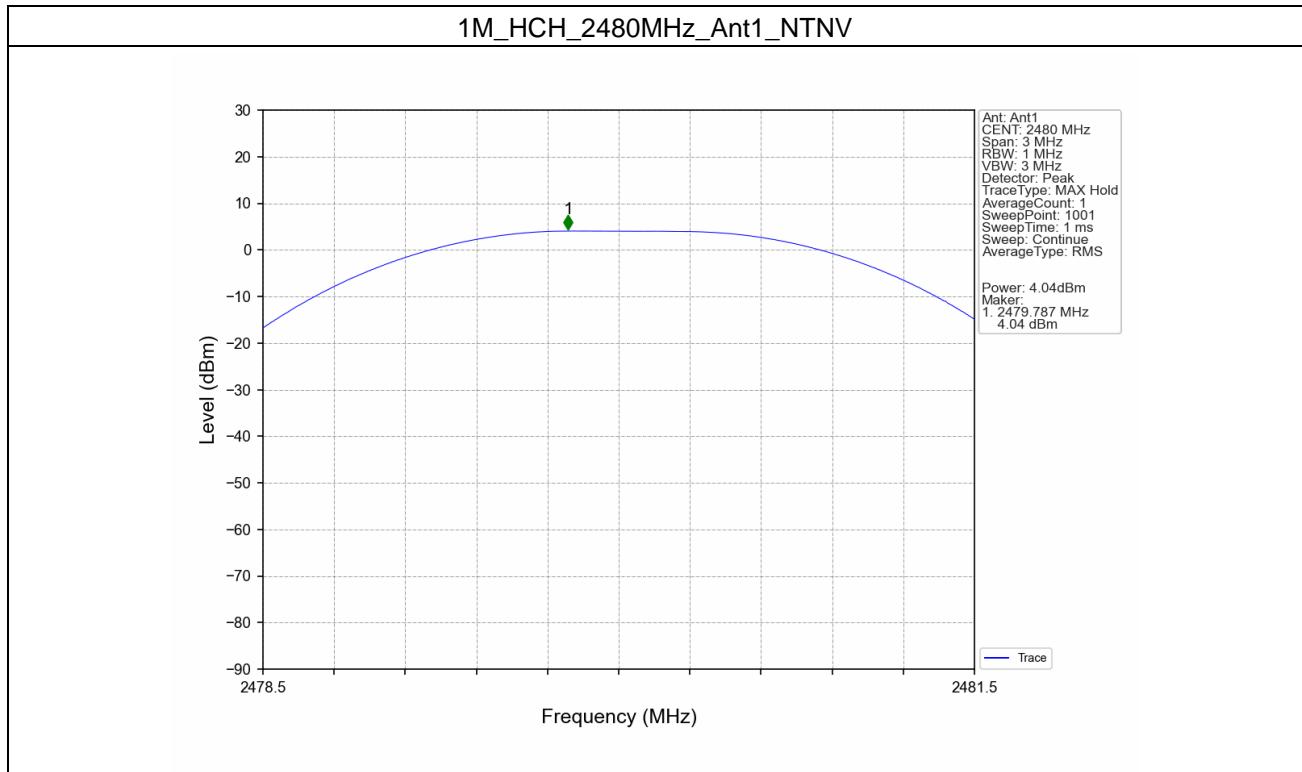
Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
1M	SISO	2402	5.20	<=30	Pass
		2440	5.71	<=30	Pass
		2480	4.04	<=30	Pass

Note1: Antenna Gain: Ant1: 2.5dBi;

## 3.2 Test Graph

### 3.2.1 Power





## 4. Maximum Power Spectral Density

### 4.1 Test Result

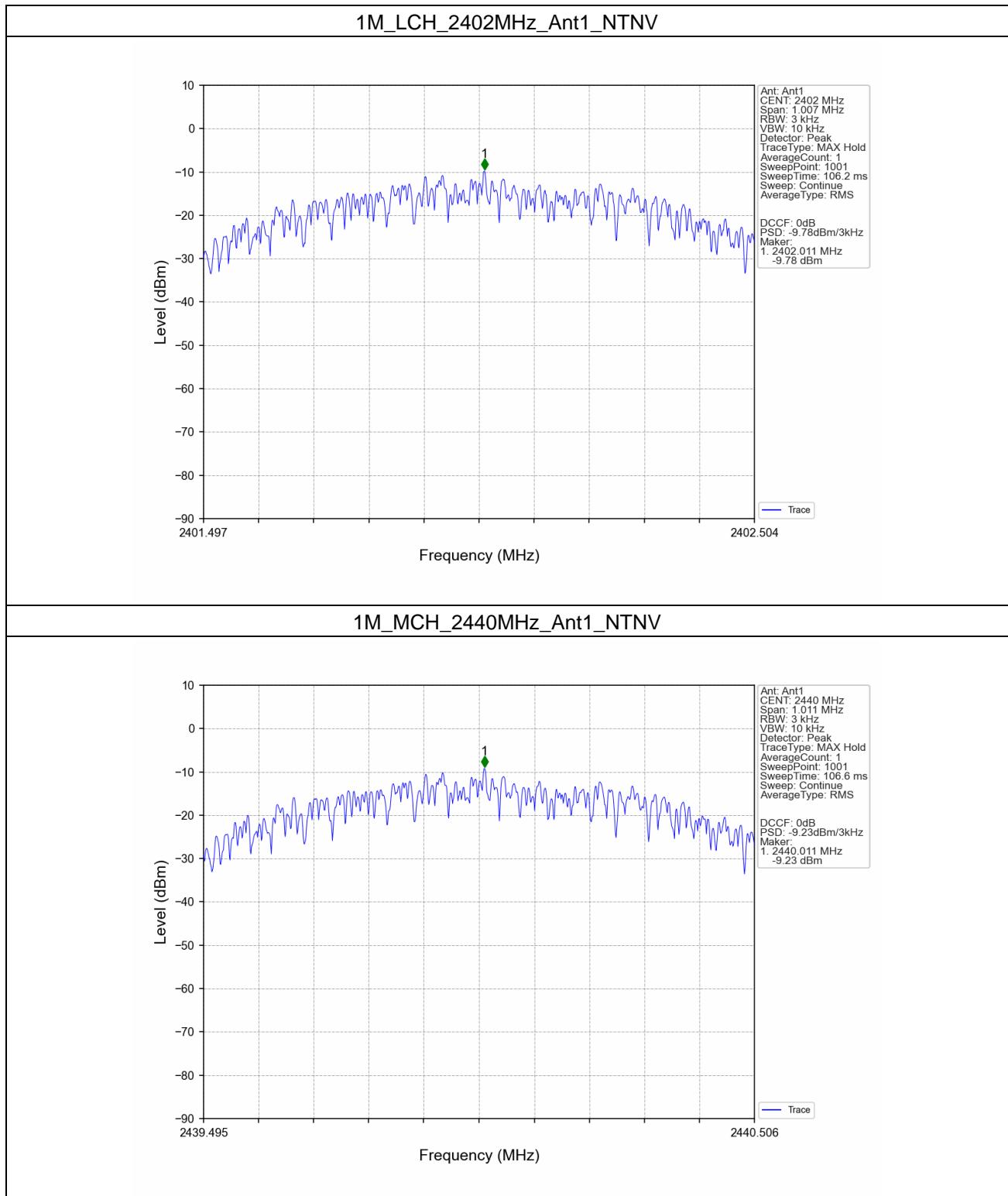
#### 4.1.1 PSD

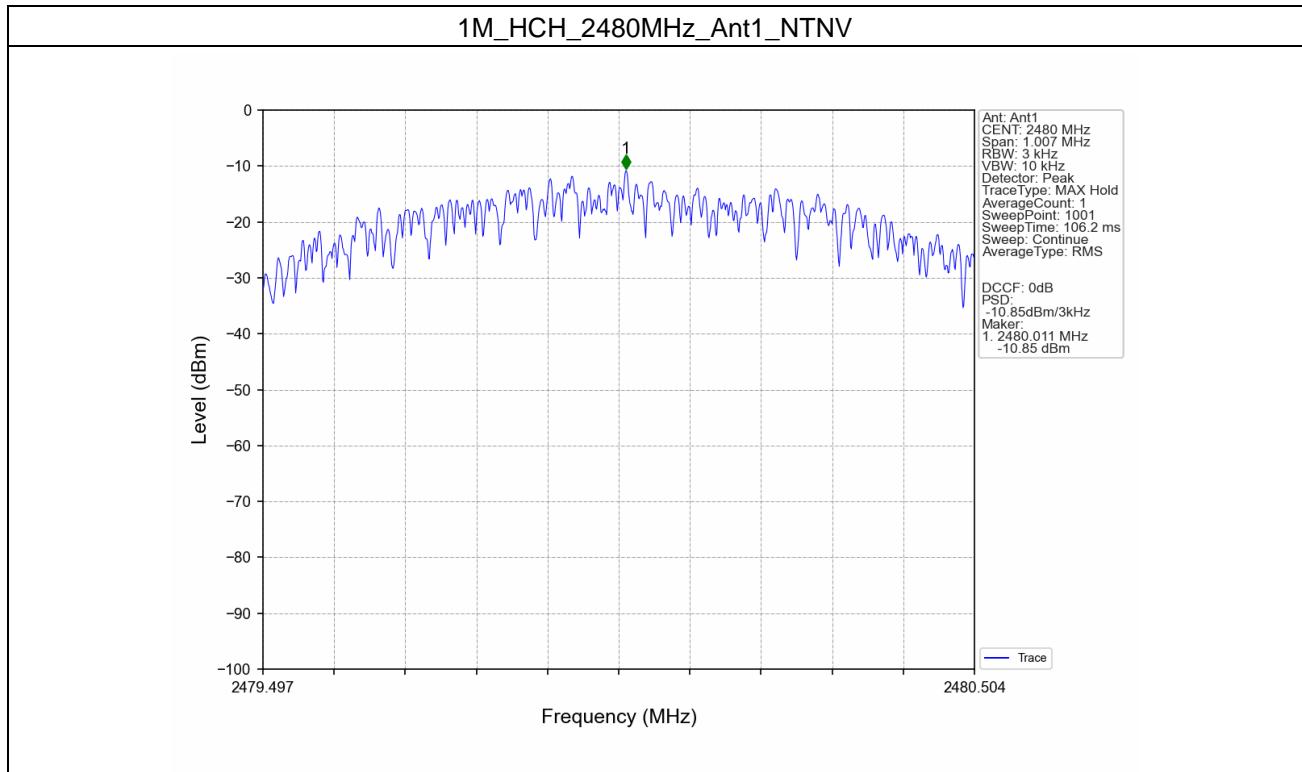
Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT1	Limit	
1M	SISO	2402	-9.78	<=8	Pass
		2440	-9.23	<=8	Pass
		2480	-10.85	<=8	Pass

Note1: Antenna Gain: Ant1: 2.5dBi;

## 4.2 Test Graph

### 4.2.1 PSD





## 5. Unwanted Emissions In Non-restricted Frequency Bands

### 5.1 Test Result

#### 5.1.1 Ref

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
1M	SISO	2402	1	4.57
		2440	1	5.11
		2480	1	3.44

Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.

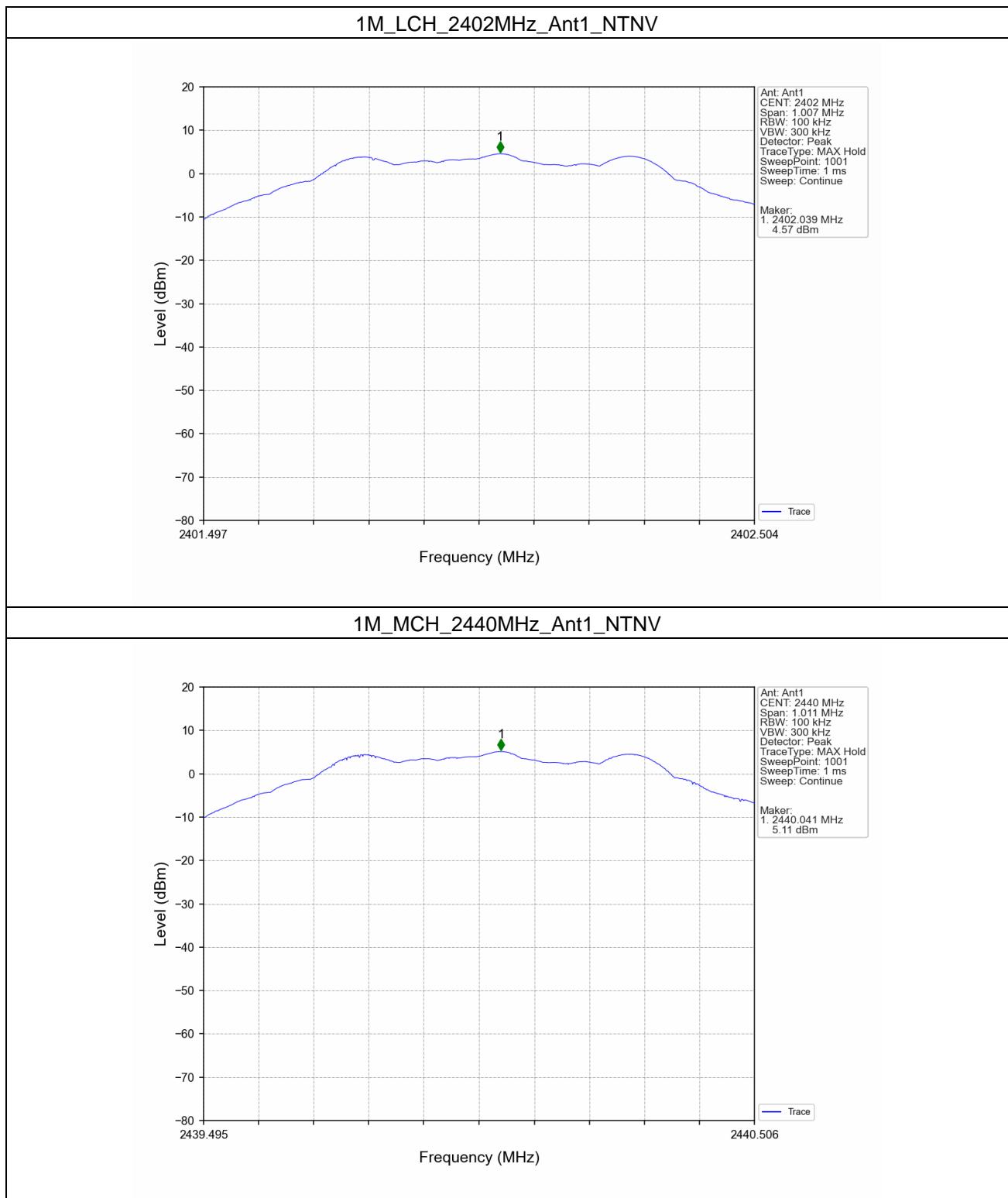
#### 5.1.2 CSE

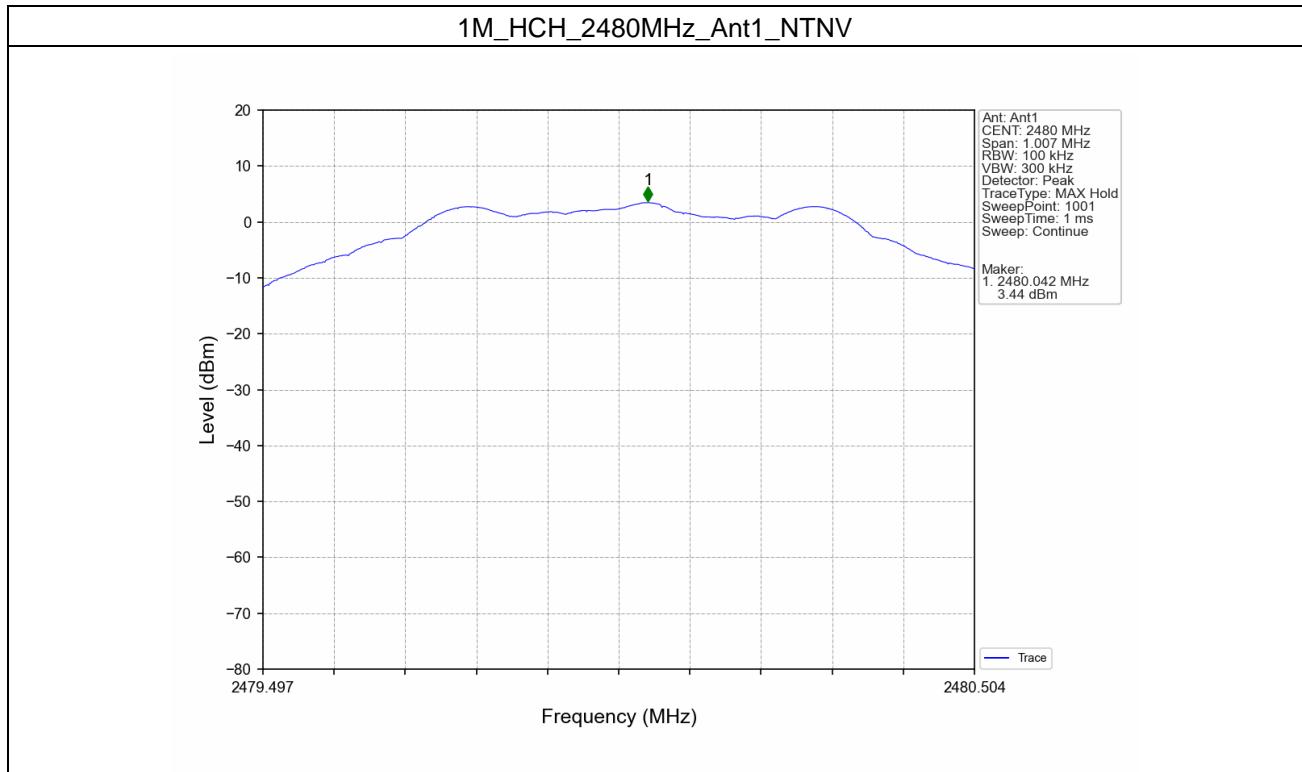
Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
1M	SISO	2402	1	5.11	-14.89	Pass
		2440	1	5.11	-14.89	Pass
		2480	1	5.11	-14.89	Pass

Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.

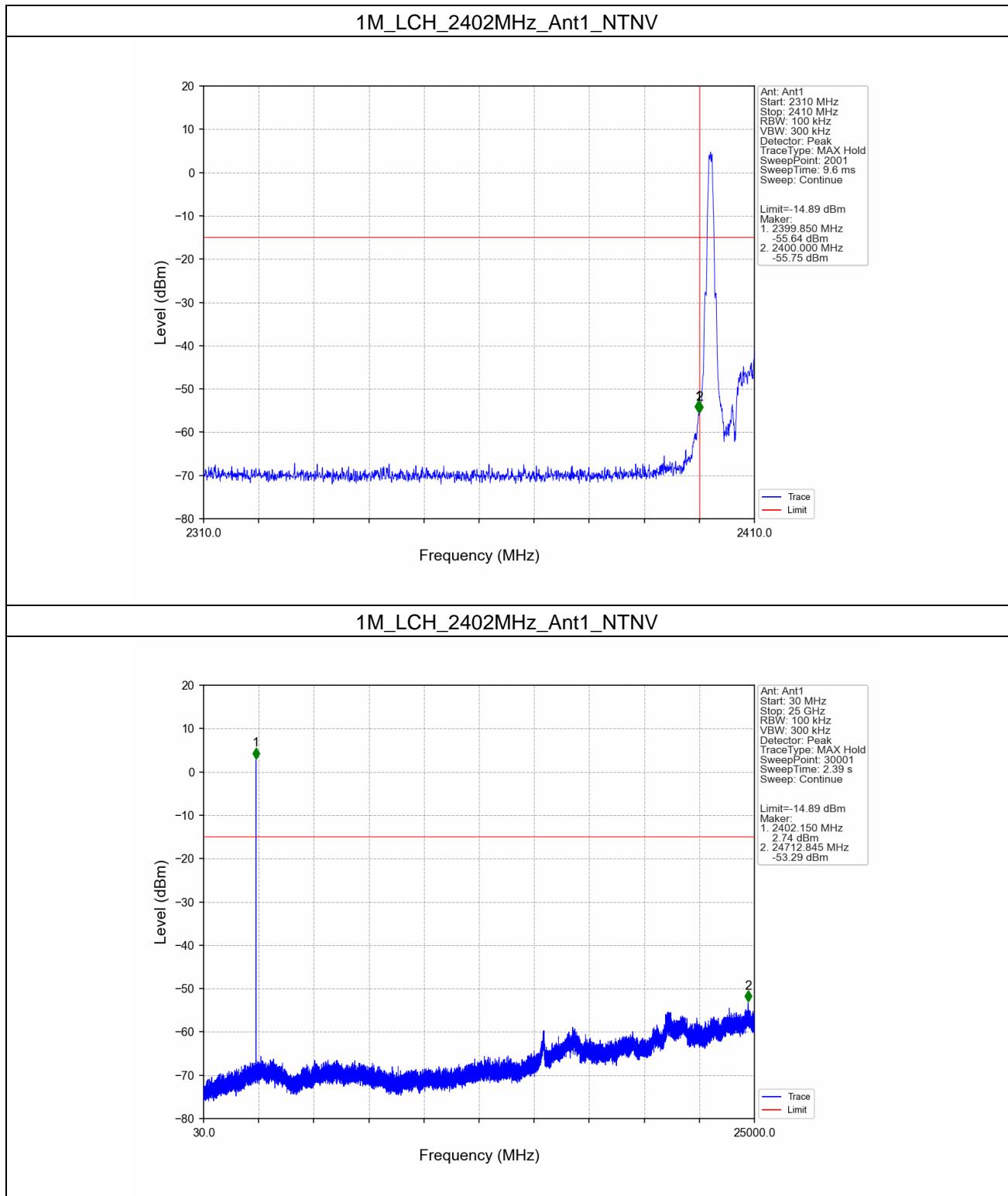
## 5.2 Test Graph

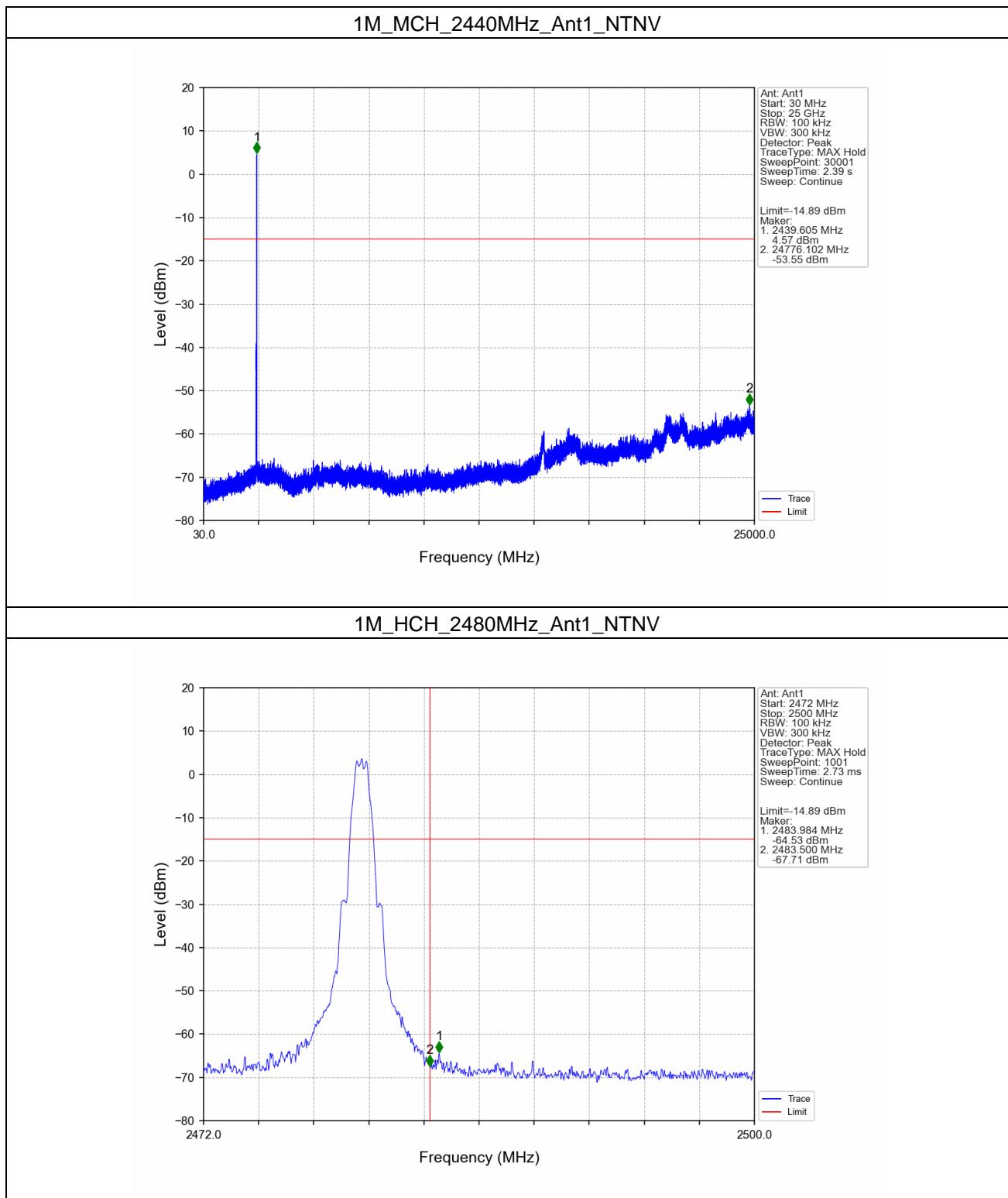
### 5.2.1 Ref

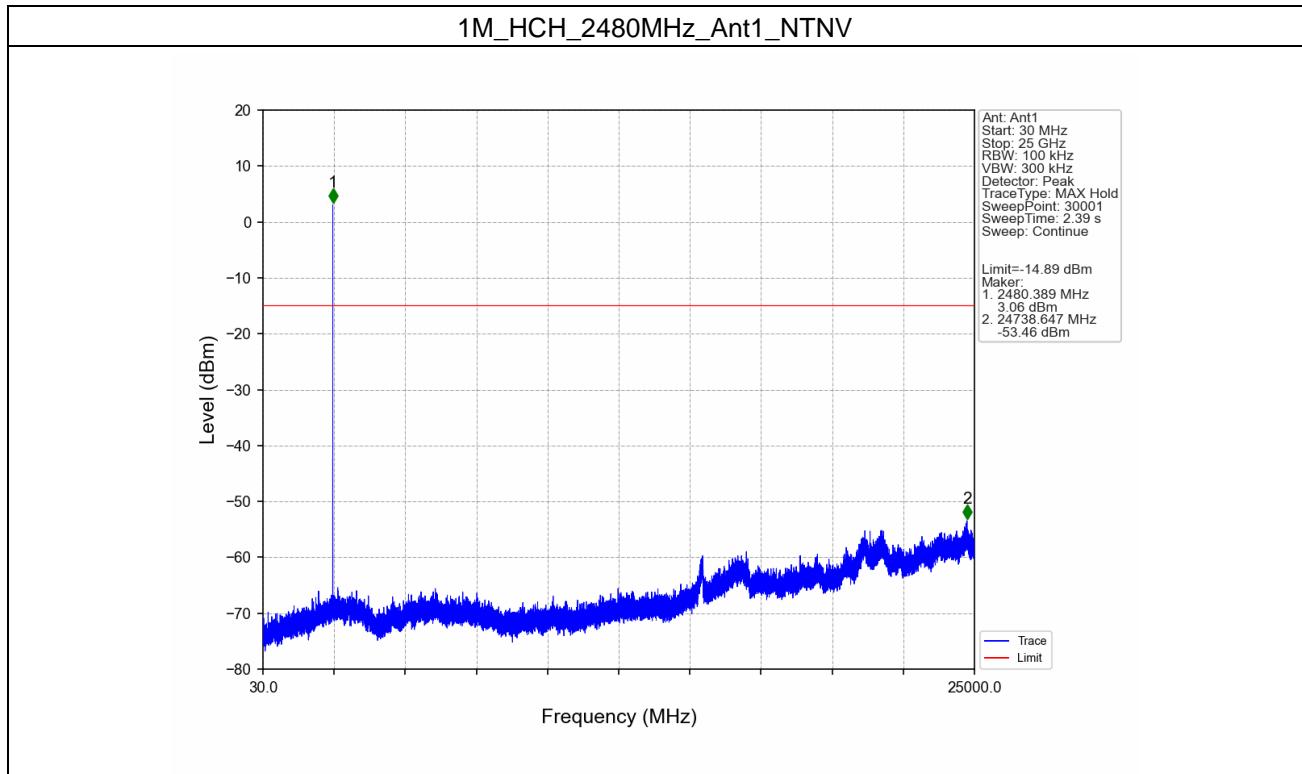




## 5.2.2 CSE







- End of the Report -