

TEST REPORT

Application No.: SHCR2206001225LM
FCC ID: 2A7Z9XY2209
Applicant: Taizhou Xinye Technology Co.,Ltd.
Address of Applicant: No.371,Baihutang,Zhenxi Village, Toutuo Town, Huangyan District, Taizhou, Zhejiang, China
Manufacturer: Taizhou Xinye Technology Co.,Ltd.
Address of Manufacturer: No. 371,Baihutang, Zhenxi Village, Toutuo Town, Huangyan District, Taizhou, Zhejiang, China
Factory: Taizhou Xinye Technology Co.,Ltd.
Address of Factory: No. 371,Baihutang, Zhenxi Village, Toutuo Town, Huangyan District, Taizhou, Zhejiang, China
Equipment Under Test (EUT):
EUT Name: Bluetooth control string light
Model No.: Refer To Page 2 ♣
 ♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2022-06-17
Date of Test: 2022-08-01 to 2022-08-10
Date of Issue: 2022-08-16

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Parlam Zhan

Parlam Zhan
Laboratory Manager



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EEC EMC Lab

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中国·上海·松江区金都西路588号 邮编: 201612

t (86-21) 61915666
t (86-21) 61915666

f (86-21) 61915678
f (86-21) 61915678

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Model list:

XYIP-*LED-**-**-*

The first “*” can be voltage of lighting chain, which could be “3E-24E” for “3V-24V”

The second “*” can be any integer value between “2” – “200”, indicating the total number of LEDs.

The third “*” can be blank, “C”, “A” or “R” indicating lighting chain with controller,

Blank = LED driver without control fuction, “C” = LED driver with control fuction, “A” = lighting chain with controller, “R” = lighting chain with remote controller

The forth “*” can be blank, “I”, “N”, “S”, “C”, “SN”, “CL” or “T”, indicating the lighting chain style/shape:

Blank = line, “I” = Icicle, “N” = Net, “S” = Swag, “C” = Curtain, “SN” = Snake, “CL” = Cluster, “T” = Tree

The fifth “*” can be “A”, “B”, “M”, “RGB”, “RGB1”, “RGB2” or “RGB3”, indicating a different LED type/color:

Value of the asterisk	Light colour	Electric ratings
A	Red, Yellow, Yellow / Green & Amber	20 Ma / 1.8 – 2.2 V
B	Aqua, Blue, Green, Ice White, Lilac, Peachblow, Pink, Purple & Warm White, Rosiness	20 Ma / 2.8 – 3.2 V
M	Mixed, RGB	20 Ma / 1.8 – 2.2 V and 2.8 – 3.2 V
RGB	RGB	12 Ma – 20 Ma / 5 V
RGB1	RGBWW	11 Ma – 28 Ma / 5 V
RGB2	RGBW	9 Ma – 21 Ma / 5 V
RGB3	RBWW	12Ma – 20Ma/5V

The sixth “*” can be lighting chain with decoration or motif,

“D” means lighting chain with decoration, “M” means lighting chain with motif, blank means lighting chain without decoration and motif



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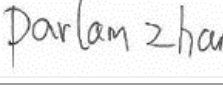
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t (86-21) 61915666
t (86-21) 61915666

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Revision Record			
Version	Description	Date	Remark
00	Original	2022-08-16	/

Authorized for issue by:			
			
		<hr/> Bill Wu/Project Engineer	
			
		<hr/> Parlam Zhan/Reviewer	



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2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
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

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	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€	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
Radiated Emissions which fall in the restricted bands		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

Declaration of EUT Family Grouping:

Note: There are series models mentioned in this report, and they are the similar in electrical and electronic characters. All models used same adapter and controller (BLE module installed in the controller) only difference is connected with different light strings which not influence RF performance. Consider the difference only the model XYIP-24ELED-200A-RGB was tested.



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t (86-21) 61915666
t (86-21) 61915666

f (86-21) 61915678
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f (86-21) 61915678

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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 24V 1A By adapter Adapter: Model:JT-DC240V1000-G Input:120V~60Hz Output:24V 1A
Test Voltage:	AC 120V 60Hz
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.0 LE
Data Rate	1Mbps
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	PCB Antenna
Antenna Gain:	-7.53dBi (Provided by manufacturer)

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Laptop	LENOVO	L460	-
Serial port adapter plate	-	Test Plate 3	-

4.3 Power level setting using in test:

Channel	Level
2402	-3.0
2440	-3.0
2480	-3.0



4.4 Measurement Uncertainty & Decision Rule

No.	Item	Measurement Uncertainty
1	Radio Frequency	8.4 x 10 ⁻⁸
2	Timeout	2s
3	Duty cycle	0.4%
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-6GHz)
		5.4dB (6GHz-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.

4.5 Test Location

All tests were performed at:

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Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

No tests were sub-contracted.

Note:

1. SGS is not responsible for wrong test results due to incorrect information (e.g. max. clock frequency, highest internal 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).



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中国·上海·松江区金都西路588号 邮编: 201612

t (86-21) 61915666
t (86-21) 61915666

f (86-21) 61915678
f (86-21) 61915678

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4.6 Test Facility

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

• **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **A2LA (Certificate No. 6332.01)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA).

• **FCC (Designation Number: CN1301)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized as an accredited testing laboratory.

• **ISED (CAB Identifier: CN0020)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. EMC Laboratory has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory. Company Number: 8617A

• **VCCI (Member No.: 3061)**

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4.7 Deviation from Standards

None

4.8 Abnormalities from Standard Conditions

None



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5 Equipment List

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
RF Conducted Test					
Spectrum Analyzer	R&S	FSP-30	SHEM002-1	2021-12-20	2022-12-19
Spectrum Analyzer	Keysight	N9020B	SHEM241-1	2021-08-30	2022-08-29
Spectrum Analyzer	Agilent	N9020A	SHEM181-1	2021-08-13	2022-08-12
Signal Generator	R&S	SMR20	SHEM006-1	2021-08-13	2022-08-12
Signal Generator	Agilent	N5182A	SHEM182-1	2021-08-13	2022-08-12
Communication Tester	R&S	CMW270	SHEM183-1	2022-07-28	2023-07-27
Communication Tester	R&S	CMW500	SHEM183-2	2022-04-01	2023-03-31
Switcher	Tonscend	JS0806	SHEM184-1	2021-08-13	2022-08-12
Power Sensor	Keysight	U2021XA * 4	SHEM184-1	2021-08-13	2022-08-12
Splitter	Anritsu	MA1612A	SHEM185-1	/	/
Coupler	e-meca	803-S-1	SHEM186-1	/	/
High-low Temp Cabinet	Suzhou Zhihe	TL-40	SHEM087-1	2020-04-15	2023-04-14
AC Power Stabilizer	APC	KDF-31020T-V0-F0	SHEM216-1	2021-12-20	2022-12-19
DC Power Supply	MCH	MCH-303A	SHEM210-1	2021-12-20	2022-12-19
Conducted test Cable	/	RF01~RF04	/	2021-12-20	2022-12-19
Test software	Tonscend	JS Tonscend BT/WIFI System	Version: 2.6	/	/
RF Radiated Test					
EMI test Receiver	R&S	ESU40	SHEM051-1	2021-12-20	2022-12-19
Spectrum Analyzer	R&S	FSP-30	SHEM002-1	2021-12-20	2022-12-19
Communication Tester	R&S	CMW500	SHEM183-2	2022-04-01	2023-03-31
Loop Antenna (9kHz-30MHz)	Schwarzbeck	FMZB1519	SHEM135-1	2021-12-20	2022-12-19
Antenna (25MHz-2GHz)	Schwarzbeck	VULB9168	SHEM048-1	2021-09-11	2023-09-10
Antenna (25MHz-2GHz)	Schwarzbeck	VULB9168	SHEM202-1	2021-05-07	2023-05-06
Horn Antenna (1-18GHz)	Schwarzbeck	HF906	SHEM009-1	2021-06-09	2023-06-08
Horn Antenna (1-18GHz)	Schwarzbeck	BBHA9120D	SHEM050-1	2021-09-18	2023-09-17
Horn Antenna (14-40GHz)	Schwarzbeck	BBHA 9170	SHEM049-1	2021-09-18	2023-09-17
Pre-Amplifier	HP	8447D	SHEM236-1	2022-05-27	2023-05-26
Pre-Amplifier	PANSHAN	LNA 1-18G	SHEM235-1	2022-05-27	2023-05-26
High-amplifier (14-40GHz)	Schwarzbeck	10001	SHEM049-2	2021-12-20	2022-12-19
Band Filter	LORCH	9BRX-875/X150	SHEM156-1	/	/
Band Filter	LORCH	13BRX-1950/X500	SHEM083-2	/	/
Band Filter	LORCH	5BRX-2400/X200	SHEM155-1	/	/
Band Filter	LORCH	5BRX-5500/X1000	SHEM157-2	/	/
High pass Filter	Wainwright	WHK3.0/18G	SHEM157-1	/	/
High pass Filter	Wainwright	WHKS1700	SHEM157-3	/	/
Semi/Fully Anechoic	ST	11*6*6M	SHEM078-2	2020-05-25	2023-05-24
RE test Cable	/	RE01, RE02, RE06	/	2022-01-07	2023-01-06
Test software	ESE	E3	Version: 6.111221a	/	/



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EEC EMC Lab

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Conducted Emissions at AC Mains Power Port (150kHz-30MHz)					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
EMI test receiver	Rohde & Schwarz	ESR7	SHEM162-1	2021/12/20	2022/12/19
Line impedance stabilization network	SCHWARZBECK	NSLK8127	SHEM061-1	2021/12/20	2022/12/19
Line impedance stabilization network	EMCO	3816_2	SHEM019-1	2021/12/20	2022/12/19
Pulse limiter	Rohde & Schwarz	ESH3-Z2	SHEM029-1	2021/12/20	2022/12/19
Shielding Room	ZHONGYU	8*4*3M	SHEM079-2	2020/12/20	2023/12/19
CE test Cable	/	/	SHEM172-1	2022/1/7	2023/1/6
Test Software	ESE	e3	Version: 6.111221a	N/A	N/A



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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 PCB antenna and no consideration of replacement. The best case gain of the antenna is -7.53 dBi.

Antenna location: Refer to internal photo.



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t (86-21) 61915666

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f (86-21) 61915678

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7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		
Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz		

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 24.3 °C

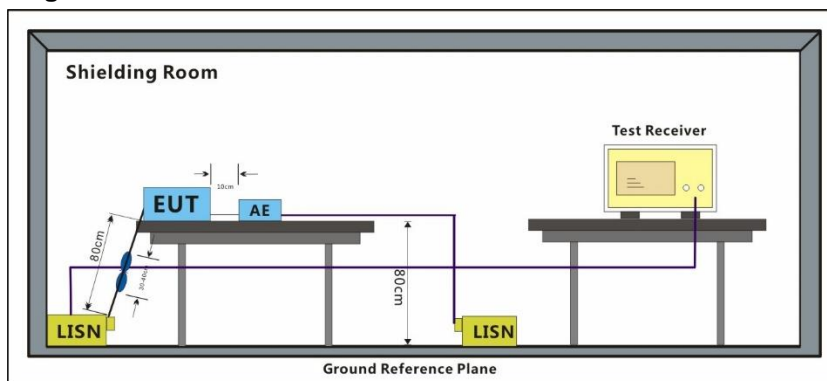
Humidity: 51.1 % RH

Atmospheric Pressure: 1010 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.1.3 Test Setup Diagram



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7.1.4 Measurement Procedure and Data

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: Level=Read Level+ Cable Loss+ LISN Factor



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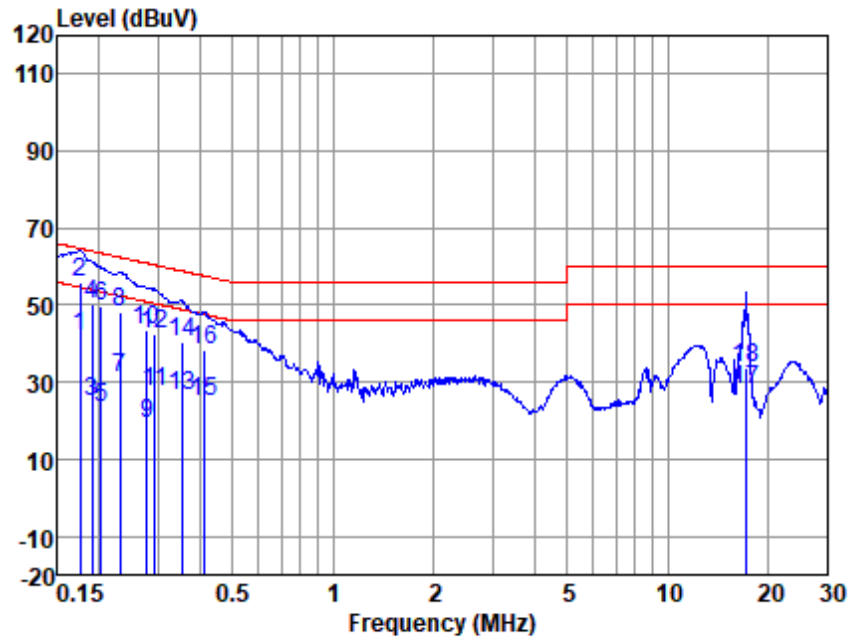
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t (86-21) 61915666

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Test Mode: 00; Line: Live line



LISN : LINE
EUT/Project No : 01225LM
Test Mode : 00

	Freq (MHz)	Read level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Emission Level (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
1	0.17	31.86	0.12	10.02	42.00	54.72	-12.72	Average
2	0.17	45.74	0.12	10.02	55.88	64.72	-8.84	QP
3	0.19	14.74	0.11	10.02	24.87	54.02	-29.15	Average
4	0.19	40.30	0.11	10.02	50.43	64.02	-13.59	QP
5	0.20	13.05	0.10	10.03	23.18	53.49	-30.31	Average
6	0.20	39.65	0.10	10.03	49.78	63.49	-13.71	QP
7	0.23	21.04	0.10	10.04	31.18	52.44	-21.26	Average
8	0.23	38.13	0.10	10.04	48.27	62.44	-14.17	QP
9	0.28	9.19	0.10	10.05	19.34	50.90	-31.56	Average
10	0.28	33.35	0.10	10.05	43.50	60.90	-17.40	QP
11	0.29	17.56	0.10	10.05	27.71	50.46	-22.75	Average
12	0.29	32.47	0.10	10.05	42.62	60.46	-17.84	QP
13	0.35	16.20	0.10	10.06	26.36	48.91	-22.55	Average
14	0.35	30.37	0.10	10.06	40.53	58.91	-18.38	QP
15	0.41	14.57	0.10	10.07	24.74	47.64	-22.90	Average

Notes: Emission Level = Read Level + LISN Factor + Cable loss



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Test Mode: 00; Line: Live line

	Freq (MHz)	Read level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Emission Level (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
16	0.41	28.31	0.10	10.07	38.48	57.64	-19.16	QP
17	17.20	17.27	0.49	10.35	28.11	50.00	-21.89	Average
18	17.20	22.65	0.49	10.35	33.49	60.00	-26.51	QP

Notes: Emission Level = Read Level + LISN Factor + Cable loss



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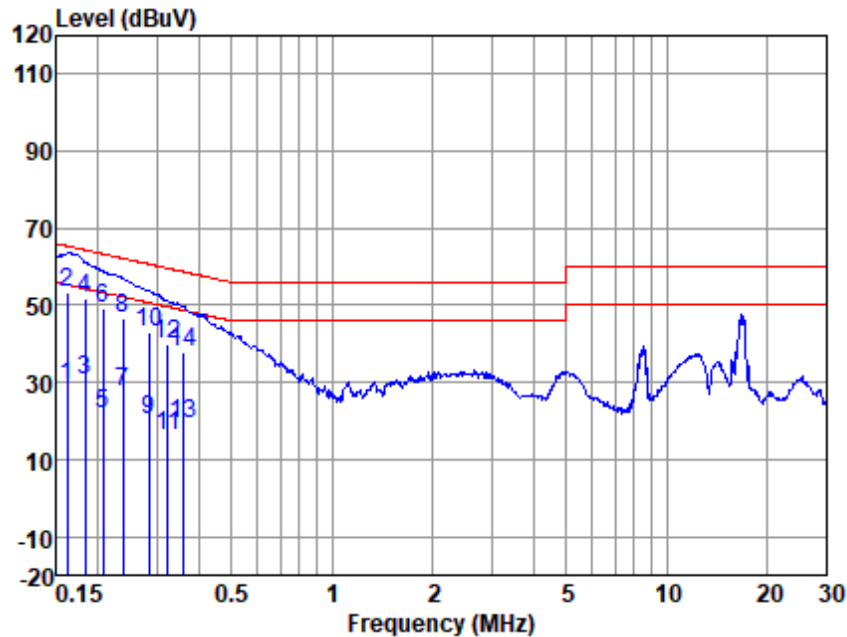
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Test Mode: 00; Line: Neutral Line



LISN : NEUTRAL
EUT/Project No : 01225LM
Test Mode : 00

	Freq (MHz)	Read level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Emission Level (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
1	0.16	19.20	0.10	10.02	29.32	55.38	-26.06	Average
2	0.16	43.08	0.10	10.02	53.20	65.38	-12.18	QP
3	0.18	20.41	0.10	10.02	30.53	54.37	-23.84	Average
4	0.18	41.54	0.10	10.02	51.66	64.37	-12.71	QP
5	0.21	11.93	0.10	10.03	22.06	53.36	-31.30	Average
6	0.21	38.96	0.10	10.03	49.09	63.36	-14.27	QP
7	0.24	17.41	0.10	10.04	27.55	52.22	-24.67	Average
8	0.24	36.58	0.10	10.04	46.72	62.22	-15.50	QP
9	0.28	10.16	0.10	10.05	20.31	50.72	-30.41	Average
10	0.28	32.75	0.10	10.05	42.90	60.72	-17.82	QP
11	0.32	5.87	0.10	10.06	16.03	49.62	-33.59	Average
12	0.32	29.83	0.10	10.06	39.99	59.62	-19.63	QP
13	0.36	8.93	0.10	10.06	19.09	48.78	-29.69	Average
14	0.36	27.51	0.10	10.06	37.67	58.78	-21.11	QP

Notes: Emission Level = Read Level + LISN Factor + Cable loss



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t (86-21) 61915666
t (86-21) 61915666

f (86-21) 61915678
f (86-21) 61915678

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7.2 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 ≥ 50 hopping channels
	0.25 for $25 \leq$ hopping channels < 50
	1 for digital modulation
2400-2483.5	1 for ≥ 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

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C

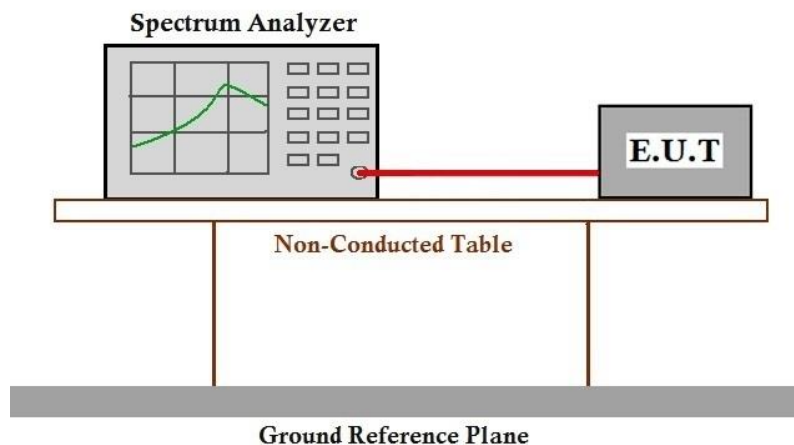
Humidity: 53.8 % RH

Atmospheric Pressure: 1010 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.2.3 Test Setup Diagram



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7.2.4 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



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7.3 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

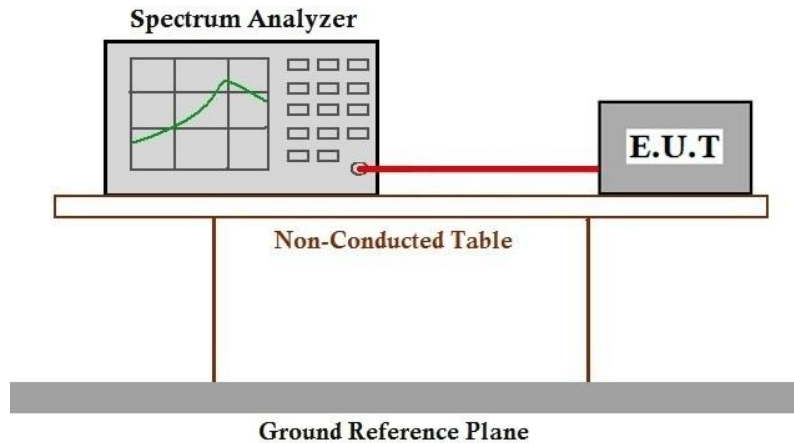
7.3.1 E.U.T. Operation

Operating Environment:
Temperature: 25.0 °C Humidity: 53.8 % RH Atmospheric Pressure: 1010 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	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

Please Refer to Appendix for Details



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7.4 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

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C

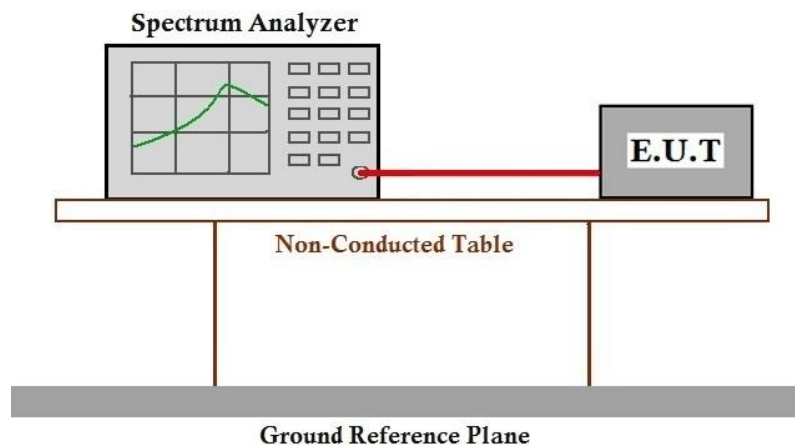
Humidity: 53.8 % RH

Atmospheric Pressure: 1010 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	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

Please Refer to Appendix for Details



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t (86-21) 61915666
t (86-21) 61915666

f (86-21) 61915678
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7.5 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)).

7.5.1 E.U.T. Operation

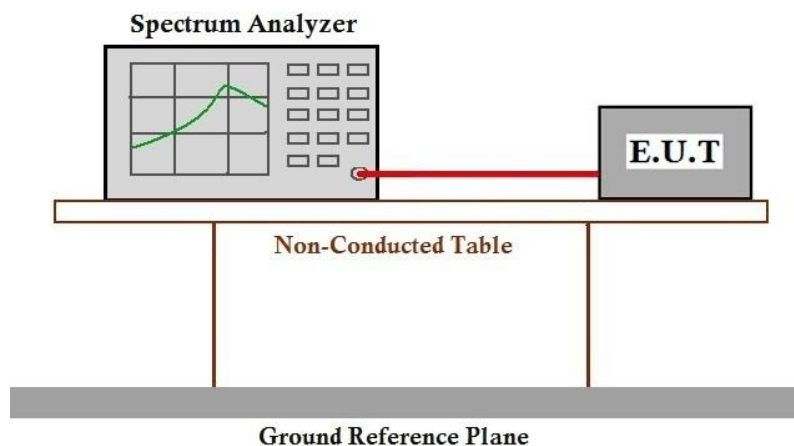
Operating Environment:

Temperature: 25.0 °C Humidity: 53.7 % RH Atmospheric Pressure: 1010 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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7.6 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)).

7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C

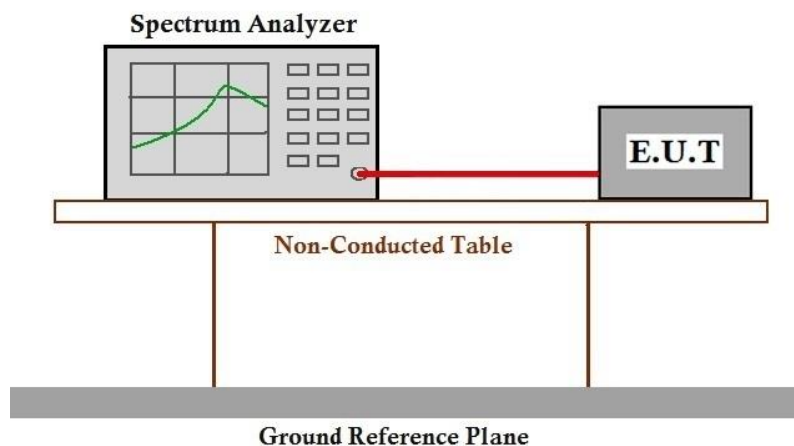
Humidity: 54.0 % RH

Atmospheric Pressure: 1010 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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7.7 Radiated Emissions which fall in the restricted bands

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

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

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.

7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C Humidity: 54.1 % RH Atmospheric Pressure: 1010 mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.



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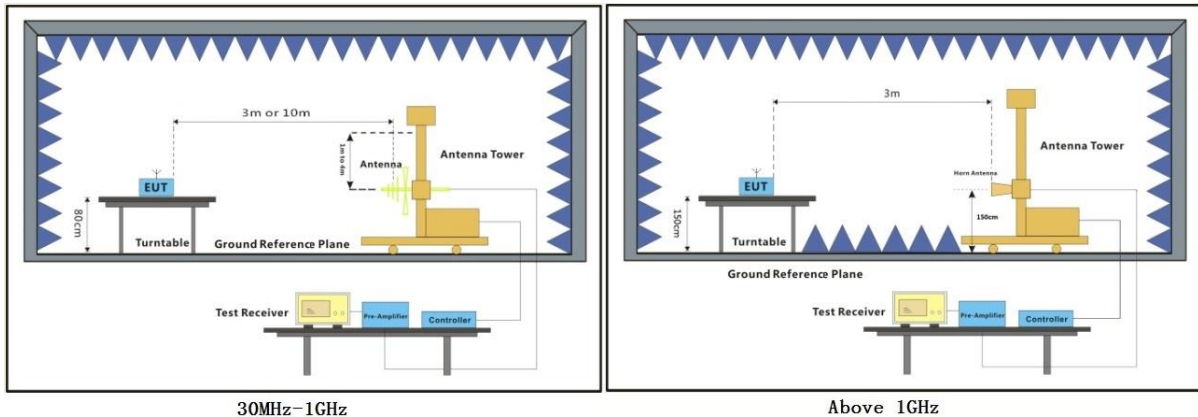
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7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

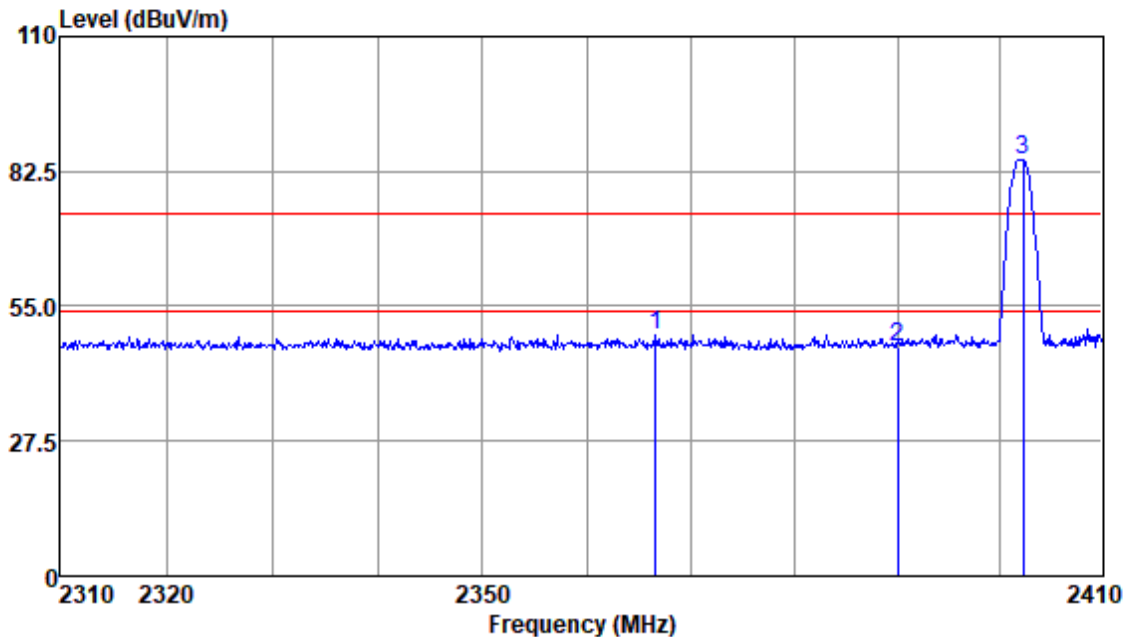
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 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.
- c. 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.
- d. 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.
- e. 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.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. 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.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. 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.
- j. 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.



Test Mode: 00; Polarity: Horizontal; Modulation: GFSK; Channel: Low



Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2366.58	50.90	28.94	4.56	35.16	49.24	74.00	-24.76	Peak
2390.00	48.43	28.97	4.60	35.18	46.82	74.00	-27.18	Peak
2402.25	86.49	29.01	4.62	35.19	84.93	74.00	10.93	Peak

Note: Emission Level = Read Level + Antenna Factor + Cable loss - Preamplifier Factor



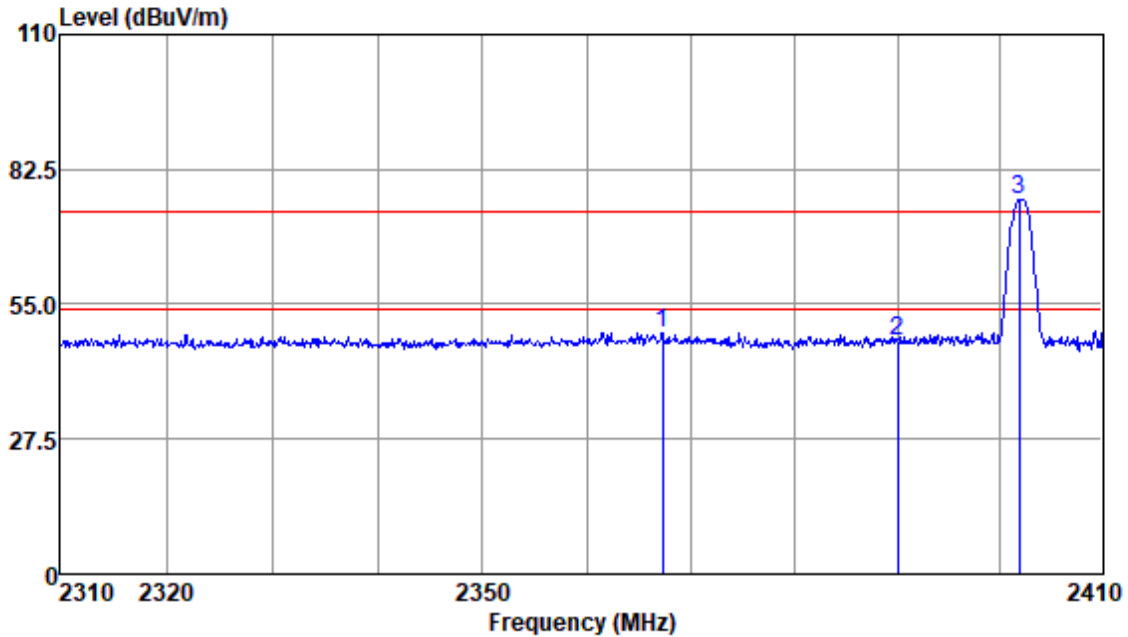
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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



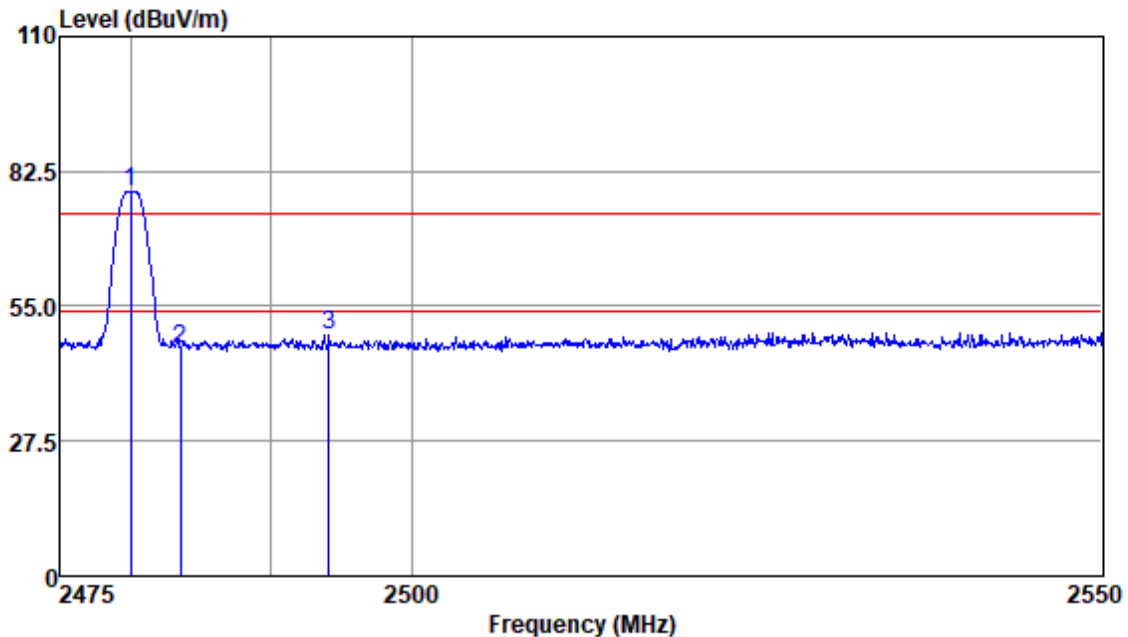
Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2367.28	50.82	28.94	4.56	35.16	49.16	74.00	-24.84	Peak
2390.00	48.99	28.97	4.60	35.18	47.38	74.00	-26.62	Peak
2401.84	77.95	29.01	4.62	35.19	76.39	74.00	2.39	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



Test Mode: 00; Polarity: Horizontal; Modulation: GFSK; Channel: High



Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2479.96	79.79	29.10	4.76	35.25	78.40	74.00	4.40	Peak
2483.50	47.51	29.11	4.78	35.26	46.14	74.00	-27.86	Peak
2494.14	50.49	29.13	4.79	35.26	49.15	74.00	-24.85	Peak

Note: Emission Level = Read Level + Antenna Factor + Cable loss - Preamplifier Factor



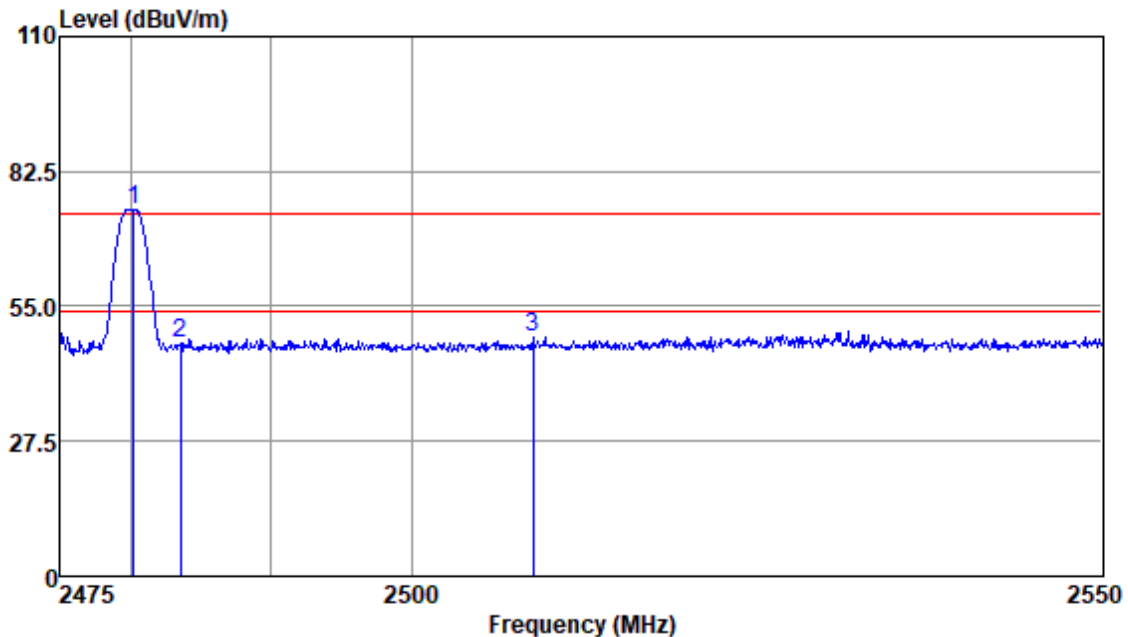
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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2480.18	76.25	29.10	4.76	35.25	74.86	74.00	0.86	Peak
2483.50	48.68	29.11	4.78	35.26	47.31	74.00	-26.69	Peak
2508.77	49.92	29.21	4.81	35.28	48.66	74.00	-25.34	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor



7.8 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

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

7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 27.3 °C

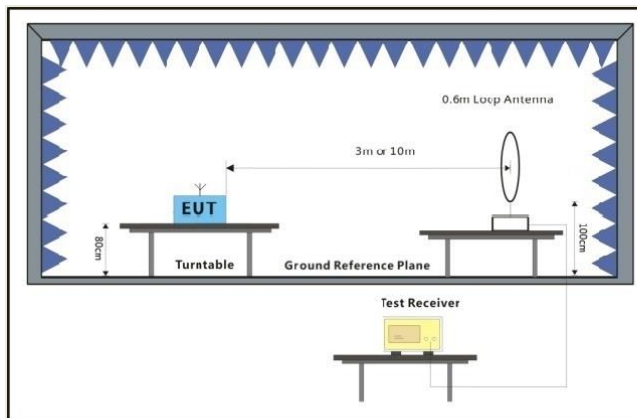
Humidity: 48.1 % RH

Atmospheric Pressure: 1010 mbar

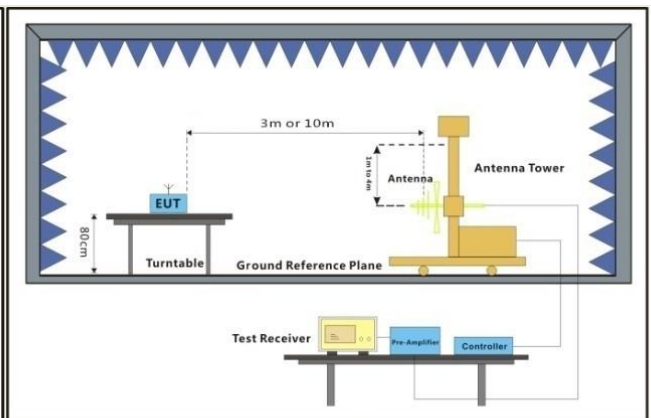
7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.8.3 Test Setup Diagram



Below 30MHz



30MHz-1GHz



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7.8.4 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.
3. The disturbance below 1GHz was very low and the harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.



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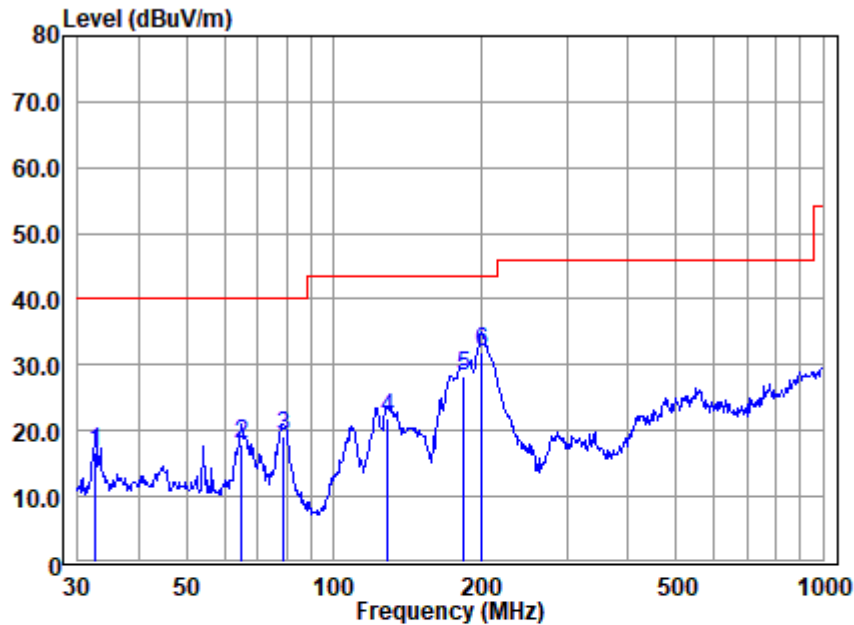
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Test Mode: 00; Polarity: Horizontal



Antenna Polarity :Horizontal
EUT/Project :1225LM
Test mode :00

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
	MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
1	32.54	34.77	12.15	1.53	31.70	16.75	40.00	-23.25	QP
2	64.95	35.32	12.50	1.98	31.90	17.90	40.00	-22.10	QP
3	79.19	39.49	9.13	2.16	31.70	19.08	40.00	-20.92	QP
4	128.99	39.19	11.87	2.61	31.90	21.77	43.50	-21.73	QP
5	184.10	45.89	11.13	3.27	32.10	28.19	43.50	-15.31	QP
6	199.69	50.79	9.86	3.38	32.18	31.85	43.50	-11.65	QP

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



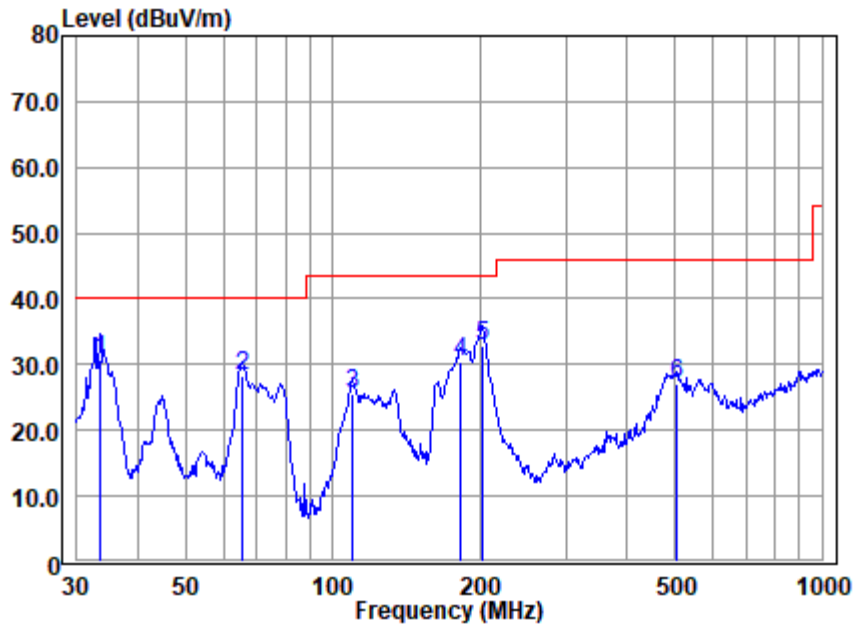
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Test Mode: 00; Polarity: Vertical



Antenna Polarity :Vertical
EUT/Project :1225LM
Test mode :00

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
	MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
1	33.55	48.46	12.30	1.52	31.70	30.58	40.00	-9.42	QP
2	65.28	45.86	12.40	1.99	31.90	28.35	40.00	-11.65	QP
3	109.63	44.96	10.27	2.48	32.10	25.61	43.50	-17.89	QP
4	183.16	48.13	11.25	3.25	32.10	30.53	43.50	-12.97	QP
5	201.73	52.00	9.82	3.40	32.22	33.00	43.50	-10.50	QP
6	506.12	36.93	17.96	5.64	33.55	26.98	46.00	-19.02	QP

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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7.9 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

Limit:

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

7.9.1 E.U.T. Operation

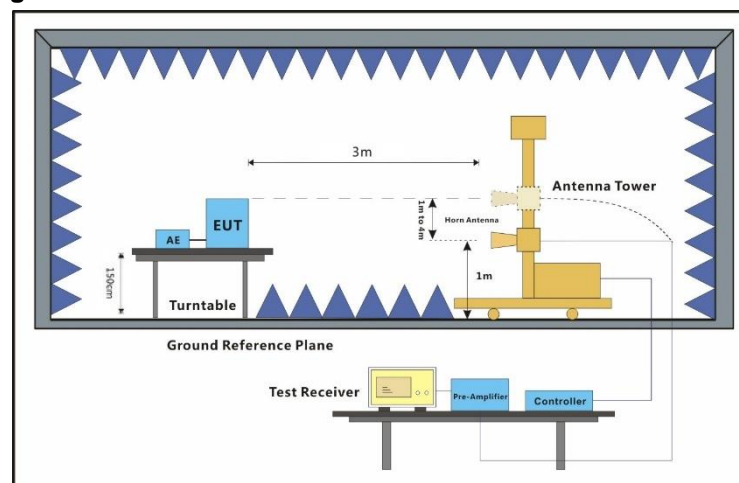
Operating Environment:

Temperature: 25.0 °C Humidity: 53.6 % RH Atmospheric Pressure: 1010 mbar

7.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.9.3 Test Setup Diagram



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7.9.4 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.



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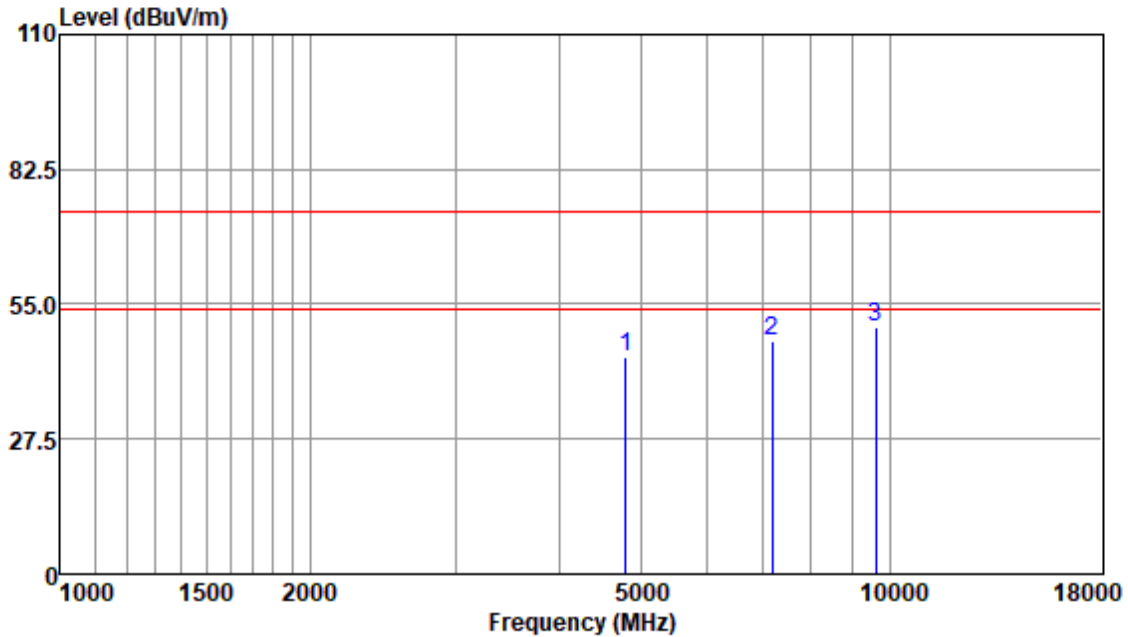
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Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4804.00	44.02	33.72	5.09	38.71	44.12	74.00	-29.88	Peak
7206.00	42.50	36.28	5.75	37.18	47.35	74.00	-26.65	Peak
9608.00	39.85	37.70	6.78	34.18	50.15	74.00	-23.85	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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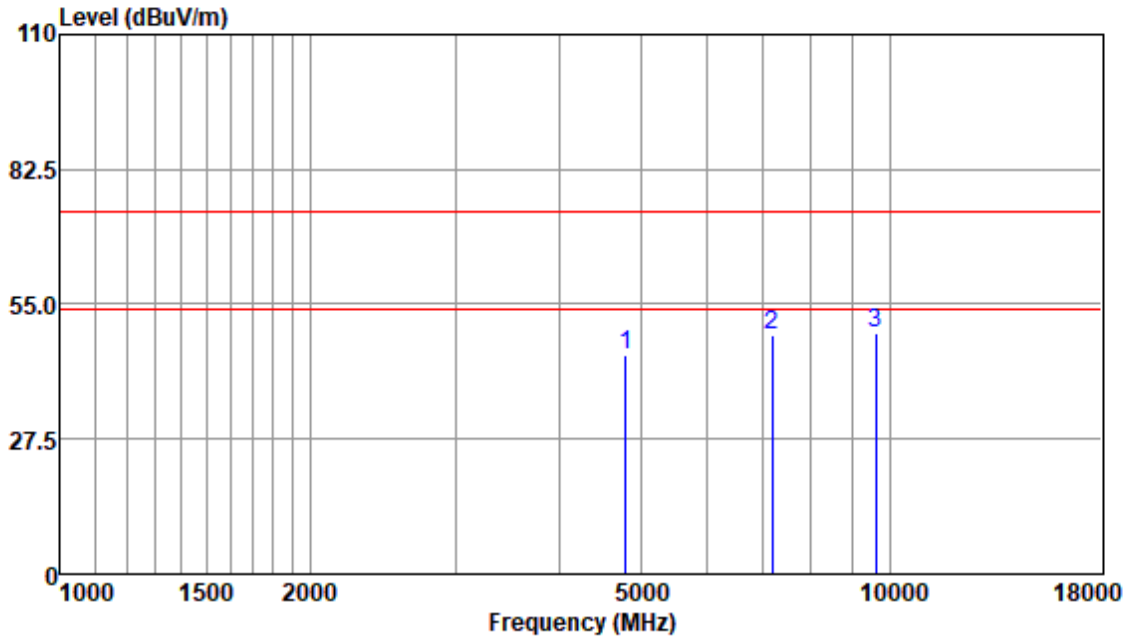
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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



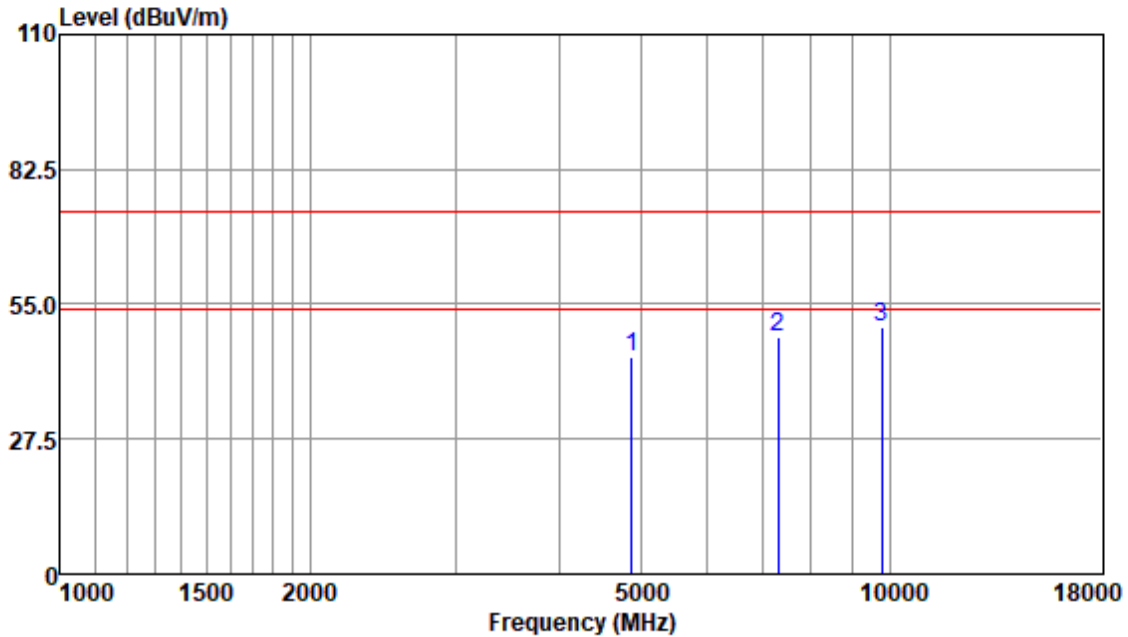
Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4804.00	44.42	33.72	5.09	38.71	44.52	74.00	-29.48	Peak
7206.00	43.80	36.28	5.75	37.18	48.65	74.00	-25.35	Peak
9608.00	38.97	37.70	6.78	34.18	49.27	74.00	-24.73	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:middle



Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4880.00	44.49	33.93	4.48	38.78	44.12	74.00	-29.88	Peak
7320.00	42.99	36.47	5.80	37.10	48.16	74.00	-25.84	Peak
9760.00	40.16	37.68	6.48	34.15	50.17	74.00	-23.83	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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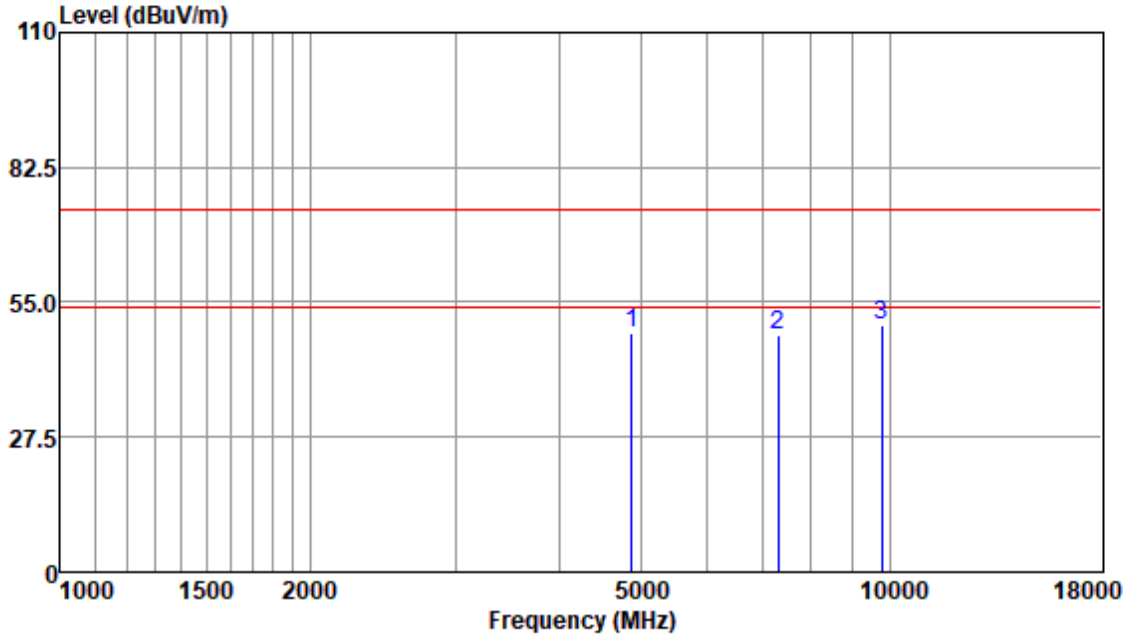
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t (86-21) 61915666

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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:middle



Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4880.00	48.92	33.93	4.48	38.78	48.55	74.00	-25.45	Peak
7320.00	43.10	36.47	5.80	37.10	48.27	74.00	-25.73	Peak
9760.00	40.16	37.68	6.48	34.15	50.17	74.00	-23.83	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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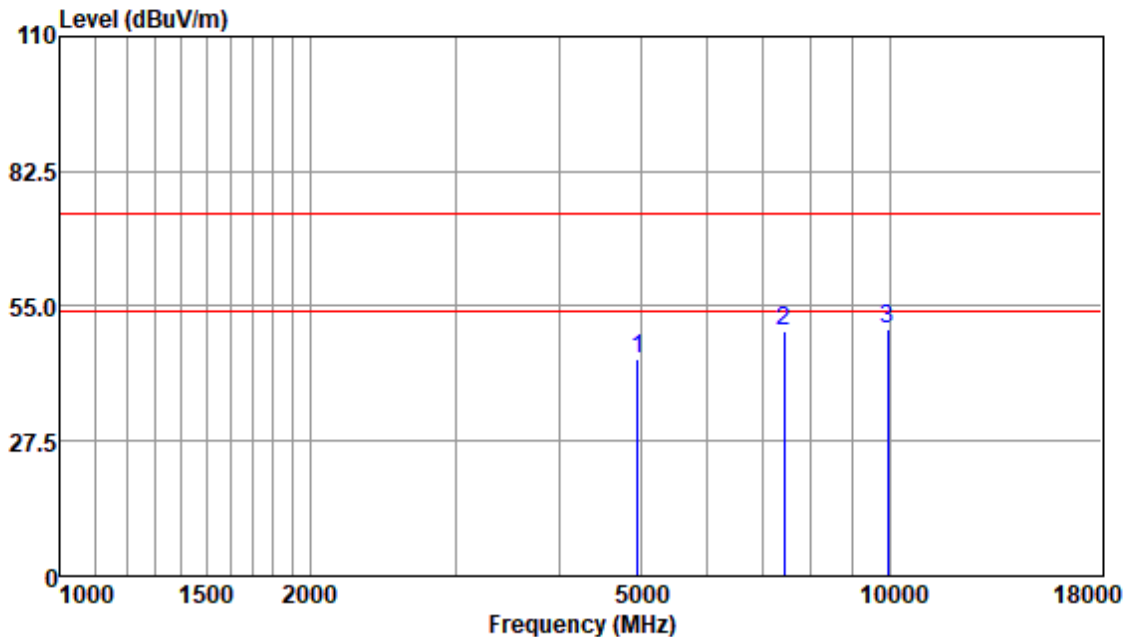
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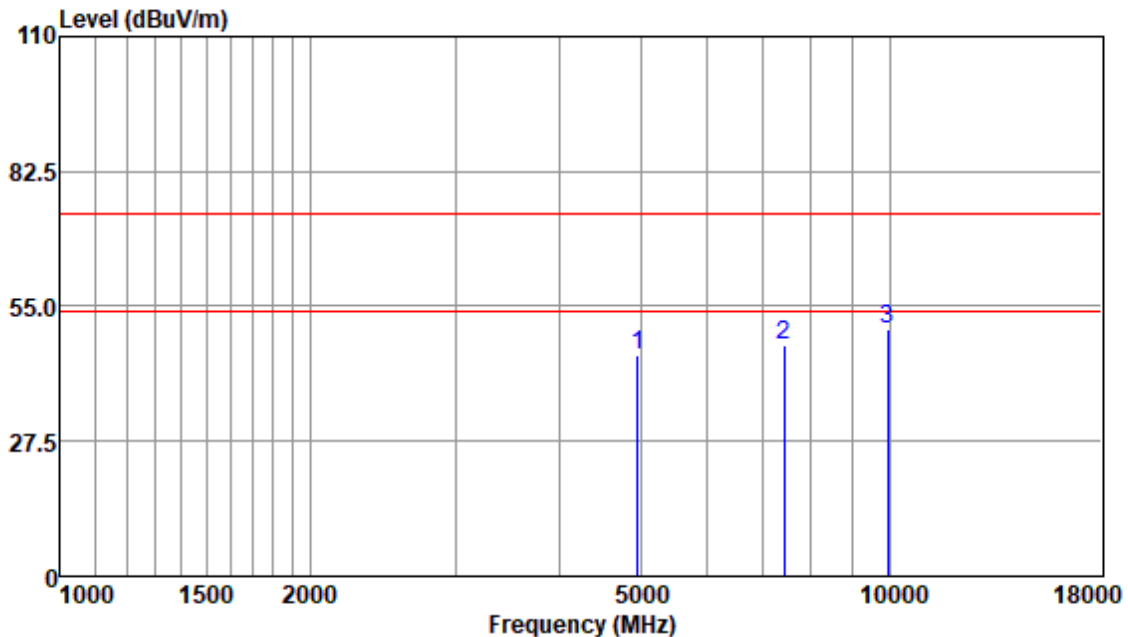
Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4960.00	44.01	33.98	5.04	38.87	44.16	74.00	-29.84	Peak
7440.00	44.39	36.40	6.09	37.03	49.85	74.00	-24.15	Peak
9920.00	40.18	37.81	6.53	34.11	50.41	74.00	-23.59	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4960.00	45.06	33.98	5.04	38.87	45.21	74.00	-28.79	Peak
7440.00	41.79	36.40	6.09	37.03	47.25	74.00	-26.75	Peak
9920.00	39.92	37.81	6.53	34.11	50.15	74.00	-23.85	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SHCR2206001225LM

9 EUT Constructional Details (EUT Photos)

Refer to Appendix - Photographs of EUT Constructional Details for SHCR2206001225LM

10 Appendix

1. Duty Cycle

1.1 Ant1

1.1.1 Test Result

Ant1							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
1M	SISO	2402	100.000	100.000	100.00	0.00	0.00
		2440	100.000	100.000	100.00	0.00	0.00
		2480	100.000	100.000	100.00	0.00	0.00



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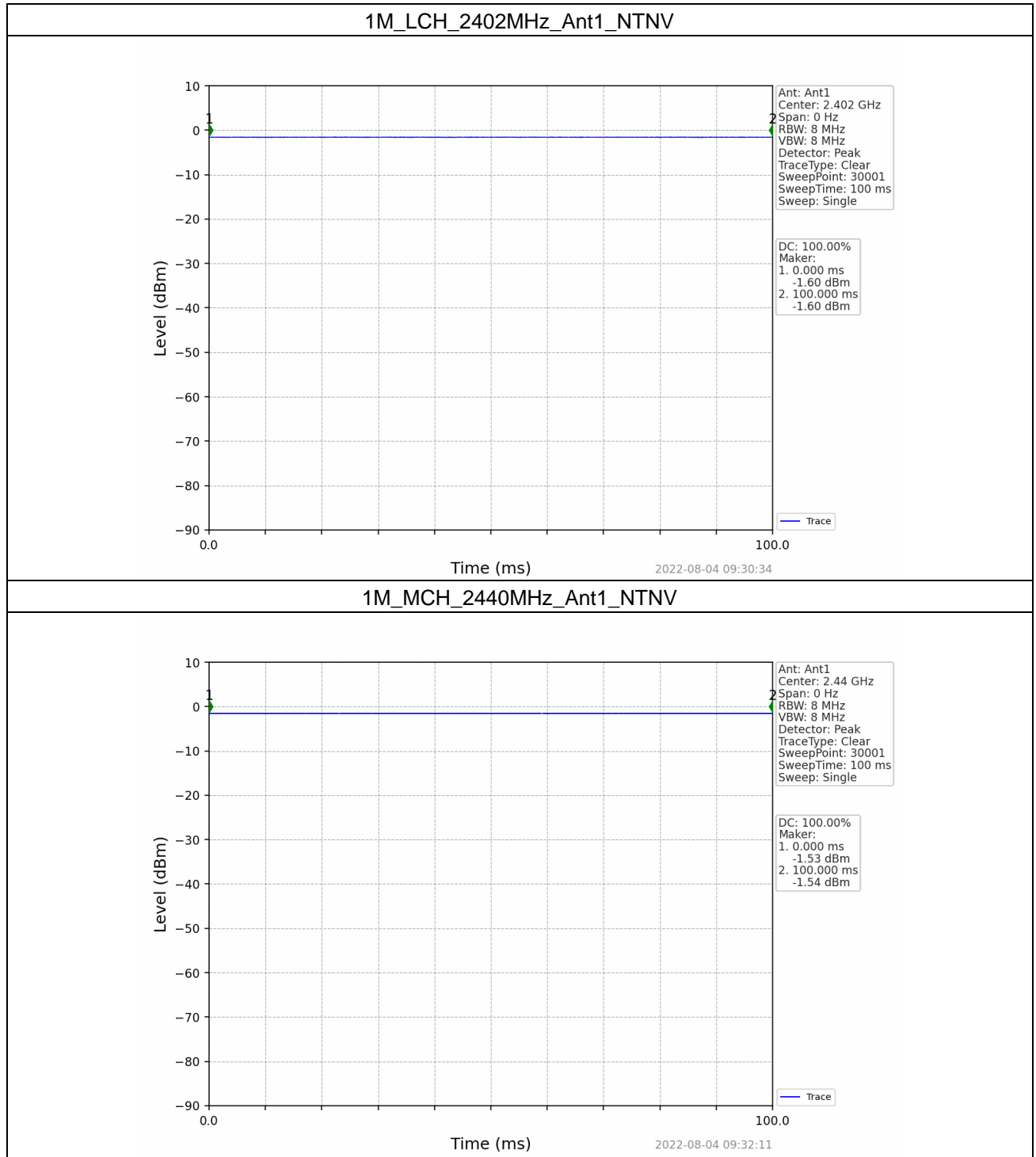
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1.1.2 Test Graph



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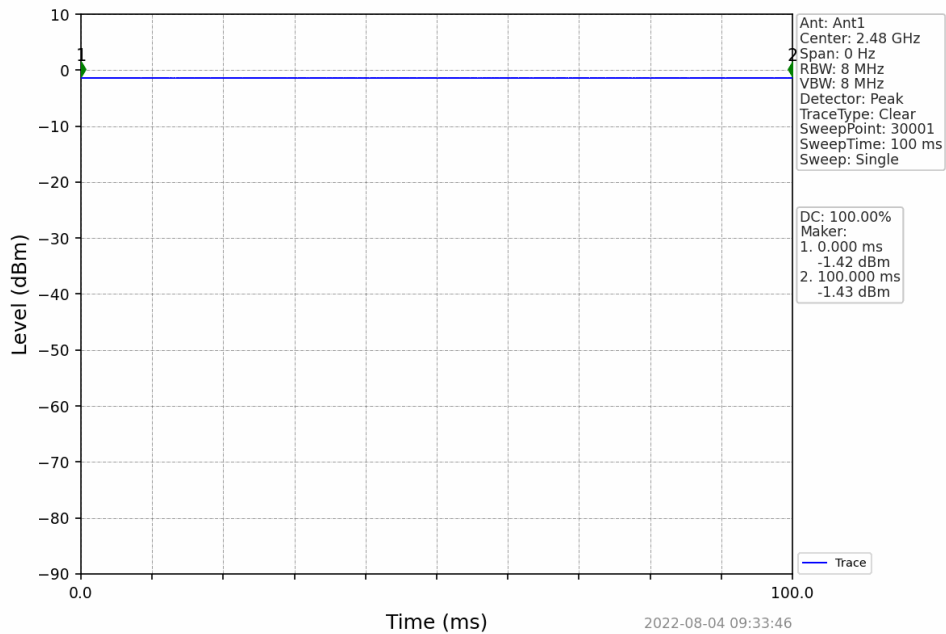
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1M_HCH_2480MHz_Ant1_NTNV



2. Bandwidth

2.1 OBW

2.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)	Verdict
				Result	
1M	SISO	2402	1	1.029	Pass
		2440	1	1.023	Pass
		2480	1	1.006	Pass



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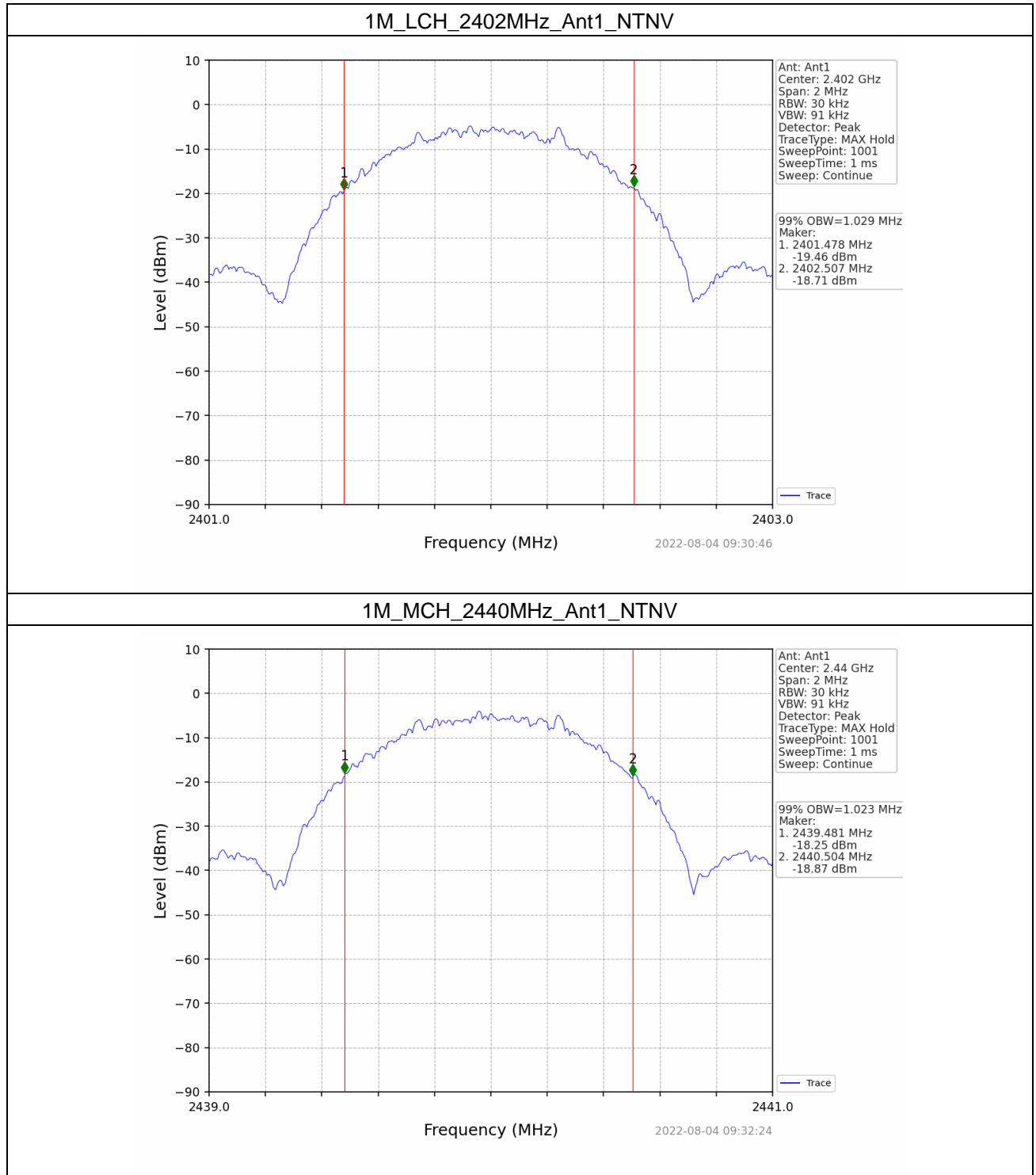
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2.1.2 Test Graph



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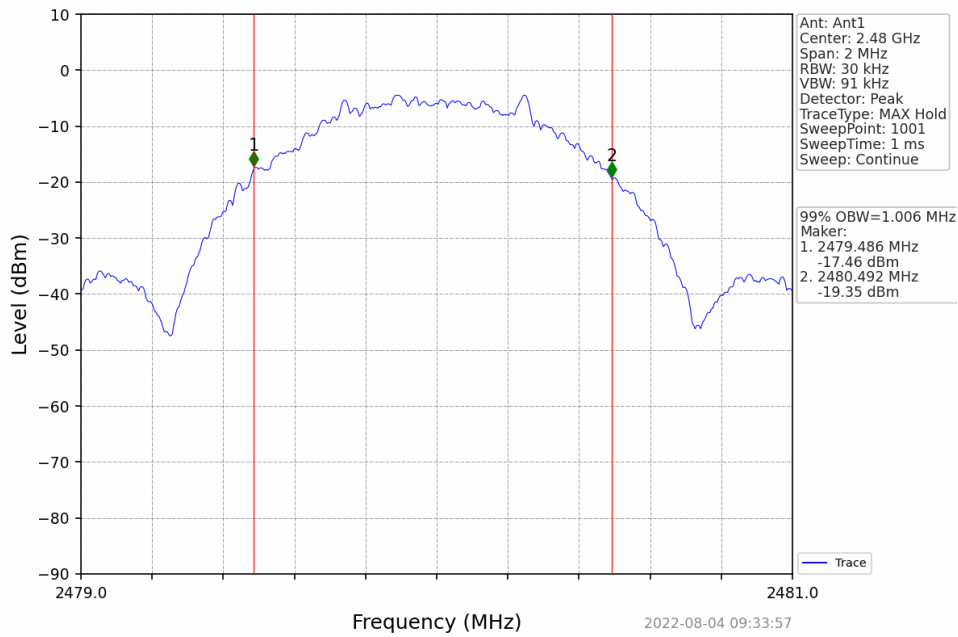
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t (86-21) 61915666

f (86-21) 61915678
f (86-21) 61915678

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1M_HCH_2480MHz_Ant1_NTNV



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t (86-21) 61915666

f (86-21) 61915678
f (86-21) 61915678

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2.2 6dB BW

2.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	1	0.682	≥ 0.5	Pass
		2440	1	0.669	≥ 0.5	Pass
		2480	1	0.661	≥ 0.5	Pass



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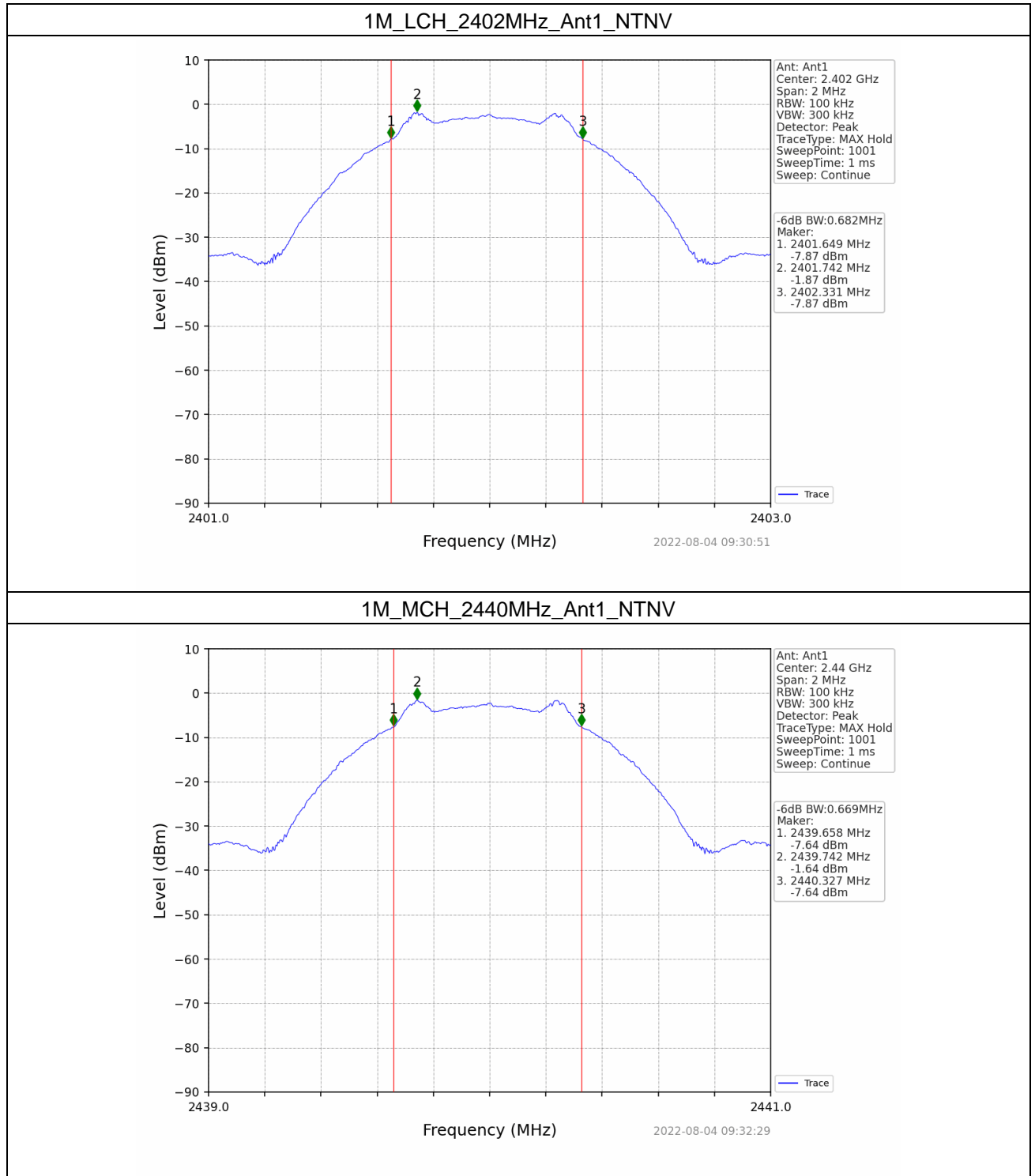
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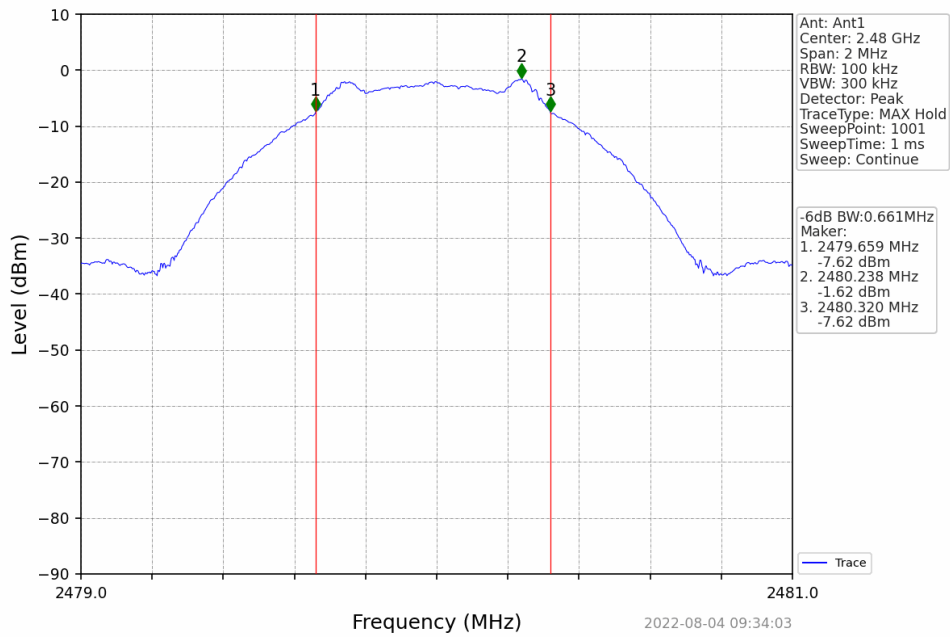
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f (86-21) 61915678

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3. Maximum Conducted Output Power

3.1 Power

3.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
1M	SISO	2402	-1.60	<=30	Pass
		2440	-1.54	<=30	Pass
		2480	-1.43	<=30	Pass

Note1: Antenna Gain: Ant1: 0.00dBi;



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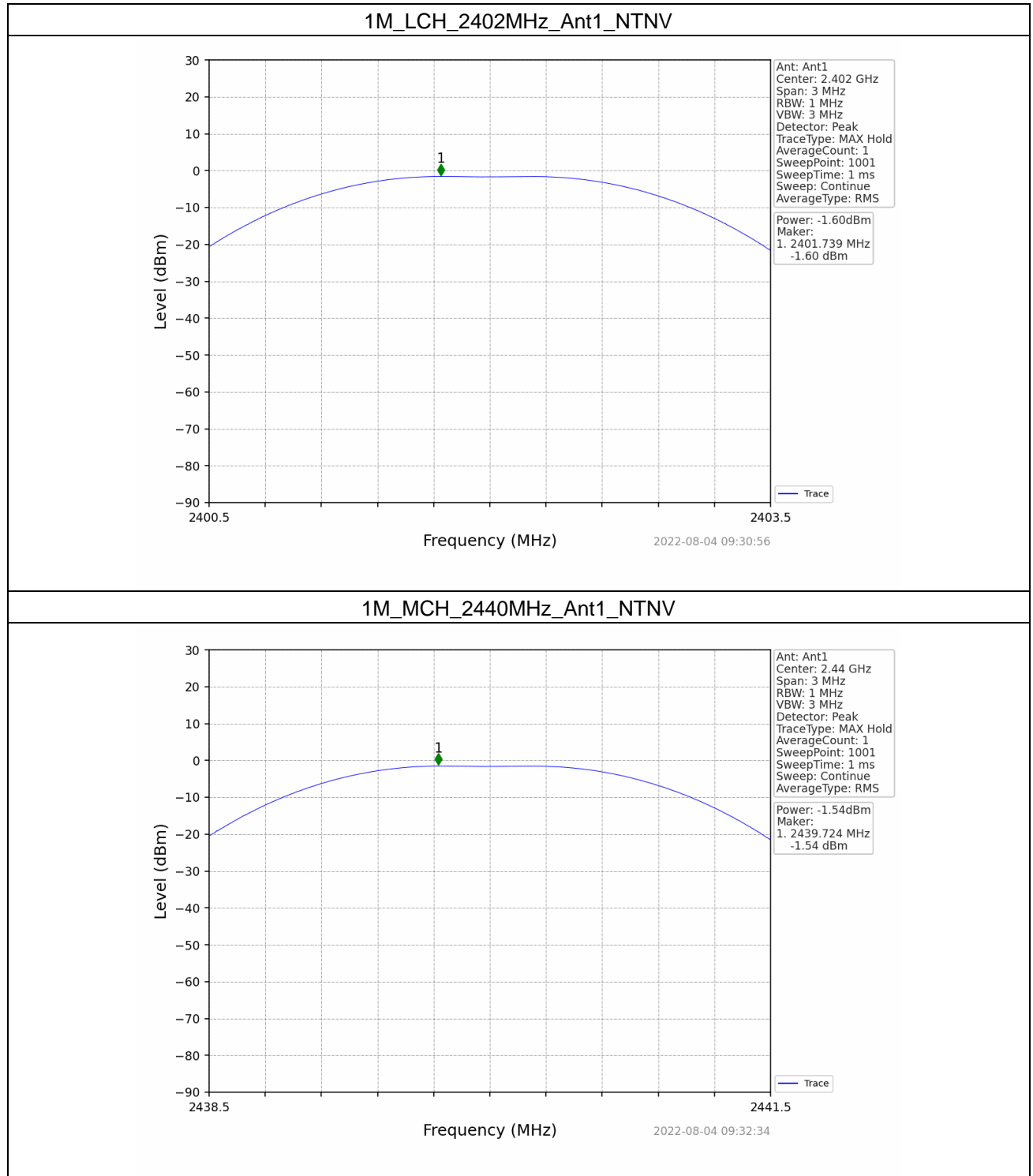
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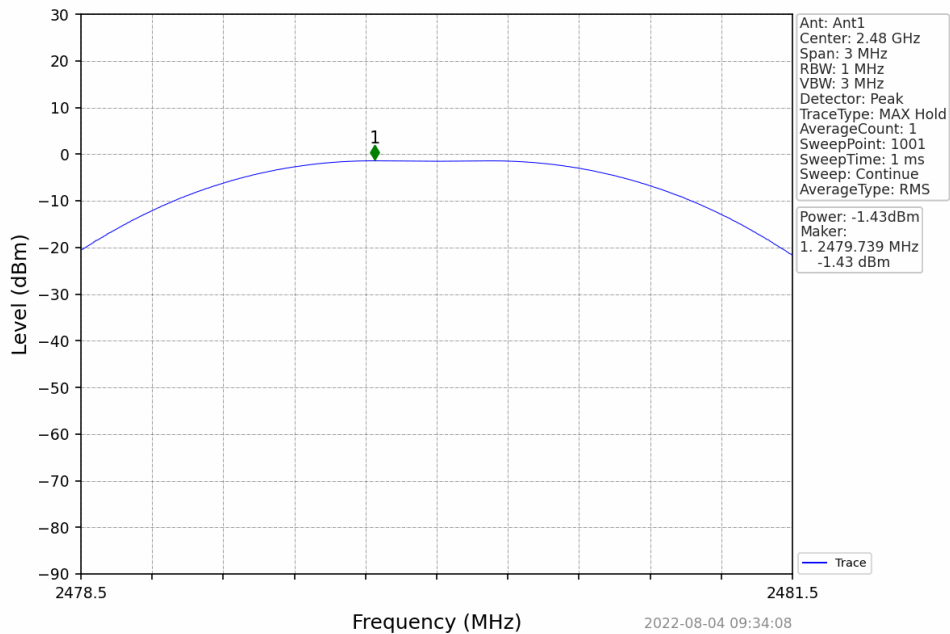
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4. Maximum Power Spectral Density

4.1 PSD

4.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT1	Limit	
1M	SISO	2402	-12.18	<=8	Pass
		2440	-11.93	<=8	Pass
		2480	-10.83	<=8	Pass

Note1: Antenna Gain: Ant1: 0.00dBi;



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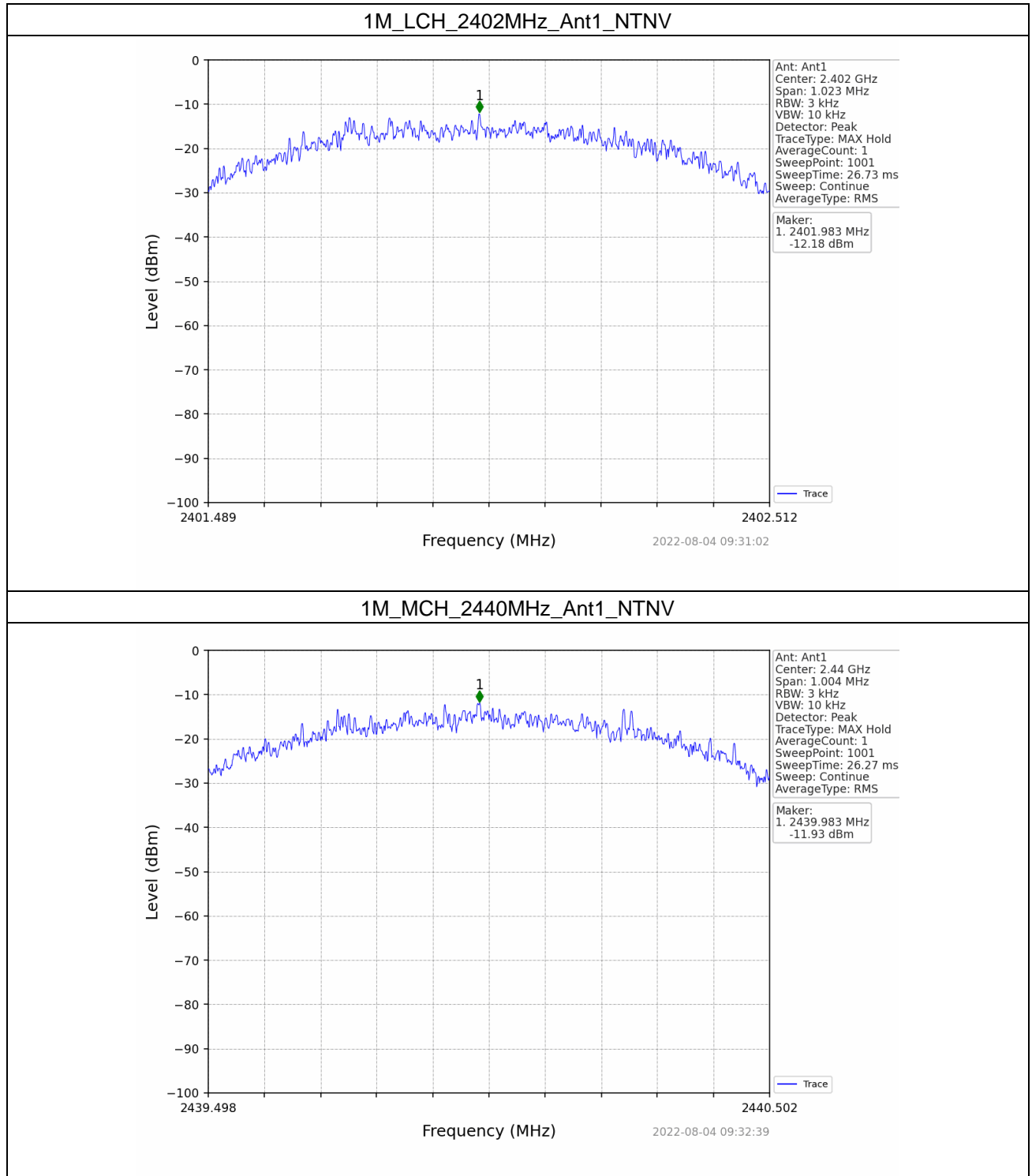
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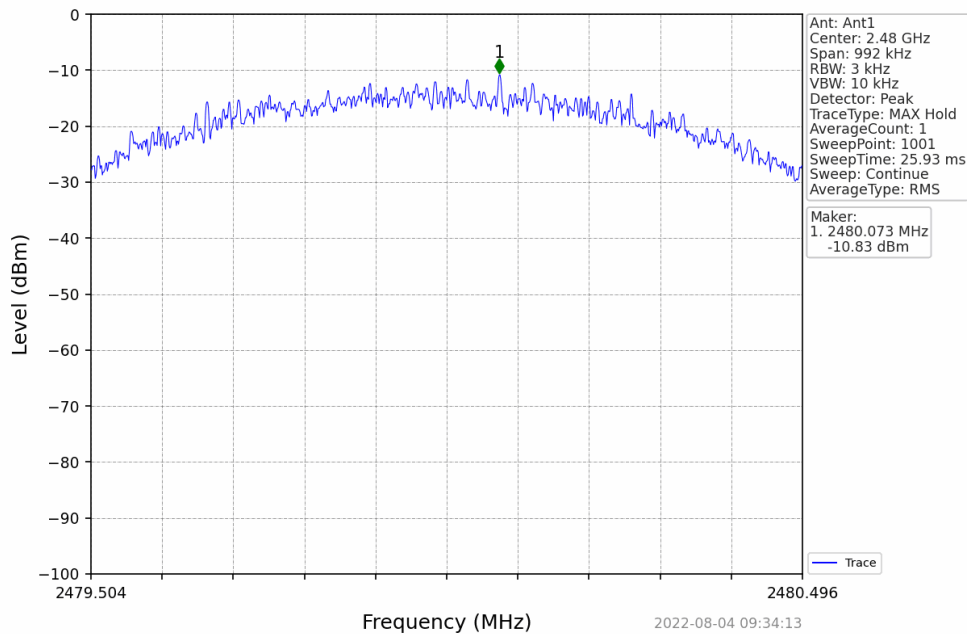
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5. Unwanted Emissions InStandard Non-restricted Frequency Bands

5.1 Ref

5.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
1M	SISO	2402	1	-1.77
		2440	1	-1.83
		2480	1	-1.63

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.

Note2: RBW = 1MHz was used during the pre-test. The final test will be performed at RBW=100kHz while the margin is less than 3dB.



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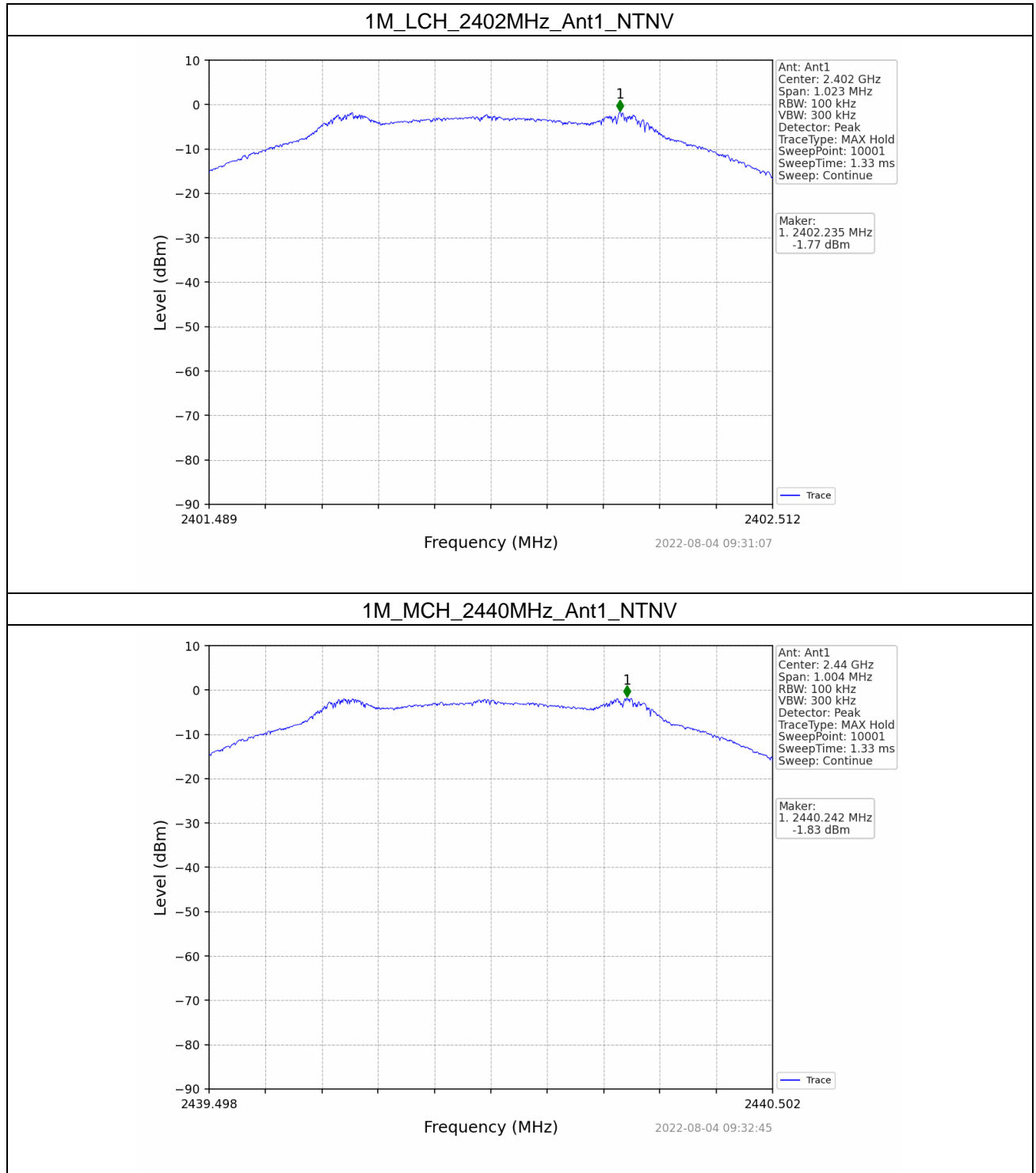
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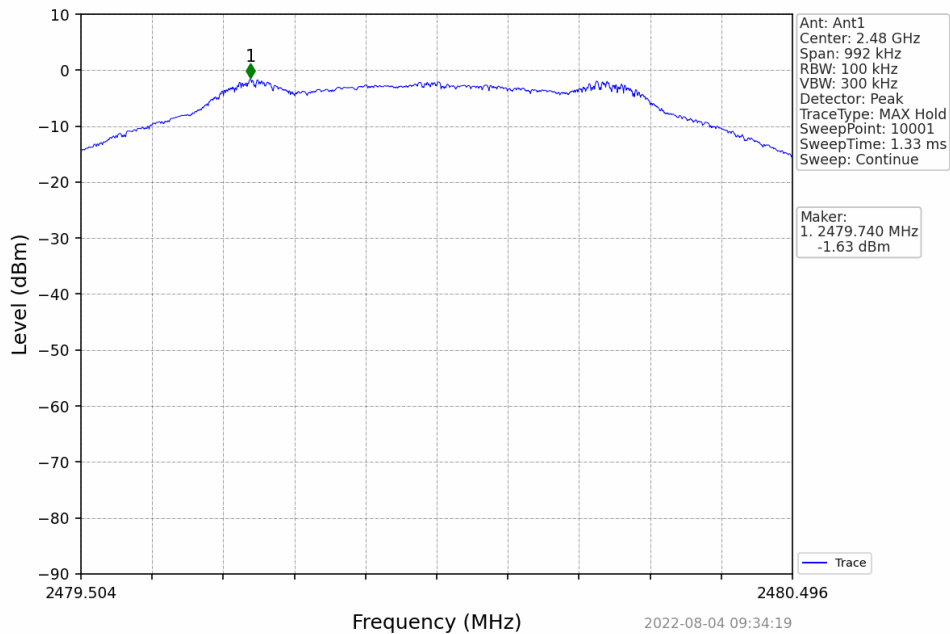
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5.2 CSE

5.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
1M	SISO	2402	1	-1.63	-21.63	Pass
		2440	1	-1.63	-21.63	Pass
		2480	1	-1.63	-21.63	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.

Note2: RBW = 1MHz was used during the pre-test. The final test will be performed at RBW=100kHz while the margin is less than 3dB.



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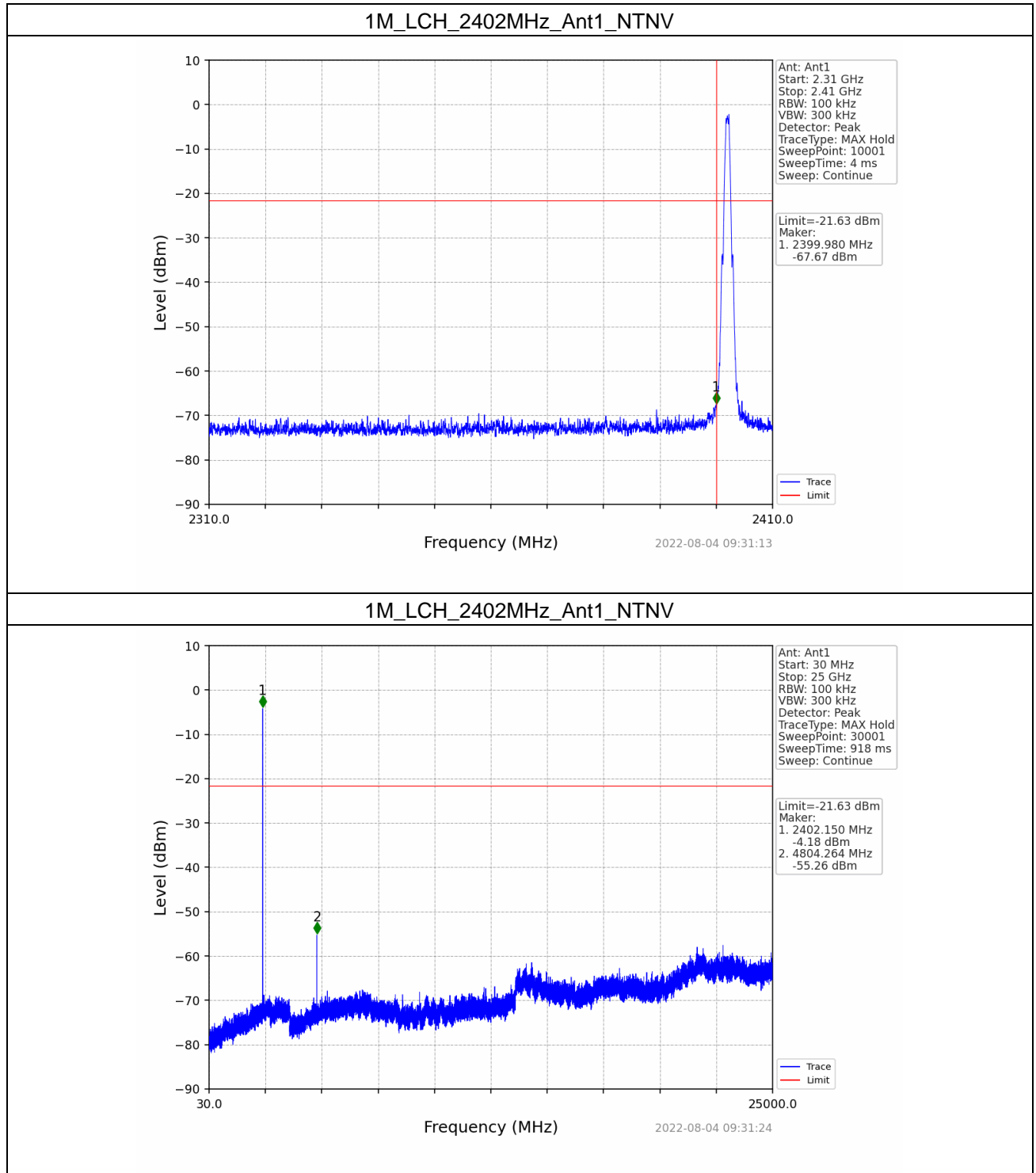
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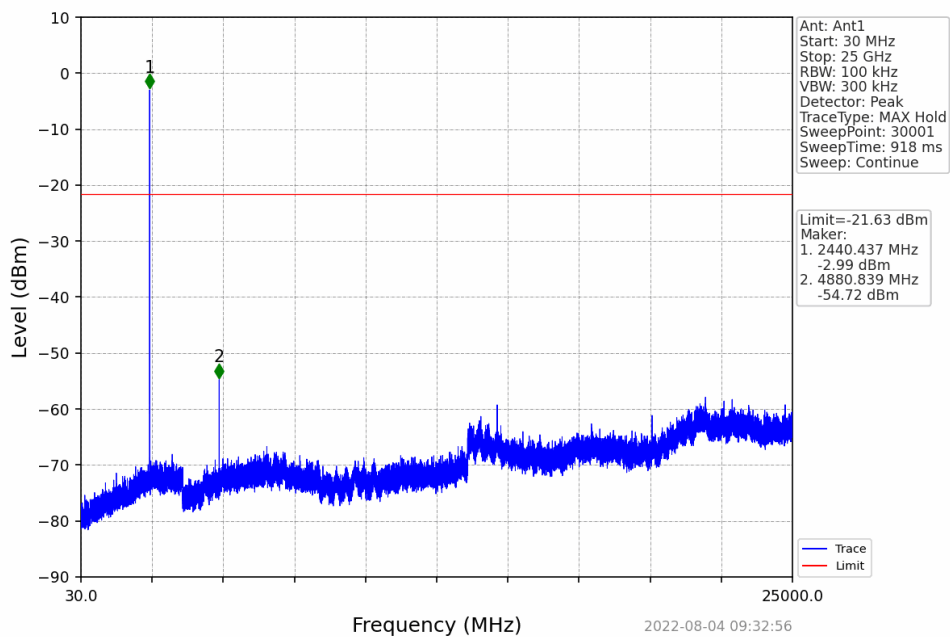
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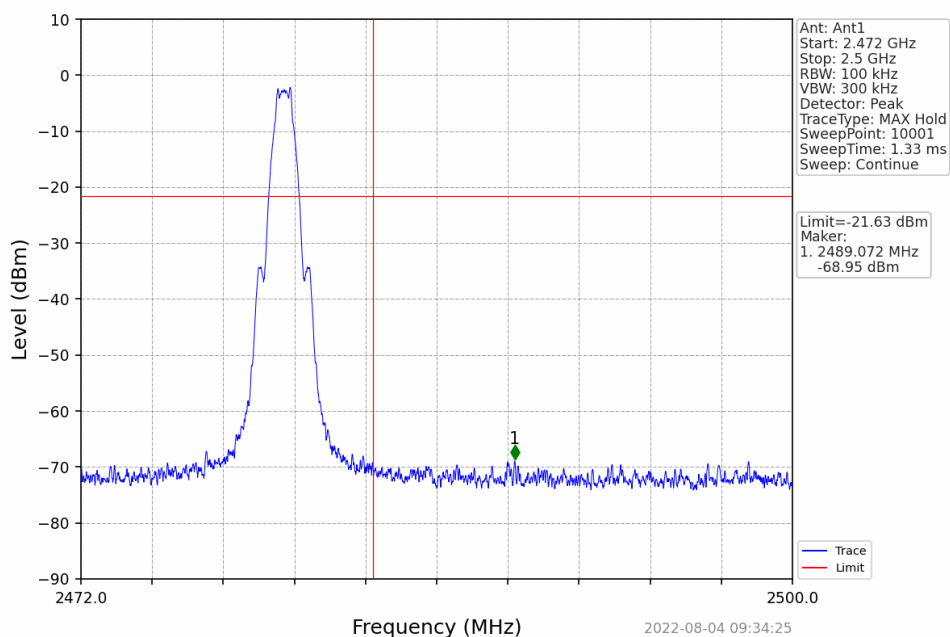
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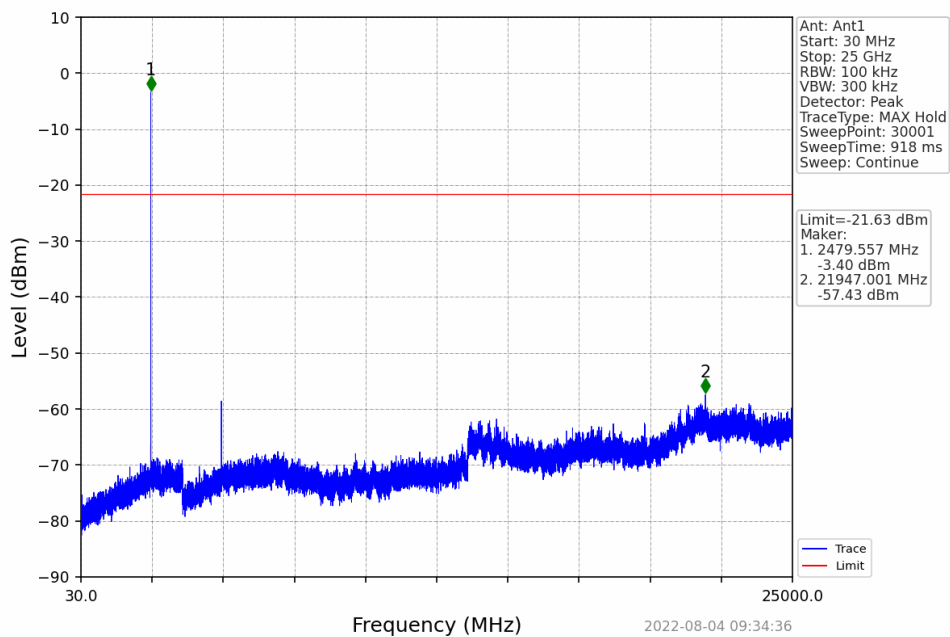
NO.588 West Jindu Road, Songjiang District, Shanghai China 201612
中国·上海·松江区金都西路588号 邮编: 201612

t (86-21) 61915666
t (86-21) 61915666

f (86-21) 61915678
f (86-21) 61915678

www.sgs.com
sgs.china@sgs.com

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