

TEST REPORT

Application No.: GZCR2308000879AT
Applicant: Milwaukee Electric Tool Corporation
Address of Applicant: 13135 West Lisbon Road Brookfield Wisconsin 53005 United States
Manufacturer: Milwaukee Electric Tool Corporation
Address of Manufacturer: 13135 West Lisbon Road Brookfield Wisconsin 53005 United States
Factory:
 1. Huizhou Topband Electrical Technology Co., Ltd.
 2. TOPBAND SMART DONG NAI (VIET NAM) COMPANY LIMITED
Address of Factory:
 1. No.113 Dongxin Road, Dongjiang Hi-Tech Industrial Zone, Zhongkai Hi-Tech District, Huizhou, Guangdong, China
 2. Lot D, Loc An-Binh Son Industrial Park, Long An Commune, Long Thanh District, Dong Nai Province, Viet Nam
Equipment Under Test (EUT):
EUT Name: Flat Pack
Model No.: 48-11-2330
Trade Mark: 
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2023-08-28
Date of Test: 2023-09-05 to 2023-11-10
Date of Issue: 2023-11-22

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

Ricky Liu

Ricky Liu
Manager



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Revision Record			
Version	Report No.	Date	Remark
01	GZCR230800087902	2023-11-22	Original

Authorized for issue by			
		Kevin Zhang	
		Kevin Zhang/Project Engineer	
		Vico Cui	
		Vico Cui/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(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
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2013) Section 11.12	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

Note:

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 10.8V powered by built-in battery (3* 3.6Vdc/3000mAh) Charging Voltage: 5Vdc, 9Vdc, 12Vdc, 15Vdc Discharging Voltage (type-c): 5Vdc/3A Discharging Voltage (DC Jack): 12Vdc/2.4A
Test Voltage:	AC 120V, 60Hz powered by DC Power Supply refer to section 4.2
Cable(s):	Type-c port DC Jack port Data port
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	Bluetooth LE 5.2
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	Integrated antenna
Antenna Gain:	0 dBi

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Mobile Phone	APPLE	iPhone 12 mini	F71DP3NG0GQY
Note Book Computer	LENOVO	ThinkPad T490	PF1D1MVJ
Heated Jacket and USB cables supplied by the client.	/	/	/
DC Power Supply	GWINSTEK	GPS-3030DD (Input: AC100-240V, 50/60Hz; Output: DC Max.30V, 3A)	EMC0008



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4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±2.76dB
Conducted Peak Output Power	± 0.75dB
Minimum 6dB Bandwidth	± 3%
Power Spectrum Density	± 2.84dB
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Radiated Emissions which fall in the restricted bands	±5.00dB (30MHz-1GHz; 3m);±4.38dB (30MHz-1GHz; 10m);± 5.12dB (1GHz-6GHz); ±5.38dB (6GHz-18GHz); ±5.61dB(18GHz-40GHz)
Radiated Spurious Emissions Below 1GHz	±5.00dB (3m); ±4.38dB (10m)
Radiated Spurious Emissions Above 1GHz	±5.12dB (1GHz-6GHz); ±5.38dB (6GHz-18GHz); ±5.61dB(18GHz-40GHz)
Remark: The U _{lab} (lab Uncertainty) is less than U _{ETSI} (ETSI Uncertainty), so the test results – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit; – non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.	

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
198 Kezhu Road, Sciencetech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663

Tel: +86 20 82155555

Fax: +86 20 82075059

No tests were sub-contracted.



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4.5 Test Facility

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

● ACMA

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

● SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

● FCC Recognized Accredited Test Firm(Registration No.: 486818)

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

● ISED (Registration No.: 4620B, CAB identifier: CN0052)

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

● VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

● CBTL (Lab Code: TL129)

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Coaxial Cable	HangTianXing	2m	EMC0107	2023-08-04	2024-08-03
Shielding Room	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	2022-10-16	2025-10-15
Two-Line V-Network-GZ	Rohde & Schwarz	ENV216	EMC2135	2023-09-08	2024-09-07
EMI Test Receiver (9kHz-3.6GHz)	Rohde & Schwarz	ESR3	EMC2221	2023-05-19	2024-05-18
Test Software E3r	Audix	Ver.6.11812	GZE100-77	N/A	N/A

Conducted Peak Output Power					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2136	2023-11-02	2025-11-01
EXA Signal Analyzer	Agilent Technologies	N9010A	EMC2222	2023-06-14	2024-06-13
4X4 Power sensor Unit	TST	TSPS2023R	EMC2257	2023-08-23	2024-08-22
Test Software	TST	V2.0	GZE100-82	N/A	N/A

Minimum 6dB Bandwidth					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2136	2023-11-02	2025-11-01
EXA Signal Analyzer	Agilent Technologies	N9010A	EMC2222	2023-06-14	2024-06-13
4X4 Power sensor Unit	TST	TSPS2023R	EMC2257	2023-08-23	2024-08-22
Test Software	TST	V2.0	GZE100-82	N/A	N/A

Power Spectrum Density					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2136	2023-11-02	2025-11-01
EXA Signal Analyzer	Agilent Technologies	N9010A	EMC2222	2023-06-14	2024-06-13
4X4 Power sensor Unit	TST	TSPS2023R	EMC2257	2023-08-23	2024-08-22
Test Software	TST	V2.0	GZE100-82	N/A	N/A

Conducted Band Edges Measurement					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2136	2023-11-02	2025-11-01
EXA Signal Analyzer	Agilent Technologies	N9010A	EMC2222	2023-06-14	2024-06-13
4X4 Power sensor Unit	TST	TSPS2023R	EMC2257	2023-08-23	2024-08-22
Test Software	TST	V2.0	GZE100-82	N/A	N/A



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Conducted Spurious Emissions					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2136	2023-11-02	2025-11-01
EXA Signal Analyzer	Agilent Technologies	N9010A	EMC2222	2023-06-14	2024-06-13
4X4 Power sensor Unit	TST	TSPS2023R	EMC2257	2023-08-23	2024-08-22
Test Software	TST	V2.0	GZE100-82	N/A	N/A

Radiated Emissions which fall in the restricted bands					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2022-12-16	2023-12-15
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2022-12-16	2023-12-15
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2022-08-24	2024-08-23
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2022-09-23	2025-09-22
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2023-10-20	2024-10-19
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A



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Radiated Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2022-10-16	2025-10-15
Coaxial cable	Mirco-COAX UTIFLEX	311A	EMC0540	2023-06-14	2025-06-13
Amplifier (9kHz-1.3GHz)	HP	8447F	EMC2065	2023-06-14	2024-06-13
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2022-04-06	2024-04-05
EMI Test Receiver (1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2023-05-19	2024-05-18
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Trilog Broadband Antenna (25MHz-1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	EMC2174	2022-06-19	2025-06-18

Radiated Spurious Emissions Above 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2022-12-16	2023-12-15
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2022-12-16	2023-12-15
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2022-08-24	2024-08-23
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2022-09-23	2025-09-22
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2022-12-16	2023-12-15
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2023-10-20	2024-10-19
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2023-06-11	2024-06-10



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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 integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0 dBi.

Antenna location: Refer to internal photo.



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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: 24.9 °C

Humidity: 54.5 % RH

Atmospheric Pressure: 1000 mbar

7.1.2 Test Mode Description

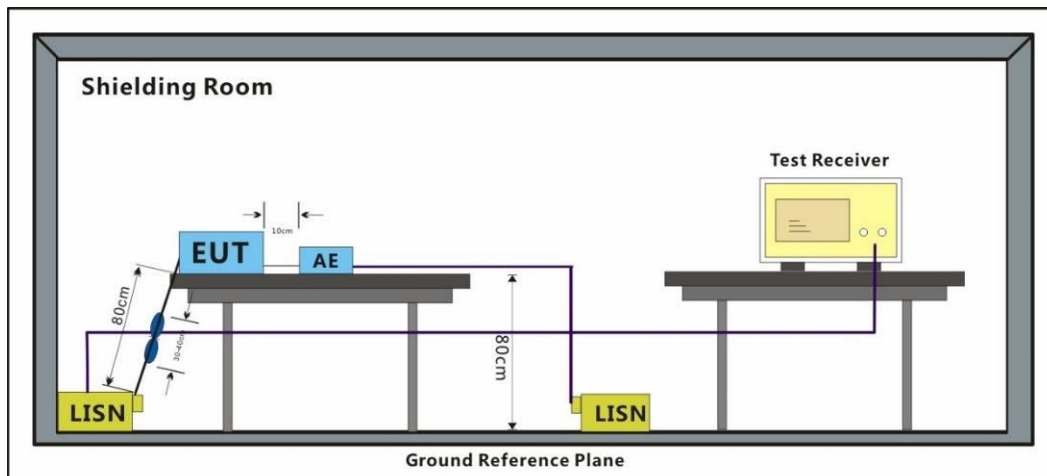
Pre-scan / Final test	Mode Code	Description
Final test	02	BT mode+5Vdc charging mode+discharging with heated Jacket as load+data transmission with heated Jacket.
Final test	03	BT mode+9Vdc charging mode+discharging with heated Jacket as load+data transmission with heated Jacket.
Final test	04	BT mode+12Vdc charging mode+discharging with heated Jacket as load+data transmission with heated Jacket.
Final test	05	BT mode+15Vdc charging mode+discharging with heated Jacket as load+data transmission with heated Jacket.



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7.1.3 Test Setup Diagram



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.

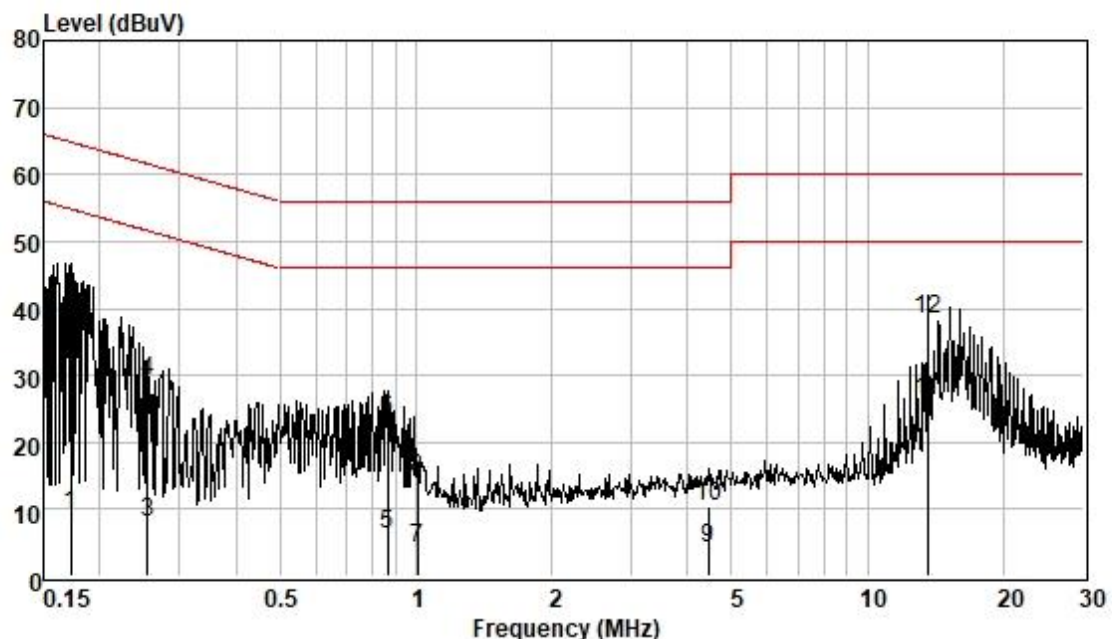
Remark: Level=Read Level+ Cable Loss+ LISN Factor



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Test Mode: 02; Line: Live line



Pol :LINE
Mode :BT
Model :
Power :DC 5V

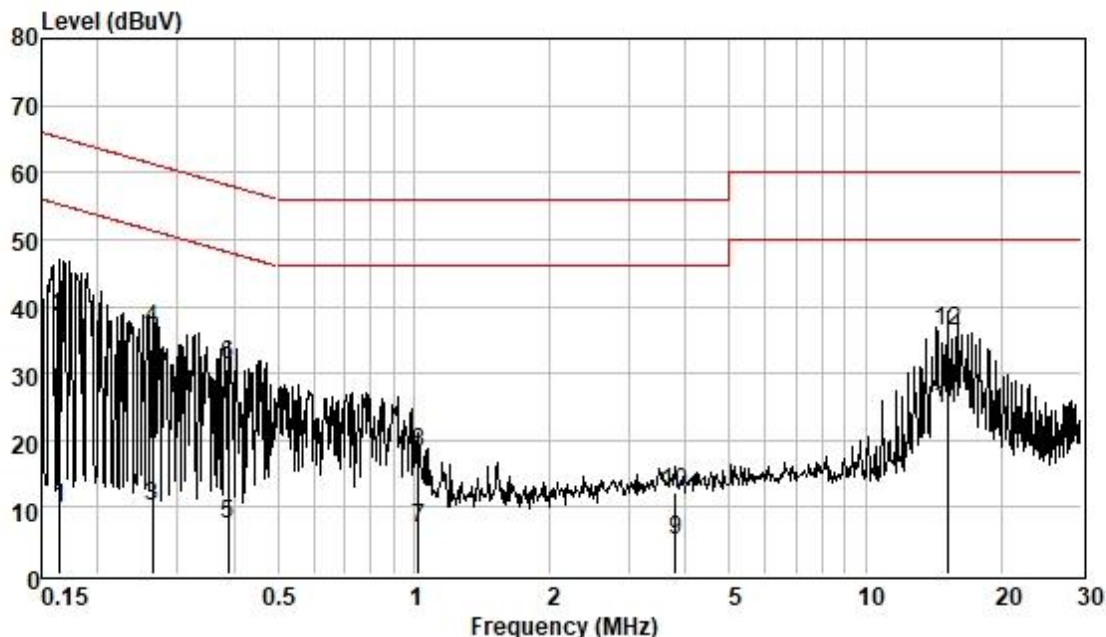
	Freque	Read	Cable	LISN	Measured	Limit	Over	Remark
	nc	Level	Loss	Factor	Level	Line	Limit	
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.172	-0.49	0.04	9.61	9.16	54.86	-45.70	Average
2	0.172	27.99	0.04	9.61	37.64	64.86	-27.22	QP
3	0.255	-1.64	0.04	9.61	8.01	51.60	-43.59	Average
4	0.255	19.36	0.04	9.61	29.01	61.60	-32.59	QP
5	0.866	-3.47	0.07	9.60	6.20	46.00	-39.80	Average
6	0.866	13.68	0.07	9.60	23.35	56.00	-32.65	QP
7	1.010	-5.54	0.07	9.59	4.12	46.00	-41.88	Average
8	1.010	4.79	0.07	9.59	14.45	56.00	-41.55	QP
9	4.430	-5.81	0.19	9.64	4.02	46.00	-41.98	Average
10	4.430	0.68	0.19	9.64	10.51	56.00	-45.49	QP
11	13.551	16.31	0.31	9.69	26.31	50.00	-23.69	Average
12	13.551	28.24	0.31	9.69	38.24	60.00	-21.76	QP



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Test Mode: 02; Line: Neutral Line



Pol : NEUTRAL
Mode : BT
Model :
Power : DC 5V

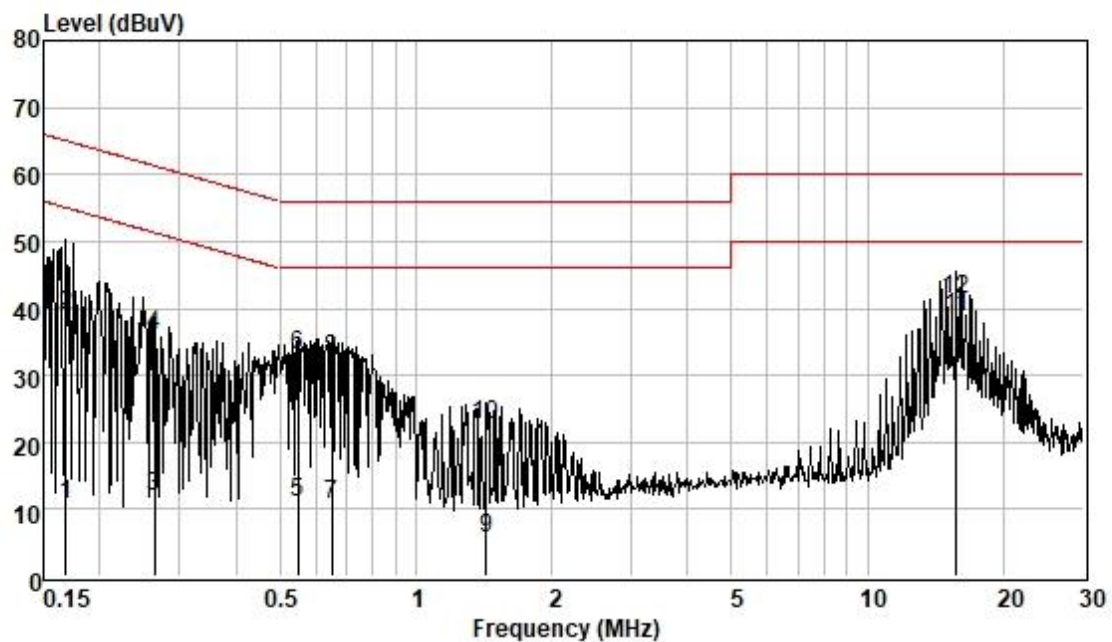
	Freque	Read	Cable	LISN	Measured	Limit	Over	Remark
	nc	Level	Loss	Factor	Level	Line	Limit	
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.165	0.08	0.04	9.61	9.73	55.21	-45.48	Average
2	0.165	28.79	0.04	9.61	38.44	65.21	-26.77	QP
3	0.264	0.55	0.04	9.60	10.19	51.29	-41.10	Average
4	0.264	27.08	0.04	9.60	36.72	61.29	-24.57	QP
5	0.389	-2.21	0.05	9.61	7.45	48.08	-40.63	Average
6	0.389	21.45	0.05	9.61	31.11	58.08	-26.97	QP
7	1.027	-2.98	0.07	9.61	6.70	46.00	-39.30	Average
8	1.027	8.59	0.07	9.61	18.27	56.00	-37.73	QP
9	3.799	-4.68	0.17	9.64	5.13	46.00	-40.87	Average
10	3.799	2.43	0.17	9.64	12.24	56.00	-43.76	QP
11	15.146	14.67	0.33	9.80	24.80	50.00	-25.20	Average
12	15.146	26.14	0.33	9.80	36.27	60.00	-23.73	QP



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Test Mode: 03; Line: Live line



Pol :LINE

Mode :BT

Model :

Power :DC 9V

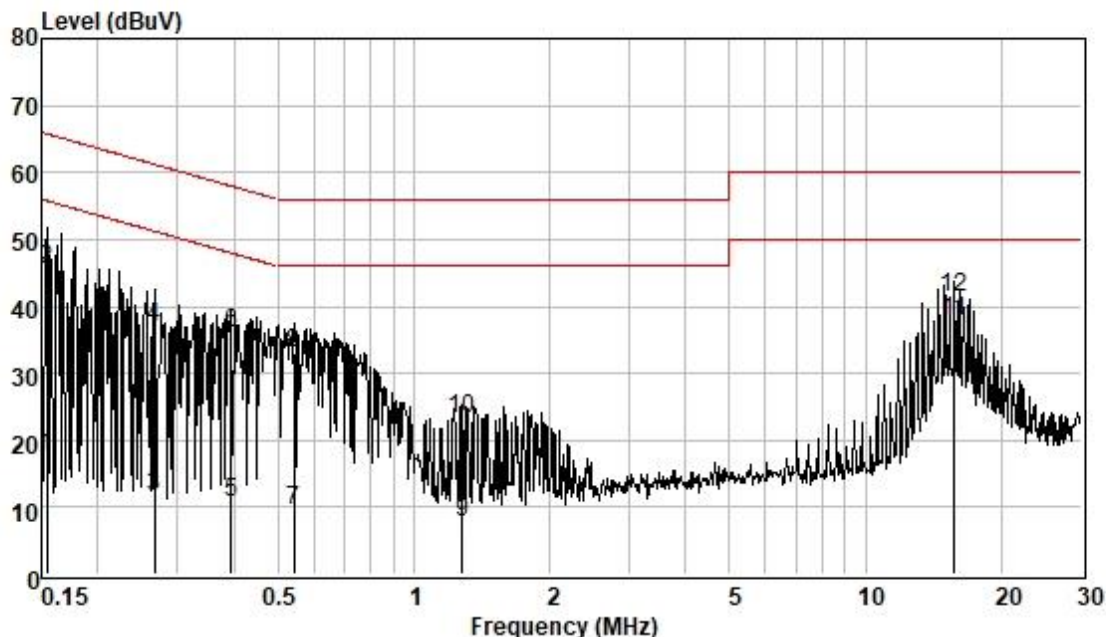
	Freque	Read	Cable	LISN	Measured	Limit	Over	Remark
	nc	Level	Loss	Factor	Level	Line	Limit	
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.169	1.03	0.04	9.61	10.68	55.03	-44.35	Average
2	0.169	29.23	0.04	9.61	38.88	65.03	-26.15	QP
3	0.264	2.30	0.04	9.61	11.95	51.29	-39.34	Average
4	0.264	26.36	0.04	9.61	36.01	61.29	-25.28	QP
5	0.549	1.50	0.05	9.60	11.15	46.00	-34.85	Average
6	0.549	23.22	0.05	9.60	32.87	56.00	-23.13	QP
7	0.651	1.12	0.06	9.60	10.78	46.00	-35.22	Average
8	0.651	22.87	0.06	9.60	32.53	56.00	-23.47	QP
9	1.433	-3.94	0.10	9.61	5.77	46.00	-40.23	Average
10	1.433	12.81	0.10	9.61	22.52	56.00	-33.48	QP
11	15.718	28.58	0.34	9.70	38.62	50.00	-11.38	Average
12	15.718	31.40	0.34	9.70	41.44	60.00	-18.56	QP



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Test Mode: 03; Line: Neutral Line



Pol : NEUTRAL
Mode : BT
Model :
Power : DC 9V

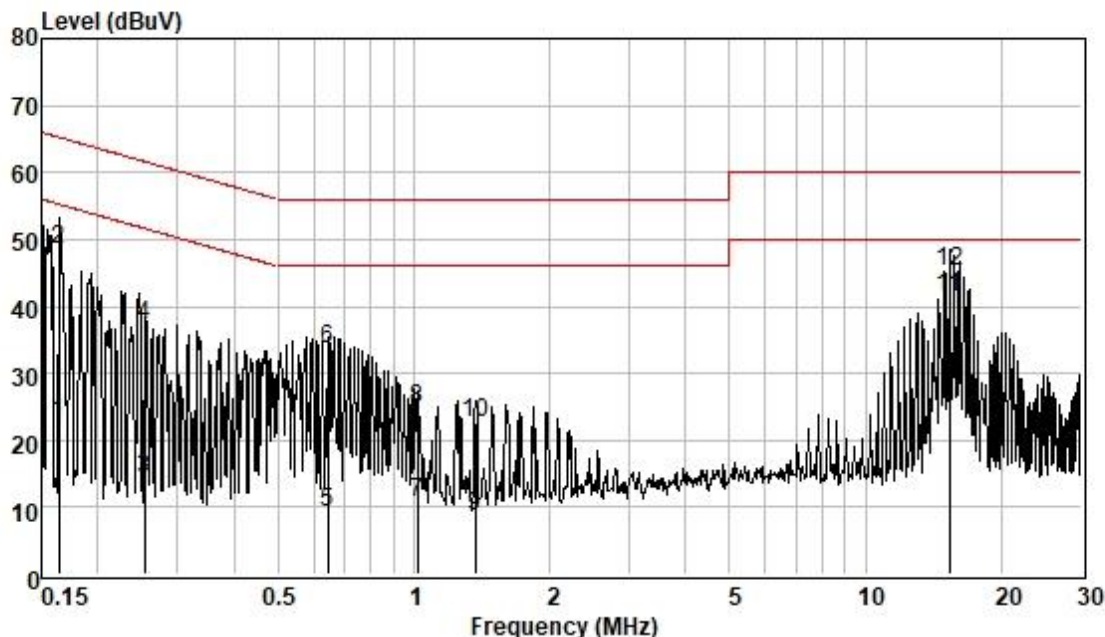
	Frequency MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.154	7.85	0.04	9.62	17.51	55.78	-38.27	Average
2	0.154	35.73	0.04	9.62	45.39	65.78	-20.39	QP
3	0.267	1.98	0.04	9.60	11.62	51.20	-39.58	Average
4	0.267	27.27	0.04	9.60	36.91	61.20	-24.29	QP
5	0.393	0.91	0.05	9.61	10.57	47.99	-37.42	Average
6	0.393	26.40	0.05	9.61	36.06	57.99	-21.93	QP
7	0.544	-0.09	0.05	9.61	9.57	46.00	-36.43	Average
8	0.544	23.41	0.05	9.61	33.07	56.00	-22.93	QP
9	1.282	-2.02	0.09	9.61	7.68	46.00	-38.32	Average
10	1.282	13.49	0.09	9.61	23.19	56.00	-32.81	QP
11	15.718	27.62	0.34	9.81	37.77	50.00	-12.23	Average
12	15.718	31.05	0.34	9.81	41.20	60.00	-18.80	QP



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Test Mode: 04; Line: Live line



Pol :LINE
Mode :BT
Model :
Power :DC 12V

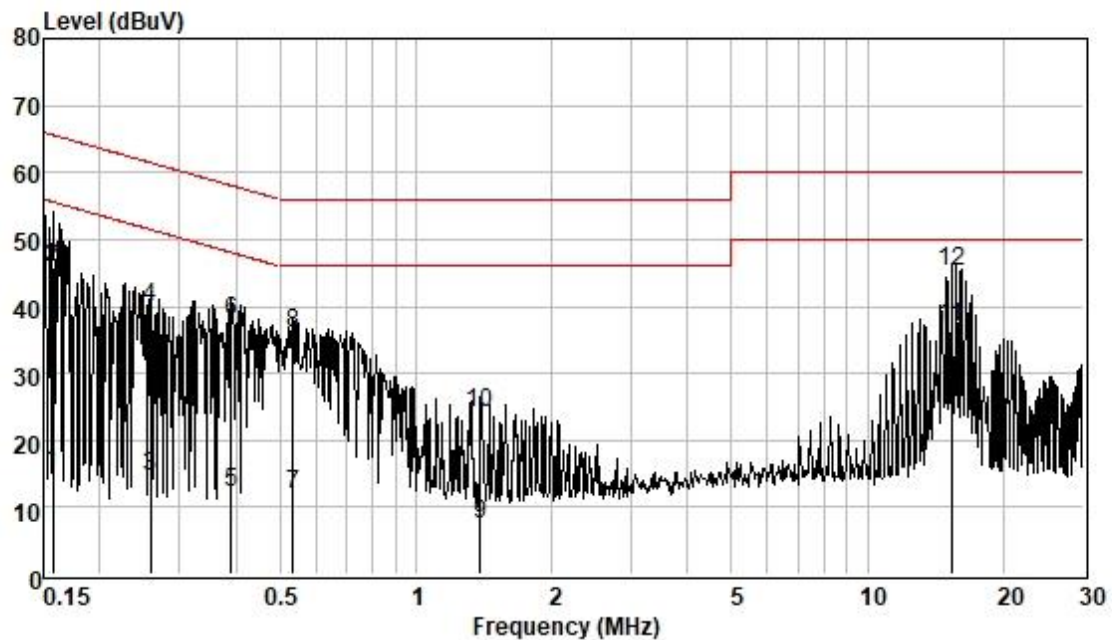
	Freque	Read	Cable	LISN	Measured	Limit	Over	Remark
	nc	Level	Loss	Factor	Level	Line	Limit	
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.164	13.05	0.04	9.61	22.70	55.25	-32.55	Average
2	0.164	38.95	0.04	9.61	48.60	65.25	-16.65	QP
3	0.253	4.48	0.04	9.61	14.13	51.64	-37.51	Average
4	0.253	27.39	0.04	9.61	37.04	61.64	-24.60	QP
5	0.644	-0.53	0.06	9.61	9.14	46.00	-36.86	Average
6	0.644	23.80	0.06	9.61	33.47	56.00	-22.53	QP
7	1.021	0.97	0.07	9.59	10.63	46.00	-35.37	Average
8	1.021	15.06	0.07	9.59	24.72	56.00	-31.28	QP
9	1.367	-1.08	0.09	9.61	8.62	46.00	-37.38	Average
10	1.367	12.96	0.09	9.61	22.66	56.00	-33.34	QP
11	15.307	31.30	0.33	9.70	41.33	50.00	-8.67	Average
12	15.307	35.20	0.33	9.70	45.23	60.00	-14.77	QP



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Test Mode: 04; Line: Neutral Line



Pol : NEUTRAL
Mode : BT
Model :
Power : DC 12V

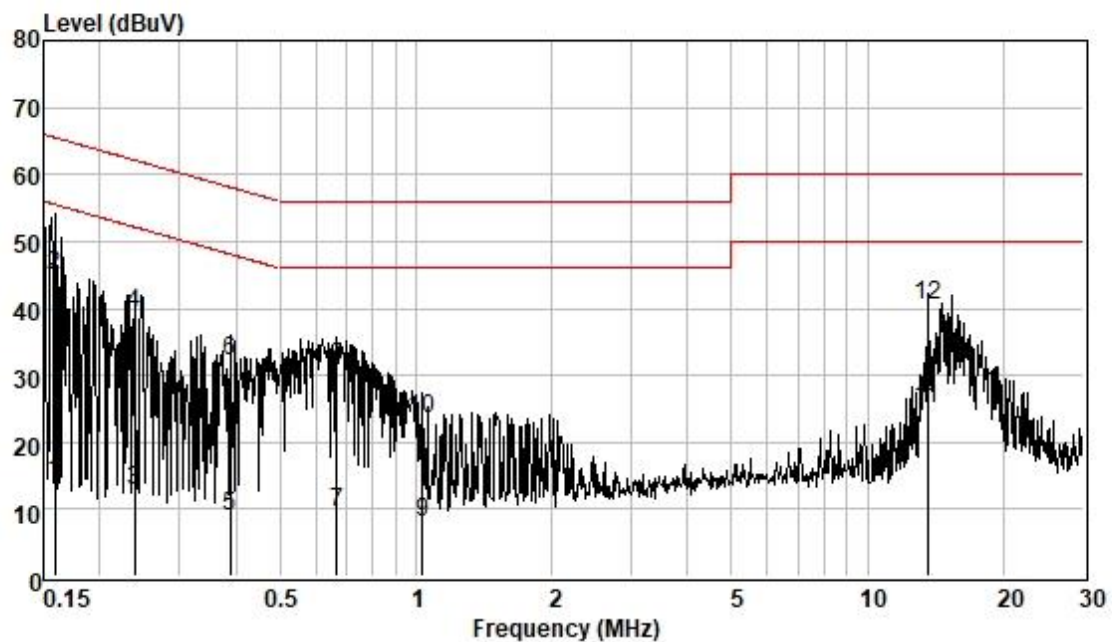
	Frequency MHz	Read Level dBUV	Cable Loss dB	LISN Factor dB	Measured Level dBUV	Limit Line dBUV	Over Limit dB	Remark
1	0.157	5.61	0.04	9.62	15.27	55.60	-40.33	Average
2	0.157	36.18	0.04	9.62	45.84	65.60	-19.76	QP
3	0.259	4.87	0.04	9.60	14.51	51.47	-36.96	Average
4	0.259	30.34	0.04	9.60	39.98	61.47	-21.49	QP
5	0.391	2.54	0.05	9.61	12.20	48.03	-35.83	Average
6	0.391	28.10	0.05	9.61	37.76	58.03	-20.27	QP
7	0.535	2.19	0.05	9.61	11.85	46.00	-34.15	Average
8	0.535	26.37	0.05	9.61	36.03	56.00	-19.97	QP
9	1.388	-2.39	0.10	9.60	7.31	46.00	-38.69	Average
10	1.388	14.28	0.10	9.60	23.98	56.00	-32.02	QP
11	15.307	26.70	0.33	9.80	36.83	50.00	-13.17	Average
12	15.307	35.16	0.33	9.80	45.29	60.00	-14.71	QP



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Test Mode: 05; Line: Live line



Pol :LINE

Mode :BT

Model :

Power :DC 15V

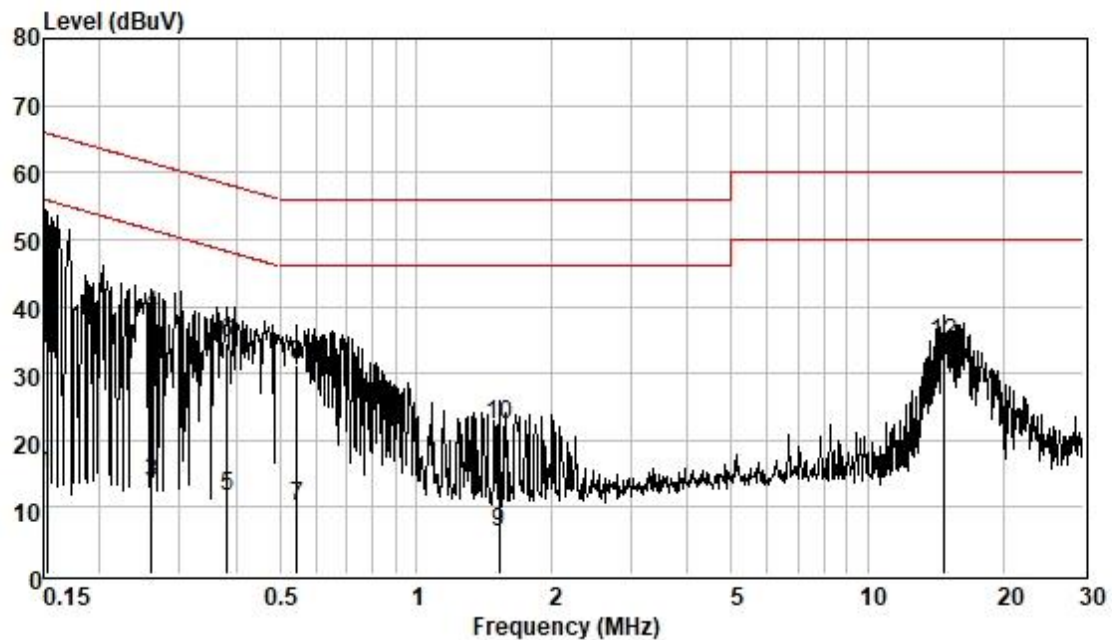
	Frequeunc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.159	4.38	0.04	9.61	14.03	55.52	-41.49	Average
2	0.159	35.33	0.04	9.61	44.98	65.52	-20.54	QP
3	0.239	3.13	0.04	9.61	12.78	52.13	-39.35	Average
4	0.239	29.65	0.04	9.61	39.30	62.13	-22.83	QP
5	0.389	-0.80	0.05	9.59	8.84	48.08	-39.24	Average
6	0.389	22.53	0.05	9.59	32.17	58.08	-25.91	QP
7	0.668	-0.24	0.06	9.60	9.42	46.00	-36.58	Average
8	0.668	21.69	0.06	9.60	31.35	56.00	-24.65	QP
9	1.032	-1.77	0.07	9.59	7.89	46.00	-38.11	Average
10	1.032	13.87	0.07	9.59	23.53	56.00	-32.47	QP
11	13.551	14.99	0.31	9.69	24.99	50.00	-25.01	Average
12	13.551	30.58	0.31	9.69	40.58	60.00	-19.42	QP



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Test Mode: 05; Line: Neutral Line



Pol : NEUTRAL
Mode : BT
Model :
Power : DC 15V

	Frequency MHz	Read Level dBUV	Cable Loss dB	LISN Factor dB	Measured Level dBUV	Limit Line dBUV	Over Limit dB	Remark
1	0.152	5.09	0.04	9.63	14.76	55.87	-41.11	Average
2	0.152	36.06	0.04	9.63	45.73	65.87	-20.14	QP
3	0.260	3.92	0.04	9.60	13.56	51.42	-37.86	Average
4	0.260	28.87	0.04	9.60	38.51	61.42	-22.91	QP
5	0.383	2.00	0.05	9.61	11.66	48.21	-36.55	Average
6	0.383	24.97	0.05	9.61	34.63	58.21	-23.58	QP
7	0.546	0.43	0.05	9.61	10.09	46.00	-35.91	Average
8	0.546	21.52	0.05	9.61	31.18	56.00	-24.82	QP
9	1.527	-3.52	0.10	9.60	6.18	46.00	-39.82	Average
10	1.527	12.67	0.10	9.60	22.37	56.00	-33.63	QP
11	14.750	20.60	0.32	9.79	30.71	50.00	-19.29	Average
12	14.750	24.35	0.32	9.79	34.46	60.00	-25.54	QP



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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: 24.0 °C

Humidity: 66.9 % RH

Atmospheric Pressure: 1000 mbar

7.2.2 Test Mode Description

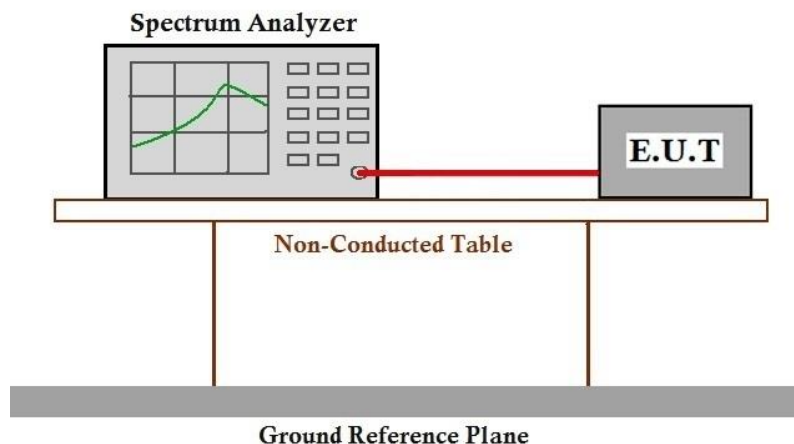
Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.



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7.2.3 Test Setup Diagram



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

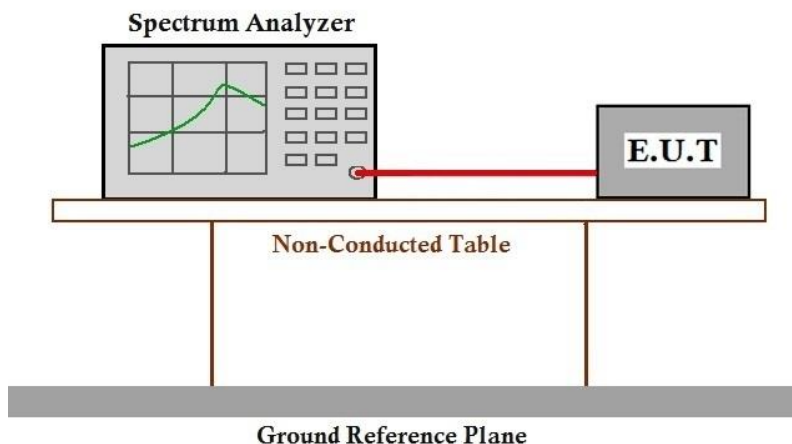
Operating Environment:

Temperature: 24.0 °C Humidity: 66.9 % RH Atmospheric Pressure: 1000 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.
Final test	01	TX mode(2Mbps)_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: 24.0 °C

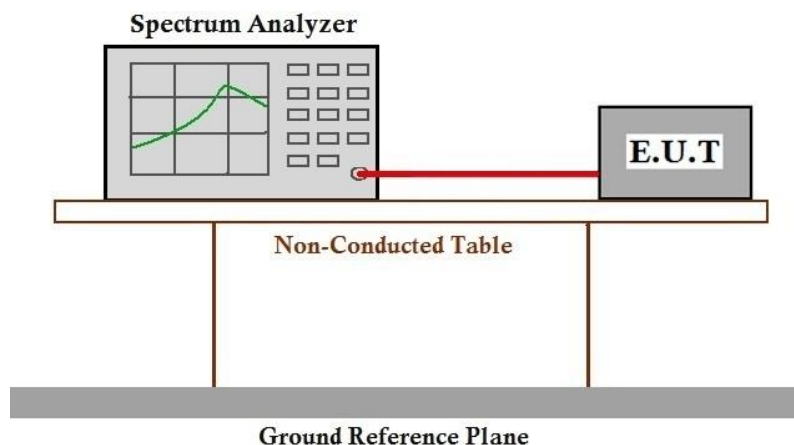
Humidity: 66.9 % RH

Atmospheric Pressure: 1000 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.
Final test	01	TX mode(2Mbps)_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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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: 24.0 °C

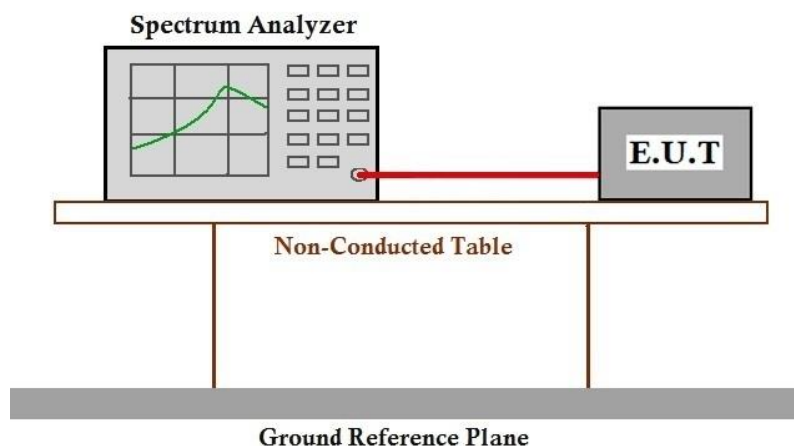
Humidity: 66.9 % RH

Atmospheric Pressure: 1000 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.
Final test	01	TX mode(2Mbps)_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: 24.0 °C

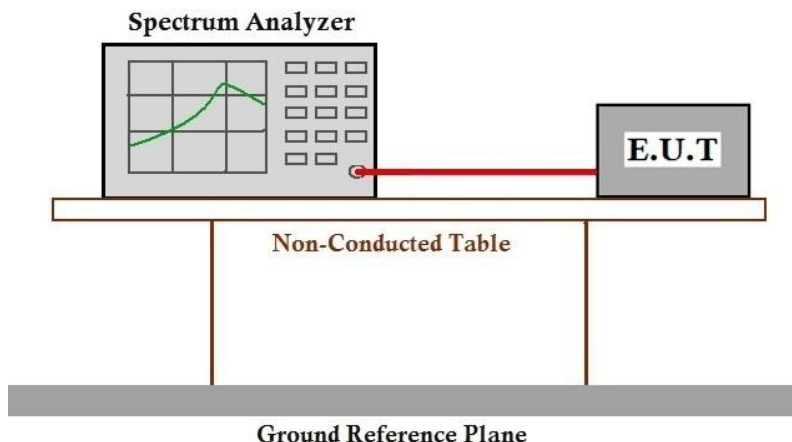
Humidity: 66.9 % RH

Atmospheric Pressure: 1000 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.
Final test	01	TX mode(2Mbps)_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: 11.12

Limit:

Test Distance: 3 m

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: 23.5 °C

Humidity: 55.1 % RH

Atmospheric Pressure: 1000 mbar

7.7.2 Test Mode Description

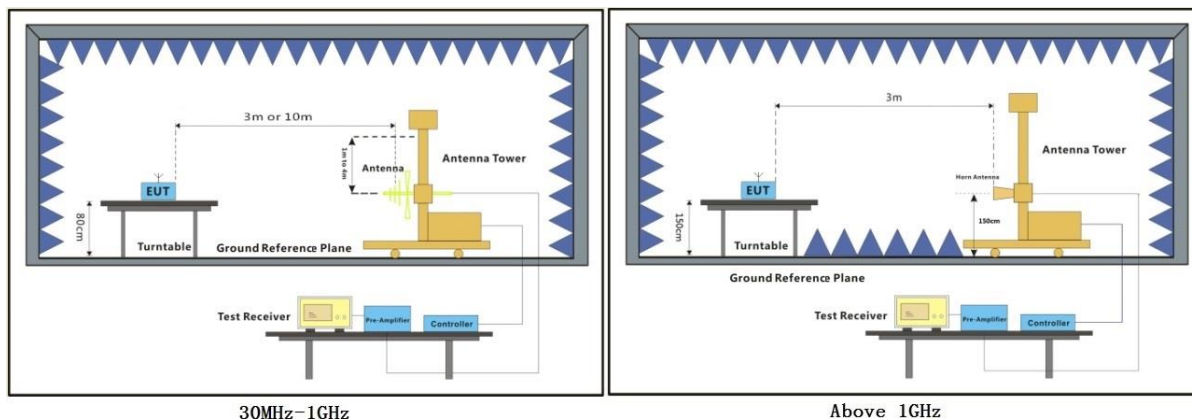
Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.



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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 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.

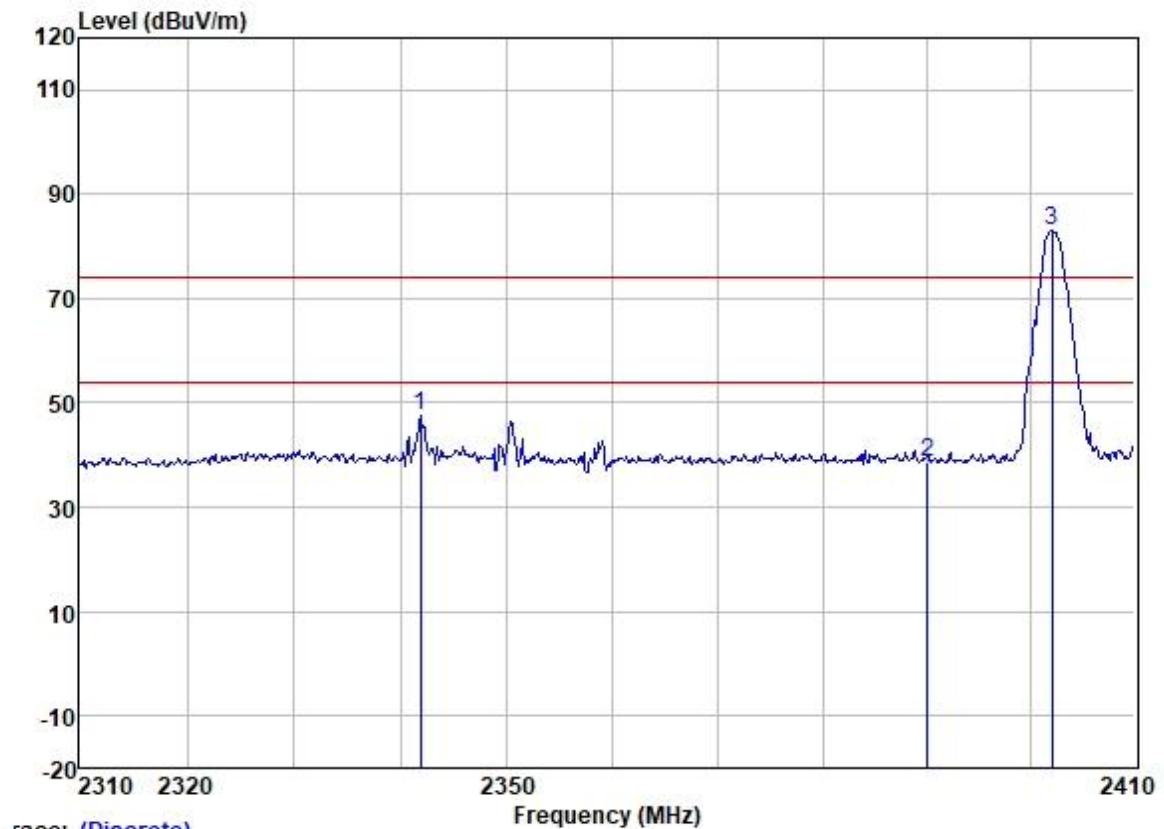
However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



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



Trace: (Discrete)

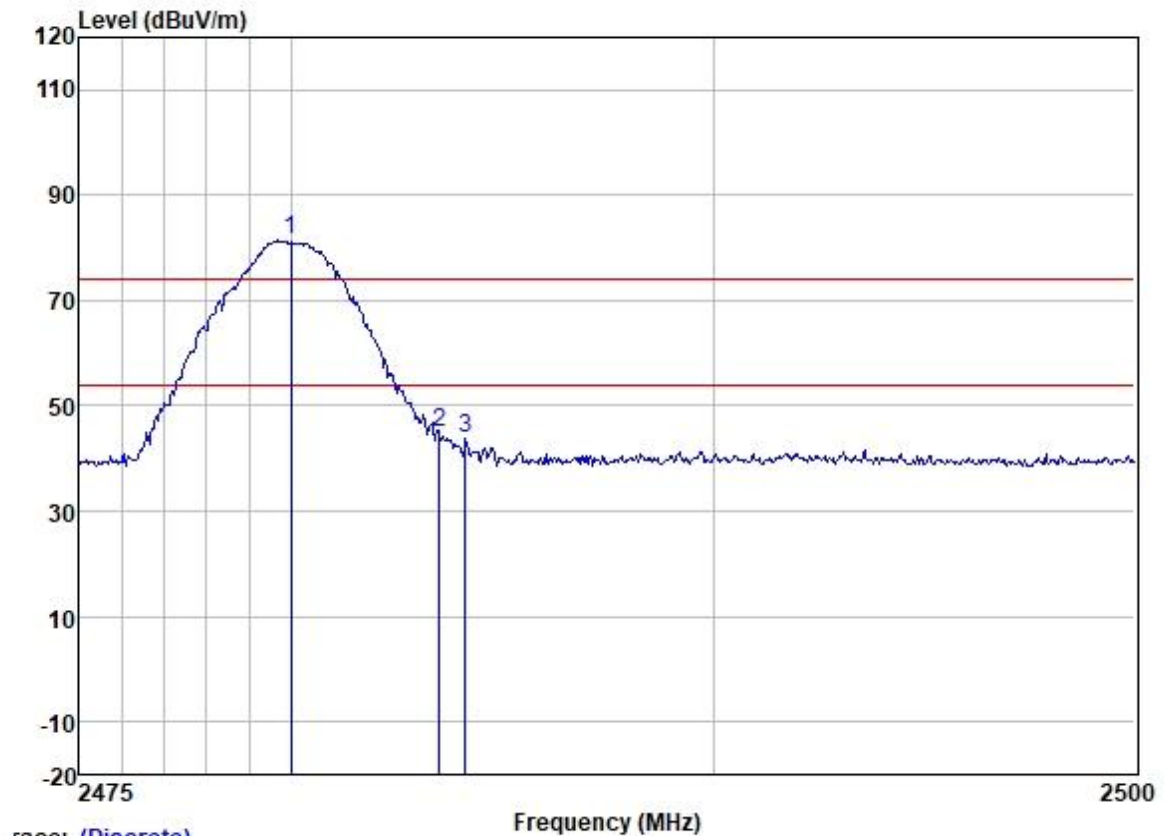
	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	Pol/Phase	Remark
	MHz	Level	Factor	Loss	Factor	Line	Limit		
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2341.838	54.01	27.57	3.73	37.78	47.53	74.00	-26.47	VERTICAL Peak
2	2390.000	45.09	27.68	3.77	37.76	38.78	74.00	-35.22	VERTICAL Peak
3 *	2402.000	89.16	27.71	3.78	37.76	82.89	74.00	8.89	VERTICAL Peak



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



Trace: (Discrete)

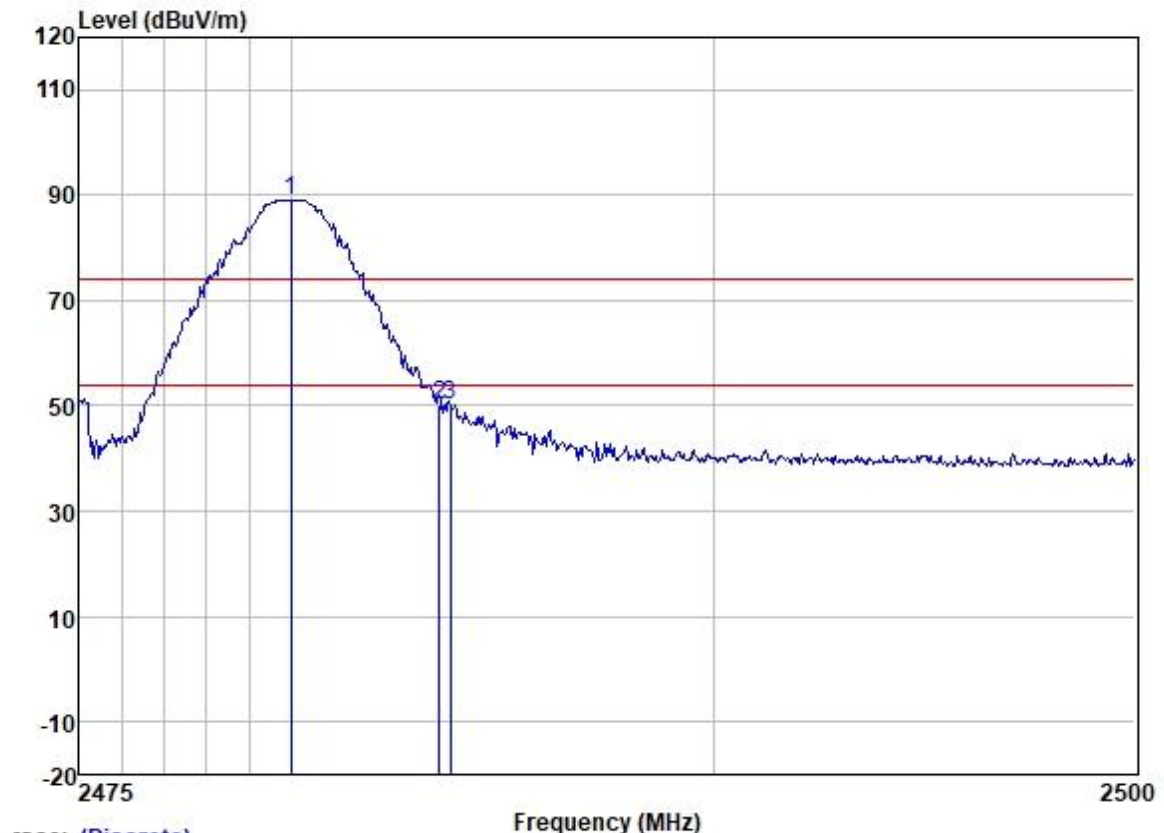
	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 *	2480.000	87.46	27.84	3.82	37.73	81.39	74.00	7.39	VERTICAL	Peak
2	2483.500	51.06	27.85	3.82	37.73	45.00	74.00	-29.00	VERTICAL	Peak
3	2484.121	49.73	27.85	3.82	37.73	43.67	74.00	-30.33	VERTICAL	Peak



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



Trace: (Discrete)

	ReadAntenna	Cable	Preamp		Limit	Over		
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1 *	2480.000	95.18	27.84	3.82	37.73	89.11	74.00	15.11 HORIZONTAL
2	2483.500	56.24	27.85	3.82	37.73	50.18	74.00	-23.82 HORIZONTAL
3	2483.746	56.36	27.85	3.82	37.73	50.30	74.00	-23.70 HORIZONTAL



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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:

Test Distance: 3 m

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: 23.6 °C

Humidity: 56.3 % RH

Atmospheric Pressure: 1000 mbar

7.8.2 Test Mode Description

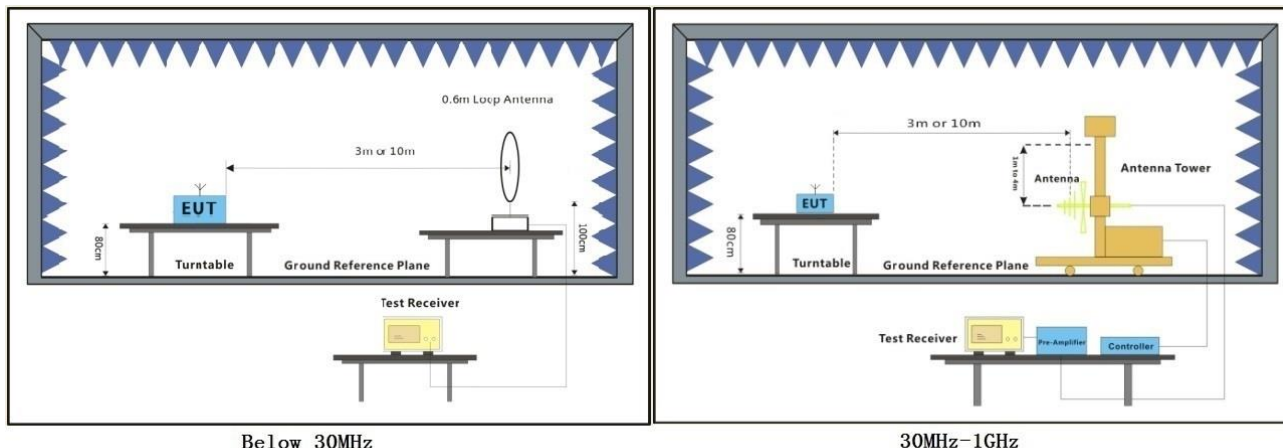
Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.



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7.8.3 Test Setup Diagram



7.8.4 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.
- 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 quasi-peak 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:

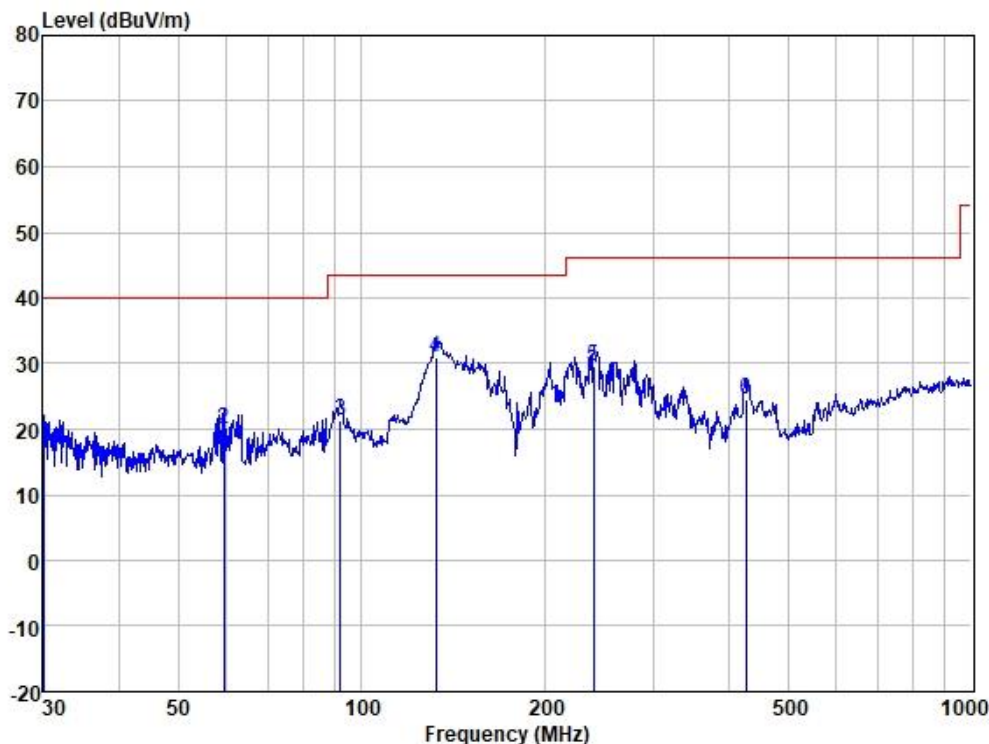
- Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
- Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 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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Test Mode: 00; Polarity: Horizontal



Site : SGS
Job :
Model :
Power :
Test Mode : TX

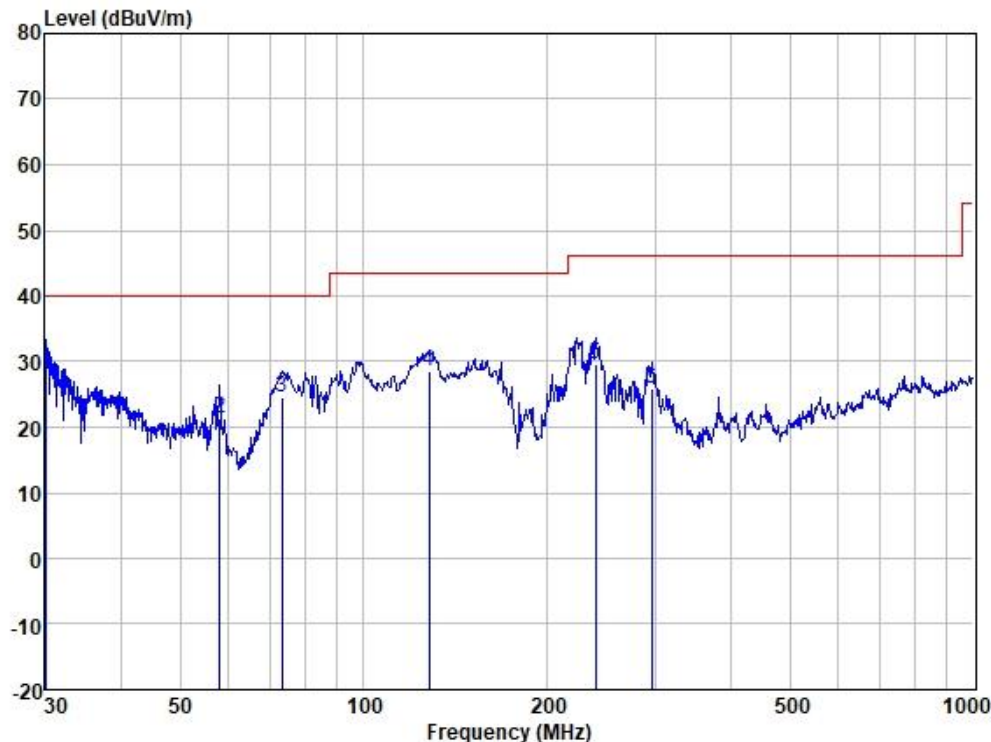
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	30.000	33.72	12.94	0.37	28.17	18.86	40.00	-21.14	HORIZONTAL	QP
2	59.441	34.07	13.45	0.52	28.10	19.94	40.00	-20.06	HORIZONTAL	QP
3	92.139	40.83	7.96	0.64	28.10	21.33	43.50	-22.17	HORIZONTAL	QP
4	132.221	45.90	12.31	0.77	27.99	30.99	43.50	-12.51	HORIZONTAL	QP
5	239.987	44.54	11.60	1.05	27.54	29.65	46.00	-16.35	HORIZONTAL	QP
6	426.521	35.02	16.31	1.40	28.20	24.53	46.00	-21.47	HORIZONTAL	QP



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Test Mode: 00; Polarity: Vertical



Site : SGS
Job :
Model :
Power :
Test Mode : TX

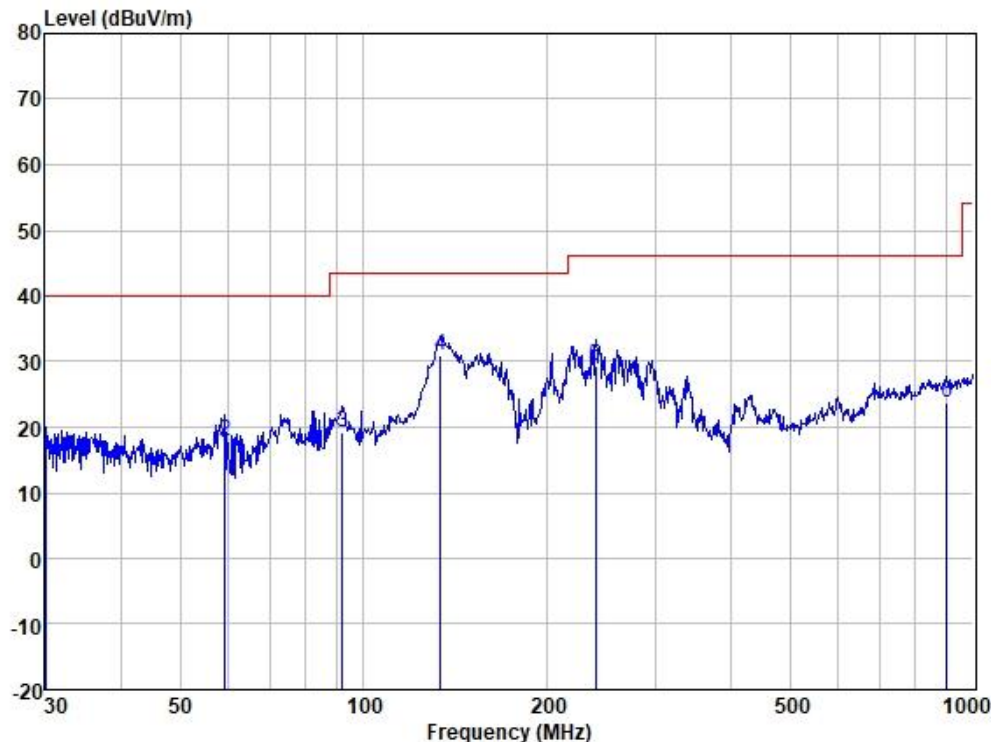
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	30.000	44.20	12.94	0.37	28.17	29.34	40.00	-10.66	VERTICAL	QP
2	57.999	35.37	13.56	0.51	28.10	21.34	40.00	-18.66	VERTICAL	QP
3	73.359	41.23	10.71	0.57	28.10	24.41	40.00	-15.59	VERTICAL	QP
4	128.113	43.93	11.99	0.75	28.02	28.65	43.50	-14.85	VERTICAL	QP
5	239.987	44.55	11.60	1.05	27.54	29.66	46.00	-16.34	VERTICAL	QP
6	296.184	38.84	13.32	1.17	27.40	25.93	46.00	-20.07	VERTICAL	QP



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Test Mode: 01; Polarity: Horizontal



Site : SGS
Job :
Model :
Power :
Test Mode : TX

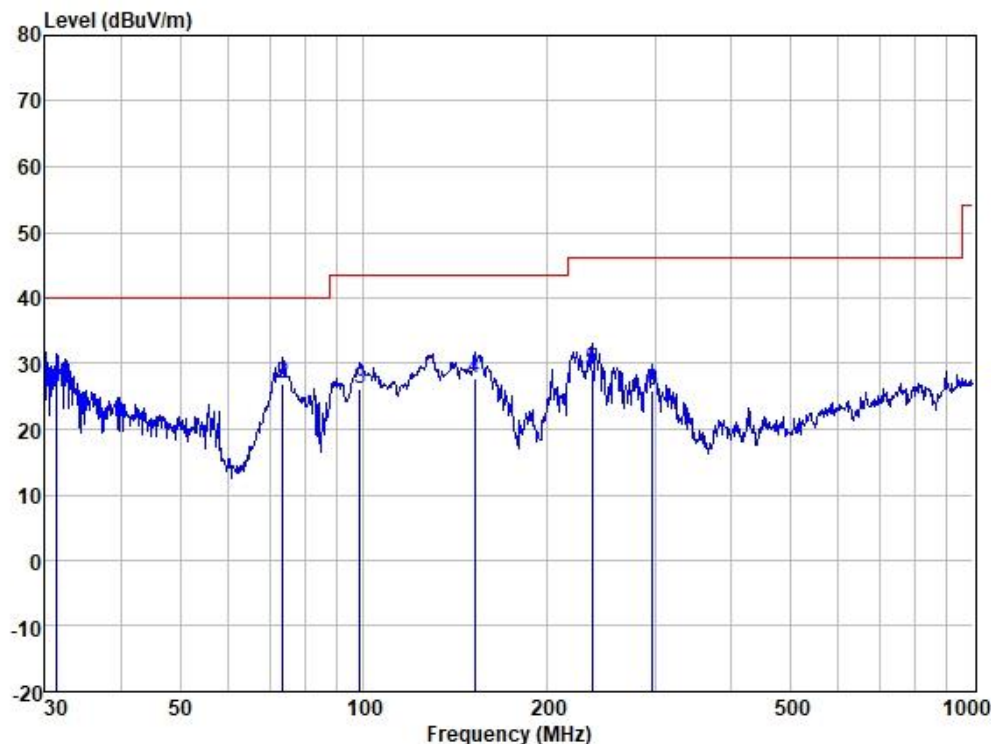
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	30.000	30.80	12.94	0.37	28.17	15.94	40.00	-24.06	HORIZONTAL	QP
2	59.232	32.10	13.45	0.52	28.10	17.97	40.00	-22.03	HORIZONTAL	QP
3	92.139	38.71	7.96	0.64	28.10	19.21	43.50	-24.29	HORIZONTAL	QP
4	133.619	45.64	12.56	0.77	27.99	30.98	43.50	-12.52	HORIZONTAL	QP
5	239.987	44.27	11.60	1.05	27.54	29.38	46.00	-16.62	HORIZONTAL	QP
6	903.309	26.92	23.12	2.05	28.30	23.79	46.00	-22.21	HORIZONTAL	QP



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Test Mode: 01; Polarity: Vertical



Site : SGS
Job :
Model :
Power :
Test Mode : TX

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	31.399	41.34	12.85	0.38	28.17	26.40	40.00	-13.60	VERTICAL	QP
2	73.617	43.86	10.71	0.57	28.10	27.04	40.00	-12.96	VERTICAL	QP
3	98.487	44.76	8.80	0.67	28.10	26.13	43.50	-17.37	VERTICAL	QP
4	152.130	41.08	13.59	0.83	27.82	27.68	43.50	-15.82	VERTICAL	QP
5	236.645	44.26	11.40	1.04	27.55	29.15	46.00	-16.85	VERTICAL	QP
6	297.224	38.86	13.34	1.17	27.40	25.97	46.00	-20.03	VERTICAL	QP



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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: 23.6 °C

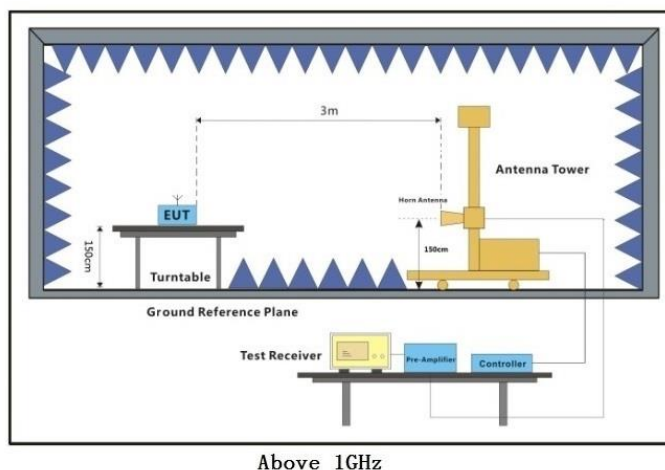
Humidity: 53.2 % RH

Atmospheric Pressure: 1016 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.
Pre-scan	01	TX mode(2Mbps)_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:

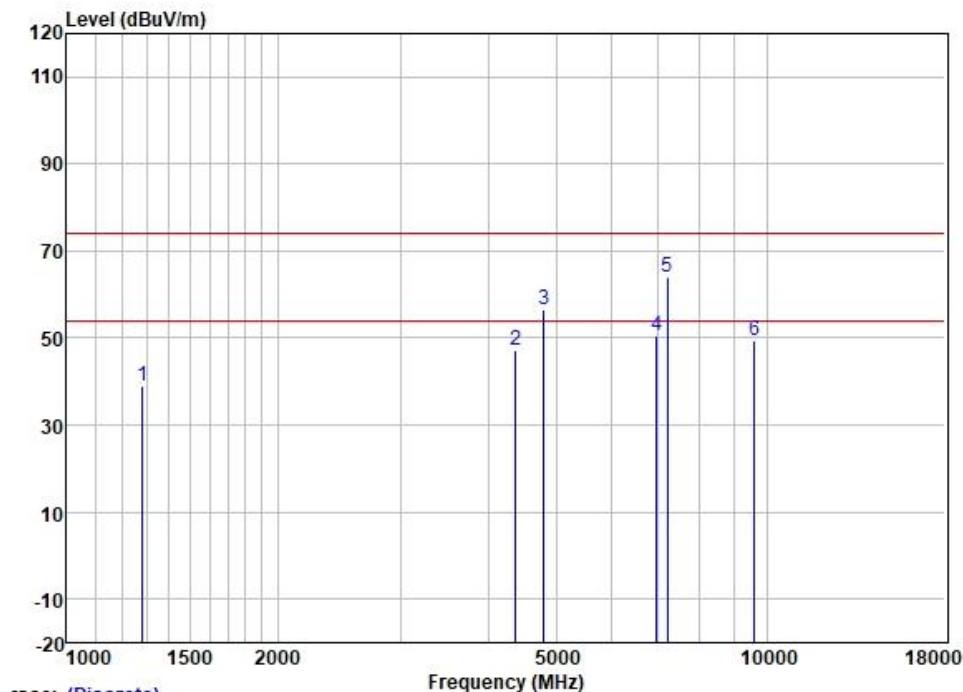
1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from 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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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



Trace: (Discrete)

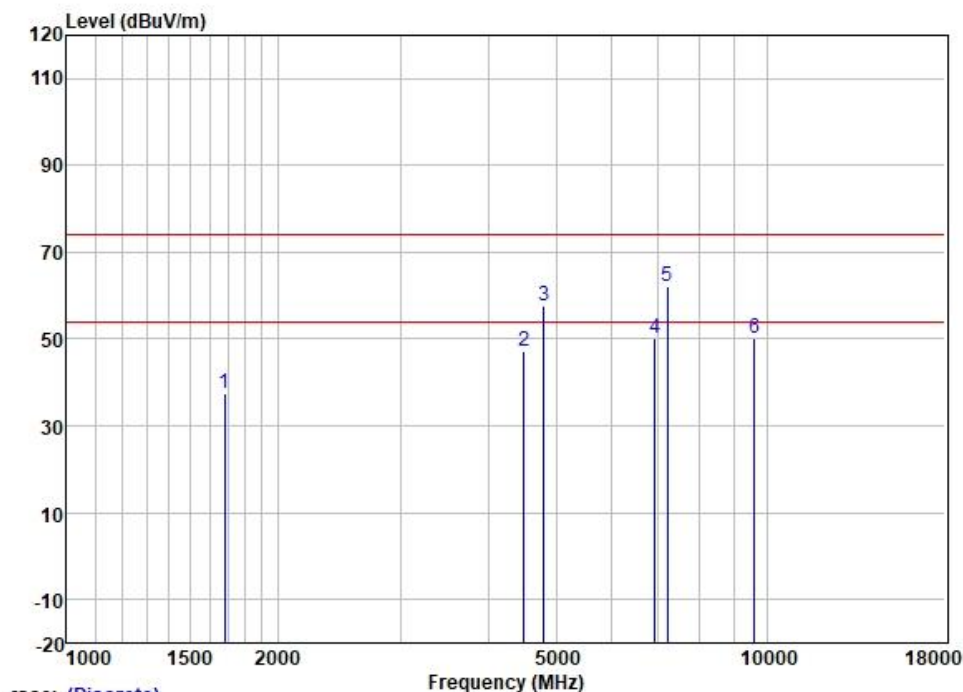
	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	Pol/Phase	Remark
	MHz	Level	Factor	Loss	Factor	Line	Limit		
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1282.193	50.22	23.89	2.78	37.98	38.91	74.00	-35.09	VERTICAL peak
2	4379.699	45.68	33.59	4.80	36.82	47.25	74.00	-26.75	VERTICAL peak
3	4804.000	54.02	34.16	5.15	36.86	56.47	74.00	-17.53	VERTICAL peak
4	6954.852	45.58	35.04	7.10	37.09	50.63	74.00	-23.37	VERTICAL peak
5	7206.000	58.40	35.63	6.96	37.13	63.86	74.00	-10.14	VERTICAL peak
6	9608.000	40.25	38.68	7.65	37.02	49.56	74.00	-24.44	VERTICAL peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
4804.000	56.47	None	74.00	-17.53	PK
4804.000	40.17	-16.30	54.00	-13.83	AV
7206.000	63.86	None	74.00	-10.14	PK
7206.000	47.56	-16.30	54.00	-6.44	AV

Note: Refer to appendix Duty Cycle test data for more detail about Factor.



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



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	Pol/Phase	Remark
	MHz	Level	Factor	Loss	Factor	Line	Limit		
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1682.477	47.45	25.03	3.06	37.93	37.61	74.00	-36.39	HORIZONTAL peak
2	4495.125	44.96	34.17	4.78	36.83	47.08	74.00	-26.92	HORIZONTAL peak
3	4804.000	55.30	34.16	5.15	36.86	57.75	74.00	-16.25	HORIZONTAL peak
4	6914.763	45.23	34.97	7.08	37.08	50.20	74.00	-23.80	HORIZONTAL peak
5	7206.000	56.64	35.63	6.96	37.13	62.10	74.00	-11.90	HORIZONTAL peak
6	9608.000	40.69	38.68	7.65	37.02	50.00	74.00	-24.00	HORIZONTAL peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
4804.000	57.75	None	74.00	-16.25	PK
4804.000	41.45	-16.30	54.00	-12.55	AV
7206.000	62.10	None	74.00	-11.90	PK
7206.000	45.80	-16.30	54.00	-8.20	AV

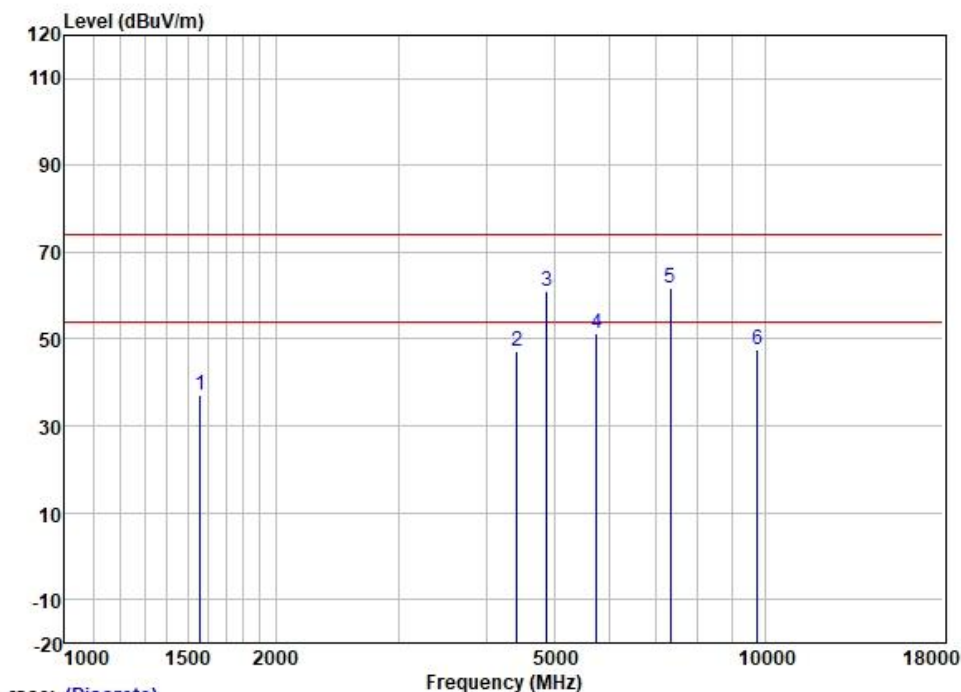
Note: Refer to appendix Duty Cycle test data for more detail about Factor.



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



Trace: (Discrete)

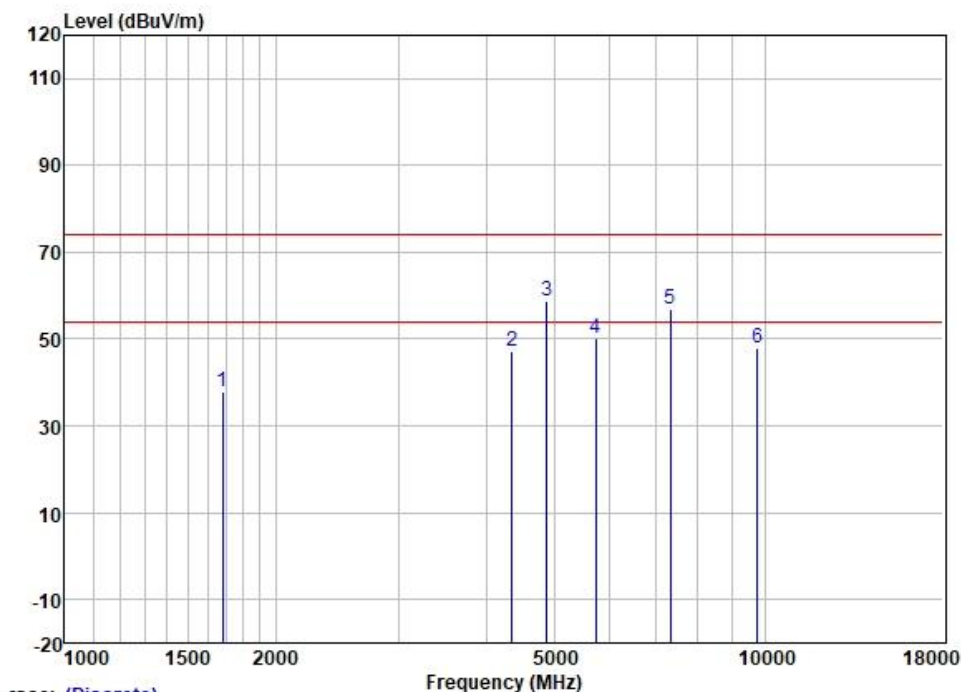
	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	Pol/Phase	Remark
	MHz	Level	Factor	Loss	Factor	Line	Limit		
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1560.673	47.65	24.57	2.97	37.94	37.25	74.00	-36.75	VERTICAL peak
2	4430.628	45.28	33.87	4.79	36.83	47.11	74.00	-26.89	VERTICAL peak
3	4880.000	58.46	34.15	5.22	36.87	60.96	74.00	-13.04	VERTICAL peak
4	5746.982	49.84	32.65	5.74	36.99	51.24	74.00	-22.76	VERTICAL peak
5	7320.000	55.94	36.07	6.81	37.15	61.67	74.00	-12.33	VERTICAL peak
6	9760.000	37.98	38.81	7.65	37.01	47.43	74.00	-26.57	VERTICAL peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
4880.000	60.96	None	74.00	-13.04	PK
4880.000	44.66	-16.30	54.00	-9.34	AV
7320.000	61.67	None	74.00	-12.33	PK
7320.000	45.37	-16.30	54.00	-8.63	AV

Note: Refer to appendix Duty Cycle test data for more detail about Factor.



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



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1682.477	47.59	25.03	3.06	37.93	37.75	74.00	-36.25	HORIZONTAL peak
2	4354.454	45.73	33.43	4.80	36.82	47.14	74.00	-26.86	HORIZONTAL peak
3	4880.000	56.42	34.15	5.22	36.87	58.92	74.00	-15.08	HORIZONTAL peak
4	5730.396	48.79	32.65	5.72	36.99	50.17	74.00	-23.83	HORIZONTAL peak
5	7320.000	51.01	36.07	6.81	37.15	56.74	74.00	-17.26	HORIZONTAL peak
6	9760.000	38.46	38.81	7.65	37.01	47.91	74.00	-26.09	HORIZONTAL peak

Frequency (MHz)	Level (dBUV/m)	Factor (dB)	Limit Line (dBUV/m)	Over limit (dB)	Remark
4880.000	58.92	None	74.00	-15.08	PK
4880.000	42.62	-16.30	54.00	-11.38	AV
7320.000	56.74	None	74.00	-17.26	PK
7320.000	40.44	-16.30	54.00	-13.56	AV

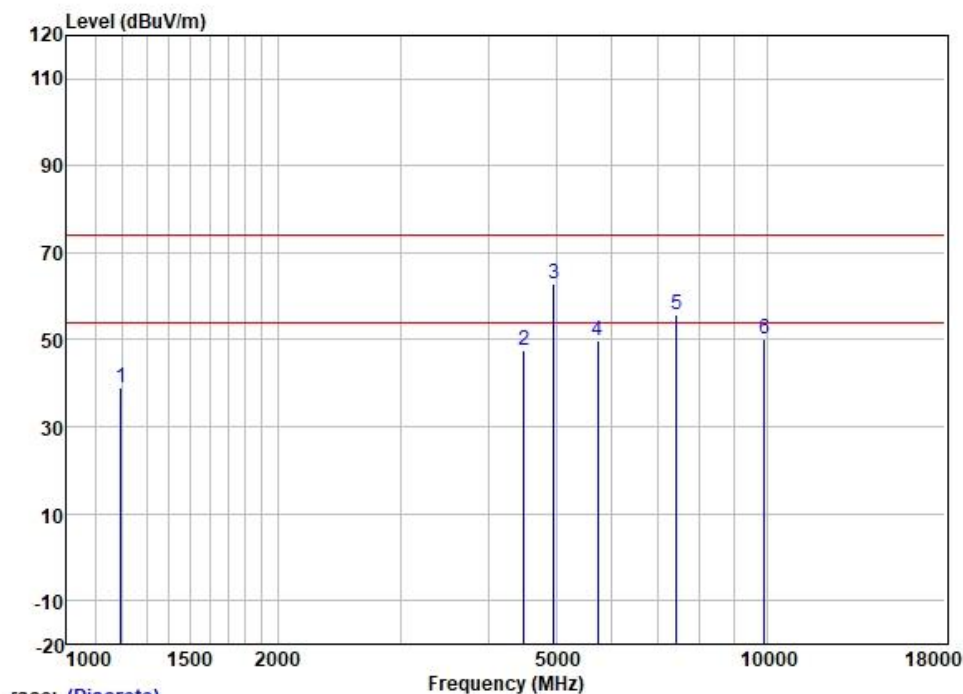
Note: Refer to appendix Duty Cycle test data for more detail about Factor.



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



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	Pol/Phase	Remark
	MHz	Level	Factor	Loss	Factor	Line	Limit		
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1196.264	51.40	23.14	2.55	37.99	39.10	74.00	-34.90	VERTICAL peak
2	4495.125	45.31	34.17	4.78	36.83	47.43	74.00	-26.57	VERTICAL peak
3	4960.000	60.25	34.15	5.28	36.89	62.79	74.00	-11.21	VERTICAL peak
4	5730.396	48.46	32.65	5.72	36.99	49.84	74.00	-24.16	VERTICAL peak
5	7440.000	49.95	36.33	6.72	37.16	55.84	74.00	-18.16	VERTICAL peak
6	9920.000	40.42	38.95	7.67	37.00	50.04	74.00	-23.96	VERTICAL peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
4960.000	62.79	None	74.00	-11.21	PK
4960.000	46.51	-16.28	54.00	-7.49	AV
7440.000	55.84	None	74.00	-18.16	PK
7440.000	39.56	-16.28	54.00	-14.44	AV

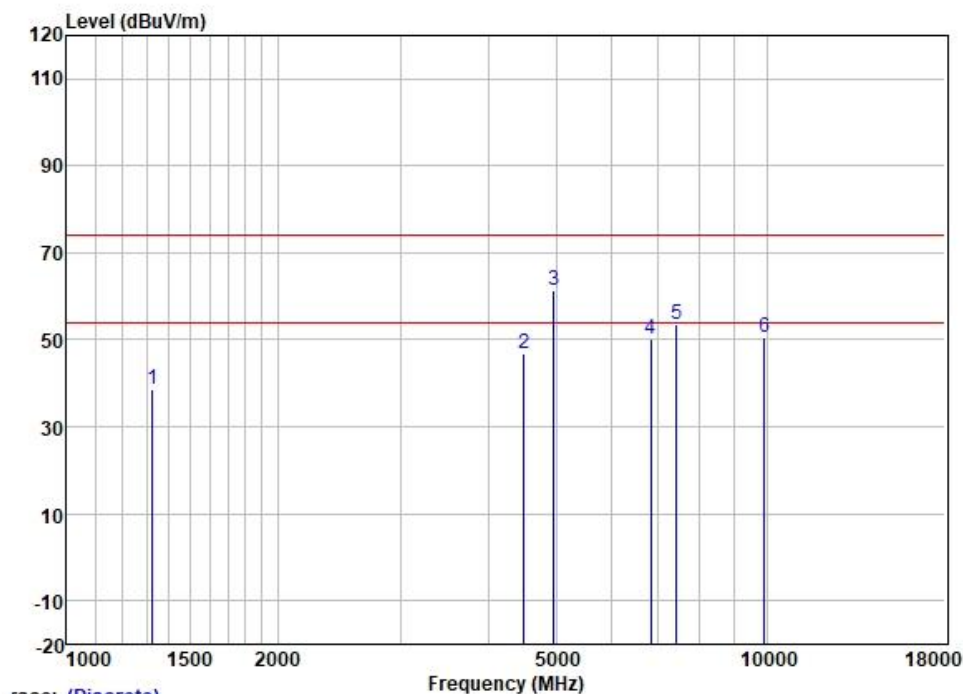
Note: Refer to appendix Duty Cycle test data for more detail about Factor.



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



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1327.446	49.58	24.07	2.83	37.97	38.51	74.00	-35.49	HORIZONTAL peak
2	4495.125	44.62	34.17	4.78	36.83	46.74	74.00	-27.26	HORIZONTAL peak
3	4960.000	58.70	34.15	5.28	36.89	61.24	74.00	-12.76	HORIZONTAL peak
4	6835.278	45.34	34.79	7.01	37.07	50.07	74.00	-23.93	HORIZONTAL peak
5	7440.000	47.74	36.33	6.72	37.16	53.63	74.00	-20.37	HORIZONTAL peak
6	9920.000	41.05	38.95	7.67	37.00	50.67	74.00	-23.33	HORIZONTAL peak

Frequency (MHz)	Level (dBUV/m)	Factor (dB)	Limit Line (dBUV/m)	Over limit (dB)	Remark
4960.000	61.24	None	74.00	-12.76	PK
4960.000	44.96	-16.28	54.00	-9.04	AV

Note: Refer to appendix Duty Cycle test data for more detail about Factor.



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8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR230800087902



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9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2308000879AT



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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	0.096	0.627	15.31	-16.30	0.09
		2440	0.096	0.627	15.31	-16.30	0.09
		2480	0.096	0.626	15.34	-16.28	0.10
2M	SISO	2402	0.060	0.625	9.60	-20.35	0.03
		2440	0.060	0.625	9.60	-20.35	0.06
		2480	0.060	0.627	9.57	-20.38	0.09

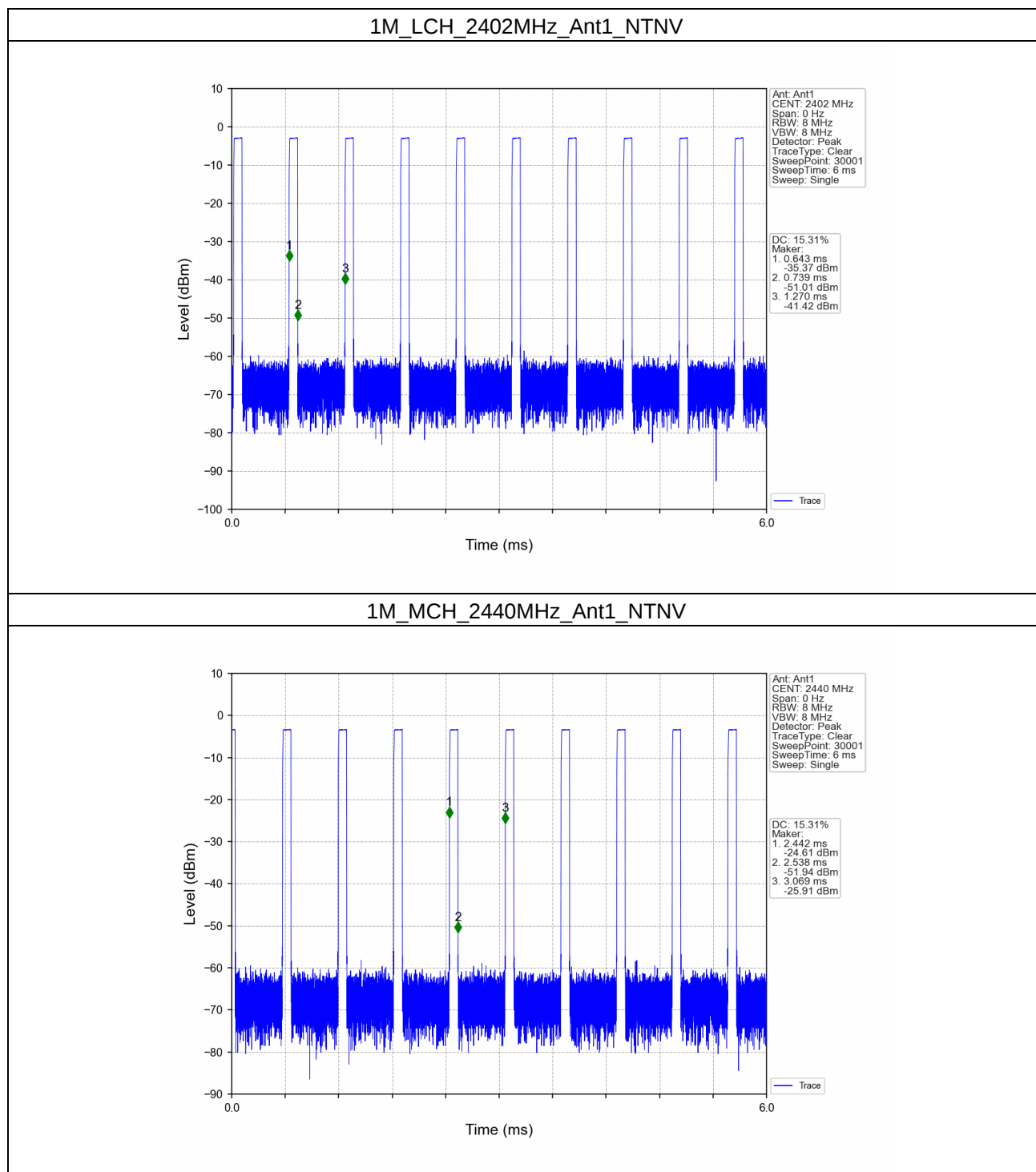
Note: Duty Cycle Correction Factor (dB)= 20log(Duty Cycle) according to ANSI C63.10-2013 clause 7.5



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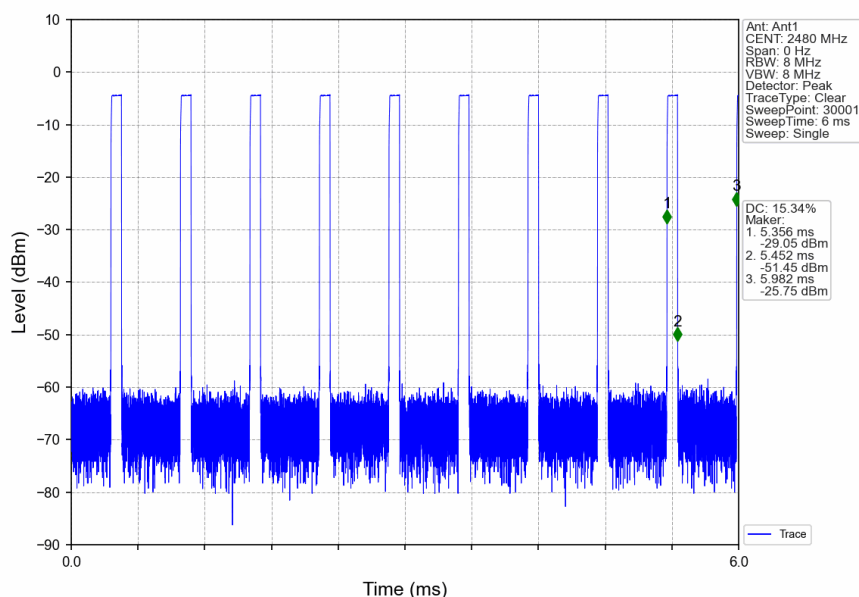
1.1.2 Test Graph



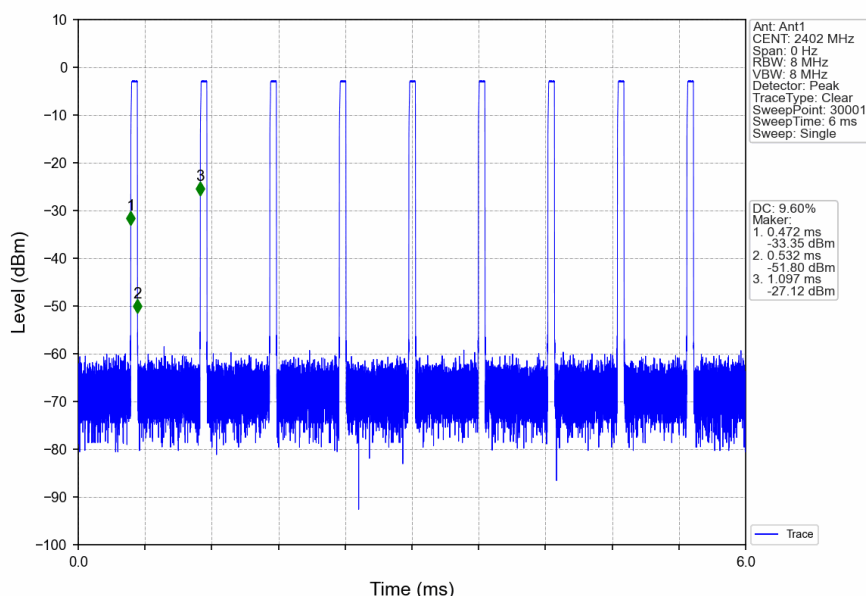
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1M_HCH_2480MHz_Ant1_NTNV



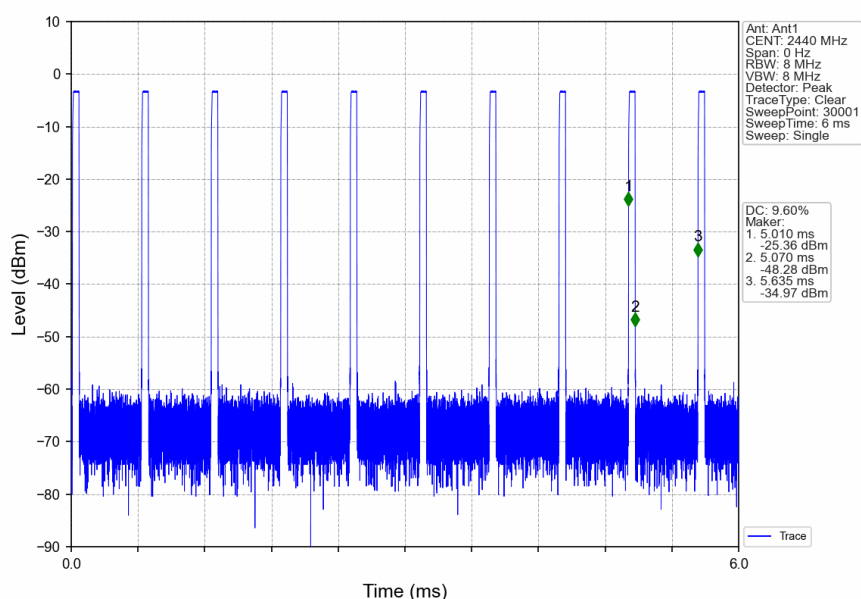
2M_LCH_2402MHz_Ant1_NTNV



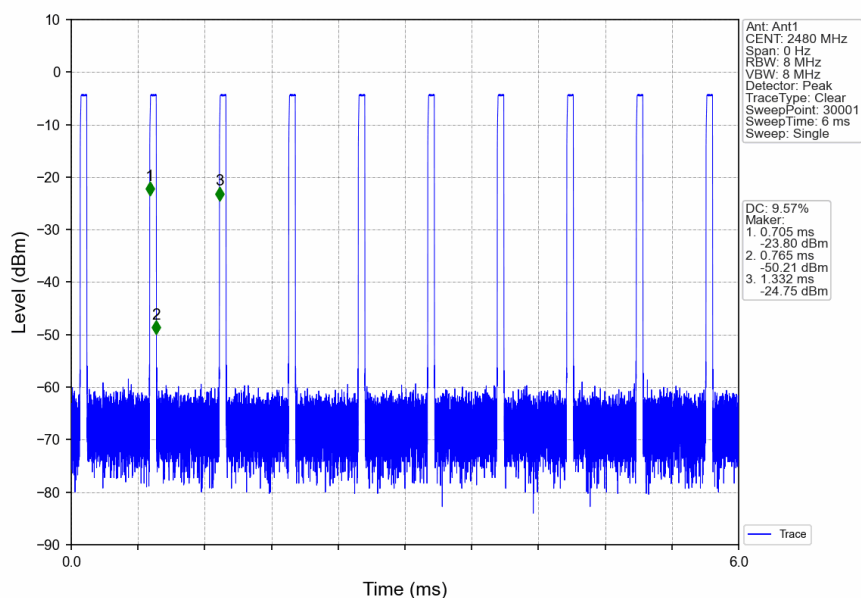
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2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



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2. Bandwidth

2.1 6dB BW

2.1.1 Test Result

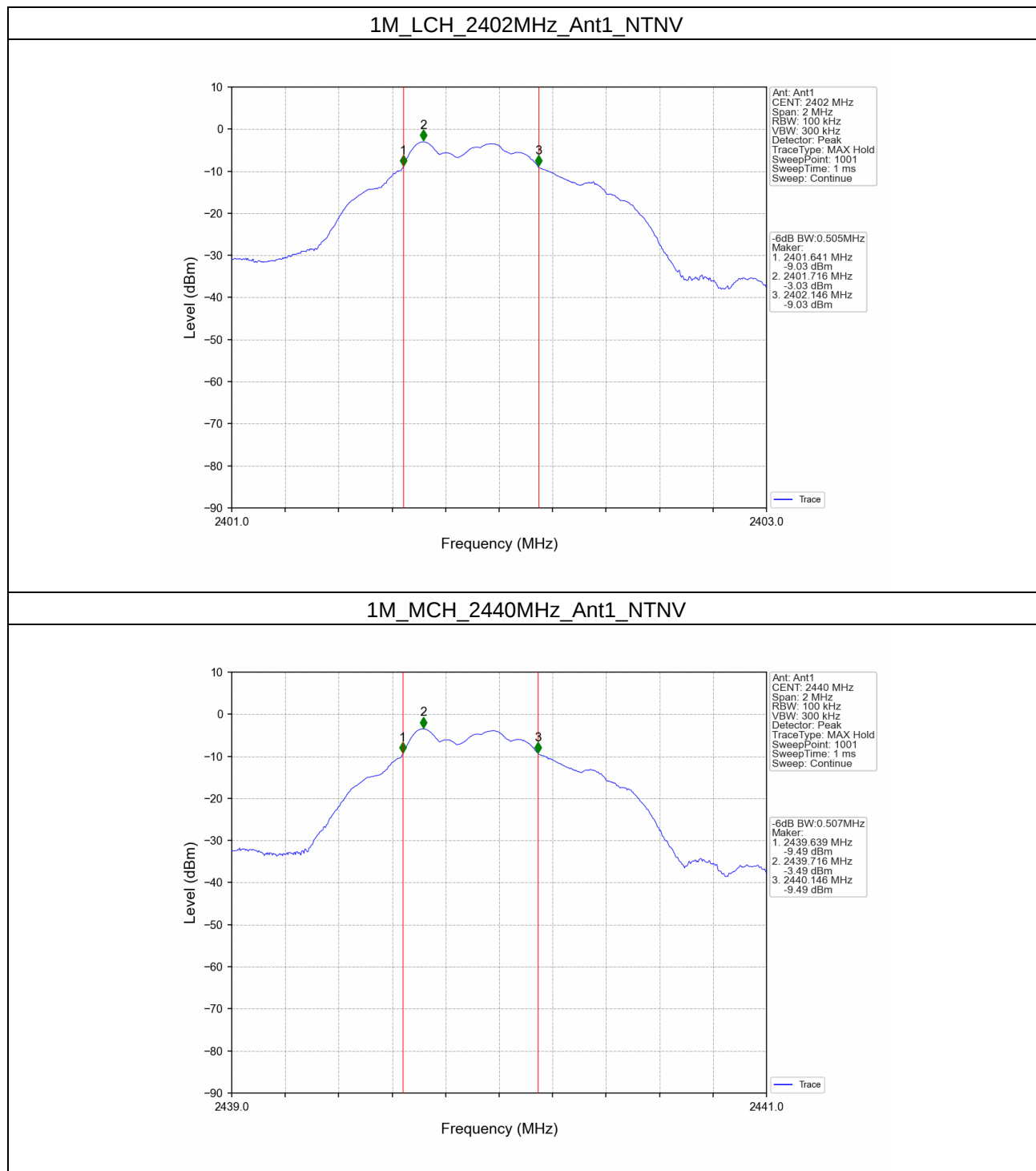
Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	1	0.505	≥ 0.5	Pass
		2440	1	0.507	≥ 0.5	Pass
		2480	1	0.511	≥ 0.5	Pass
2M	SISO	2402	1	0.870	≥ 0.5	Pass
		2440	1	0.875	≥ 0.5	Pass
		2480	1	0.870	≥ 0.5	Pass



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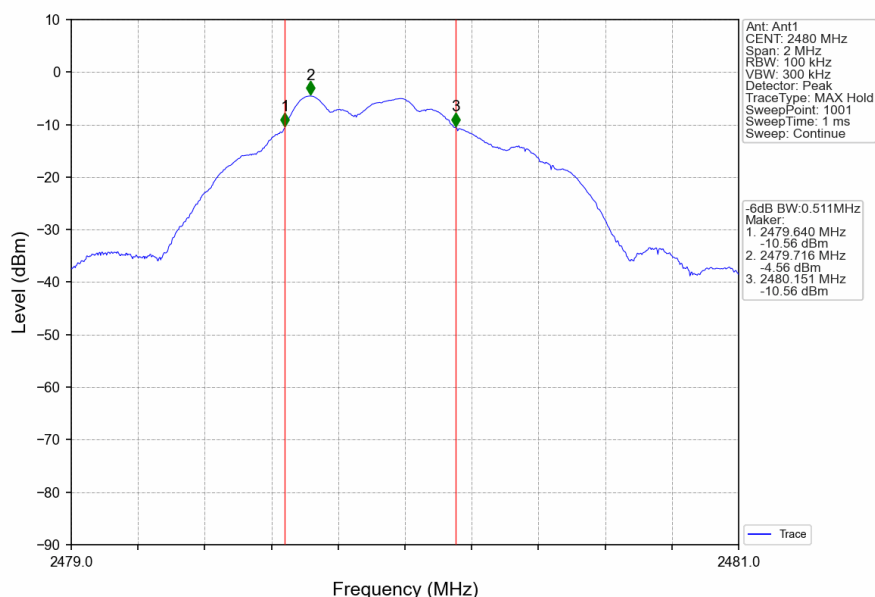
2.2.2 Test Graph



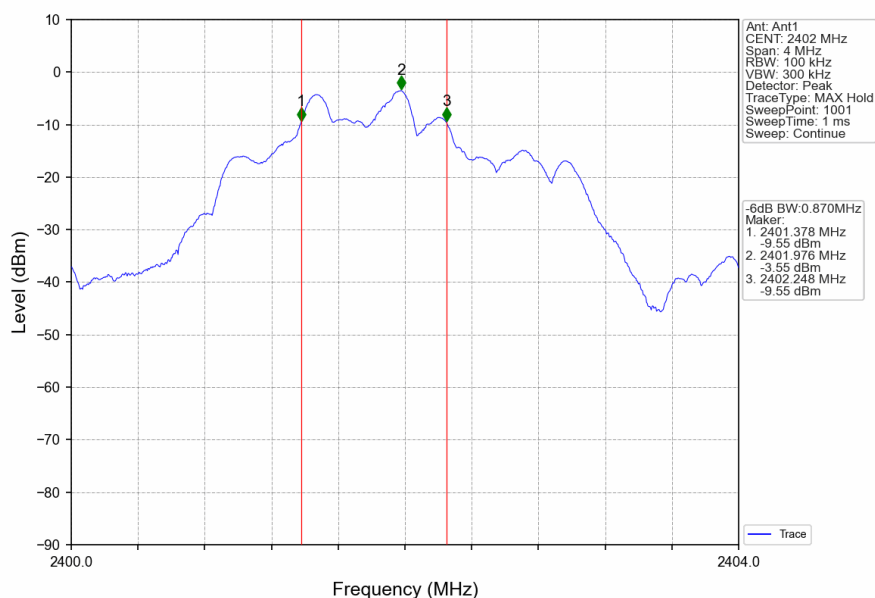
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1M_HCH_2480MHz_Ant1_NTNV



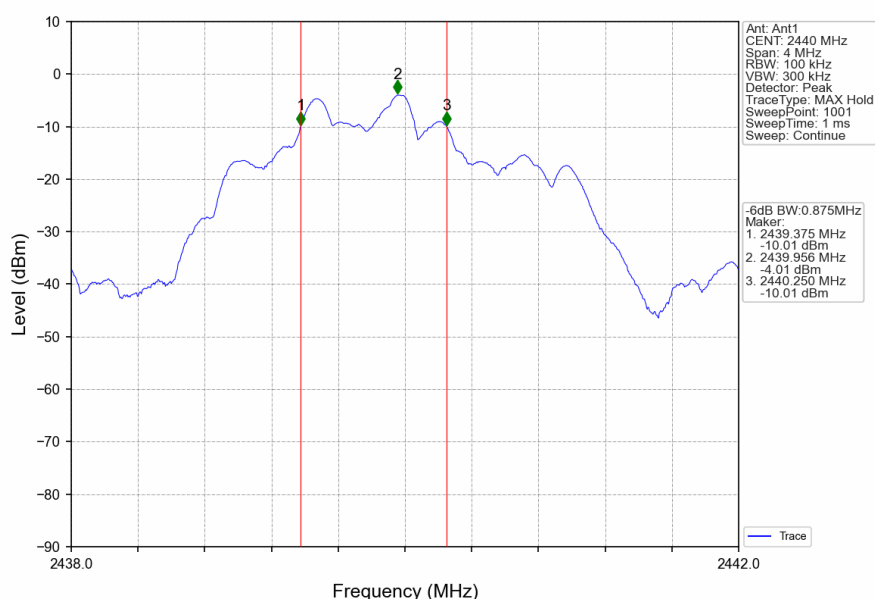
2M_LCH_2402MHz_Ant1_NTNV



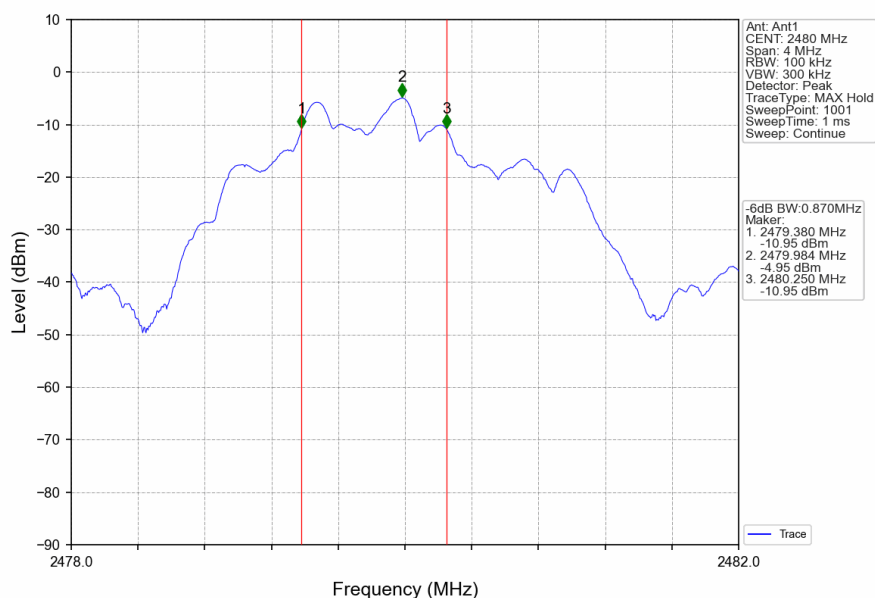
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2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



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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	-2.86	<=30	Pass
		2440	-3.35	<=30	Pass
		2480	-4.41	<=30	Pass
2M	SISO	2402	-2.87	<=30	Pass
		2440	-3.28	<=30	Pass
		2480	-4.36	<=30	Pass

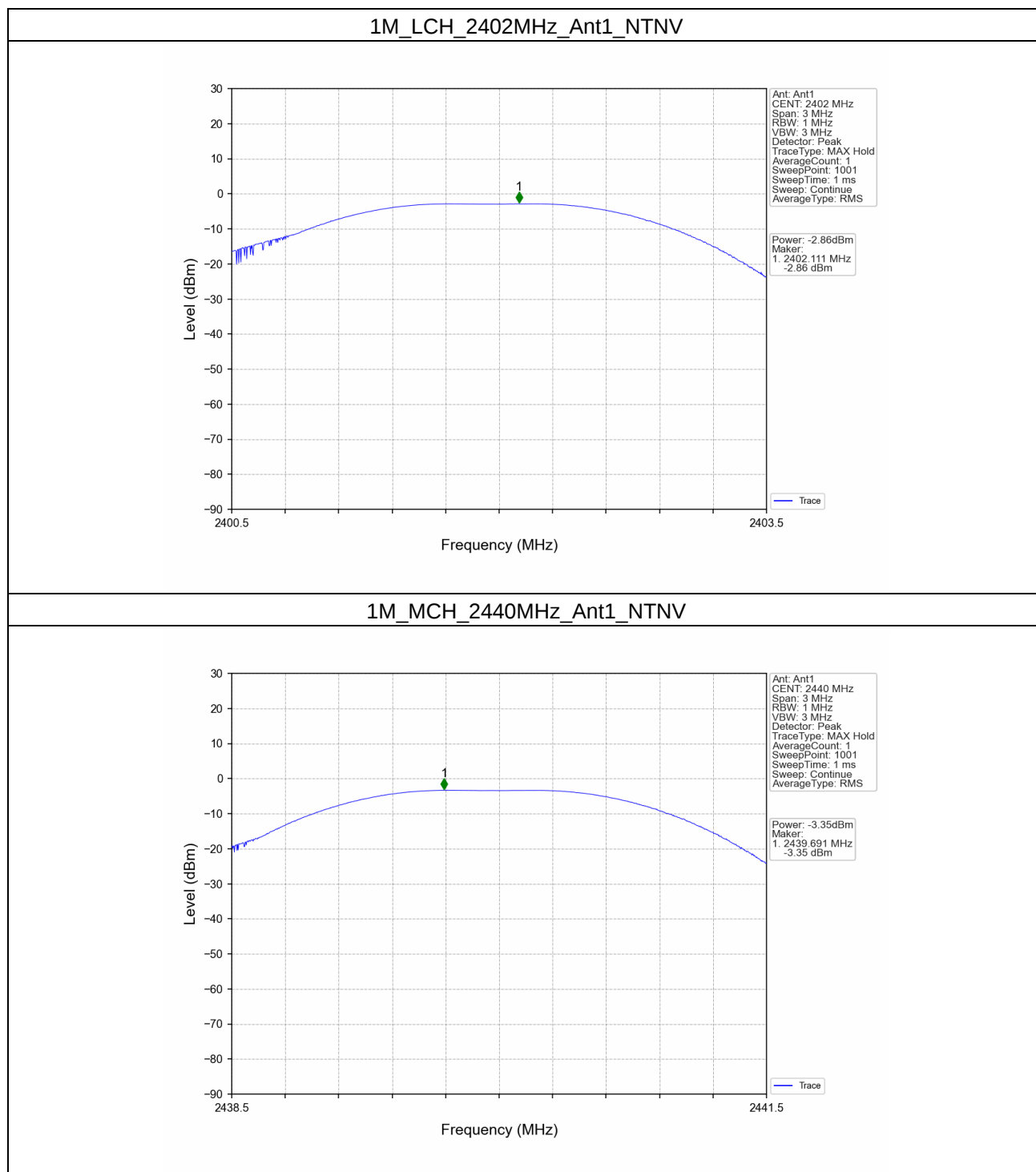
Note1: Antenna Gain: Ant1: 0.00dBi;



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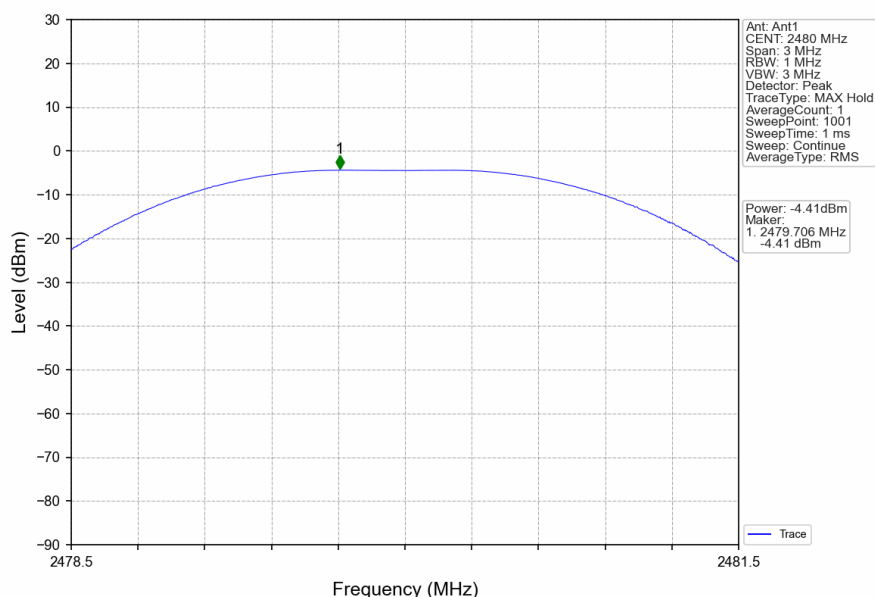
3.1.2 Test Graph



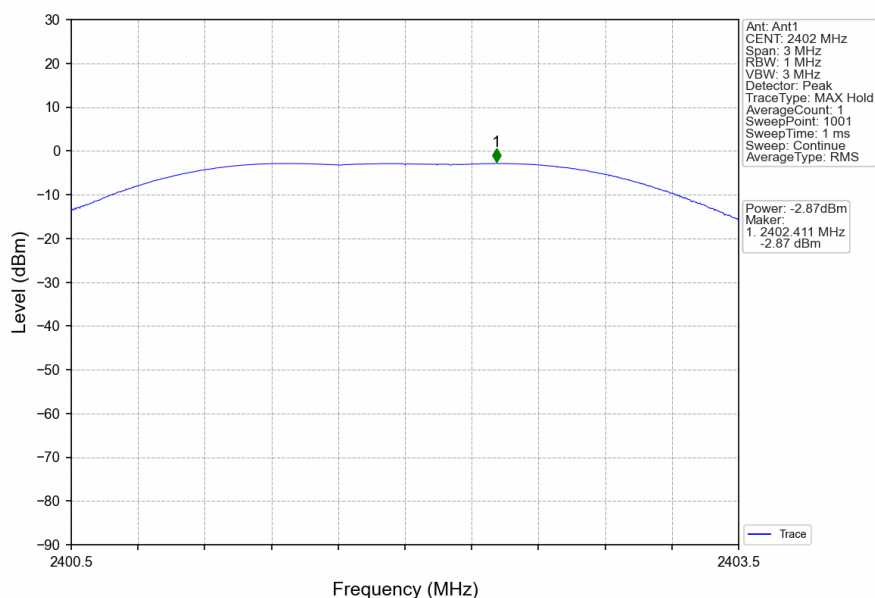
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1M_HCH_2480MHz_Ant1_NTNV



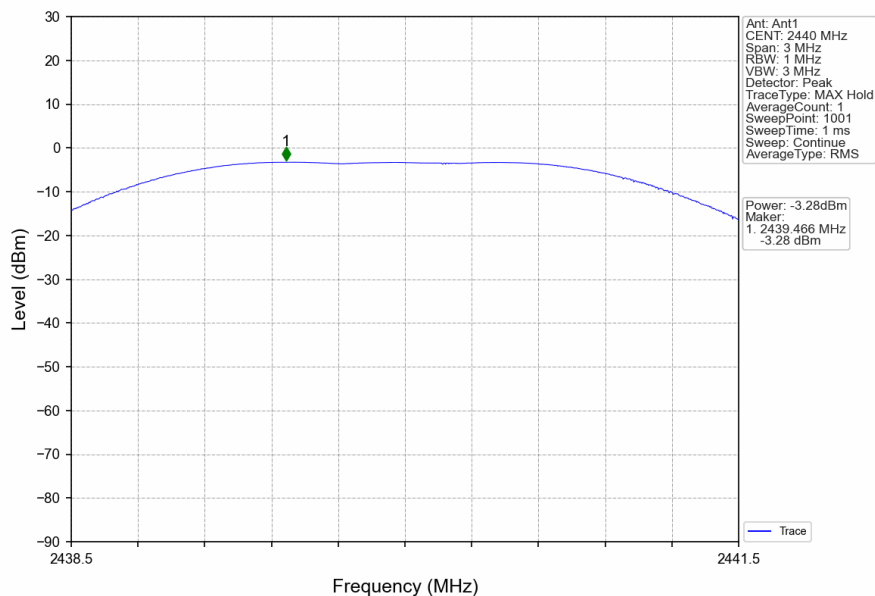
2M_LCH_2402MHz_Ant1_NTNV



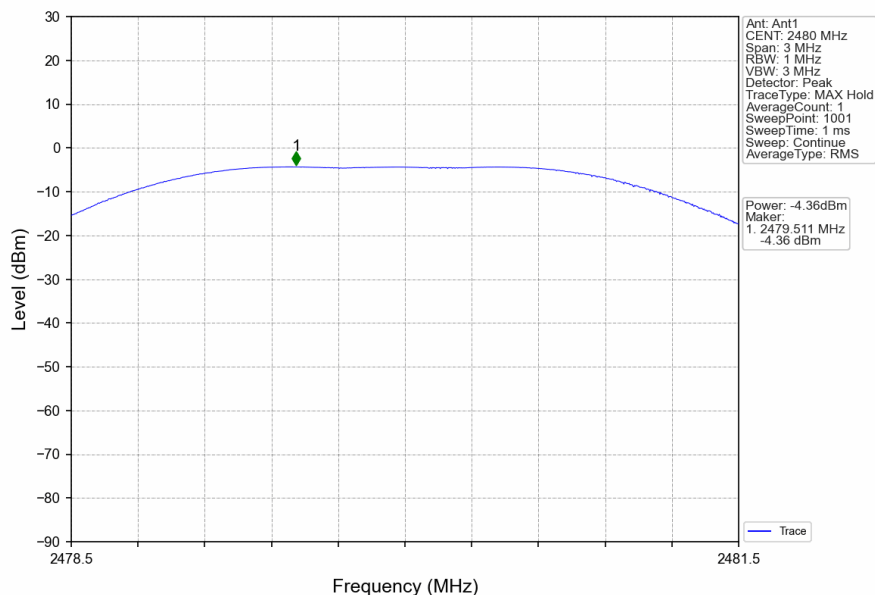
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2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



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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	-20.72	<=8	Pass
		2440	-20.89	<=8	Pass
		2480	-21.69	<=8	Pass
2M	SISO	2402	-23.54	<=8	Pass
		2440	-23.70	<=8	Pass
		2480	-24.89	<=8	Pass

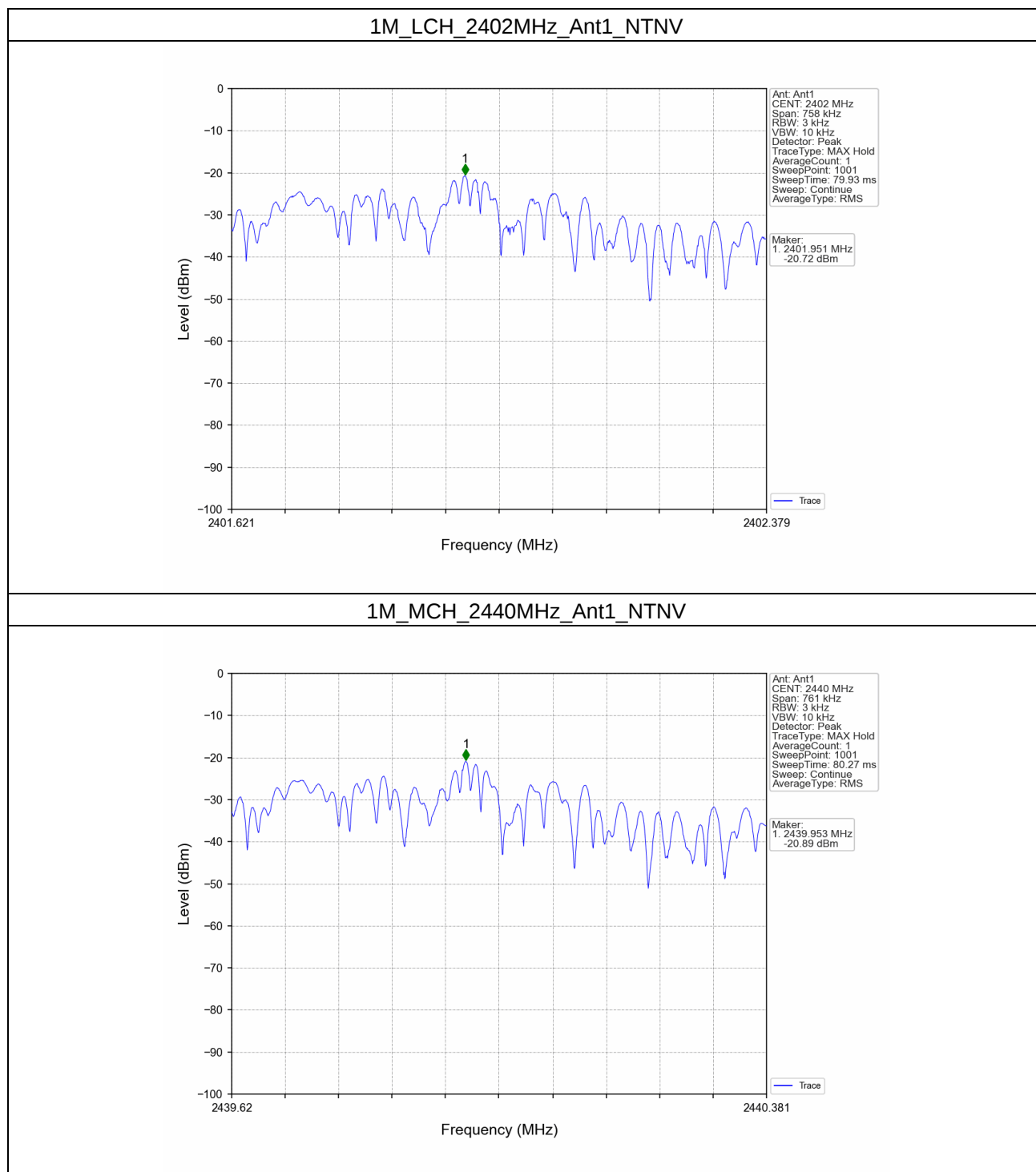
Note1: Antenna Gain: Ant1: 0.00dBi;



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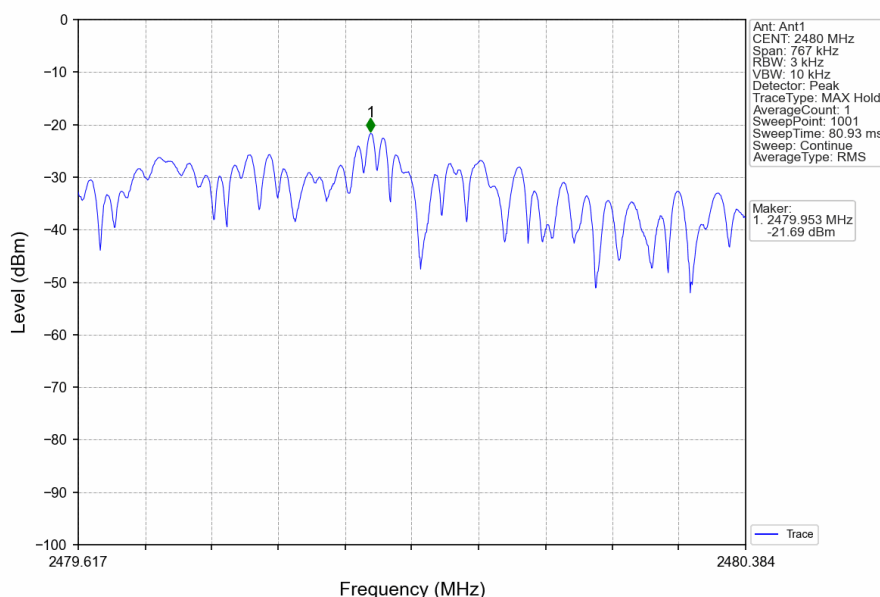
4.1.2 Test Graph



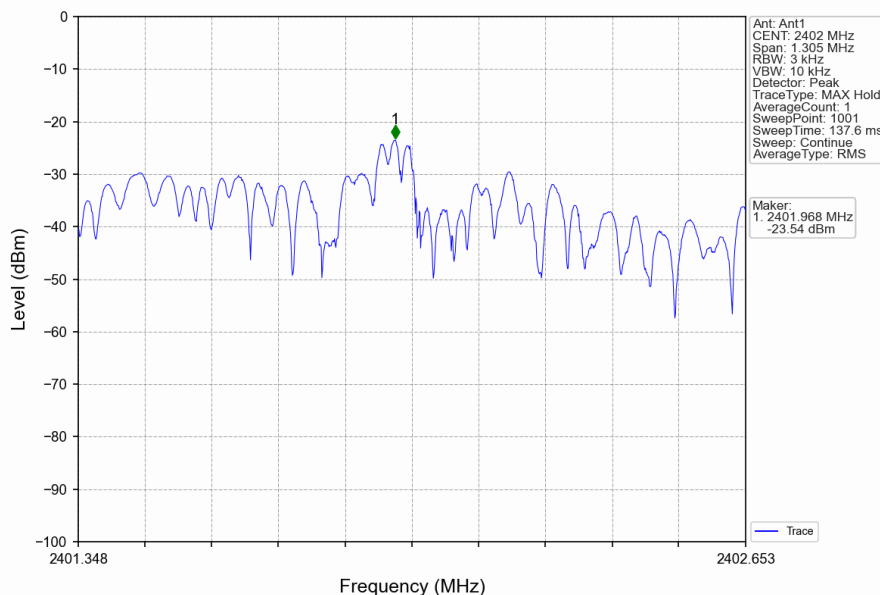
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1M_HCH_2480MHz_Ant1_NTNV



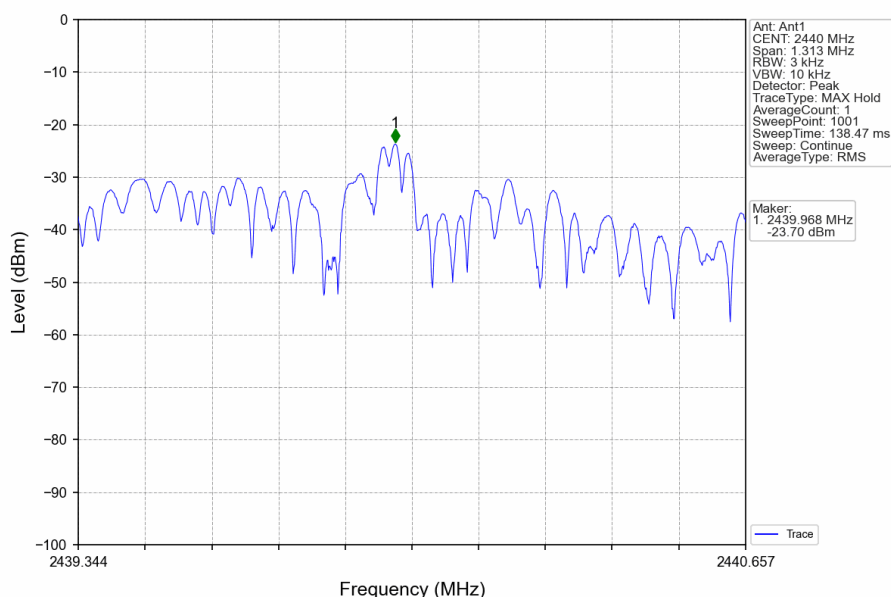
2M_LCH_2402MHz_Ant1_NTNV



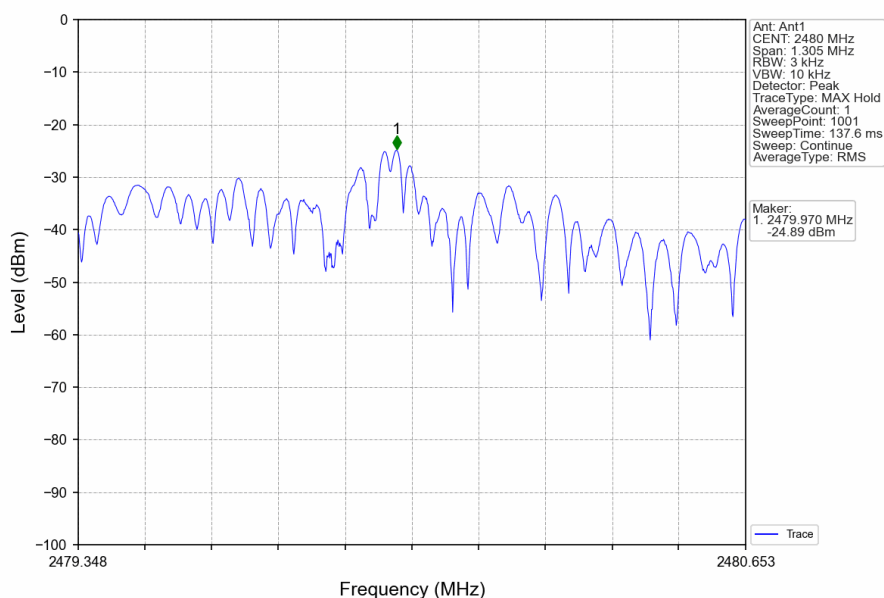
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2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



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5. Unwanted Emissions In 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	-3.03
		2440	1	-3.49
		2480	1	-4.58
2M	SISO	2402	1	-3.50
		2440	1	-3.93
		2480	1	-5.04

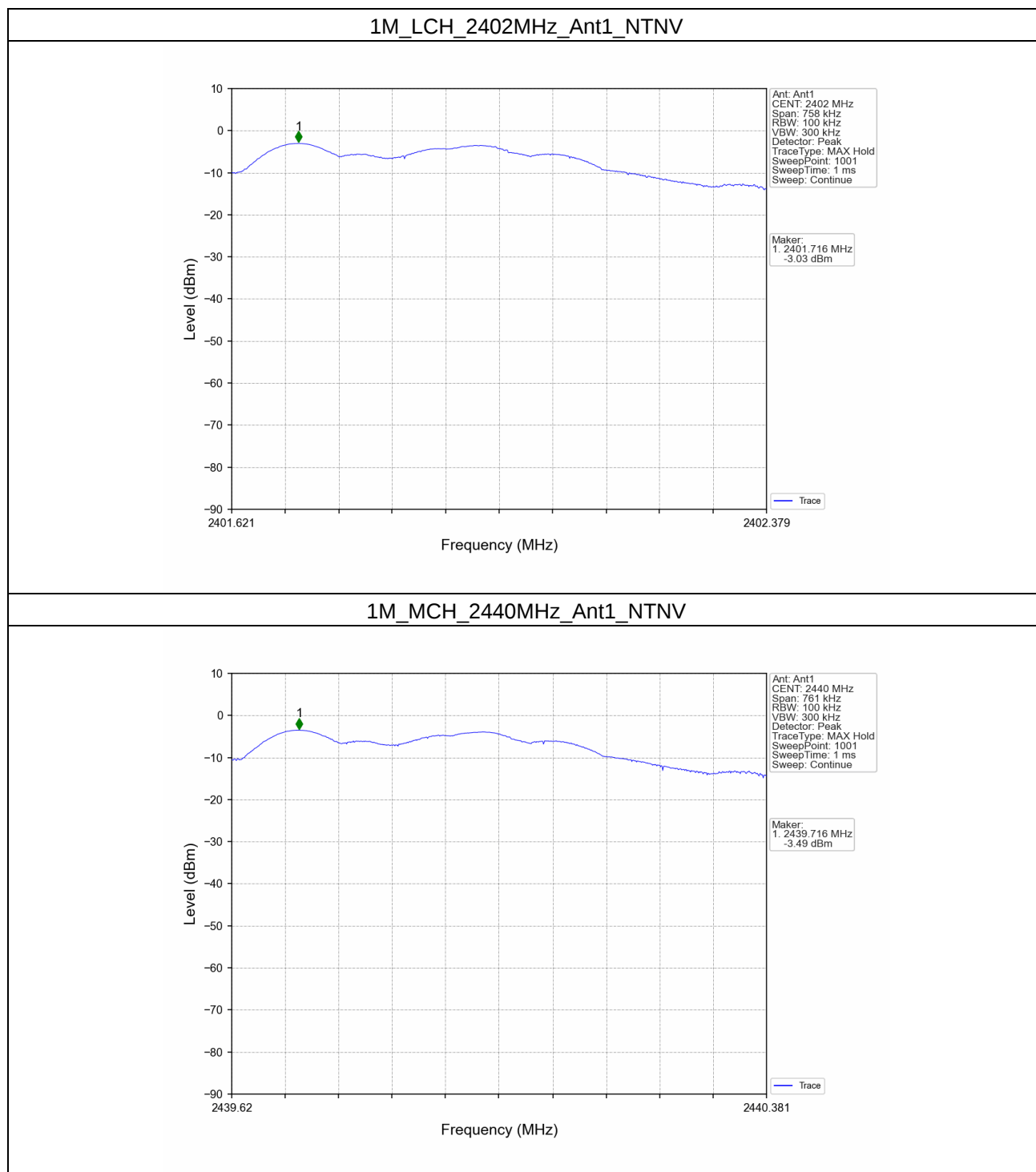
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.



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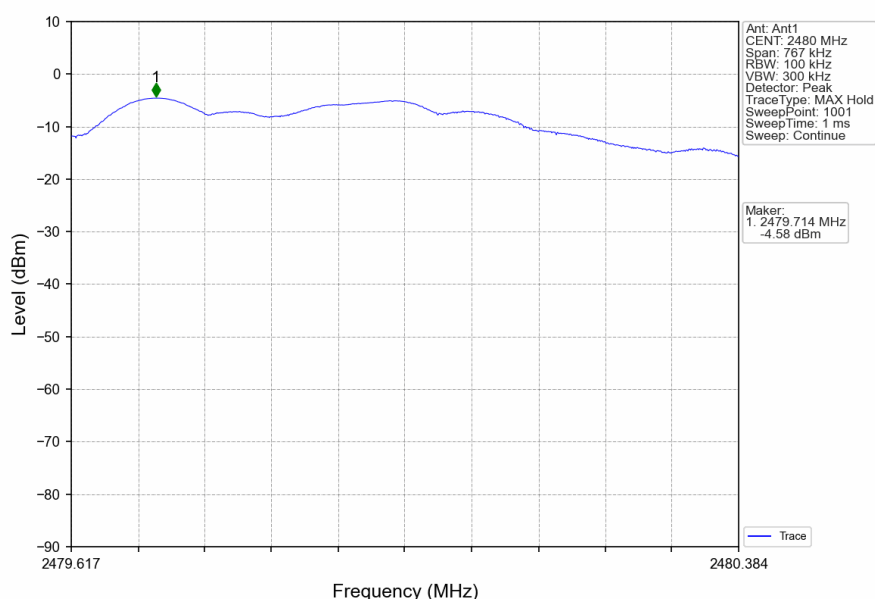
5.1.2 Test Graph



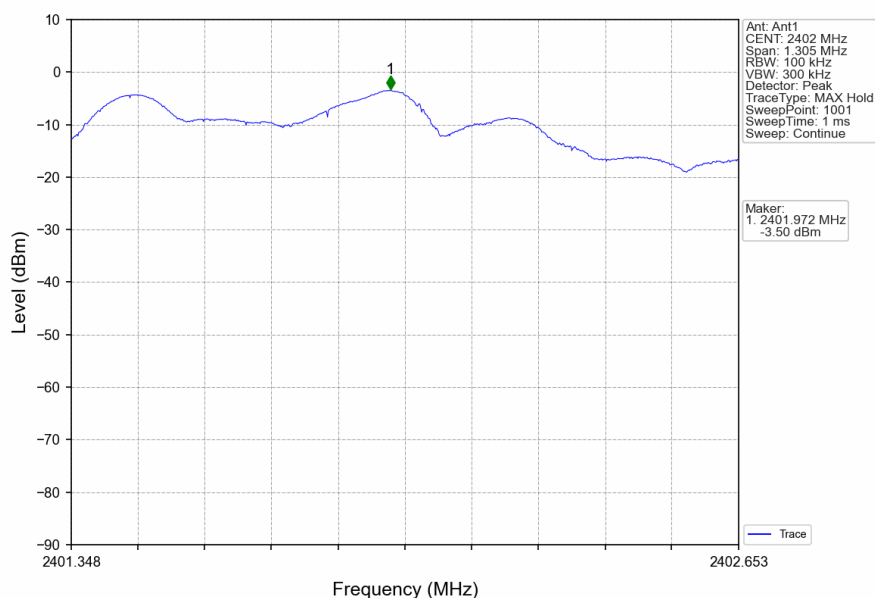
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1M_HCH_2480MHz_Ant1_NTNV



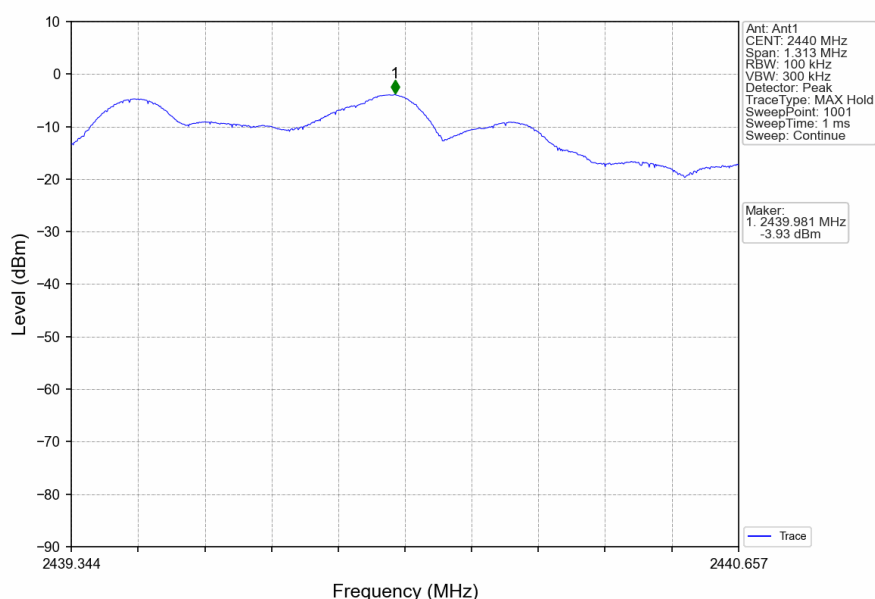
2M_LCH_2402MHz_Ant1_NTNV



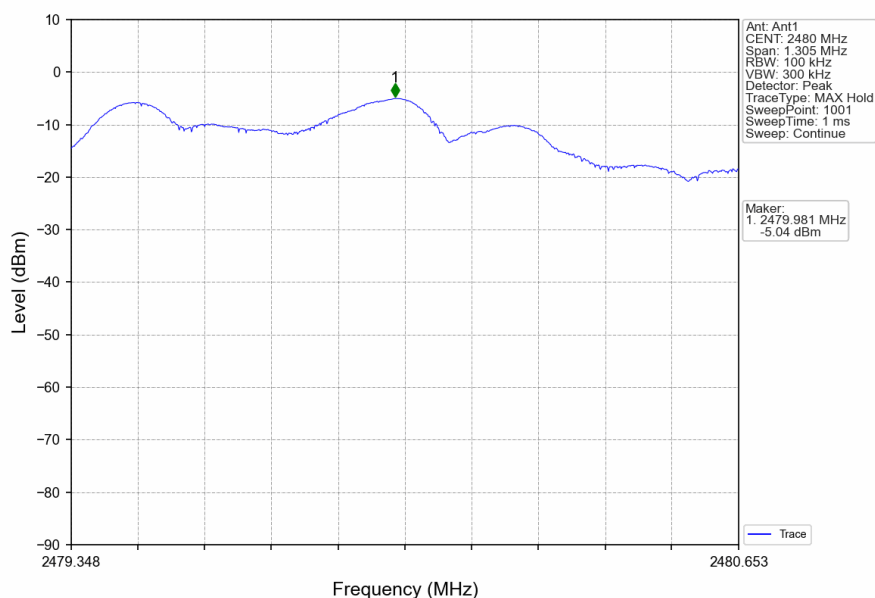
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2M_MCH_2440MHz_Ant1_NTNV



2M_HCH_2480MHz_Ant1_NTNV



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5.2 CSE and Band Edges

5.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
1M	SISO	2402	1	-3.03	-23.03	Pass
		2440	1	-3.03	-23.03	Pass
		2480	1	-3.03	-23.03	Pass
2M	SISO	2402	1	-3.50	-23.50	Pass
		2440	1	-3.50	-23.50	Pass
		2480	1	-3.50	-23.50	Pass

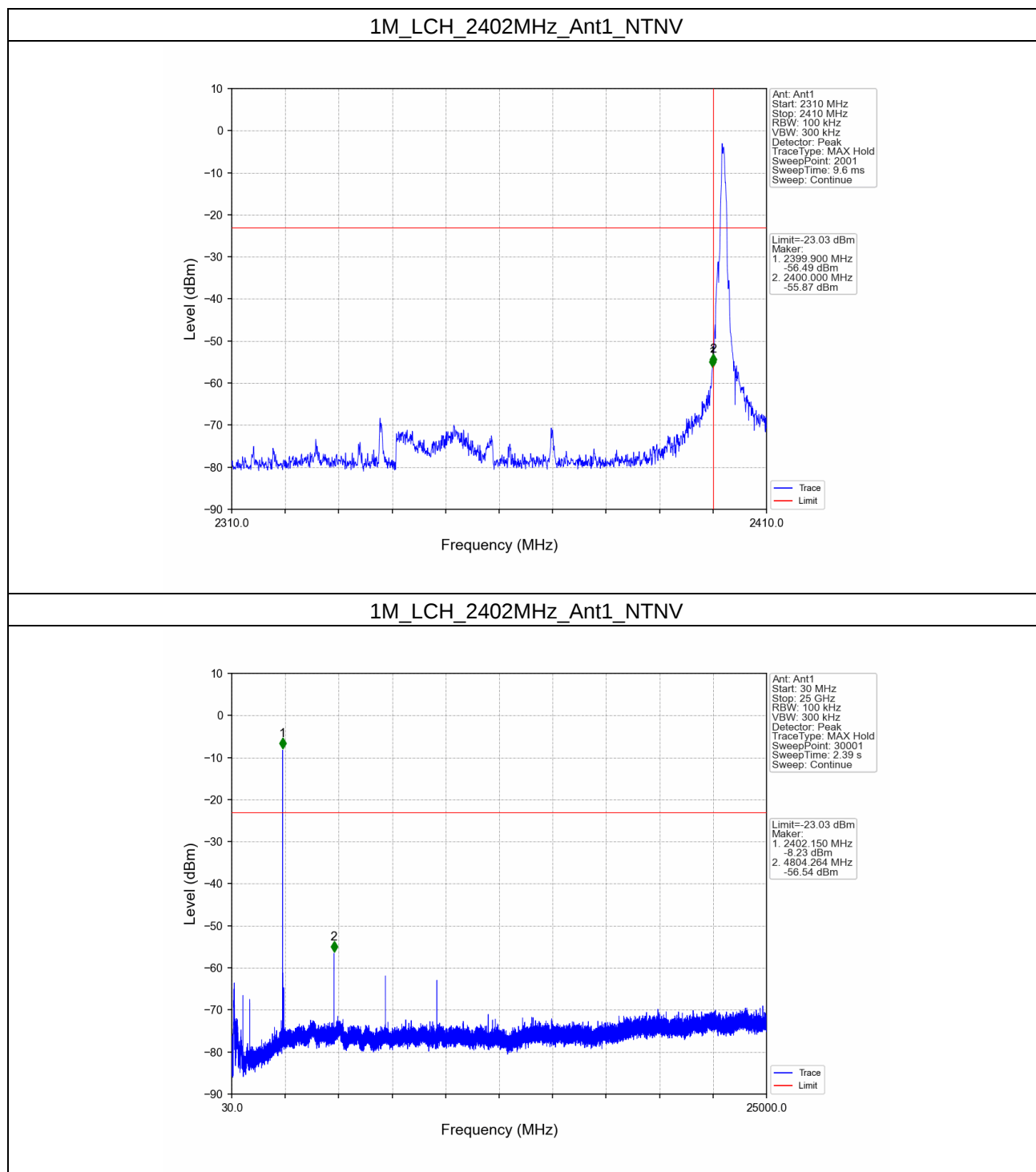
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.



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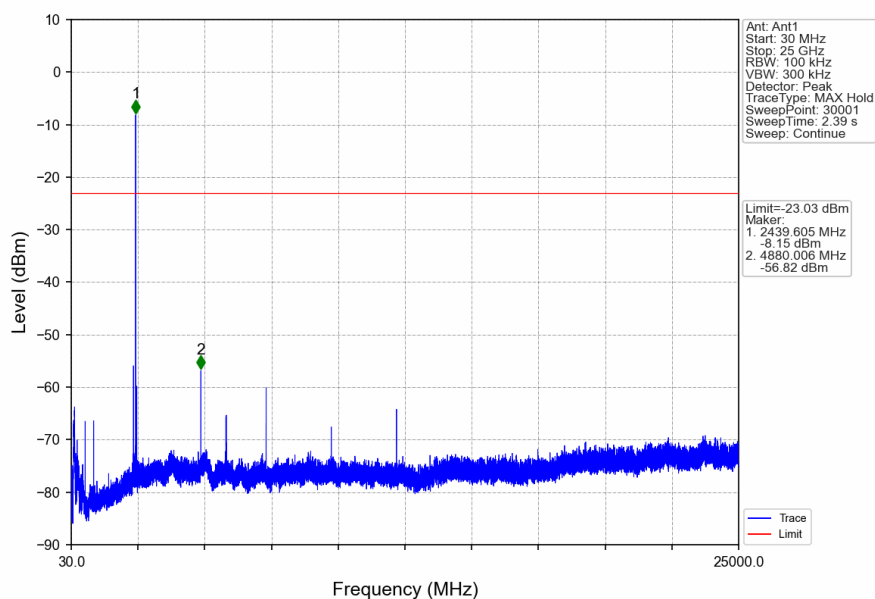
5.2.2 Test Graph



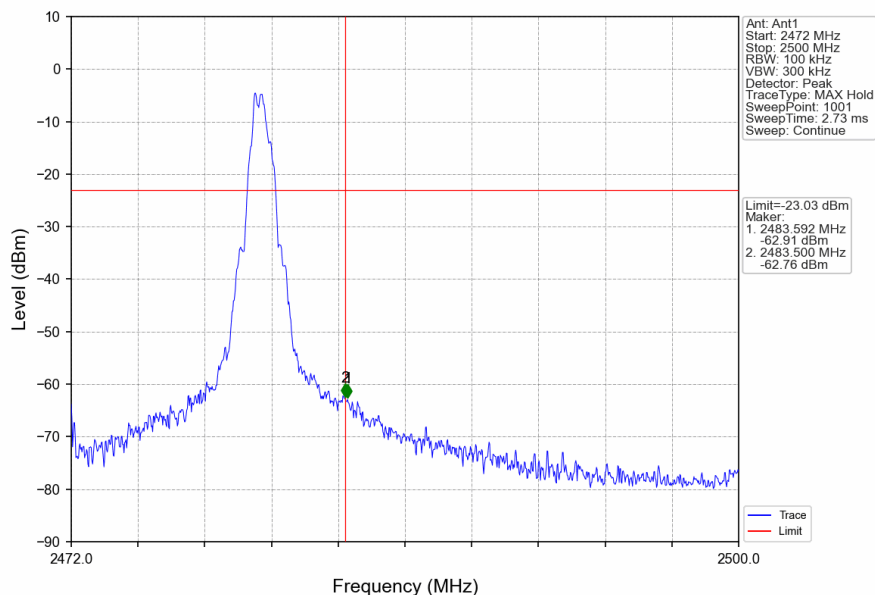
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1M_MCH_2440MHz_Ant1_NTNV



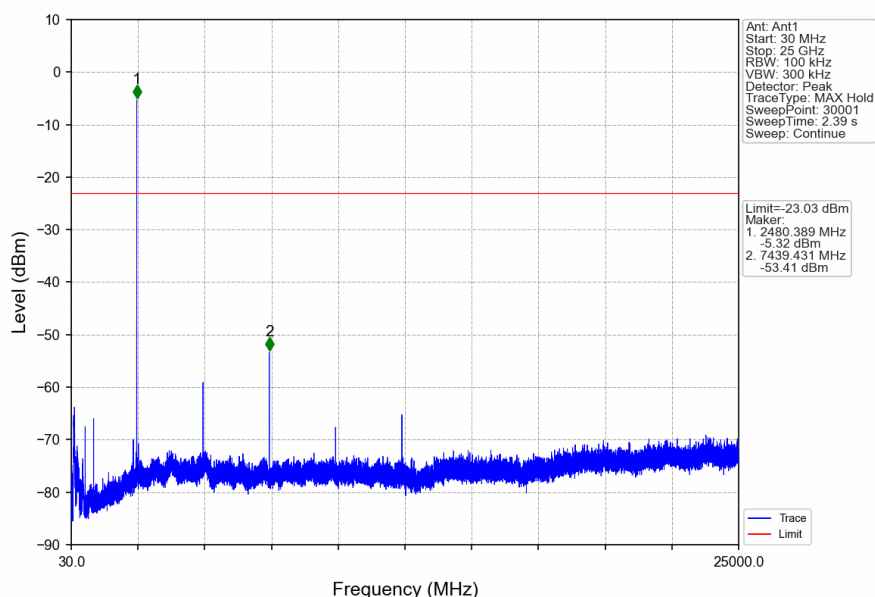
1M_HCH_2480MHz_Ant1_NTNV



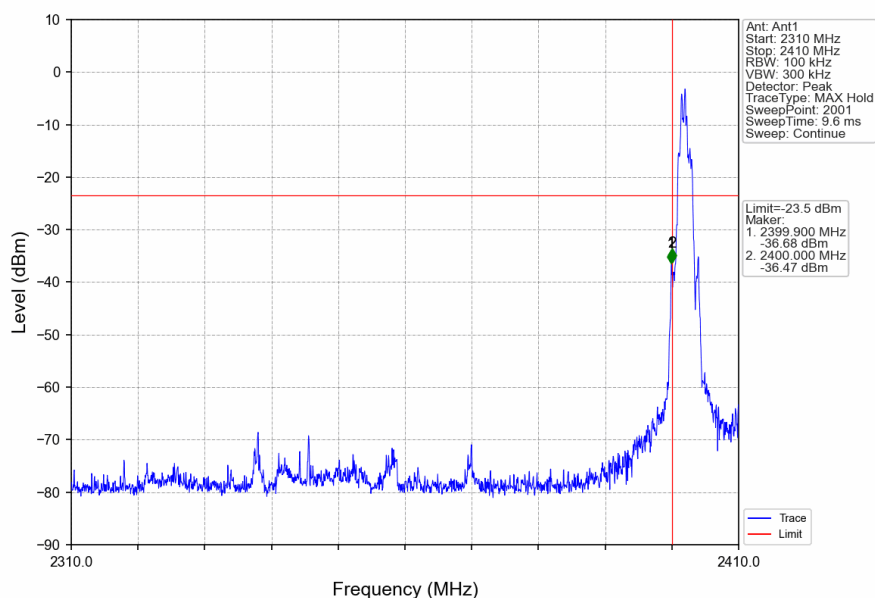
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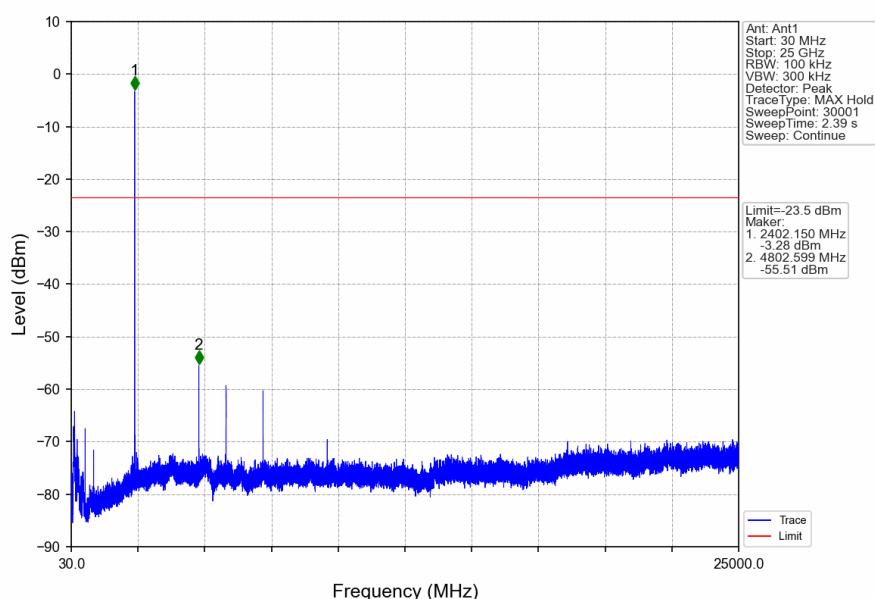
2M_LCH_2402MHz_Ant1_NTNV



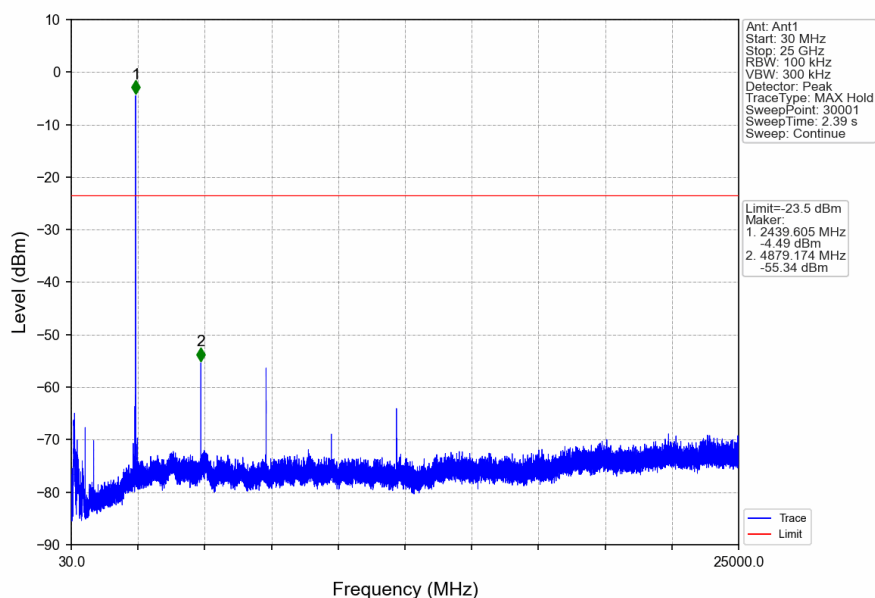
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2M_LCH_2402MHz_Ant1_NTNV



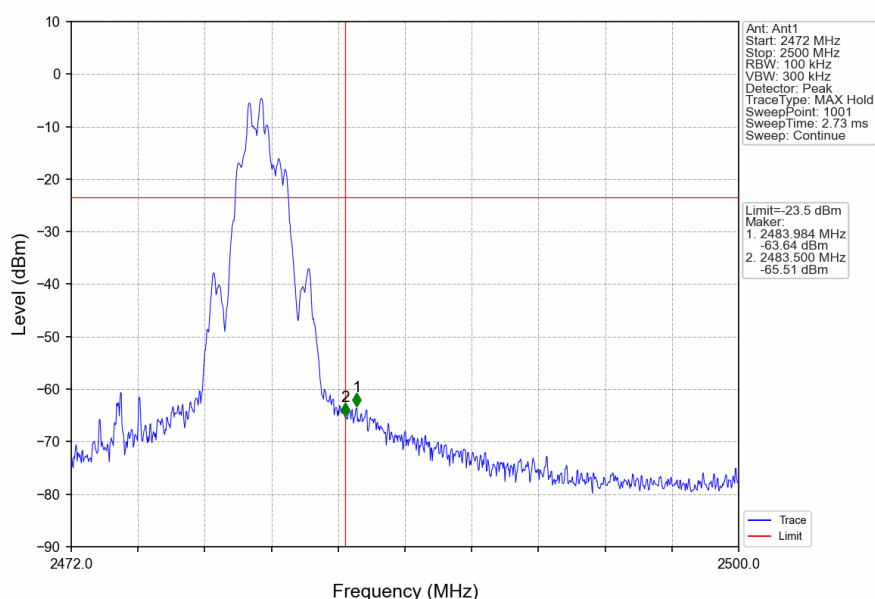
2M_MCH_2440MHz_Ant1_NTNV



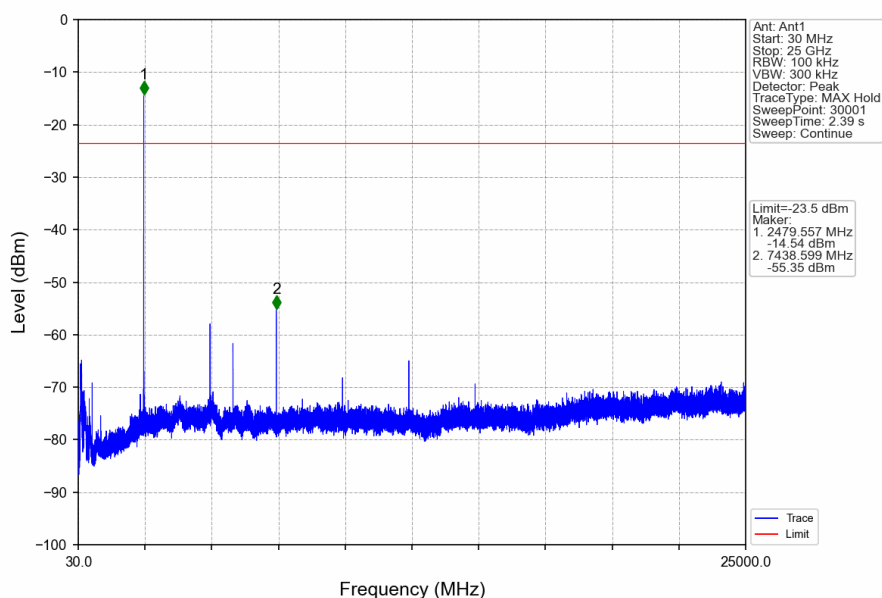
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2M_HCH_2480MHz_Ant1_NTNV



- End of the Report -



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