



## TEST REPORT

**Application No.:** GZCR2108020830AT  
**Applicant:** Avnet Inc  
**Address of Applicant:** 2211 South 47th Street; Phoenix, Arizona 85034; USA  
**Manufacturer:** Avnet Inc  
**Address of Manufacturer:** 2211 South 47th Street; Phoenix, Arizona 85034; USA  
**Factory:** NOTE-China Electronics (Dongguan) Ltd  
**Address of Factory:** 8 Ling Dong 3 Road Lincun Industrial Center TangXia, Dongguan China, 523710

**Equipment Under Test (EUT):**

**EUT Name:** Human machine interface single board computer with touchscreen  
**Model No.:** KDP HMI 10  
**Trade Mark:**



**Standard(s) :** 47 CFR Part 15, Subpart C 15.247  
**Date of Receipt:** 2021-08-19  
**Date of Test:** 2021-08-20 to 2021-08-27  
**Date of Issue:** 2021-08-30

<b>Test Result:</b>	<b>Pass*</b>
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\* In the configuration tested, the EUT complied with the standards specified above.

Kobe Jian  
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2021-08-30		Original

Authorized for issue by			
		Curry Wu /Project Engineer	
		Ricky Liu/Reviewer	

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## 2 Test Summary

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

<b>Radio Spectrum Matter Part</b>				
<b>Item</b>	<b>Standard</b>	<b>Method</b>	<b>Requirement</b>	<b>Result</b>
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 11.9.1.3	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 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions (Below 1GHz)		ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions (Above 1GHz)		ANSI C63.10 (2013) Section 6.4,6.5,6.6	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 12.0V, 1.5A AC/DC Adapter Model: SMI24-12 Input: AC100-240V, 50-60Hz, 0.58A Output: DC 12.0V, 2.0A
Test Voltage:	AC 120V, 60Hz
Cable(s):	DC Cable: 1.5m, Unshielded, USB Cable: 2.0m, Unshielded
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V4.2
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Data Rate:	1Mbps
Antenna Type:	Chip Antenna
Antenna Gain:	1.5dBi

### 4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
--	--	--	--

The EUT has been tested as an independent unit.

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**4.3 Measurement Uncertainty**

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±3.12dB
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	±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz)
Radiated Spurious Emissions (Below 1GHz)	±5.06dB (3m); ±4.46dB (10m)
Radiated Spurious Emissions (Above 1GHz)	±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz)
Remark:	
The $U_{lab}$ (lab Uncertainty) is less than $U_{cispr}$ (CISPR 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.	



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## 4.4 Test Location

All tests were performed at:

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Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

## 4.5 Test Facility

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

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **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.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

- **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)**

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- **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.

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**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
Shielding Room	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	N/A	N/A
Two-Line V-Network	Rohde & Schwarz	ENV216	EMC0118	2021-01-08	2022-01-06
Two-Line V-Network-GZ	Rohde & Schwarz	ENV216	EMC2135	2020-09-25	2021-09-24
Coaxial Cable	HangTianXing	2m	EMC0107	2020-09-09	2022-09-08
Test Software E3c	Audix	Ver. 5.4.1221b	GZE100-62	N/A	N/A
EMI Test Receiver(9kHz-3.6GHz)	Rohde & Schwarz	ESR4	EMC2221	2021-06-01	2022-05-31

Conducted Peak Output Power					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Minimum 6dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Power Spectrum Density					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

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**Conducted Band Edges Measurement**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

**Conducted Spurious Emissions**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

**Radiated Emissions which fall in the restricted bands**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(20Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-01-08	2022-01-07
Chamber cable(Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020-09-09	2022-09-08
Horn Antenna(1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-01-08	2022-01-07
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-01-08	2022-01-07
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2020-11-13	2021-11-12
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2020-09-17	2021-09-16
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2020-09-09	2021-09-08

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**Radiated Spurious Emissions (Below 1GHz)**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Chamber cable	HangTianXing	N/A	EMC0542	2020-09-09	2022-09-08
Trilog Broadband Antenna(25MHz-1GHz)-Lab	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	SEM003-18	2019-02-22	2022-02-22
Amplifier(9kHz-1.3GHz)	HP	8447F	EMC2065	2021-05-19	2022-05-18
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2019-12-27	2021-12-26
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2019-10-20	2022-10-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2021-05-26	2022-05-25

**Radiated Spurious Emissions (Above 1GHz)**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(20Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-01-08	2022-01-07
Chamber cable(Above 1GHz)	Scoflex	KMKG-8.0m	EMC0545	2020-09-09	2022-09-08
Horn Antenna(1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-01-08	2022-01-07
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-01-08	2022-01-07
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2020-11-13	2021-11-12
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2020-09-17	2021-09-16
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2020-09-09	2021-09-08

**General used equipment**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2021-07-05	2022-07-05
DMM	Fluke	73	EMC0007	2021-07-05	2022-07-05

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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 1.5 dBi.

Please refer to internal photos.

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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.

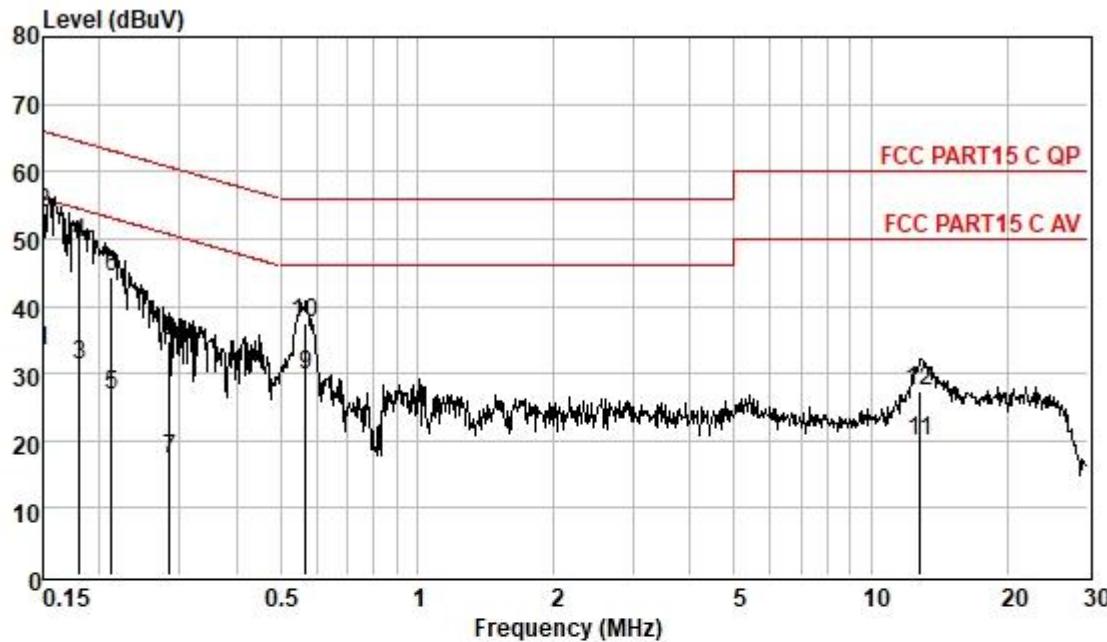
Remark: LISN=Read Level+ Cable Loss+ LISN Factor



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Test Mode: 02; Line: Live line Modulation:GFSK; Channel:Low



Pol :LINE

Mode :02

Model :

Frequenc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
0.15	23.59	0.06	9.62	33.27	56.00	-22.73	Average
0.15	44.18	0.06	9.62	53.86	66.00	-12.14	QP
0.18	21.53	0.06	9.62	31.21	54.46	-23.25	Average
0.18	39.56	0.06	9.62	49.24	64.46	-15.22	QP
0.21	17.18	0.06	9.63	26.87	53.10	-26.23	Average
0.21	34.60	0.06	9.63	44.29	63.10	-18.81	QP
0.28	7.59	0.06	9.62	17.27	50.68	-33.41	Average
0.28	25.14	0.06	9.62	34.82	60.68	-25.86	QP
0.57	19.92	0.07	9.63	29.62	46.00	-16.38	Average
0.57	27.85	0.07	9.63	37.55	56.00	-18.45	QP
12.85	9.90	0.28	9.72	19.90	50.00	-30.10	Average
12.85	17.28	0.28	9.72	27.28	60.00	-32.72	QP

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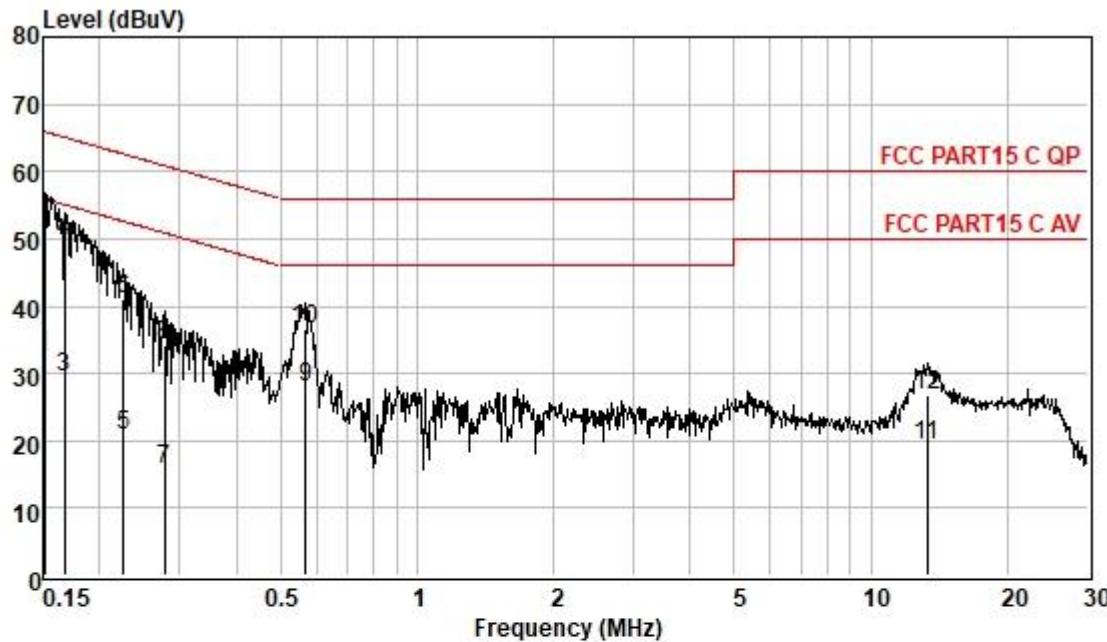
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Test Mode: 02; Line: Neutral Line Modulation:GFSK; Channel:Low



Pol :NEUTRAL

Mode :02

Model :

Frequenc MHz	Read Level dBuV	Cable Loss dB	LIISN Factor	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
0.15	22.73	0.06	9.55	32.34	55.96	-23.62	Average
0.15	43.27	0.06	9.55	52.88	65.96	-13.08	QP
0.17	19.92	0.06	9.55	29.53	55.08	-25.55	Average
0.17	39.97	0.06	9.55	49.58	65.08	-15.50	QP
0.23	11.22	0.06	9.55	20.83	52.61	-31.78	Average
0.23	31.39	0.06	9.55	41.00	62.61	-21.61	QP
0.28	6.29	0.06	9.54	15.89	50.90	-35.01	Average
0.28	24.67	0.06	9.54	34.27	60.90	-26.63	QP
0.57	18.42	0.07	9.54	28.03	46.00	-17.97	Average
0.57	26.94	0.07	9.54	36.55	56.00	-19.45	QP
13.27	9.36	0.29	9.62	19.27	50.00	-30.73	Average
13.27	16.74	0.29	9.62	26.65	60.00	-33.35	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 11.9.1.3

Limit:

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

**7.2.1 E.U.T. Operation**

Operating Environment:

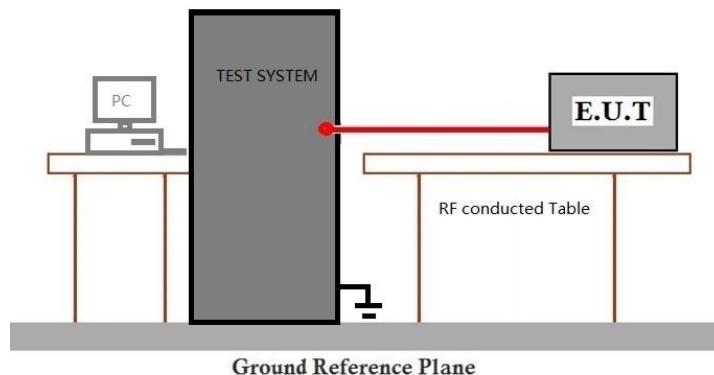
Temperature: 25.5 °C

Humidity: 34.4 % RH

Atmospheric Pressure: 1010 mbar

**7.2.2 Test Mode Description**

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_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**

cable loss=0.9dB

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:  $\geq 500$  kHz

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

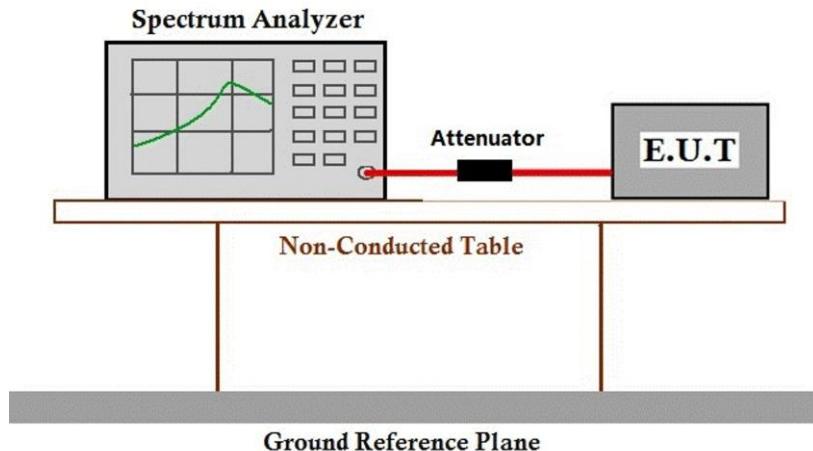
Operating Environment:

Temperature: 25.5 °C Humidity: 34.4 % RH Atmospheric Pressure: 1010 mbar

#### 7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

#### 7.3.3 Test Setup Diagram



#### 7.3.4 Measurement Procedure and Data

cable loss=0.9dB

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

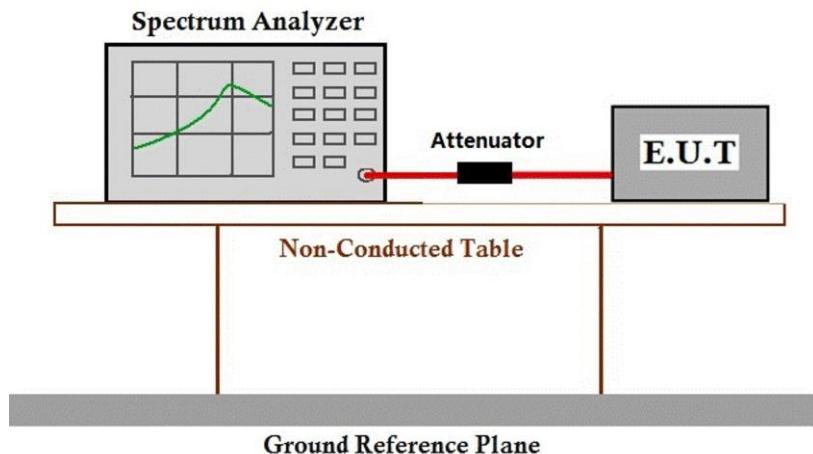
Operating Environment:

Temperature: 25.5 °C      Humidity: 34.4 % RH      Atmospheric Pressure: 1010 mbar

### 7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.4.3 Test Setup Diagram



### 7.4.4 Measurement Procedure and Data

cable loss=0.9dB

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

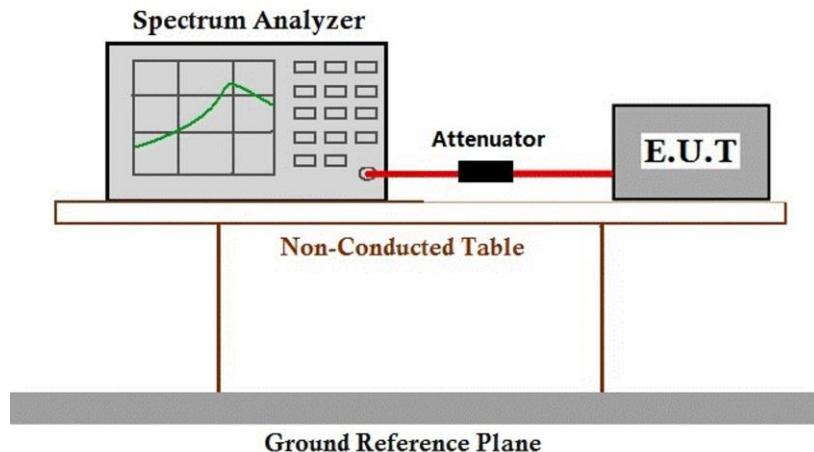
Operating Environment:

Temperature: 25.5 °C Humidity: 34.4 % RH Atmospheric Pressure: 1010 mbar

### 7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.5.3 Test Setup Diagram



### 7.5.4 Measurement Procedure and Data

cable loss=0.9dB

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

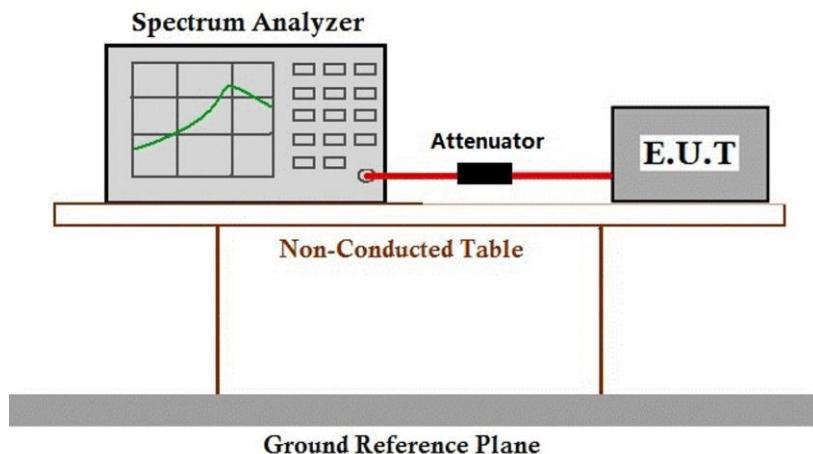
Operating Environment:

Temperature: 25.5 °C      Humidity: 34.4 % RH      Atmospheric Pressure: 1010 mbar

### 7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.6.3 Test Setup Diagram



### 7.6.4 Measurement Procedure and Data

cable loss=0.9dB

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**7.7 Radiated Emissions which fall in the restricted bands**

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

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

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.

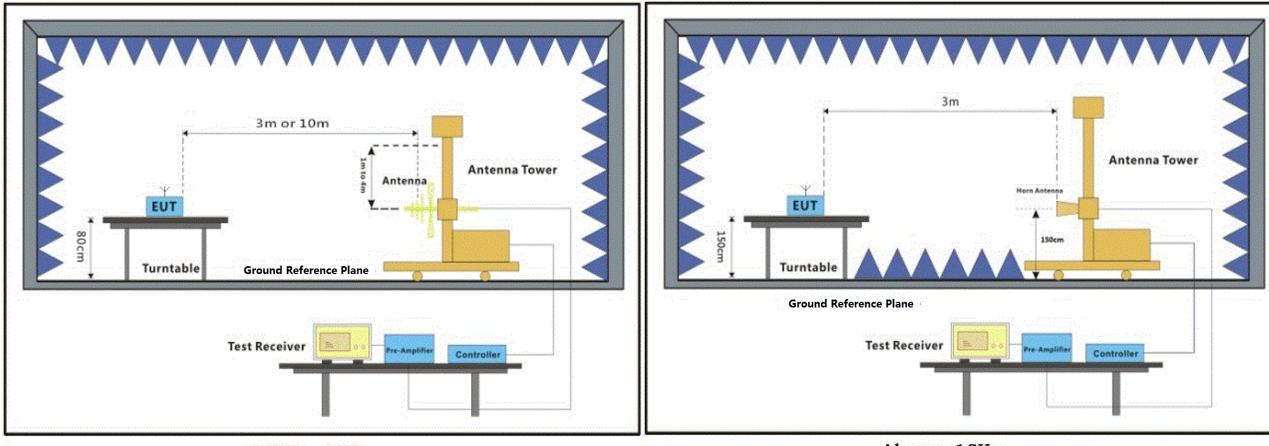
**7.7.1 E.U.T. Operation**

Operating Environment:

Temperature: 26.2 °C      Humidity: 46.4 % RH      Atmospheric Pressure: 1010 mbar

**7.7.2 Test Mode Description**

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

**7.7.3 Test Setup Diagram**

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**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.

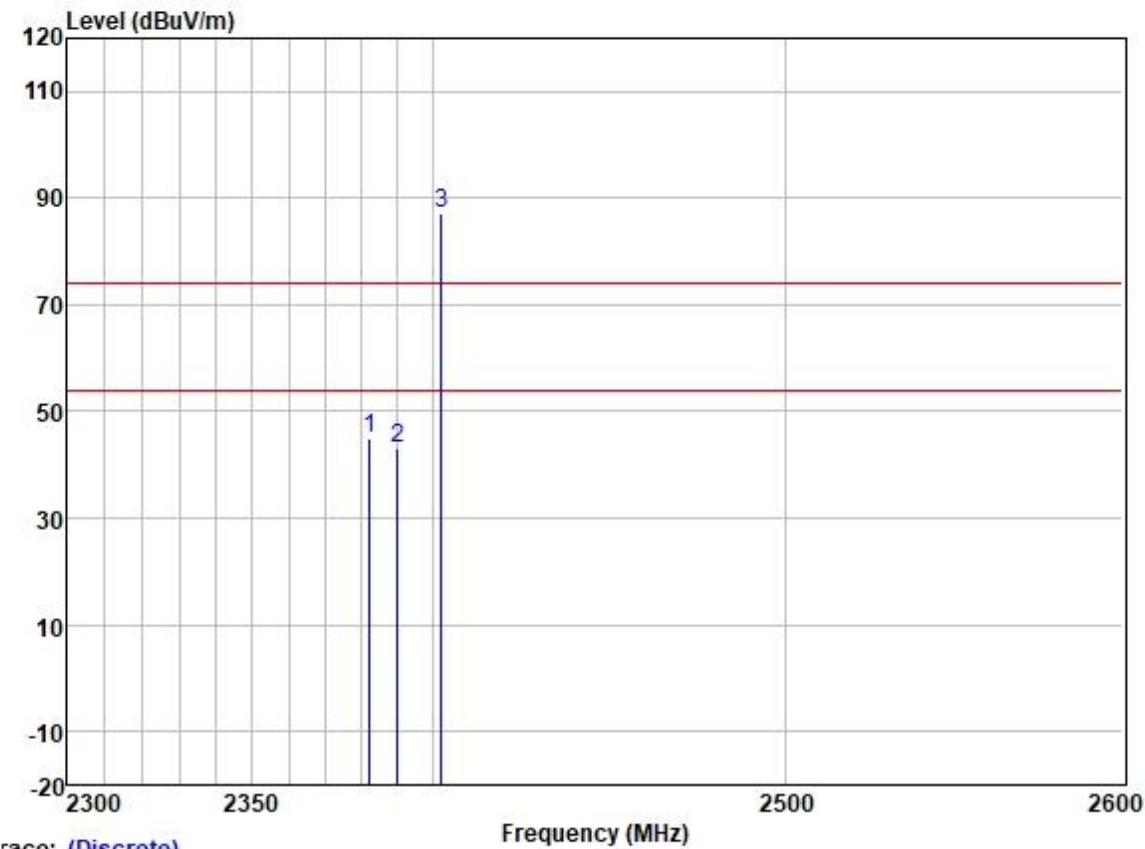
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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Limit Line Level	Over Line Level	Pol/Phase	Remark
1	2382.278	51.88	27.31	3.46	37.60	45.05	74.00	-28.95	HORIZONTAL Peak
2	2390.000	50.00	27.33	3.48	37.59	43.22	74.00	-30.78	HORIZONTAL Peak
3 *	2402.000	93.91	27.35	3.50	37.59	87.17	74.00	13.17	HORIZONTAL Peak

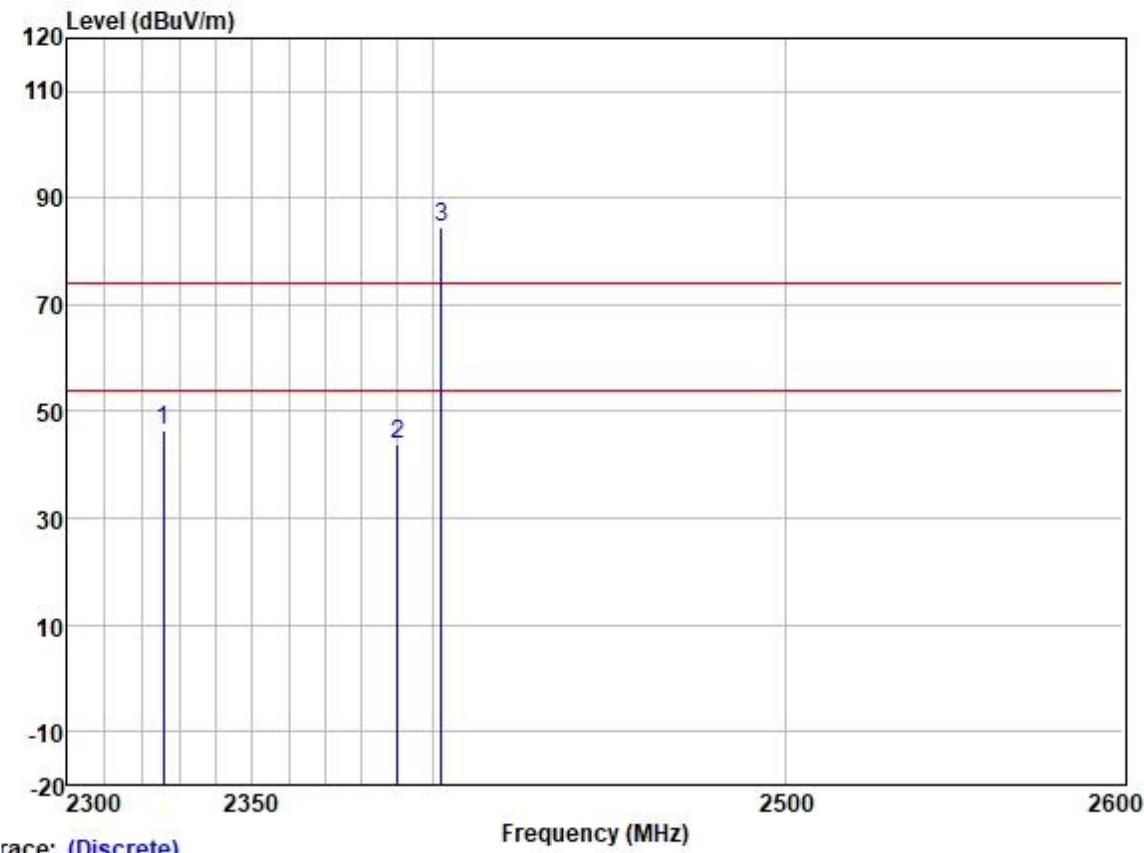
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low

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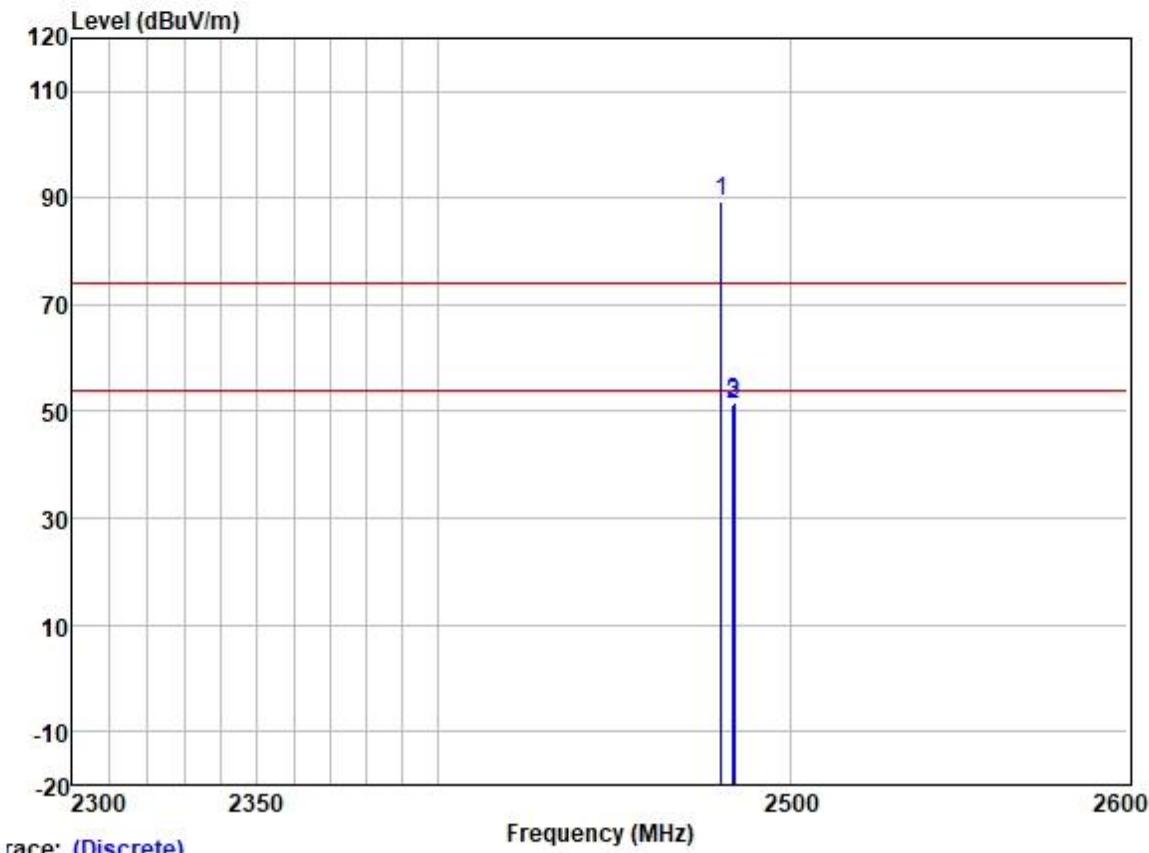
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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:High

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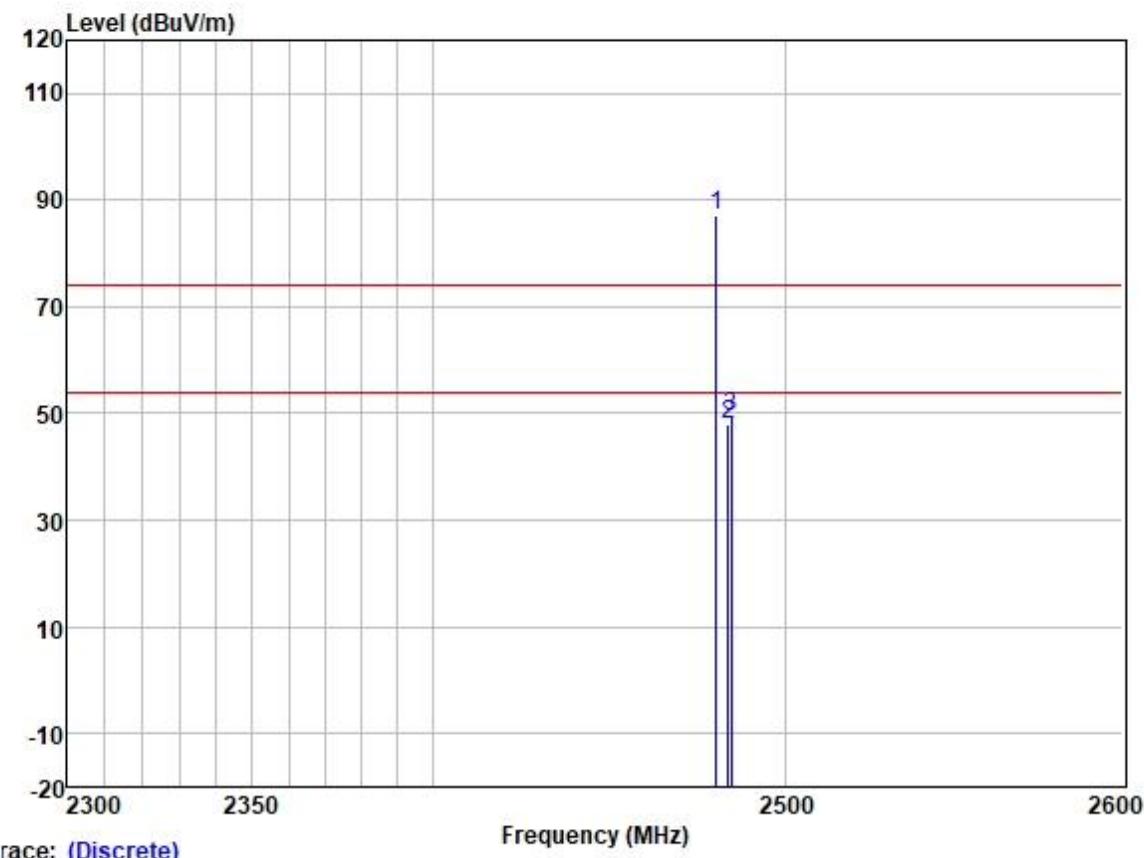
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



Freq	ReadAntenna	Cable	Preamp	Limit	Over	Line	Limit	Pol/Phase	Remark
	Level	Factor	Loss						
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 * 2480.000	93.48	27.47	3.60	37.57	86.98	74.00	12.98	VERTICAL	Peak
2 2483.500	54.64	27.48	3.53	37.57	48.08	74.00	-25.92	VERTICAL	Peak
3 2484.221	56.17	27.48	3.53	37.57	49.61	74.00	-24.39	VERTICAL	Peak

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**7.8 Radiated Spurious Emissions (Below 1GHz)**

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

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

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.

**7.8.1 E.U.T. Operation**

Operating Environment:

Temperature: 25.9 °C

Humidity: 65.9 % RH

Atmospheric Pressure: 1010 mbar

**7.8.2 Test Mode Description**

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

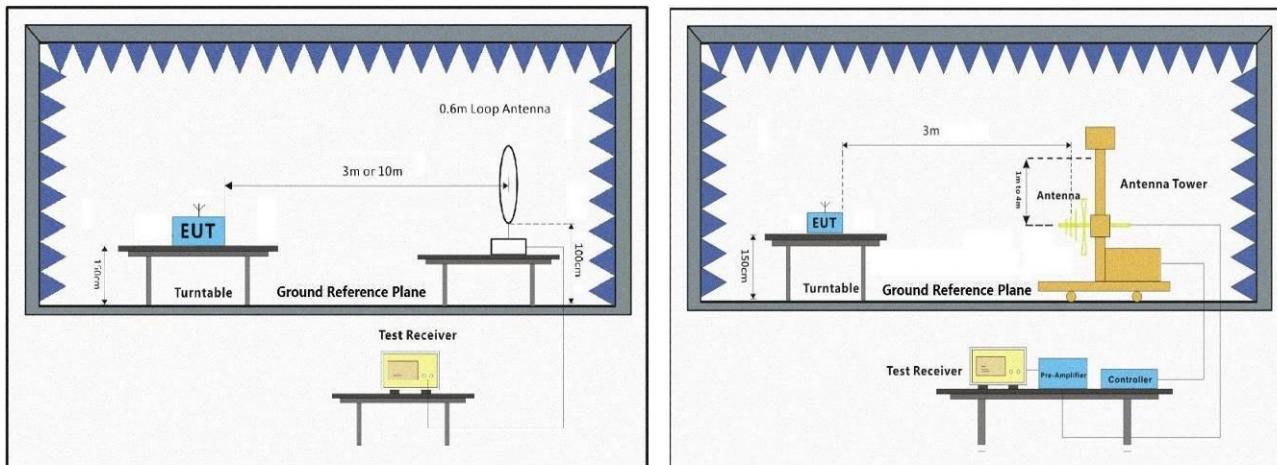
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**7.8.3 Test Setup Diagram**

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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 peak, quasi-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) Through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

- 3) Scan from 9kHz to 1 GHz, 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.

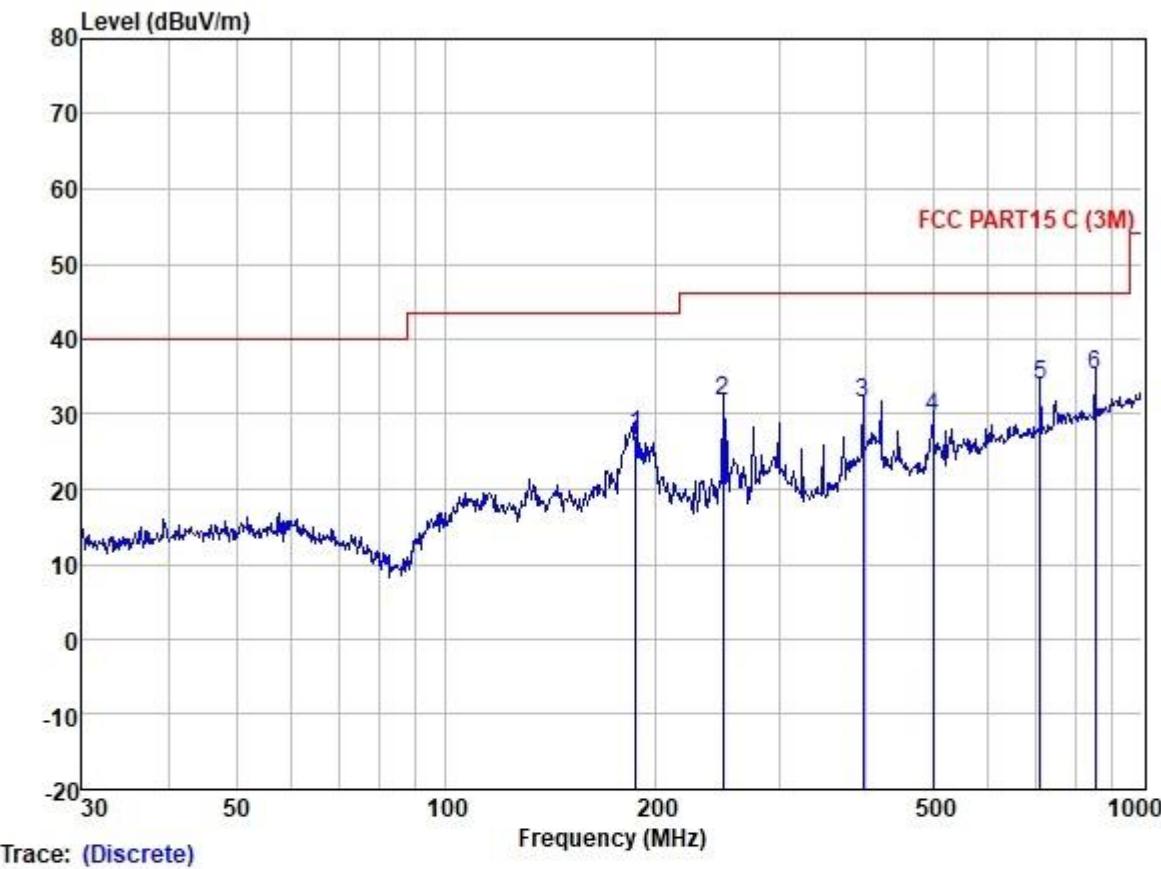
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Test Mode: 02; Polarity: Horizontal Modulation:GFSK; Channel:Low



Site : SGS  
Condition : FCC PART15 C (3M)  
Job :  
Model :  
Power :  
Test Mode :

Freq	Read	Antena	Cable	Preamp	Measured	Limit	Over	Pol/	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	Phase	
1	187.10	40.21	11.17	2.48	26.74	27.12	43.50	-16.38	HORIZONTAL QP
2	249.43	43.28	12.08	2.90	26.62	31.64	46.00	-14.36	HORIZONTAL QP
3	396.24	39.29	15.62	3.91	27.31	31.51	46.00	-14.49	HORIZONTAL QP
4	499.42	35.20	17.90	4.39	27.98	29.51	46.00	-16.49	HORIZONTAL QP
5	711.67	35.03	21.27	5.83	28.15	33.98	46.00	-12.02	HORIZONTAL QP
6	854.02	33.60	22.87	6.55	27.92	35.10	46.00	-10.90	HORIZONTAL QP

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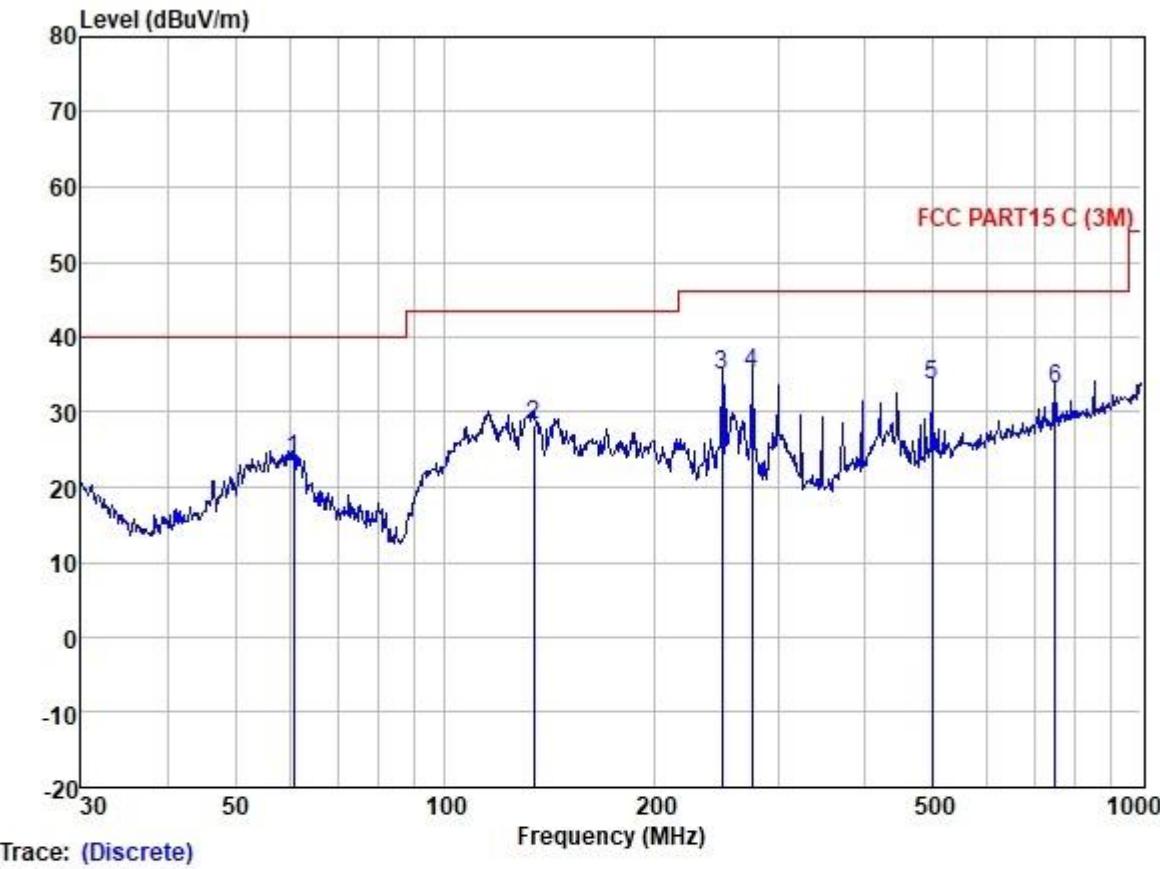


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Test Mode: 02: Polarity: Vertical Modulation:GFSK; Channel:Low



Site : SGS  
Condition : FCC PART15 C (3M)  
Job :  
Model :  
Power :  
Test Mode :

Freq	Read	Antena	Cable	Preamp	Measured	Limit	Over	Pol/	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	Phase	
1 60.49	36.35	13.33	1.27	27.16	23.79	40.00	-16.21	VERTICAL	QP
2 134.09	40.68	12.50	2.01	26.97	28.22	43.50	-15.28	VERTICAL	QP
3 249.43	46.55	12.08	2.90	26.62	34.91	46.00	-11.09	VERTICAL	QP
4 276.12	45.70	13.05	3.07	26.57	35.25	46.00	-10.75	VERTICAL	QP
5 499.42	39.31	17.90	4.39	27.98	33.62	46.00	-12.38	VERTICAL	QP
6 750.11	32.88	22.20	5.97	28.10	32.95	46.00	-13.05	VERTICAL	QP

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**7.9 Radiated Spurious Emissions (Above 1GHz)**

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

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

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.

**7.9.1 E.U.T. Operation**

Operating Environment:

Temperature: 23.5 °C      Humidity: 53.2 % RH      Atmospheric Pressure: 1010 mbar

**7.9.2 Test Mode Description**

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

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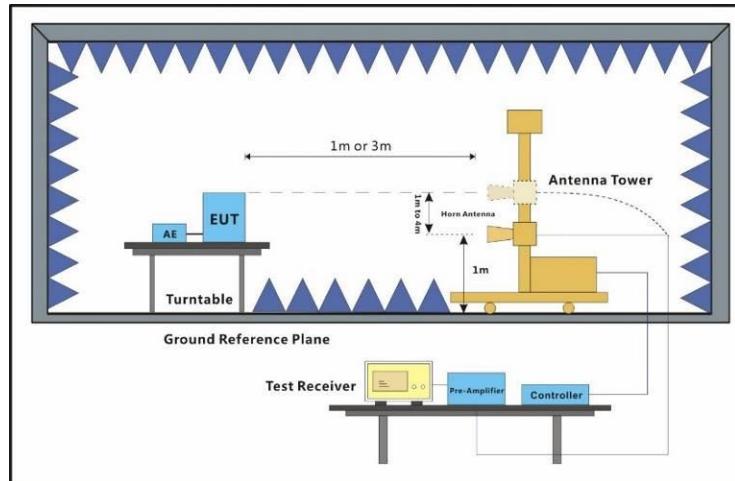
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**7.9.3 Test Setup Diagram**

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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 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, quasi-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) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

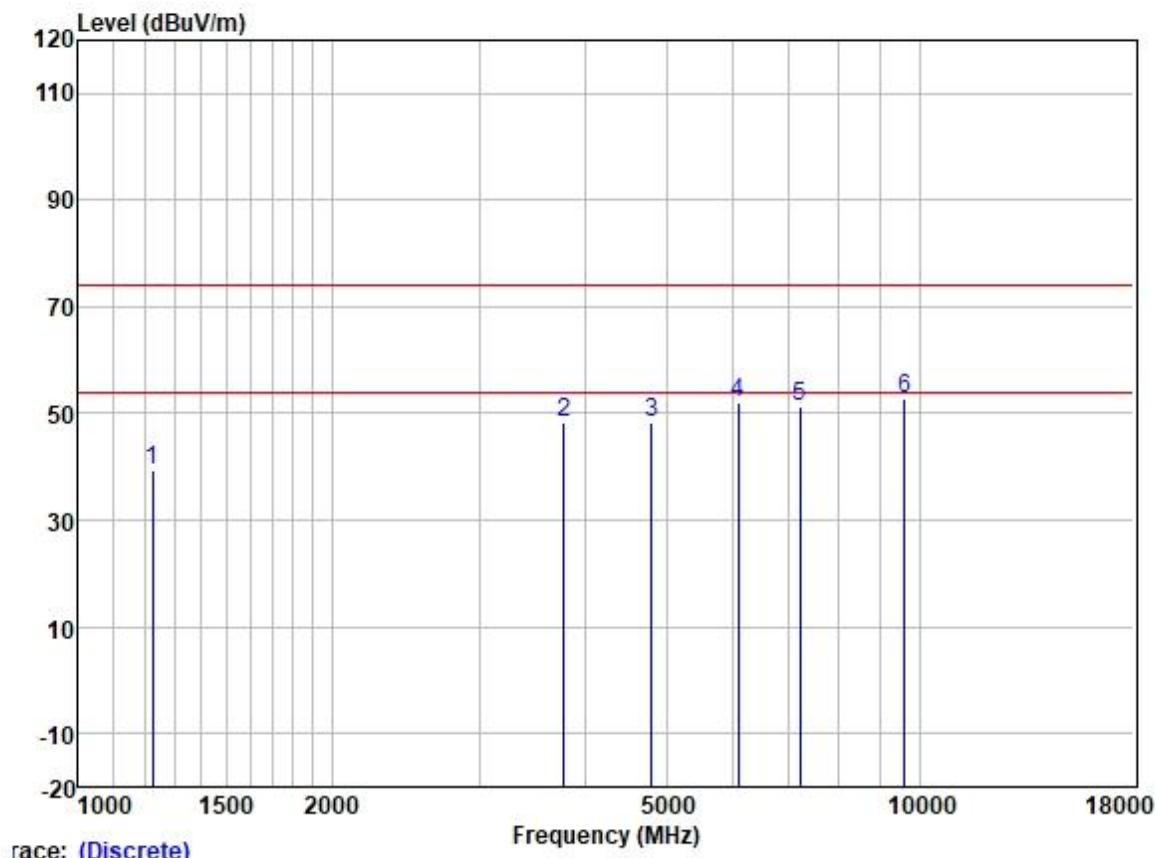
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

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) 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: 02; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Freq	ReadAntenna		Cable		Preamp		Limit	Over	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	Level	Factor	Loss	Factor						
1	1224.049	50.74	24.85	2.31	38.37	39.53	74.00	-34.47	HORIZONTAL	Peak		
2	3776.210	50.99	29.47	4.59	36.86	48.19	74.00	-25.81	HORIZONTAL	Peak		
3	4804.000	48.22	31.42	5.40	36.83	48.21	74.00	-25.79	HORIZONTAL	Peak		
4	6096.406	50.32	32.61	6.15	36.92	52.16	74.00	-21.84	HORIZONTAL	Peak		
5	7206.000	47.26	35.54	5.98	37.38	51.40	74.00	-22.60	HORIZONTAL	Peak		
6	9608.000	44.65	38.37	7.07	37.42	52.67	74.00	-21.33	HORIZONTAL	Peak		

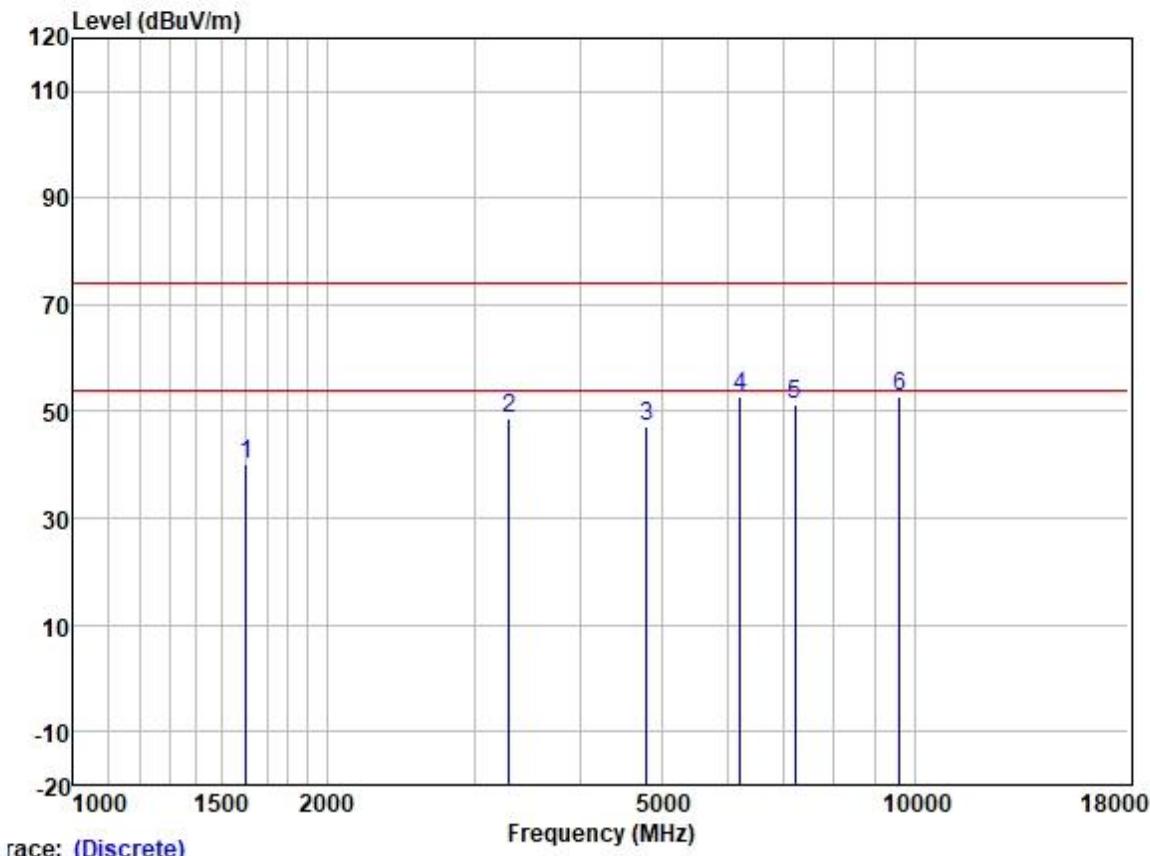
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



Race: (Discrete)

Freq	ReadAntenna		Cable		Preamp		Limit	Over	Line	Limit	Pol/Phase	Remark
	MHz	Level	Factor	Loss	Factor	dB	dBuV/m	dBuV/m	dB			
1	1606.749	49.58	25.59	2.80	37.98	39.99	74.00	-34.01	VERTICAL		Peak	
2	3292.990	53.02	28.74	4.05	37.03	48.78	74.00	-25.22	VERTICAL		Peak	
3	4804.000	47.09	31.42	5.40	36.83	47.08	74.00	-26.92	VERTICAL		Peak	
4	6199.285	50.86	32.96	6.07	36.94	52.95	74.00	-21.05	VERTICAL		Peak	
5	7206.000	47.33	35.54	5.98	37.38	51.47	74.00	-22.53	VERTICAL		Peak	
6	9608.000	44.62	38.37	7.07	37.42	52.64	74.00	-21.36	VERTICAL		Peak	

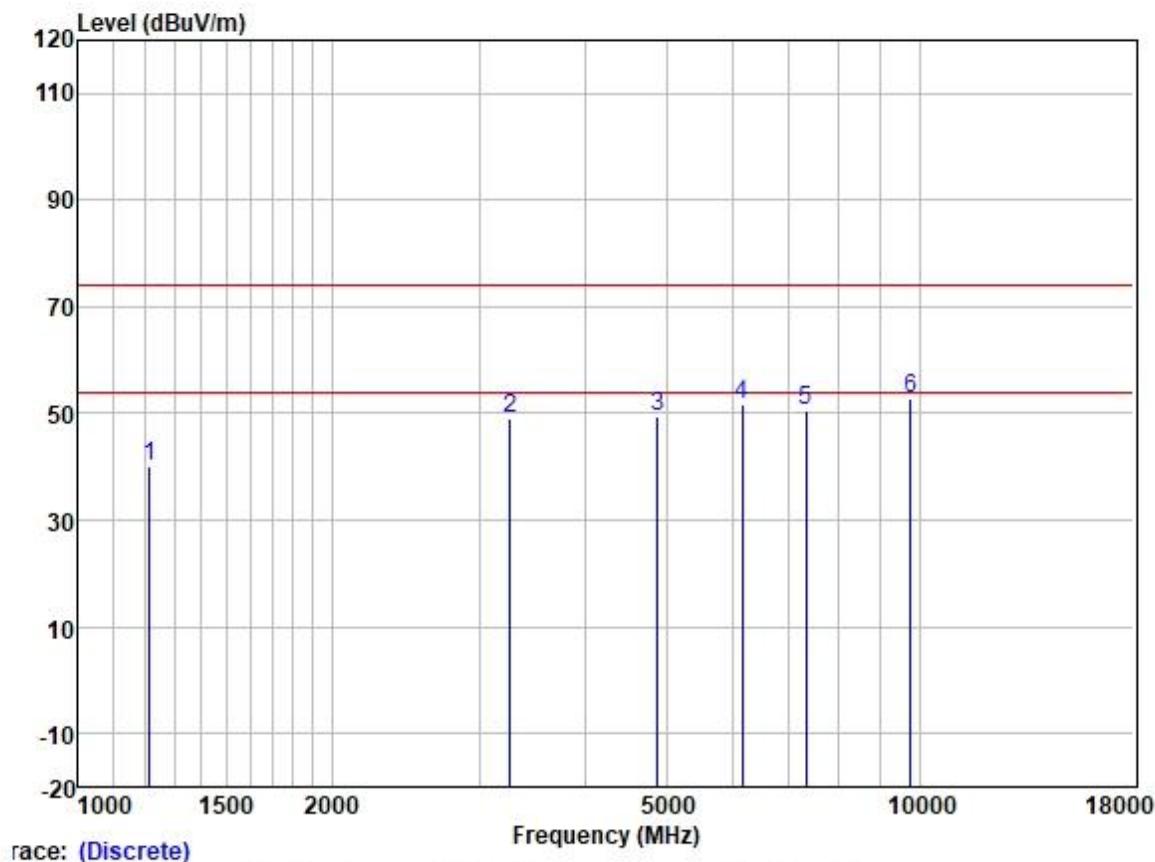
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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:middle



Freq	ReadAntenna		Cable		Preamp	Limit	Over	Line	Limit	Pol/Phase	Remark
	Level	Factor	Loss	Factor							
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB				
1 1213.440	51.35	24.77	2.32	38.37	40.07	74.00	-33.93	HORIZONTAL	Peak		
2 3260.186	53.43	28.70	4.03	37.06	49.10	74.00	-24.90	HORIZONTAL	Peak		
3 4880.000	49.24	31.54	5.50	36.84	49.44	74.00	-24.56	HORIZONTAL	Peak		
4 6157.258	49.51	32.83	6.10	36.93	51.51	74.00	-22.49	HORIZONTAL	Peak		
5 7320.000	45.76	36.00	6.13	37.43	50.46	74.00	-23.54	HORIZONTAL	Peak		
6 9760.000	44.71	38.50	7.02	37.41	52.82	74.00	-21.18	HORIZONTAL	Peak		

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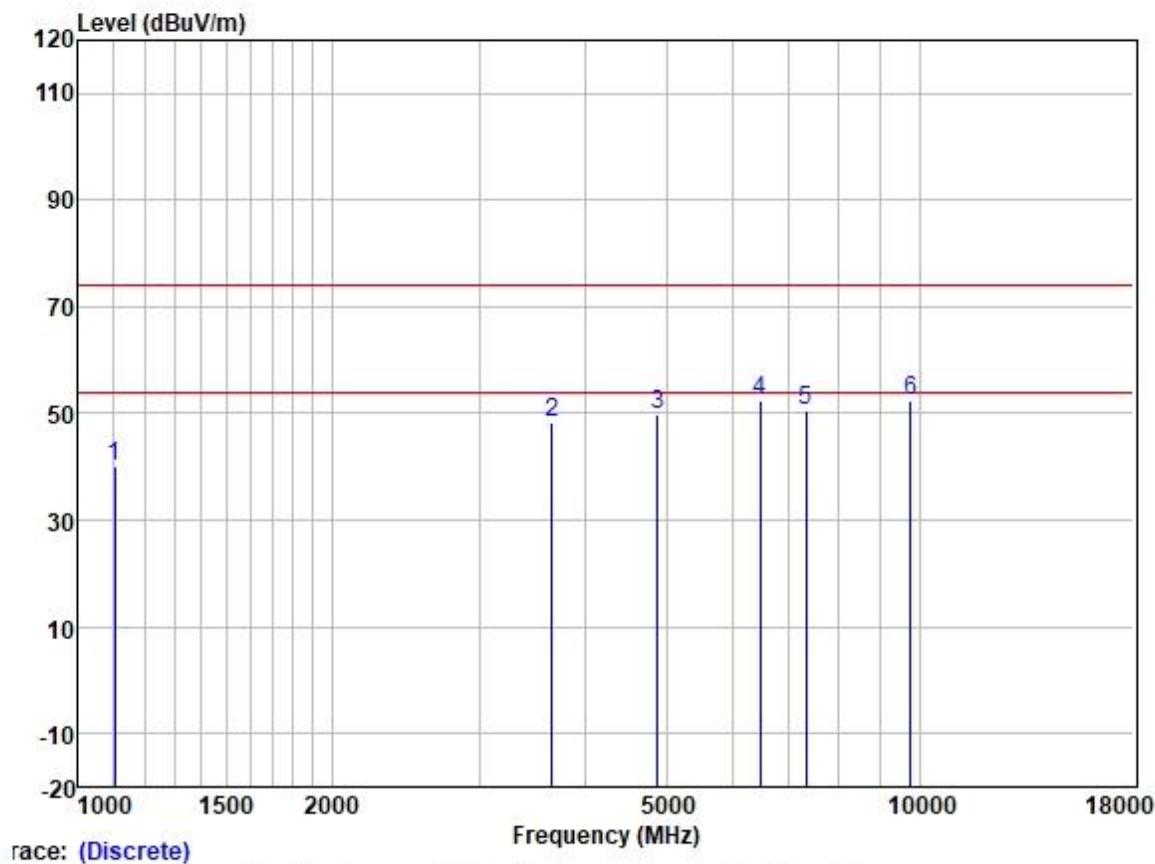
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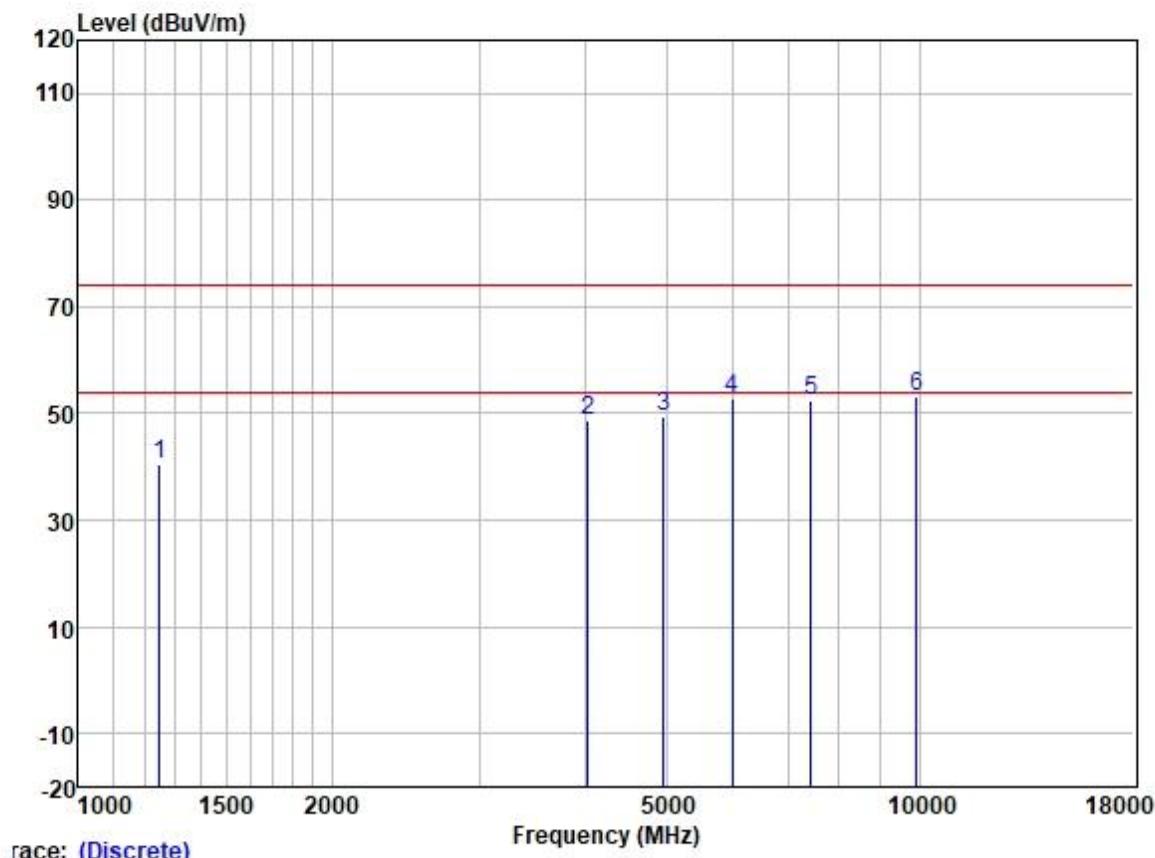
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:middle



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



Freq	ReadAntenna		Cable		Preamp		Limit	Over	Pol/Phase	Remark
	MHz	Level	Factor	Loss	Factor	Level				
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1249.880	51.50	25.02	2.34	38.35	40.51	74.00	-33.49	HORIZONTAL	Peak
2	4030.377	51.23	29.83	4.60	36.80	48.86	74.00	-25.14	HORIZONTAL	Peak
3	4960.000	48.84	31.65	5.65	36.84	49.30	74.00	-24.70	HORIZONTAL	Peak
4	5989.868	51.07	32.39	6.15	36.90	52.71	74.00	-21.29	HORIZONTAL	Peak
5	7440.000	47.41	36.27	6.22	37.47	52.43	74.00	-21.57	HORIZONTAL	Peak
6	9920.000	45.07	38.65	6.96	37.40	53.28	74.00	-20.72	HORIZONTAL	Peak

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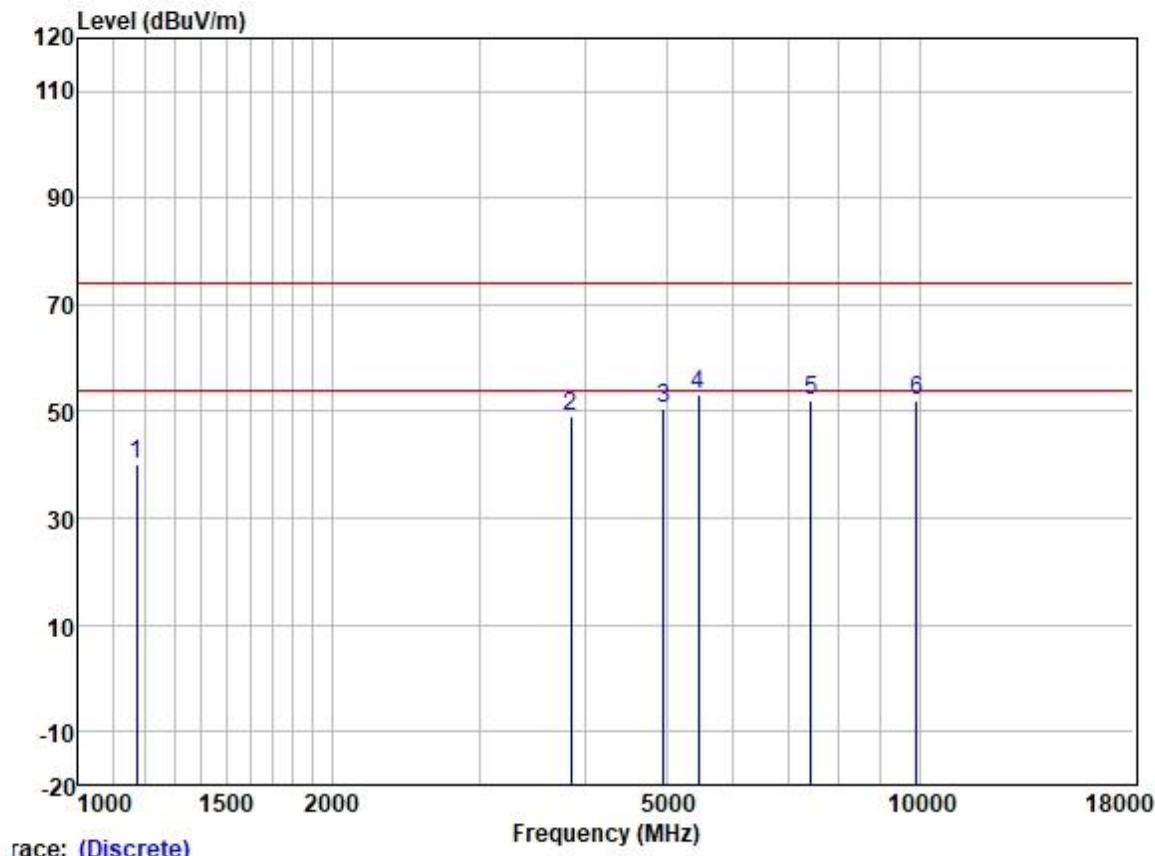
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



Race: (Discrete)

Freq	ReadAntenna		Cable		Preamp		Limit	Over	Pol/Phase	Remark
	Level	Factor	Loss	Factor	Level	Line				
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB			
1 1172.327	51.51	24.56	2.39	38.40	40.06	74.00	-33.94	VERTICAL	Peak	
2 3854.107	51.68	29.62	4.60	36.84	49.06	74.00	-24.94	VERTICAL	Peak	
3 4960.000	50.24	31.65	5.65	36.84	50.70	74.00	-23.30	VERTICAL	Peak	
4 5460.510	52.14	31.79	6.26	36.88	53.31	74.00	-20.69	VERTICAL	Peak	
5 7440.000	46.93	36.27	6.22	37.47	51.95	74.00	-22.05	VERTICAL	Peak	
6 9920.000	43.91	38.65	6.96	37.40	52.12	74.00	-21.88	VERTICAL	Peak	

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## 8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR2108020830AT



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## 9 EUT Constructional Details (EUT Photos)

Refer to external and internal photos for GZCR2108020830AT



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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	0.413	0.625	66.08	1.80	0.00
		2440	0.390	0.625	62.40	2.05	0.00
		2480	0.390	0.625	62.40	2.05	0.00

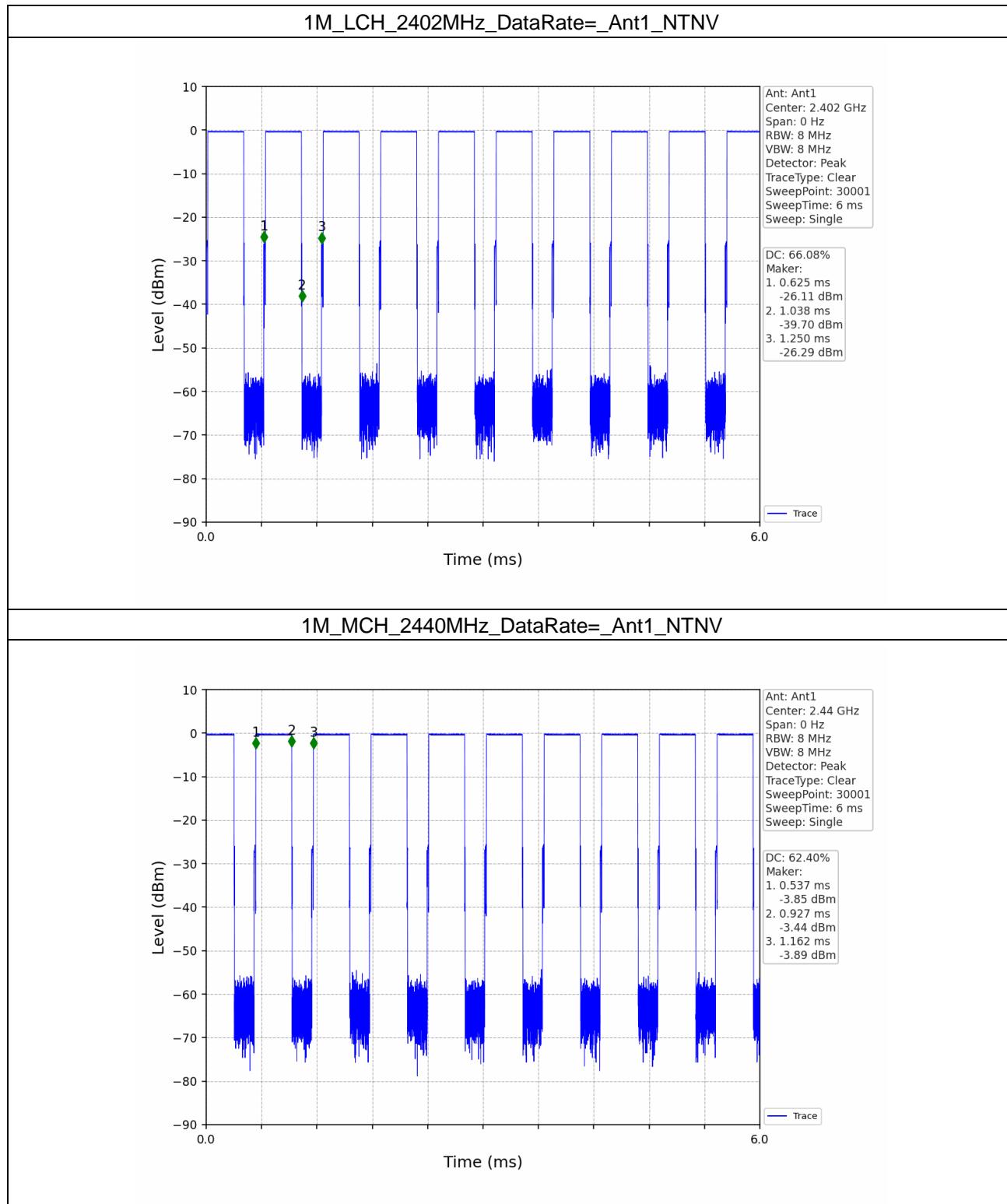
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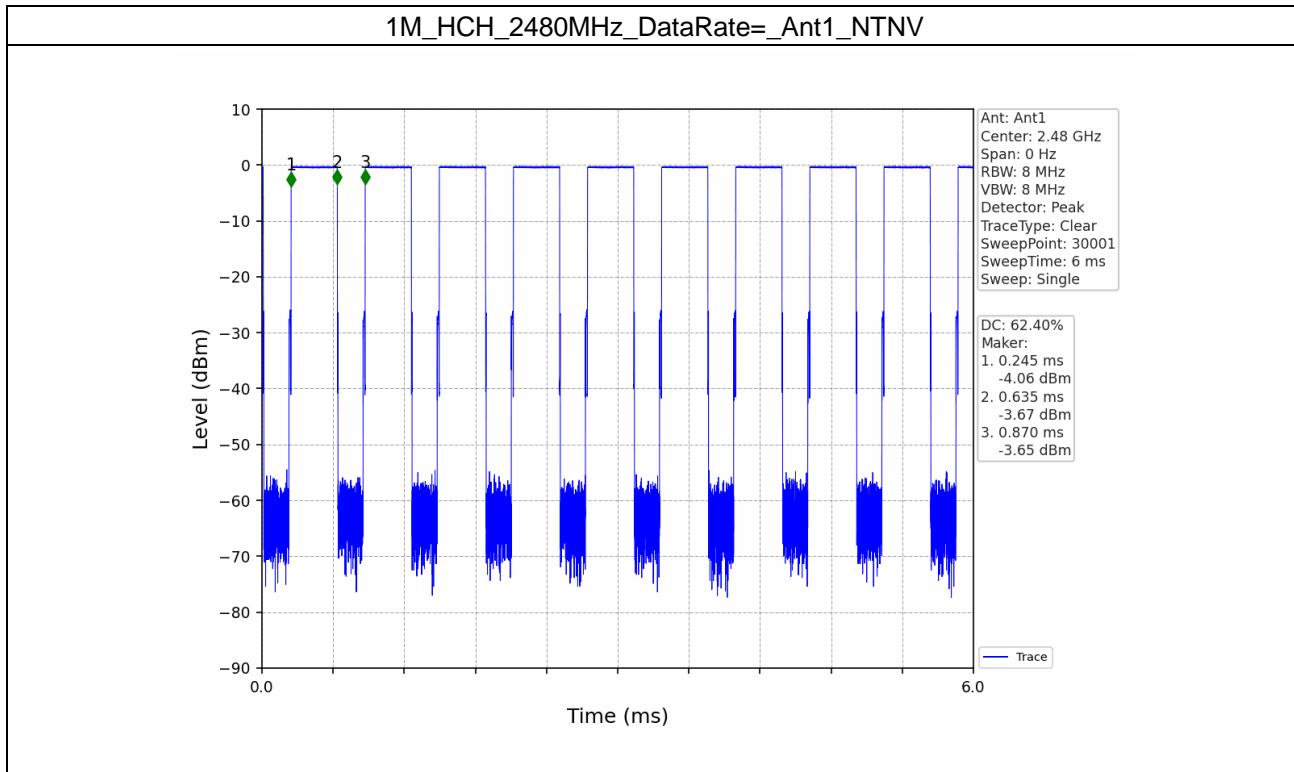
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**1.1.2 Test Graph**

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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	0.706	>=0.5	Pass
		2440	1	0.707	>=0.5	Pass
		2480	1	0.714	>=0.5	Pass

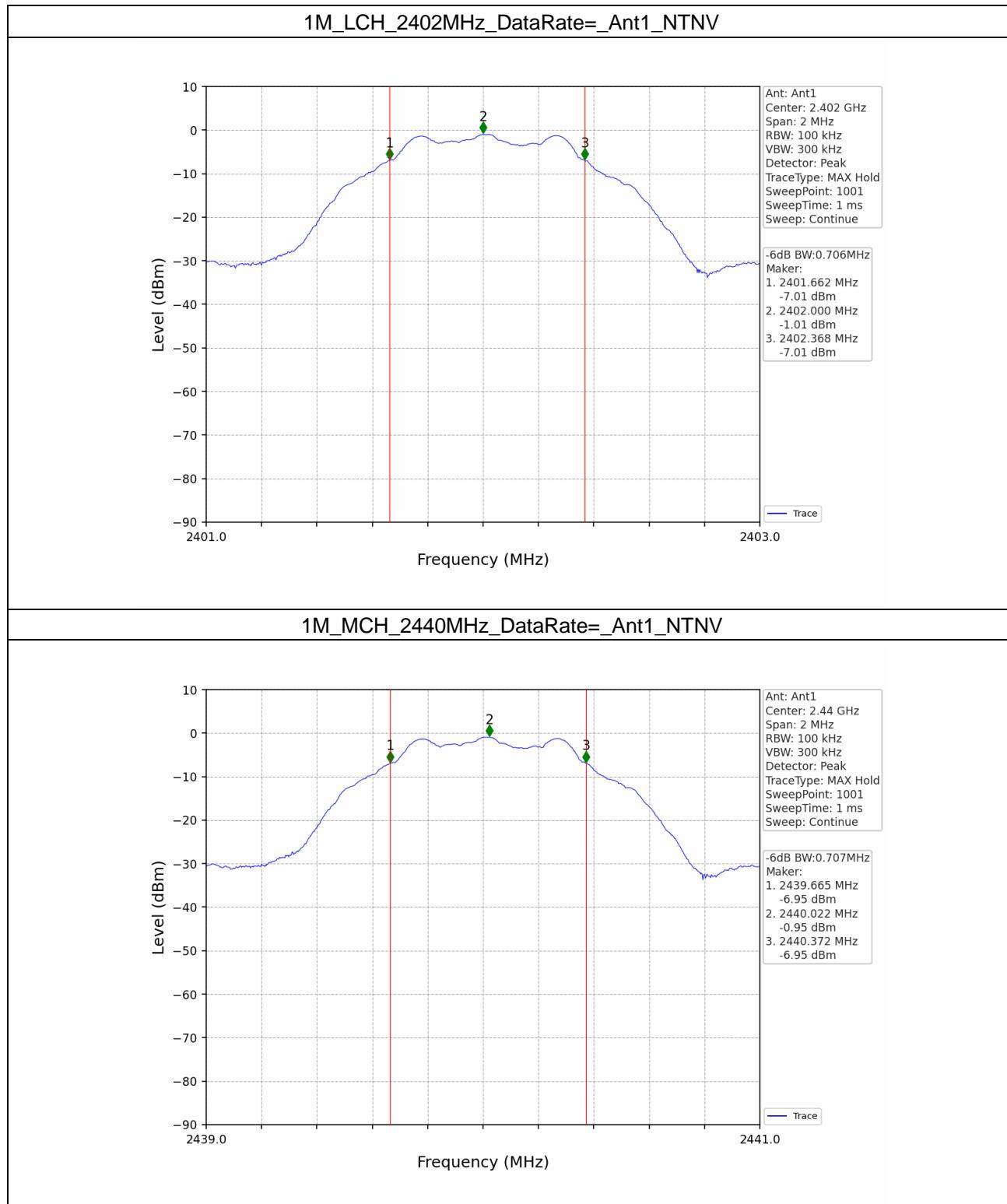
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## 2.2.2 Test Graph



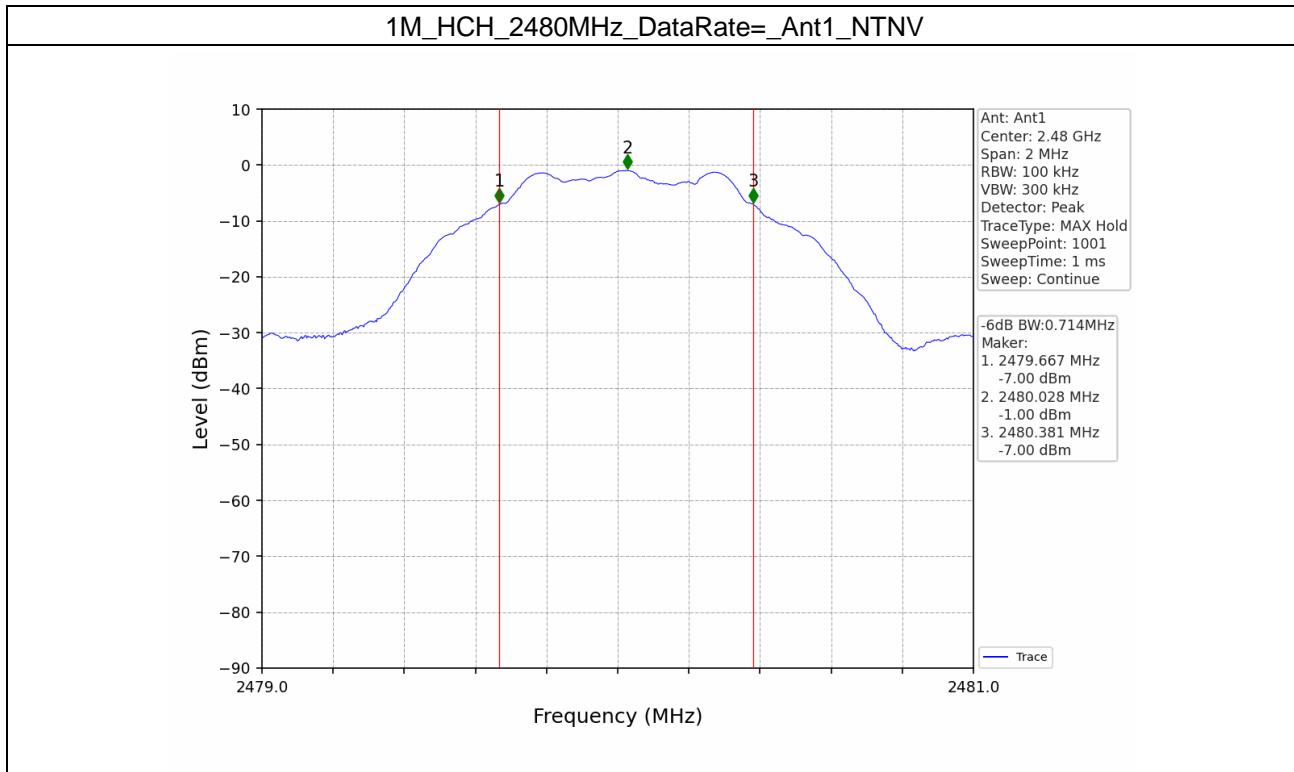
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### 3. Maximum Conducted Output Power

#### 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	-0.31	<=30	Pass
		2440	-0.26	<=30	Pass
		2480	-0.29	<=30	Pass

Note1: Antenna Gain: Ant1: 1.50dBi;

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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	-14.21	<=8	Pass
		2440	-14.17	<=8	Pass
		2480	-14.22	<=8	Pass

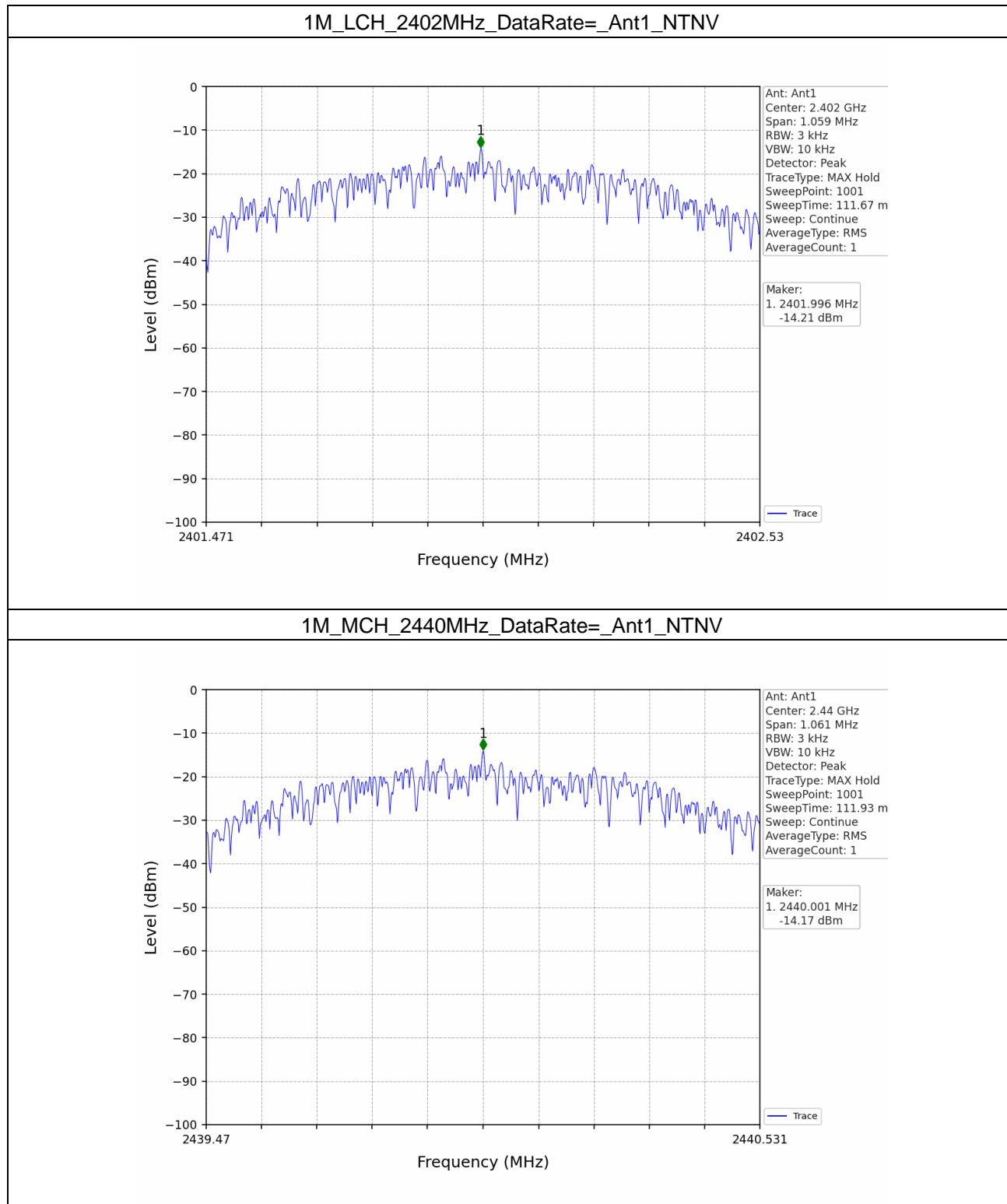
Note1: Antenna Gain: Ant1: 1.50dBi;

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**4.1.2 Test Graph**

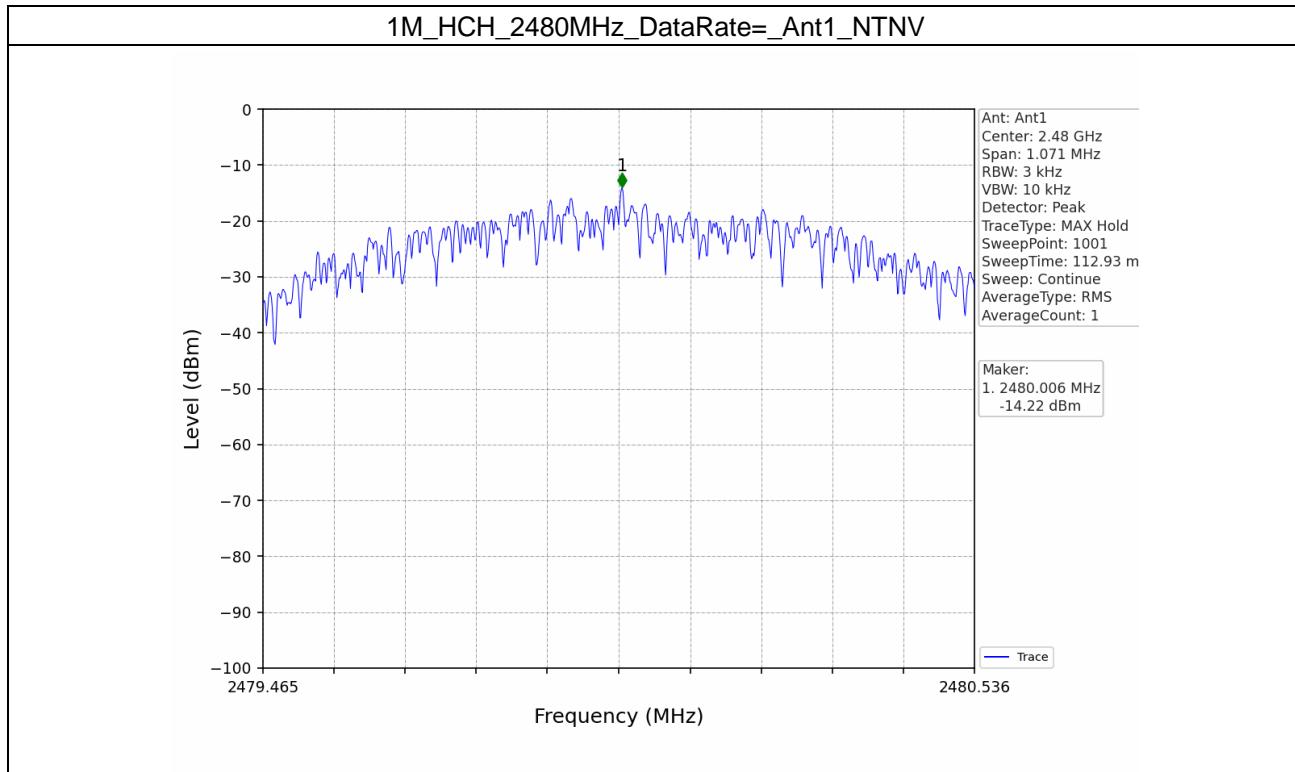
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**5. Unwanted Emissions In Non-restricted Frequency Bands****5.1 Ref****5.1.1 Test Result**

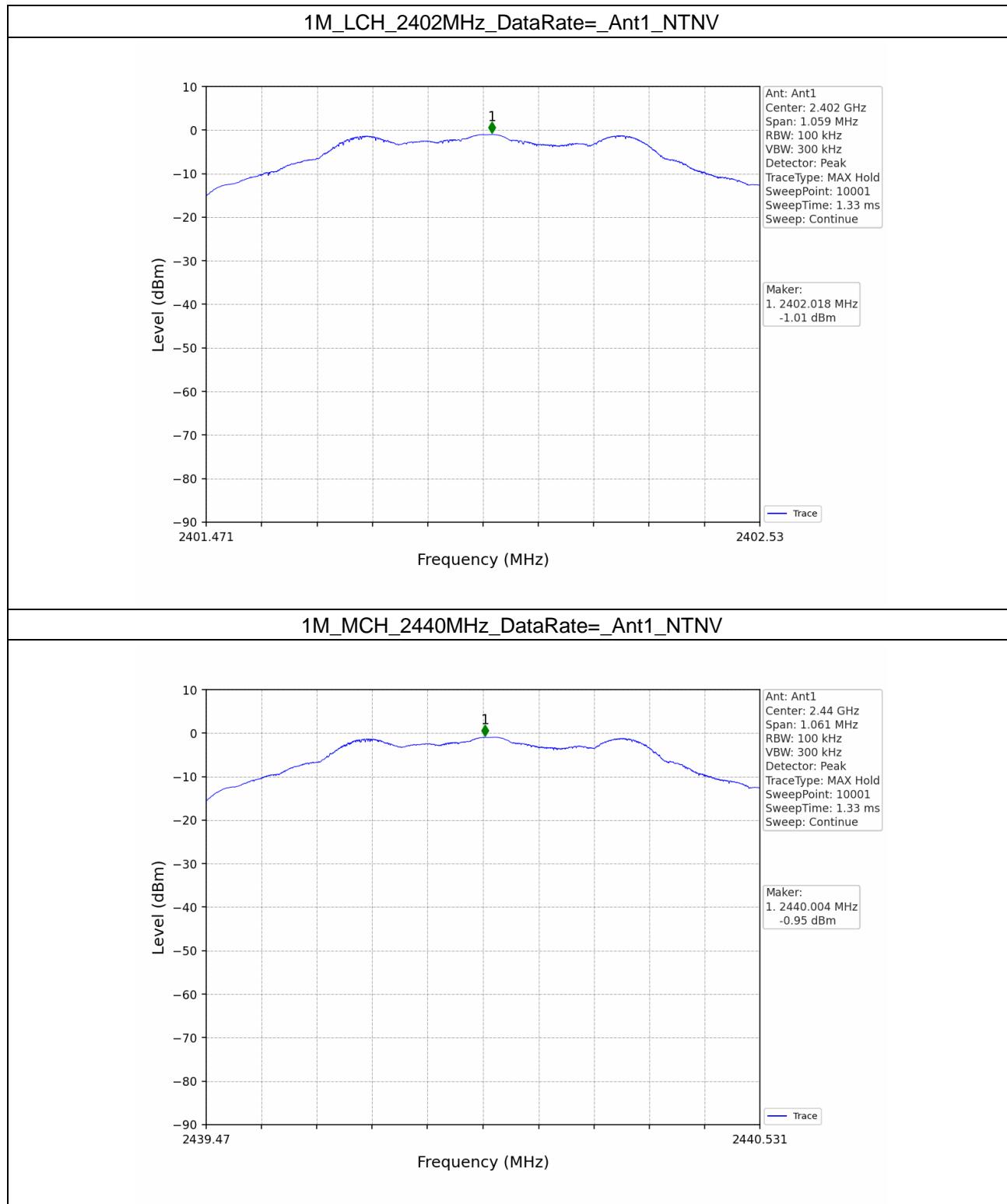
Mode	TX Type	Frequency (MHz)	Ant	Level of Reference (dBm)
1M	SISO	2402	1	-1.01
		2440	1	-0.95
		2480	1	-0.98

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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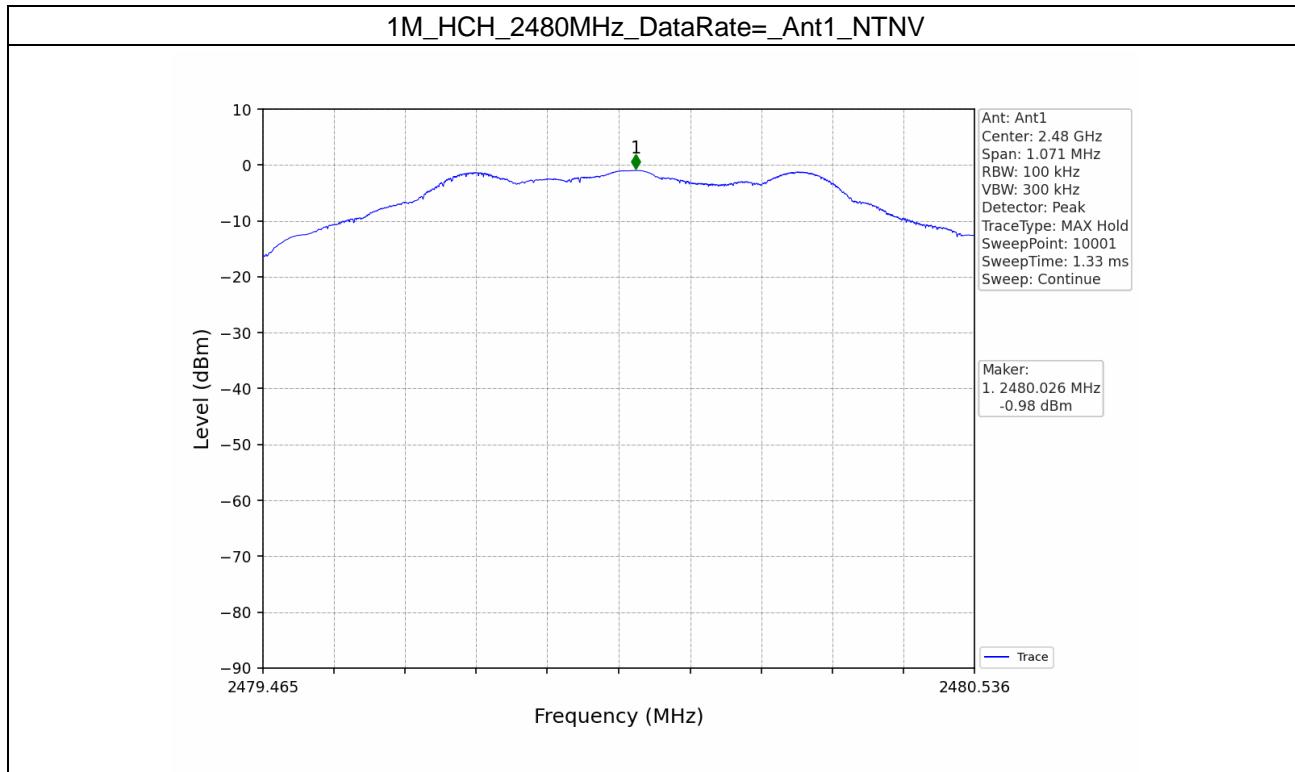
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**5.1.2 Test Graph**

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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	-0.95	-20.95	Pass
		2440	1	-0.95	-20.95	Pass
		2480	1	-0.95	-20.95	Pass

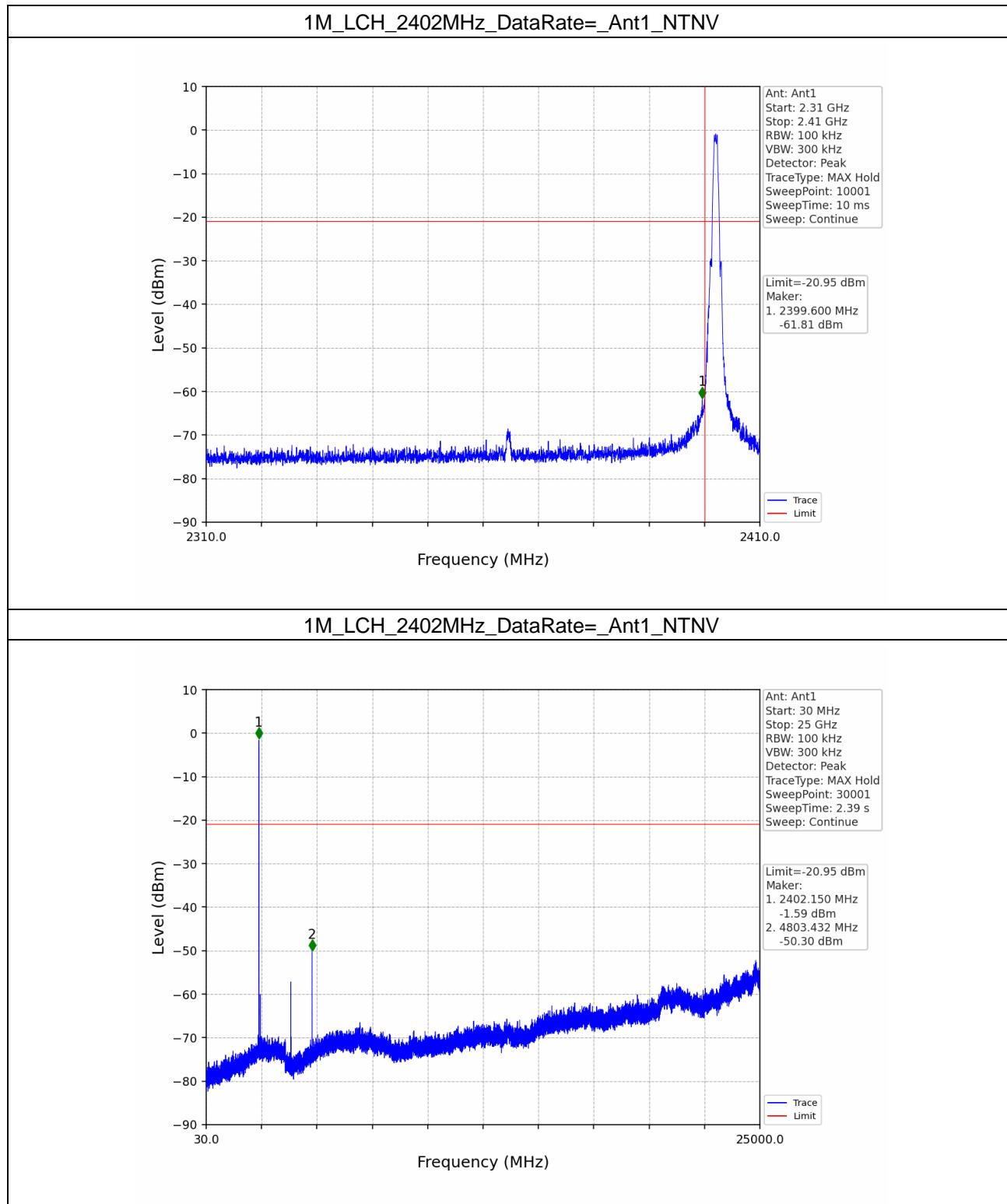
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.



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### 5.2.2 Test Graph



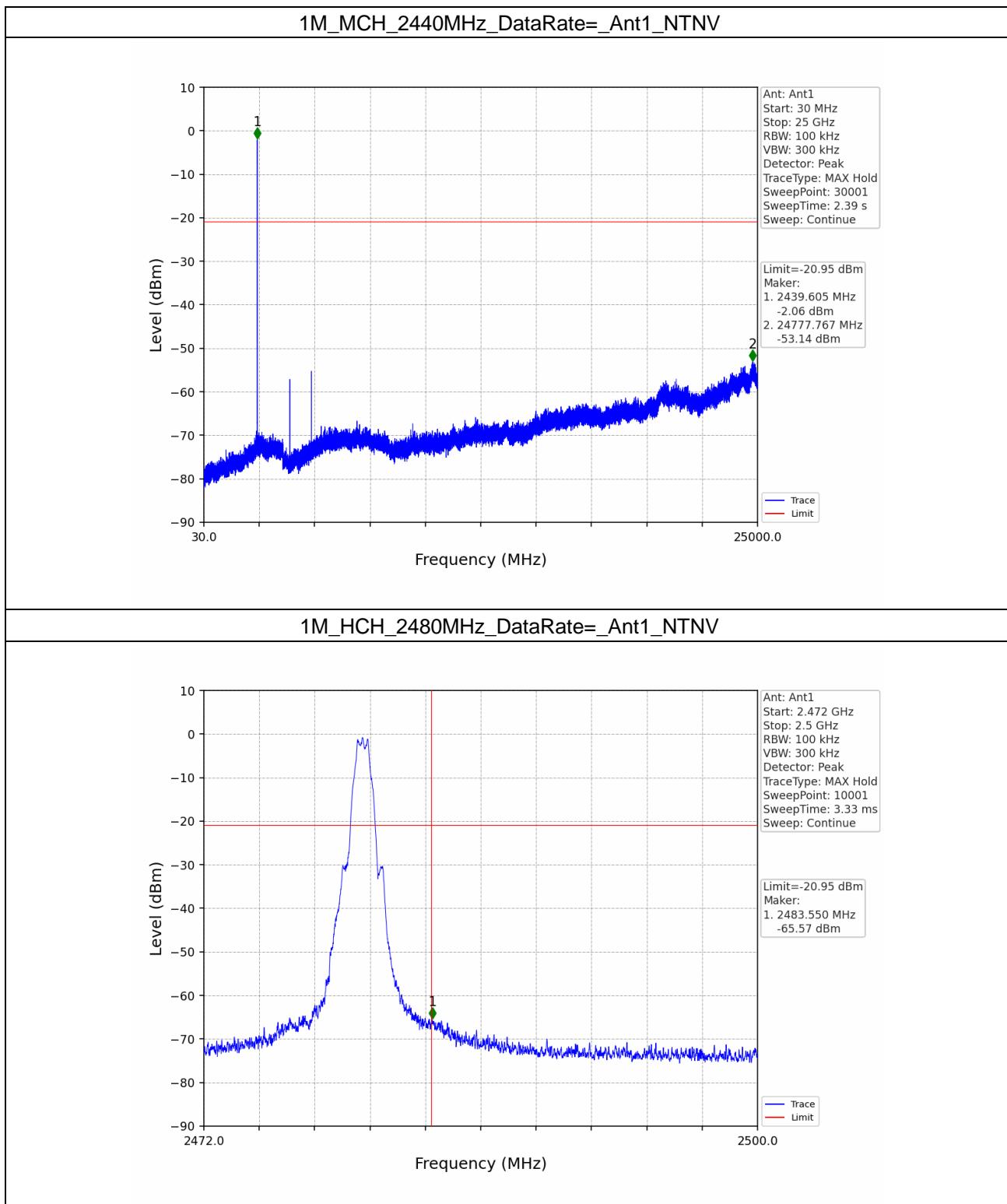
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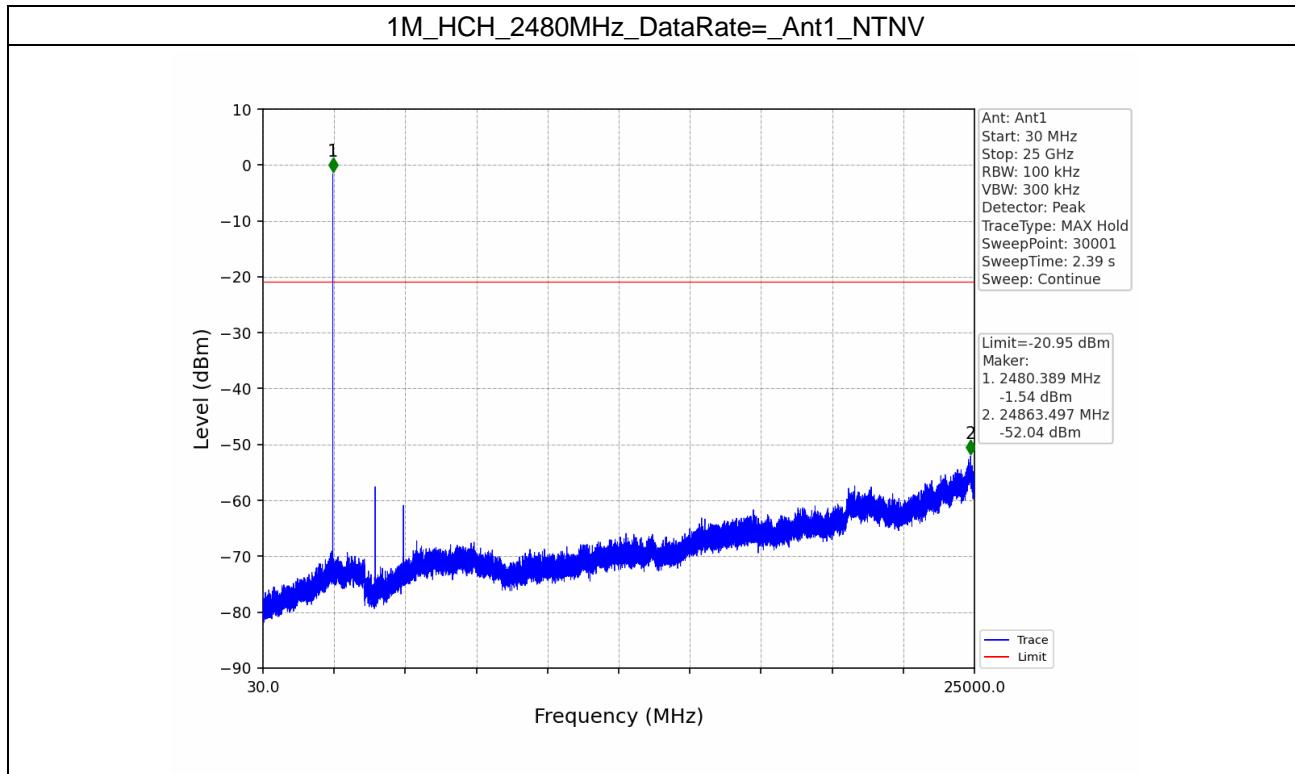
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