

TEST REPORT

Application No.: GZCR2405000514AT
Applicant: Guilin Gemred Sensor Technology Co., LTD
Address of Applicant: No.D-08, Information Industrial Park, Chaoyang Road Qixing District, Guilin City, Guangxi zhuang Autonomous Region
Manufacturer: Guilin Gemred Sensor Technology Co., LTD
Address of Manufacturer: No.D-08, Information Industrial Park, Chaoyang Road Qixing District, Guilin City, Guangxi zhuang Autonomous Region
Factory: Guilin Gemred Sensor Technology Co., LTD
Address of Factory: No.D-08, Information Industrial Park, Chaoyang Road Qixing District, Guilin City, Guangxi zhuang Autonomous Region
Product Name: Machine leveler ML200
Model No.: 82427-00-F
Trade Mark: Gemred
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2024-05-20
Date of Test: 2024-05-27 to 2024-06-06
Date of Issue: 2024-07-04

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

Ricky Liu

Ricky Liu
Manager



SGS-CSTC Standards Technical Services Co., Ltd.
Guangzhou Branch Testing Center EEC Laboratory

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Revision Record			
Version	Report No.	Date	Remark
01	GZCR240500051402	2024-07-04	Original

Authorized for issue by			
		Key Liang	
		Key Liang/Project Engineer	
		Vico Cui	
		Vico Cui/Reviewer	



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
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
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

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 5V charging.
Battery operation: DC 3.7V for internal rechargeable battery as below:
Model: 605097
Rated: DC 3.7 V, 4000mAh, 14.8Wh
Test voltage: AC 120V 60Hz powered by AC/DC adapter. & DC 3.7V

Cable(s): Type-c charging port.
TF card port.

Operation Frequency: 2420MHz to 2465MHz
Modulation Type: GFSK
Number of Channels: 46
Channel Spacing: 1MHz
Antenna Gain: 0.89 dBi according to antenna specification
Antenna Number: 1

Remark: The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Machine leveler ML200	CemRed	82427	EC00000200
AC/DC Adapter	HUAWEI	Model:HW-110600C02; Input:AC 100-240V,1.8A Max.50/60Hz; Output:DC 5V/2A, 10V/4A, 11V/6A Max.	JL28L4NBM03275
About 0.8m unscreened USB charging cable.	SGS	--	--



4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±2.76dB
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)
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
Remark: The U_{lab} (lab Uncertainty) is less than $U_{CISPR/ETSI}$ (CISPR/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,
No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou,
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Tel: +86 20 82155555

No tests were sub-contracted.



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Guangzhou Branch EMC Laboratory

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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	2024-05-13	2025-05-12
Test Software E3r	Audix	Ver.6.11812	GZE100-77	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	2023-11-10	2024-11-09
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2023-12-15	2024-12-14
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	2023-12-20	2026-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

Radiated Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
966 Anechoic Chamber	Shenzhen C.R.T	CRTSGSSAC966	EMC2230	2022-04-12	2025-04-11
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2229	2024-02-19	2025-02-18
Amplifier(9k-1000MHz)	SONOMA	310	EMC2237	2024-03-22	2025-03-21
TRILOG Broadband Antenna (25M-2GHz)	SCHWRZBECK	VULB 9168	EMC2238	2022-04-20	2025-04-19
Coaxial Cable	Mirco-COAX UTIFLEX ve	LA2-C125-8000	EMC2239	2023-06-14	2025-06-13
Test Software E3	Audix	Ver.6.191211	GZE100-81	N/A	N/A
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2024-04-08	2026-04-07

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	2023-11-10	2024-11-09
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2023-12-15	2024-12-14
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	2023-11-10	2024-11-09
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	2023-12-20	2026-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

RF Conducted Test					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2137	2023-11-02	2025-11-01
4X4 Power sensor Unit	TST	TSPS2023R	EMC2226	2023-08-23	2024-08-22
Test Software	TST	V2.0	GZE100-78	N/A	N/A
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22



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General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2024-06-13	2025-06-12



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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 0.89 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: 25.1 °C

Humidity: 52.0 % RH

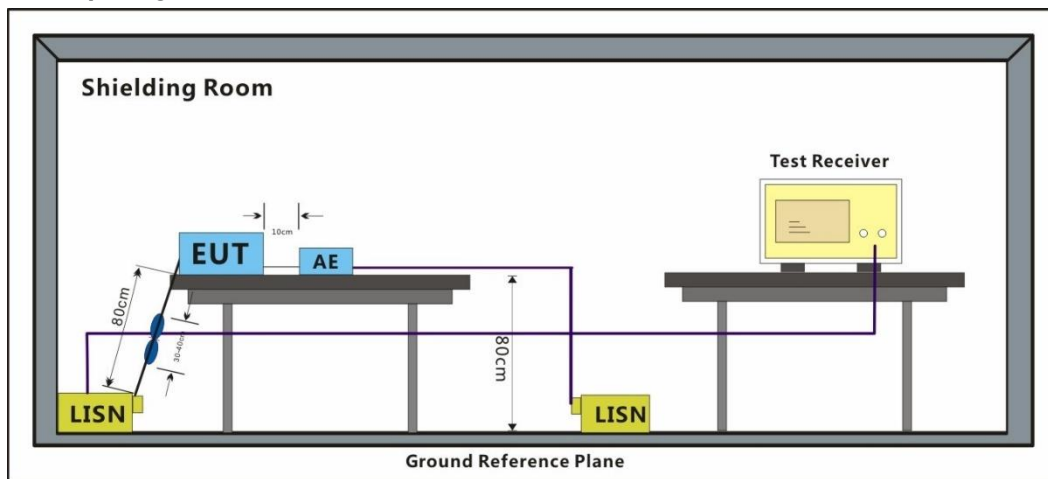
Atmospheric Pressure: 1003 mbar

7.1.2 Test Mode Description

Pre-scan / Mode
Final test Code Description

Final test 03 Charge + TX mode_Keep the EUT in charging and transmitting with modulation mode.

7.1.3 Test Setup Diagram



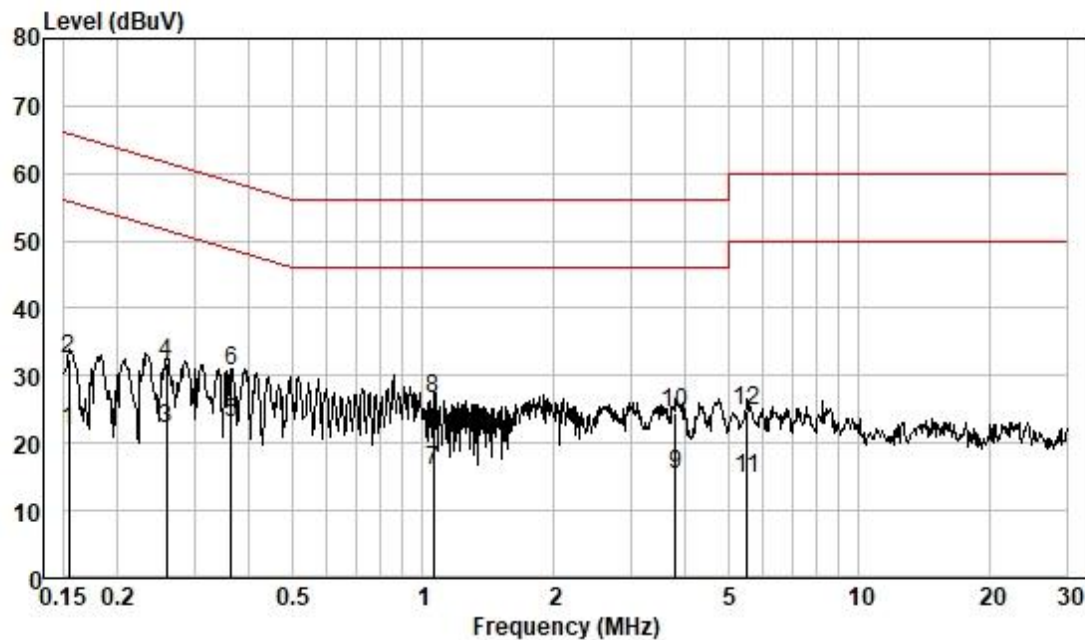
7.1.4 Measurement Procedure and Data

- 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



Test Mode: 03; Line: Live line

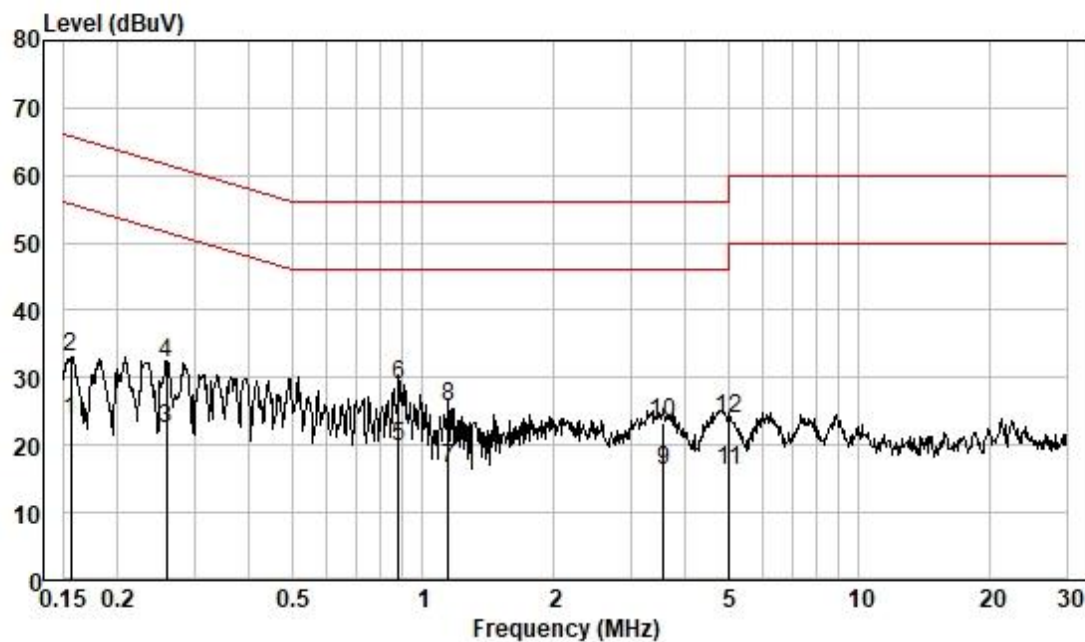


Pol : LINE
Mode :
Model :
Power :

	Frequency MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.154	12.22	0.04	9.55	21.81	55.78	-33.97	Average
2	0.154	22.91	0.04	9.55	32.50	65.78	-33.28	QP
3	0.259	12.56	0.04	9.56	22.16	51.47	-29.31	Average
4	0.259	22.16	0.04	9.56	31.76	61.47	-29.71	QP
5	0.363	13.28	0.05	9.57	22.90	48.65	-25.75	Average
6	0.363	20.96	0.05	9.57	30.58	58.65	-28.07	QP
7	1.060	6.19	0.07	9.57	15.83	46.00	-30.17	Average
8	1.060	17.05	0.07	9.57	26.69	56.00	-29.31	QP
9	3.799	5.60	0.17	9.60	15.37	46.00	-30.63	Average
10	3.799	14.79	0.17	9.60	24.56	56.00	-31.44	QP
11	5.535	4.88	0.20	9.65	14.73	50.00	-35.27	Average
12	5.535	14.91	0.20	9.65	24.76	60.00	-35.24	QP



Test Mode: 03; Line: Neutral Line



Pol : NEUTRAL
Mode :
Model :
Power :

	Frequency MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.156	14.15	0.04	9.52	23.71	55.69	-31.98	Average
2	0.156	23.41	0.04	9.52	32.97	65.69	-32.72	QP
3	0.259	12.95	0.04	9.53	22.52	51.47	-28.95	Average
4	0.259	22.49	0.04	9.53	32.06	61.47	-29.41	QP
5	0.880	10.26	0.07	9.55	19.88	46.00	-26.12	Average
6	0.880	19.35	0.07	9.55	28.97	56.00	-27.03	QP
7	1.141	6.79	0.08	9.55	16.42	46.00	-29.58	Average
8	1.141	16.16	0.08	9.55	25.79	56.00	-30.21	QP
9	3.565	6.61	0.17	9.58	16.36	46.00	-29.64	Average
10	3.565	13.60	0.17	9.58	23.35	56.00	-32.65	QP
11	5.031	6.30	0.20	9.63	16.13	50.00	-33.87	Average
12	5.031	14.17	0.20	9.63	24.00	60.00	-36.00	QP



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中国·广东·广州高新技术产业开发区科学城科珠路198号 邮编: 510663

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7.2 Radiated Emissions which fall in the restricted bands

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

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

7.2.1 E.U.T. Operation

Operating Environment:

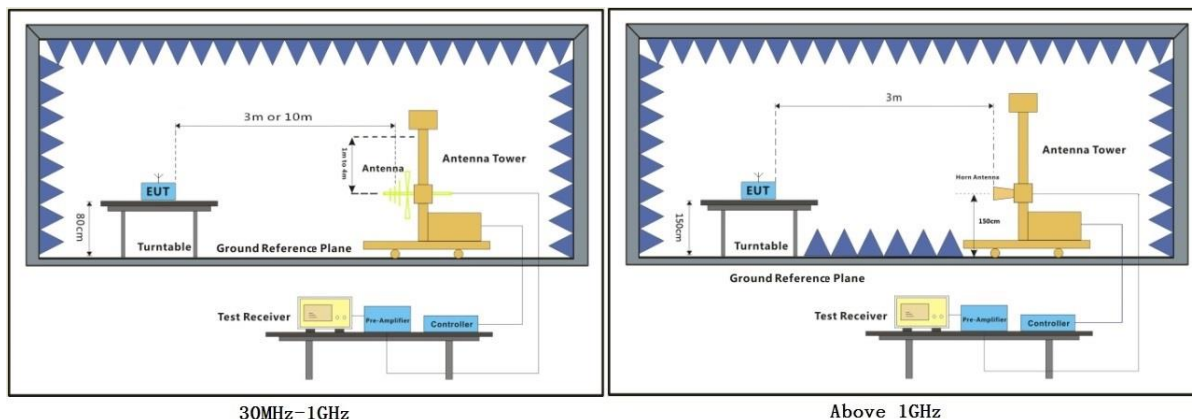
Temperature: 25.2 °C Humidity: 55.5 % RH Atmospheric Pressure: 1003 mbar

7.2.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 02	TX mode_Keep the EUT in transmitting with modulation mode.
Pre-scan 03	Charge + TX mode_Keep the EUT in charging and transmitting with modulation mode.



7.2.3 Test Setup Diagram



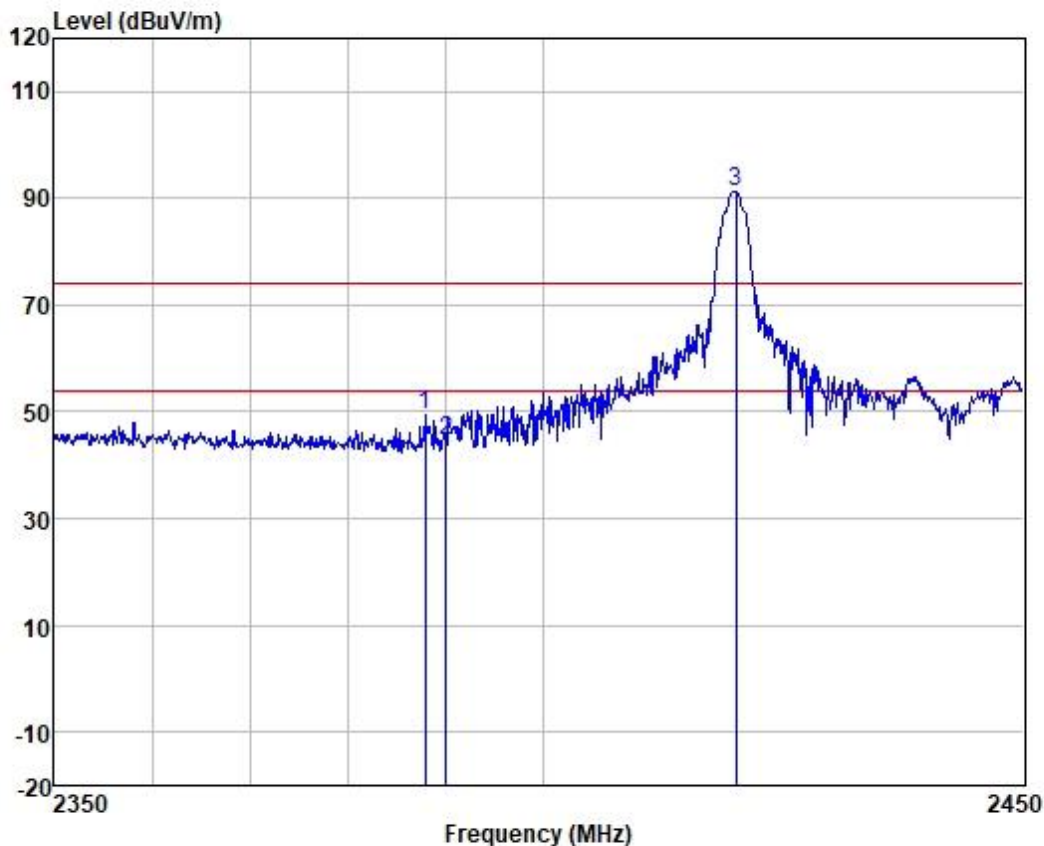
7.2.4 Measurement Procedure and Data

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

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

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

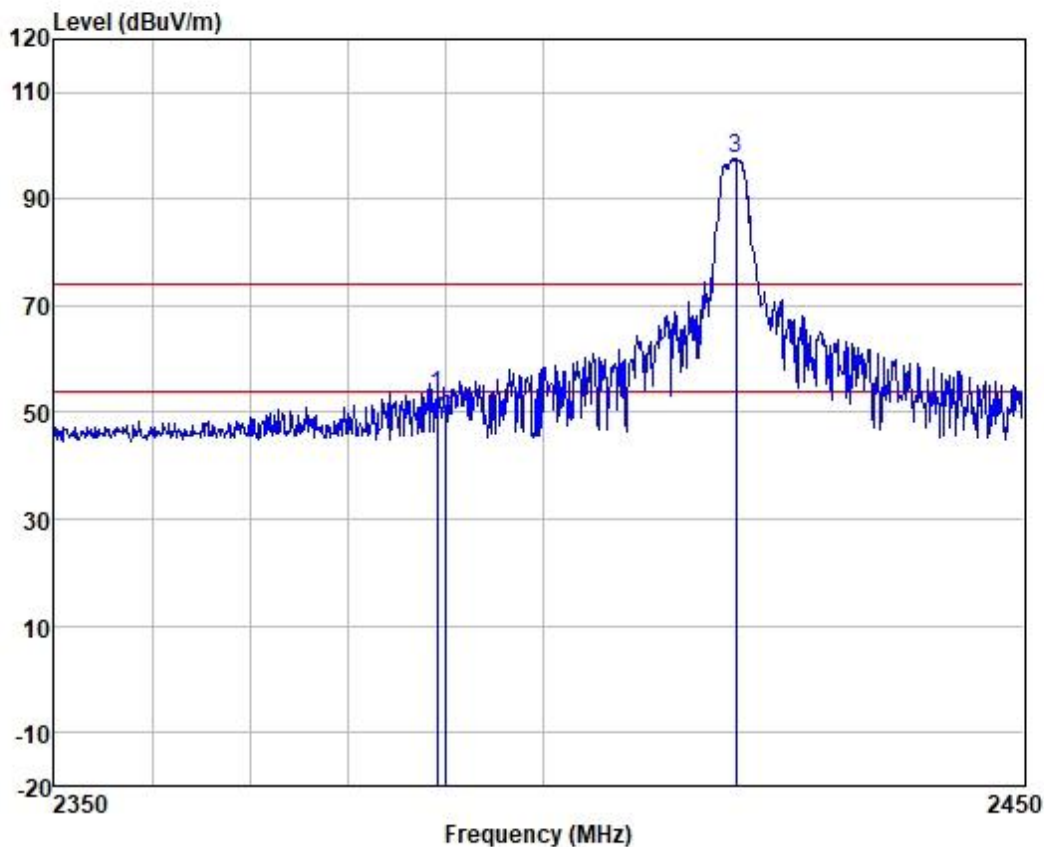
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



	Freq	ReadAntenna	Cable	Preamp		Limit	Over		
	MHz	Level	Factor	Loss	Factor	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2387.808	55.32	27.68	3.54	37.22	49.32	74.00	-24.68	VERTICAL peak
2	2390.000	50.66	27.68	3.54	37.21	44.67	74.00	-29.33	VERTICAL peak
3 *	2420.000	96.96	27.75	3.60	37.21	91.10	74.00	17.10	VERTICAL Peak



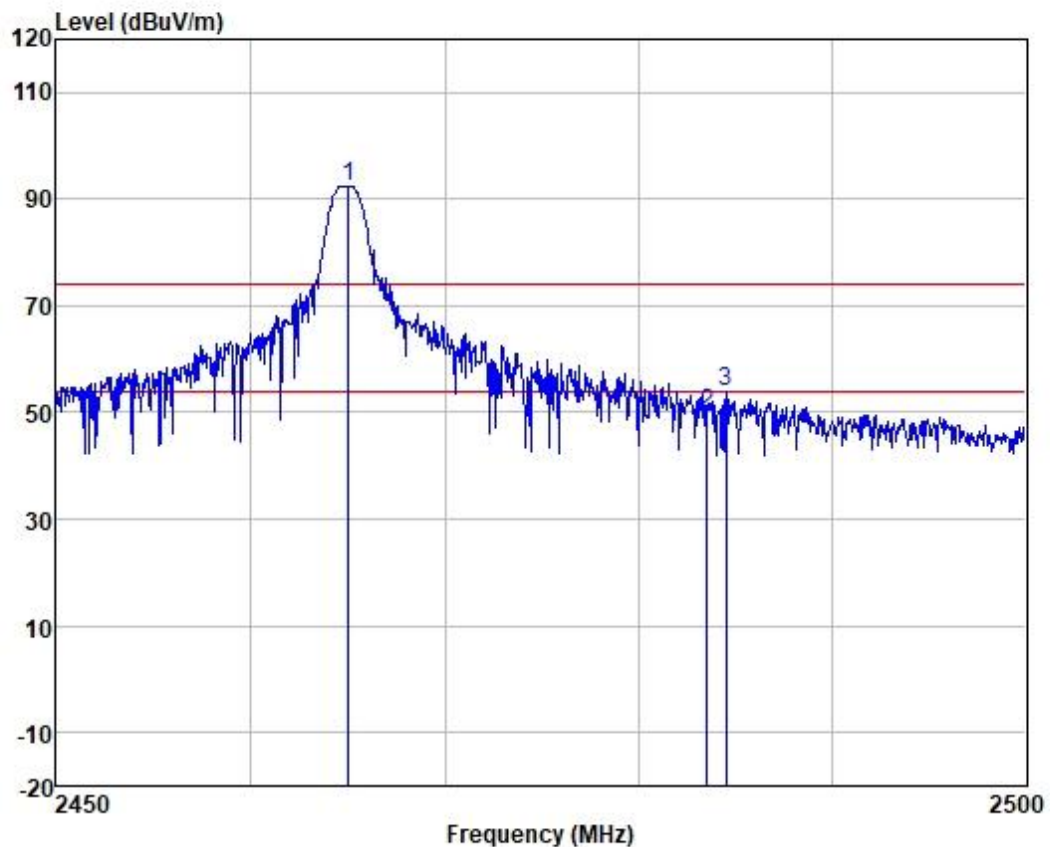
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over		
	MHz	Level	Factor	Loss	Factor	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2389.102	59.28	27.68	3.54	37.22	53.28	74.00	-20.72	HORIZONTAL peak
2	2390.000	54.54	27.68	3.54	37.21	48.55	74.00	-25.45	HORIZONTAL peak
3 *	2420.000	103.28	27.75	3.60	37.21	97.42	74.00	23.42	HORIZONTAL Peak



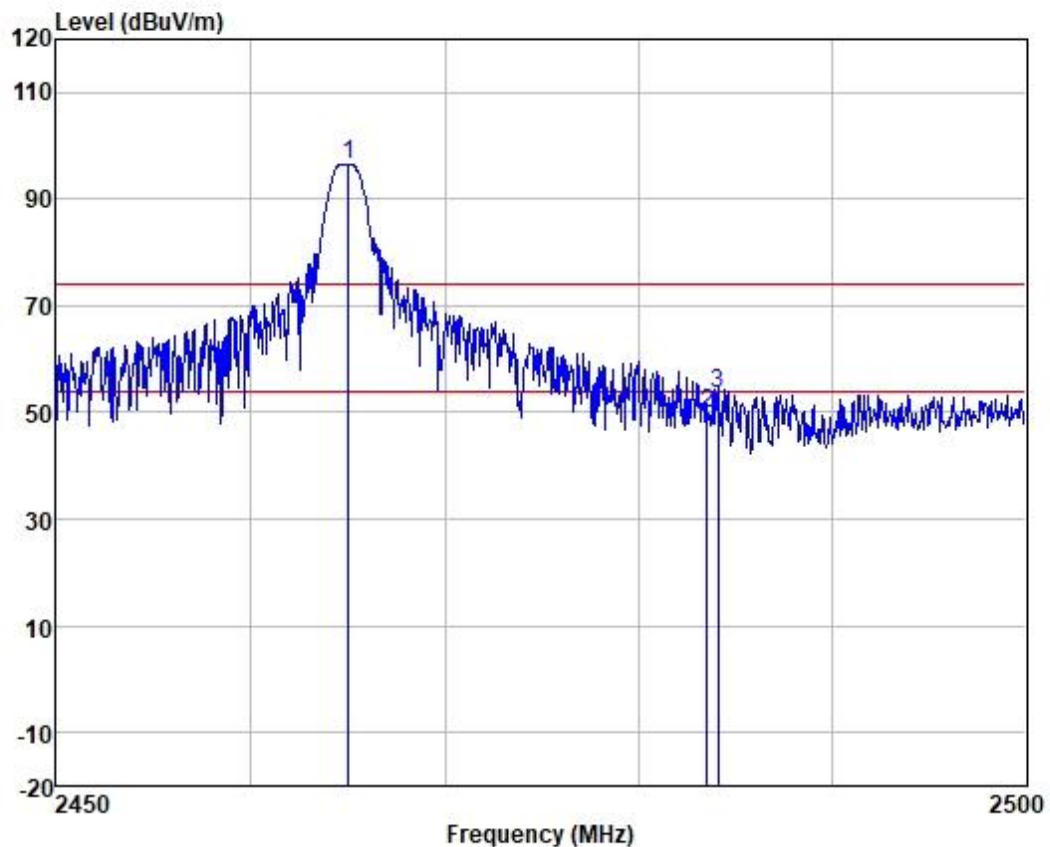
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over		
	MHz	Level	Loss	Factor	dBuV/m	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dB		
1 *	2465.000	98.17	27.82	3.69	37.20	92.48	74.00	18.48	VERTICAL peak
2	2483.500	55.38	27.85	3.74	37.19	49.78	74.00	-24.22	VERTICAL peak
3	2484.492	59.40	27.85	3.74	37.19	53.80	74.00	-20.20	VERTICAL peak



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



	Freq	ReadAntenna	Cable	Preamp	Level	Limit	Over		
	MHz	Level	Loss	Factor	dBuV/m	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dB		
1 *	2465.000	102.30	27.82	3.69	37.20	96.61	74.00	22.61	HORIZONTAL peak
2	2483.500	55.31	27.85	3.74	37.19	49.71	74.00	-24.29	HORIZONTAL peak
3	2484.091	59.12	27.85	3.74	37.19	53.52	74.00	-20.48	HORIZONTAL peak



7.3 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

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22.7 °C

Humidity: 52.7 % RH

Atmospheric Pressure: 1008 mbar

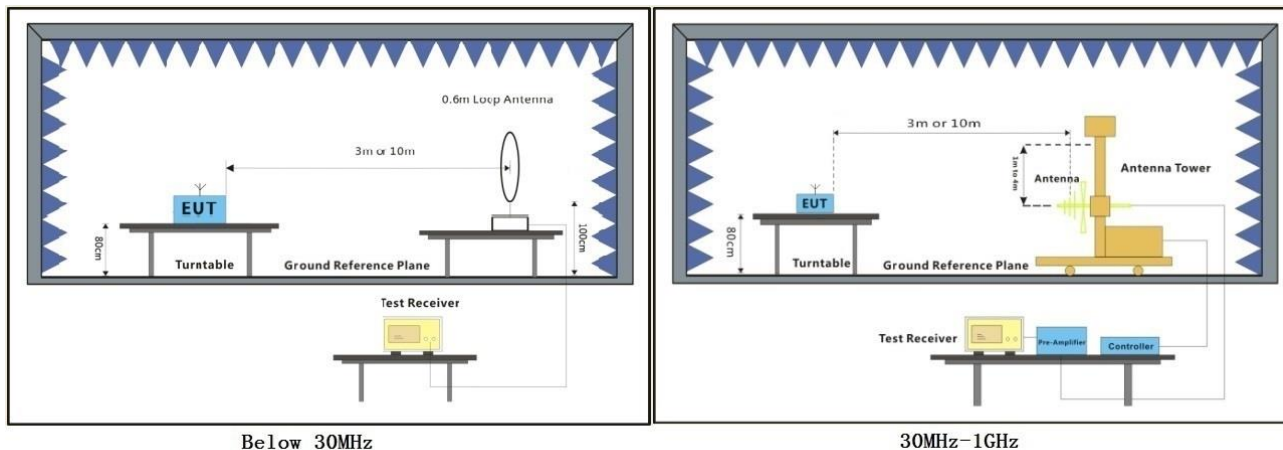
7.3.2 Test Mode Description

Pre-scan / Mode Description
Final test Code

Final test 02 TX mode_Keep the EUT in transmitting with modulation mode.

Pre-scan 03 Charge + TX mode_Keep the EUT in charging and transmitting with modulation mode.

7.3.3 Test Setup Diagram



7.3.4 Measurement Procedure and Data

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

Remark:

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



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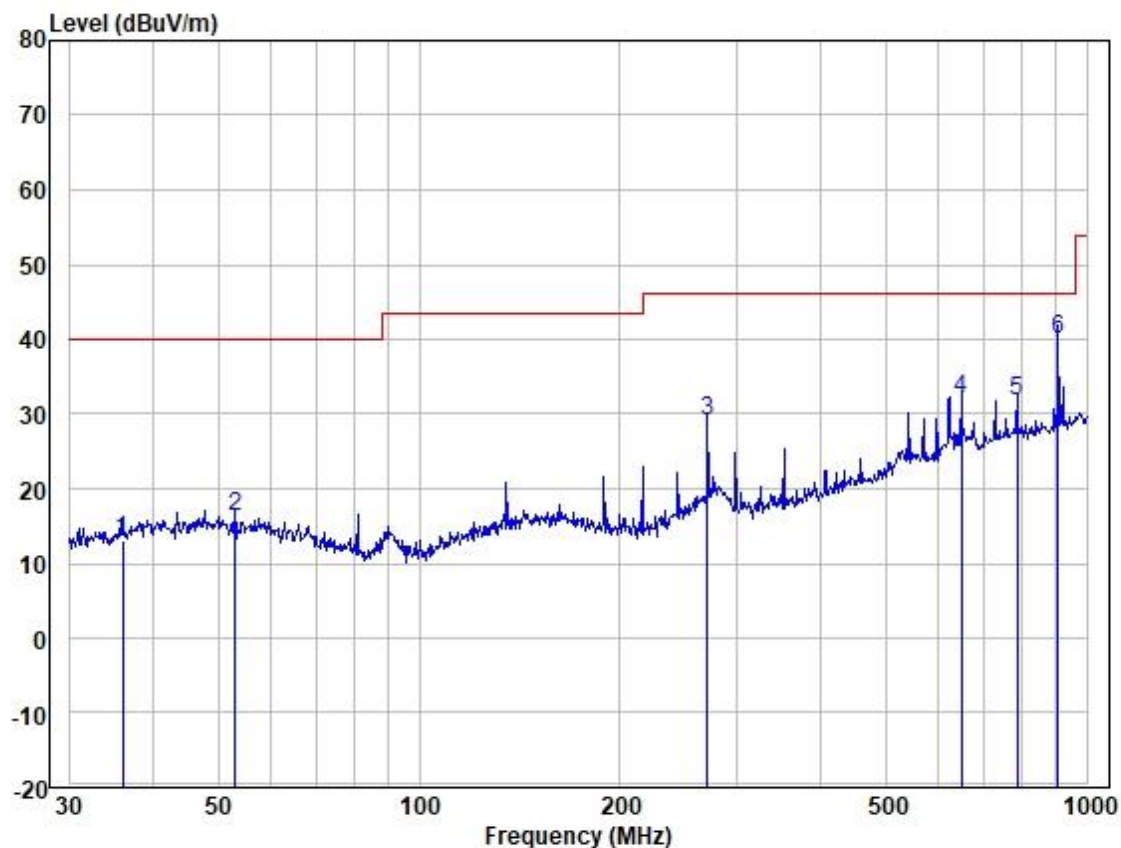
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Test Mode: 02; Polarity: Horizontal

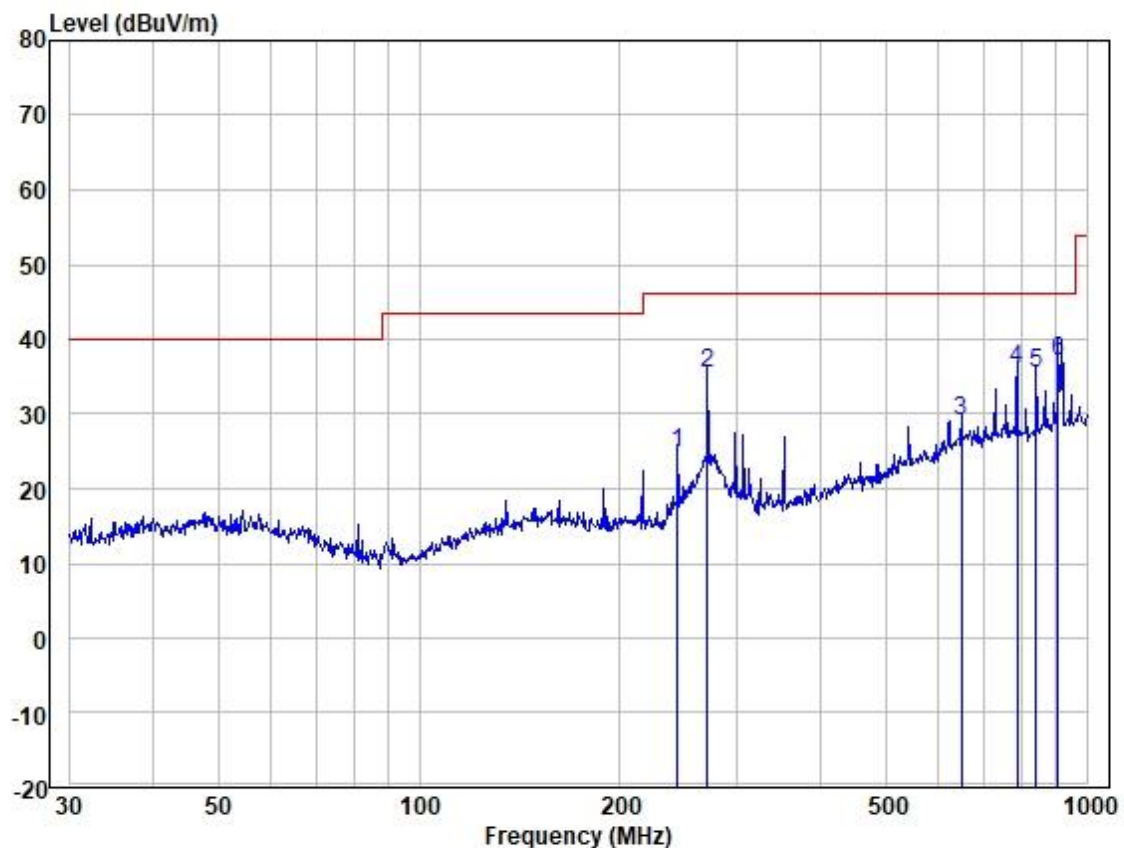


Site : 966 Chamber
Job :
Model :
Power :
Test Mode :

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	36.001	27.22	18.39	0.33	32.86	13.08	40.00	-26.92	HORIZONTAL	QP
2	53.131	29.26	19.39	0.40	32.88	16.17	40.00	-23.83	HORIZONTAL	QP
3	270.375	42.68	18.30	0.94	32.87	29.05	46.02	-16.97	HORIZONTAL	QP
4	649.660	36.55	26.70	1.48	32.71	32.02	46.02	-14.00	HORIZONTAL	QP
5	785.093	34.25	28.40	1.65	32.44	31.86	46.02	-14.16	HORIZONTAL	QP
6	906.482	40.70	29.48	1.76	31.96	39.98	46.02	-6.04	HORIZONTAL	QP



Test Mode: 02; Polarity: Vertical



Site : 966 Chamber
Job :
Model :
Power :
Test Mode :

	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	243.377	39.36	17.40	0.86	32.85	24.77	46.02	-21.25	VERTICAL	QP
2	270.375	49.18	18.30	0.94	32.87	35.55	46.02	-10.47	VERTICAL	QP
3	649.660	33.68	26.70	1.48	32.71	29.15	46.02	-16.87	VERTICAL	QP
4	785.093	38.32	28.40	1.65	32.44	35.93	46.02	-10.09	VERTICAL	QP
5	839.182	37.49	28.72	1.69	32.36	35.54	46.02	-10.48	VERTICAL	QP
6	906.482	37.91	29.48	1.76	31.96	37.19	46.02	-8.83	VERTICAL	QP



7.4 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

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 25.2 °C

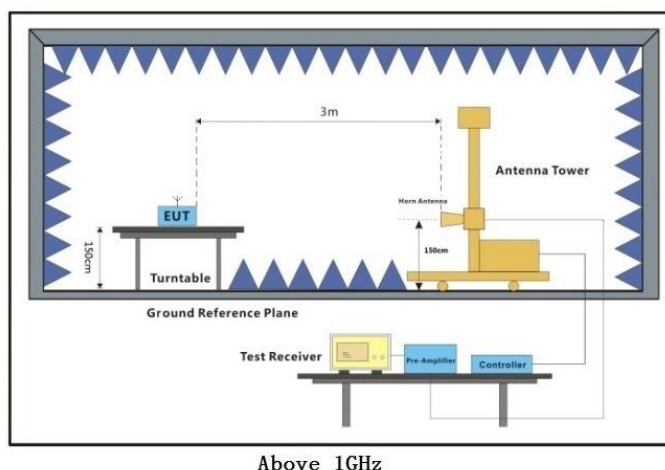
Humidity: 55.5 % RH

Atmospheric Pressure: 1003 mbar

7.4.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 02	TX mode_Keep the EUT in transmitting with modulation mode.
Pre-scan 03	Charge + TX mode_Keep the EUT in charging and transmitting with modulation mode.

7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

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

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
3. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



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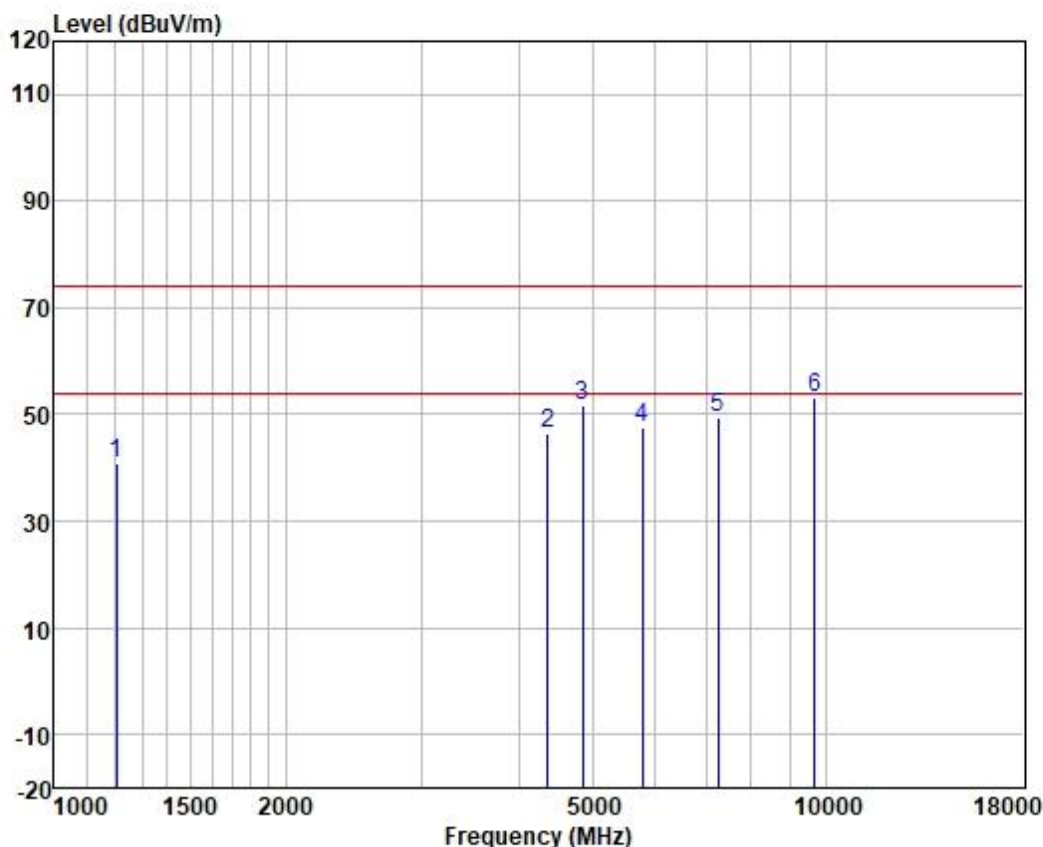
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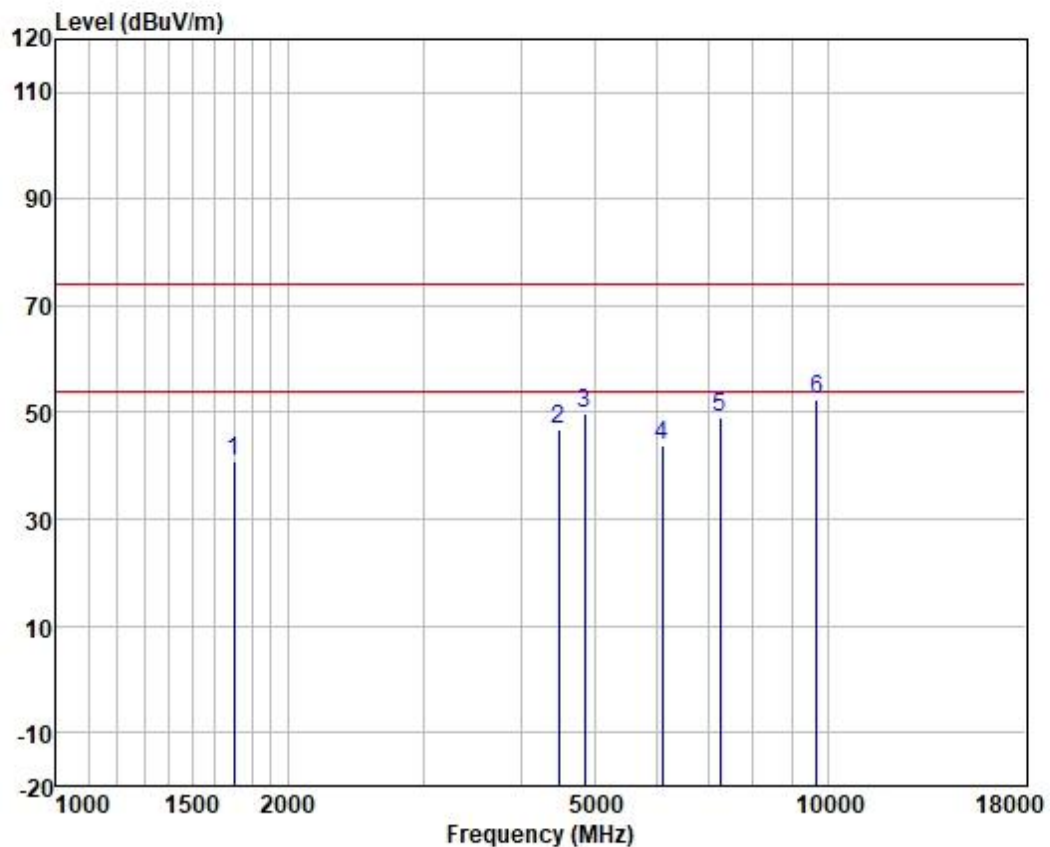
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



	Freq	ReadAntenna	Cable	Preamp	Limit	Over			
	MHz	Level	Factor	Loss	Factor	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1203.199	52.93	23.20	2.55	37.64	41.04	74.00	-32.96	VERTICAL peak
2	4367.058	43.92	33.51	5.78	36.62	46.59	74.00	-27.41	VERTICAL peak
3	4840.000	48.46	34.15	5.85	36.67	51.79	74.00	-22.21	VERTICAL peak
4	5780.300	45.13	32.66	6.66	36.79	47.66	74.00	-26.34	VERTICAL peak
5	7260.000	43.08	35.86	7.54	36.94	49.54	74.00	-24.46	VERTICAL peak
6	9680.000	43.02	38.73	8.13	36.82	53.06	74.00	-20.94	VERTICAL peak



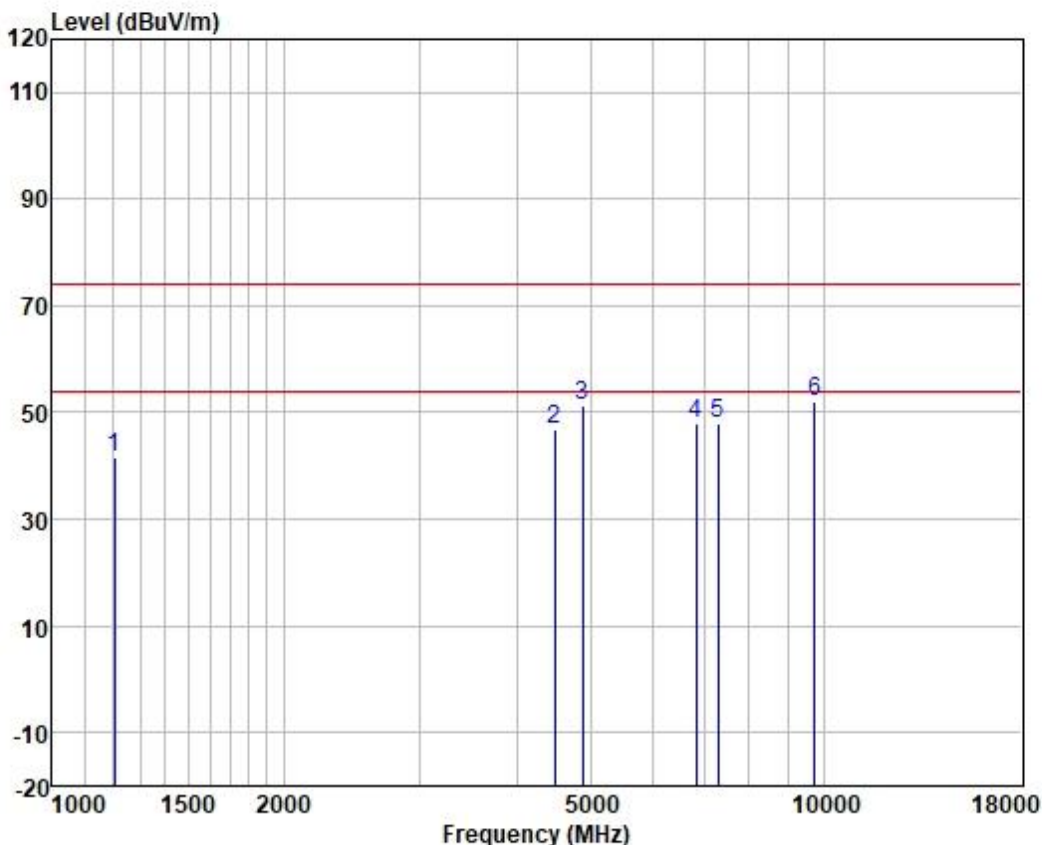
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	ReadAntenna	Cable	Preamp		Limit	Over		
	MHz	Level	Factor	Loss	Factor	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1702.042	50.01	25.15	3.18	37.39	40.95	74.00	-33.05	HORIZONTAL peak
2	4482.150	43.36	34.12	5.80	36.63	46.65	74.00	-27.35	HORIZONTAL peak
3	4840.000	46.42	34.15	5.85	36.67	49.75	74.00	-24.25	HORIZONTAL peak
4	6106.616	40.88	32.89	6.83	36.81	43.79	74.00	-30.21	HORIZONTAL Peak
5	7260.000	42.45	35.86	7.54	36.94	48.91	74.00	-25.09	HORIZONTAL peak
6	9680.000	42.41	38.73	8.13	36.82	52.45	74.00	-21.55	HORIZONTAL peak



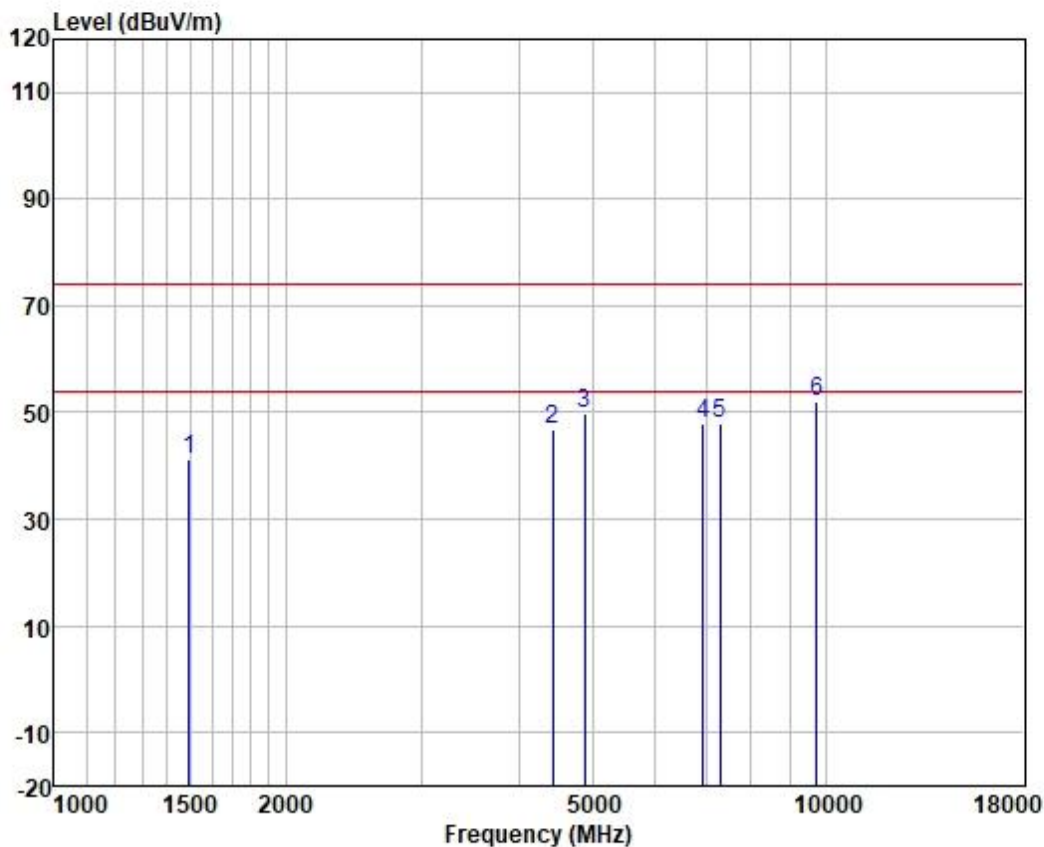
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:middle



	Freq	ReadAntenna	Cable	Preamp	Limit	Over			
	MHz	Level	Factor	Loss	Factor	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1203.199	53.42	23.20	2.55	37.64	41.53	74.00	-32.47	VERTICAL peak
2	4482.150	43.48	34.12	5.80	36.63	46.77	74.00	-27.23	VERTICAL peak
3	4866.000	48.11	34.15	5.85	36.67	51.44	74.00	-22.56	VERTICAL peak
4	6835.278	42.46	34.79	7.44	36.87	47.82	74.00	-26.18	VERTICAL peak
5	7299.000	41.38	36.00	7.55	36.95	47.98	74.00	-26.02	VERTICAL peak
6	9732.000	41.98	38.78	8.15	36.82	52.09	74.00	-21.91	VERTICAL peak



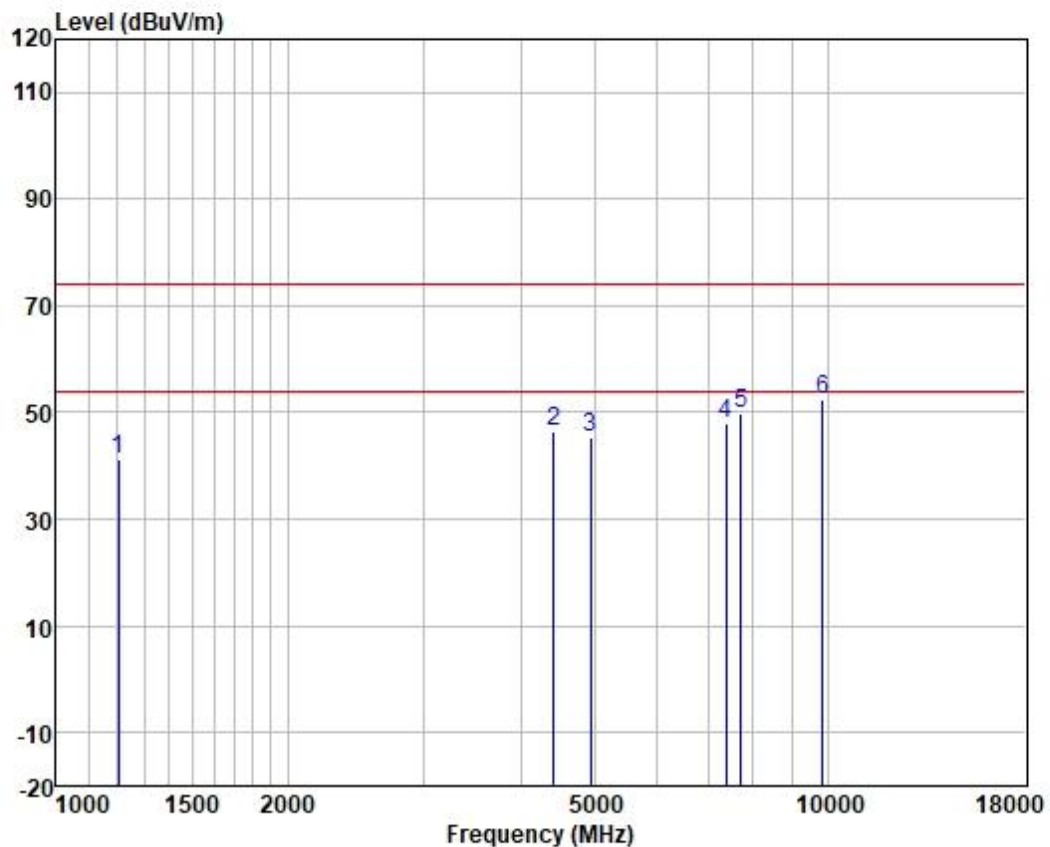
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:middle



	Freq	ReadAntenna	Cable	Preamp	Limit	Over			
	MHz	Level	Factor	Loss	Factor	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dB		
1	1494.455	51.31	24.42	3.03	37.52	41.24	74.00	-32.76	HORIZONTAL peak
2	4430.628	43.61	33.87	5.79	36.63	46.64	74.00	-27.36	HORIZONTAL peak
3	4866.000	46.41	34.15	5.85	36.67	49.74	74.00	-24.26	HORIZONTAL peak
4	6934.778	42.50	35.01	7.49	36.88	48.12	74.00	-25.88	HORIZONTAL peak
5	7299.000	41.35	36.00	7.55	36.95	47.95	74.00	-26.05	HORIZONTAL peak
6	9732.000	41.88	38.78	8.15	36.82	51.99	74.00	-22.01	HORIZONTAL peak



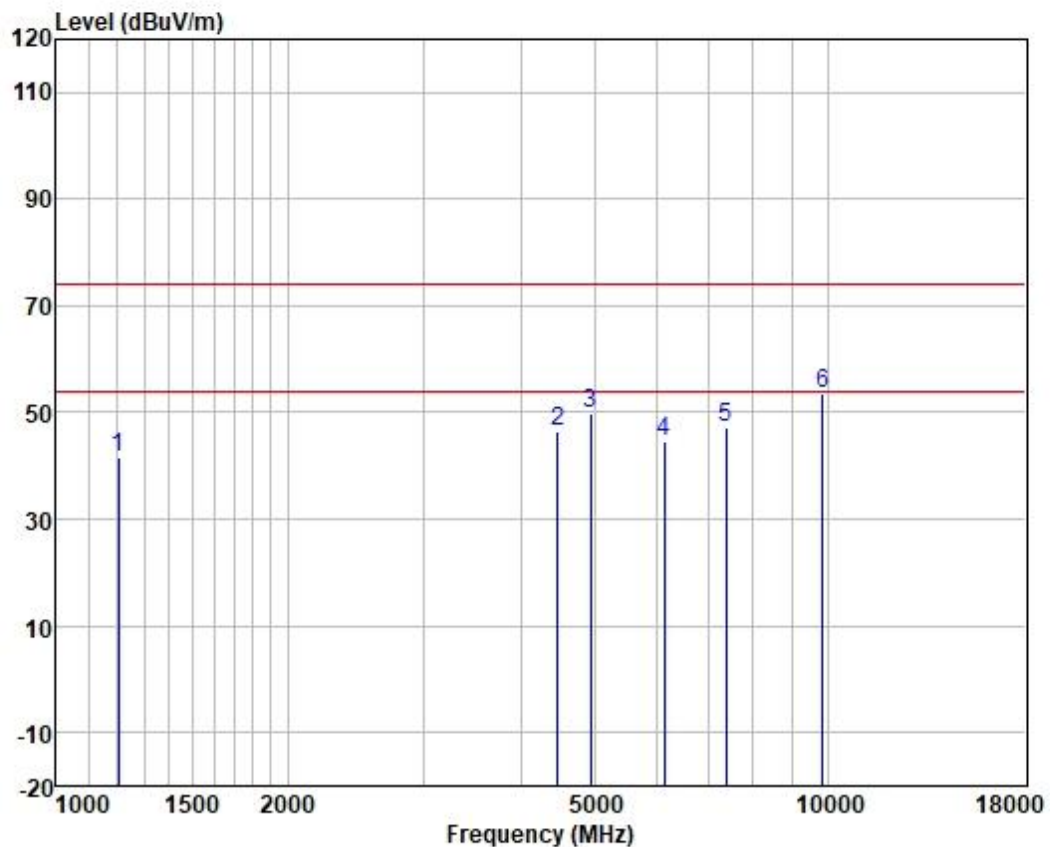
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



	Freq	ReadAntenna	Cable	Preamp		Limit	Over		
	MHz	Level	Factor	Loss	Factor	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1203.199	53.21	23.20	2.55	37.64	41.32	74.00	-32.68	VERTICAL peak
2	4417.841	43.61	33.81	5.79	36.62	46.59	74.00	-27.41	VERTICAL peak
3	4930.000	41.95	34.15	5.86	36.68	45.28	74.00	-28.72	VERTICAL peak
4	7395.000	40.97	36.23	7.57	36.96	47.81	74.00	-26.19	VERTICAL peak
5	7717.518	42.23	36.75	7.64	36.98	49.64	74.00	-24.36	VERTICAL peak
6	9860.000	42.15	38.91	8.21	36.81	52.46	74.00	-21.54	VERTICAL peak



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



	Freq	ReadAntenna	Cable	Preamp	Limit	Over			
	MHz	Level	Factor	Loss	Factor	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1203.199	53.64	23.20	2.55	37.64	41.75	74.00	-32.25	HORIZONTAL peak
2	4469.214	43.35	34.06	5.80	36.63	46.58	74.00	-27.42	HORIZONTAL peak
3	4930.000	46.34	34.15	5.86	36.68	49.67	74.00	-24.33	HORIZONTAL peak
4	6142.019	41.45	32.97	6.85	36.81	44.46	74.00	-29.54	HORIZONTAL Peak
5	7395.000	40.17	36.23	7.57	36.96	47.01	74.00	-26.99	HORIZONTAL peak
6	9860.000	43.18	38.91	8.21	36.81	53.49	74.00	-20.51	HORIZONTAL peak



7.5 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

7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 21.6 °C

Humidity: 69.9 % RH

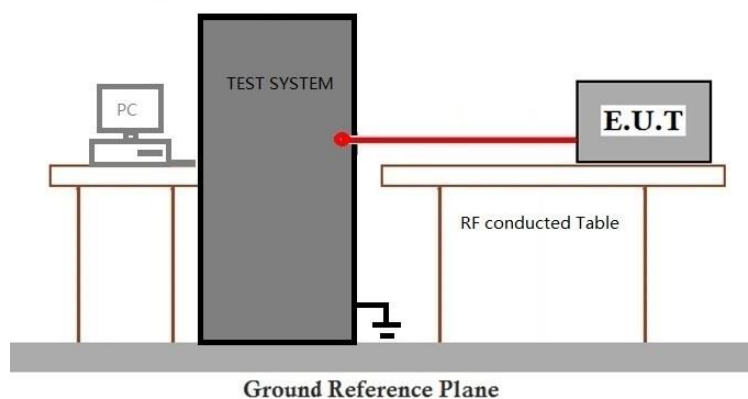
Atmospheric Pressure: 1008 mbar

7.5.2 Test Mode Description

Pre-scan / Mode
Final test Code Description

Final test 02 TX mode_Keep the EUT in transmitting with modulation mode.

7.5.3 Test Setup Diagram



7.5.4 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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t (86-20) 82155555 sgs.china@sgs.com

7.6 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

7.6.1 E.U.T. Operation

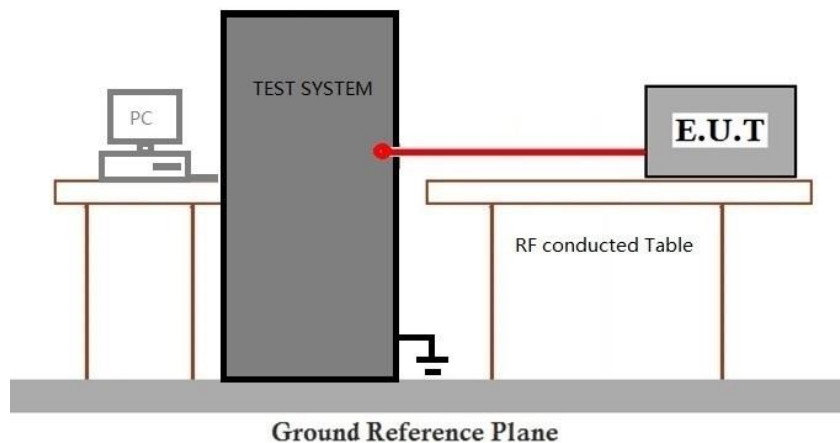
Operating Environment:

Temperature: 21.6 °C Humidity: 69.9 % RH Atmospheric Pressure: 1008 mbar

7.6.2 Test Mode Description

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

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.7 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

7.7.1 E.U.T. Operation

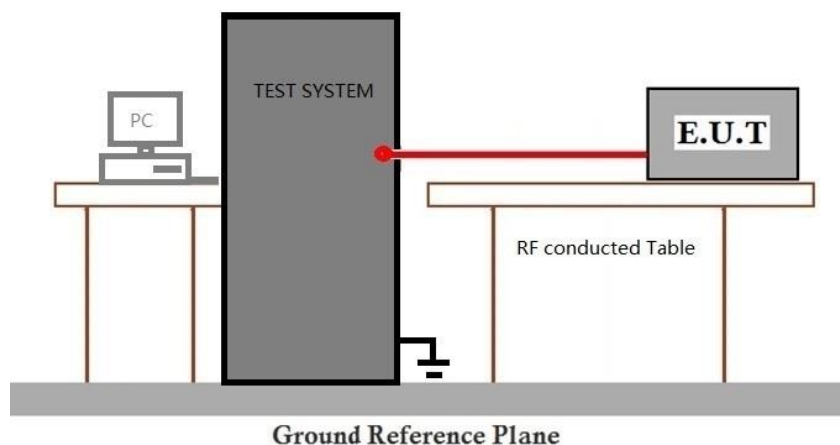
Operating Environment:

Temperature: 21.6 °C Humidity: 69.9 % RH Atmospheric Pressure: 1008 mbar

7.7.2 Test Mode Description

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

7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.8 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)).

7.8.1 E.U.T. Operation

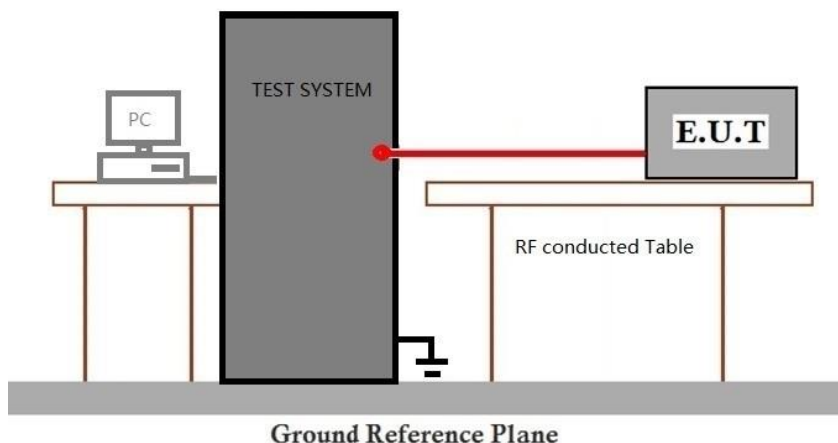
Operating Environment:

Temperature: 21.6 °C Humidity: 69.9 % RH Atmospheric Pressure: 1008 mbar

7.8.2 Test Mode Description

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

7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

Please Refer to Appendix for Details



7.9 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)).

7.9.1 E.U.T. Operation

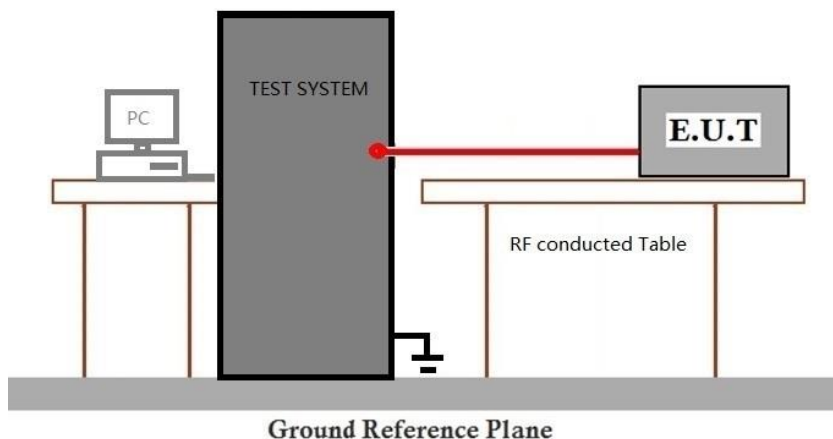
Operating Environment:

Temperature: 21.6 °C Humidity: 69.9 % RH Atmospheric Pressure: 1008 mbar

7.9.2 Test Mode Description

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

7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

Please Refer to Appendix for Details



8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR240500051402



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9 EUT Constructional Details (EUT Photos)

Refer to External and Internal Photos for GZCR2405000514AT



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10 Appendix

1. Duty Cycle

1.1 Test Result

1.1.1 Ant1

Ant1							
Mode	TX Type	Frequency (MHz)	T _{on} (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
2.4gProprietary	SISO	2420	2.899	3.749	77.33	1.12	0.03
		2440	0.092	0.625	14.72	8.32	0.00
		2465	2.900	3.749	77.35	1.12	0.01



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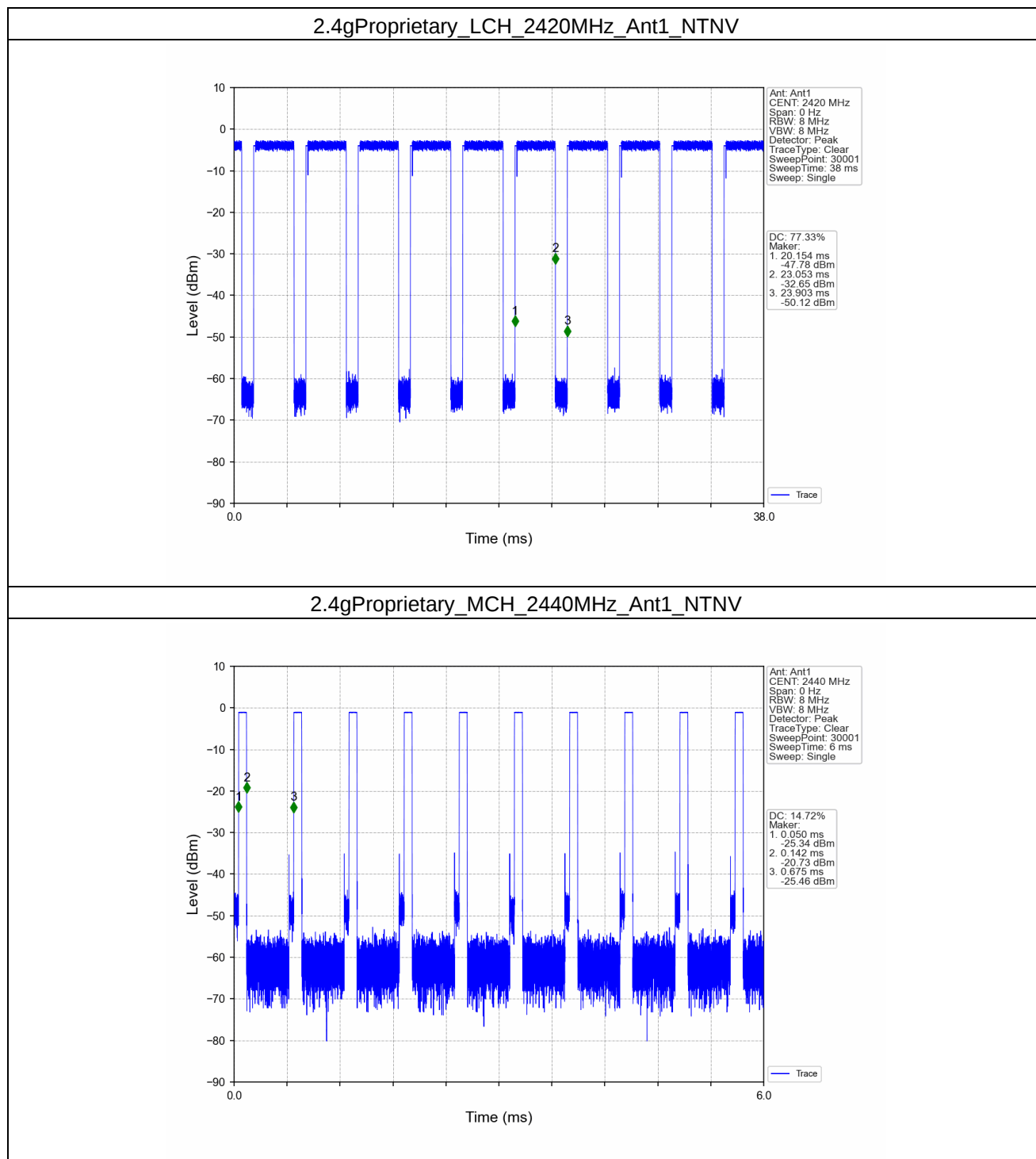
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1.2 Test Graph

1.2.1 Ant1



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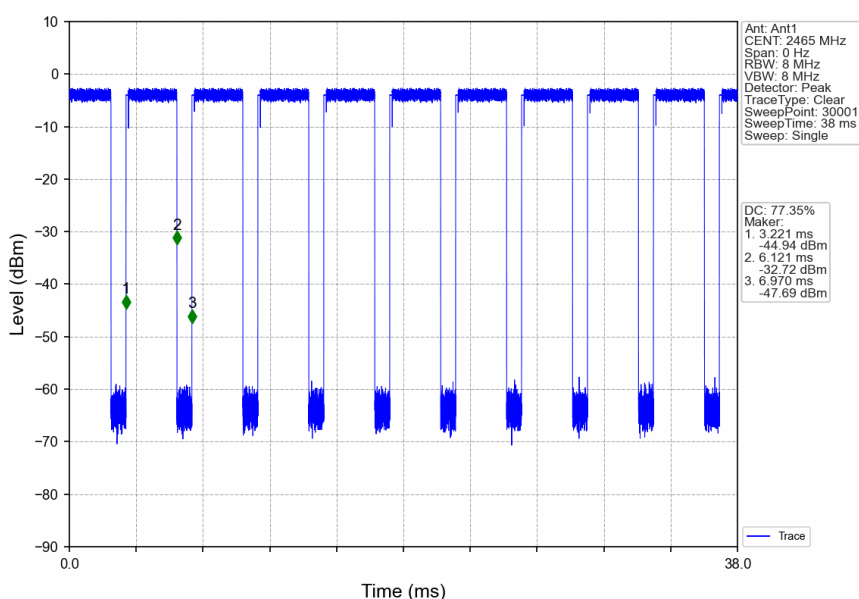
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2.4gProprietary_HCH_2465MHz_Ant1_NTNV



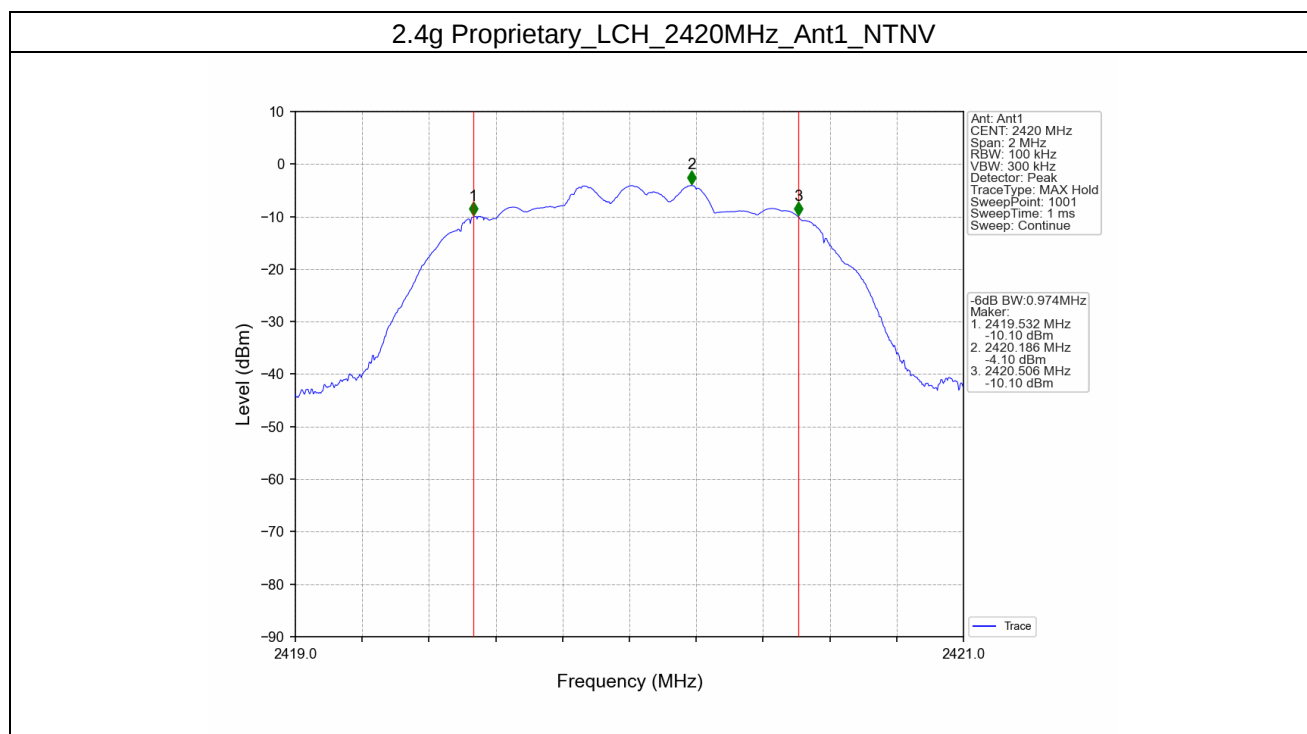
2. Bandwidth

2.1.1 6dB BW

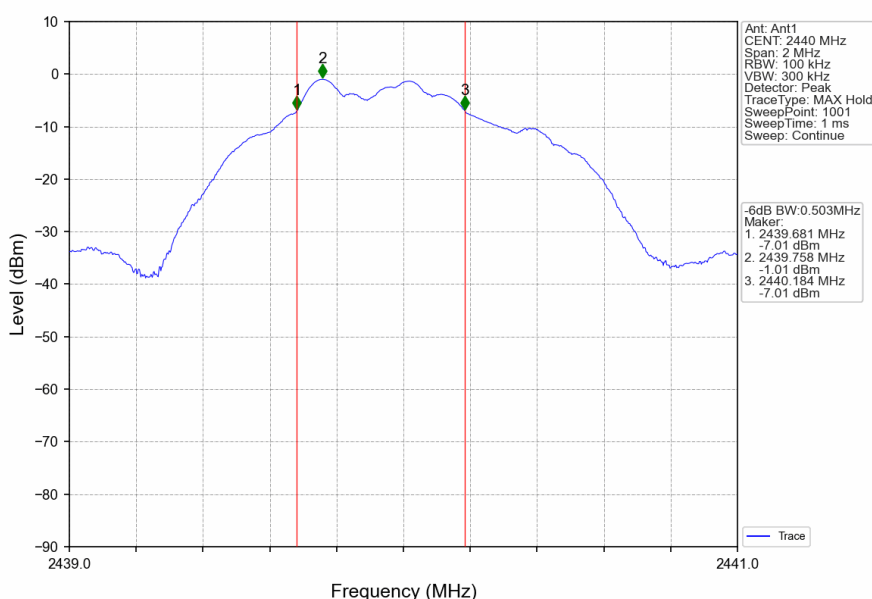
Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
2.4gProprietary	SISO	2420	1	0.974	≥ 0.5	Pass
		2440	1	0.503	≥ 0.5	Pass
		2465	1	0.979	≥ 0.5	Pass

2.2 Test Graph

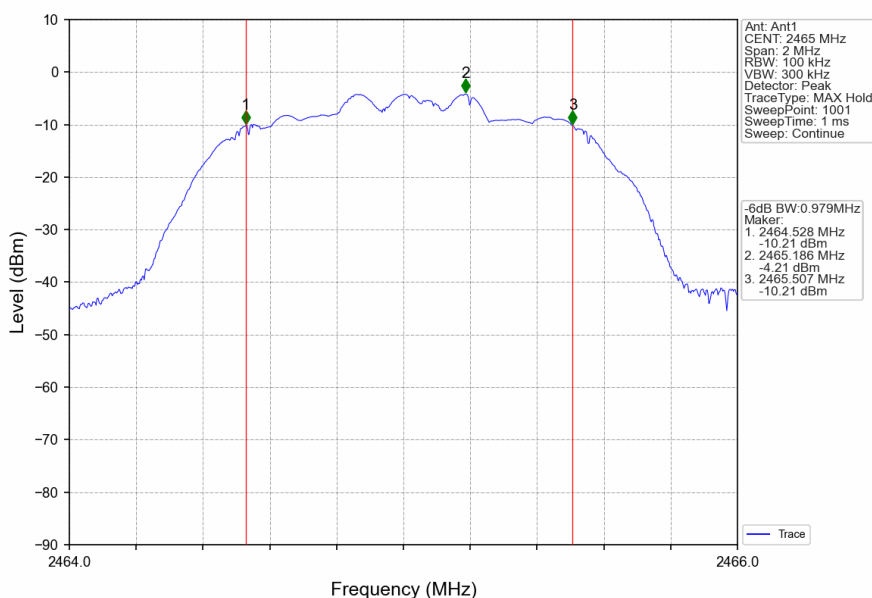
2.2.1 6dB BW



2.4g Proprietary_MCH_2440MHz_Ant1_NTNV



2.4g Proprietary_HCH_2465MHz_Ant1_NTNV



3. Maximum Conducted Output Power

3.1 Test Result

3.1.1 Power

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
2.4gProprietary	SISO	2420	-3.20	<=30	Pass
		2440	-1.02	<=30	Pass
		2465	-3.20	<=30	Pass

Note1: Antenna Gain: Ant1: 0.89 dBi;



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4. Maximum Power Spectral Density

4.1 Test Result

4.1.1 PSD

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT1	Limit	
2.4gProprietary	SISO	2420	-16.00	<=8	Pass
		2440	-19.39	<=8	Pass
		2465	-15.96	<=8	Pass
Note1: Antenna Gain: Ant1: 0.89 dBi;					

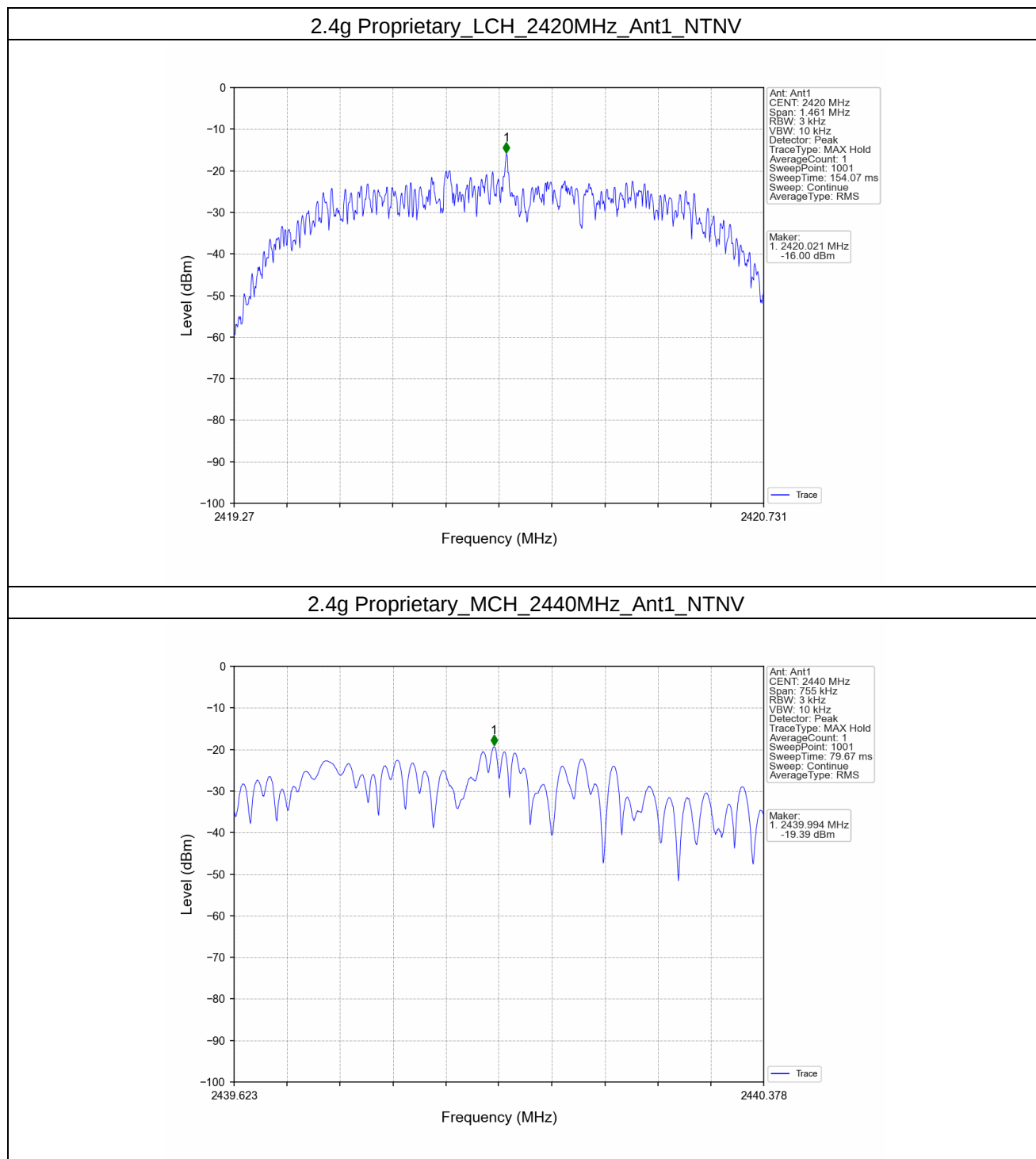


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4.2 Test Graph

4.2.1 PSD



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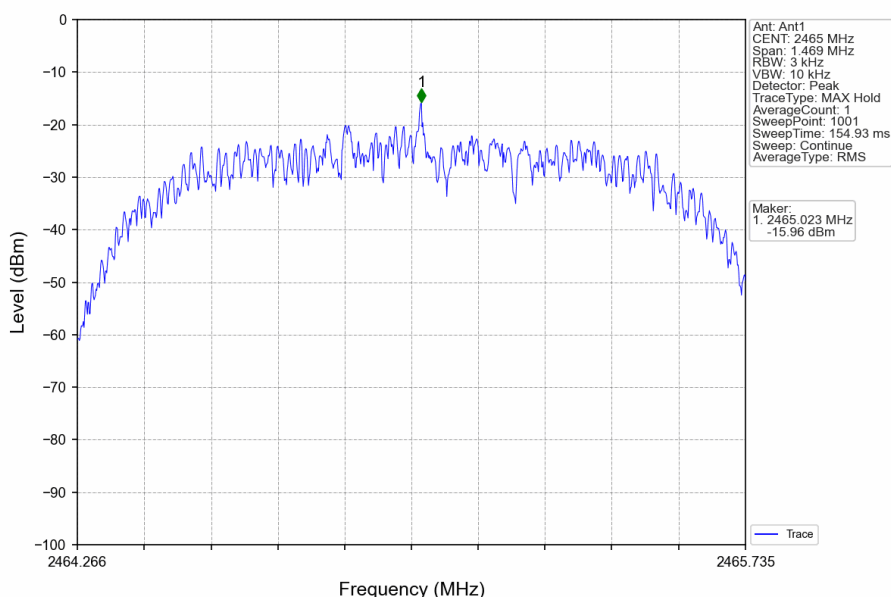
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SGS-CSTC Standards Technical Services Co., Ltd.
Guangzhou Branch, Testing Center, CEC Laboratory.

No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou, Guangdong, China 510663
中国·广东·广州高新技术产业开发区科学城科珠路198号 邮编: 510663

t (86-20) 82155555 www.sgsgroup.com.cn
t (86-20) 82155555 sgs.china@sgs.com

2.4g Proprietary_HCH_2465MHz_Ant1_NTNV



5. Unwanted Emissions In Non-restricted Frequency Bands

5.1 Test Result

5.1.1 Ref

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
2.4gProprietary	SISO	2420	1	-4.12
		2440	1	-1.03
		2465	1	-4.19

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

5.1.2 CSE and Band Edges

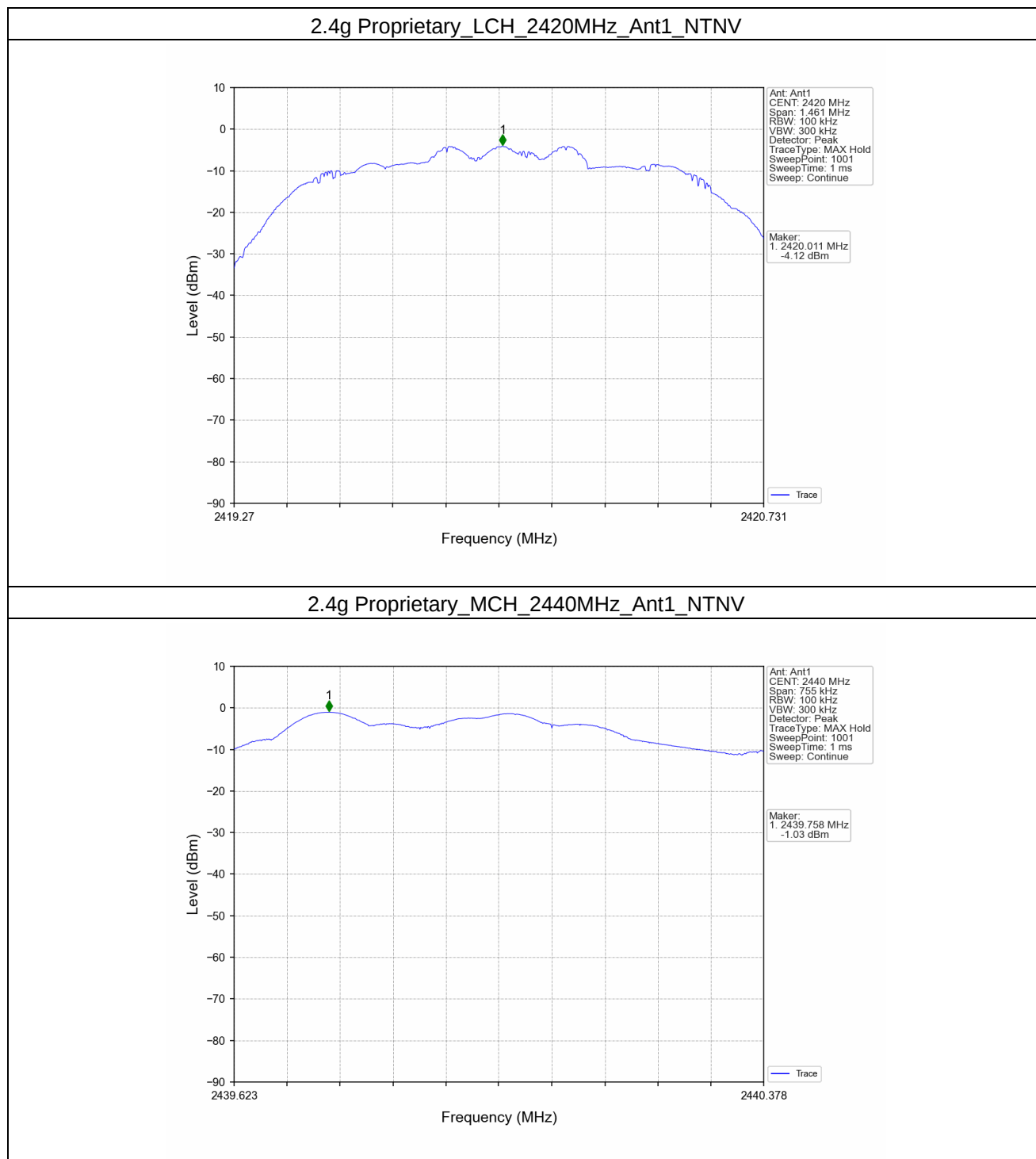
Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
2.4gProprietary	SISO	2420	1	-1.03	-21.03	Pass
		2440	1	-1.03	-21.03	Pass
		2465	1	-1.03	-21.03	Pass

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



5.2 Test Graph

5.2.1 Ref



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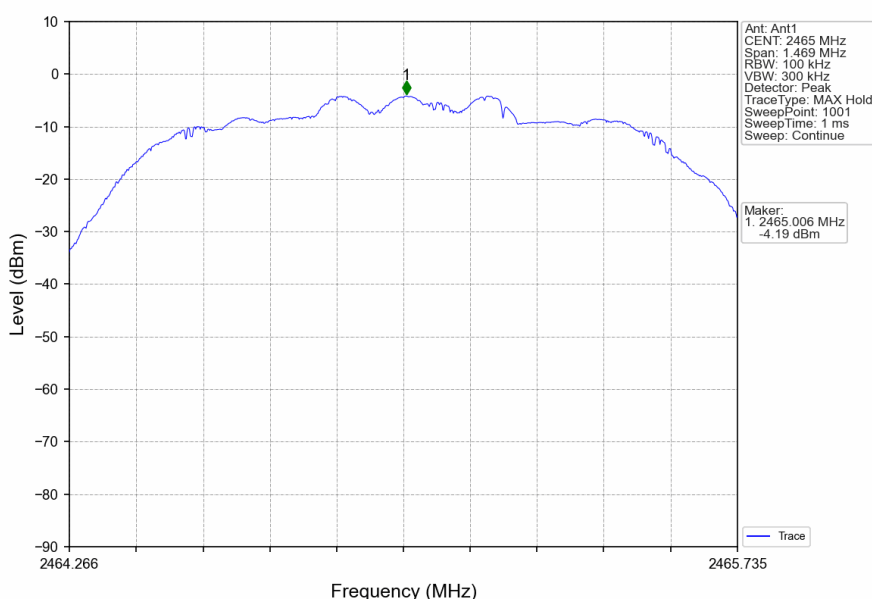
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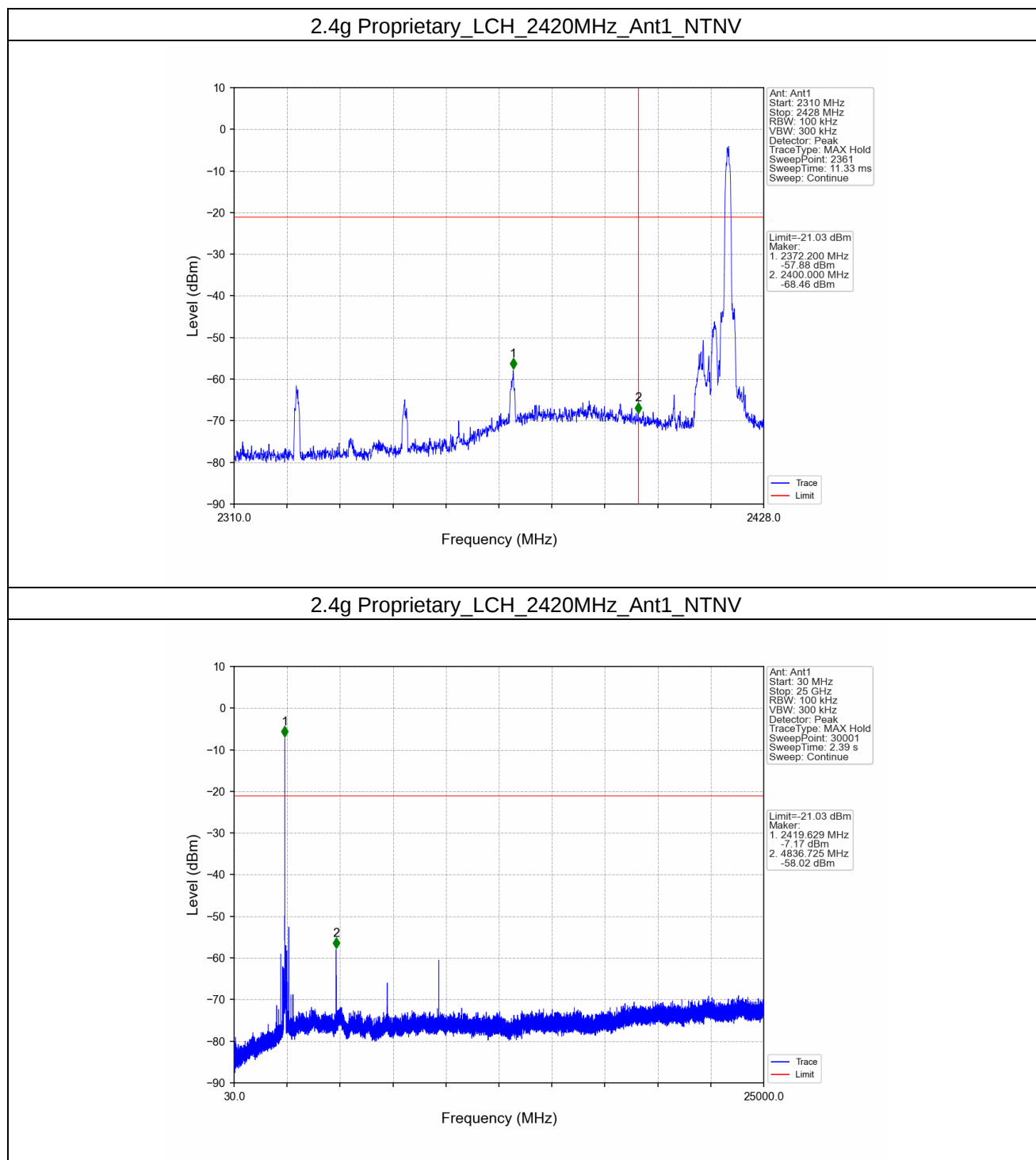
2.4g Proprietary_HCH_2465MHz_Ant1_NTNV



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5.2.2 CSE and Band Edges



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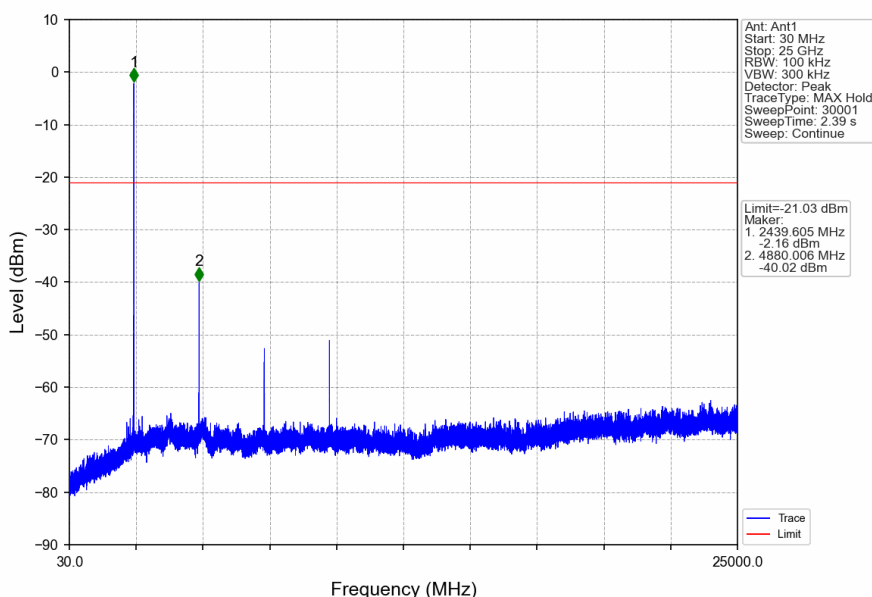
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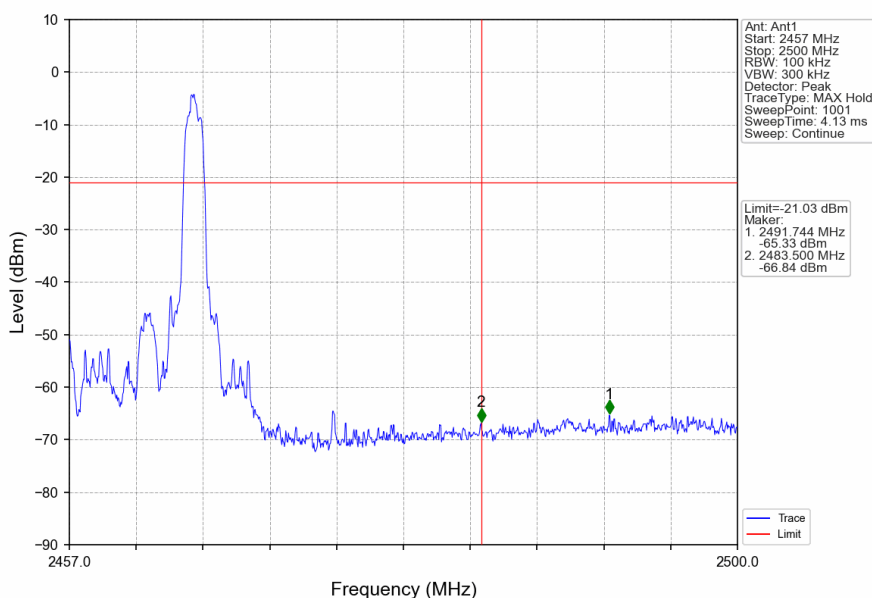
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t (86-20) 82155555 www.sgsgroup.com.cn
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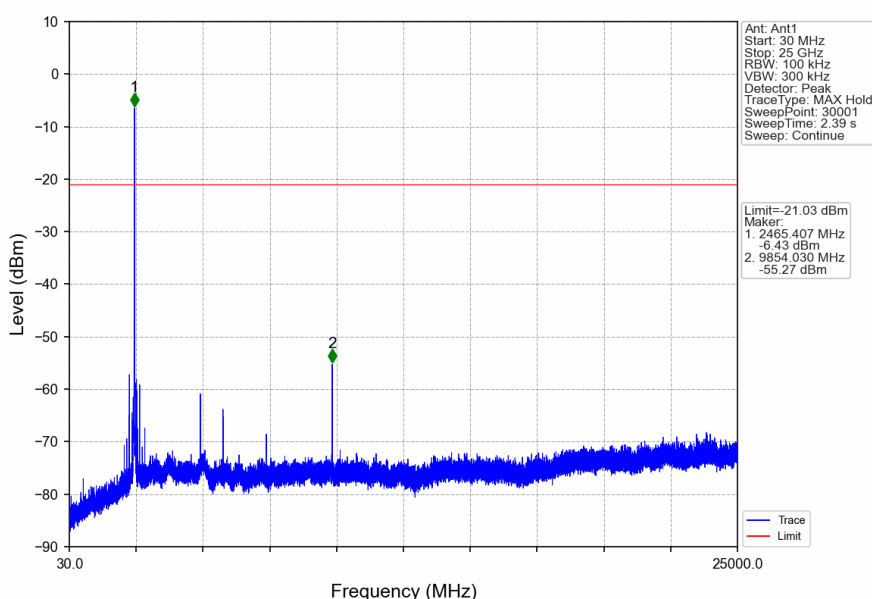
2.4g Proprietary_MCH_2440MHz_Ant1_NTNV



2.4g Proprietary_HCH_2465MHz_Ant1_NTNV



2.4g Proprietary_HCH_2465MHz_Ant1_NTNV



- End of the Report -

