

TEST REPORT

Application No.: GZCR2512001921AT

Applicant: Guangzhou Andea Electronics Technology Co., Ltd.

Address of Applicant: 11th Floor, Building C2, Lian Dong U-Valley, Yihang Intelligent Technology Park, No.29, Bishan Street, Huang Pu District, Guangzhou, Guangdong, China.

Manufacturer: Guangzhou Andea Electronics Technology Co., Ltd.

Address of Manufacturer: 11th Floor, Building C2, Lian Dong U-Valley, Yihang Intelligent Technology Park, No.29, Bishan Street, Huang Pu District, Guangzhou, Guangdong, China.

Factory: Guangzhou Andea Electronics Technology Co., Ltd.

Address of Factory: 11th Floor, Building C2, Lian Dong U-Valley, Yihang Intelligent Technology Park, No.29, Bishan Street, Huang Pu District, Guangzhou, Guangdong, China.

Product Name: Industrial ultra-high frequency RFID read-write device

Model No.: ARU5321M&T-S04, ARU5321M&X-S04 (X=A-Z), ARU5321X-S04 (X=A-Z)

♣

♣ Please refer to section 2 of this report which indicates which item was actually tested and which were electrically identical.

Trade Mark: **ANDEAWELL**

Standard(s) : 47 CFR Part 15, Subpart C 15.247

Date of Receipt: 2025-12-02

Date of Test: 2026-02-09

Date of Issue: 2026-03-12

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



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Revision Record			
Version	Report No.	Date	Remark
01	GZCR251200192102	2026-03-12	Original

Authorized for issue by:			
		Key Liang	
		Key Liang/Project Engineer	
Approved By		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
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence		N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	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 (2020) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2020) Section 6.10.5 & 7.8.8	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Below 1GHz		ANSI C63.10 (2020) Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Above 1GHz		ANSI C63.10 (2020) Section 6.6 & 7.8.8	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Maximum Conducted Output Power		ANSI C63.10 (2020) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(2)	Pass
20dB Bandwidth		ANSI C63.10 (2020) Section 6.9.2	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation		ANSI C63.10 (2020) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number		ANSI C63.10 (2020) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(i)	Pass
Dwell Time		ANSI C63.10 (2020) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(i)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2020) Section 7.8.7.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2020) Section 7.8.7	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.



♣ Declaration of EUT Family Grouping:

Model No.: ARU5321M&T-S04, ARU5321M&X-S04 (X=A-Z), ARU5321X-S04 (X=A-Z)

According to the declaration from the applicant, the electrical circuit design, layout, components used and internal wiring were identical for all models, with only difference being the model name.

Therefore only one model **ARU5321M&T-S04** was tested in this report.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 24V
Test voltage:	AC 120V, 60Hz powered by AC/DC adapter provided by applicant
Cable(s):	SMA antenna ports*4. LAN ports (4pins). DC+UART ports (5pins). GPIO ports (8pins).
Operation Frequency:	902.75MHz to 927.25MHz
Modulation Type:	ASK
Channel Spacing:	500 kHz
Number of Channels:	50
Antenna Type:	Ceramic antenna
Antenna Gain:	6 dBi declared by manufacture
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Number:	4(Only one antenna is enabled)

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.
AC/DC adapter provided by applicant	MEAN WELL	MODEL NO: GSM36U24INPUT: 100-240VAC, 50/60Hz, 0.9-0.45A OUTPUT: DC 24V, 1.5A, 36W MAX.	GSM36U24-P1J
1.0m unscreened DB9 cable provided by applicant	\	\	\
0.3m unscreened USB cable provided by applicant	\	\	\
AC/DC adapter provided by applicant	MEAN WELL	MODEL NO: GSM36U24INPUT: 100-240VAC, 50/60Hz, 0.9-0.45A OUTPUT: DC 24V, 1.5A, 36W MAX.	GSM36U24-P1J
ceramic antenna provided by applicant	\	VS-ATU1031S-A-199010073	2C12390106
ceramic antenna provided by applicant	\	VS-ATU1031S-A-199010073	2012440023
ceramic antenna provided by applicant	\	VS-ATU1031S-A-199010073	2012440024
ceramic antenna provided by applicant	\	VS-ATU1031S-A-199010073	2C12390080



4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±3.22dB
Radiated Emissions which fall in the restricted bands	±5.14dB (3m); ±4.90dB (10m); ±4.88dB (1GHz-6GHz); ±5.06dB (6GHz-18GHz); ±5.30dB (18GHz-40GHz)
Radiated Spurious Emissions Below 1GHz	±3.08dB (9kHz to 150kHz); ±3.19dB (150kHz to 30MHz); ±5.14dB (30MHz-1GHz) (3m); ±4.90dB (30MHz-1GHz) (10m)
Radiated Spurious Emissions Above 1GHz	±4.88dB (1GHz-6GHz); ±5.06dB (6GHz-18GHz); ±5.30dB (18GHz-40GHz)
Maximum Conducted Output Power	± 0.75dB
20dB Bandwidth	± 0.274%
Carrier Frequencies Separation	± 7.25 x 10 ⁻⁸
Hopping Channel Number	± 7.25 x 10 ⁻⁸
Dwell Time	± 0.029%
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Remark: The U_{lab} (lab Uncertainty) is less than U_{cispr} (CISPR Uncertainty) or U_{ETSI} (ETSI Uncertainty). Emission decision rule: – Compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit, marked as Pass in the report. – Non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit, marked as Fail in the report.	

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,
Guangdong, China 510663

Tel: +86 20 82155555

No tests were sub-contracted.



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4.5 Test Facility

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

● **ACMA**

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

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

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

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

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

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

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

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

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

● **CBTL (Lab Code: TL129)**

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

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Coaxial Cable	HangTianXing	BL03-NMNM-6.00M	EMC0107	2025-08-12	2026-08-11
Shielding Room	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	2025-08-14	2028-08-13
Two-Line V-Network-GZ	Rohde & Schwarz	ENV216	EMC2135	2025-08-13	2026-08-12
EMI Test Receiver (9kHz-3.6GHz)	Rohde & Schwarz	ESR3	EMC2221	2025-11-18	2026-11-17
Test Software E3r	Audix	Ver.6.191211	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
966 Anechoic Chamber	Shenzhen C.R.T	CRTSGSSAC966	EMC2230	2025-03-22	2028-03-21
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2229	2025-11-18	2026-11-17
Amplifier(9k-1000MHz)	SONOMA	310	EMC2237	2025-11-25	2026-11-24
Trilog Broadband Antenna (25MHz-2GHz)	Schwarzbeck Mess-Elektronik	VULB 9168	EMC2238	2025-03-24	2027-03-23
Coaxial Cable	Mirco-COAX UTIFLEX ve	LA2-C125-8000	EMC2239	2025-11-25	2026-11-24
Test Software E3	Audix	Ver.6.191211	GZE100-81	N/A	N/A
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2024-04-16	2026-04-15

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	2025-03-22	2028-03-21
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2229	2025-11-18	2026-11-17
Amplifier(9k-1000MHz)	SONOMA	310	EMC2237	2025-11-25	2026-11-24
Trilog Broadband Antenna (25MHz-2GHz)	Schwarzbeck Mess-Elektronik	VULB 9168	EMC2238	2025-03-24	2027-03-23
Coaxial Cable	Mirco-COAX UTIFLEX ve	LA2-C125-8000	EMC2239	2025-11-25	2026-11-24
Test Software E3	Audix	Ver.6.191211	GZE100-81	N/A	N/A
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2024-04-16	2026-04-15



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Radiated Spurious Emissions Above 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
1-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2025-08-11	2026-08-10
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2025-08-11	2026-08-10
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2024-08-19	2026-08-18
Horn Antenna (1-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2025-05-13	2027-05-12
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2025-08-12	2026-08-11
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2025-08-11	2026-08-10
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2023-12-23	2026-12-22
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	EMC2136	2025-11-02	2026-11-01
4X4 Power sensor Unit	TST	TSPS2023R	EMC2257	2025-08-12	2026-08-11
Test Software	TST	V2.0	GZE100-82	N/A	N/A
EXA Signal Analyzer	Agilent Technologies	N9010A	EMC2222	2025-11-25	2026-11-24

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2025-06-03	2026-06-02



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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 6 dBi.

Antenna location: Refer to internal photo.

6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

6.2.2 Conclusion

Frequency-Hopping Spread Spectrum (FHSS) is a wireless communication technology that transmits signals by rapidly switching among multiple frequencies to enhance anti-interference capability and communication security. In RFID systems, FHSS can effectively reduce interference and improve reading efficiency as well as the reliability of data transmission.

1. Basic Principle of Frequency-Hopping Technology

The basic principle of frequency-hopping technology is that the transmitting and receiving ends synchronously hop among a predetermined sequence of frequencies. Specifically, a frequency-hopping controller generates a pseudo-random sequence that controls the carrier frequency to hop according to this sequence. In this way, signals are transmitted on different frequencies, avoiding prolonged stays on a single frequency and thus reducing the likelihood of interference.

2. Implementation Steps of Frequency-Hopping Technology in RFID

3. Frequency Selection: First, determine a set of available frequencies that will be used for frequency hopping. Typically, these frequencies are located in the Industrial, Scientific and Medical (ISM) bands, such as the 902 MHz to 928 MHz range.

4. Frequency-Hopping Sequence Generation: Use a pseudo-random number generator (PRNG) to generate a frequency-hopping sequence that determines the order of frequency hopping.

5. Synchronization Mechanism: Ensure that the transmitting and receiving ends synchronously hop according to the same frequency-hopping sequence. This can be achieved through pre-shared keys or synchronization signals.

6. Frequency Switching: During communication, rapidly switch among different frequencies according to the frequency-hopping sequence. The time spent on each frequency is called the "dwell time," which is usually a few milliseconds.

7. Advantages and Limitations of Frequency-Hopping Technology

Advantages:

- Strong Anti-interference Capability: Frequency hopping can effectively avoid narrowband interference and multipath interference.
- Improved Communication Security: Frequency-hopping signals are difficult to intercept and decode, enhancing the privacy of communication.

Limitations:

- Complex Implementation: It requires precise synchronization mechanisms and rapid frequency-switching capabilities.
- Reduced Efficiency: Frequency switching may lead to a decrease in transmission efficiency, especially in high data rate applications.

In conclusion, the application of frequency-hopping technology in RFID systems can significantly improve the system's anti-interference capability and communication security, but it also requires overcoming challenges such as implementation complexity and reduced efficiency.



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 (2020) Section 6.2

Test Engineer: Sunny Yang

Limit:

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

7.1.1 E.U.T. Operation

Operating Environment:

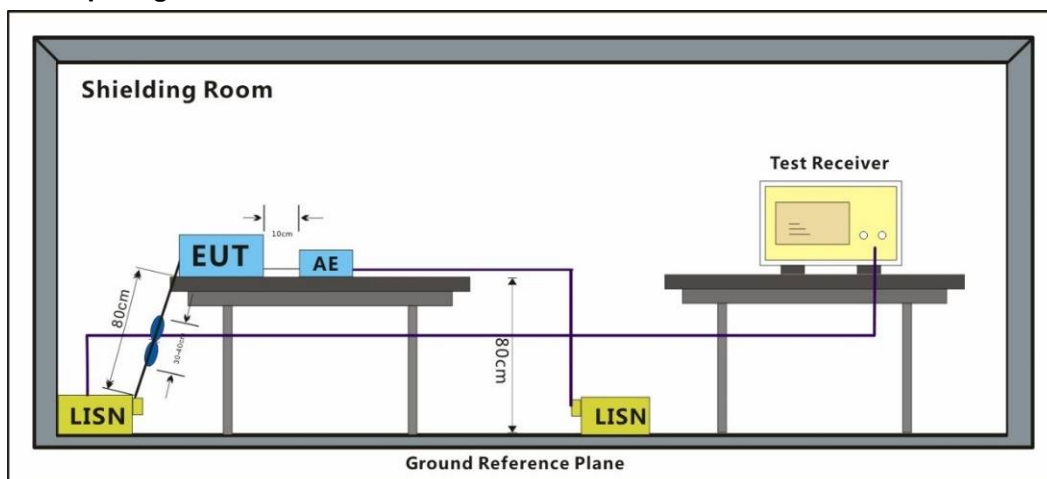
Temperature: 24.1 °C Humidity: 52.4 % RH Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 05	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with ASK modulation.



7.1.3 Test Setup Diagram

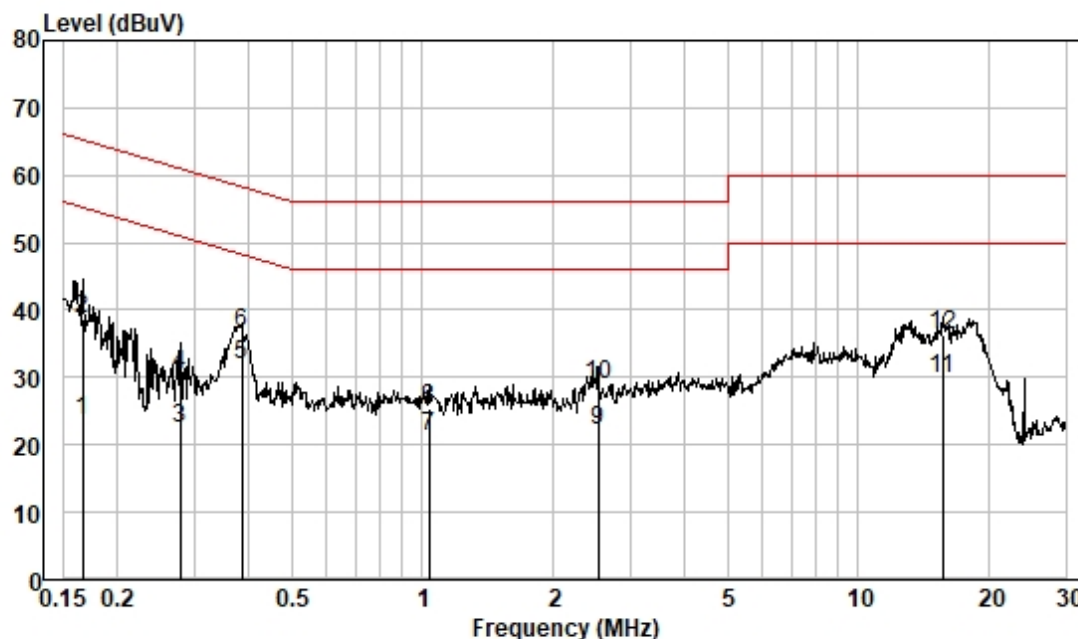


7.1.4 Measurement Procedure and Data

- 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

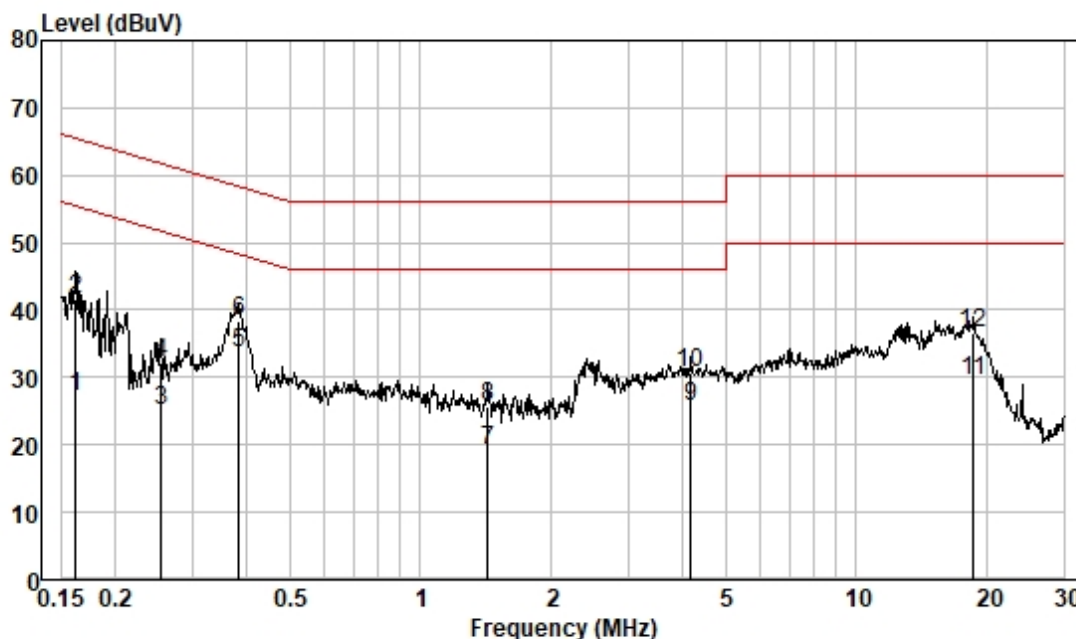
Test Mode: 05; Line: Live line



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	0.166	13.99	0.04	9.55	23.58	55.16	-31.58	Average
2	0.166	29.07	0.04	9.55	38.66	65.16	-26.50	QP
3	0.277	12.82	0.04	9.56	22.42	50.90	-28.48	Average
4	0.277	20.70	0.04	9.56	30.30	60.90	-30.60	QP
5	0.385	22.38	0.05	9.55	31.98	48.17	-16.19	Average
6	0.385	27.02	0.05	9.55	36.62	58.17	-21.55	QP
7	1.037	11.58	0.07	9.54	21.19	46.00	-24.81	Average
8	1.037	15.86	0.07	9.54	25.47	56.00	-30.53	QP
9	2.527	12.38	0.14	9.54	22.06	46.00	-23.94	Average
10	2.527	19.31	0.14	9.54	28.99	56.00	-27.01	QP
11	15.635	19.49	0.34	9.85	29.68	50.00	-20.32	Average
12	15.635	26.15	0.34	9.85	36.34	60.00	-23.66	QP

Test Mode: 05; 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	0.162	17.65	0.04	9.53	27.22	55.38	-28.16	Average
2	0.162	32.19	0.04	9.53	41.76	65.38	-23.62	QP
3	0.255	15.52	0.04	9.53	25.09	51.60	-26.51	Average
4	0.255	22.48	0.04	9.53	32.05	61.60	-29.55	QP
5	0.383	23.99	0.05	9.53	33.57	48.21	-14.64	Average
6	0.383	28.69	0.05	9.53	38.27	58.21	-19.94	QP
7	1.426	9.50	0.10	9.54	19.14	46.00	-26.86	Average
8	1.426	16.14	0.10	9.54	25.78	56.00	-30.22	QP
9	4.180	15.93	0.18	9.60	25.71	46.00	-20.29	Average
10	4.180	20.85	0.18	9.60	30.63	56.00	-25.37	QP
11	18.524	19.37	0.37	9.90	29.64	50.00	-20.36	Average
12	18.524	26.44	0.37	9.90	36.71	60.00	-23.29	QP



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 (2020) Section 6.10.5 & 7.8.8
 Test Engineer: Jarry Li
 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

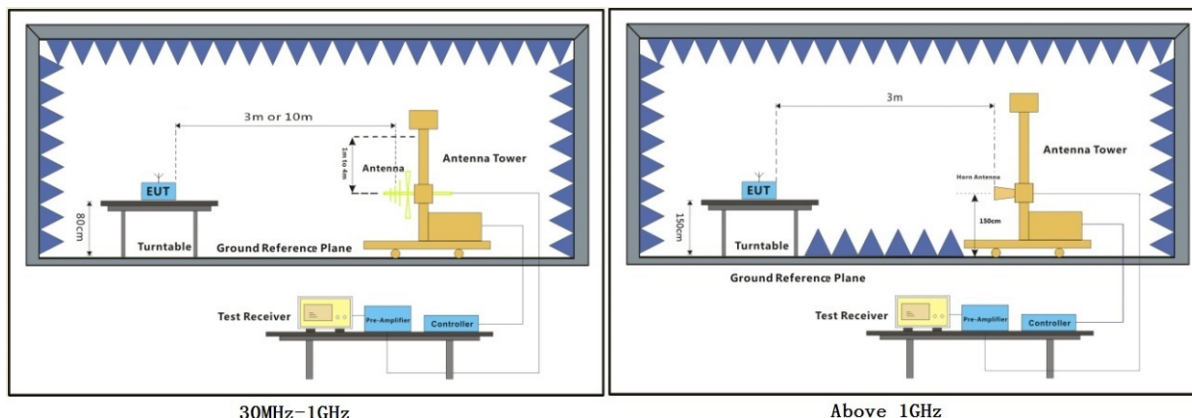
Operating Environment:
 Temperature: 25.0 °C Humidity: 55.4 % RH Atmospheric Pressure: 1024 mbar

7.2.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 05	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with ASK modulation.



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 middle channel, the Highest channel.
- The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- Repeat above procedures until all frequencies measured was complete.

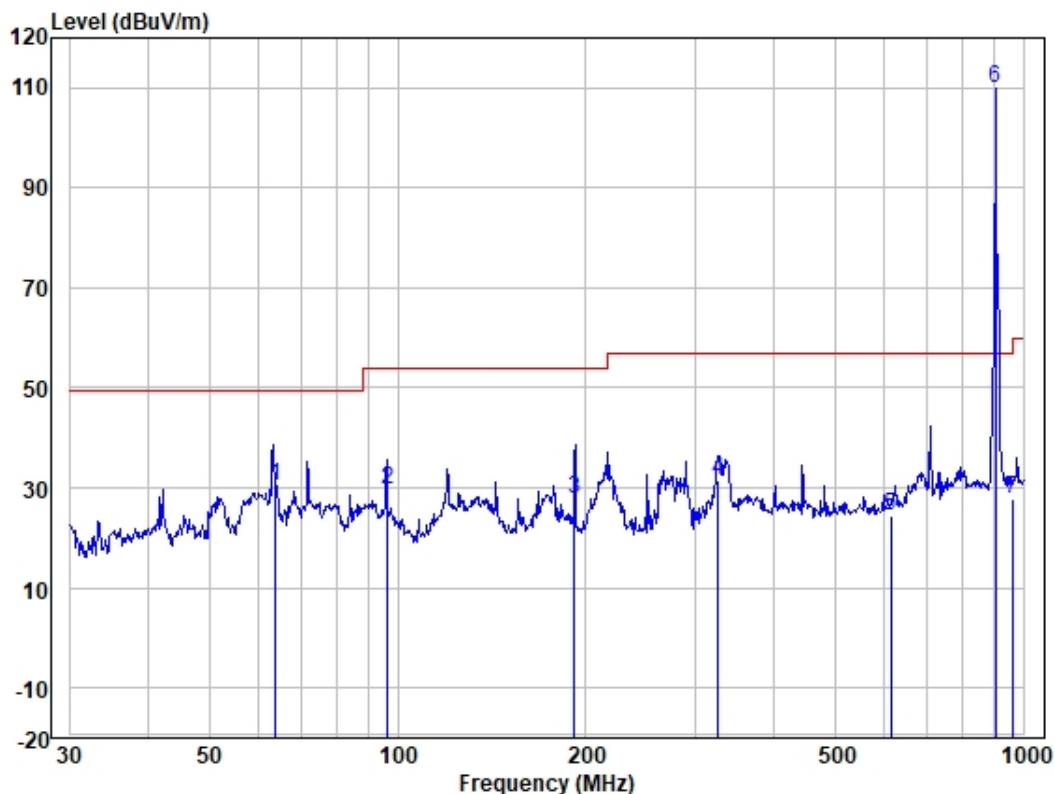
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

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

Remark 3: Point 6th was the fundamental frequency of the EUT, please refer to section 7.5 for details.



Test Mode: 00; Polarity: Horizontal

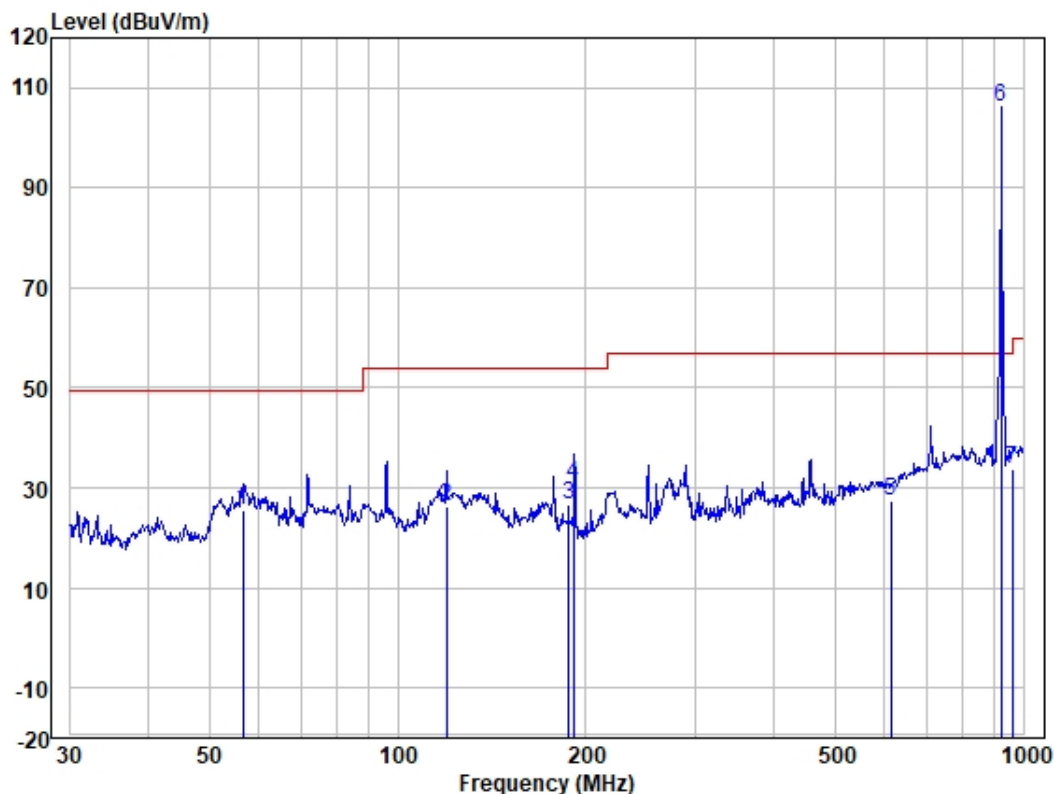


Site : 966 Chamber
Job :
Model :
Power :
Test Mode : 902mhz

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	63.812	44.47	18.37	0.43	32.77	30.50	49.54	-19.04	HORIZONTAL	QP
2	96.410	47.70	14.11	0.53	32.70	29.64	53.98	-24.34	HORIZONTAL	QP
3	191.815	43.64	16.17	0.78	32.81	27.78	53.98	-26.20	HORIZONTAL	QP
4	324.824	43.28	19.99	1.01	32.87	31.41	56.90	-25.49	HORIZONTAL	QP
5	614.000	29.83	25.88	1.44	32.64	24.51	56.90	-32.39	HORIZONTAL	QP
6	903.114	110.06	29.00	1.76	31.07	109.75	56.90	52.85	HORIZONTAL	Peak
7	960.000	26.75	30.12	1.82	30.73	27.96	56.90	-28.94	HORIZONTAL	QP



Test Mode: 00; Polarity: Horizontal

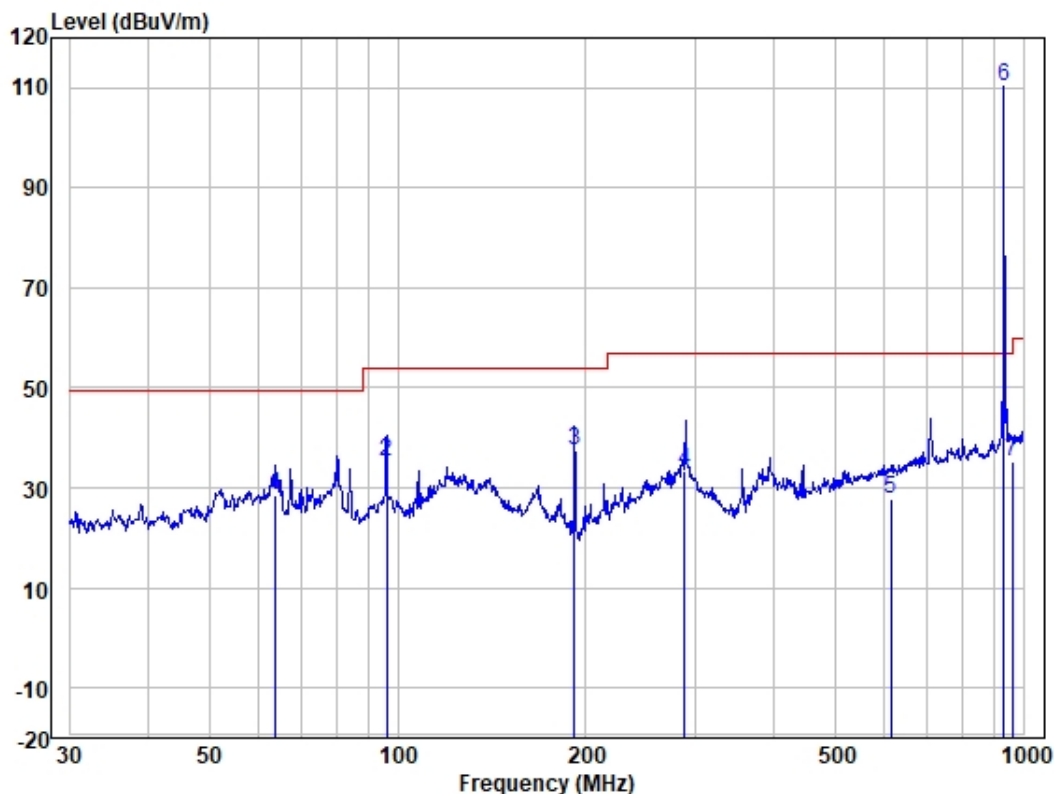


Site : 966 Chamber
Job :
Model :
Power :
Test Mode : 918mhz

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	56.710	38.82	19.17	0.40	32.78	25.61	49.54	-23.93	HORIZONTAL	QP
2	119.842	41.43	16.94	0.60	32.71	26.26	53.98	-27.72	HORIZONTAL	QP
3	187.452	42.16	16.55	0.76	32.80	26.67	53.98	-27.31	HORIZONTAL	QP
4	190.987	46.56	16.23	0.77	32.81	30.75	53.98	-23.23	HORIZONTAL	QP
5	614.000	32.75	25.88	1.44	32.64	27.43	56.90	-29.47	HORIZONTAL	QP
6	919.284	105.76	29.57	1.77	30.91	106.19	56.90	49.29	HORIZONTAL	Peak
7	960.000	32.68	30.12	1.82	30.73	33.89	56.90	-23.01	HORIZONTAL	QP



Test Mode: 00; Polarity: Horizontal

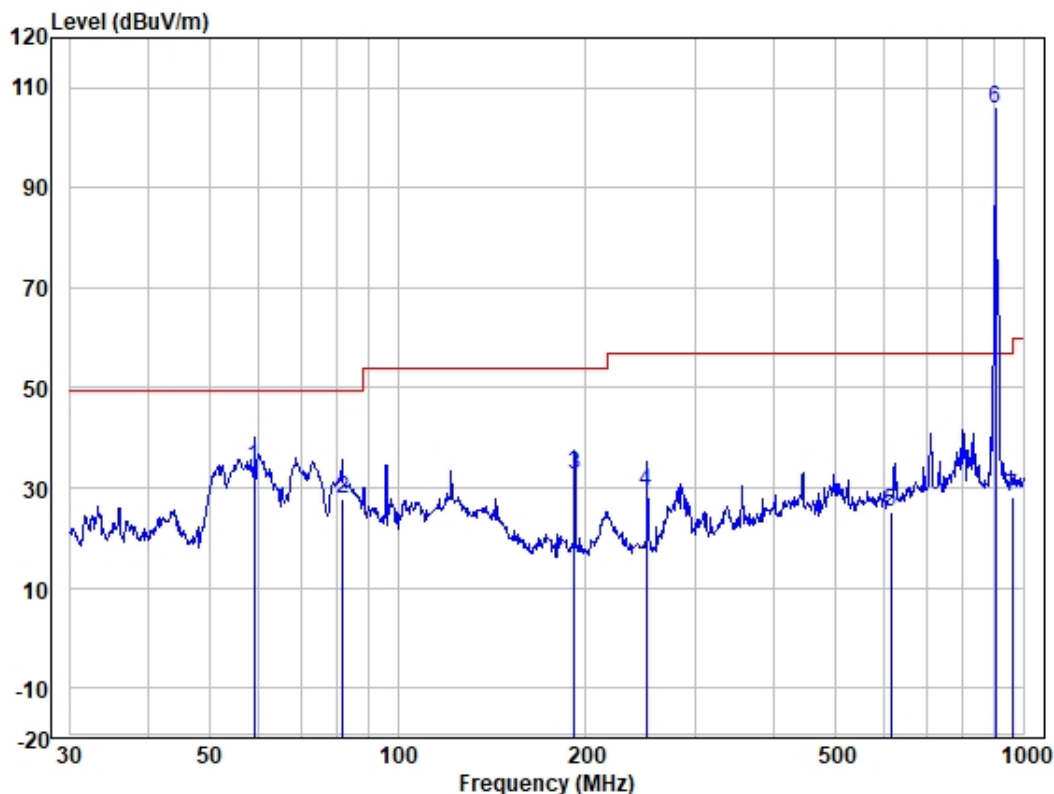


Site : 966 Chamber
Job :
Model :
Power :
Test Mode : 927mhz

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	63.851	40.86	18.37	0.44	31.16	28.51	49.54	-21.03	HORIZONTAL	QP
2	96.121	52.06	14.11	0.65	31.39	35.43	53.98	-18.55	HORIZONTAL	QP
3	191.487	51.69	16.23	0.92	31.50	37.34	53.98	-16.64	HORIZONTAL	QP
4	287.452	44.78	18.94	1.21	31.50	33.43	56.90	-23.47	HORIZONTAL	QP
5	614.000	31.46	25.88	1.88	31.37	27.85	56.90	-29.05	HORIZONTAL	QP
6	929.121	108.17	29.77	2.23	29.80	110.37	56.90	53.47	HORIZONTAL	Peak
7	960.000	32.47	30.12	2.34	29.63	35.30	56.90	-21.60	HORIZONTAL	QP



Test Mode: 00; Polarity: Vertical

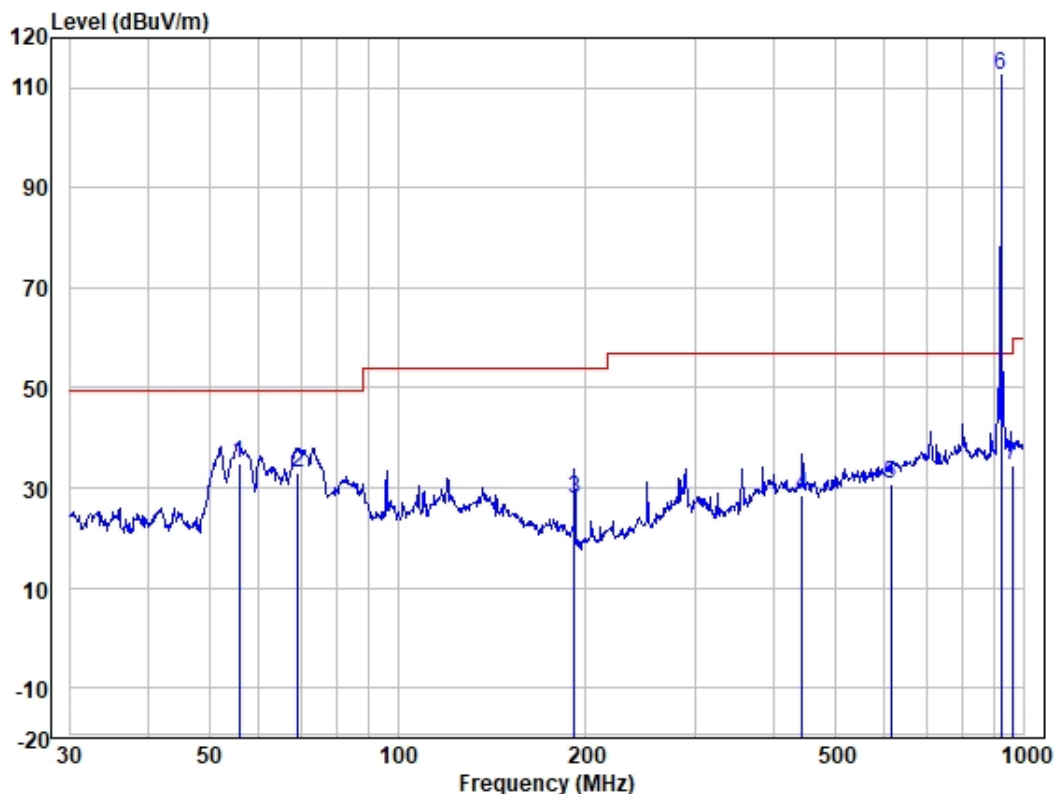


Site : 966 Chamber
Job :
Model :
Power :
Test Mode : 902mhz

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	59.124	47.52	19.00	0.41	32.78	34.15	49.54	-15.39	VERTICAL	QP
2	81.785	45.26	14.72	0.50	32.73	27.75	49.54	-21.79	VERTICAL	QP
3	191.842	48.50	16.17	0.78	32.81	32.64	53.98	-21.34	VERTICAL	QP
4	250.045	43.49	17.61	0.88	32.84	29.14	56.90	-27.76	VERTICAL	QP
5	614.000	30.37	25.88	1.44	32.64	25.05	56.90	-31.85	VERTICAL	QP
6	903.114	106.07	29.00	1.76	31.07	105.76	56.90	48.86	VERTICAL	Peak
7	960.000	27.11	30.12	1.82	30.73	28.32	56.90	-28.58	VERTICAL	QP



Test Mode: 00; Polarity: Vertical

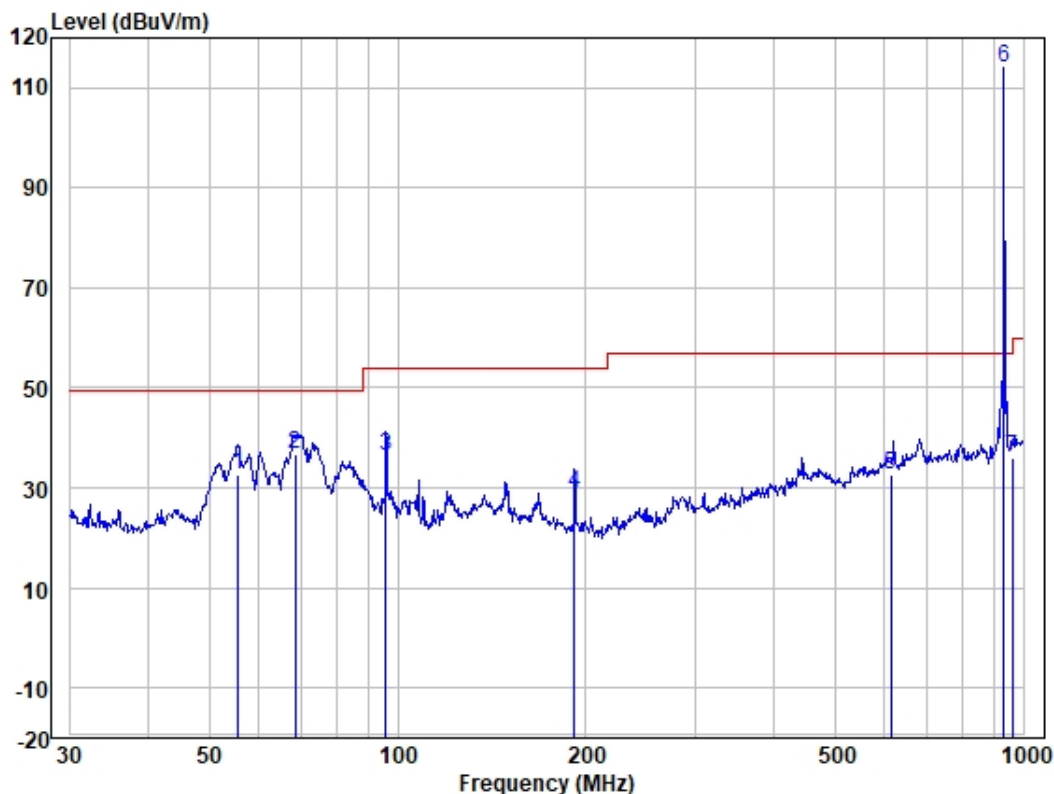


Site : 966 Chamber
Job :
Model :
Power :
Test Mode : 918mhz

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	55.805	46.30	19.30	0.38	31.12	34.86	49.54	-14.68	VERTICAL	QP
2	69.357	46.22	17.37	0.47	31.19	32.87	49.54	-16.67	VERTICAL	QP
3	191.745	42.22	16.17	0.92	31.50	27.81	53.98	-26.17	VERTICAL	QP
4	443.294	35.96	22.60	1.52	31.50	28.58	56.90	-28.32	VERTICAL	QP
5	614.000	34.48	25.88	1.88	31.37	30.87	56.90	-26.03	VERTICAL	QP
6	919.284	110.83	29.57	2.21	29.89	112.72	56.90	55.82	VERTICAL	Peak
7	960.000	31.70	30.12	2.34	29.63	34.53	56.90	-22.37	VERTICAL	QP



Test Mode: 00; Polarity: Vertical



Site : 966 Chamber
Job :
Model :
Power :
Test Mode : 927mhz

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	55.741	43.94	19.30	0.38	31.12	32.50	49.54	-17.04	VERTICAL	QP
2	68.745	49.79	17.50	0.47	31.19	36.57	49.54	-12.97	VERTICAL	QP
3	95.713	52.88	14.11	0.65	31.39	36.25	53.98	-17.73	VERTICAL	QP
4	191.642	43.30	16.17	0.92	31.50	28.89	53.98	-25.09	VERTICAL	QP
5	614.000	36.07	25.88	1.88	31.37	32.46	56.90	-24.44	VERTICAL	QP
6	929.121	111.94	29.77	2.23	29.80	114.14	56.90	57.24	VERTICAL	Peak
7	960.000	32.99	30.12	2.34	29.63	35.82	56.90	-21.08	VERTICAL	QP



7.3 Radiated Spurious Emissions Below 1GHz

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

Test Method: ANSI C63.10 (2020) Section 6.4,6.5

Test Engineer: Jarry Li

Test Distance: 3m

Limit:

Frequency (MHz)	Field strength(microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
960-1000	500	3

Note

1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

2. At frequencies below 1GHz, measurements may be performed at a distance different to specified in the regulations.

Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor+ Aux Factor (if applicable)

The aux factor needs to be added when measurements are performed at a distance other than the limit distance provided.

EX. Below 30MHz, Aux Factor = 40 dB/decade of distance, the aux factor is $40\log(3/300) = -80\text{dB}$ (for 3m test distance).

EX. Above 30MHz, Aux Factor = 20 dB/decade of distance, the aux factor is $20\log(10/3) = 10.46\text{dB}$ (for 10m test distance).

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C

Humidity: 55.4 % RH

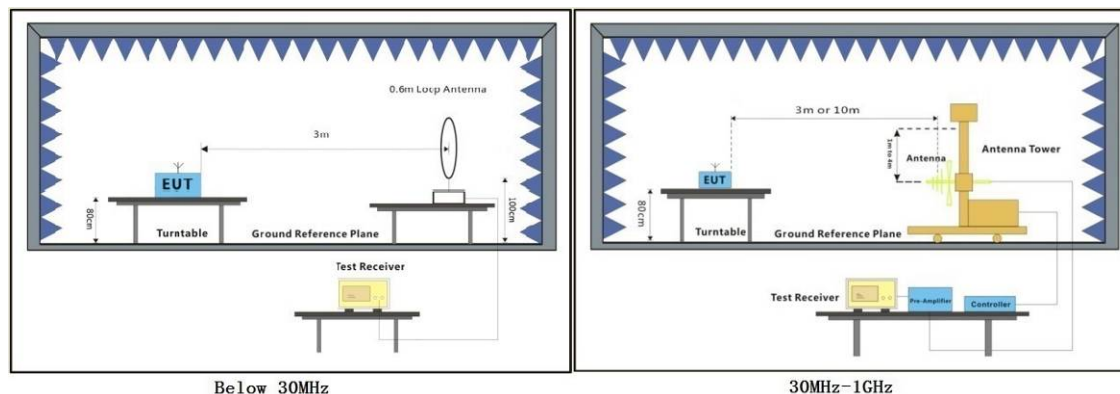
Atmospheric Pressure: 1024 mbar

7.3.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 05	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with ASK modulation.



7.3.3 Test Setup Diagram



7.3.4 Measurement Procedure and Data

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

Remark:

- 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 below points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- The disturbance below 1GHz was very low and the harmonics were the highest point could be found when testing, so only the worst-case test curve is displayed.

Please refer to section 7.2.4 for test data.



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7.4 Radiated Spurious Emissions Above 1GHz

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

Test Method: ANSI C63.10 (2020) Section 6.6 & 7.8.8

Test Engineer: Lin Liao

Limit:

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

Note:

At Above 18GHz, measurements may be performed at a distance shorter than that specified in the regulations

Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor+ Aux Factor (if applicable)

The aux factor needs to be added when measurements are performed at a distance other than the limit distance provided.

EX. Above 18GHz, Aux Factor = 20 dB/decade of distance, the aux factor is $20\log(1/3) = -9.54\text{dB}$ (for 1m test distance).

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 24.1 °C

Humidity: 52.4 % RH

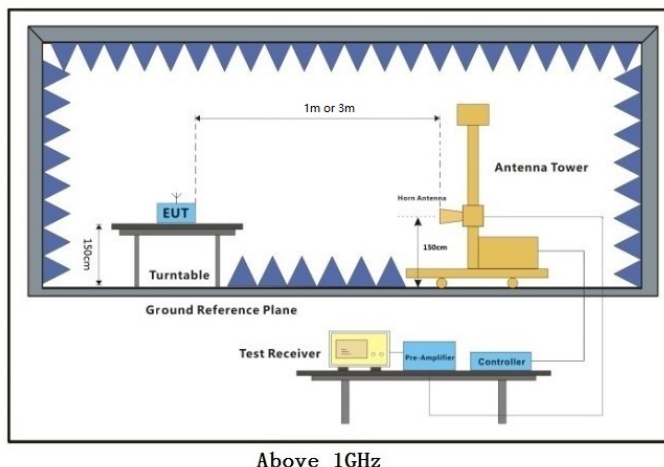
Atmospheric Pressure: 1020 mbar

7.4.2 Test Mode Description

Pre-scan / Mode
Final test Code Description

Final test 05 TX_non-Hop mode_Keep the EUT in continuously transmitting mode with ASK modulation.

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 1.5m above the ground at a 3m fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3m away from the interference-receiving antenna from 1GHz to 18GHz, and 1m away from the interference-receiving antenna above 18GHz.
- b. The interference-receiving antenna was mounted on the variable-height antenna tower, with its boresight facing the EUT throughout the test.
- c. The antenna height is varied from 1m to 4m 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 1m to 4m 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. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- g. 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.
- h. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Scan from 18GHz to 10th harmonic of the highest frequency or 40 GHz, whichever is lower.
2. 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.
3. For the frequency above 18GHz, testing had been executed under all test modes, only the worst-case test curve is displayed in the report.
4. For devices with multiple operating modes, measurements on the middle channel is used to determine the worst-case mode(s). Only the worst-case mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum) is recorded in the test report.



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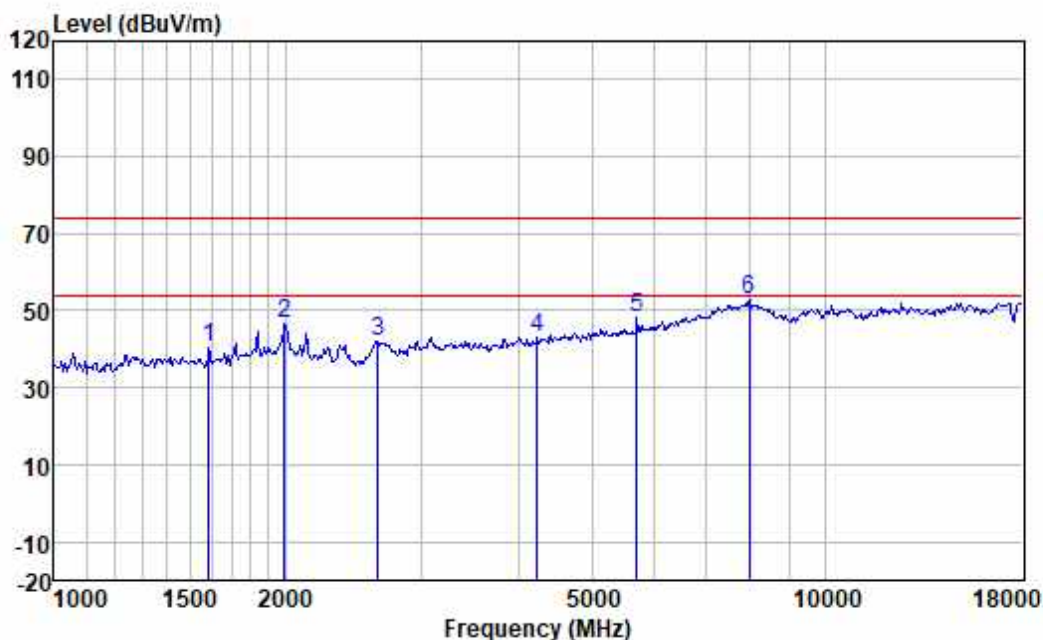
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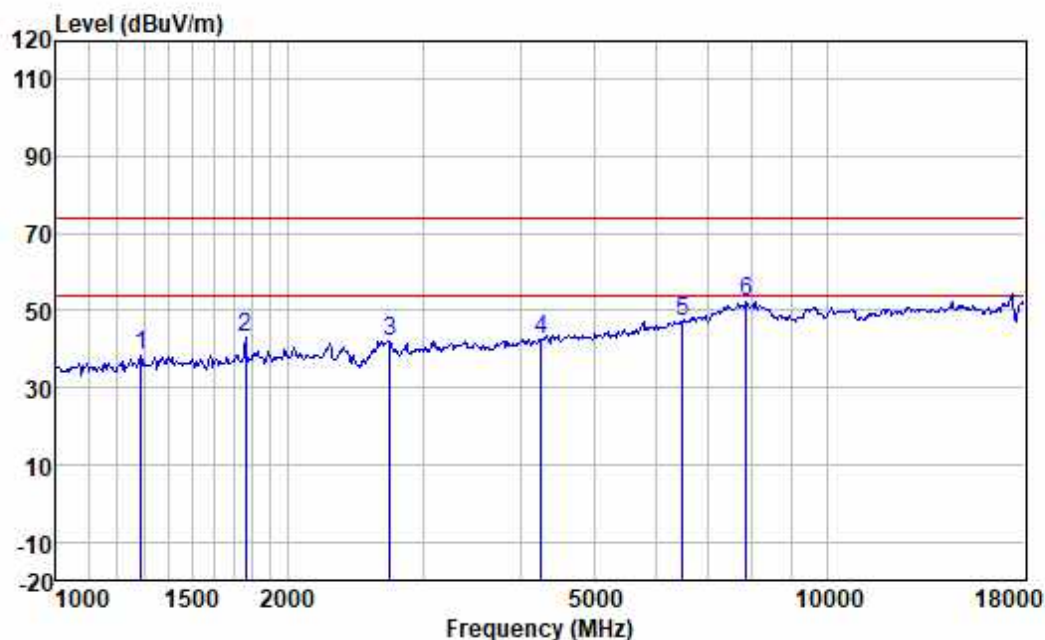
Test Mode: 05; Polarity: Vertical; Modulation: ASK; Channel: Low



	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1587.975	49.98	25.99	2.75	38.15	40.57	74.00	-33.43	VERTICAL	Peak
2	1989.550	54.74	26.64	3.12	37.81	46.69	74.00	-27.31	VERTICAL	Peak
3	2633.397	48.23	27.96	3.56	37.74	42.01	74.00	-31.99	VERTICAL	Peak
4	4230.396	45.61	30.42	4.55	37.48	43.10	74.00	-30.90	VERTICAL	Peak
5	5697.365	47.72	32.36	5.26	37.13	48.21	74.00	-25.79	VERTICAL	Peak
6	7989.893	46.68	37.23	6.20	37.20	52.91	74.00	-21.09	VERTICAL	Peak



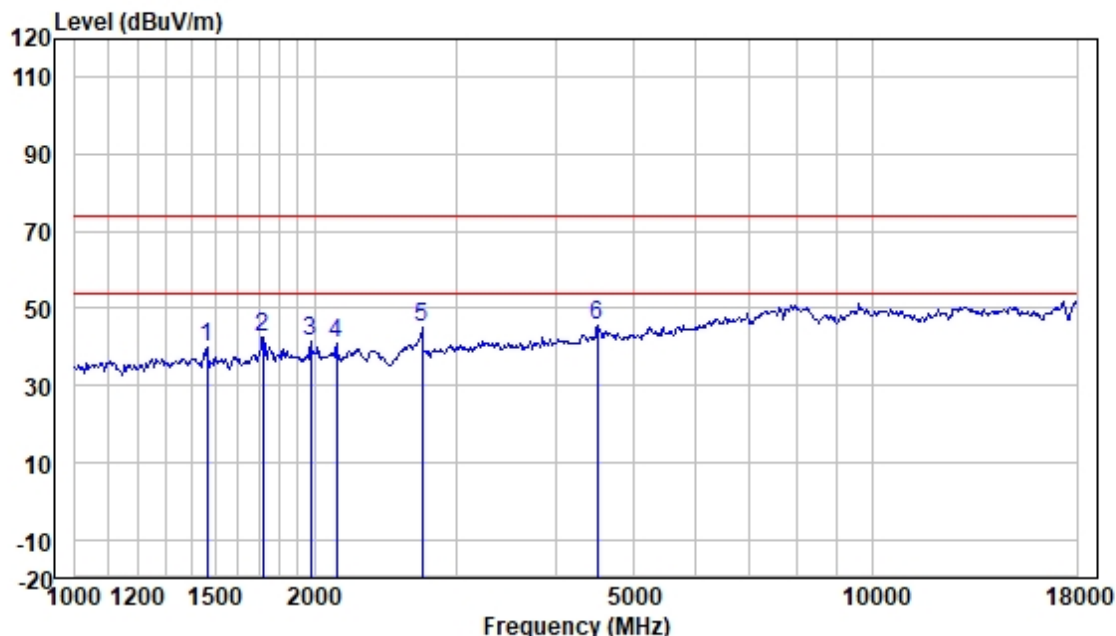
Test Mode: 05; Polarity: Horizontal; Modulation: ASK; Channel: Low



	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1289.627	48.63	25.56	2.58	38.60	38.17	74.00	-35.83	HORIZONTAL	Peak
2	1762.112	51.63	26.38	2.97	37.96	43.02	74.00	-30.98	HORIZONTAL	Peak
3	2710.622	48.00	28.14	3.62	37.73	42.03	74.00	-31.97	HORIZONTAL	Peak
4	4267.237	45.12	30.53	4.57	37.47	42.75	74.00	-31.25	HORIZONTAL	Peak
5	6507.536	44.65	34.18	5.65	37.11	47.37	74.00	-26.63	HORIZONTAL	Peak
6	7852.524	46.43	37.11	6.16	37.20	52.50	74.00	-21.50	HORIZONTAL	Peak



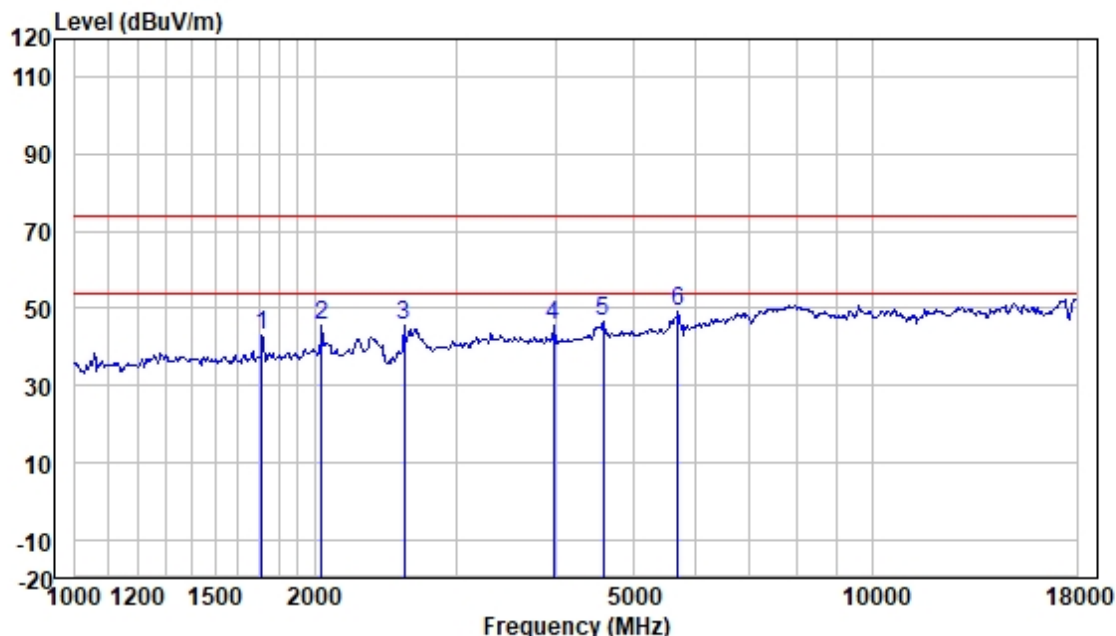
Test Mode: 05; Polarity: Vertical; Modulation: ASK; Channel: middle



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1464.52	49.86	25.88	2.69	38.39	40.04	74.00	-33.96	VERTICAL	Peak
2	1721.83	51.52	26.24	2.89	38.01	42.64	74.00	-31.36	VERTICAL	Peak
3	1978.08	49.47	26.64	3.11	37.81	41.41	74.00	-32.59	VERTICAL	Peak
4	2126.31	48.77	26.86	3.19	37.79	41.03	74.00	-32.97	VERTICAL	Peak
5	2726.34	50.92	28.20	3.64	37.72	45.04	74.00	-28.96	VERTICAL	Peak
6	4508.14	47.33	30.93	4.62	37.44	45.44	74.00	-28.56	VERTICAL	Peak



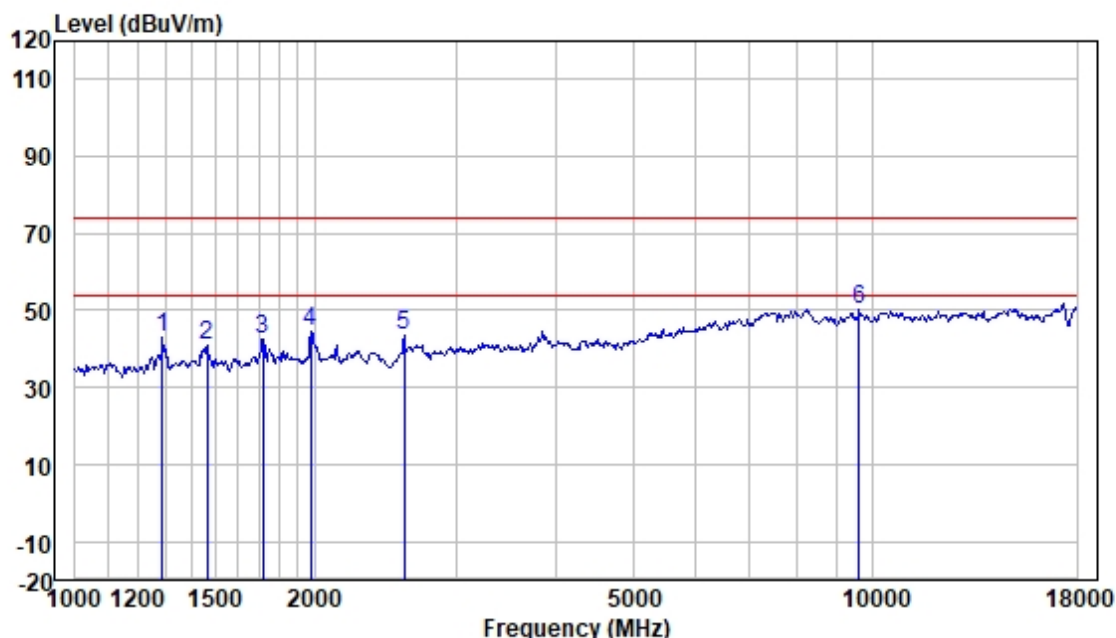
Test Mode: 05; Polarity: Horizontal; Modulation: ASK; Channel: middle



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1716.86	52.05	26.23	2.88	38.01	43.15	74.00	-30.85	HORIZONTAL	Peak
2	2036.09	53.58	26.70	3.14	37.80	45.62	74.00	-28.38	HORIZONTAL	Peak
3	2588.12	51.97	27.88	3.53	37.75	45.63	74.00	-28.37	HORIZONTAL	Peak
4	3981.26	48.66	29.97	4.49	37.50	45.62	74.00	-28.38	HORIZONTAL	Peak
5	4587.00	48.31	31.03	4.66	37.43	46.57	74.00	-27.43	HORIZONTAL	Peak
6	5697.37	48.49	32.36	5.26	37.13	48.98	74.00	-25.02	HORIZONTAL	Peak



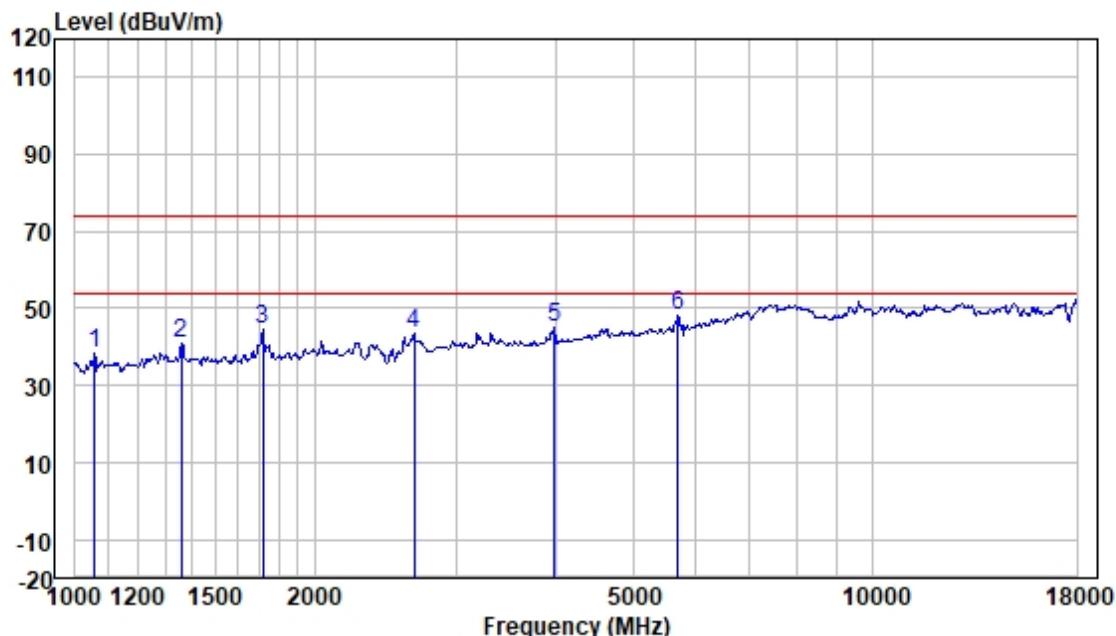
Test Mode: 05; Polarity: Vertical; Modulation: ASK; Channel: High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1289.63	53.27	25.56	2.58	38.60	42.81	74.00	-31.19	VERTICAL	Peak
2	1464.52	50.86	25.88	2.69	38.39	41.04	74.00	-32.96	VERTICAL	Peak
3	1721.83	51.52	26.24	2.89	38.01	42.64	74.00	-31.36	VERTICAL	Peak
4	1978.08	52.47	26.64	3.11	37.81	44.41	74.00	-29.59	VERTICAL	Peak
5	2588.12	50.02	27.88	3.53	37.75	43.68	74.00	-30.32	VERTICAL	Peak
6	9585.68	46.21	38.67	7.03	41.85	50.06	74.00	-23.94	VERTICAL	Peak



Test Mode: 05; Polarity: Horizontal; Modulation: ASK; Channel: High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1059.51	50.35	24.63	2.24	38.76	38.46	74.00	-35.54	HORIZONTAL	Peak
2	1362.43	51.35	25.73	2.64	38.53	41.19	74.00	-32.81	HORIZONTAL	Peak
3	1721.83	53.46	26.24	2.89	38.01	44.58	74.00	-29.42	HORIZONTAL	Peak
4	2664.02	49.46	28.02	3.58	37.74	43.32	74.00	-30.68	HORIZONTAL	Peak
5	3992.78	48.33	29.99	4.49	37.50	45.31	74.00	-28.69	HORIZONTAL	Peak
6	5697.37	47.49	32.36	5.26	37.13	47.98	74.00	-26.02	HORIZONTAL	Peak

7.5 Maximum Conducted Output Power

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

Test Method: ANSI C63.10 (2020) Section 7.8.5

Test Engineer: Lily Kuang

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: 22.2 °C

Humidity: 42.3 % RH

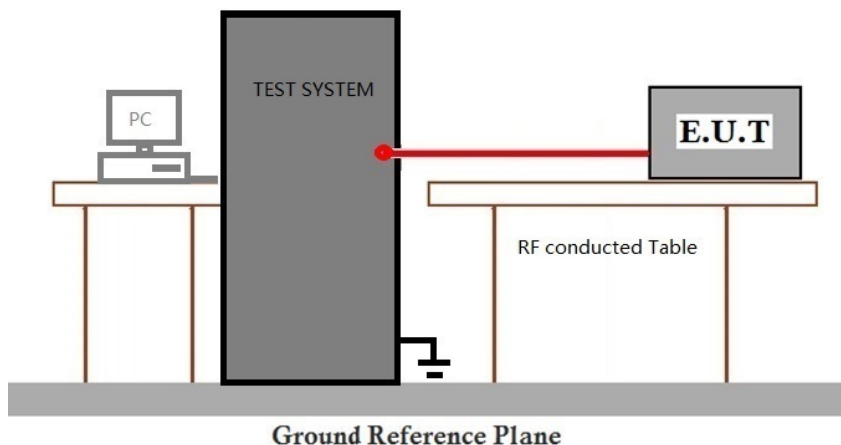
Atmospheric Pressure: 1024 mbar

7.5.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 05	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with ASK modulation.



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

7.6 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)

Test Method: ANSI C63.10 (2020) Section 6.9.2

Test Engineer: Lily Kuang

Limit:

20 dB bandwidth of the hopping channel	Hopping frequencies	Average time of occupancy
less than 250 kHz	least 50 hopping frequencies	shall not be greater than 0.4 seconds within a 20 second period
250 kHz to 500kHz	least 25 hopping frequencies	shall not be greater than 0.4 seconds within a 10 second period.

7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 22.2 °C

Humidity: 42.3 % RH

Atmospheric Pressure: 1024 mbar

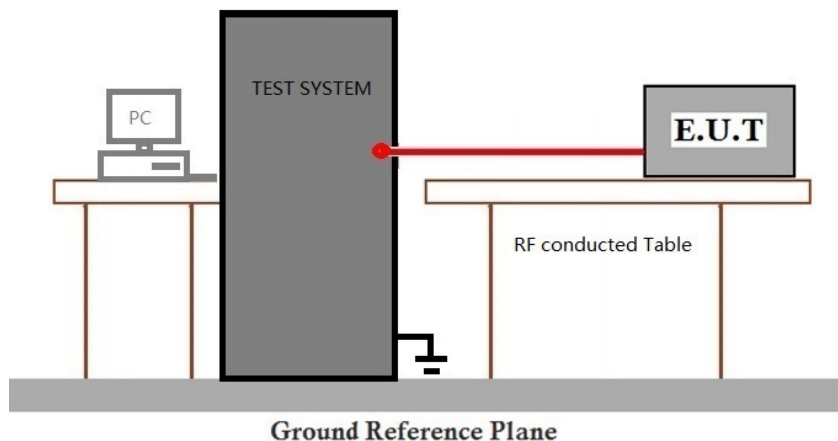
7.6.2 Test Mode Description

Pre-scan / Mode
Final test Code Description

Final test 05 TX_non-Hop mode_Keep the EUT in continuously transmitting mode with ASK modulation.



7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.7 Carrier Frequencies Separation

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)

Test Method: ANSI C63.10 (2020) Section 7.8.2

Test Engineer: Lily Kuang

Limit:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 22.2 °C

Humidity: 42.3 % RH

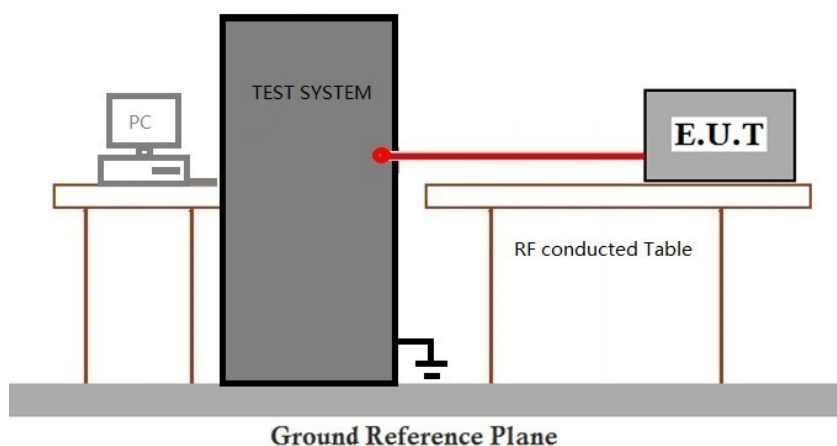
Atmospheric Pressure: 1024 mbar

7.7.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	

Final test	04	TX_Hop mode_Keep the EUT in frequency hopping mode with ASK modulation.
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7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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7.8 Hopping Channel Number

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(i)

Test Method: ANSI C63.10 (2020) Section 7.8.3

Test Engineer: Lily Kuang

Limit:

Frequency range(MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 22.2 °C

Humidity: 42.3 % RH

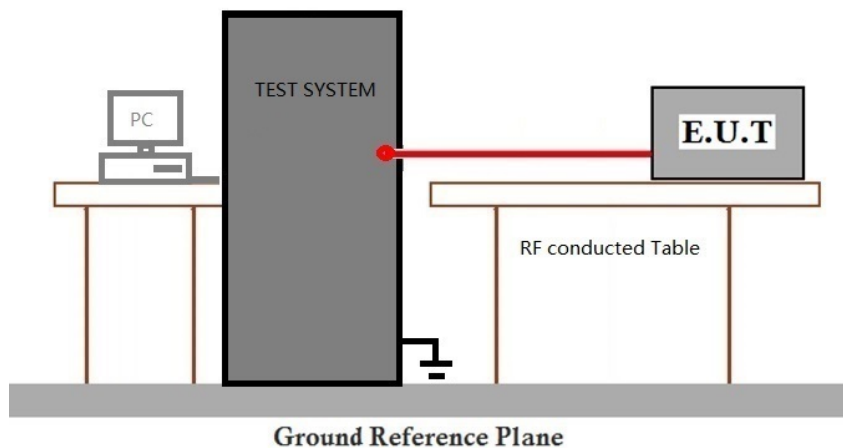
Atmospheric Pressure: 1024 mbar

7.8.2 Test Mode Description

Pre-scan / Mode
Final test Code Description

Final test 04 TX_Hop mode_Keep the EUT in frequency hopping mode with ASK modulation.

7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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7.9 Dwell Time

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(i)

Test Method: ANSI C63.10 (2020) Section 7.8.4

Test Engineer: Lily Kuang

Limit:

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 22.2 °C

Humidity: 42.3 % RH

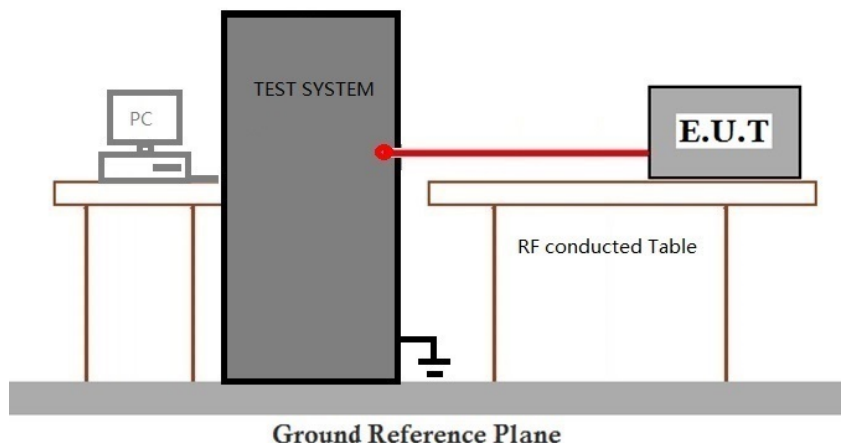
Atmospheric Pressure: 1024 mbar

7.9.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 04	TX_Hop mode_Keep the EUT in frequency hopping mode with ASK modulation.



7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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7.10 Conducted Band Edges Measurement

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

Test Method: ANSI C63.10 (2020) Section 7.8.7.2

Test Engineer: Lily Kuang

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)).

7.10.1 E.U.T. Operation

Operating Environment:

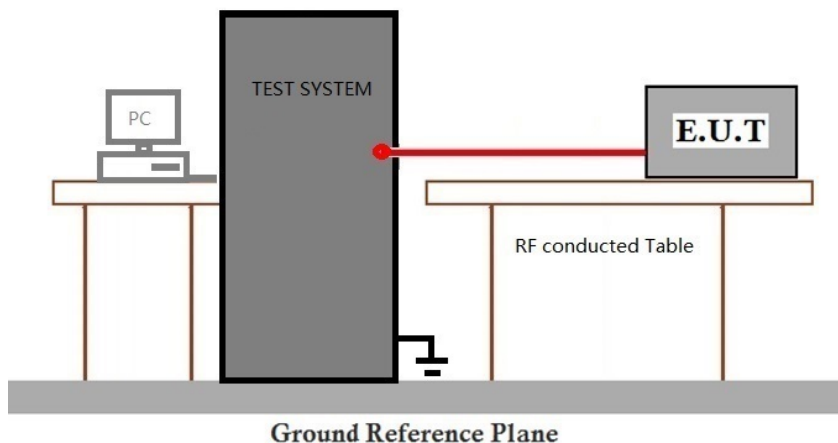
Temperature: 22.2 °C Humidity: 42.3 % RH Atmospheric Pressure: 1024 mbar

7.10.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	04	TX_Hop mode_Keep the EUT in frequency hopping mode with ASK modulation.
Final test	05	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with ASK modulation.



7.10.3 Test Setup Diagram



7.10.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.11 Conducted Spurious Emissions

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

Test Method: ANSI C63.10 (2020) Section 7.8.7

Test Engineer: Lily Kuang

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)).

7.11.1 E.U.T. Operation

Operating Environment:

Temperature: 22.2 °C

Humidity: 42.3 % RH

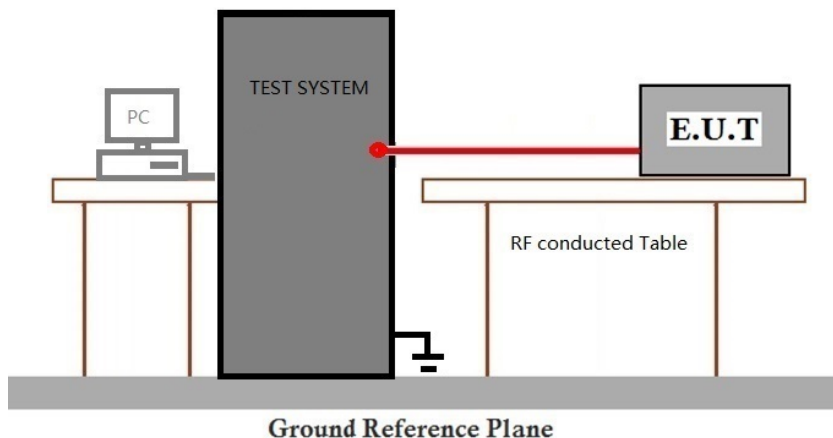
Atmospheric Pressure: 1024 mbar

7.11.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 05	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with ASK modulation.



7.11.3 Test Setup Diagram



7.11.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR251200192102



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9 EUT Constructional Details (EUT Photos)

Refer to External and Internal Photos for GZCR2512001921AT



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10 Appendix

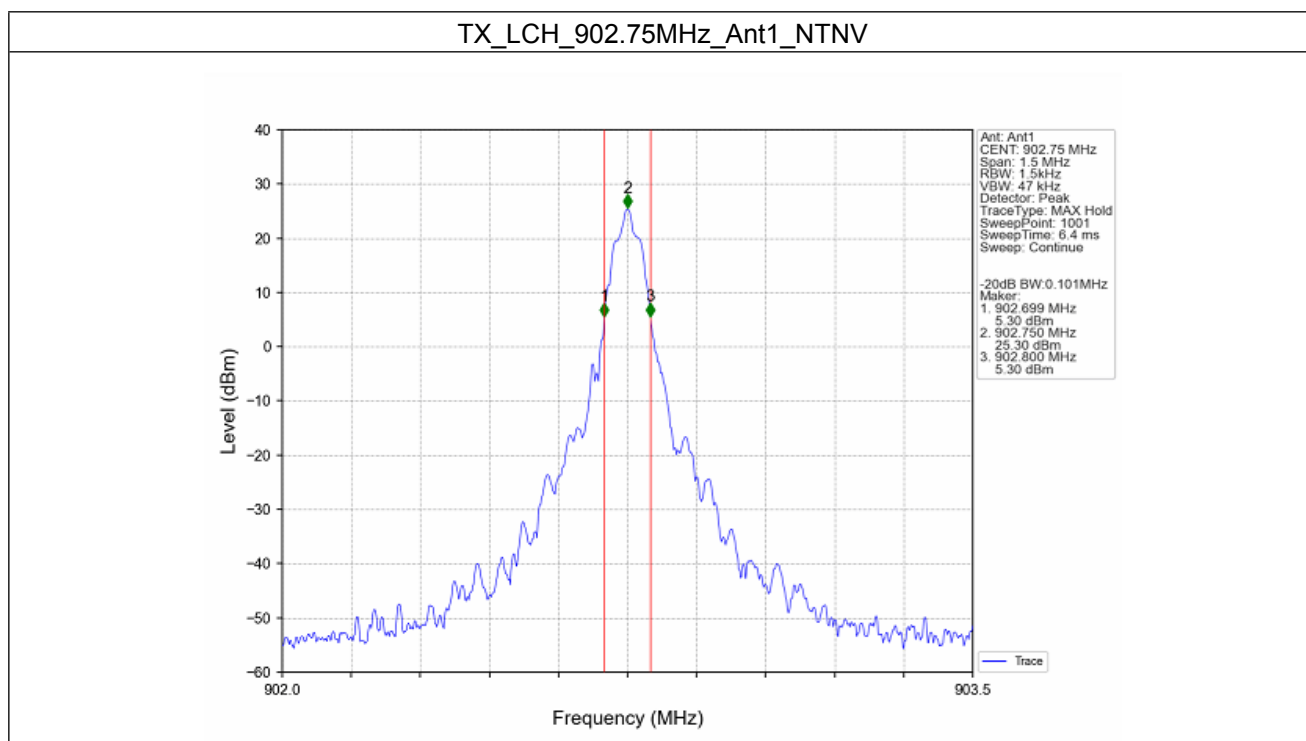
1. Bandwidth

1.1 Test Result

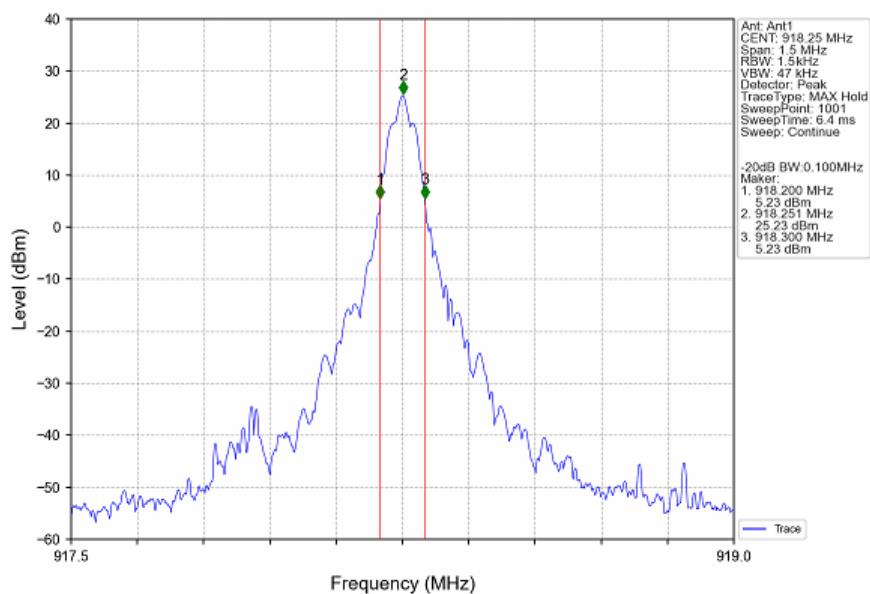
1.1.1 20dB BW

Mode	TX Type	Frequency (MHz)	ANT	20dB Bandwidth (MHz)		Verdict
				Result	Limit	
TX	SISO	902.75	1	0.101	/	Pass
		918.25	1	0.100	/	Pass
		927.25	1	0.101	/	Pass

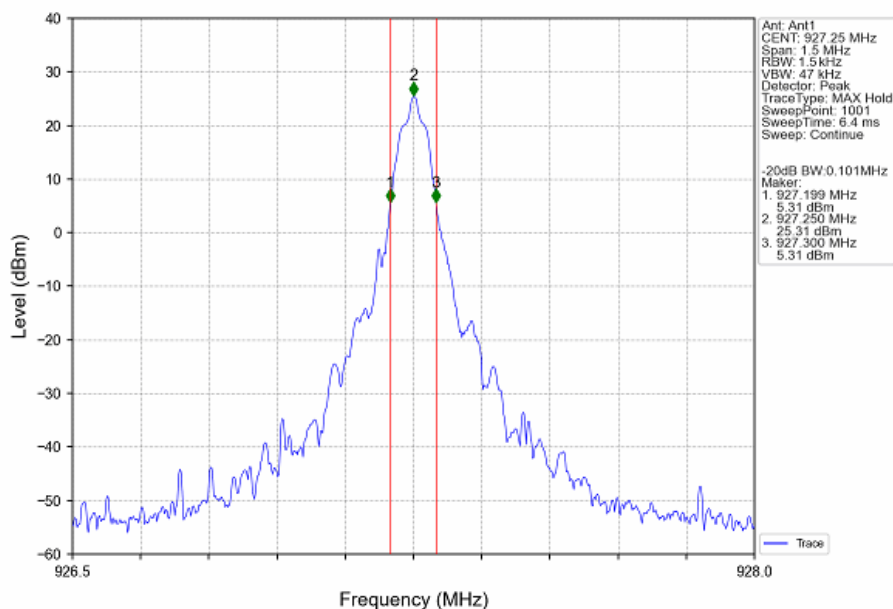
1.2.1 20dB BW



TX_MCH_918.25MHz_Ant1_NTNV



TX_HCH_927.25MHz_Ant1_NTNV



2. Maximum Conducted Output Power

2.1 Test Result

2.1.1 Power

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
TX	SISO	902.75	25.47	<=30	Pass
		918.25	25.35	<=30	Pass
		927.25	25.37	<=30	Pass



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3. Carrier Frequency Separation

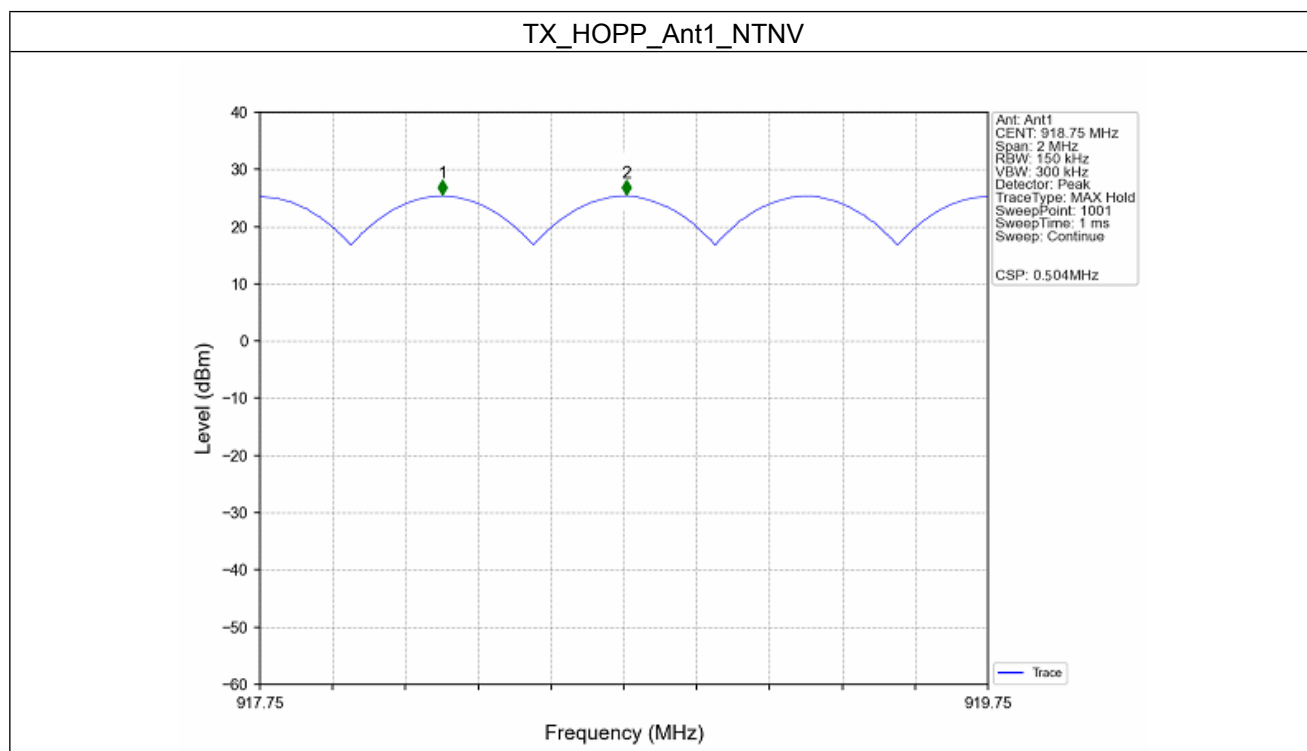
3.1 Test Result

3.1.1 Ant1

Ant1						
Mode	TX Type	Frequency (MHz)	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
TX	SISO	HOPP	0.504	0.101	≥ 0.101	Pass

3.2 Test Graph

3.2.1 Ant1



4. Number of Hopping Frequencies

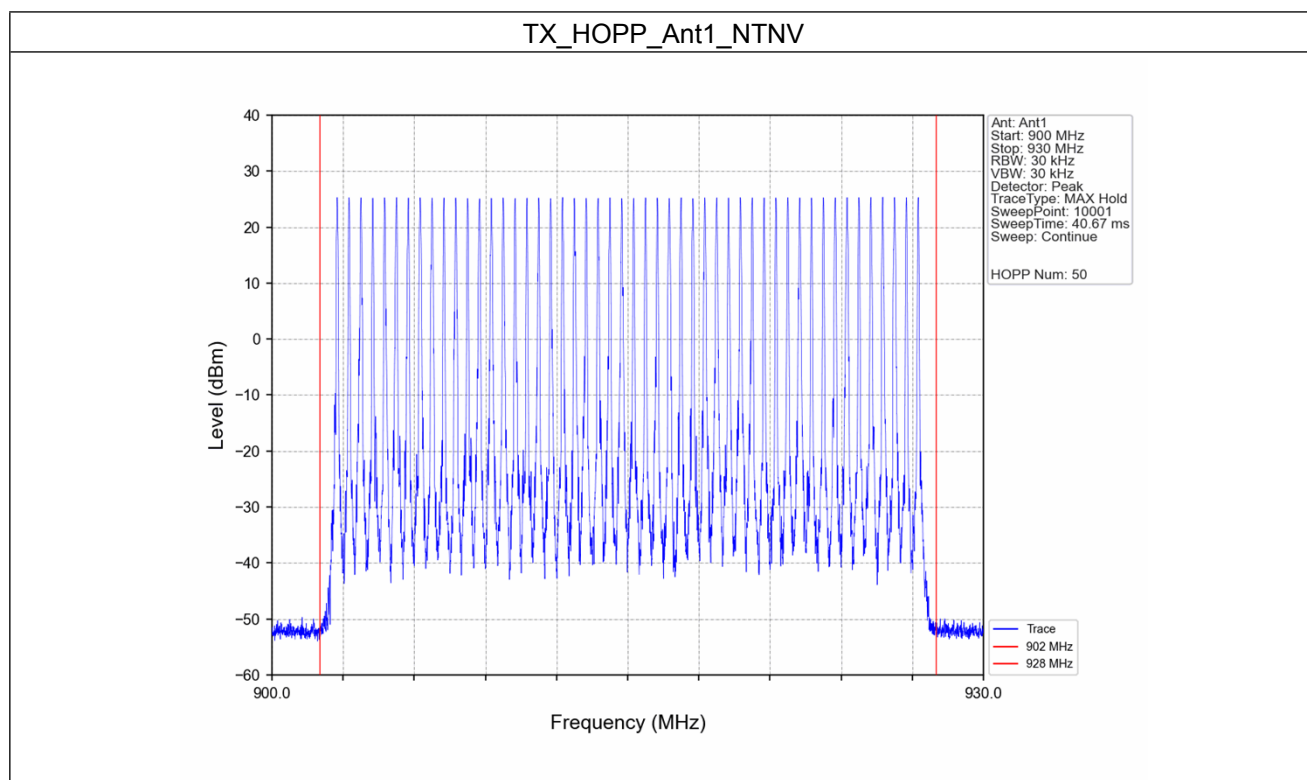
4.1 Test Result

4.1.1 HoppNum

Mode	TX Type	Frequency (MHz)	Num of Hopping Frequencies		Verdict
			ANT1	Limit	
TX	SISO	HOPP	50	>=50	Pass

4.2 Test Graph

4.2.1 HoppNum



5. Time of Occupancy (Dwell Time)

5.1 Test Result

5.1.1 Ant1

Ant1								
Mode	TX Type	Frequency (MHz)	Duration of Single Pulse (ms)	Observation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limit (ms)	Verdict
TX	SISO	HOPP	80.981	20.000	1	80.981	<=400	Pass

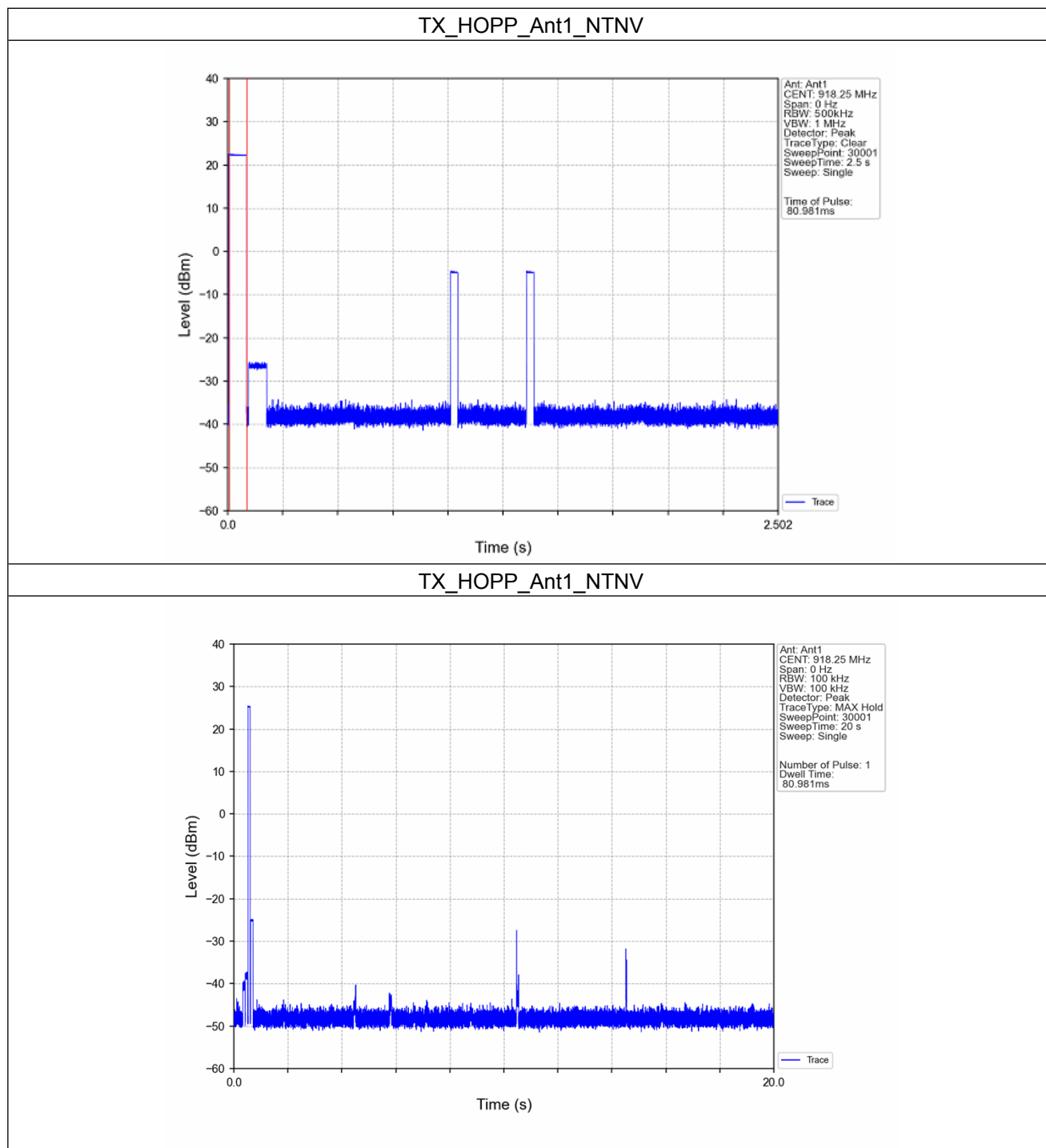


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5.2 Test Graph

5.2.1 Ant1



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6. Unwanted Emissions In Non-restricted Frequency Bands

6.1 Test Result

6.1.1 Ref

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
TX	SISO	902.75	1	25.40
		918.25	1	25.37
		927.25	1	25.40

Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2020, the channel contains the maximum PSD level was used to establish the reference level.

6.1.2 CSE and Band Edges

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
TX	SISO	902.75	1	25.40	5.40	Pass
		918.25	1	25.40	5.40	Pass
		927.25	1	25.40	5.40	Pass
		HOPP	1	25.40	5.40	Pass
				25.40	5.40	Pass

Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2020, the channel contains the maximum PSD level was used to establish the reference level.

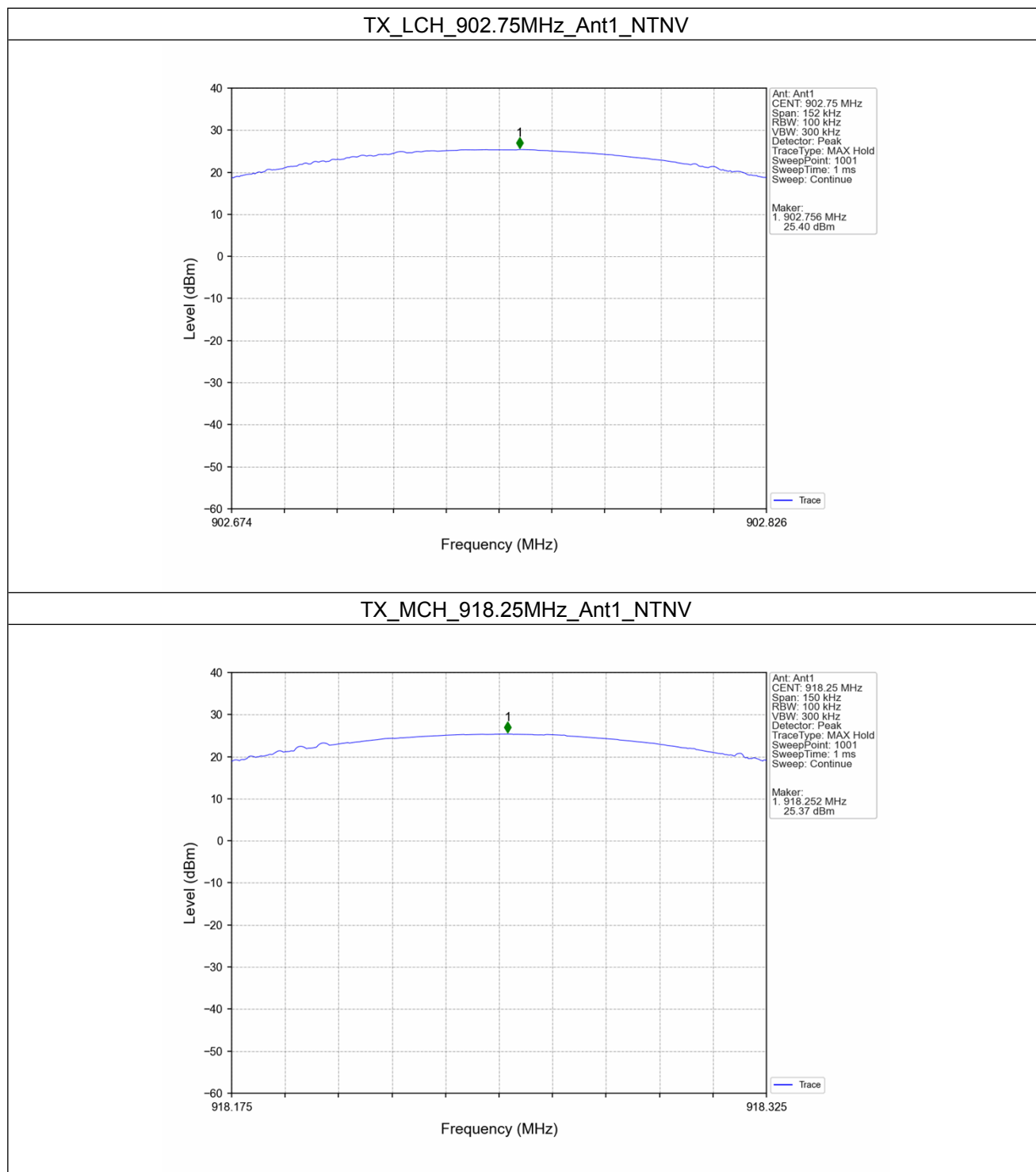


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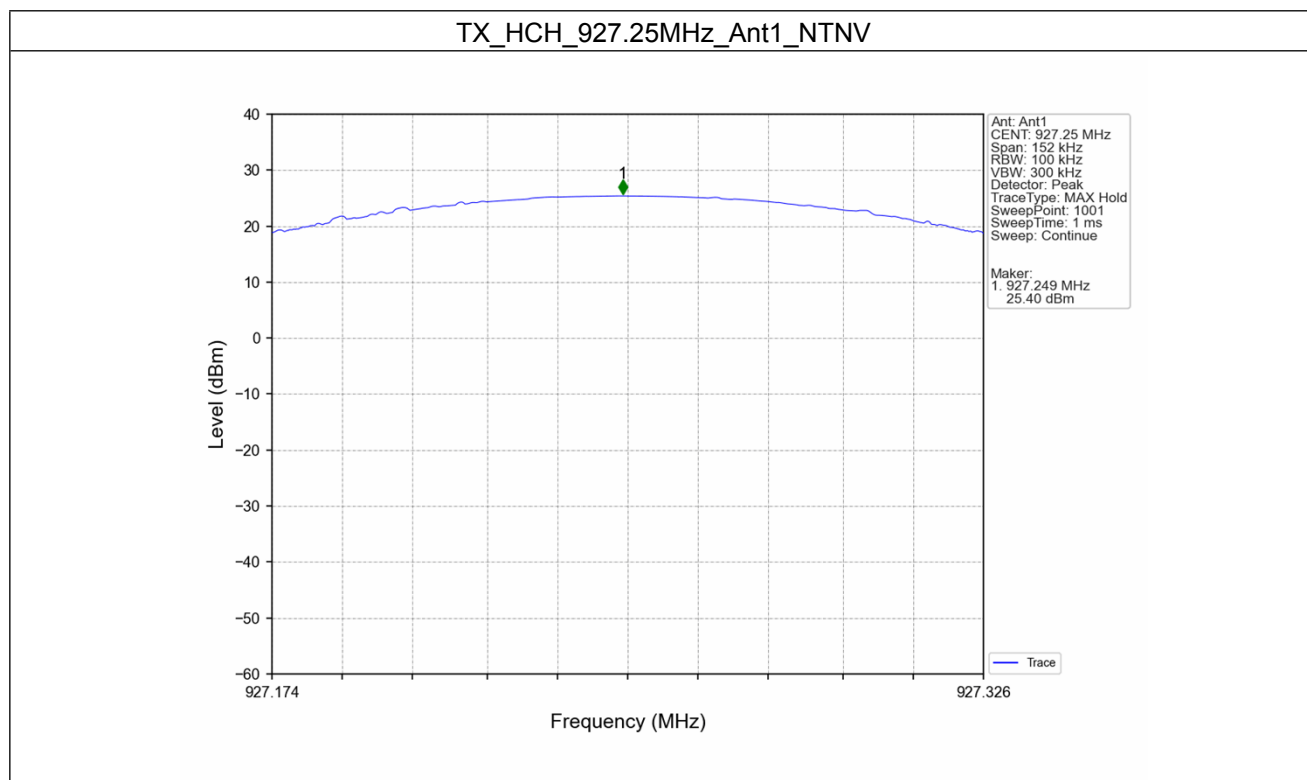
6.2 Test Graph

6.2.1 Ref



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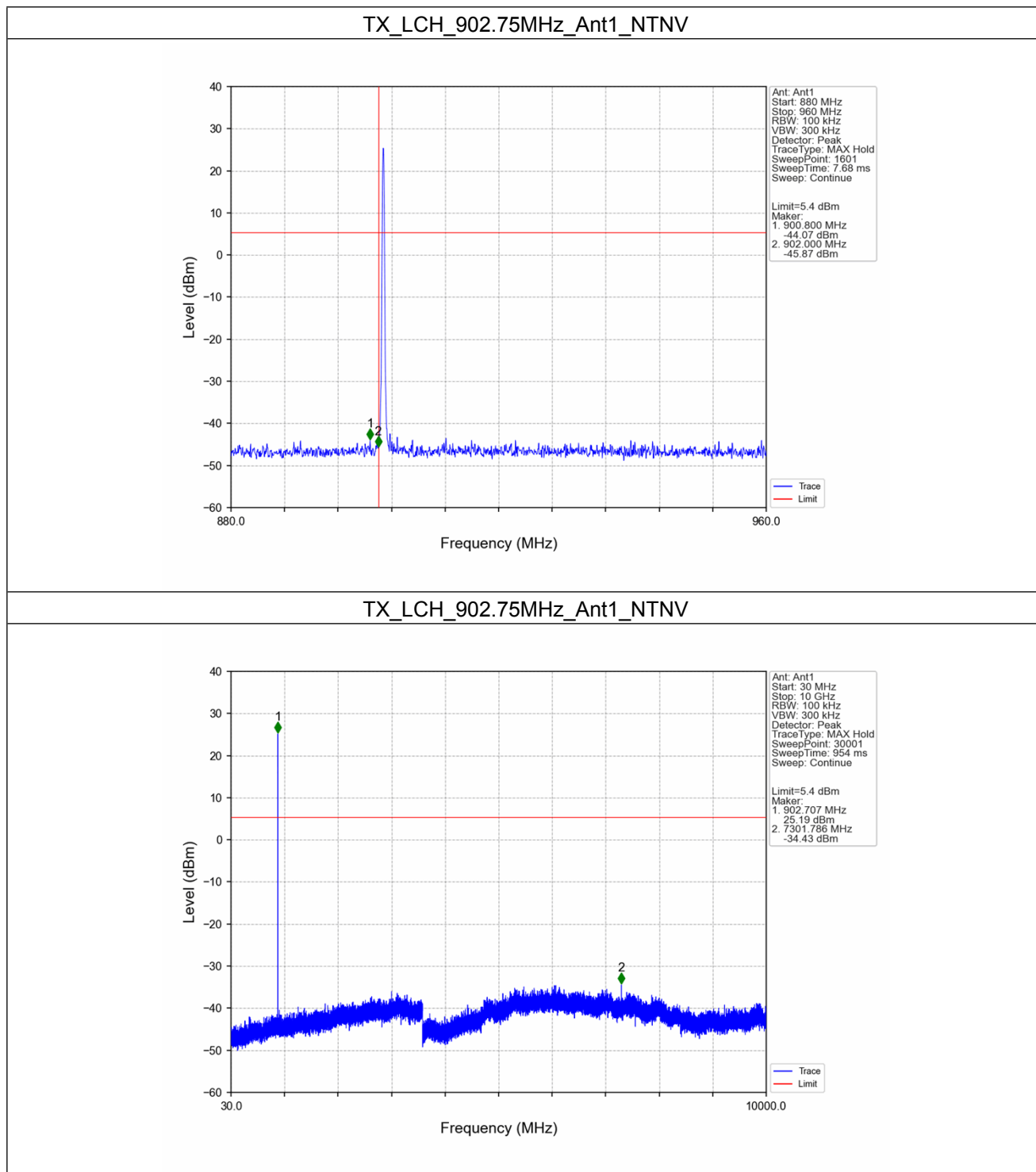
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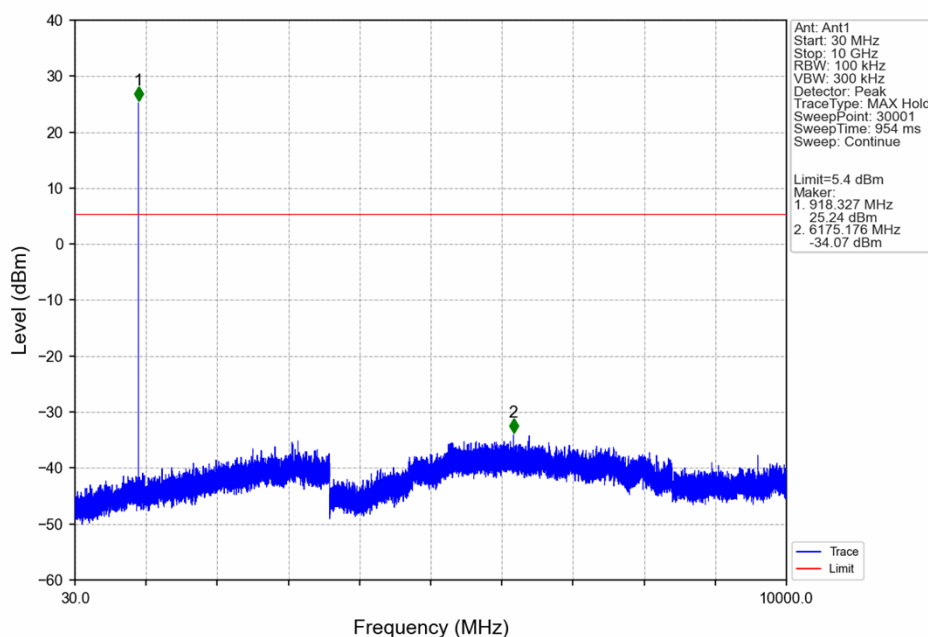
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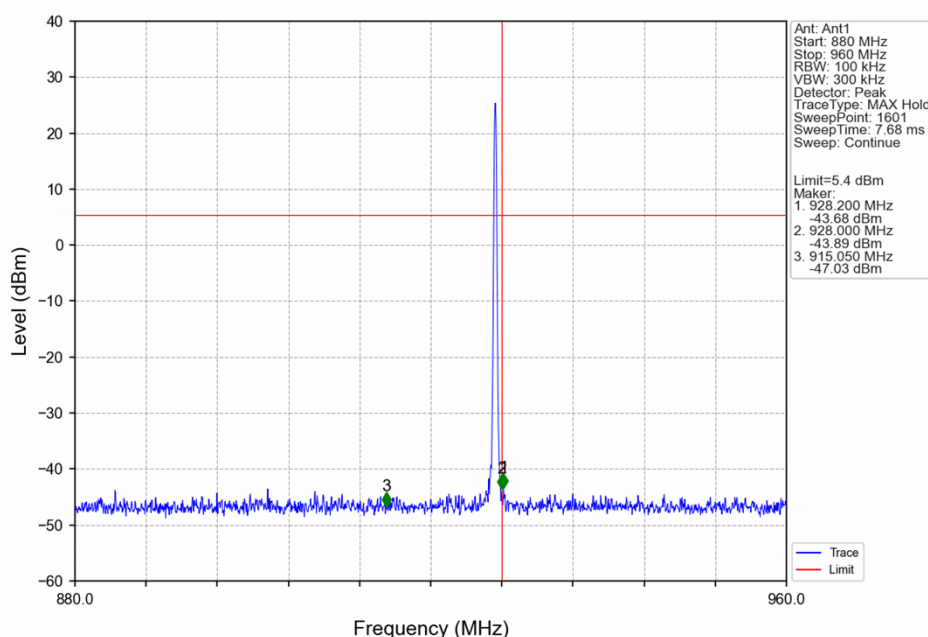
6.2.2 CSE



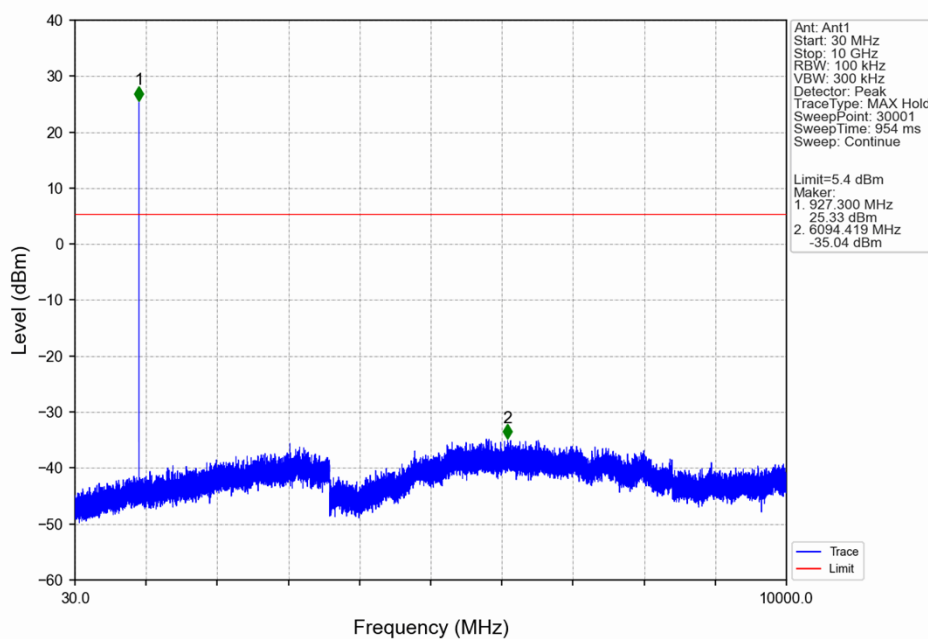
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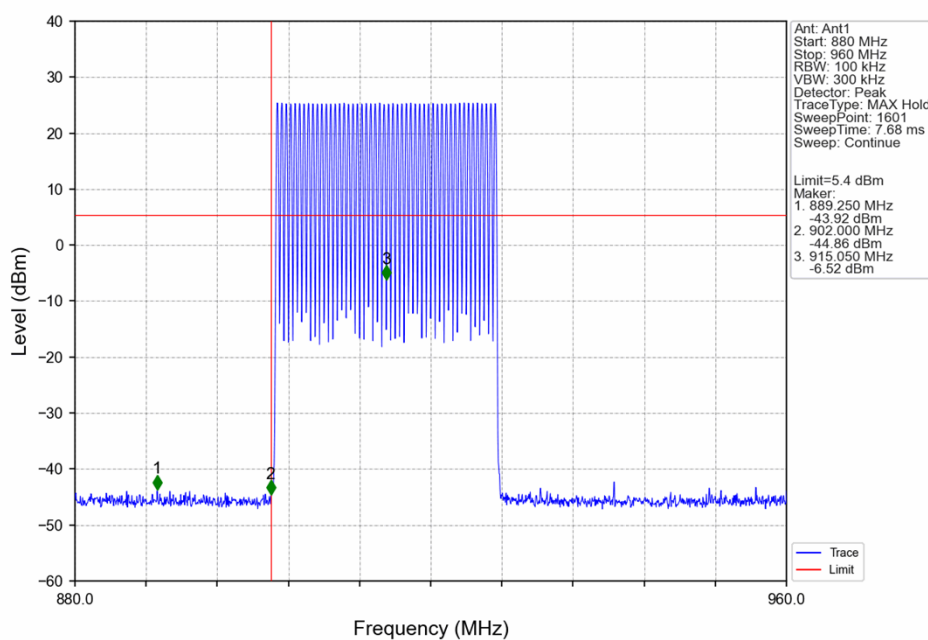
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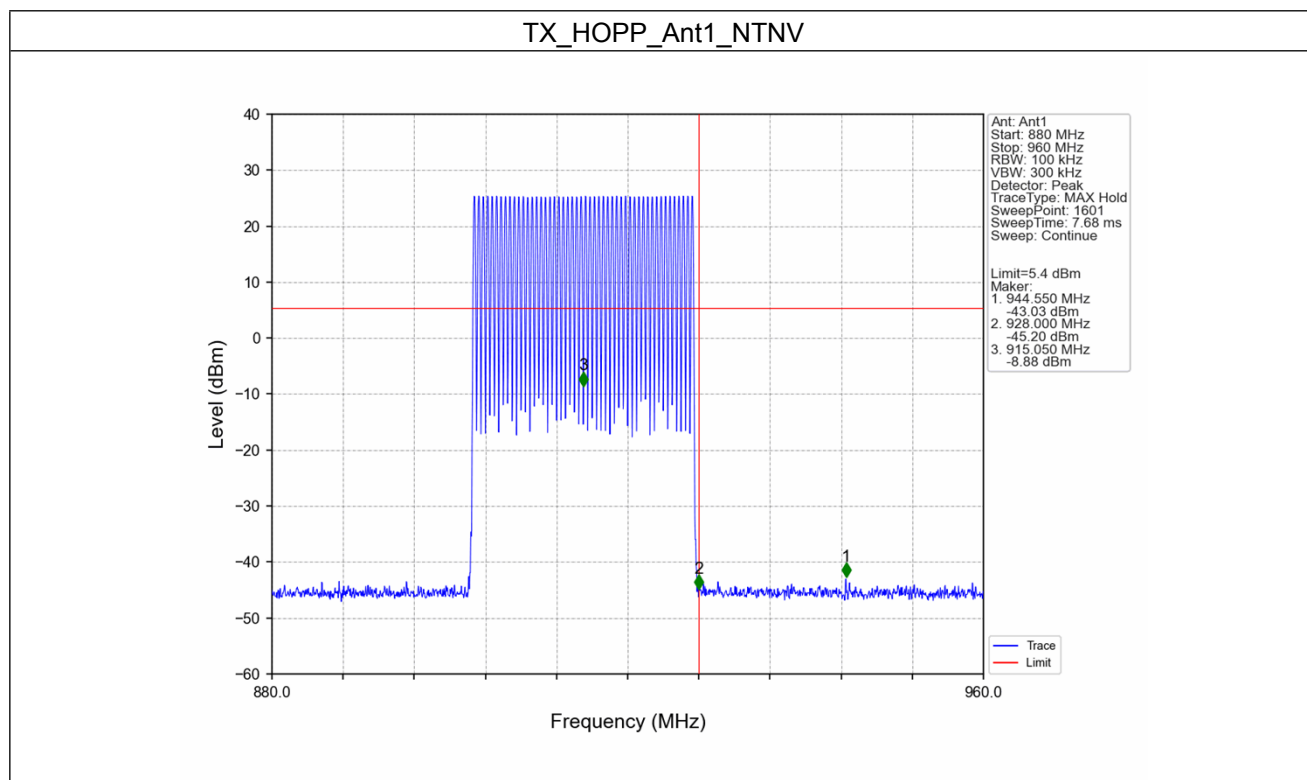


TX_HCH_927.25MHz_Ant1_NTNV



TX_HOPP_Ant1_NTNV





- End of the Report -