RSS-247 Issue 3, RSS-Gen Issue 5

TEST REPORT

For

Module

MODEL NUMBER: RFM95C

REPORT NUMBER: E04A24070244I00101

ISSUE DATE: September 18, 2024

IC: 24999-RFM95C

Prepared for

Shenzhen HOPE Microelectronics Co., Ltd

30th floor of 8th Building, C Zone Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, Guangdong, China

Prepared by

Guangdong Global Testing Technology Co., Ltd.

Room 101-105, 203-210, Building 1, No.2, Keji 8 Road, Songshan Lake Park, Dongguan city, Guangdong, People's Republic of China, 523808

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	September 18, 2024	Initial Issue	

Summary of Test Results

Test Item	Clause	Limit/Requirement	Result
Antenna Requirement	N/A	RSS-Gen Issue 5, Clause 6.8	Pass
AC Power Line Conducted Emission	ANSI C63.10-2020, Clause 6.2	RSS-GEN Clause 8.8	Pass
Conducted Output Power	ANSI C63.10-2020, Clause 11.9.1.3	RSS-247 Clause 5.4 (d)	Pass
6dB Bandwidth and 99% Occupied Bandwidth	ANSI C63.10-2020, Clause 11.8.1	RSS-247 Clause 5.2 (a) ISED RSS-Gen Clause 6.7	Pass
Power Spectral Density	ANSI C63.10-2020, Clause 11.10.2	RSS-247 Clause 5.2 (b)	Pass
Conducted Band edge and spurious emission	ANSI C63.10-2020, Clause 11.11	RSS-247 Clause 5.5	Pass
Radiated Band edge and Spurious Emission	ANSI C63.10-2020, Clause 11.11 & Clause 11.12	RSS-247 Clause 5.5 RSS-GEN Clause 8.9	Pass
Duty Cycle	ANSI C63.10-2020, Clause 12.2	None; for reporting purposes only.	Pass

*This test report is only published to and used by the applicant, and it is not for evidence purpose in China.
*The measurement result for the sample received is <Pass> according to <ISED RSS-247 ISSUE 3> when <Accuracy Method> decision rule is applied.

CONTENTS

1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	Shenzhen HOPE Microelectronics Co., Ltd
Address:	30th floor of 8th Building, C Zone Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, Guangdong, China

Manufacturer Information

Company Name:	Shenzhen HOPE Microelectronics Co., Ltd
Address:	30th floor of 8th Building, C Zone Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, Guangdong, China

EUT Information

Product Description:	Module
Model:	RFM95C
Series Model:	/
Brand:	HOPERF
Sample Received Date:	August 1, 2024
Sample Status:	Normal
Sample ID:	A24070244 001
Date of Tested:	August 1, 2024 to September 18, 2024

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
ISED RSS-247 ISSUE 3, RSS-Gen Issue 5	**Pass**

Prepared By:

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Checked By:

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Approved By:

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Laboratory Manager

2. TEST METHODOLOGY

All tests were performed in accordance with the standard ISED RSS-247 ISSUE 3, RSS-Gen Issue 5 (DTS)

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 6947.01)** Guangdong Global Testing Technology Co., Ltd. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1343)** Guangdong Global Testing Technology Co., Ltd. has been recognized to perform compliance testing on equipment subject to Supplier's Declaration of Conformity (SDoC) and Certification rules **ISED (Company No.: 30714)** Guangdong Global Testing Technology Co., Ltd. has been registered and fully described in a report filed with ISED. The Company Number is 30714 and the test lab Conformity Assessment Body Identifier (CABID) is CN0148.

Note: All tests measurement facilities use to collect the measurement data are located at Room 101-105, 203-210, Building 1, No.2, Keji 8 Road, Songshan Lake Park, Dongguan city, Guangdong, People's Republic of China, 523808

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Items	k	Uncertainty
DTS Bandwidth	1.96	±9.2 PPM
20dB Emission Bandwidth	1.96	±9.2 PPM
Carrier Frequency Separation	1.96	±9.2 PPM
Time of Occupancy	1.96	±0.57%
Conducted Output Power	1.96	±1.5 dB
Power Spectral Density Level	1.96	±1.9 dB
Conducted Spurious Emission	1.96	9 kHz-30 MHz: ± 0.95 dB 30 MHz-1 GHz: ± 1.5 dB 1GHz-12.75GHz: ± 1.8 dB 12.75 GHz-26.5 GHz: ± 2.1dB
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.		

Test Item	Measurement Frequency Range	K	U(dB)
Conducted emissions from the AC mains power ports (AMN)	150 kHz ~ 30 MHz	2	3.37
Radiated emissions	9 kHz ~ 30 MHz	2	4.16
Radiated emissions	30 MHz ~ 1 GHz	2	3.79
Radiated emissions	1 GHz ~ 18 GHz	2	5.62
Radiated emissions	18 GHz ~ 40 GHz	2	5.54
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.			

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name		Module
Model		RFM95C
Series Model		/
Model Difference		/
Hardware Version		V1.1
Software Version		V1.0
Ratings		DC 3.3V 500mA
Power Supply	DC	5V

Frequency Band:	902.0 MHz to 928.0 MHz
Frequency Range:	903.0 MHz to 927.5 MHz
Type of Modulation:	LoRa
Number of Channels:	16
Maximum Peak Power:	10.33 dBm
Antenna Type:	External Antenna
Antenna Gain:	2.15 dBi
Normal Test Voltage:	5 Vdc
EUT Test software:	EUT factory mode
Note:	The Antenna Gain was provided by customer, and this information may affect the validity of the results, customer should be responsible for this.

5.2. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH64	903.0	CH75	925.1
CH65	904.6	CH76	925.7
CH66	906.2	CH77	926.3
CH67	907.8	CH78	926.9
CH68	909.4	CH79	927.5
CH69	911.0	/	/
CH70	912.6	/	/
CH71	914.2	/	/
CH72	923.3	/	/
CH73	923.9	/	/
CH74	924.5	/	/

5.3. MAXIMUM EIRP

Test Mode	Frequency (MHz)	Channel Number	Maximum Peak Output Power (dBm)	Maximum EIRP (dBm)
LoRa	903.0 ~ 927.5	64-79[16]	10.33	12.48

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
LoRa	CH 64(Low Channel), CH 72(MID Channel), CH 79(High Channel)	903.0 MHz, 923.3 MHz, 927.5 MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 902.0 MHz to 928.0 MHz Band				
Test Software Version		EUT factory mode		
Modulation Type	Transmit Antenna Number	Test Software setting value		
		CH 64	CH 72	CH 79
LoRa	1	10	10	10

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	903.0 ~ 927.5	External	2.15

Test Mode	Transmit and Receive Mode	Description
LoRa	☒1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.
Note:		

5.7. SUPPORT UNITS FOR SYSTEM TEST

The following support units or accessories were used to form a representative test configuration during the tests.

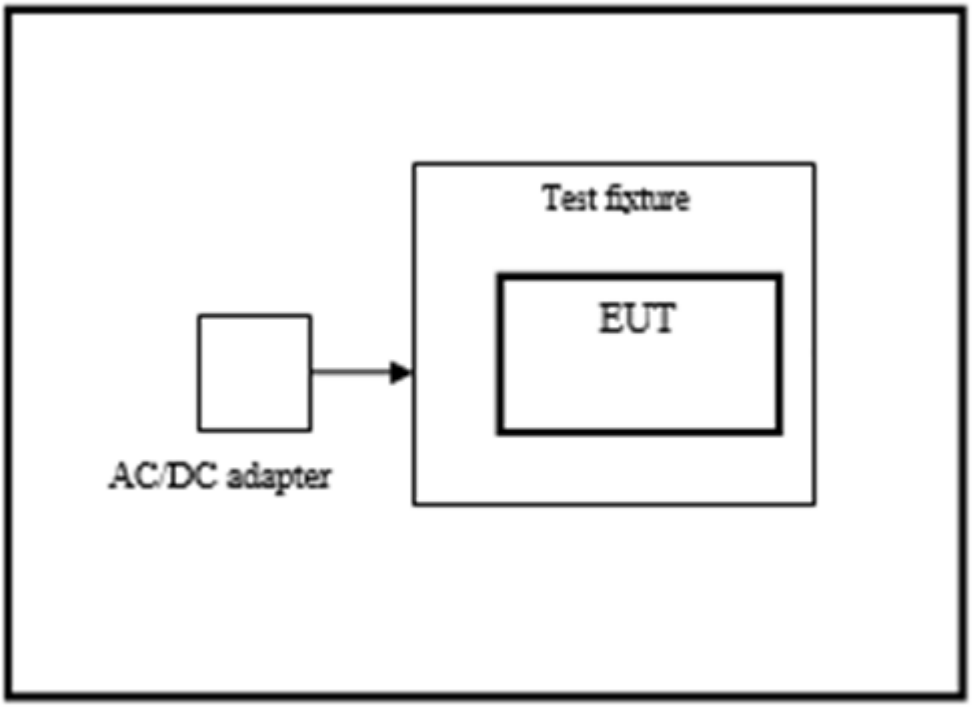
Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Adapter	Xiaomi	MDY-11-EX	N/A	GTG Support

The following cables were used to form a representative test configuration during the tests.

Item	Type of cable	Shielded Type	Ferrite Core	Length
C-1	USB cable	Unshielded	without ferrite	1.0 m

5.8. SETUP DIAGRAM

Radiated emissions & AC Power Line Conducted Emission:



6. MEASURING EQUIPMENT AND SOFTWARE USED

Test Equipment of Conducted RF					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
Spectrum Analyzer	Rohde & Schwarz	FSV40	102257	2023/09/18	2024/09/17
Spectrum Analyzer	KEYSIGHT	N9020A	MY51285127	2023/09/18	2024/09/17
EXG Analog Signal Generator	KEYSIGHT	N5173B	MY61253075	2023/09/18	2024/09/17
Vector Signal Generator	Rohde & Schwarz	SMM100A	101899	2023/09/18	2024/09/17
RF Control box	MWRF-test	MW100-RFCB	MW220926GTG	2023/09/18	2024/09/17
Wideband Radio Communication Tester	Rohde & Schwarz	CMW270	102792	2023/09/18	2024/09/17
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	103235	2023/09/18	2024/09/17
temperature humidity chamber	Espec	SH-241	SH-241-2014	2023/09/18	2024/09/17
RF Test Software	MWRF-test	MTS8310E (Ver. V2/0)	N/A	N/A	N/A

Test Equipment of Radiated emissions below 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
3m Semi-anechoic Chamber	ETS	9m*6m*6m	Q2146	2022/08/30	2025/08/29
EMI Test Receiver	Rohde & Schwarz	ESCI3	101409	2023/09/18	2024/09/17
Spectrum Analyzer	KEYSIGHT	N9020A	MY51283932	2023/09/18	2024/09/17
Pre-Amplifier	HzEMC	HPA-9K0130	HYPA21001	2023/09/18	2024/09/17
Biconilog Antenna	Schwarzbeck	VULB 9168	01315	2022/10/10	2025/10/09
Biconilog Antenna	ETS	3142E	00243646	2022/03/23	2025/03/22
Loop Antenna	ETS	6502	243668	2022/03/30	2025/03/29
Test Software	Farad	EZ-EMC (Ver.FA-03A2 RE)	N/A	N/A	N/A

Test Equipment of Radiated emissions above 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
3m Semi-anechoic Chamber	ETS	9m*6m*6m	Q2149	2022/08/30	2025/08/29
Spectrum Analyzer	Rohde & Schwarz	FSV40	101413	2023/09/18	2024/09/17
Spectrum Analyzer	KEYSIGHT	N9020A	MY51283932	2023/09/18	2024/09/17
Pre-Amplifier	A-INFO	HPA-1G1850	HYPA21003	2023/09/18	2024/09/17
Horn antenna	A-INFO	3117	246069	2022/03/11	2025/03/10
Pre-Amplifier	ZKJC	HPA-184057	HYPA21004	2023/09/18	2024/09/17

Horn antenna	ZKJC	3116C	246265	2022/03/29	2025/03/28
Test Software	Farad	EZ-EMC (Ver.FA-03A2 RE+)	N/A	N/A	N/A

Test Equipment of Conducted emissions					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
Shielded Room	CHENG YU	8m*5m*4m	N/A	2022/10/29	2025/10/28
EMI Test Receiver	Rohde & Schwarz	ESR3	102647	2023/09/18	2024/09/17
LISN/AMN	Rohde & Schwarz	ENV216	102843	2023/09/18	2024/09/17
NNLK 8129 RC	Schwarzbeck	NNLK 8129 RC	5046	2023/09/18	2024/09/17
Test Software	Farad	EZ-EMC (Ver. EMC-con-3A1 1+)	N/A	N/A	N/A

7. ANTENNA PORT TEST RESULTS

7.1. CONDUCTED PEAK OUTPUT POWER

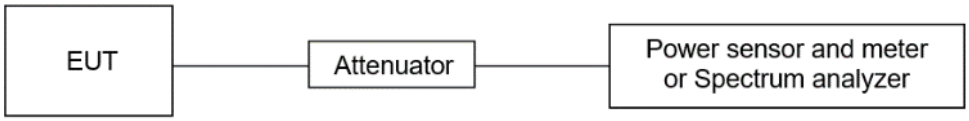
LIMITS

ISED RSS-247 ISSUE 3			
Section	Test Item	Limit	Frequency Range (MHz)
ISED RSS-247 5.4 (d)	Peak Conduct Output Power	1 watt or 30 dBm	902-928

TEST PROCEDURE

Connect the EUT to a low loss RF cable from the antenna port to the power sensor (video bandwidth is greater than the occupied bandwidth).
Measure peak emission level, the indicated level is the peak output power, after any corrections for external attenuators and cables.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1℃	Relative Humidity	53.8%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.2. 6DB BANDWIDTH AND 99% OCCUPIED BANDWIDTH

LIMITS

ISED RSS-247 ISSUE 3			
Section	Test Item	Limit	Frequency Range (MHz)
ISED RSS-247 5.2 (a)	6 dB Bandwidth	≥ 500 kHz	902-928
ISED RSS-Gen Clause 6.7	99 % Occupied Bandwidth	For reporting purposes only.	902-928

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.8 for DTS bandwidth and clause 6.9 for Occupied Bandwidth.

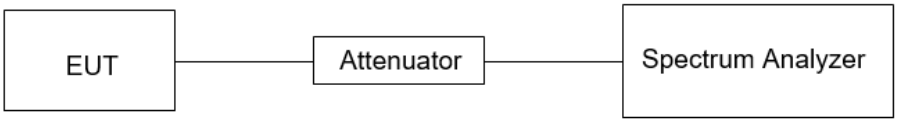
Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Frequency Span	For 6 dB Bandwidth: Enough to capture all products of the modulation carrier emission For 99 % Occupied Bandwidth: Between 1.5 times and 5.0 times the OBW
Detector	Peak
RBW	For 6 dB Bandwidth: 100 kHz For 99 % Occupied Bandwidth: 1 % to 5 % of the occupied bandwidth
VBW	For 6 dB Bandwidth: ≥3 × RBW For 99 % Occupied Bandwidth: ≥3 × RBW
Trace	Max hold
Sweep	Auto couple

a) Use the 99 % power bandwidth function of the instrument, allow the trace to stabilize and report the measured bandwidth.

b) Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1℃	Relative Humidity	53.8%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.3. POWER SPECTRAL DENSITY

LIMITS

ISED RSS-247 ISSUE 3			
Section	Test Item	Limit	Frequency Range (MHz)
ISED RSS-247 5.2 (b)	Power Spectral Density	8 dBm in any 3 kHz band	902-928

TEST PROCEDURE

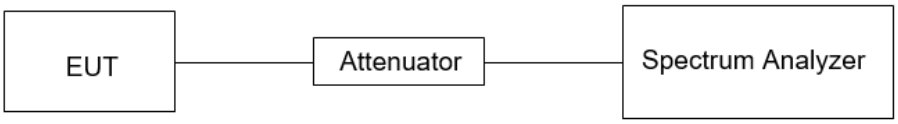
Refer to ANSI C63.10-2013 clause 11.10.

Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	PEAK
RBW	3 kHz ≤ RBW ≤ 100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1℃	Relative Humidity	53.8%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.4. CONDUCTED OUT OF BAND EMISSION

LIMITS

ISED RSS-247 ISSUE 3		
Section	Test Item	Limit
ISED RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.11 and 11.13.

Connect the EUT to the spectrum analyser and use the following settings for reference level measurement:

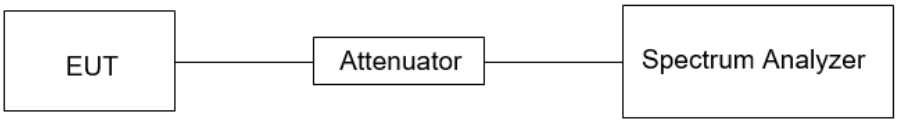
Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level.
Change the settings for emission level measurement:

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100 kHz
VBW	≥3 × RBW
measurement points	≥span/RBW
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1℃	Relative Humidity	53.8%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.5. DUTY CYCLE

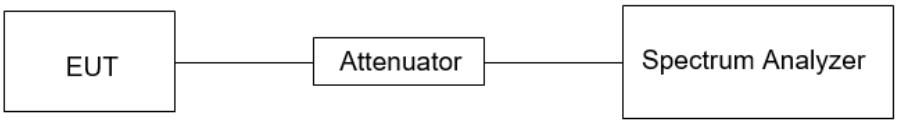
LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.6 Zero – Span Spectrum Analyzer method.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1℃	Relative Humidity	53.8%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

8. RADIATED TEST RESULTS

LIMITS

Please refer to ISED RSS-GEN Clause 8.9 and Clause 8.10.

ISED General field strength limits at frequencies below 30 MHz

Table 6 – General field strength limits at frequencies below 30 MHz		
Frequency	**Magnetic field strength (H-Field) (μA/m)**	**Measurement distance (m)**
9 - 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

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

ISED Restricted bands please refer to ISED RSS-GEN Clause 8.10

Table 7 – Restricted frequency bands[Note 1]		
MHz	**MHz**	**GHz**
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

TEST PROCEDURE

Below 30 MHz

The setting of the spectrum analyser

RBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
VBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
Sweep	Auto

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.4.

2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1 m height antenna tower.

5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

6. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.

7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.

8. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Below 1 GHz and above 30 MHz

The setting of the spectrum analyser

RBW	120 kHz
VBW	300 kHz
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.5.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

Above 1G

The setting of the spectrum analyser

RBW	1 MHz
VBW	PEAK: 3 MHz AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.6.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

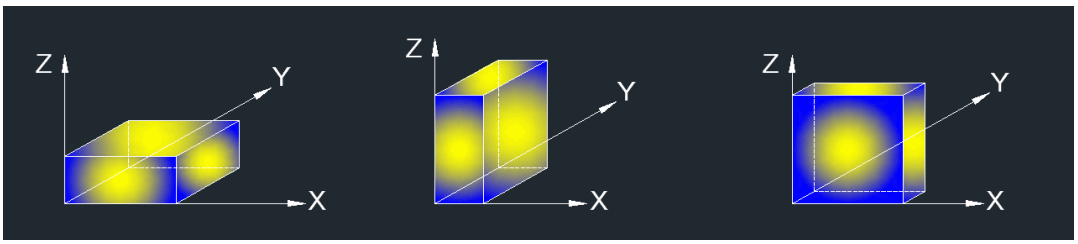
3. The EUT was placed on a turntable with 1.5 m above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement above 1 GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.

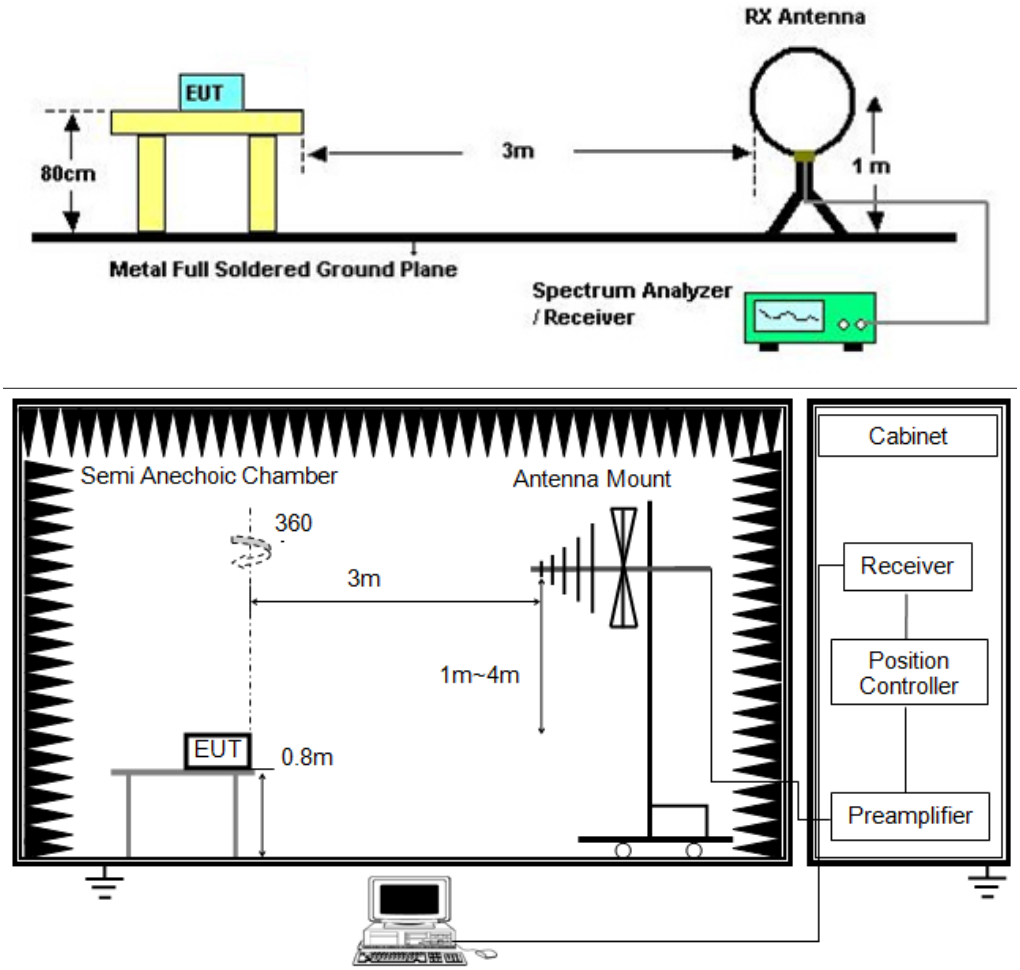
6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 7.1.ON TIME AND DUTY CYCLE.

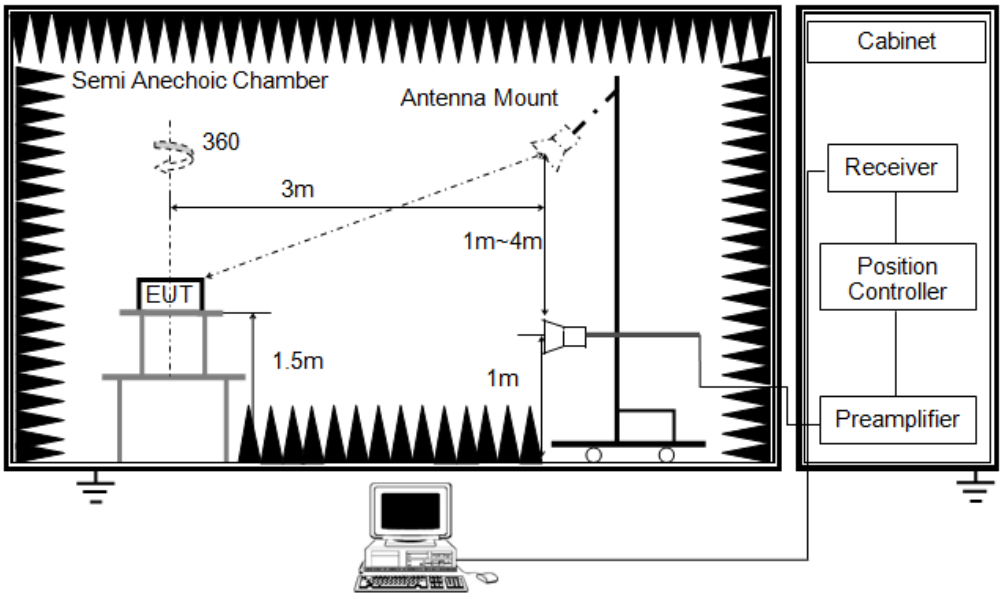
X axis, Y axis, Z axis positions:



Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

TEST SETUP





TEST ENVIRONMENT

Temperature	23.8℃	Relative Humidity	53%
Atmosphere Pressure	101kPa		

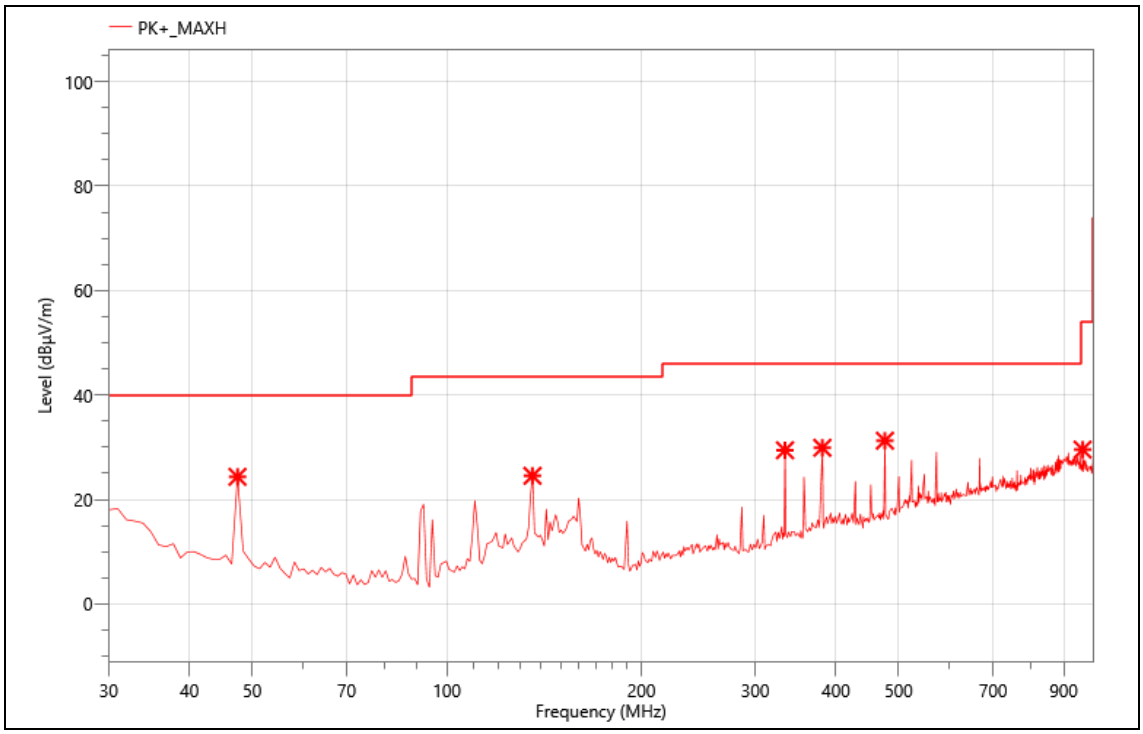
TEST RESULTS

8.1. RADIATED BAND EDGE AND SPURIOUS EMISSION

- Undesirable radiated Spurious Emission below 1GHz (30MHz to 1GHz)

All modes have been tested and the worst result as bellow:

Mode:	903MHz
Power:	DC 5V
TE:	Berny
Date	2024/8/2
T/A/P	23.8℃/53%/101Kpa

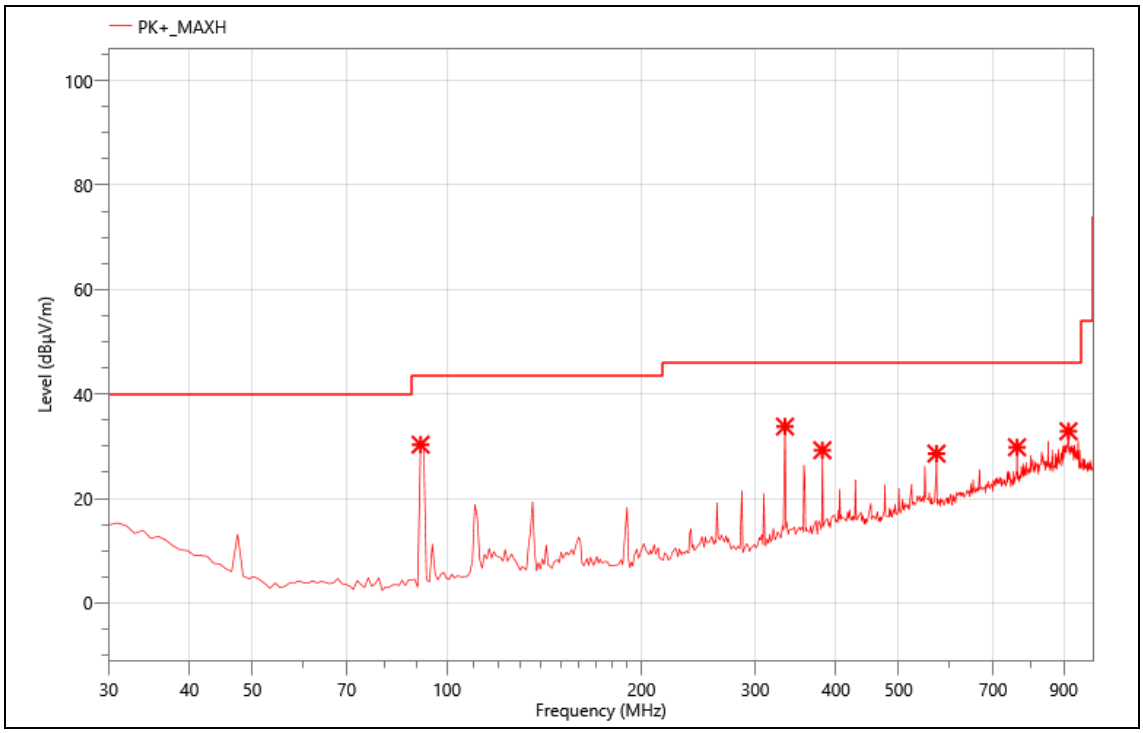


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	47.460	47.66	-23.3	24.36	40.00	15.64	PK+	V
2	135.730	48.48	-23.92	24.56	43.50	18.94	PK+	V
3	333.610	46.60	-17.16	29.44	46.00	16.56	PK+	V
4	381.140	44.77	-14.86	29.91	46.00	16.09	PK+	V
5	476.200	44.49	-13.22	31.27	46.00	14.73	PK+	V
6	963.140	33.40	-3.83	29.57	53.90	24.33	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	903MHz
Power:	DC 5V
TE:	Berny
Date	2024/8/2
T/A/P	23.8℃/53%/101Kpa



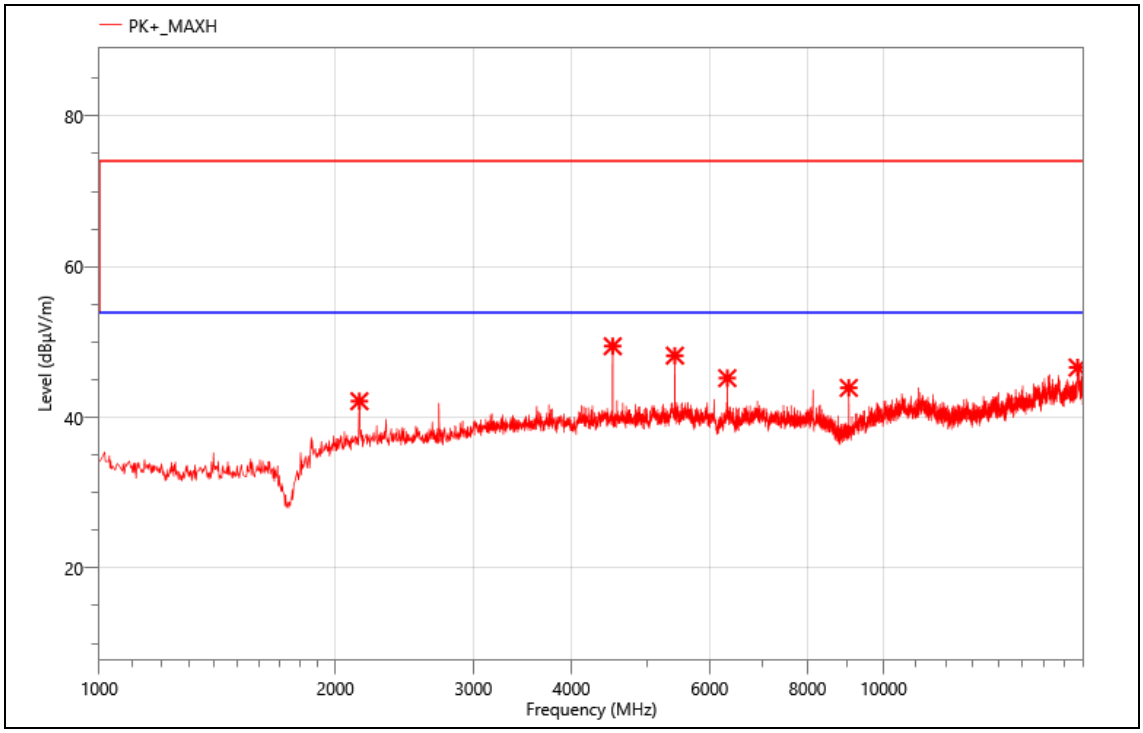
Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	91.110	55.51	-25.19	30.32	43.50	13.18	PK+	H
2	333.610	50.95	-17.16	33.79	46.00	12.21	PK+	H
3	381.140	44.11	-14.86	29.25	46.00	16.75	PK+	H
4	572.230	39.43	-10.82	28.61	46.00	17.39	PK+	H
5	762.350	37.12	-7.3	29.82	46.00	16.18	PK+	H
6	915.610	36.79	-3.91	32.88	46.00	13.12	PK+	H

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

- Undesirable radiated Spurious Emission Above 1GHz (1GHz to 40GHz)

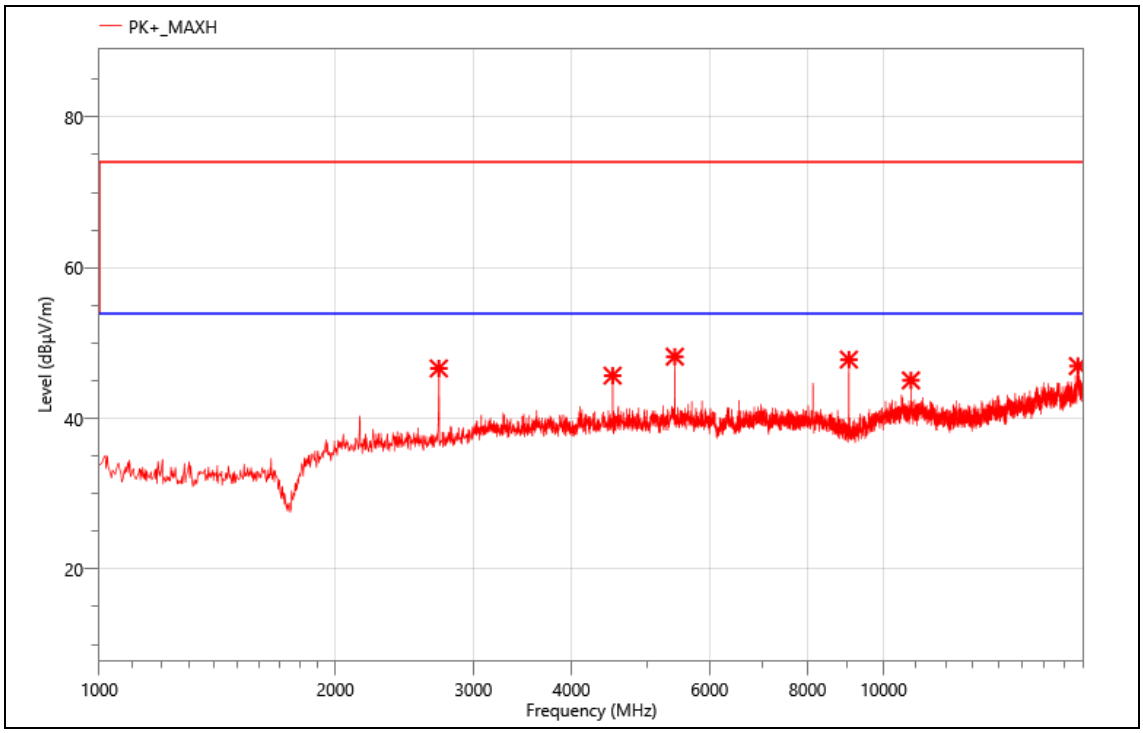
Mode:	903MHz
Power:	DC 5V
TE:	Big
Date	2024/9/13
T/A/P	23.8℃/53%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2146.000	60.14	-17.99	42.15	74.00	31.85	PK+	V
2	4515.000	61.47	-12.02	49.45	74.00	24.55	PK+	V
3	5419.500	57.98	-9.78	48.20	74.00	25.80	PK+	V
4	6321.000	52.99	-7.78	45.21	74.00	28.79	PK+	V
5	9028.500	51.43	-7.51	43.92	74.00	30.08	PK+	V
6	17680.500	46.33	0.29	46.62	74.00	27.38	PK+	V

Mode:	903MHz
Power:	DC 5V
TE:	Big
Date	2024/9/13
T/A/P	23.8℃/53%/101Kpa

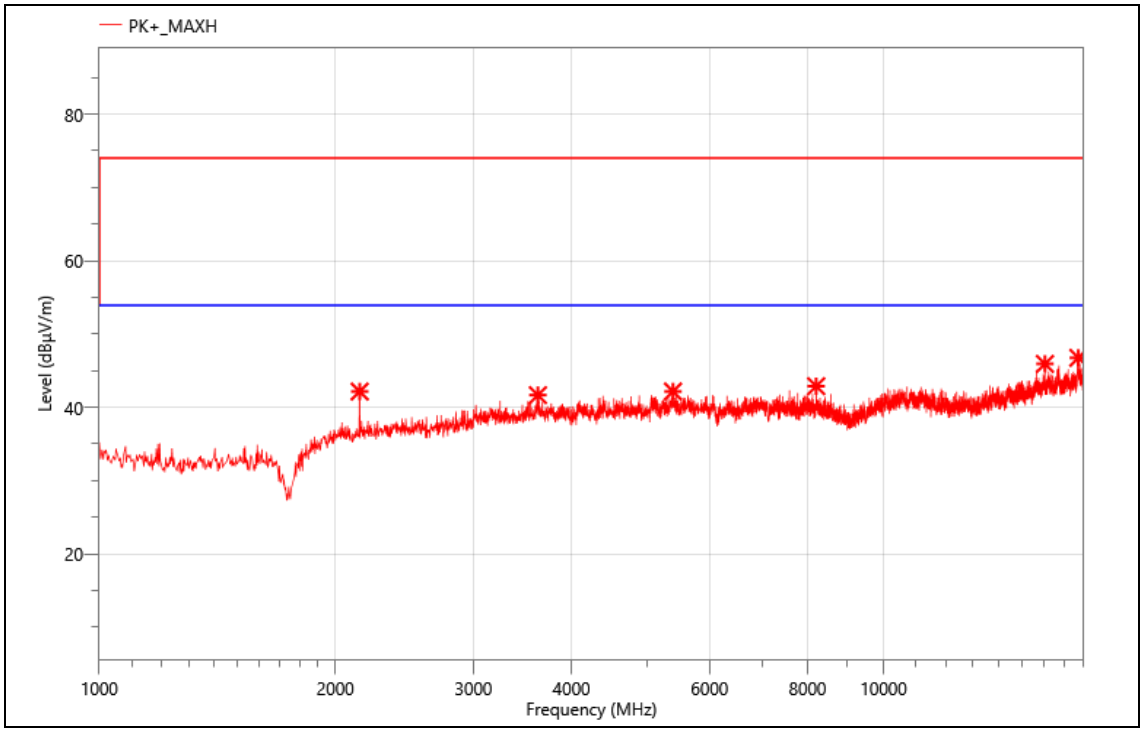


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2710.000	63.51	-16.87	46.64	74.00	27.36	PK+	H
2	4513.500	57.69	-12.01	45.68	74.00	28.32	PK+	H
3	5418.000	57.95	-9.75	48.20	74.00	25.80	PK+	H
4	9031.500	55.27	-7.46	47.81	74.00	26.19	PK+	H
5	10837.500	50.17	-5.12	45.05	74.00	28.95	PK+	H
6	17697.000	46.74	0.2	46.94	74.00	27.06	PK+	H

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	923.3MHz
Power:	DC 5V
TE:	Big
Date	2024/9/13
T/A/P	23.8℃/53%/101Kpa

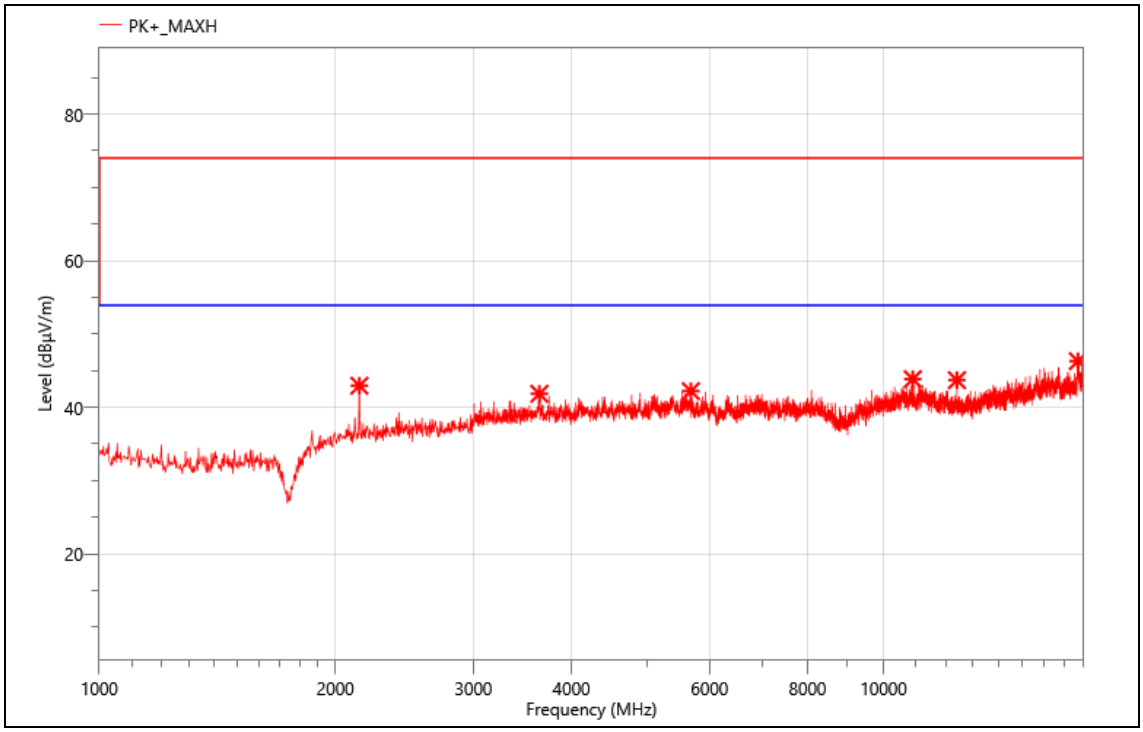


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2148.000	60.14	-17.99	42.15	74.00	31.85	PK+	H
2	3624.000	55.09	-13.43	41.66	74.00	32.34	PK+	H
3	5389.500	51.36	-9.2	42.16	74.00	31.84	PK+	H
4	8205.000	50.64	-7.76	42.88	74.00	31.12	PK+	H
5	16062.000	47.60	-1.68	45.92	74.00	28.08	PK+	H
6	17716.500	46.93	-0.18	46.75	74.00	27.25	PK+	H

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	923.3MHz
Power:	DC 5V
TE:	Big
Date	2024/9/13
T/A/P	23.8℃/53%/101Kpa

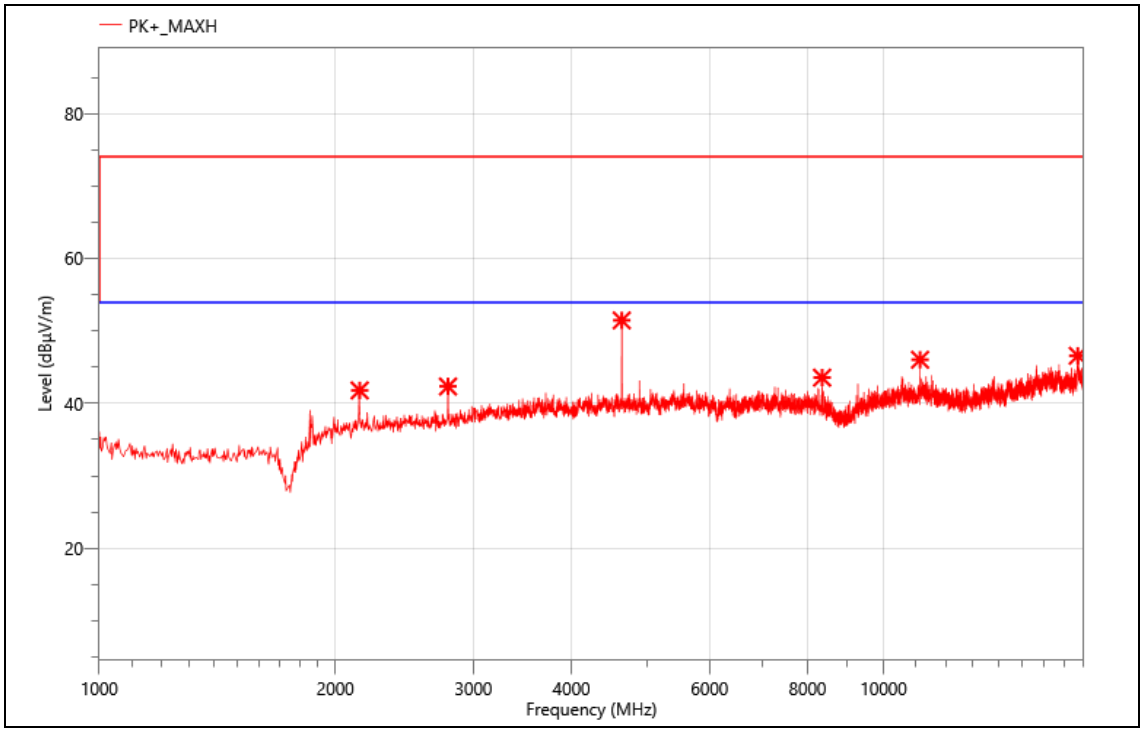


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2146.000	60.93	-17.99	42.94	74.00	31.06	PK+	V
2	3640.500	55.18	-13.34	41.84	74.00	32.16	PK+	V
3	5679.000	51.41	-9.21	42.20	74.00	31.80	PK+	V
4	10894.500	49.00	-5.16	43.84	74.00	30.16	PK+	V
5	12403.500	48.40	-4.7	43.70	74.00	30.30	PK+	V
6	17692.500	46.08	0.22	46.30	74.00	27.70	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	927.5MHz
Power:	DC 5V
TE:	Big
Date	2024/9/13
T/A/P	23.8℃/53%/101Kpa

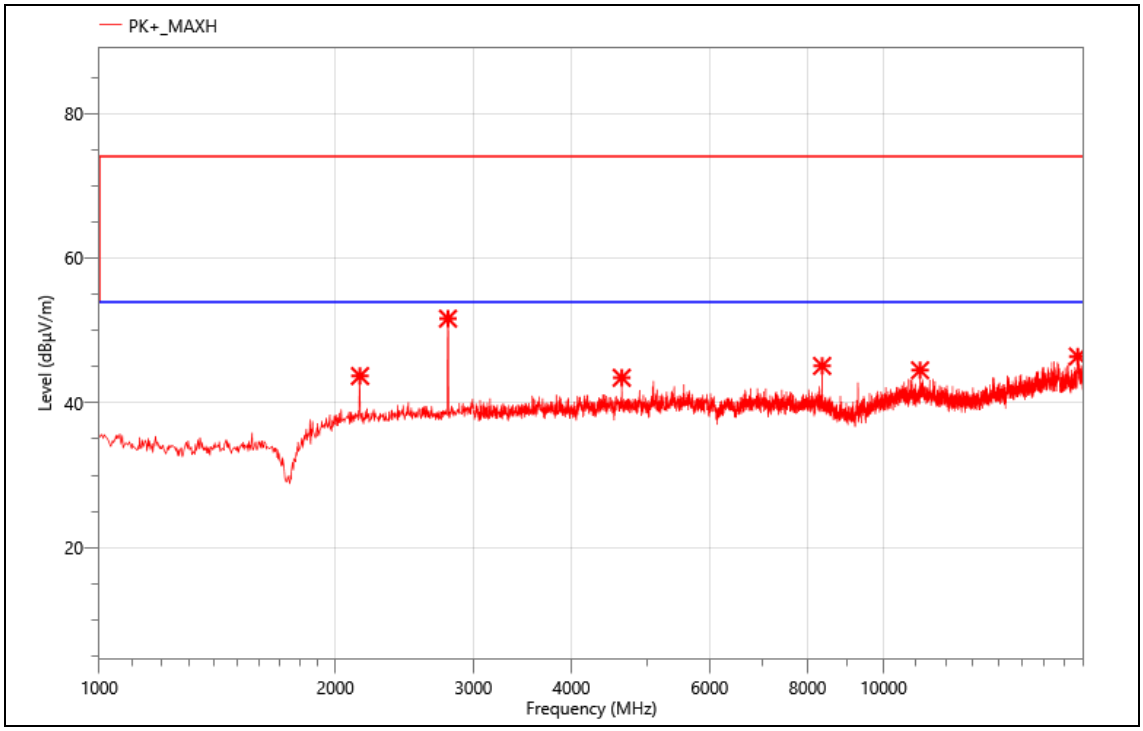


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2148.000	59.79	-17.99	41.80	74.00	32.20	PK+	V
2	2784.000	59.11	-16.77	42.34	74.00	31.66	PK+	V
3	4636.500	62.92	-11.46	51.46	74.00	22.54	PK+	V
4	8349.000	51.45	-7.89	43.56	74.00	30.44	PK+	V
5	11133.000	50.31	-4.28	46.03	74.00	27.97	PK+	V
6	17685.000	46.32	0.26	46.58	74.00	27.42	PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	927.5MHz
Power:	DC 5V
TE:	Big
Date	2024/9/13
T/A/P	23.8℃/53%/101Kpa



Critical_Freqs

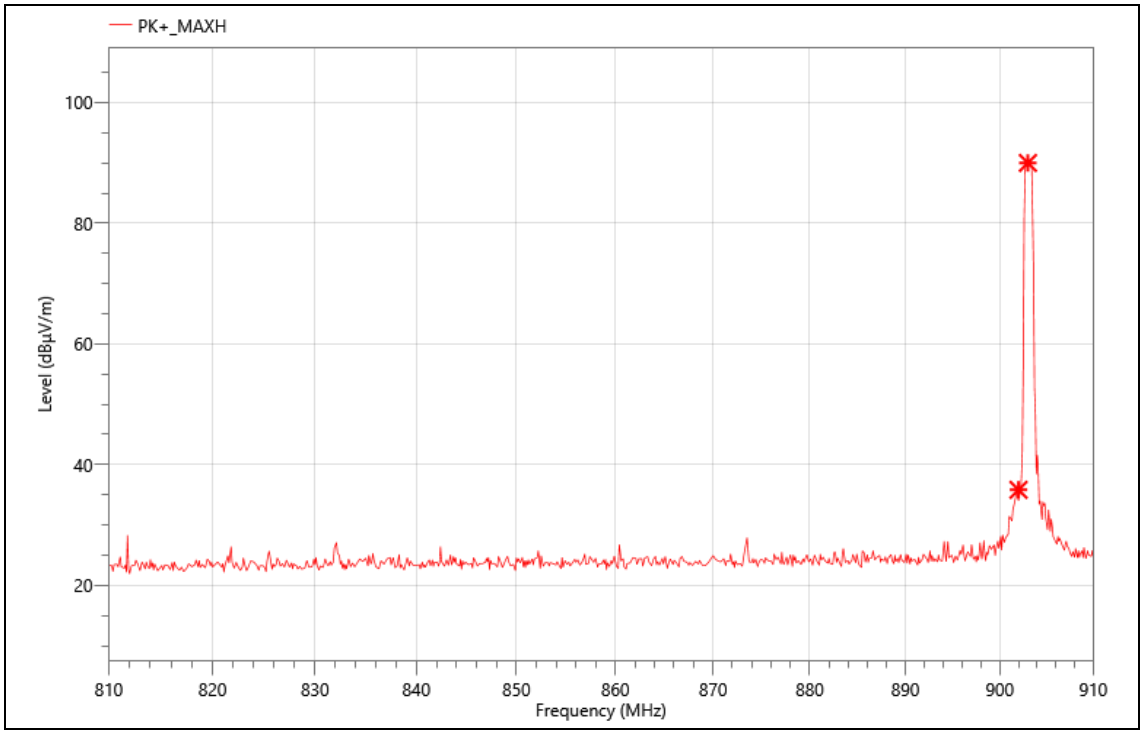
No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	2150.000	61.69	-17.98	43.71	74.00	30.29	PK+	H
2	2784.000	68.41	-16.77	51.64	74.00	22.36	PK+	H
3	4636.500	54.93	-11.46	43.47	74.00	30.53	PK+	H
4	8349.000	53.00	-7.89	45.11	74.00	28.89	PK+	H
5	11131.500	48.80	-4.29	44.51	74.00	29.49	PK+	H
6	17688.000	46.17	0.25	46.42	74.00	27.58	PK+	H

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

For the frequency above 18 GHz, a pre-scan was performed, and the result was 20 dB lower than the limit line, the test data was not shown in the report.

- Band Edge

Mode:	903MHz
Power:	DC 5V
TE:	Berny
Date	2024/8/30
T/A/P	23.8℃/53%/101Kpa

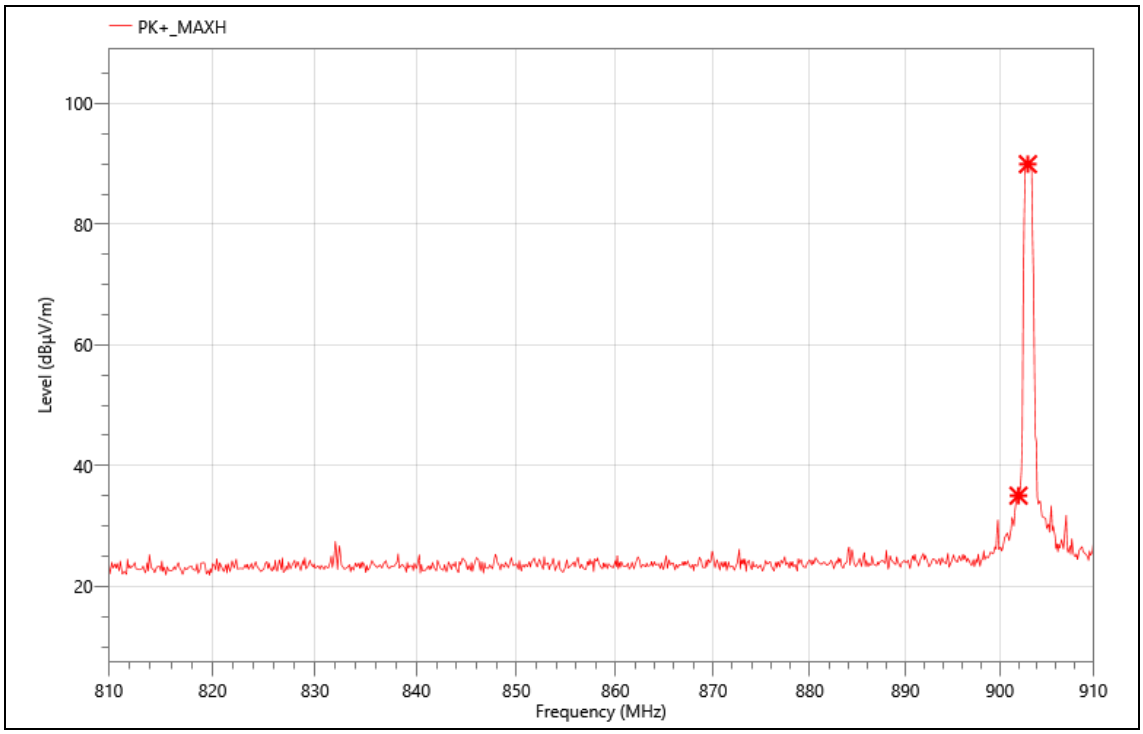


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBc)	Det.	Pol.
1	902.000	40.86	-5.03	35.83	Delta=90.01-35.83=55.18dBc		PK+	V
2	903.000	94.97	-4.96	90.01			PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	903MHz
Power:	DC 5V
TE:	Berny
Date	2024/8/30
T/A/P	23.8℃/53%/101Kpa

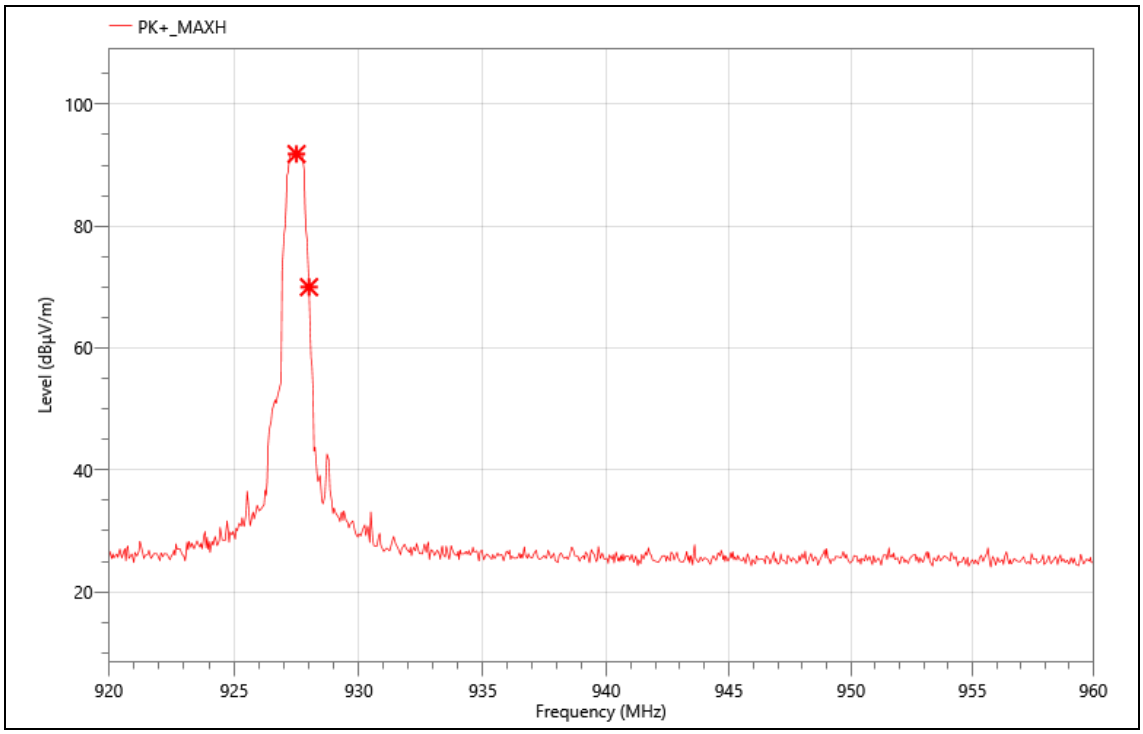


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBc)	Det.	Pol.
1	902.000	40.06	-5.03	35.03	Delta=89.97-35.03=54.94dBc		PK+	H
2	903.000	94.93	-4.96	89.97			PK+	H

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	927.5MHz
Power:	DC 5V
TE:	Berny
Date	2024/8/30
T/A/P	23.8℃/53%/101Kpa

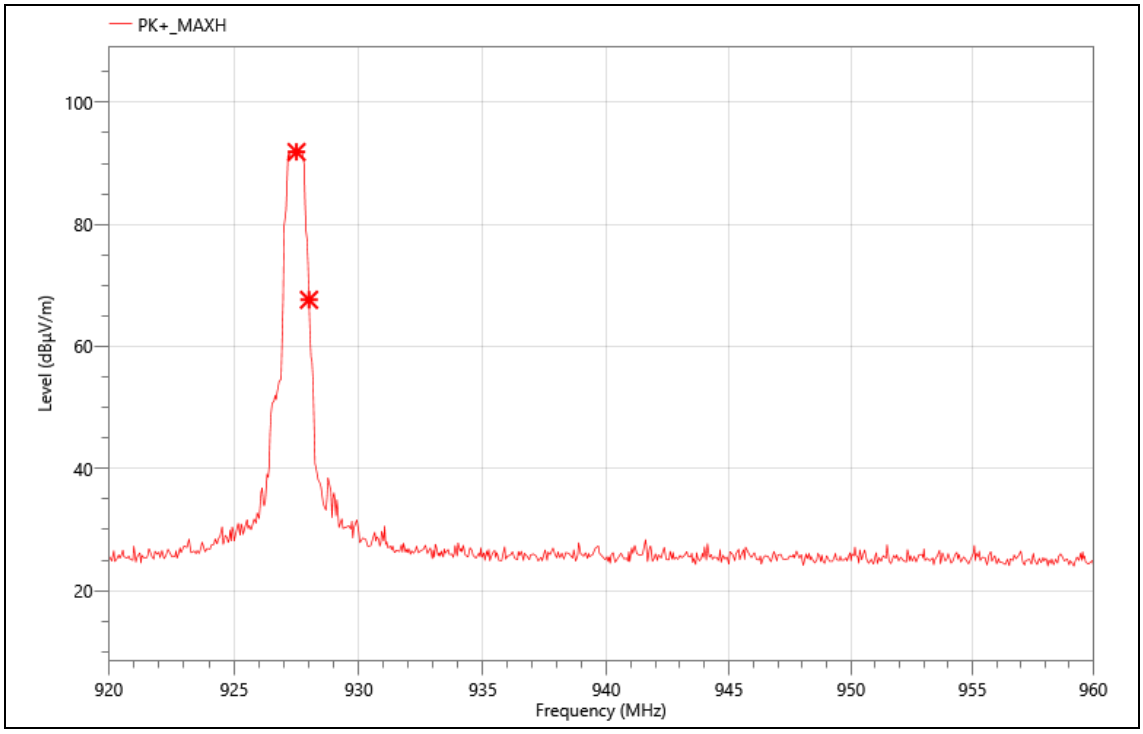


Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBc)	Det.	Pol.
1	927.500	94.93	-3.11	91.82	Delta=91.82-69.99=21.83dBc		PK+	H
2	928.000	73.09	-3.1	69.99			PK+	H

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

Mode:	927.5MHz
Power:	DC 5V
TE:	Berny
Date	2024/8/30
T/A/P	23.8℃/53%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBc)	Det.	Pol.
1	927.500	94.98	-3.11	91.87	Delta=91.87-67.65=24.22dBc		PK+	V
2	928.000	70.75	-3.1	67.65			PK+	V

Note：[Margin=Limit-Meas.]; [Meas.=Reading+Corr.]

9. ANTENNA REQUIREMENT

REQUIREMENT

RSS-Gen Issue 5 6.8

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

DESCRIPTION

Pass.

10. AC POWER LINE CONDUCTED EMISSION

LIMITS

ISED RSS-Gen Clause 8.8

Table 4 – AC power-line conducted emissions limits		
Frequency (MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	**Average**
0.15 - 0.5	66 to 56[Note 1]	56 to 46[Note 1]
0.5 – 5	56	46
5 – 30	60	50

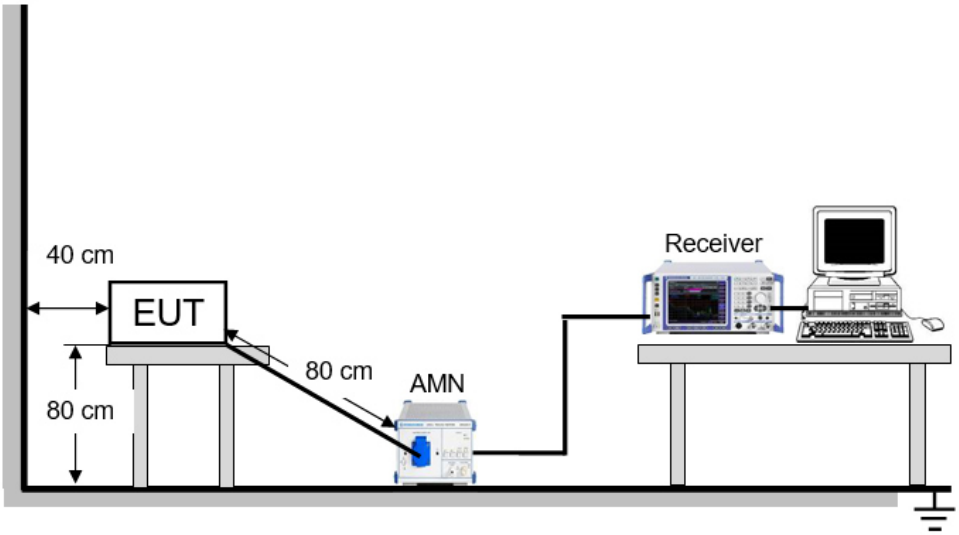
Note 1: The level decreases linearly with the logarithm of the frequency.

TEST PROCEDURE

The EUT is put on a table of non-conducting material that is 80 cm high. The vertical conducting wall of shielding is located 40 cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10-2013.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9 kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

TEST SETUP

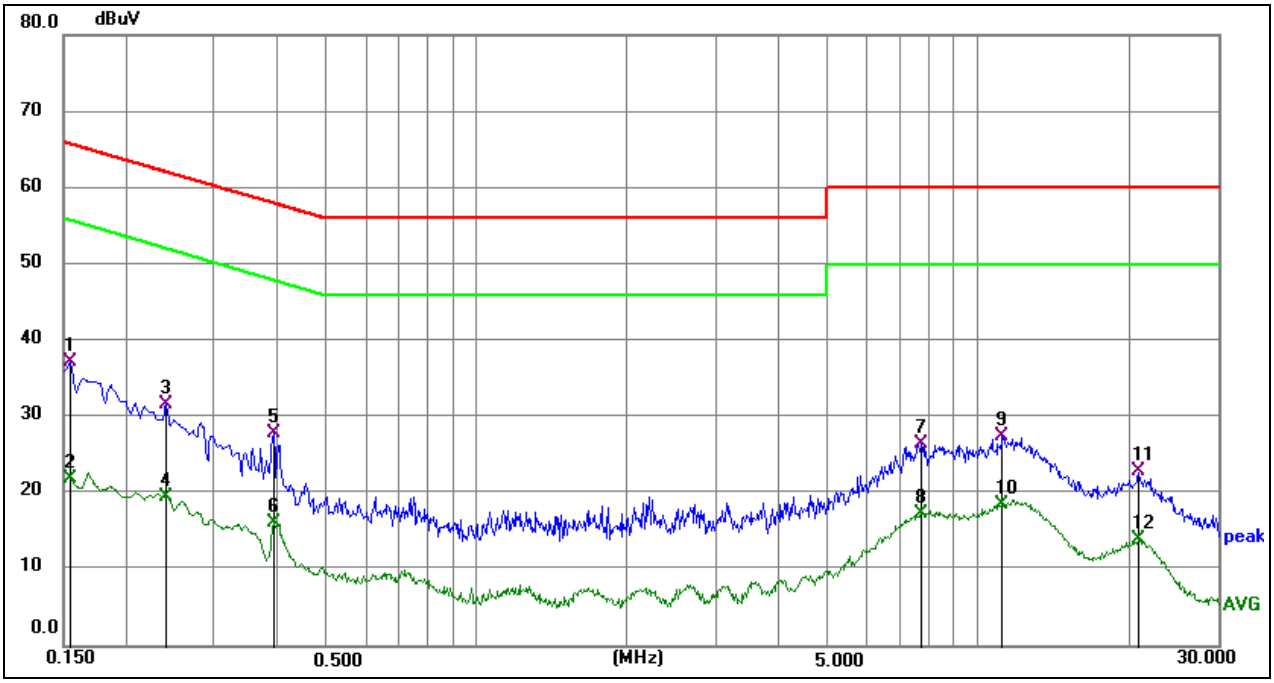


TEST ENVIRONMENT

Temperature	26℃	Relative Humidity	54%

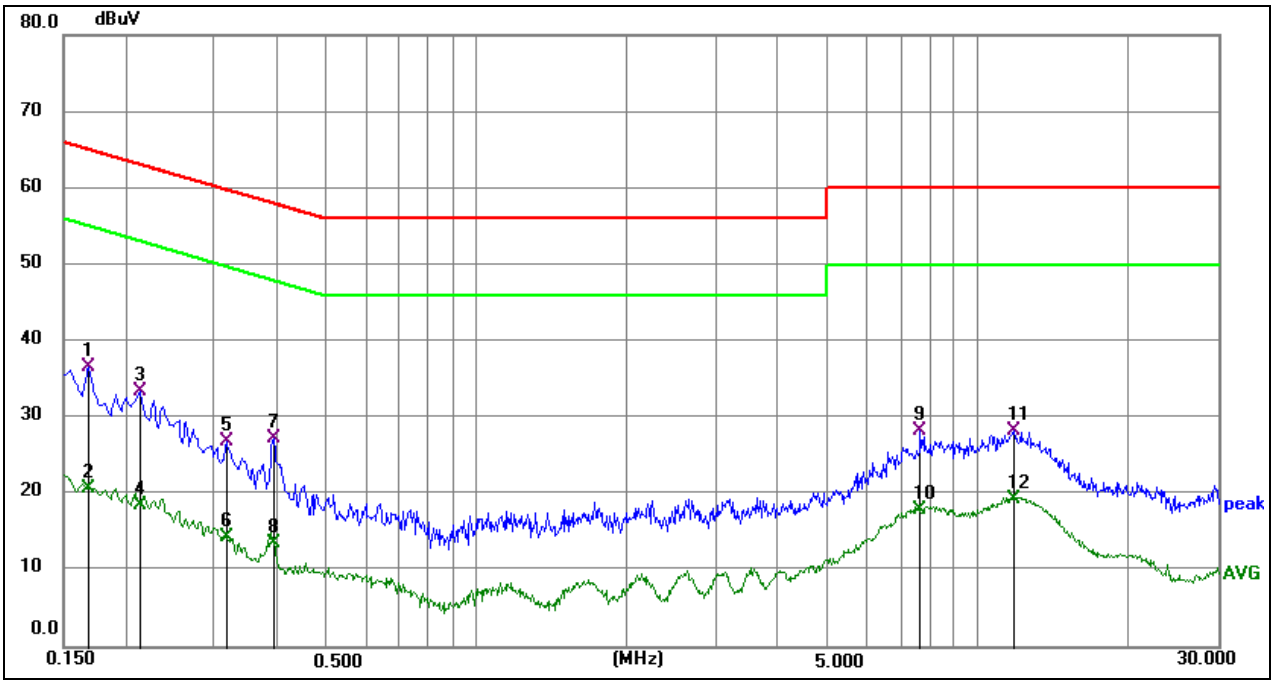
Atmosphere Pressure	101kPa		

TEST RESULTS



Phase: L1	Mode: 903MHz

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1544	27.34	9.85	37.19	65.76	-28.57	QP
2	0.1544	12.16	9.85	22.01	55.76	-33.75	AVG
3	0.2400	21.78	9.84	31.62	62.10	-30.48	QP
4	0.2400	9.75	9.84	19.59	52.10	-32.51	AVG
5	0.3930	18.07	9.79	27.86	58.00	-30.14	QP
6	0.3930	6.35	9.79	16.14	48.00	-31.86	AVG
7	7.6920	16.66	9.77	26.43	60.00	-33.57	QP
8	7.6920	7.55	9.77	17.32	50.00	-32.68	AVG
9	11.1750	17.63	9.82	27.45	60.00	-32.55	QP
10	11.1750	8.66	9.82	18.48	50.00	-31.52	AVG
11	20.8814	12.58	10.25	22.83	60.00	-37.17	QP
12	20.8814	3.66	10.25	13.91	50.00	-36.09	AVG



Phase: N	Mode: 903MHz

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1680	26.82	9.89	36.71	65.06	-28.35	QP
2	0.1680	10.79	9.89	20.68	55.06	-34.38	AVG
3	0.2130	23.55	9.87	33.42	63.09	-29.67	QP
4	0.2130	8.66	9.87	18.53	53.09	-34.56	AVG
5	0.3165	17.08	9.86	26.94	59.80	-32.86	QP
6	0.3165	4.45	9.86	14.31	49.80	-35.49	AVG
7	0.3930	17.45	9.80	27.25	58.00	-30.75	QP
8	0.3930	3.86	9.80	13.66	48.00	-34.34	AVG
9	7.6650	17.82	10.47	28.29	60.00	-31.71	QP
10	7.6650	7.53	10.47	18.00	50.00	-32.00	AVG
11	11.7915	16.64	11.59	28.23	60.00	-31.77	QP
12	11.7915	7.67	11.59	19.26	50.00	-30.74	AVG

11. TEST DATA - Appendix A

Duty Cycle

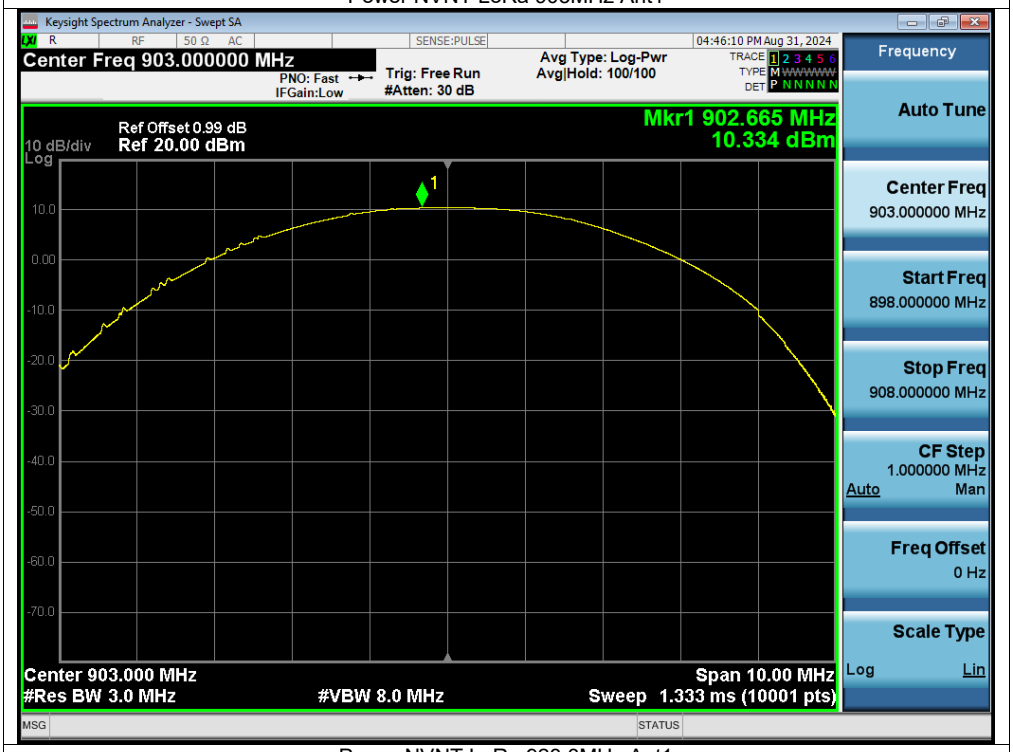
Condition	Mode	Frequency (MHz)	Antenna	On Time (ms)	Period (ms)	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)	Final settingFor VBW (kHz)
NVNT	LoRa	903	Ant1	92.7	142.95	64.85	1.88	0.01	1
NVNT	LoRa	923.3	Ant1	92.7	142.98	64.83	1.88	0.01	1
NVNT	LoRa	927.5	Ant1	92.7	142.95	64.85	1.88	0.01	1

Maximum Conducted Output Power

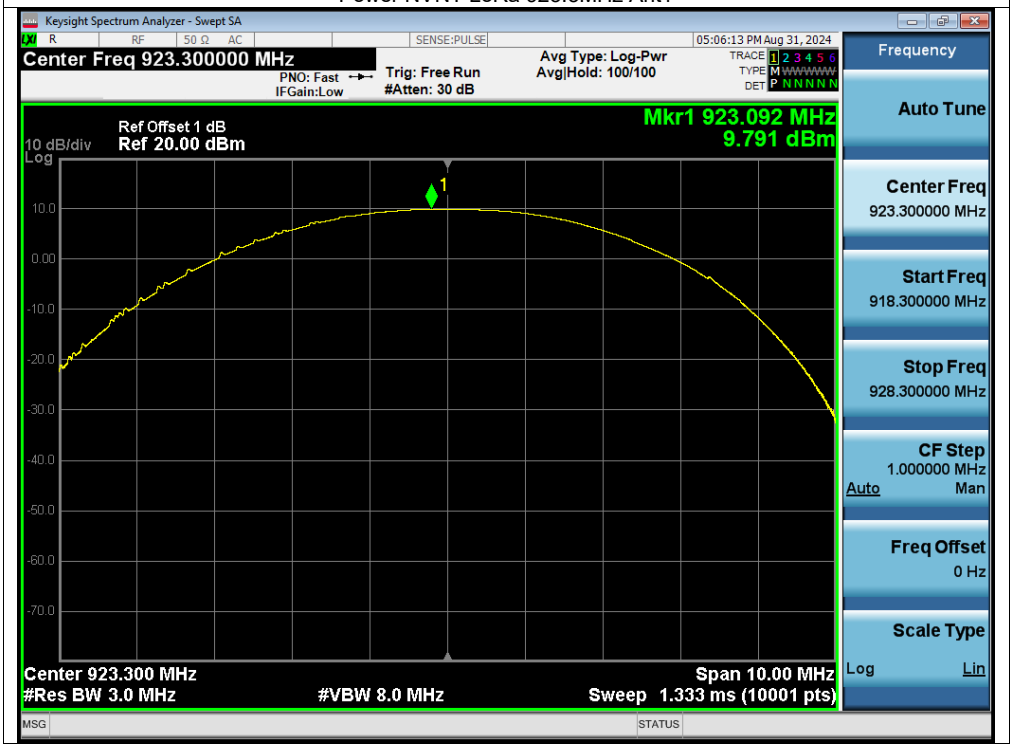
Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	E.I.R.P (dBm	E.I.R.P. Limit (dBm)	Verdict
NVNT	LoRa	903	Ant1	10.33	0	10.33	12.48	36.02	Pass
NVNT	LoRa	923.3	Ant1	9.79	0	9.79	11.94	36.02	Pass
NVNT	LoRa	927.5	Ant1	9.65	0	9.65	11.80	36.02	Pass
Note1: Antenna Gain: 2.15dBi; Note2: E.I.R.P = Total Power + Antenna Gain									

Test Graphs

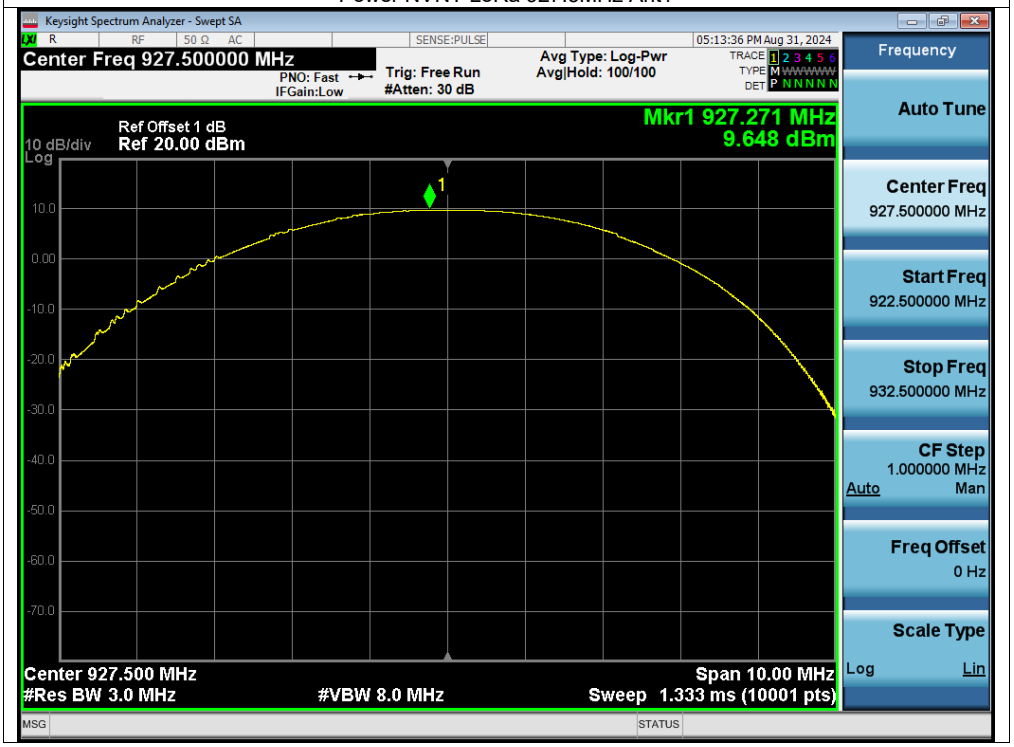
Power NVNT LoRa 903MHz Ant1



Power NVNT LoRa 923.3MHz Ant1



Power NVNT LoRa 927.5MHz Ant1

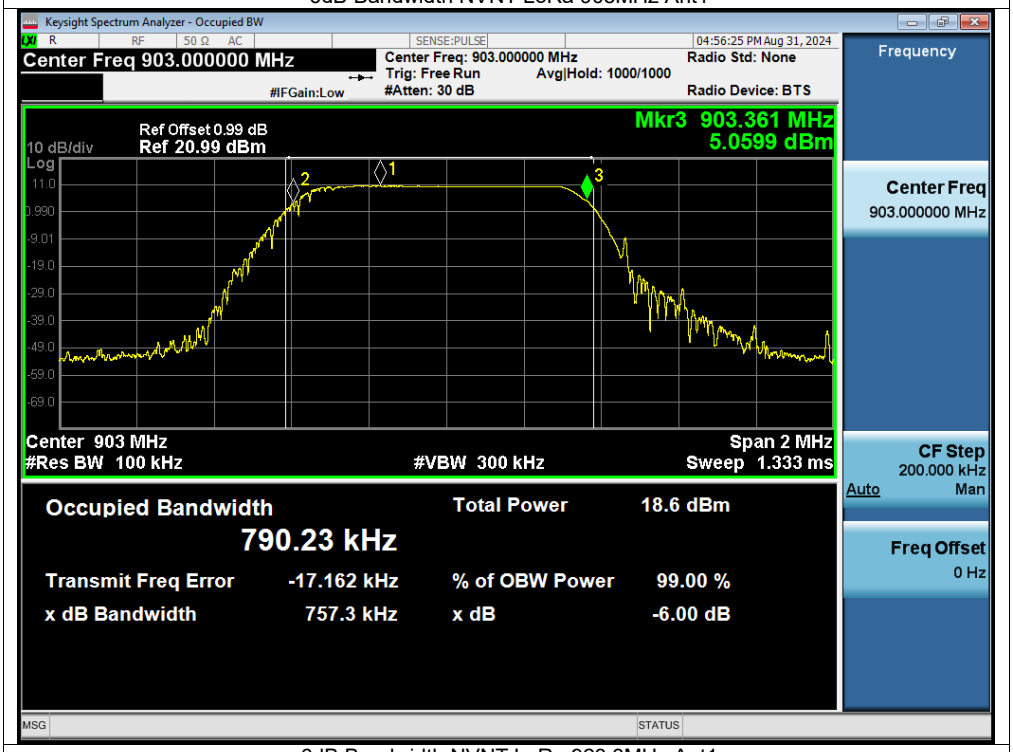


-6dB Bandwidth

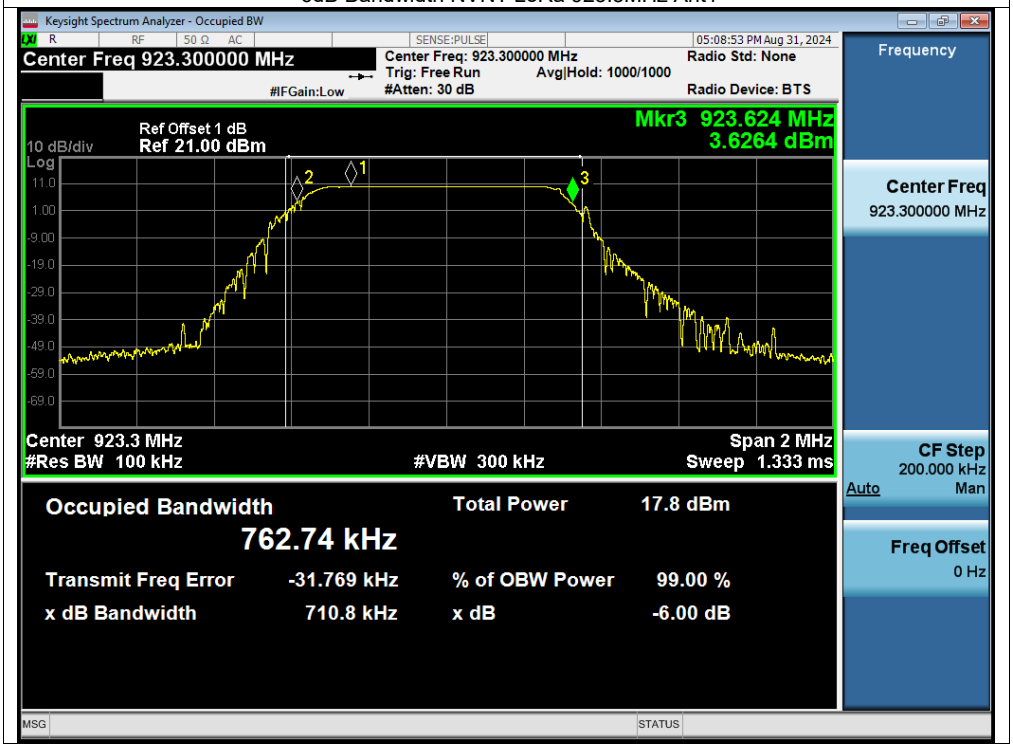
Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	LoRa	903	Ant1	0.76	0.5	Pass
NVNT	LoRa	923.3	Ant1	0.71	0.5	Pass
NVNT	LoRa	927.5	Ant1	0.75	0.5	Pass

Test Graphs

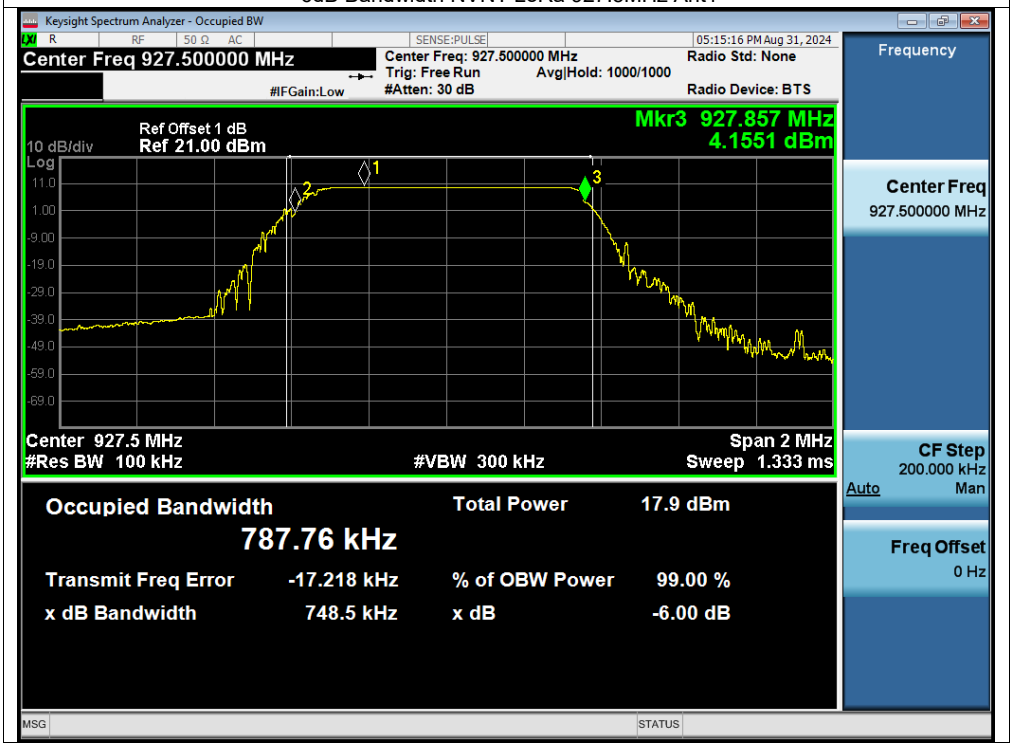
-6dB Bandwidth NVNT LoRa 903MHz Ant1



-6dB Bandwidth NVNT LoRa 923.3MHz Ant1



-6dB Bandwidth NVNT LoRa 927.5MHz Ant1



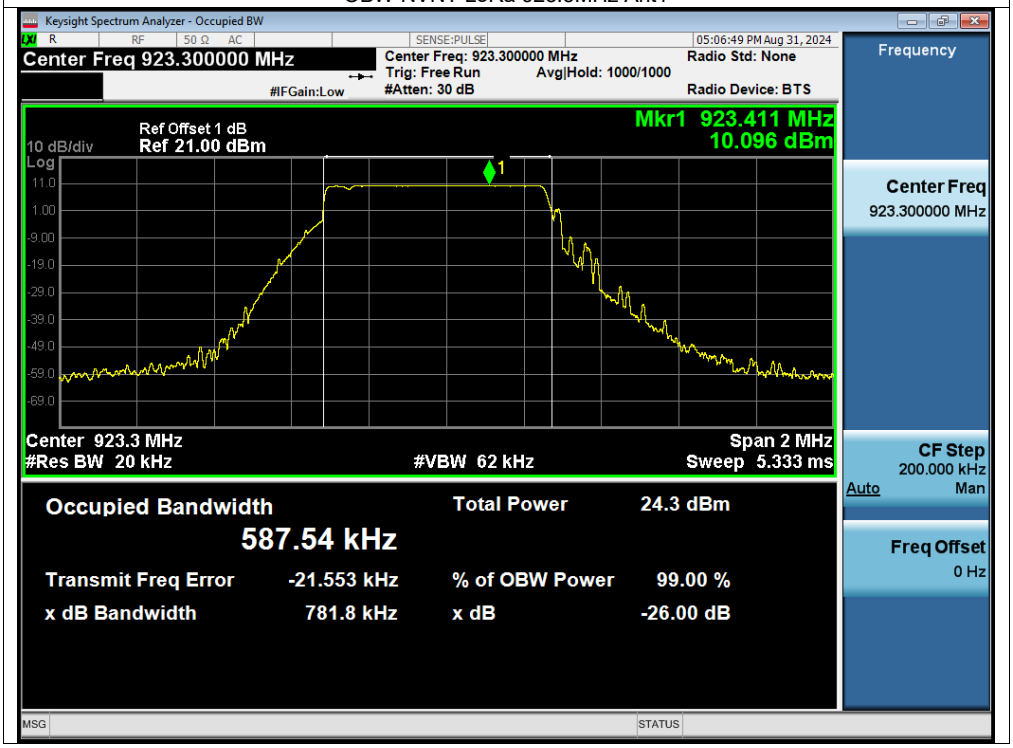
Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	LoRa	903	Ant1	0.577
NVNT	LoRa	923.3	Ant1	0.588
NVNT	LoRa	927.5	Ant1	0.614

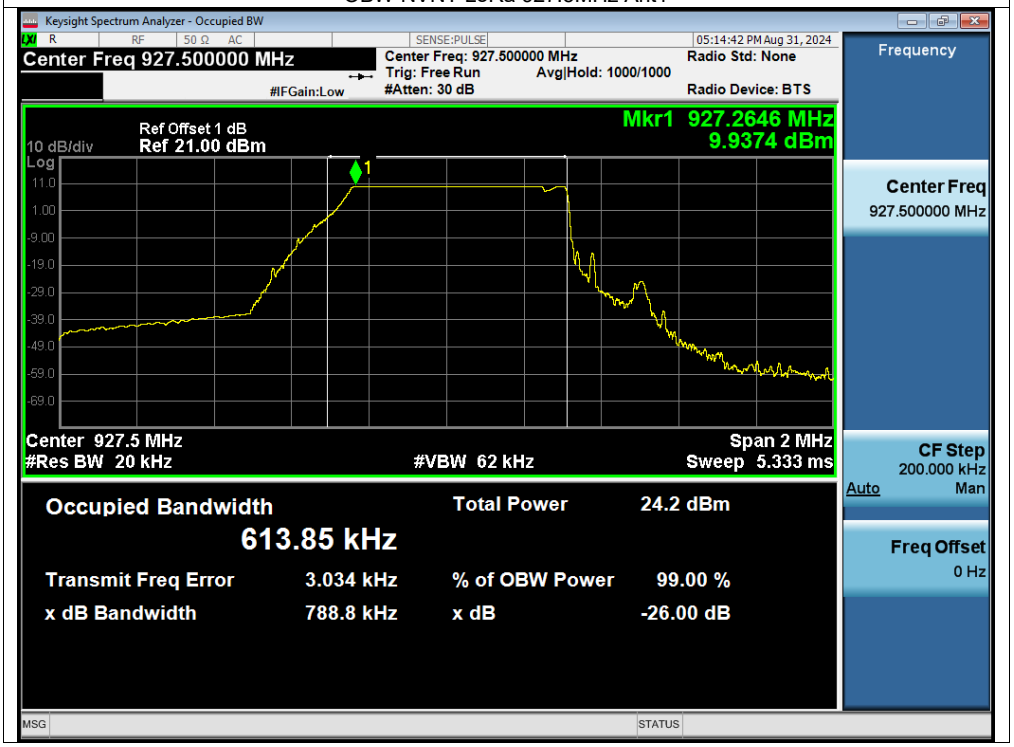
Test Graphs

OBW NVNT LoRa 903MHz Ant1

OBW NVNT LoRa 923.3MHz Ant1



OBW NVNT LoRa 927.5MHz Ant1



Maximum Power Spectral Density Level

Condition	Mode	Frequency (MHz)	Antenna	Conducted PSD (dBm/3kHz)	Duty Factor (dB)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
NVNT	LoRa	903	Ant1	3.87	0	3.87	8	Pass
NVNT	LoRa	923.3	Ant1	3.34	0	3.34	8	Pass
NVNT	LoRa	927.5	Ant1	3.23	0	3.23	8	Pass

Test Graphs

PSD NVNT LoRa 903MHz Ant1

PSD NVNT LoRa 923.3MHz Ant1

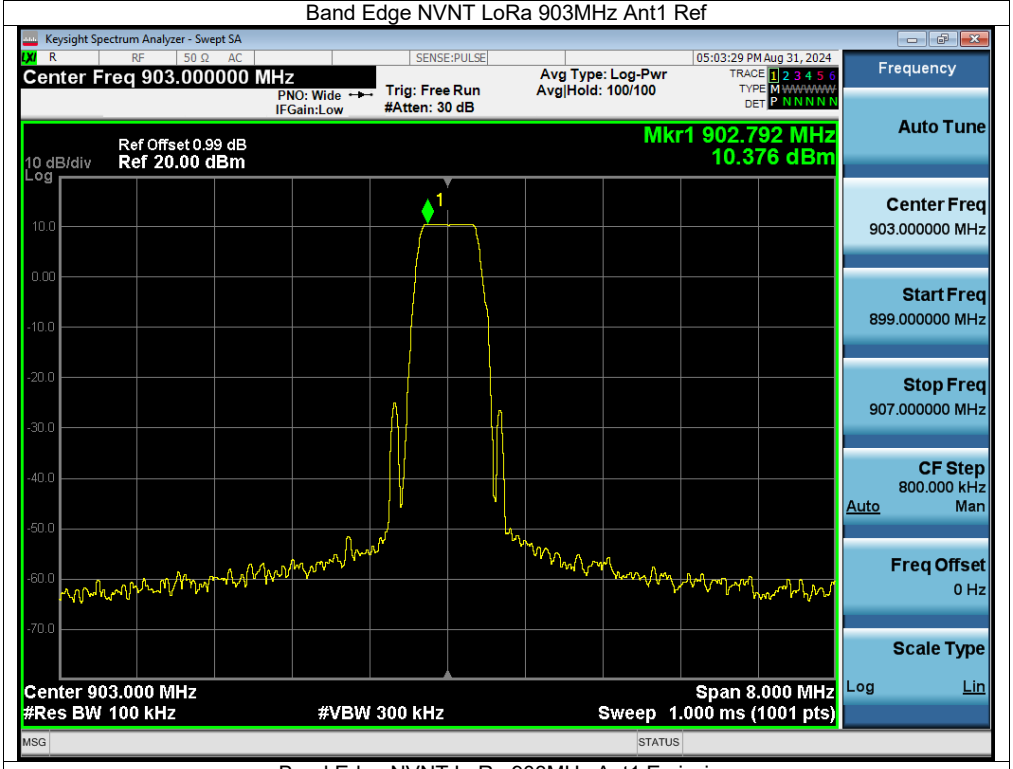
PSD NVNT LoRa 927.5MHz Ant1

Band Edge

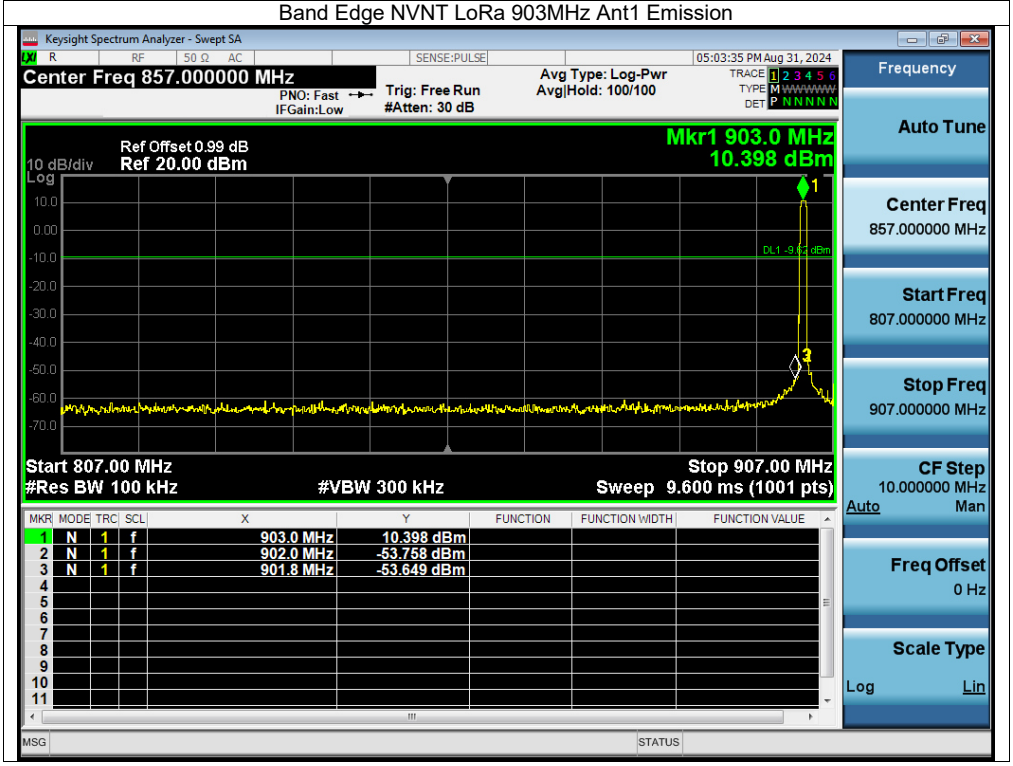
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	LoRa	903	Ant1	-64.03	-20	Pass
NVNT	LoRa	927.5	Ant1	-23.27	-20	Pass

Test Graphs

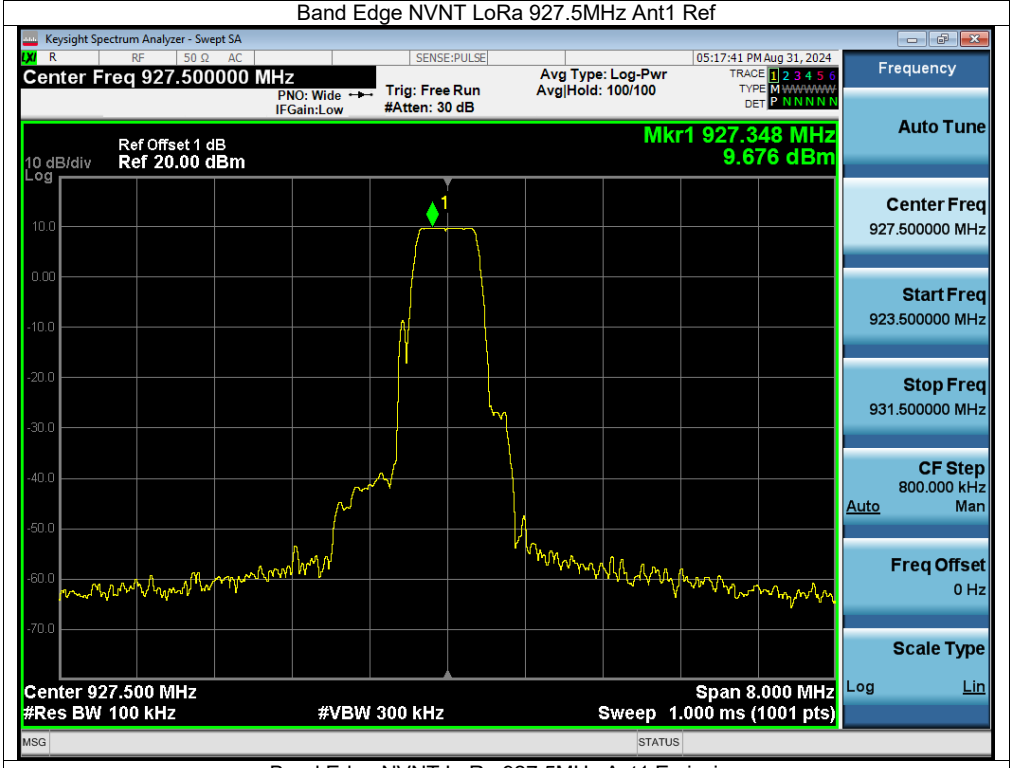
Band Edge NVNT LoRa 903MHz Ant1 Ref



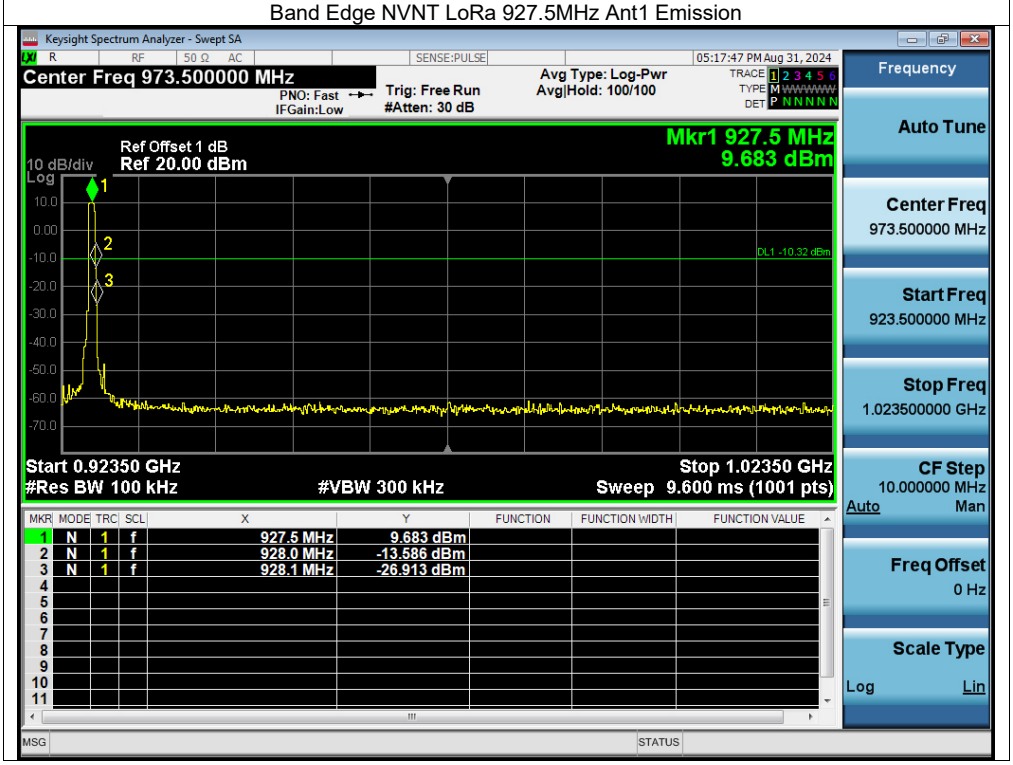
Band Edge NVNT LoRa 903MHz Ant1 Emission



Band Edge NVNT LoRa 927.5MHz Ant1 Ref



Band Edge NVNT LoRa 927.5MHz Ant1 Emission



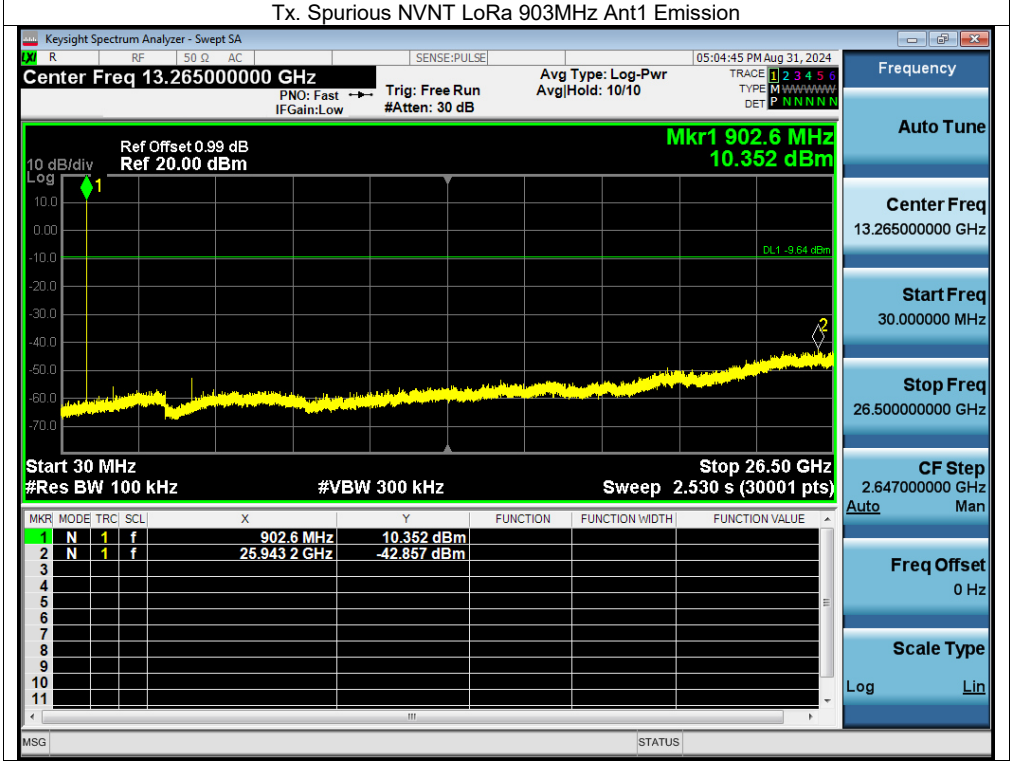
Conducted RF Spurious Emission

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	LoRa	903	Ant1	-53.22	-20	Pass
NVNT	LoRa	923.3	Ant1	-52.93	-20	Pass
NVNT	LoRa	927.5	Ant1	-52.72	-20	Pass

Test Graphs

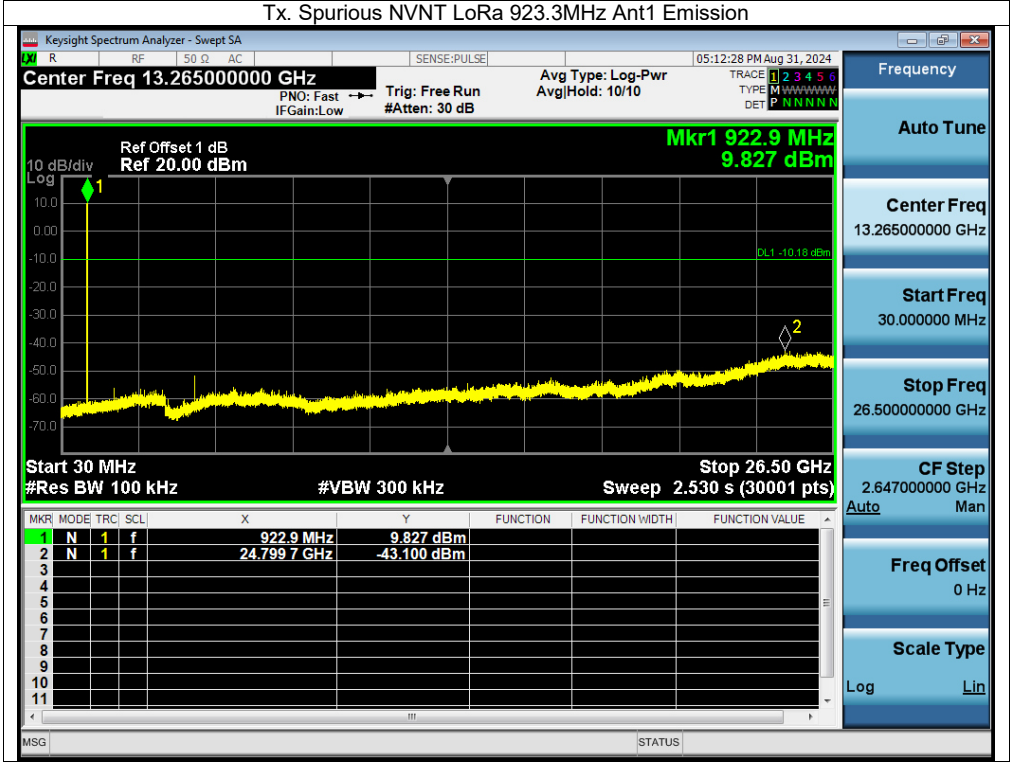
Tx. Spurious NVNT LoRa 903MHz Ant1 Ref

Tx. Spurious NVNT LoRa 903MHz Ant1 Emission



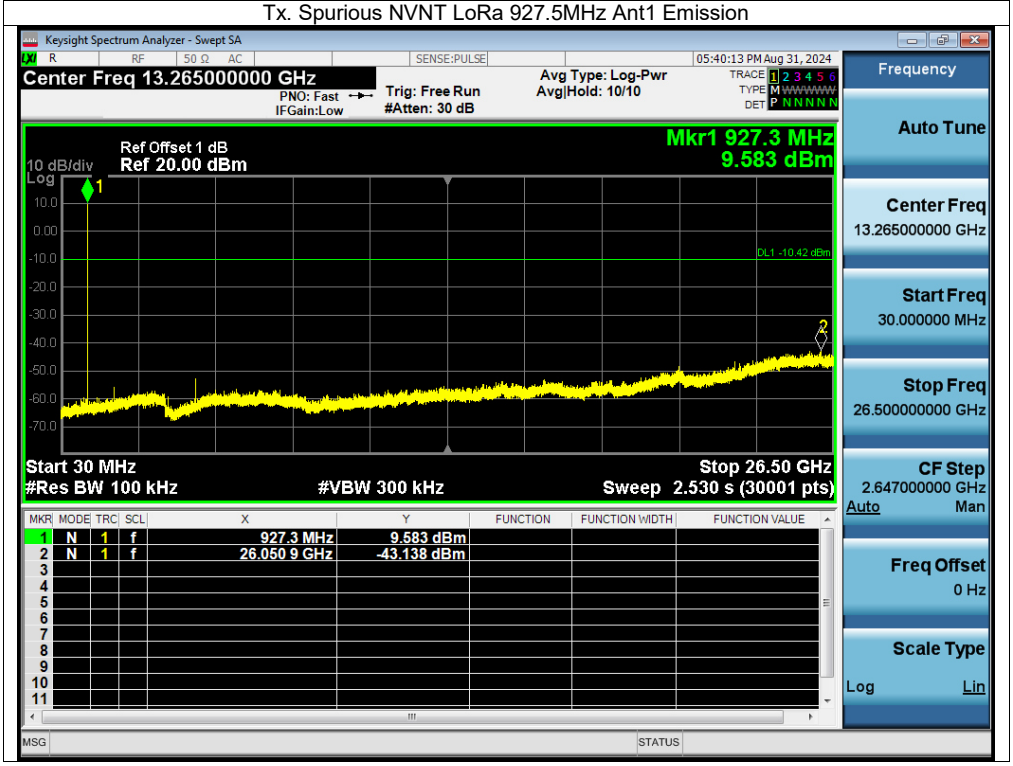
Tx. Spurious NVNT LoRa 923.3MHz Ant1 Ref

Tx. Spurious NVNT LoRa 923.3MHz Ant1 Emission



Tx. Spurious NVNT LoRa 927.5MHz Ant1 Ref

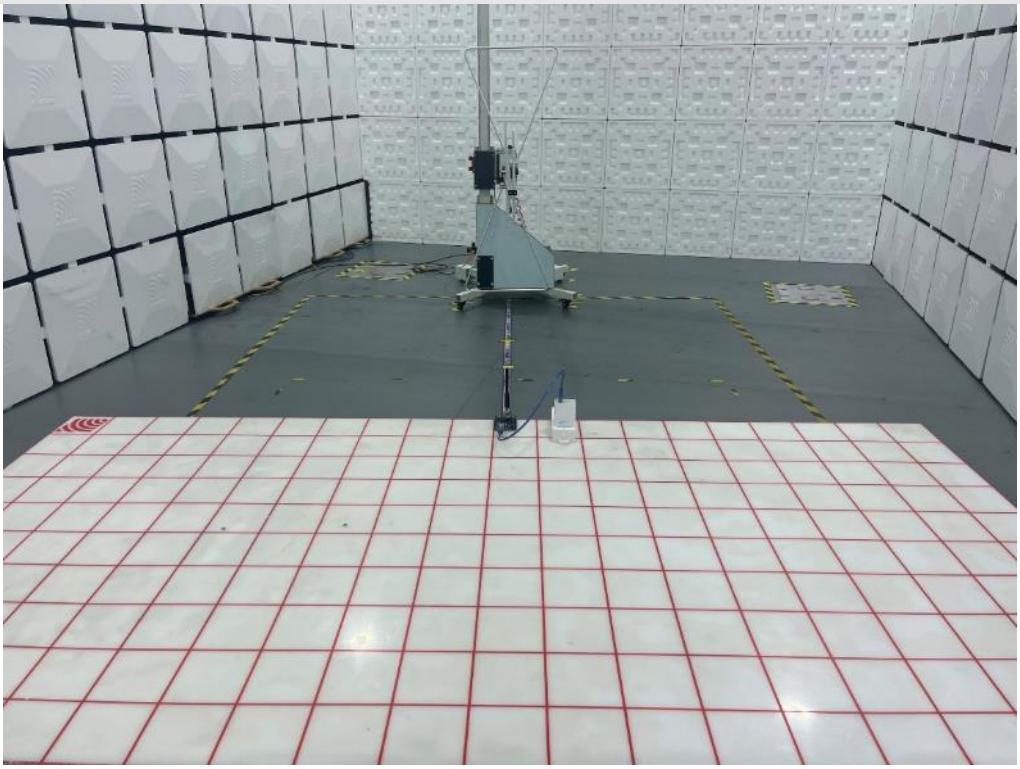
Tx. Spurious NVNT LoRa 927.5MHz Ant1 Emission

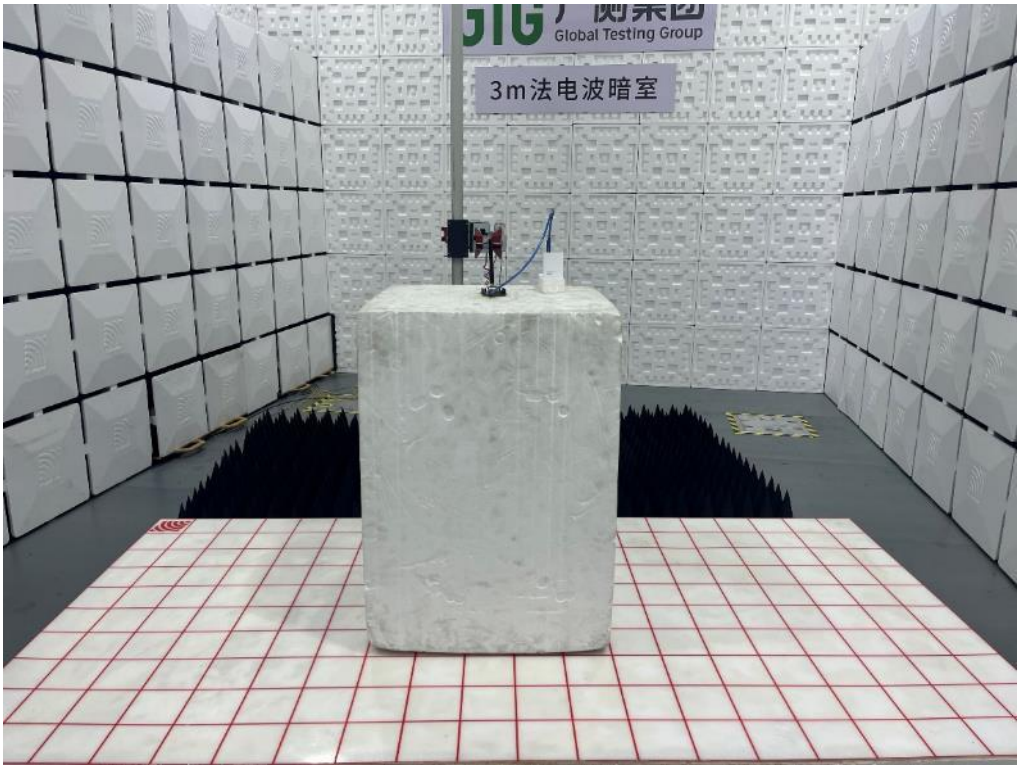


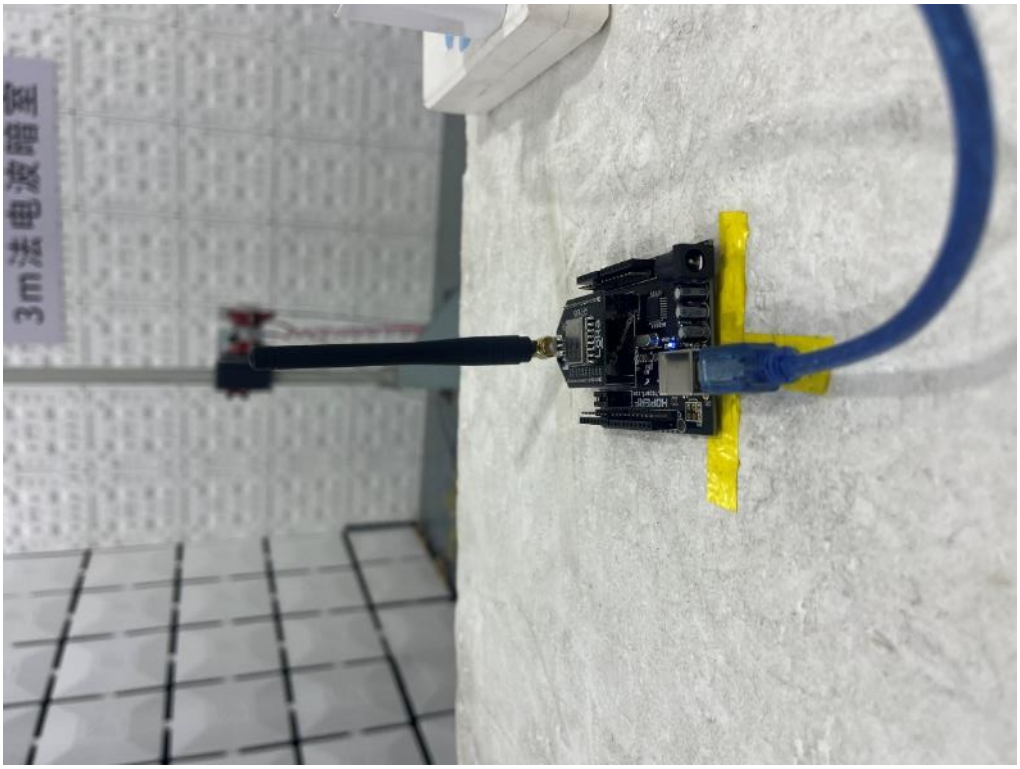
APPENDIX: PHOTOGRAPHS OF TEST CONFIGURATION

AC Power Line Conducted Emission

Radiated Emissions

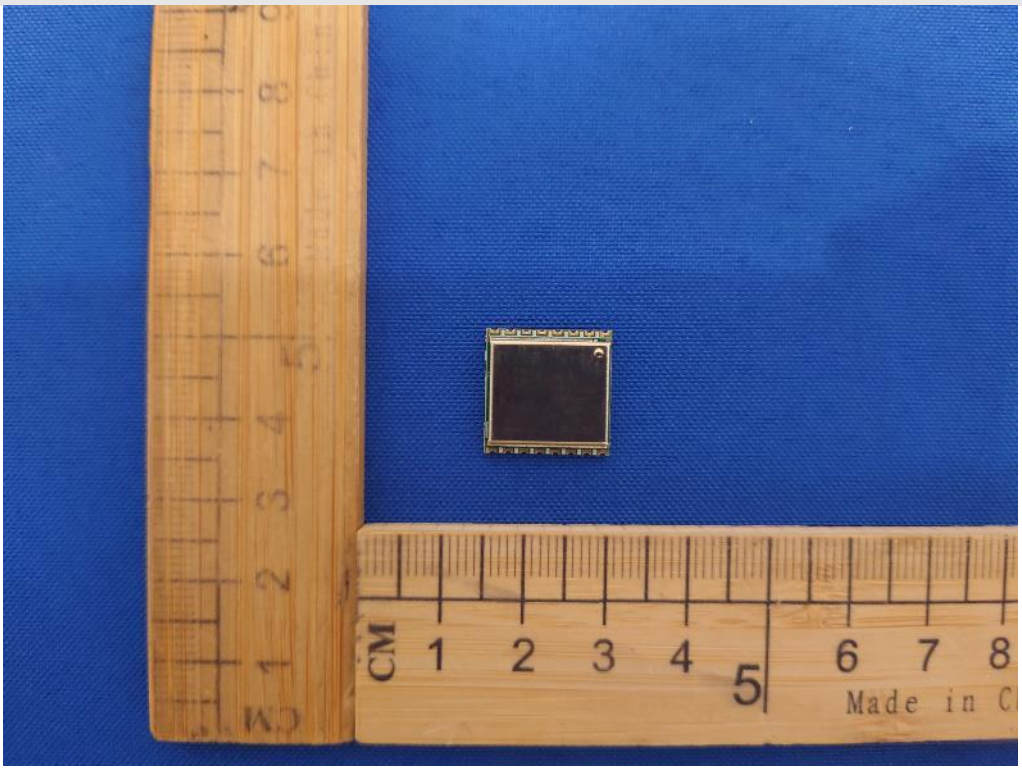


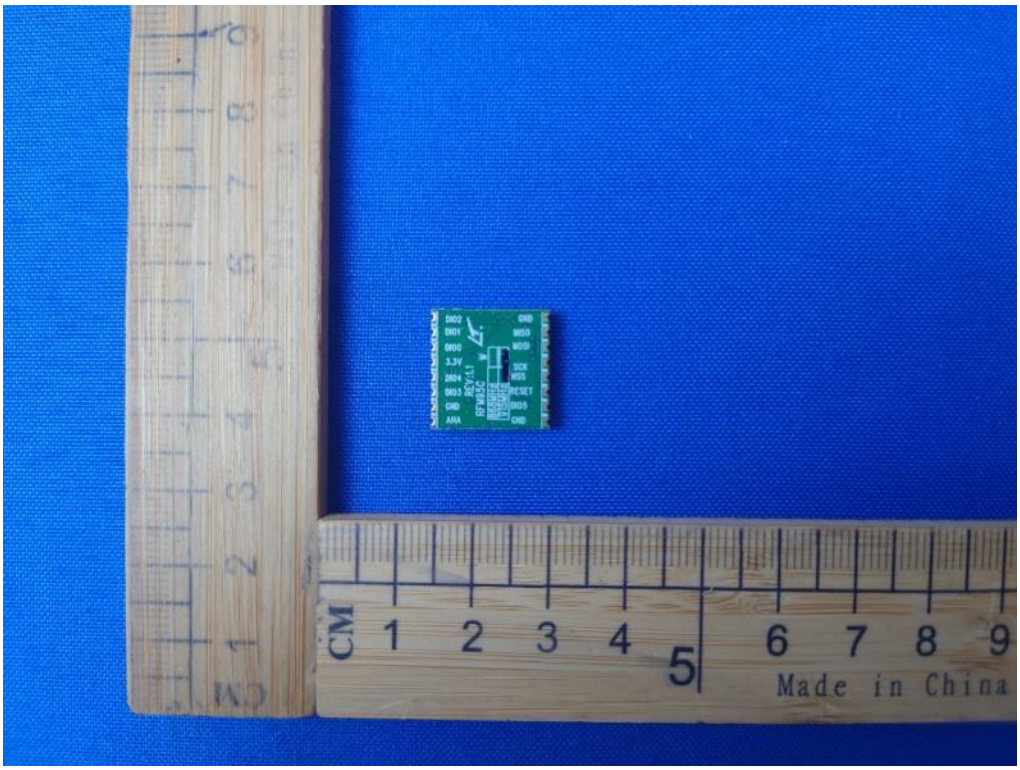

Global Testing Group
3m法电波暗室

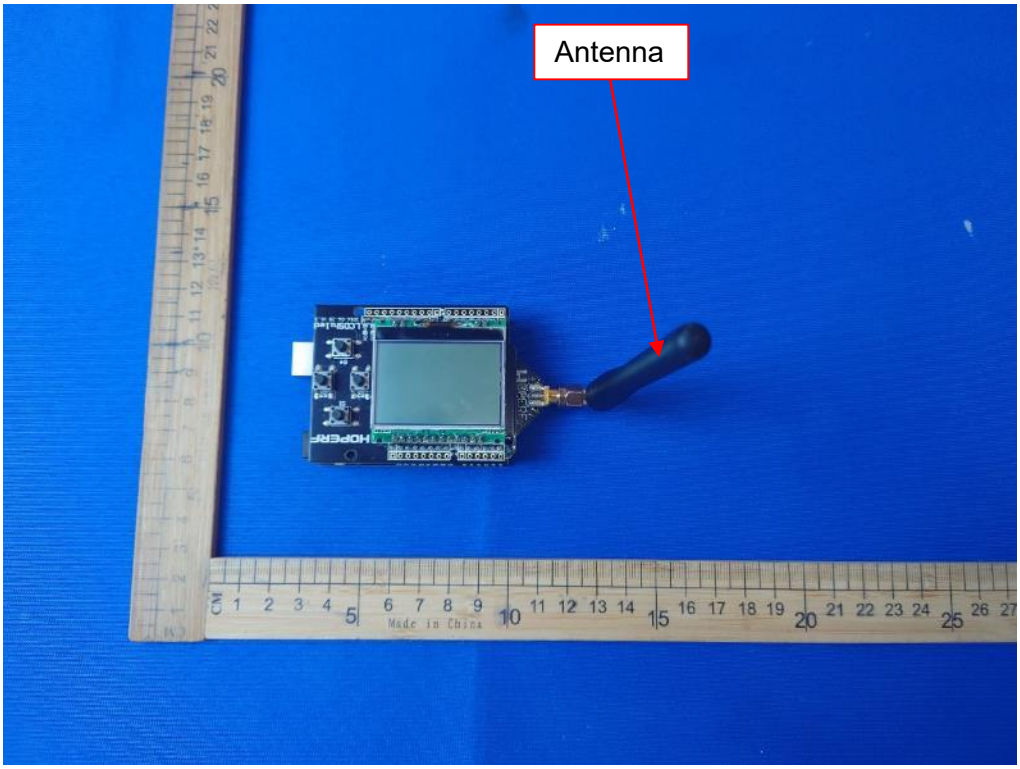

3m法电波暗室

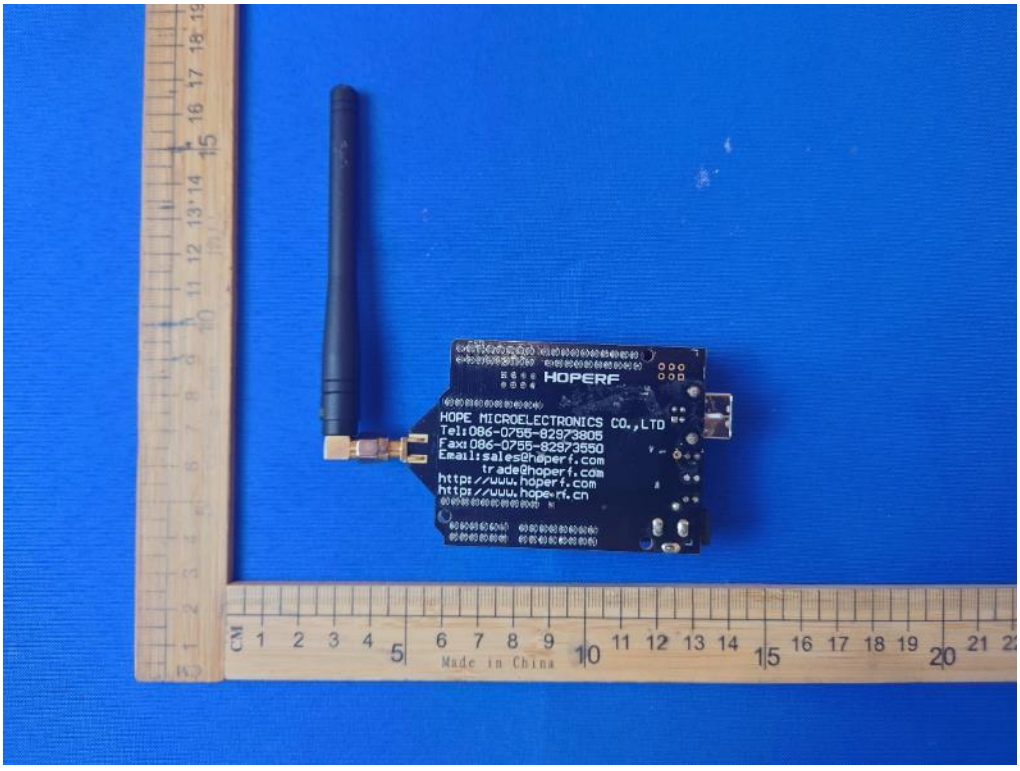
APPENDIX: PHOTOGRAPHS OF THE EUT

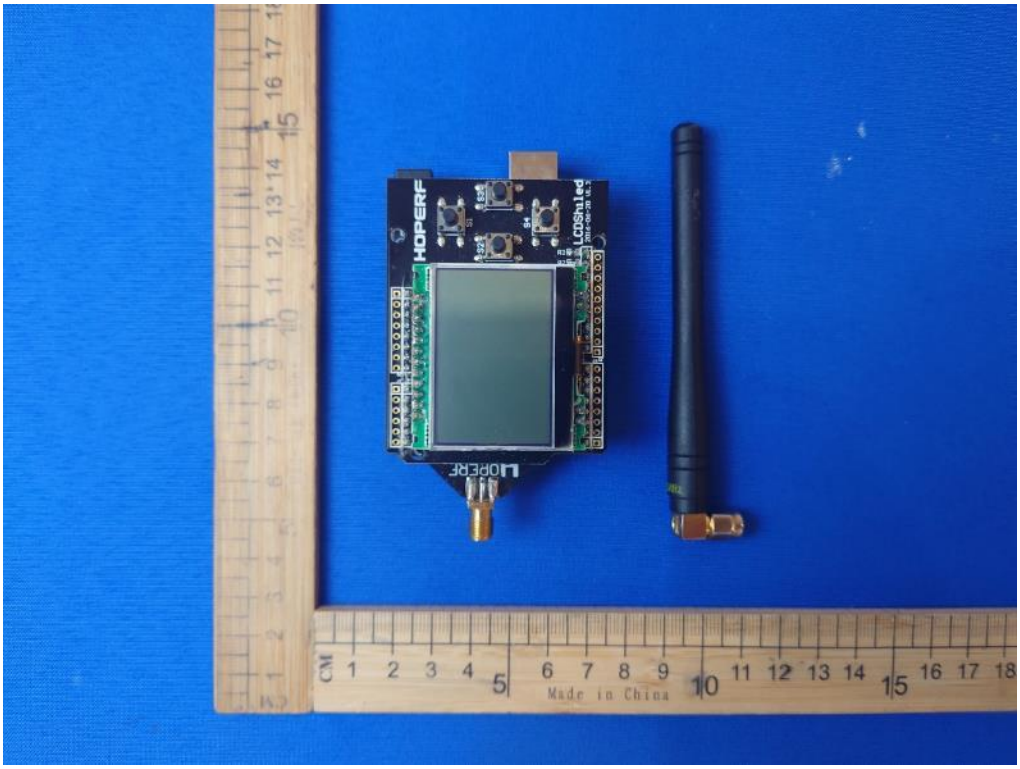
External

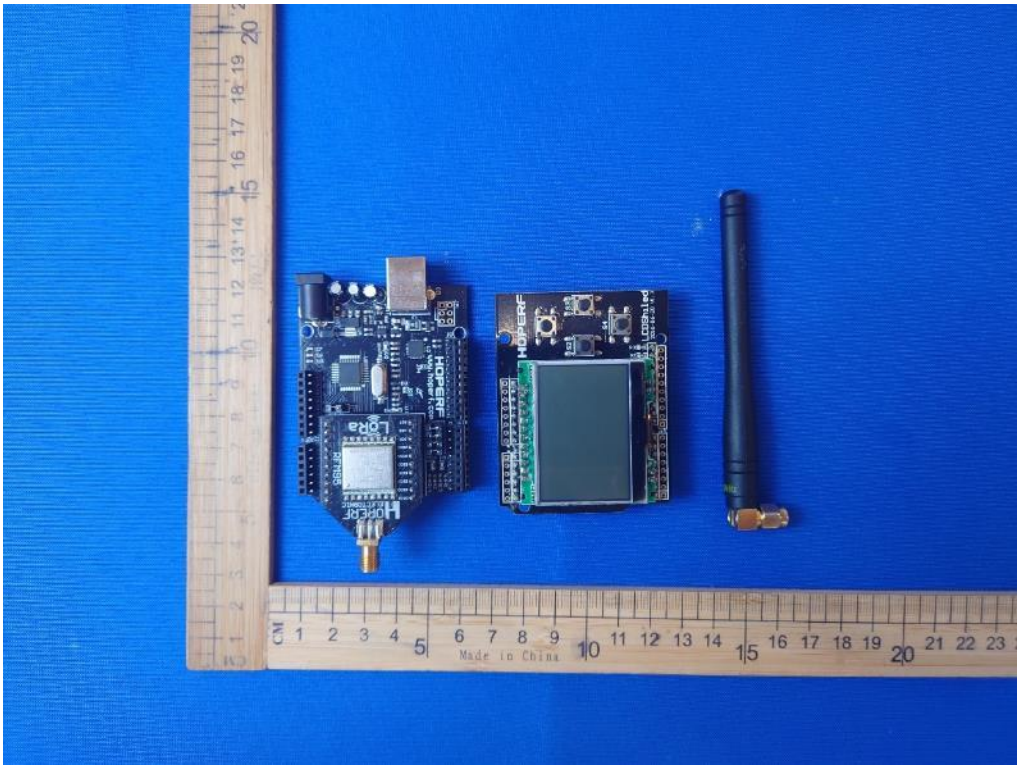


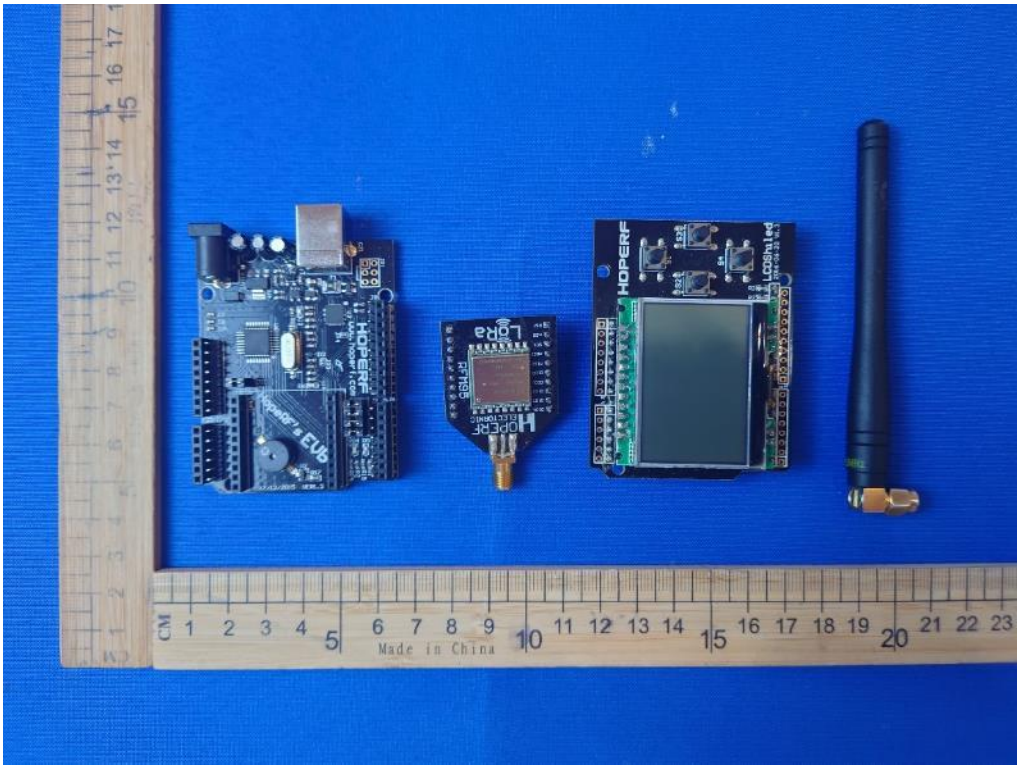


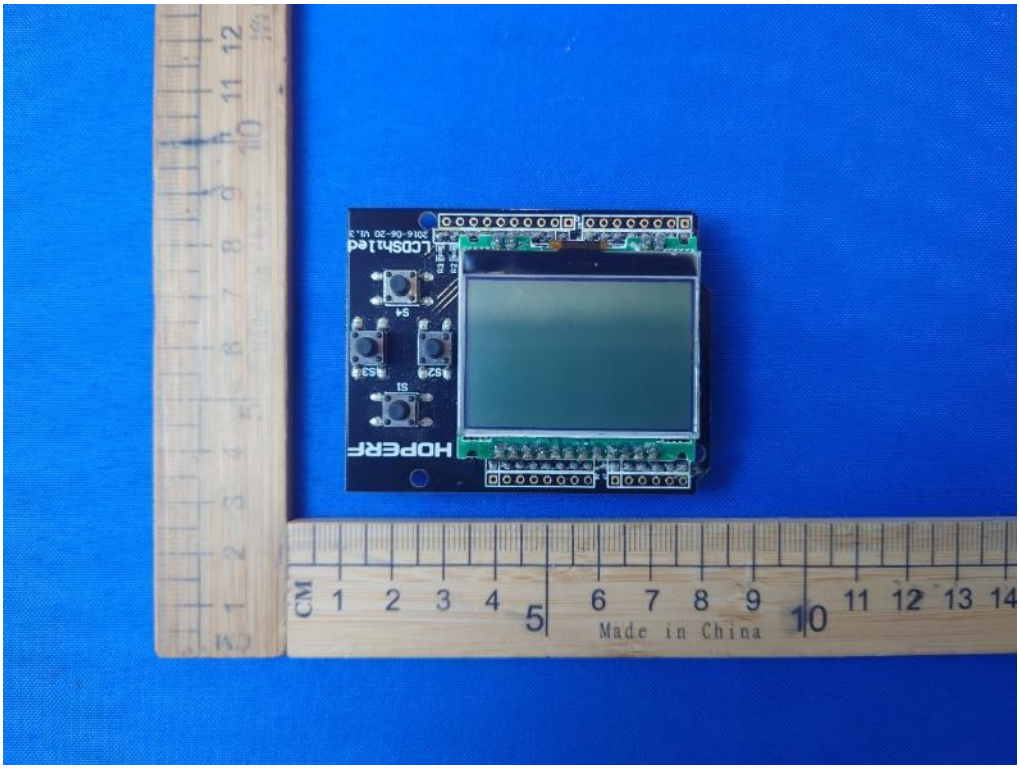

Antenna

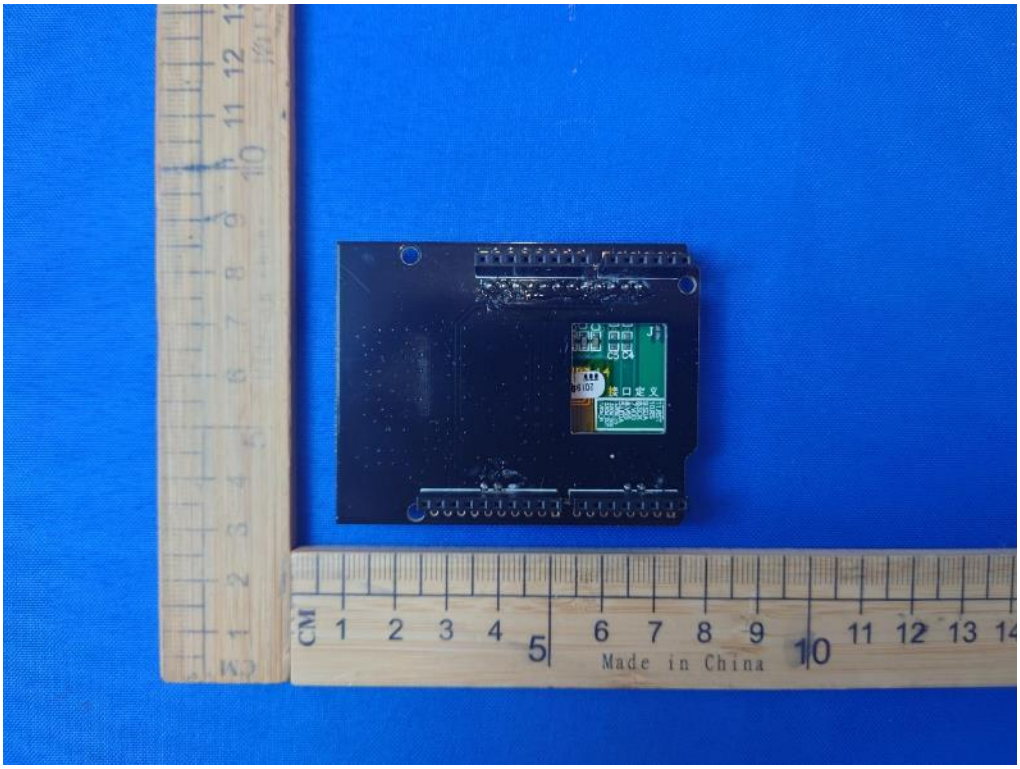

HOPERF
HOPE MICROELECTRONICS CO.,LTD
Tel:086-0755-82973805
Fax:086-0755-82973550
Email:sales@hoperf.com
trade2hoperf.com
https://www.hoperf.com
https://www.hoperf.cn


HOPERF
LOPERF
LCDShield
Made in China


HOPERF
LoRa
LCDShield
Made in China


HOPERF
LoRa
HOPERF
Made in China


HOPERF
Made in China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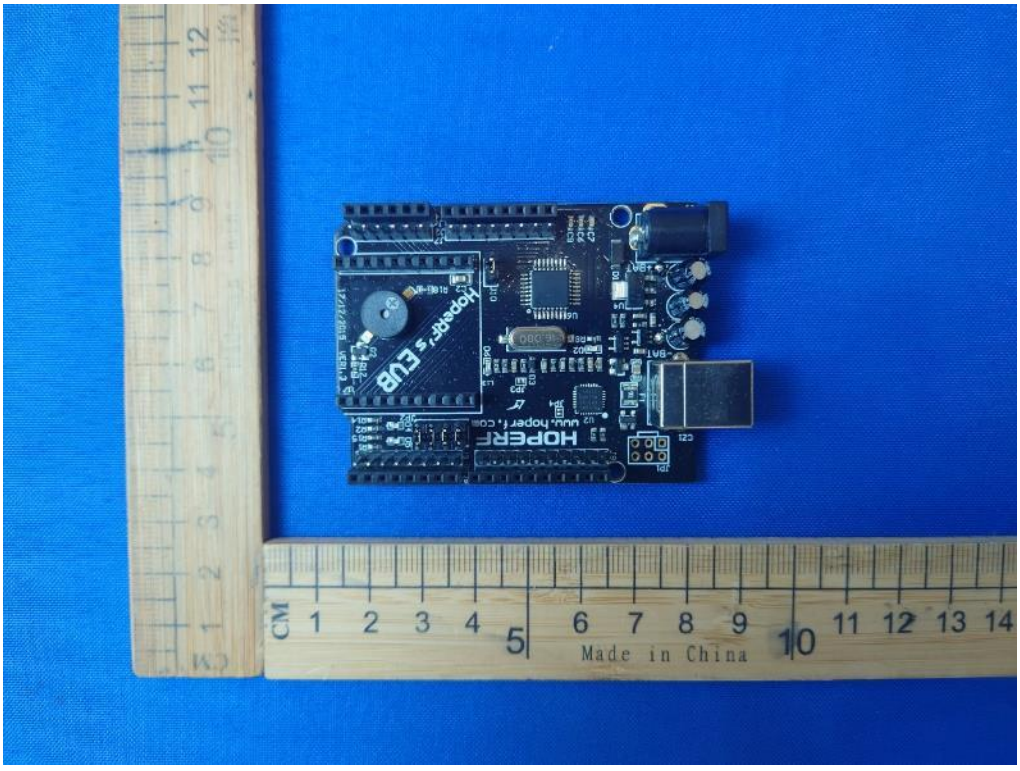
Made in China


CM 1 2 3 4 5 6 7 8 9 10 11 12 13 14
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HOPERF
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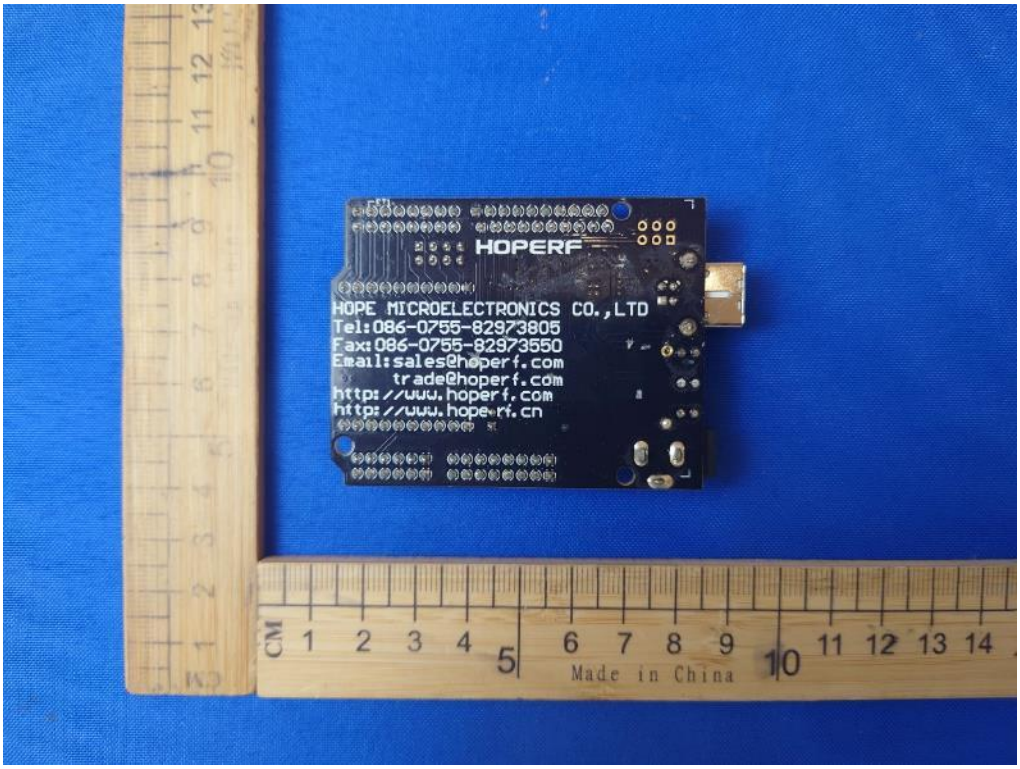
HOPERF
HOPE MICROELECTRONICS CO.,LTD
Tel:086-0755-82973805
Fax:086-0755-82973550
Email:sales@hoperf.com
trade@hoperf.com
http://www.hoperf.com
http://www.hope-rf.cn
CM
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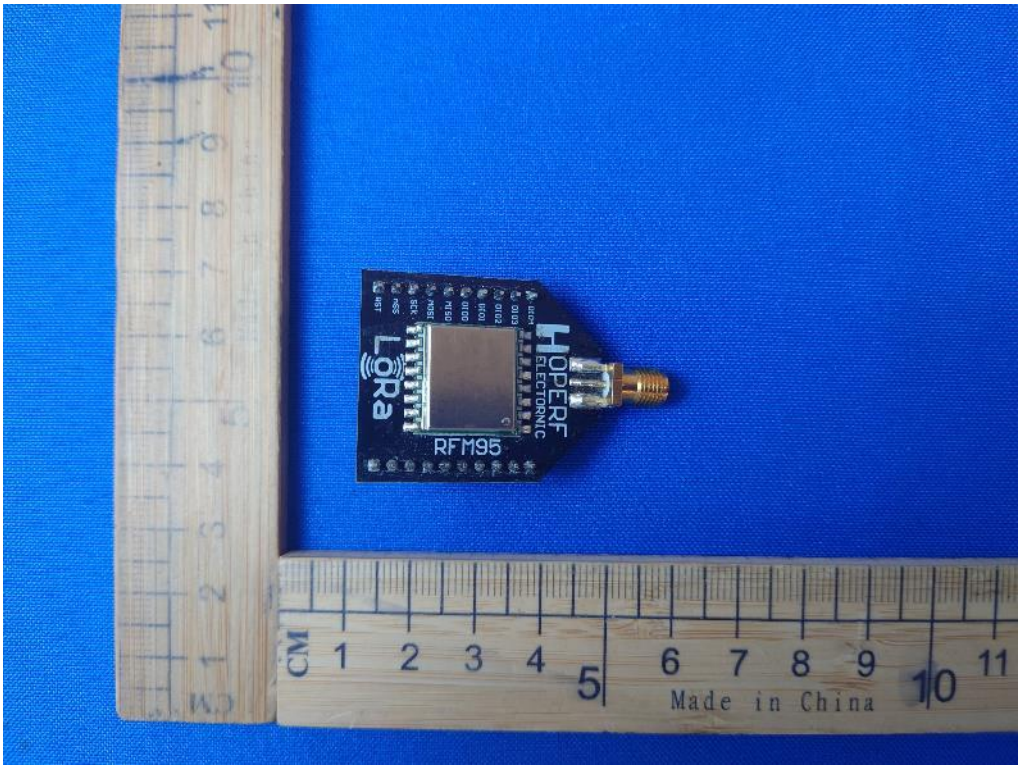
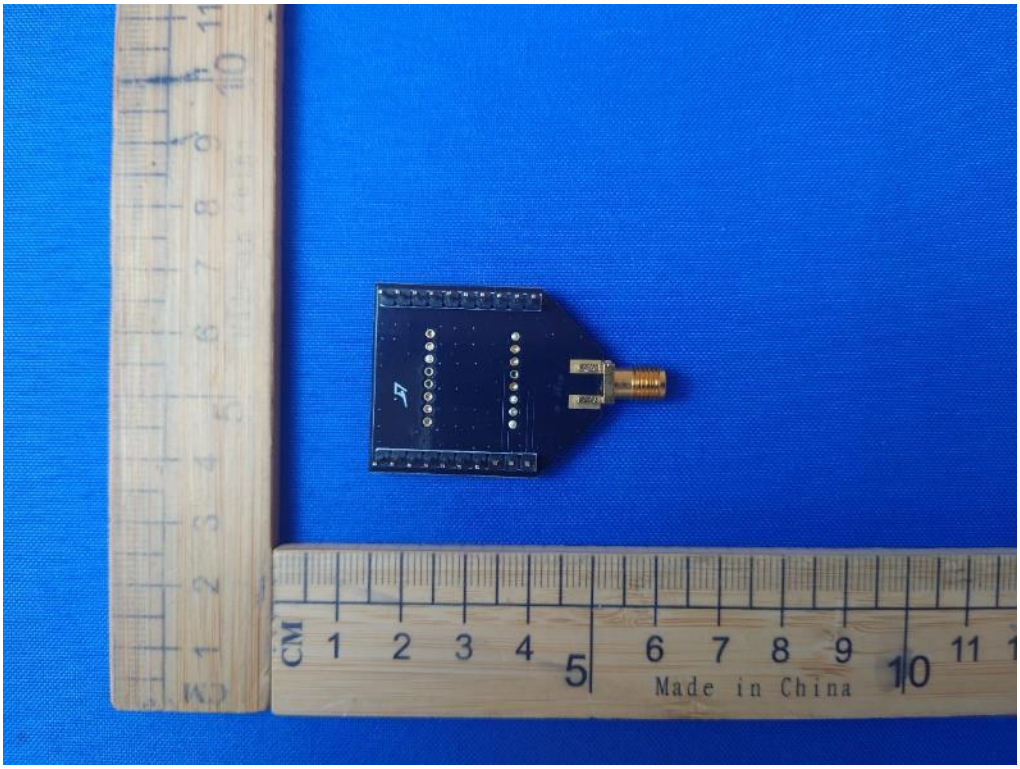

LoRa
HOPERF
ELECTRONIC
RFM95
CM
Made in China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Made in China


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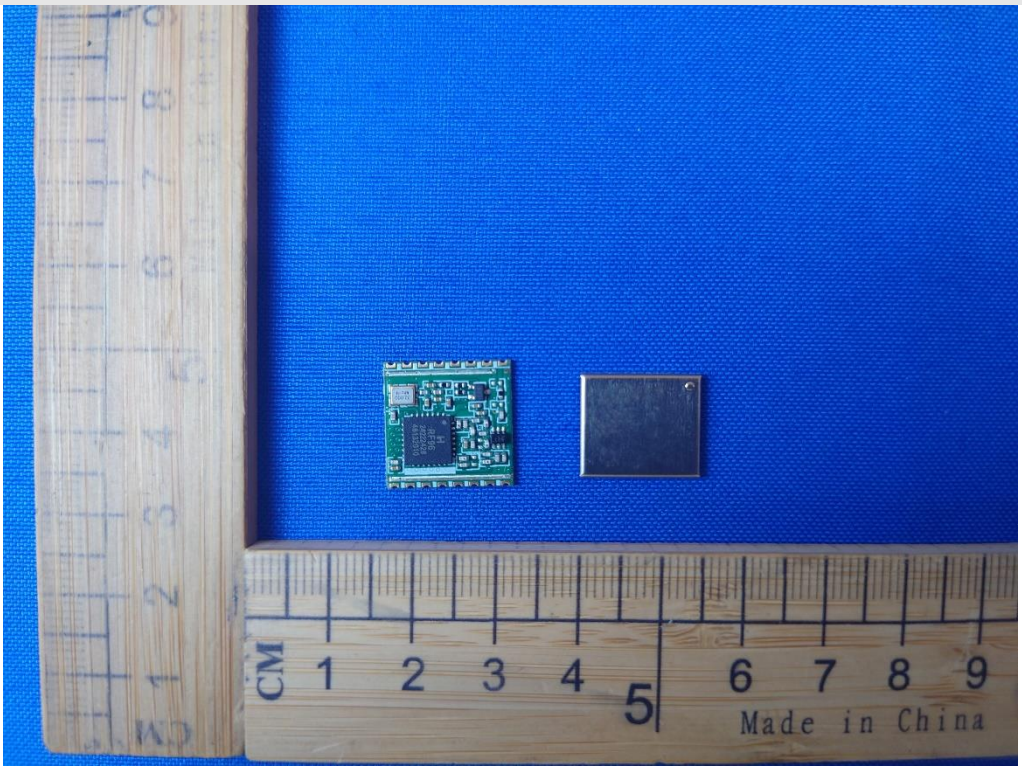
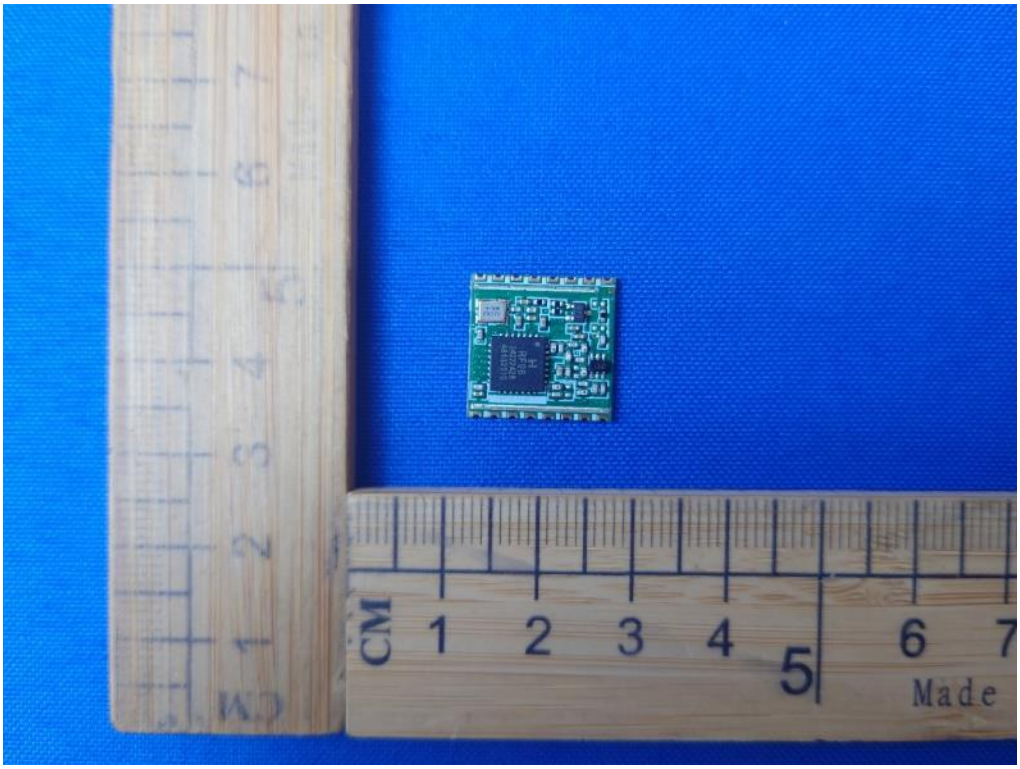
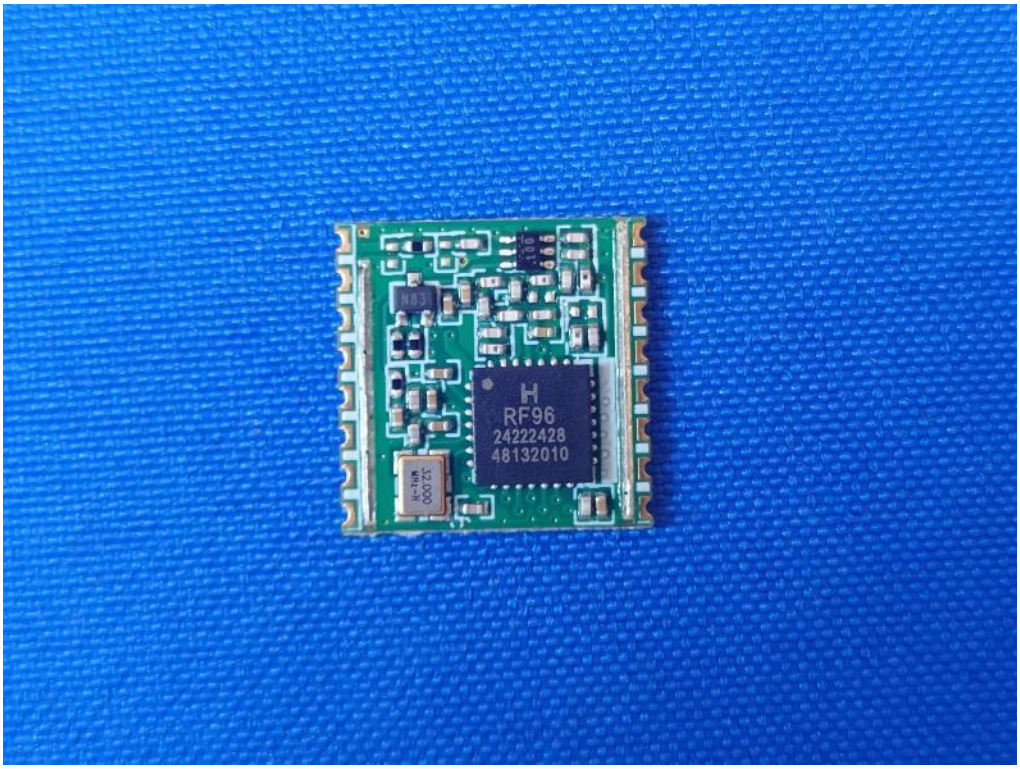
Made in China

Internal







END OF REPORT