RF TEST REPORT

Report No.:	20250517G11227X-W1
Product Name:	LoRa Modules
Model No.:	M320(H)
FCC ID:	2BM2KM320
Applicant:	Shenzhen Navynav Technology Co., Ltd
Address:	Room 502, Han's Laser Technology Centre Shennan Ave No.9988, Nv anshan District,Shenzhen, Guangdong Province, China
Dates of Testing:	05/17/2025 - 06/23/2025
Issued by:	CCIC Southern Testing Co., Ltd.
Lab Location:	Electronic Testing Building, No.43, Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China Query E-Mail: manager@ccic-set.com Feedback E-Mail: integrity@ccic-set.com Report Query Tel: 86-0755-26627338 Feedback Tel: 86-0755-86185963

Test Report

Product .....:	LoRa Modules
Trade Name .....:	Navynav
Applicant.....:	Shenzhen Navynav Technology Co., Ltd
Applicant Address .....:	Room 502, Han's Laser Technology Centre Shennan Ave No.9988, Nv anshan District,Shenzhen, Guangdong Province, China
Manufacturer .....:	Shenzhen Navynav Technology Co., Ltd
Manufacturer Address .....:	Room 502, Han's Laser Technology Centre Shennan Ave No.9988, Nv anshan District,Shenzhen, Guangdong Province, China
Test Standards.....:	47 CFR Part 15 Subpart C 15.247 ANSI C63.10-2020
Test Result.....:	Pass

Tested by .....: 2025.06.23

Chuiwang Zhang, Test Engineer

Reviewed by .....: 2025.06.23

Sun Jiaohui, Senior Engineer

Approved by .....: 2025.06.23

Chris You, Manager

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Change History		
Issue	Date	Reason for change
1.0	2025.06.23	First edition

1. General Information

1.1. EUT Description

Product Name	LoRa Modules
Frequency Range	LoRaWAN: 902MHz~928MHz
Channel Number	903.0~914.2MHz: 8 923.2~927.5MHz: 8
Data Rate	SF12, SF11, SF10, SF9, SF8, SF7, SF6, SF5
Modulation Type	LoRa
Antenna Type	External Antenna
Antenna Gain	External Antenna: 1.87dBi
Power supply	DC 3.3V

Note 1: The information of antenna gain and cable loss is provided by the manufacturer and our lab is not responsible for the accuracy of the antenna gain and cable loss information.

1.2. Test Standards and Results

The purpose of the report is to conduct testing according to the following FCC certification standards:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C	Radio Frequency Devices
2	ANSI C63.10-2020	American National Standard for Testing Unlicensed Wireless Devices
3	KDB 558074 D01 15.247 Meas Guidance v05r02	Cuidance for Compliance Measurement on Digital Transmission Systems, Frequency Hopping Spread Spectrum Systems, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Result
1	15.203 15.247(b)(4)	Antenna Requirement	PASS
2	15.247(b)(3)	Peak Conducted Output Power	PASS
3	15.247(a)(2)	6dB and 99% Bandwidth	PASS
4	15.247(d)	Conducted Band Edges and Spurious Emission	PASS
5	15.247(e)	Power spectral density (PSD)	PASS
6	15.207	AC Power Line Conducted Emission	PASS
7	15.209 15.205 15.247(d)	Radiated Band Edges and Spurious Emission	PASS

Note 1: The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10-2020.

Note 2: These RF tests were performed according to the method of measurements prescribed in KDB 558074 D01 15.247 Meas Guidance v05r02.

1.3. Carrier Frequency and channel List

LoRaWAN_903.0~914.2MHz					
Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)
0	**903.0**	**3**	**907.8**	6	912.6
1	904.6	4	909.4	**7**	**914.2**
2	906.2	5	911.0	/	/
Note 1: F(MHz) = 903.0 + 1.6*n (0 ≤ n ≤ 7).					
Note 2: Channel 0, 3 and 7 selected for LoRaWAN as Lowest, Middle and Highest channel.					

LoRaWAN_923.3~927.5MHz					
Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)
0	**923.3**	**3**	**925.1**	6	926.9
1	923.9	4	925.7	**7**	**927.5**
2	924.5	5	926.3	/	/
Note 1: F(MHz) = 923.3 + 0.6*n (0 ≤ n ≤ 7).					
Note 2: Channel 0, 3 and 7 selected for LoRaWAN as Lowest, Middle and Highest channel.					

1.4. Test environment and mode

During the measurement, the environmental conditions were within the listed ranges:

Operating Environment	
Temperature	15°C - 35°C
Humidity	30% -60%
Atmospheric Pressure	86kPa-106kPa
Test mode:	
Continuously transmitting mode	Keep the EUT in continuous transmitting with modulation

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Modulation Type	Channel
Peak Conducted Output Power Power Spectral Density 6dB and 99% Bandwidth Conducted and Spurious Emission Radiated and Spurious Emission	LoRa	L, M, H
Conducted Band Edge	LoRa	L, H

1.5. Table for Supporting Units

No.	Equipment	Brand Name	Model Name	Manufacturer	Serial No.	Note
1	Laptop	HP	TPN-Q221	HP	5CD14347QB	FCC DOC

1.6. EUT Operation Test Setup

For RF test items, an engineering test program was provided and enable to make EUT transmitting.

1.7. Laboratory Facilities and Accreditation Certificate

☒**CCIC-SET Lab 1**

Address: Electronic Testing Building, No.43, Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China

FCC-Registration No.: CN1283

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered 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: CN1283, valid time is until Jun. 30th, 2025.

ISED Registration: 11185A, CAB number: CN0064

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A on Aug. 04, 2016, valid time is until Jun. 30th, 2025.

A2LA Code: 5721.01

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

CNAS L1659

CCIC Southern Testing Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

☐**CCIC-SET Lab 4**

Address: No.125, Hongmei Section, Wangsha Road, Hongmei Town, Dongguan City, Guangdong Province, China

CNAS L1659

CCIC Southern Testing Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

2. Test Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

And according to FCC 47 CFR Section 15.203: 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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

And according to FCC 47 CFR Section 15.247(b)(4): 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.

2.1.2. Antenna Information

Antenna Category: External Antenna.

1. External antennas are installed by professionals, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded

Antenna General Information:

No.	EUT	Operating frequency range	Ant. Type	Ant. Gain
1	LoRa Modules	902-928MHz	External Antenna	1.87dBi

2.1.3. Result: Comply

Please refer to the EUT photos.

2.2. Maximum Conducted Output Power

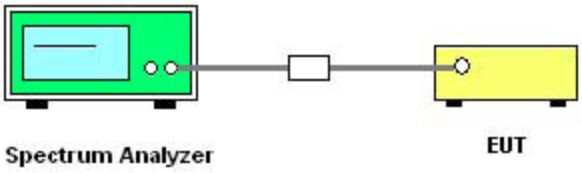
2.2.1. Limit of Peak Output Power

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3. Test Setup



2.2.4. Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2020 Section 11.9.1.1.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings:

   RBW ≥ DTS bandwidth / VBW ≥ 3*RBW / Sweep time: Auto couple / Detector mode: Peak / Trace mode: Max hold / Allow trace to fully stabilize / Use peak marker function to determine the peak amplitude level.
5. Record the measurement results in the test report.

2.2.5. Test Result of Peak Output Power

Please refer to Appendix A for detail.

2.3. 6dB and 99% Bandwidth

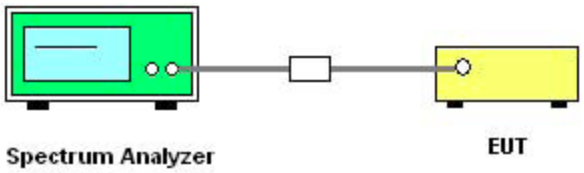
2.3.1. Limit of 6dB and 99% Bandwidth

The minimum 6 dB Occupied bandwidth shall be at least 500 kHz.

2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.3. Test Setup



2.3.4. Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2020 Section 11.8.1.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the spectrum analyzer “Channel Bandwidth” function to easurement the 6 dB EBW and 99% OBW.
5. For 6 dB EBW Use the following spectrum analyzer settings:
   RBW: 100 kHz / VBW: 300 kHz / Detector: Peak / Trace mode: Max hold / Sweep time: Auto couple / Allow trace to fully stabilize.
6. For 99% OBW Use the following spectrum analyzer settings:
   Set RBW = approximately 1% EBW or 1.5 times to 5.0 times the OBW, VBW $\geq 3 \times$ RBW.
7. Record the measurement results in the test report.

2.3.5. Test Results of 6dB and 99% Bandwidth

Please refer to Appendix A for detail.

2.4. Power spectral density (PSD)

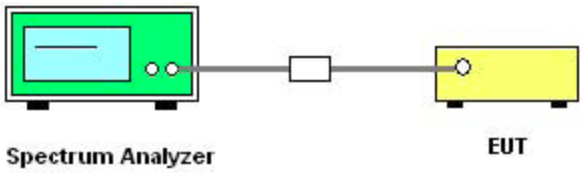
2.4.1. Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.4.3. Test Setup



2.4.4. Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2020 Section 11.10.2.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings:

   Set instrument center frequency to DTS channel center frequency / Set the span to 1.5 times the DTS bandwidth / RBW: 3kHz / VBW: 10kHz / Detector: Peak / Sweep time: Auto couple / Trace mode: Max hold / Allow trace to fully stabilize / Use the peak marker function to determine the maximum power level.
5. Record the measurement results in the test report.

2.4.5. Test Results of Power spectral density

Please refer to Appendix A for detail.

2.5. Conducted Band Edges and Spurious Emissions

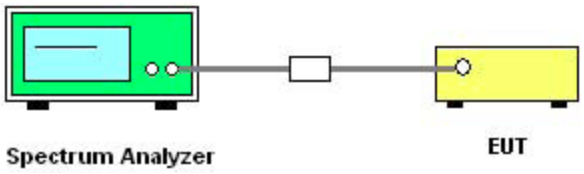
2.5.1. Limit of Conducted Band Edges and Spurious Emissions

In any 100 kHz bandwidth outside the frequency band in which the intentional radiator is perating, 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.

2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.5.3. Test Setup



2.5.4. Test Procedure

1. The testing follows the Measurement Procedure of ANSI C63.10-2020 Section 11.11 and 11.13.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings:

   Reference level measurement: Set spectrum analyzer center frequency to DTS channel center frequency / Set the span to ≥1.5 times the DTS bandwidth / RBW: 100kHz / VBW: 300kHz / Detector: Peak / Sweep time: Auto couple / Trace mode: Max hold / Allow trace to fully stabilize / Use the peak marker function to determine the maximum PSD level and attenuate it by 20dB.

   Emission level measurement: Set the center frequency and span to encompass frequency range to be measured / RBW: 100kHz / VBW: 300kHz / Detector: Peak / Sweep time: Auto couple / Trace mode: Max hold / Allow trace to fully stabilize / Use the peak marker function to determine the maximum amplitude level.
5. Record the measurement results in the test report.

2.5.5. Test Results of Conducted Band Edges and Spurious Emissions

Please refer to Appendix A for detail.

2.6. Radiated Band Edge and Spurious Emission

2.6.1. Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the frequency band in which the 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. If the transmitter uses an RMS average conducted power limit, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the estricted bands, as defi ned in §15.205(a), must also comply with the radiated emission limits specifi ed in §15.209(a).

§15.209(a) Radiated emission limits:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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

Restricted bands of operation refer to §15.205 (a):

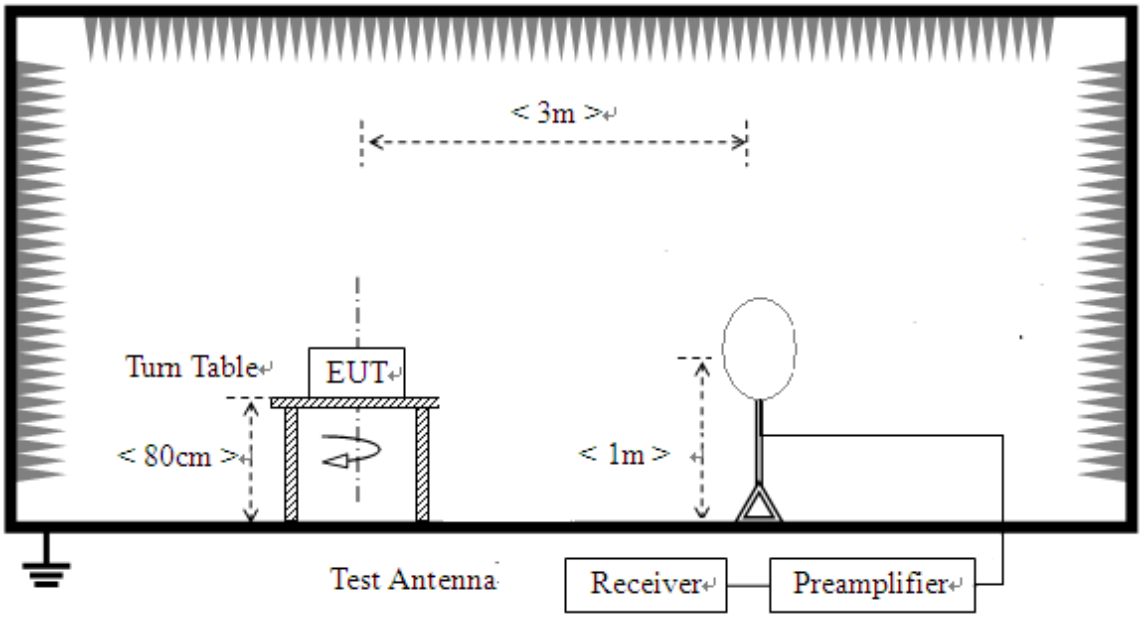
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41	/	/	/
Note: [1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz. [2]Above 38.6.			

2.6.2. Measuring Instruments

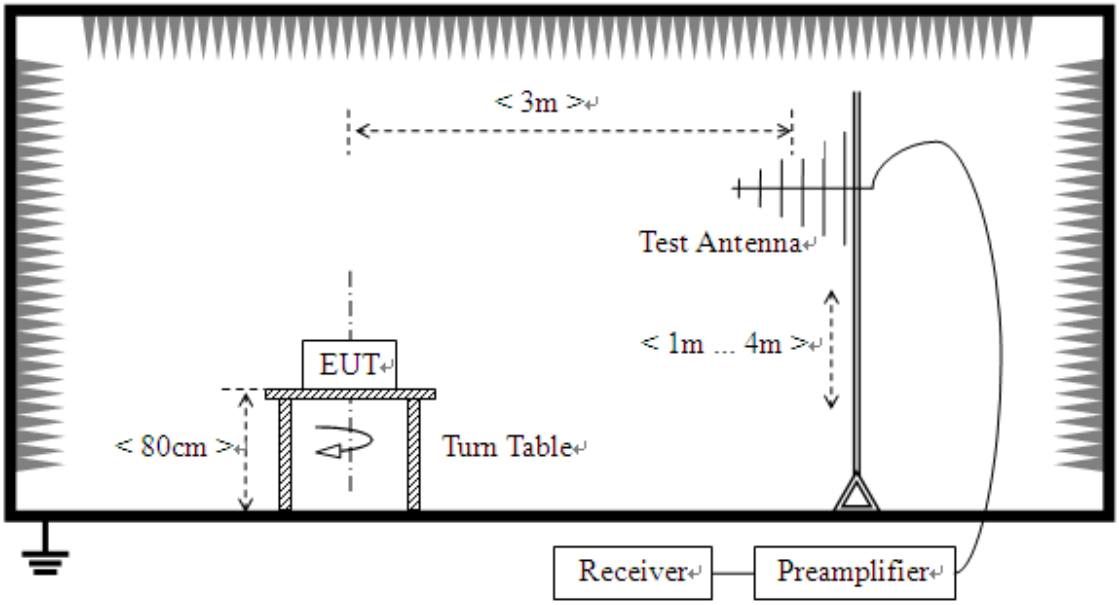
The measuring equipment is listed in the section 3 of this test report.

2.6.3. Test Setup

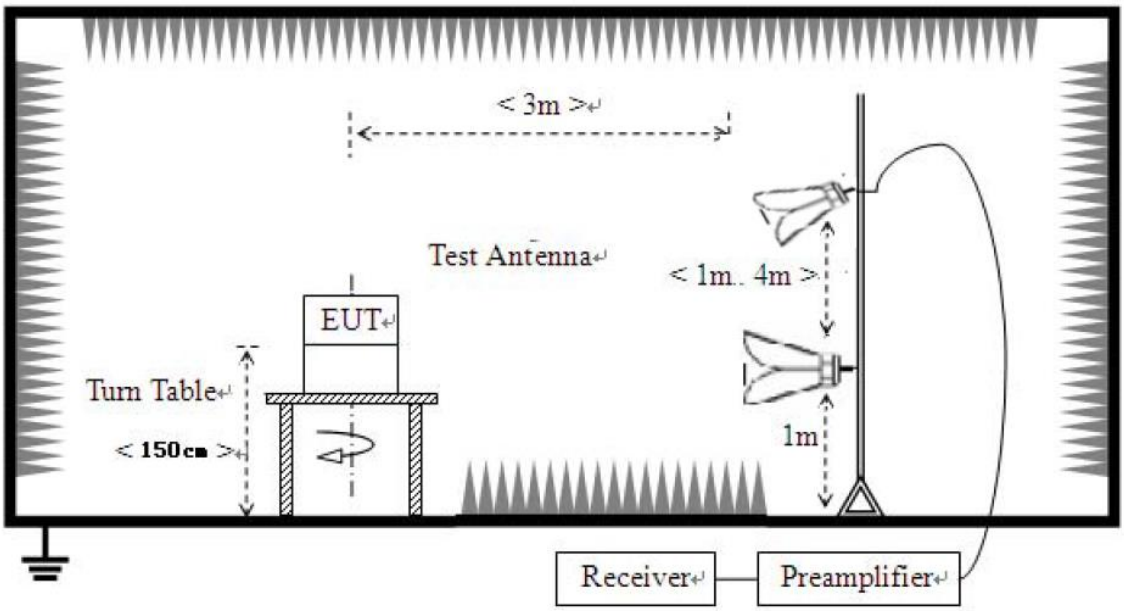
For radiated emissions from 9 kHz to 30 MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



2.6.4. Test Procedures

1. The EUT was placed on the top of a rotating table 0.8m for below 1GHz and 1.5m for above 1GHz above the ground at a 3 meters semi-anechoic chamber.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on thetop of a variable height antenna tower.
3. Height of receiving antenna 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.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported.Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then

reported in a data sheet.

7. For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T(Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

2.6.5. Test Results of Radiated Band Edge and Spurious Emission

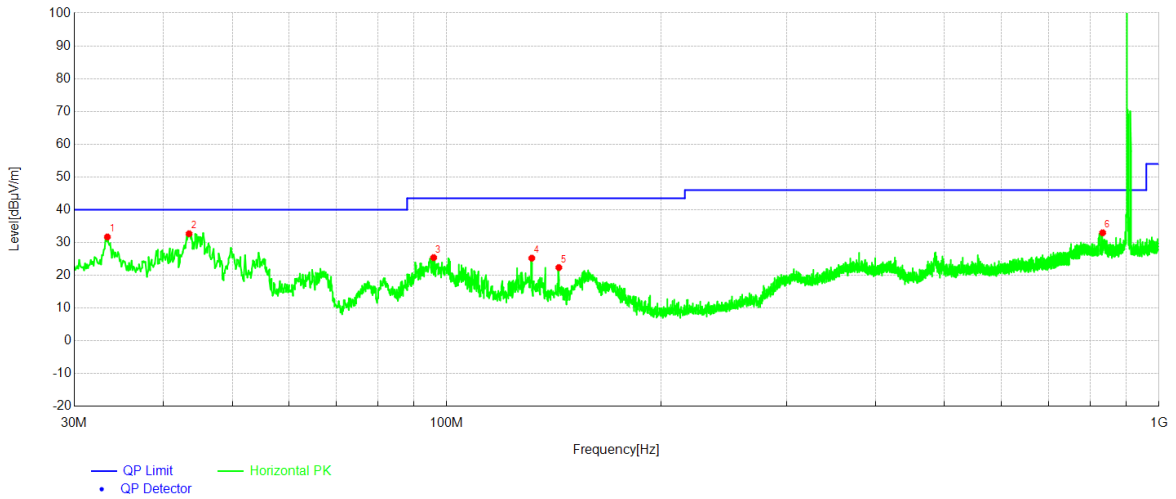
Note 1: For 9 kHz to 30MHz, The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Note 2: For 30MHz to 1GHz, All of the EUT Configure mode were tested and found 903.0MHz channel is the worst mode, the worst case is recorded in this report.

Note 3: For 1GHz to 10GHz, All of the EUT Configure mode were tested and found 903.0MHz channel is the worst mode, the worst case is recorded in this report.

Note 4: Antenna height and turntable angle are the worst positions, the worst case is recorded in this report.

For 30MHz to 1000MHz

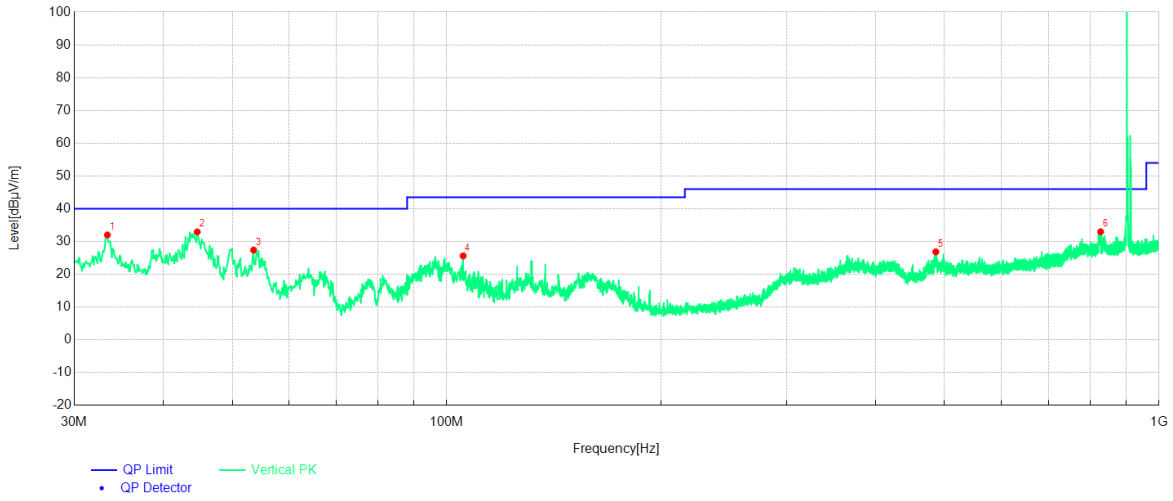


NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dBµV/m]	Height [cm]	Angle [°]	Polarity
1	33.40	31.71	19.97	40.00	8.29	100	190	Horizontal
2	43.48	32.69	14.73	40.00	7.31	100	130	Horizontal
3	95.87	25.40	10.53	43.50	18.10	100	230	Horizontal
4	131.67	25.24	10.66	43.50	18.26	100	20	Horizontal
5	143.70	22.37	10.66	43.50	21.13	100	0	Horizontal
6	833.53	32.98	25.84	46.00	13.02	100	40	Horizontal

Test Result: Pass

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB).
3. Margin value = Limit value – Emission Level.
4. The other emission levels were very low against the limit.



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dBµV/m]	Height [cm]	Angle [°]	Polarity
1	33.40	32.01	19.97	40.00	7.99	100	150	Vertical
2	44.65	32.95	14.33	40.00	7.05	100	340	Vertical
3	53.57	27.40	10.15	40.00	12.60	100	210	Vertical
4	105.47	25.63	10.79	43.50	17.87	100	20	Vertical
5	486.04	26.87	18.77	46.00	19.13	100	280	Vertical
6	828.00	33.00	25.92	46.00	13.00	100	90	Vertical

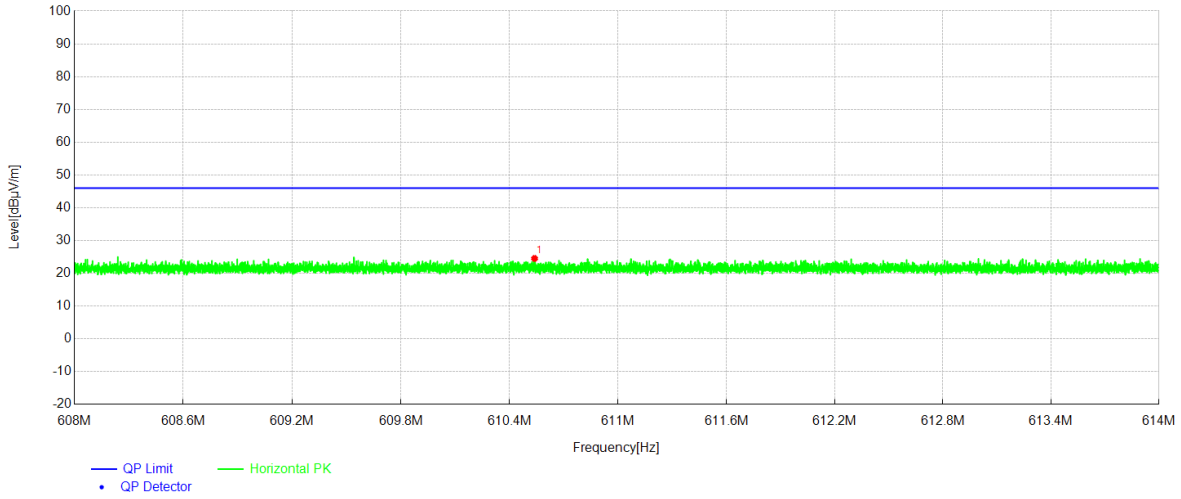
Test Result: Pass

Remark:

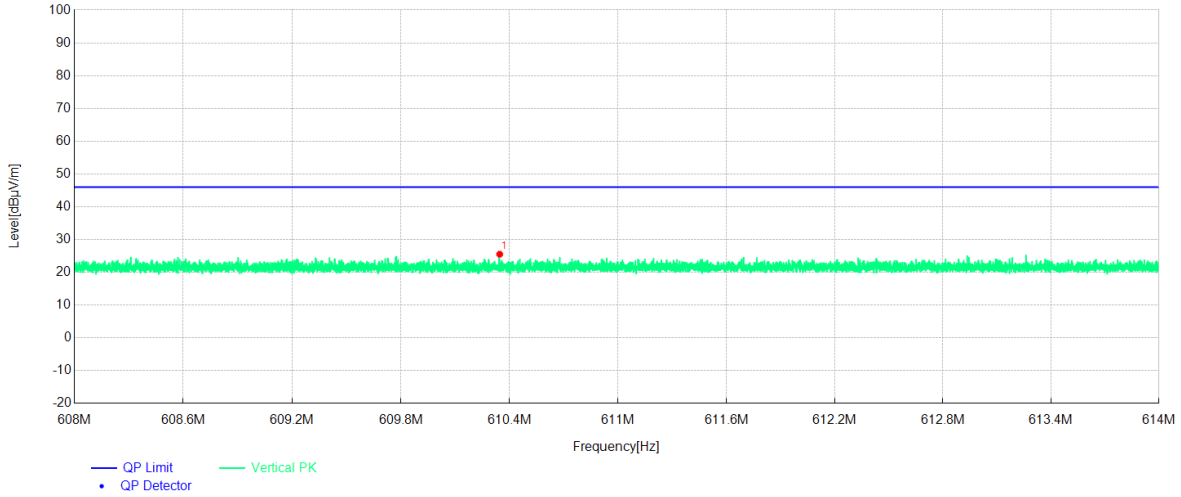
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB).
3. Margin value = Limit value – Emission Level.
4. The other emission levels were very low against the limit.

Restricted-band band-edge: 608MHz~614MHz

LoRa_903.0MHz: Horizontal



LoRa_903.0MHz: Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dBµV/m]	Height [cm]	Angle [°]	Polarity
1	610.54	24.54	20.66	46.00	21.46	100	40	Horizontal
2	610.35	25.53	20.67	46.00	20.47	100	310	Vertical

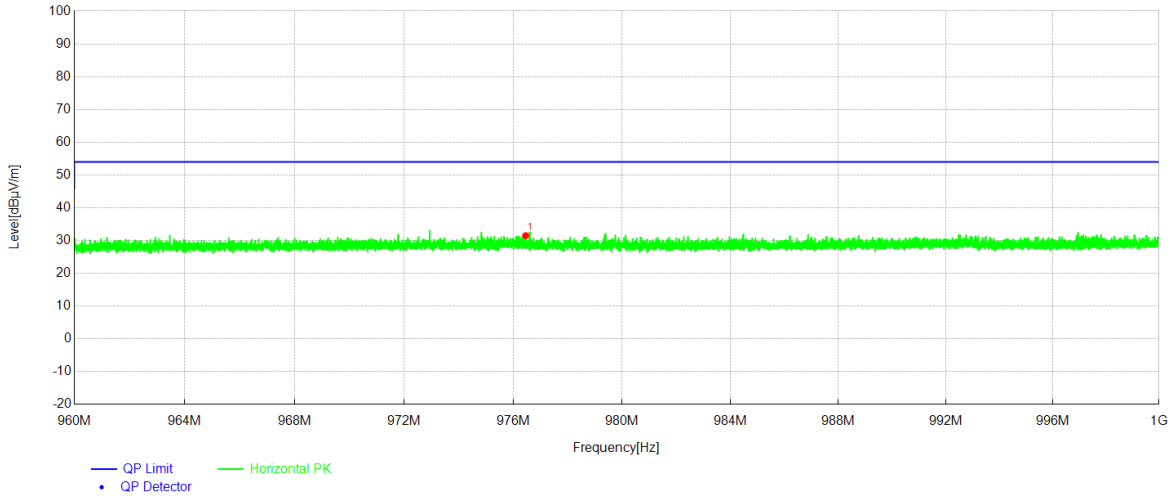
Test Result: Pass

Remark:

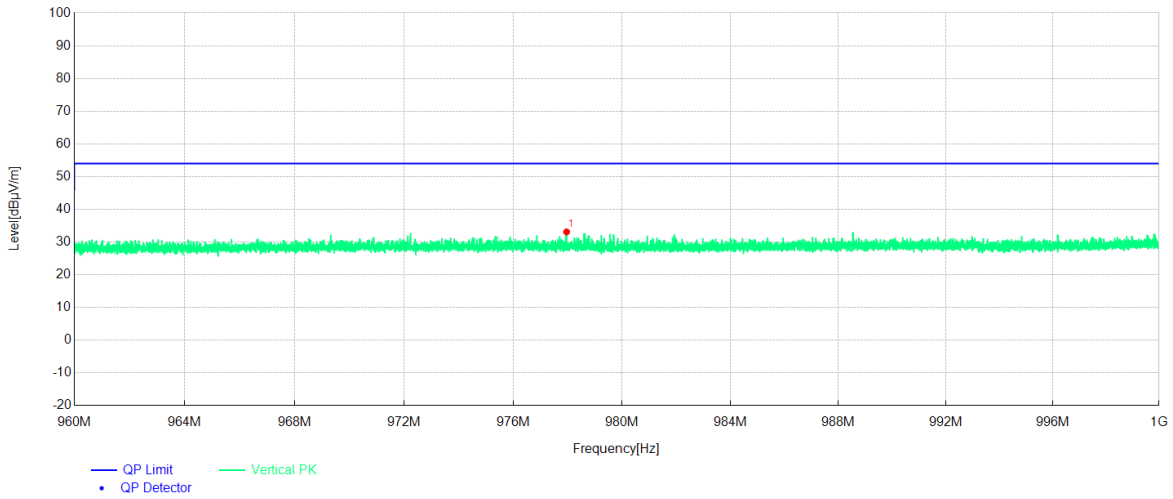
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB).
3. Margin value = Limit value – Emission Level.
4. The other emission levels were very low against the limit.

Restricted-band band-edge: 960MHz~1000MHz

LoRa_927.5MHz: Horizontal



LoRa_927.5MHz: Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dBµV/m]	Height [cm]	Angle [°]	Polarity
1	976.45	31.49	26.53	54.00	22.51	100	150	Horizontal
2	977.95	33.11	26.55	54.00	20.89	100	210	Vertical

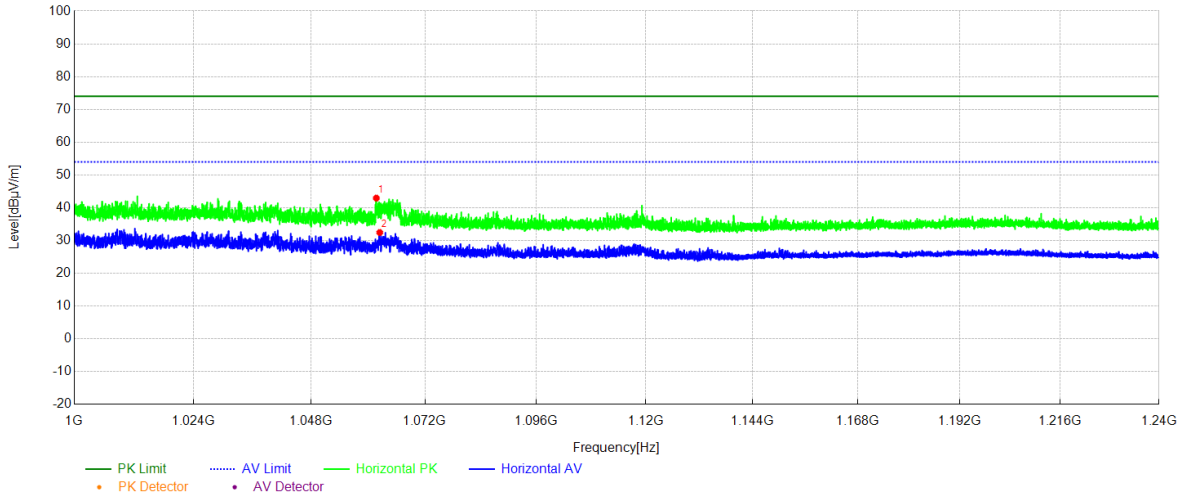
Test Result: Pass

Remark:

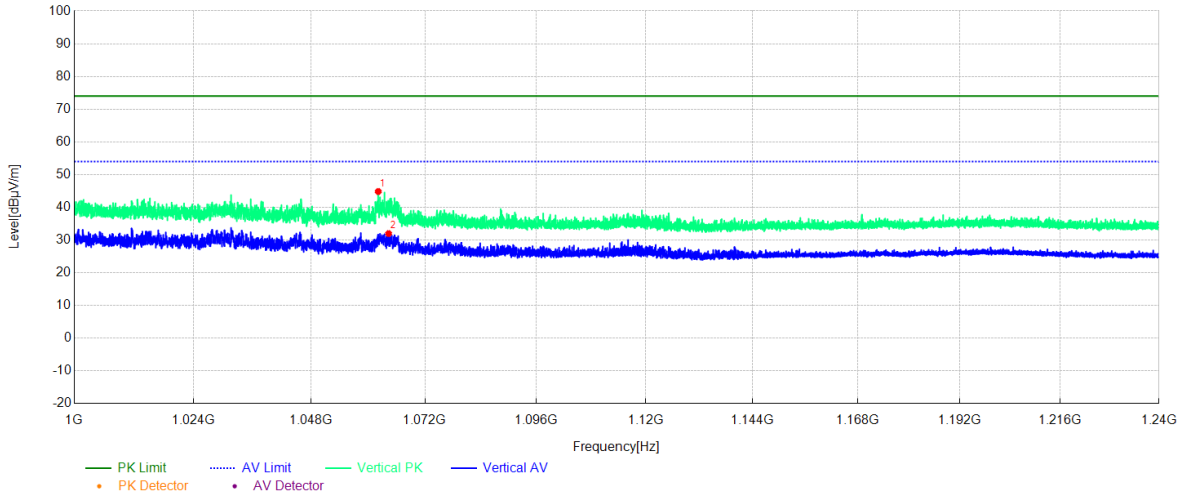
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB).
3. Margin value = Limit value – Emission Level.
4. The other emission levels were very low against the limit.

Restricted-band band-edge: 1000MHz~1240MHz

LoRa_927.5MHz: Horizontal



LoRa_927.5MHz: Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin[dBµV/m]	Trace	Height [cm]	Angle [°]	Polarity
1	1061.73	42.95	-13.55	74.00	31.05	PK	150	130	Horizontal
2	1062.45	32.46	-13.54	54.00	21.54	AV	150	160	Horizontal
3	1062.14	44.83	-13.54	74.00	29.17	PK	150	80	Vertical
4	1064.33	31.98	-13.53	54.00	22.02	AV	150	300	Vertical

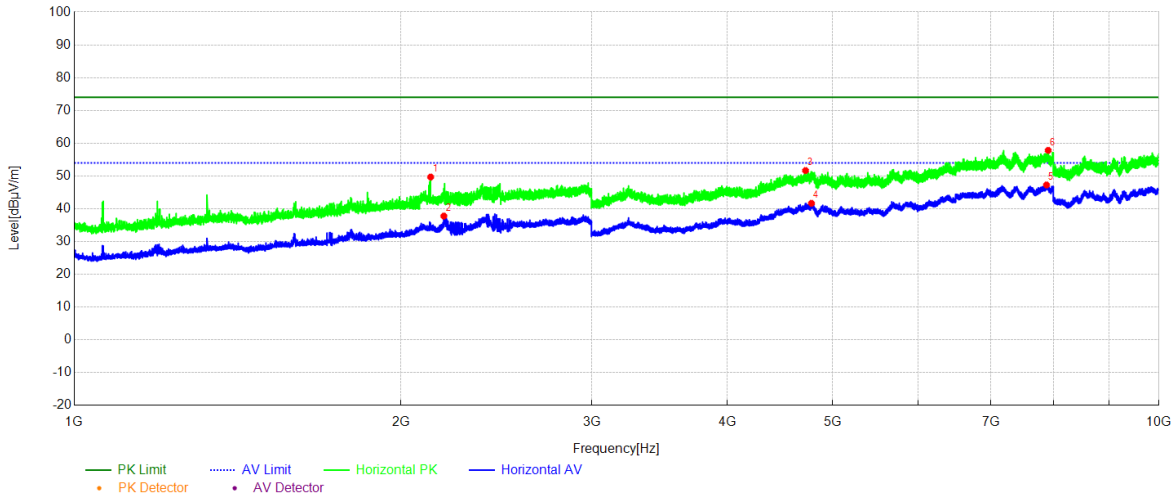
Test Result: Pass

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB).
3. Margin value = Limit value – Emission Level.
4. The other emission levels were very low against the limit.

For 1GHz to 10GHz:

LoRa_903.0MHz



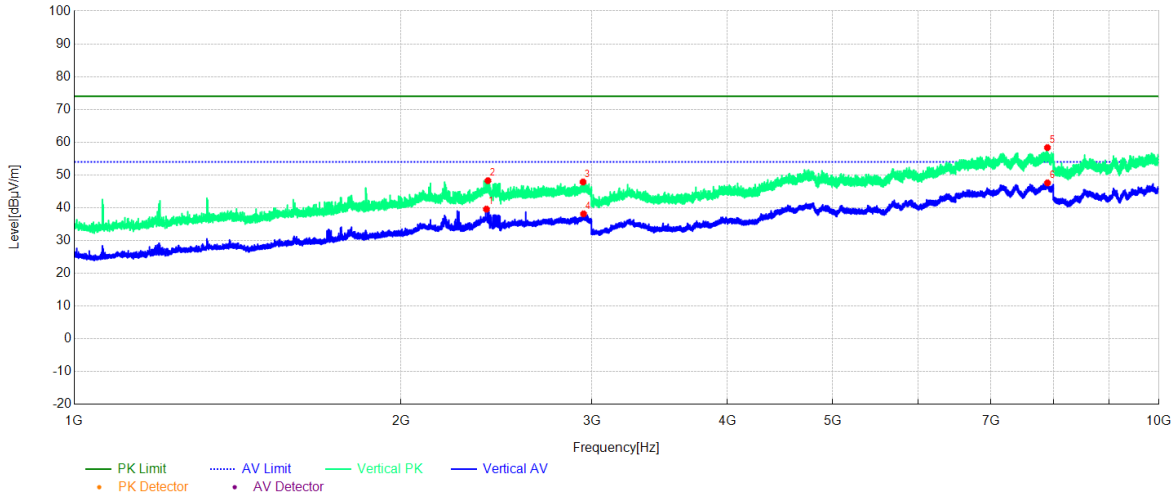
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dBµV/m]	Trace	Height [cm]	Angle [°]	Polarity
1	2130.9	49.68	-4.81	74.00	24.32	PK	150	0	Horizontal
2	2191.5	37.78	-4.93	54.00	16.22	AV	150	220	Horizontal
3	4722.5	51.66	2.27	74.00	22.34	PK	150	210	Horizontal
4	4782.3	41.66	2.73	54.00	12.34	AV	150	190	Horizontal
5	7876.3	47.26	8.33	54.00	6.74	AV	150	310	Horizontal
6	7903.9	57.81	8.45	74.00	16.19	PK	150	40	Horizontal

Test Result: Pass

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB).
3. Margin value = Limit value – Emission Level.
4. The other emission levels were very low against the limit.

LoRa_903.0MHz



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dBµV/m]	Trace	Height [cm]	Angle [°]	Polarity
1	2398.7	39.58	-2.08	54.00	14.42	AV	150	140	Vertical
2	2406.3	48.26	-2.31	74.00	25.74	PK	150	20	Vertical
3	2944.7	47.87	-2.17	74.00	26.13	PK	150	80	Vertical
4	2947.9	38.13	-2.13	54.00	15.87	AV	150	120	Vertical
5	7891.7	58.34	8.46	74.00	15.66	PK	150	10	Vertical
6	7892.7	47.58	8.48	54.00	6.42	AV	150	230	Vertical

Test Result: Pass

Remark:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB).
3. Margin value = Limit value – Emission Level.
4. The other emission levels were very low against the limit.

2.7. AC Power Line Conducted Emission

2.7.1. Limit of AC Power Line Conducted Emission

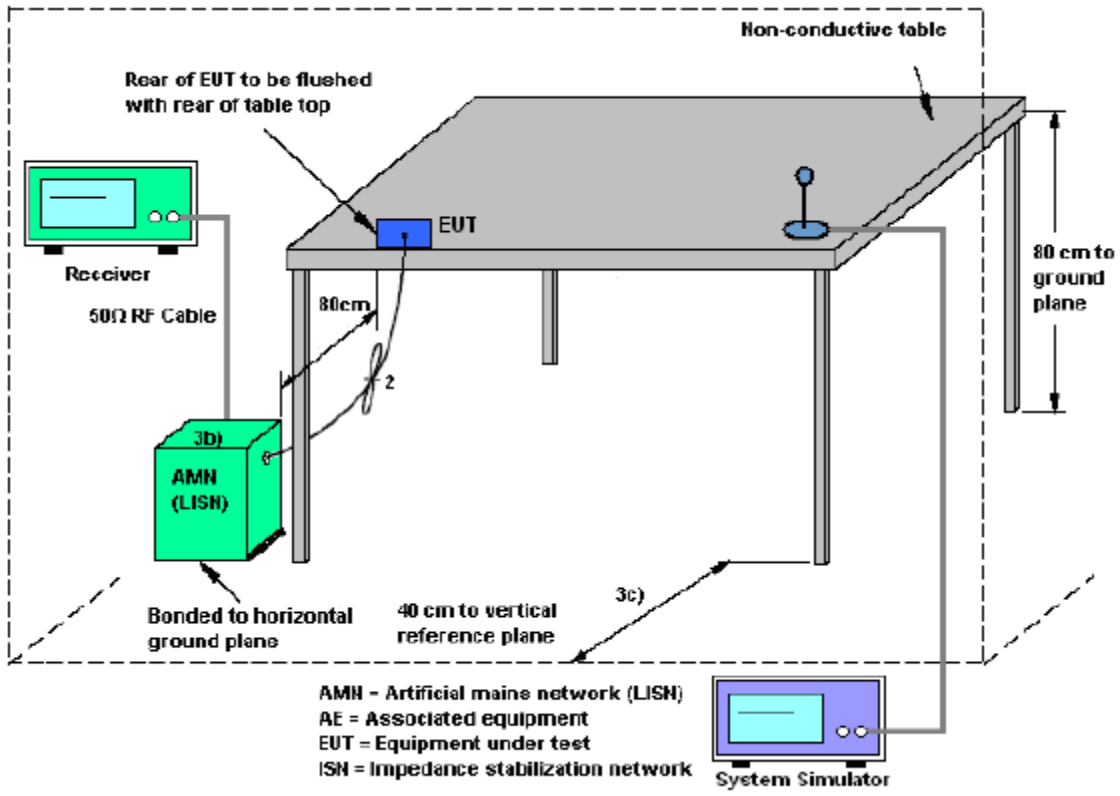
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.7.3. Test Setup



2.7.4. Test Procedures

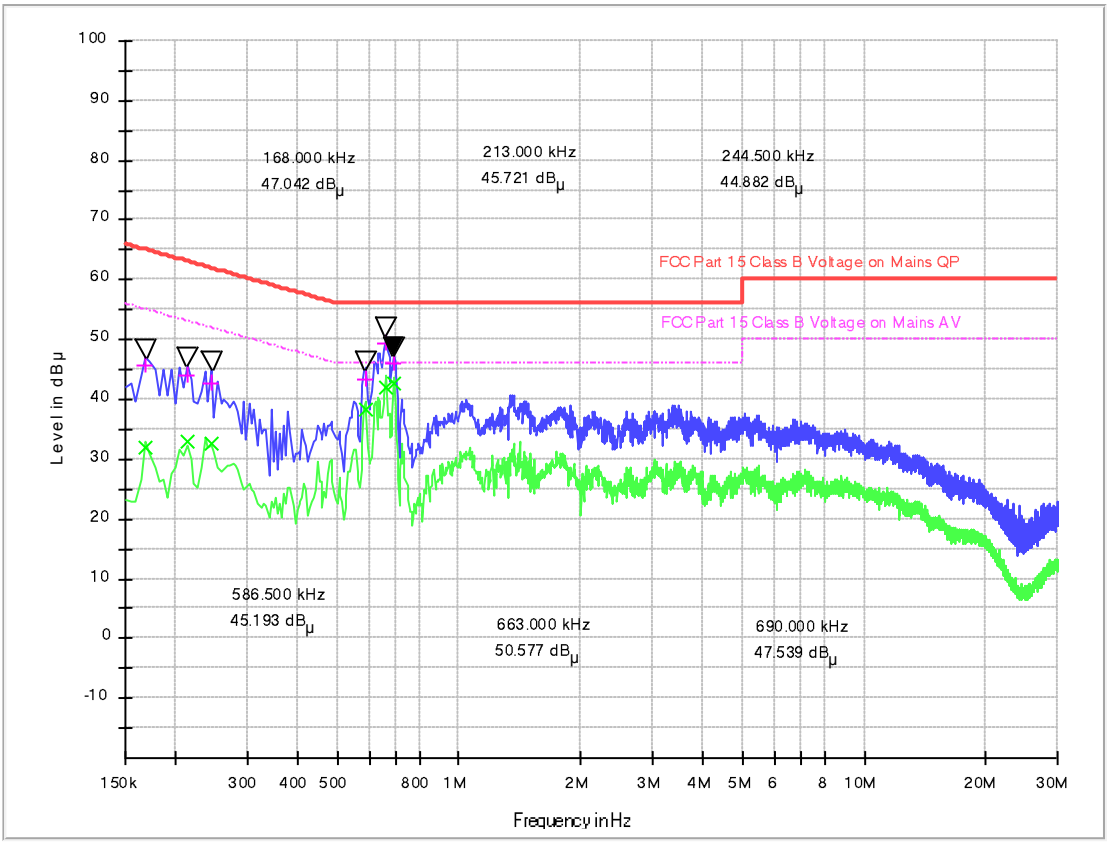
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 micrometry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

2.7.5. Test Results of Conducted Emission

The EUT configuration of the emission tests is LoRa Link + PC.

All of the EUT Configure mode were tested and found 907.8MHz channel is the worst mode, the worst case is recorded in this report.

Test site:	Shield ROOM 2	Environment:	Temp: 23℃; Humi:53%;101kPa
Operator:	Cai Fujie	Test Date:	2025.06.23
Test Mode:	LoRa - TX	Test Part:	L Line

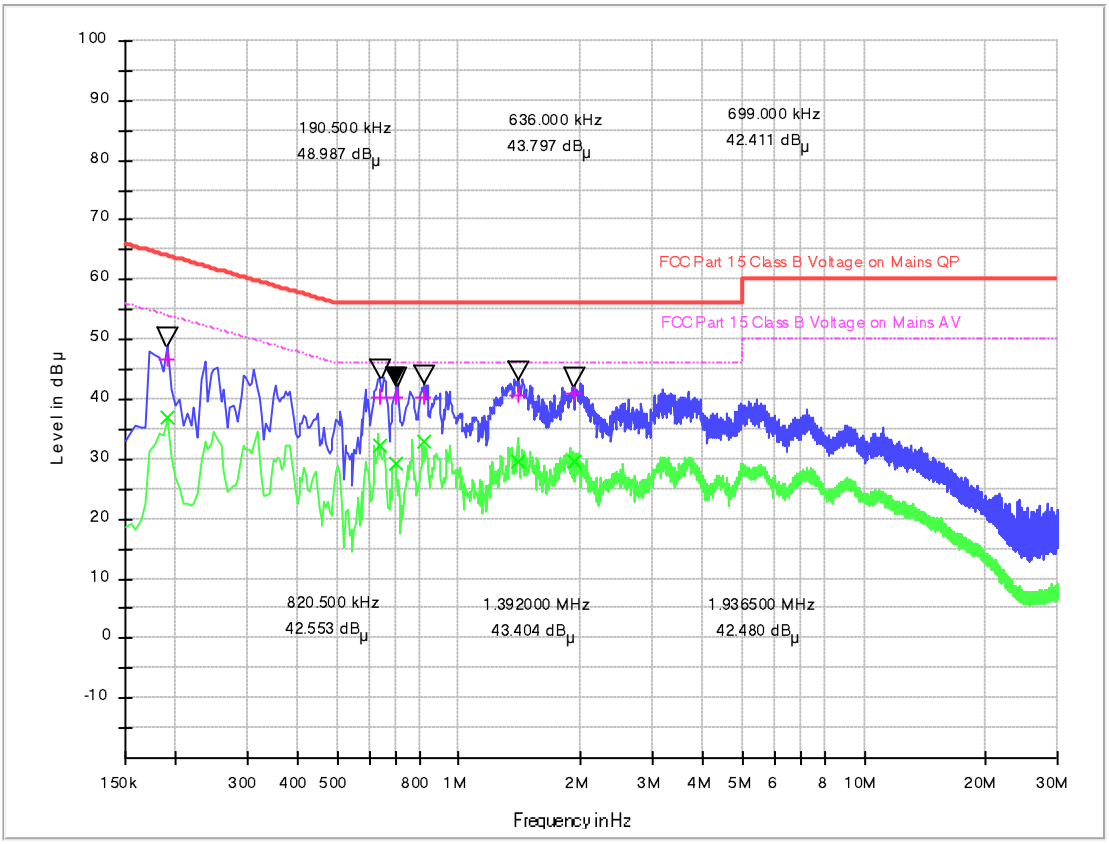


Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Corr.Factor (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - AV (dB)	Limit - AV (dBµV)
0.168000	45.83	31.94	10.3	19.23	65.06	23.12	55.06
0.213000	43.93	32.82	10.6	19.16	63.09	20.27	53.09
0.244500	42.69	32.64	10.7	19.25	61.94	19.30	51.94
0.586500	43.48	38.34	10.6	12.52	56.00	7.66	46.00
0.663000	49.23	42.03	10.3	6.77	56.00	3.97	46.00
0.690000	45.91	42.57	10.2	10.09	56.00	3.43	46.00

Test Result : Pass

Note: Final Level = Receiver Read level + Correction factor.

Test site:	Shield ROOM 2	Environment:	Temp: 23℃; Humi:53%;101kPa
Operator:	Cai Fujie	Test Date:	2025.06.23
Test Mode:	LoRa - TX	Test Part:	L Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Corr.Factor (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - AV (dB)	Limit - AV (dBµV)
0.190500	46.73	36.87	10.8	17.28	64.01	17.14	54.01
0.636000	40.36	32.22	10.6	15.64	56.00	13.78	46.00
0.699000	40.23	29.30	10.7	15.77	56.00	16.70	46.00
0.820500	40.21	32.87	10.3	15.79	56.00	13.13	46.00
1.392000	40.74	29.55	10.6	15.26	56.00	16.45	46.00
1.936500	40.95	29.67	10.4	15.05	56.00	16.33	46.00

Test Result : Pass

Note: Final Level = Receiver Read level + Correction factor.

3. List of measuring equipment

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	5M Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4m	A0304210	2023.08.01	2026.07.31
2	EMI Test Receiver	ROHDE&SCHWARZ	ESW26	A180502935	2024.12.26	2025.12.25
3	Loop Antenna	SCHWARZBECK	FMZB 1519-60 C	A240204134	2023.12.13	2026.12.12
4	Broadband antenna (30MHz~1GHz)	R&S	HL562	A0304224	2023.06.08	2026.06.07
5	EMI Horn Ant. (1-18G)	ETC	MCTD-1209	A150402241	2023.05.16	2026.05.15
6	Horn antenna (18GHz~26.5GHz)	AR	AT4510	A0804450	2023.06.01	2026.05.31
7	Amplifier 30M~1GHz	TESEQ	CBA1G-600B	A190503534	2024.09.05	2025.09.04
8	Amplifier 1G~18GHz	MILMEGA	AS0104R-800/400	A160302517	2024.12.26	2025.12.25
9	Spectrum Analyzer	KEYSIGHT	N9020A	A240604409	2024.08.22	2025.08.21
10	Test Receiver	R&S	ESIB7	A0501375	2025.01.13	2026.01.12
11	Broadband Ant.	ETC	MCTD 2786	A150402240	2023.05.22	2026.05.21
12	3M Anechoic Chamber	Albatross	SAC-3MAC 9*6*6m	A0412375	2024.02.27	2027.02.26
13	Test Receiver	KEYSIGHT	N9038A	A141202036	2024.06.05	2025.06.04
					2025.06.04	2026.06.03
14	LISN	ROHDE&SCHWARZ	ENV216	A140701847	2025.04.14	2026.04.13
15	Cable(9kHz~30MHz)	/	/	C230800587	2023.08.21	2026.08.20
16	Cable(30MHz~18GHz)	/	XSMJA750-SMNM(RA)-12M	C230800588	2023.08.21	2026.08.20
17	Cable(18GHz~40GHz)	/	SUCOFLEX102	C230800590	2023.08.21	2026.08.20

4. Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2020. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence . The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of AC Power Line Conducted Emission Measurement (150KHz~30MHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	2.8dB

Uncertainty of Radiated Emission Measurement (9KHz~30MHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	3.5dB

Uncertainty of Radiated Emission Measurement (30MHz~1GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	3.91dB

Uncertainty of Radiated Emission Measurement (1GHz~18GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	4.5dB

Uncertainty of Radiated Emission Measurement (18GHz~40GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	4.9dB

Uncertainty of RF Conducted Measurement (9KHz~40GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	1.3dB

Appendix A

Duty Cycle

Test Result and Data

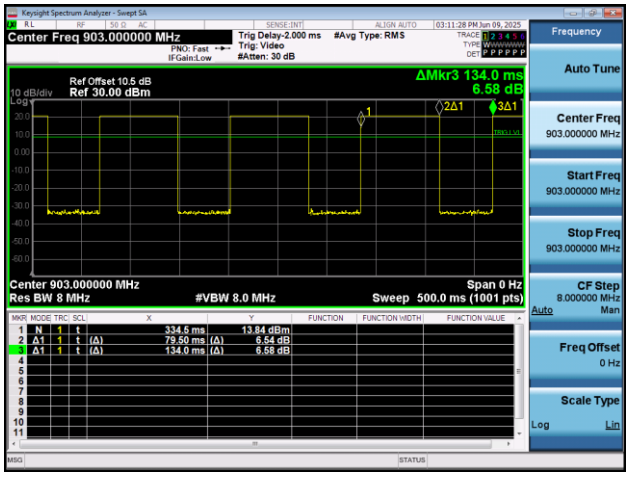
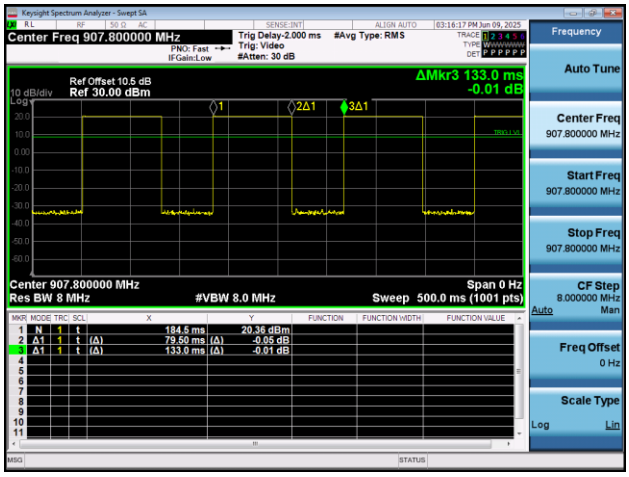
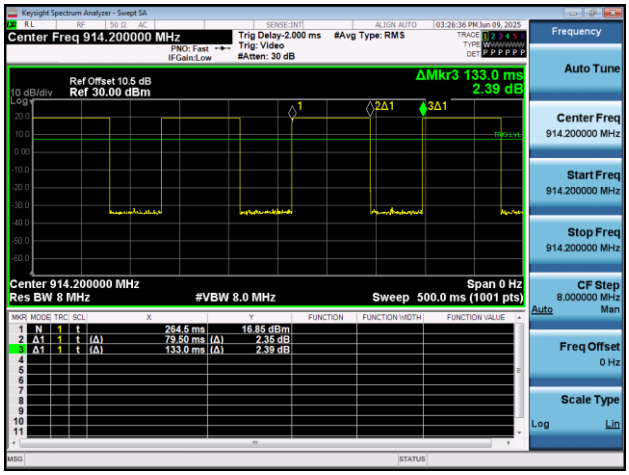
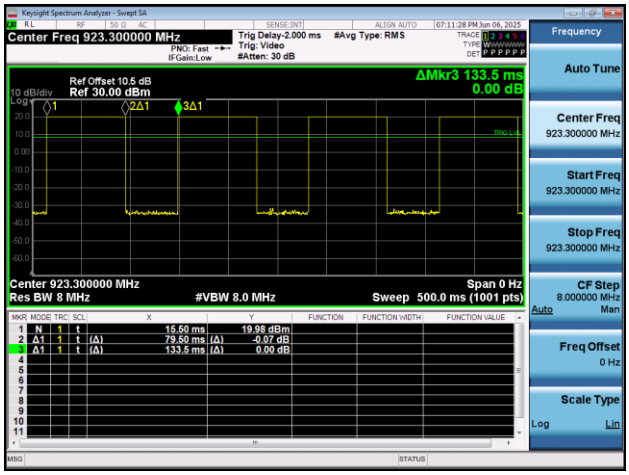
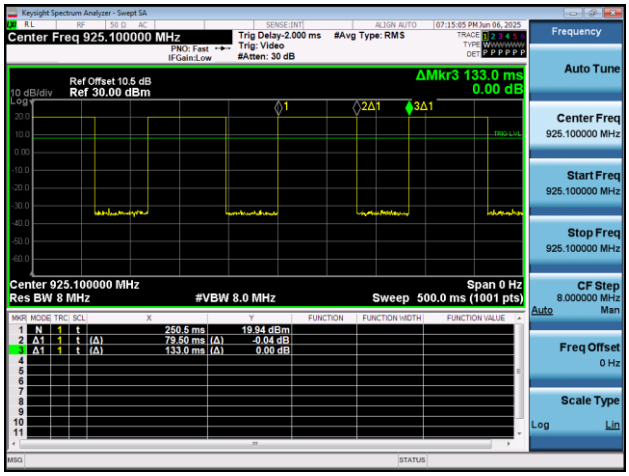
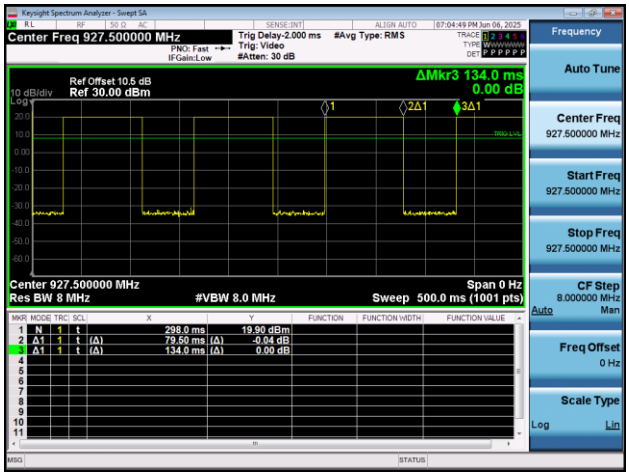
903.0~914.2MHz:

Test Mode	Antenna	Frequency[MHz]	ON Time[ms]	Period[ms]	Duty Cycle[%]	DC Factor
LORA_DTS	Ant1	903.0	79.50	134.00	59.33	2.27
LORA_DTS	Ant1	907.8	79.50	133.00	59.77	2.24
LORA_DTS	Ant1	914.2	79.50	133.00	59.77	2.24

923.2~927.5MHz:

Test Mode	Antenna	Frequency[MHz]	ON Time[ms]	Period[ms]	Duty Cycle[%]	DC Factor
LORA_DTS	Ant1	923.3	79.50	133.50	59.55	2.25
LORA_DTS	Ant1	925.1	79.50	133.00	59.77	2.24
LORA_DTS	Ant1	927.5	79.50	134.00	59.33	2.27

Test Graphs

NTNV-LORA_DTS-Ant1-903.0	NTNV-LORA_DTS-Ant1-907.8
	
NTNV-LORA_DTS-Ant1-914.2	NTNV-LORA_DTS-Ant1-923.3
	
NTNV-LORA_DTS-Ant1-925.1	NTNV-LORA_DTS-Ant1-927.5
	

Maximum Conducted Output Power

Test Result and Data

903.0~914.2MHz:

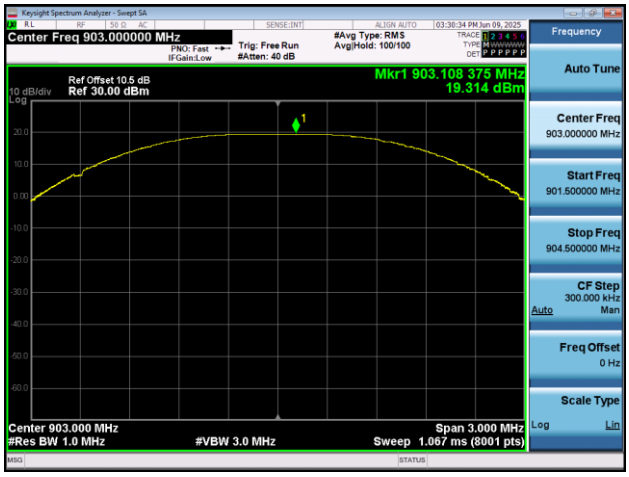
Test Mode	Antenna	Frequency[MHz]	Peak Output Power[dBm]	Limit [dBm]	Verdict
LORA_DTS	Ant1	903.0	19.31	≤30	PASS
LORA_DTS	Ant1	907.8	19.28	≤30	PASS
LORA_DTS	Ant1	914.2	19.21	≤30	PASS

923.2~927.5MHz:

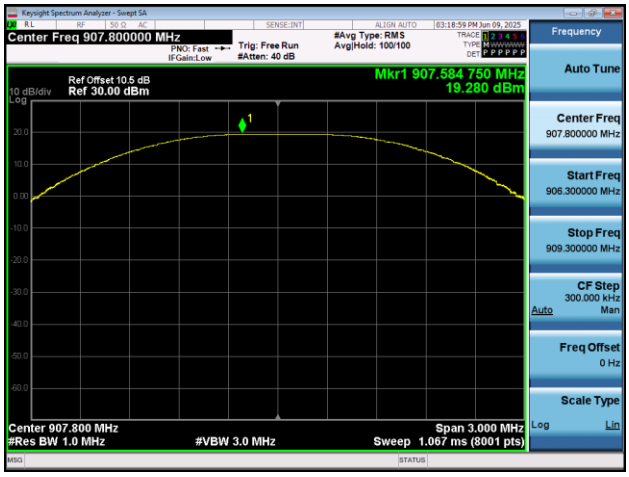
Test Mode	Antenna	Frequency[MHz]	Peak Output Power[dBm]	Limit [dBm]	Verdict
LORA_DTS	Ant1	923.3	19.05	≤30	PASS
LORA_DTS	Ant1	925.1	19.03	≤30	PASS
LORA_DTS	Ant1	927.5	18.96	≤30	PASS

Test Graphs

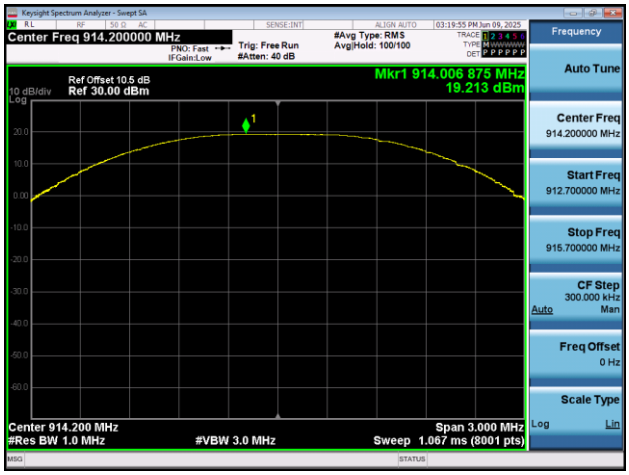
LORA_DTS-Ant1-903.0-PASS



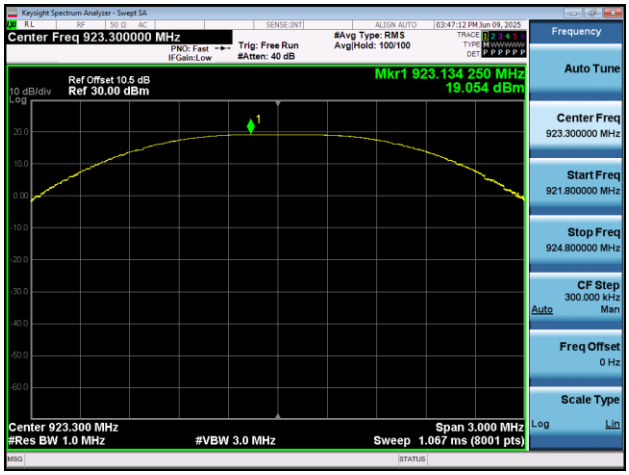
LORA_DTS-Ant1-907.8-PASS



LORA_DTS-Ant1-914.2-PASS



LORA_DTS-Ant1-923.3-PASS



LORA_DTS-Ant1-925.1-PASS

LORA_DTS-Ant1-927.5-PASS

6dB Bandwidth

Test Result and Data

903.0~914.2MHz:

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
LORA_DTS	Ant1	903.0	0.606	0.5	PASS
LORA_DTS	Ant1	907.8	0.592	0.5	PASS
LORA_DTS	Ant1	914.2	0.614	0.5	PASS

923.2~927.5MHz:

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
LORA_DTS	Ant1	923.3	0.608	0.5	PASS
LORA_DTS	Ant1	925.1	0.612	0.5	PASS
LORA_DTS	Ant1	927.5	0.618	0.5	PASS

Test Graphs

LORA_DTS-Ant1-903.0-PASS	LORA_DTS-Ant1-907.8-PASS
	
LORA_DTS-Ant1-914.2-PASS	LORA_DTS-Ant1-923.3-PASS
	
LORA_DTS-Ant1-925.1-PASS	LORA_DTS-Ant1-927.5-PASS
	

99% Occupied Bandwidth

Test Result and Data

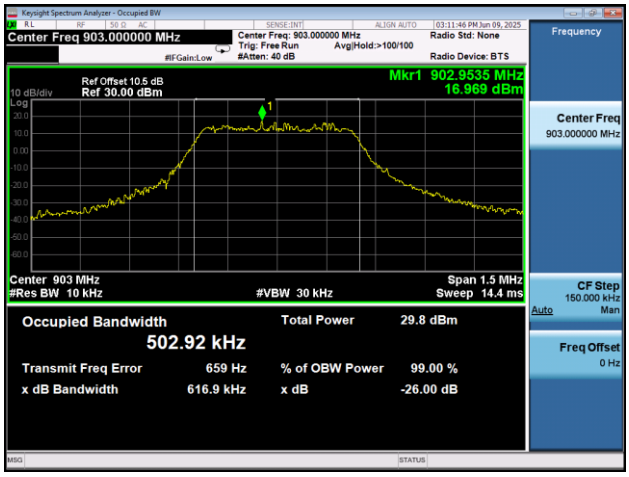
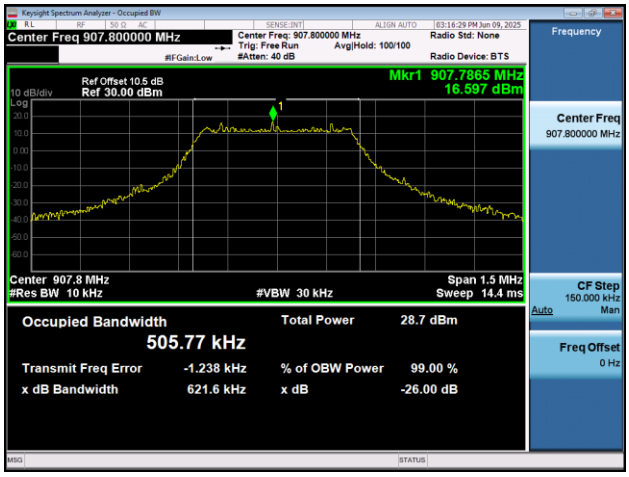
903.0~914.2MHz:

Test Mode	Antenna	Frequency[MHz]	99% OBW[MHz]	Limit[MHz]	Verdict
LORA_DTS	Ant1	903.0	0.50318	---	---
LORA_DTS	Ant1	907.8	0.50577	---	---
LORA_DTS	Ant1	914.2	0.50317	---	---

923.2~927.5MHz:

Test Mode	Antenna	Frequency[MHz]	99% OBW[MHz]	Limit[MHz]	Verdict
LORA_DTS	Ant1	923.3	0.50946	---	---
LORA_DTS	Ant1	925.1	0.50603	---	---
LORA_DTS	Ant1	927.5	0.52129	---	---

Test Graphs

LORA_DTS-Ant1-903.0	LORA_DTS-Ant1-907.8
	
LORA_DTS-Ant1-914.2	**LORA_DTS-Ant1-923.3**
	
LORA_DTS-Ant1-925.1	**LORA_DTS-Ant1-927.5**
	

Power Spectral Density

Test Result and Data

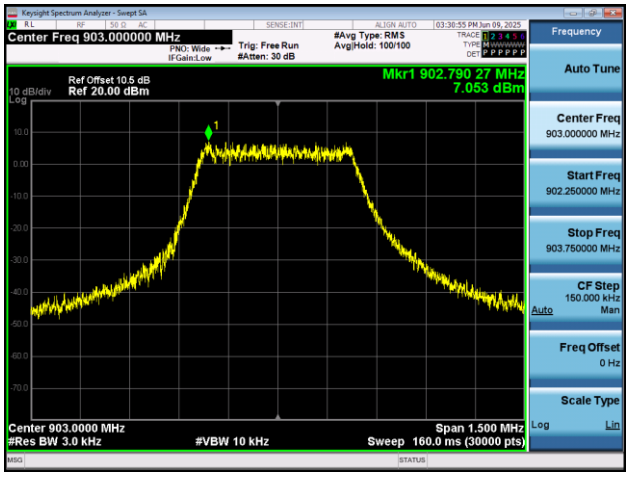
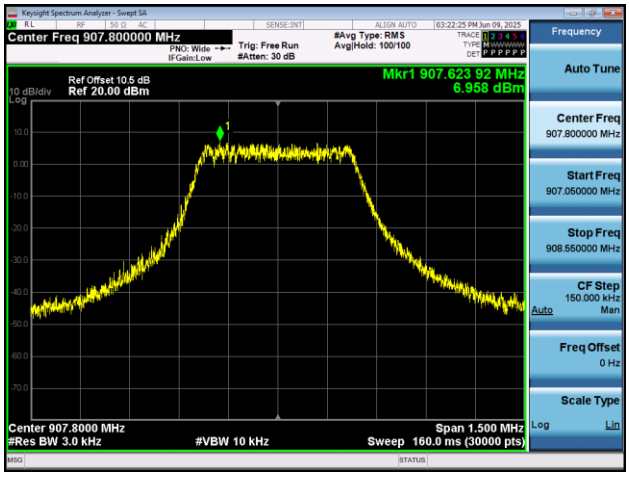
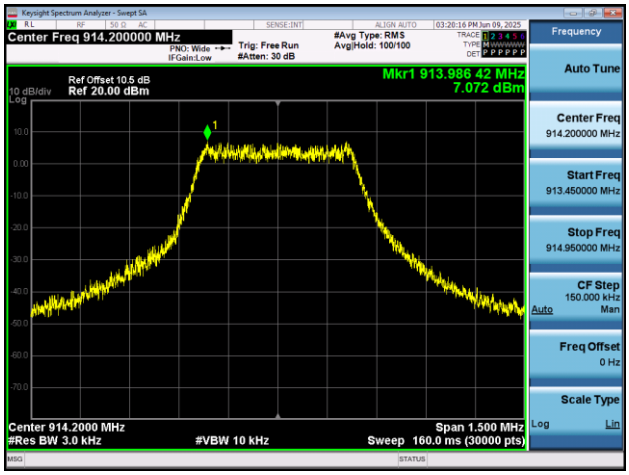
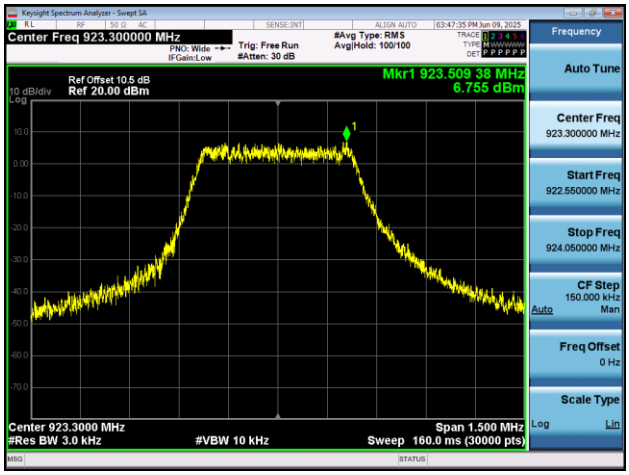
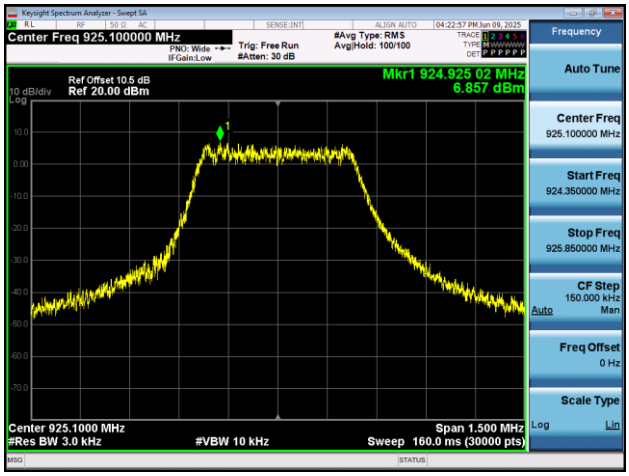
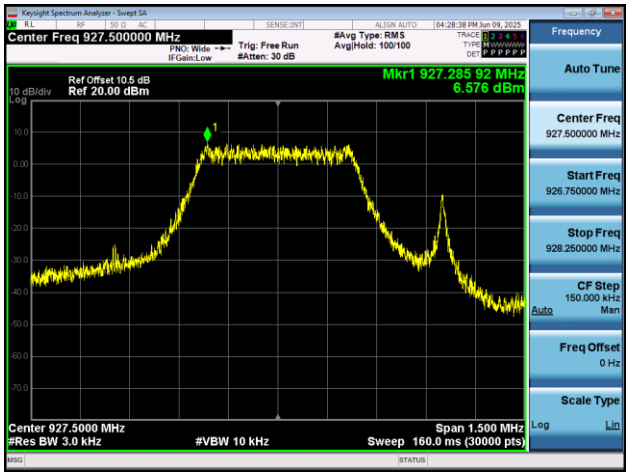
903.0~914.2MHz:

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
LORA_DTS	Ant1	903.0	7.05	≤8.00	PASS
LORA_DTS	Ant1	907.8	6.96	≤8.00	PASS
LORA_DTS	Ant1	914.2	7.07	≤8.00	PASS

923.2~927.5MHz:

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
LORA_DTS	Ant1	923.3	6.76	≤8.00	PASS
LORA_DTS	Ant1	925.1	6.86	≤8.00	PASS
LORA_DTS	Ant1	927.5	6.58	≤8.00	PASS

Test Graphs

LORA_DTS-Ant1-903.0-PASS	LORA_DTS-Ant1-907.8-PASS
	
LORA_DTS-Ant1-914.2-PASS	LORA_DTS-Ant1-923.3-PASS
	
LORA_DTS-Ant1-925.1-PASS	LORA_DTS-Ant1-927.5-PASS
	

Conducted Band Edges

Test Result and Data

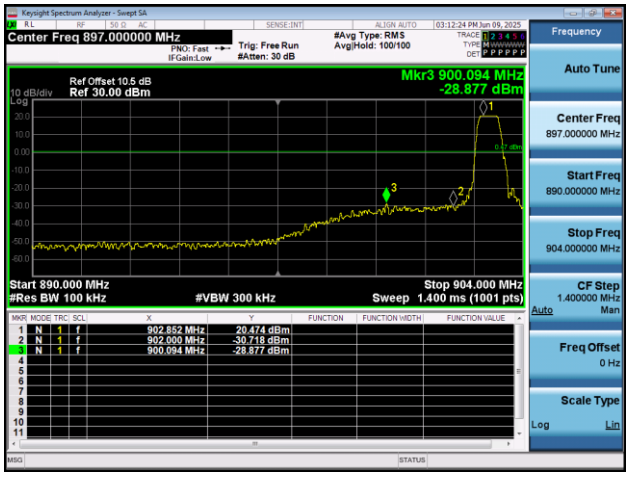
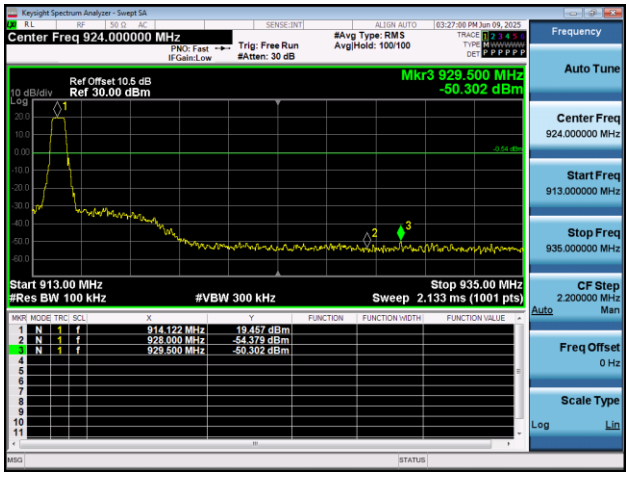
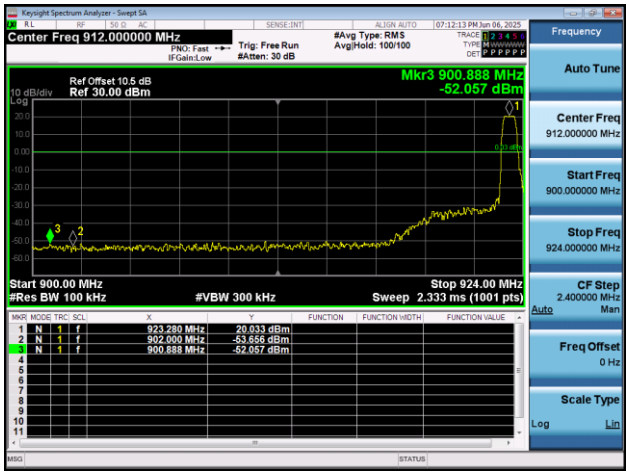
903.0~914.2MHz:

Test Mode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
LORA_DTS	Ant1	Low	903.0	20.47	-28.88	≤0.47	PASS
LORA_DTS	Ant1	High	914.2	19.46	-50.3	≤-0.54	PASS

923.2~927.5MHz:

Test Mode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
LORA_DTS	Ant1	Low	923.3	20.03	-52.06	≤0.03	PASS
LORA_DTS	Ant1	High	927.5	19.93	-3.1	≤-0.07	PASS

Test Graphs

LORA_DTS-Ant1-903.0-PASS	LORA_DTS-Ant1-914.2-PASS
	
LORA_DTS-Ant1-923.3-PASS	**LORA_DTS-Ant1-927.5-PASS**
	

Conducted Spurious Emissions

Test Result and Data

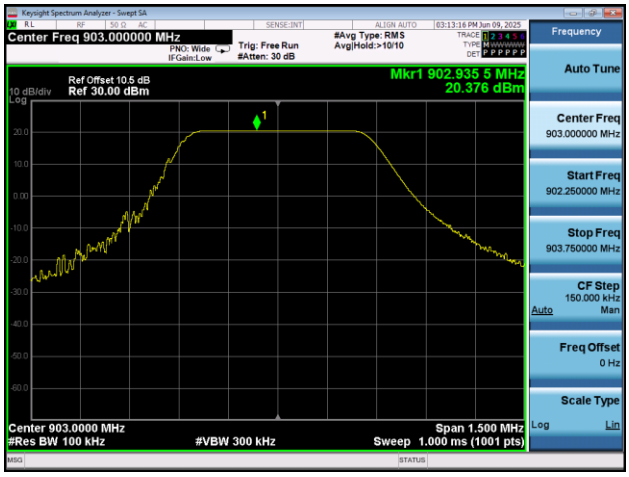
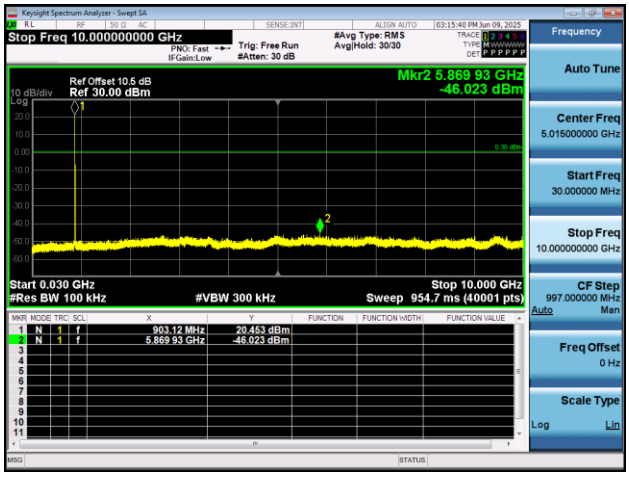
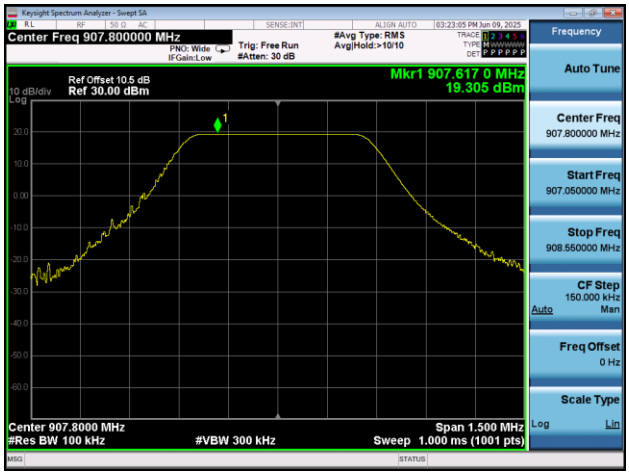
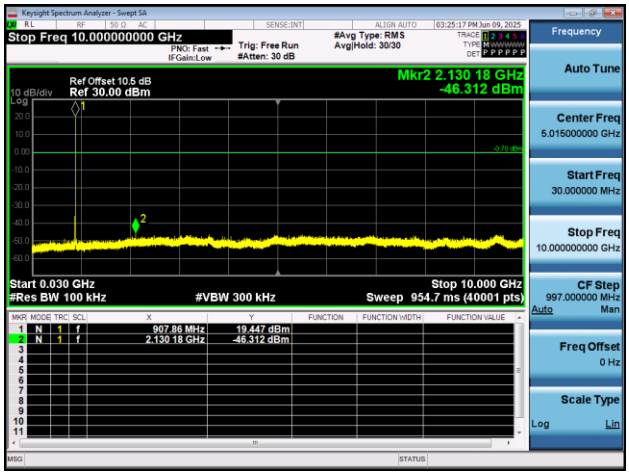
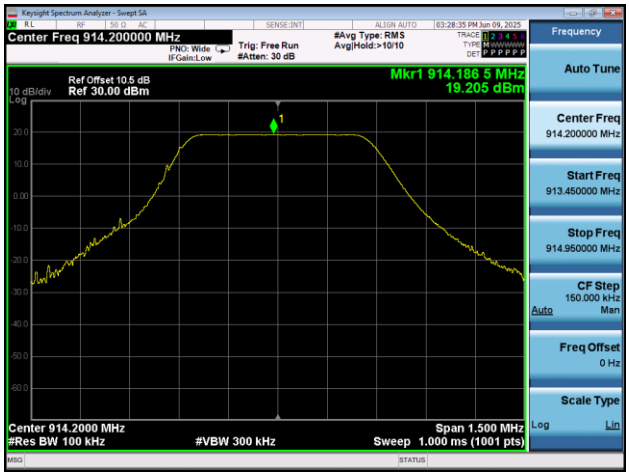
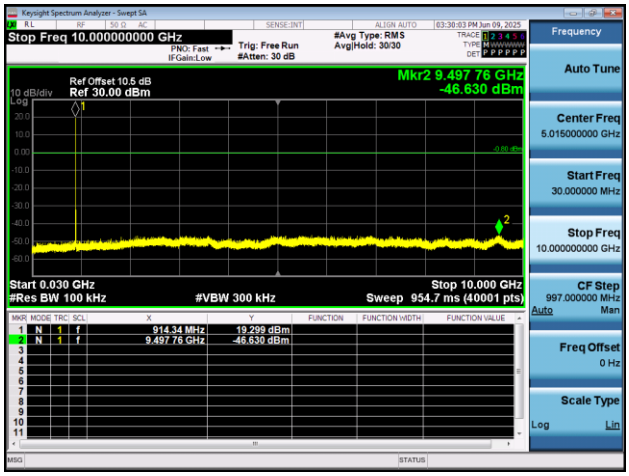
903.0~914.2MHz:

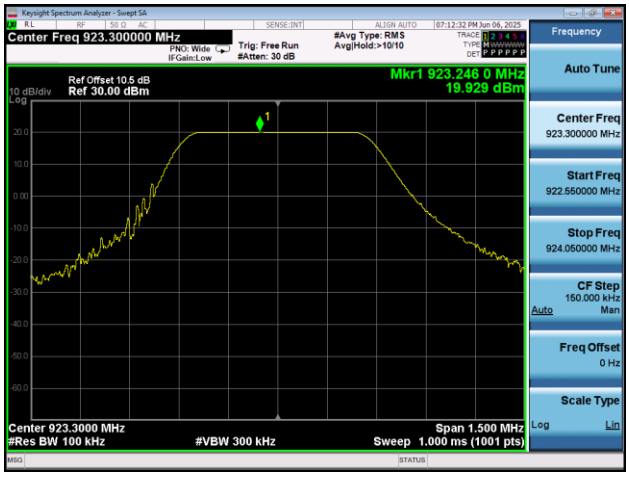
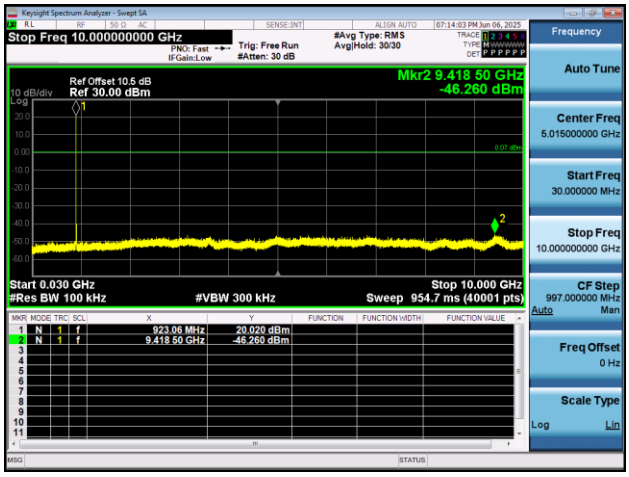
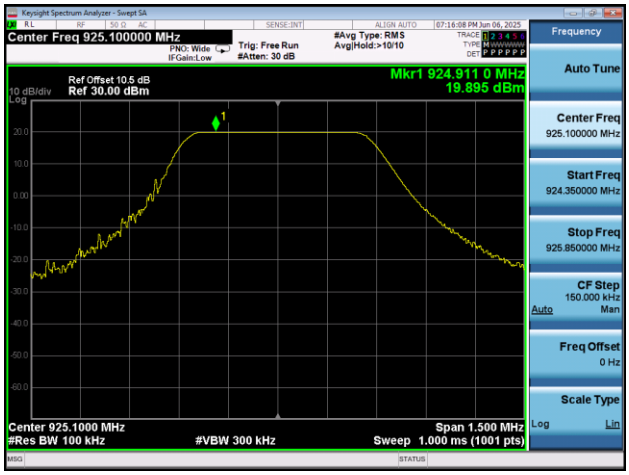
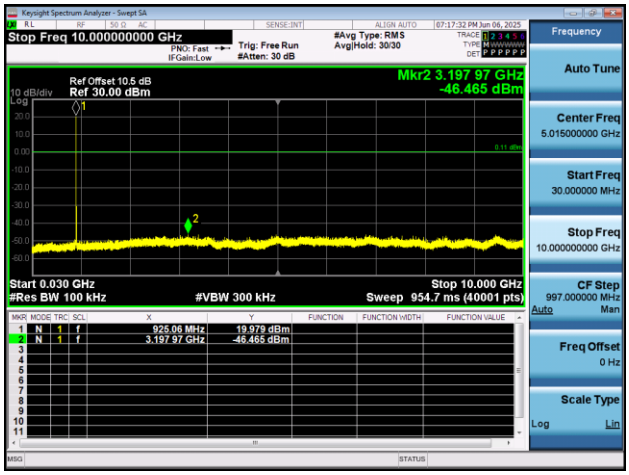
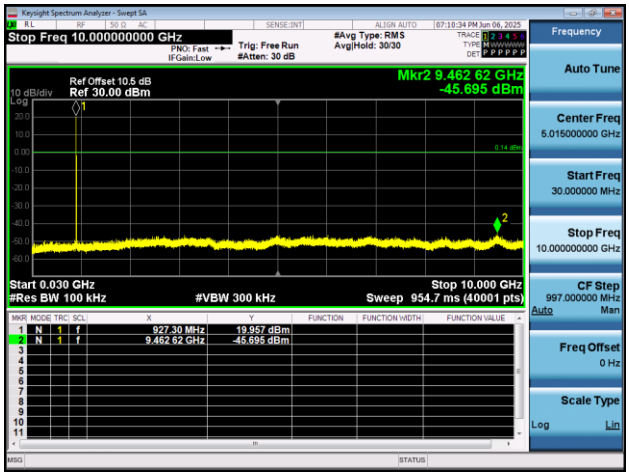
Test Mode	Antenna	Frequency[MHz]	FreqRange[Mhz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
LORA_DTS	Ant1	903.0	0~Reference	19.07	19.07	---	PASS
LORA_DTS	Ant1	903.0	30~25000	19.07	-46.02	≤-0.93	PASS
LORA_DTS	Ant1	907.8	0~Reference	19.28	19.28	---	PASS
LORA_DTS	Ant1	907.8	30~25000	19.28	-46.31	≤-0.72	PASS
LORA_DTS	Ant1	914.2	0~Reference	19.19	19.19	---	PASS
LORA_DTS	Ant1	914.2	30~25000	19.19	-46.63	≤-0.81	PASS

923.2~927.5MHz:

Test Mode	Antenna	Frequency[MHz]	FreqRange[Mhz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
LORA_DTS	Ant1	923.3	0~Reference	19.88	19.88	---	PASS
LORA_DTS	Ant1	923.3	30~25000	19.88	-46.26	≤-0.12	PASS
LORA_DTS	Ant1	925.1	0~Reference	19.87	19.87	---	PASS
LORA_DTS	Ant1	925.1	30~25000	19.87	-46.47	≤-0.13	PASS
LORA_DTS	Ant1	927.5	0~Reference	19.80	19.80	---	PASS
LORA_DTS	Ant1	927.5	30~25000	19.80	-45.7	≤-0.2	PASS

Test Graphs

LORA_DTS-Ant1-903.0-0~Reference-PASS	LORA_DTS-Ant1-903.0-30~25000-PASS
	
LORA_DTS-Ant1-907.8-0~Reference-PASS	LORA_DTS-Ant1-907.8-30~25000-PASS
	
LORA_DTS-Ant1-914.2-0~Reference-PASS	LORA_DTS-Ant1-914.2-30~25000-PASS
	

LORA_DTS-Ant1-923.3-0~Reference-PASS	LORA_DTS-Ant1-923.3-30~25000-PASS
	
LORA_DTS-Ant1-925.1-0~Reference-PASS	LORA_DTS-Ant1-925.1-30~25000-PASS
	
LORA_DTS-Ant1-927.5-0~Reference-PASS	LORA_DTS-Ant1-927.5-30~25000-PASS
	

END OF REPORT