



Test report No:
2260204R-RF-US-P06V01

FCC & ISED TEST REPORT

Product Name	LoRa module
Trademark	Murata
Model and /or type reference	CMWX1ZZABZ
FCC ID	VPYCMABZ
IC	772C-CMABZ
Applicant's name / address	Murata Manufacturing Co., Ltd. 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan
Test method requested, standard	FCC CFR Title 47 Part 15 Subpart C Section 15.247 ANSI C63.10: 2013 KD558074 D01 15.247 Meas Guidance v05r02 RSS-Gen Issue 5 / RSS-247 Issue 2
Verdict Summary	IN COMPLIANCE
Documented by (name / position & signature)	Tim Cao/Project Engineer 
Approved by (name / position & signature)	Jack Zhang/ Supervisor 
Date of issue	2022-06-28
Report Version	V1.0
Report template No	Template_FCC Part 15C-RF-V1.0

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COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

GENERAL CONDITIONS

Test Location	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China
Date(receive sample)	Jun. 16, 2022
Date (start test)	Jun. 20, 2022
Date (finish test)	Jun. 23, 2022

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT	: Equipment Under Test
QP	: Quasi-Peak
CAV	: CISPR Average
AV	: Average
CDN	: Coupling Decoupling Network
SAC	: Semi-Anechoic Chamber
OATS	: Open Area Test Site
BW	: Bandwidth
AM	: Amplitude Modulation
PM	: Pulse Modulation
HCP	: Horizontal Coupling Plane
VCP	: Vertical Coupling Plane
U_N	: Nominal voltage
T_x	: Transmitter
R_x	: Receiver
N/A	: Not Applicable
N/M	: Not Measured

DOCUMENT HISTORY

Report No.	Version	Description	Issued Date
2260204R-RF-US-P06V01	V1.0	Initial issue of report.	2022-06-28

REMARKS AND COMMENTS

1. The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).
2. These test results on a sample of the device are for the purpose of demonstrating Compliance with Part 15 Subpart C Paragraph 15.247, RSS-Gen Issue 5, RSS-247 Issue 2.
3. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
4. The test results presented in this report relate only to the object tested.
5. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
6. This report will not be used for social proof function in China market.
7. DEKRA declines any responsibility with the following test data provided by customer that may affect the validity of result:
 - Chapter 1.1 General Description of the Item(s);
 - Chapter 1.2 Antenna Informaion;
 - Chapter 1.3 Channel List.
8. This product has been passed FCC & IC certification, now a new antenna is added, after retest output power and radiated surprious emission, this change confirm with class II premissive change and C2PC requirements.

USED EQUIPMENT

Emissions in non-restricted frequency bands/ Occupied Bandwidth/ Fundamental emission output power Power Spectral Density / TR8

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2021.07.11	2022.07.10
EXA Spectrum Analyzer	Keysight	N9010A	MY55370495	2021.08.12	2022.08.11
Coaxial Cable	Woken	A50-SMAMSMAM-1m	20111443	2022.01.18	2023.01.17
Temperature/Humidity Meter	RTS	RTS-8S	RF08	2021.07.09	2022.07.08
Dekra test software	Dekra	-	-	-	-

Radiated Emission(30MHz-1GHz) / AC3

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EMI Test Receiver	R&S	ESCI	100176	2021.08.15	2022.08.14
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9168	1231	2022.05.21	2023.05.20
Coaxial Cable	Huber+Suhner	RG 214	AC3-C	2022.03.30	2023.03.29
Tunable Bandreject filter	Wainwright	WRCT890/960-5/40-8SSK	1	2021.07.19	2022.07.18
Temperature/Humidity Meter	RTS	RTS-8S	AC3-TH	2021.11.23	2022.11.22
Dekra test software	Dekra	-	-	-	-

Radiated Emission / AC5(1GHz-40GHz)(Chamber details)

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
MXA Signal Analyzer	Keysight	N9020B	MY60112218	2022.01.09	2023.01.08
Amplifier	Keleto	LNPA	SK20190225	2021.09.26	2022.09.25
Pre-Amplifier	EMCI	EMC184045SE	980263	2022.05.21	2023.05.20
DRG Horn Antenna	ETS-Lindgren	3117	167055	2021.08.06	2022.08.05
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2022.05.19	2023.05.18
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2022.03.12	2023.03.11
Coaxial Cable	ROSENBERGER	LA1-C011-2000/3000	AC5-40G	2022.03.21	2023.03.20
Temperature/Humidity Meter	RTS	RTS-8S	AC5-TH	2021.11.23	2022.11.22
Dekra test software	Dekra	-	-	-	-

UNCERTAINTY

Uncertainties have been calculated according to the DEKRA internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95% .

Test item	Uncertainty
AC Power Line Conducted Emission	9kHz~150kHz: 2.80dB 150kHz~30MHz: 2.40dB
Peak Power Output	± 1.27 dB
Radiated Emission(30MHz~1GHz)	Horizontal: 30MHz~200MHz: 3.50 dB 300MHz~1GHz: 3.60 dB Vertical: 30MHz~200MHz: 3.60 dB 300MHz~1GHz: 3.50 dB
Radiated Emission(1GHz~26.5GHz)	Horizontal: 1GHz~18GHz: 5.00 dB Vertical: 1GHz~18GHz: 4.80 dB
RF antenna conducted test	± 1.27 dB
Radiated Emission Band Edge	± 3.9 dB
DTS Bandwidth	± 150 Hz
Occupied Bandwidth	± 1 kHz
Power Density	± 1.27 dB

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Product Name..... :	LoRa module
Model No. :	CMWX1ZZABZ
Trademark :	Murata
FCC ID :	VPYCMABZ
IC..... :	772C-CMABZ
Manufacturer..... :	Murata Manufacturing Co., Ltd.
Manufacturer Address..... :	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan

Wireless specification..... :	LoRa
Operating frequency range(s)	125kHz: 902.3 ~ 914.9 MHz; 500kHz: 903 ~914.2 MHz
Type of Modulation..... :	LoRa
Spread Factor (SF)	125kHz: 7 ~ 10 500kHz: 7 ~ 12
Channel Space	125kHz: 200kHz 500kHz: 1.6MHz
Number of channel..... :	125kHz: 64 channels 500kHz: 8 channels

Rated power supply	Voltage and Frequency	
	<input type="checkbox"/>	AC: 220 – 240 V, 50/60 Hz
	<input type="checkbox"/>	AC: 110 – 130 V, 50/60 Hz
	<input checked="" type="checkbox"/>	DC: 3.0 – 3.6 V
	<input type="checkbox"/>	Battery:
	<input type="checkbox"/>	PoE:
Mounting position..... :	<input type="checkbox"/>	Table top equipment
	<input type="checkbox"/>	Wall/Ceiling mounted equipment
	<input type="checkbox"/>	Floor standing equipment
	<input type="checkbox"/>	Hand-held equipment
	<input checked="" type="checkbox"/>	Other: Wireless Module

1.2 Antenna Information

Antenna model / type number.....:	NN02-224		
Antenna serial number	N/A		
Antenna Delivery	<input checked="" type="checkbox"/>	1TX + 1RX	
	<input type="checkbox"/>	2TX + 2RX	
	<input type="checkbox"/>	Others:.....	
Antenna technology.....:	<input checked="" type="checkbox"/>	SISO	
	<input type="checkbox"/>	MIMO	<input type="checkbox"/> CDD
			<input type="checkbox"/> Beam-forming
Antenna Type.....:	<input checked="" type="checkbox"/>	External	<input type="checkbox"/> Dipole
			<input checked="" type="checkbox"/> Chip
			<input type="checkbox"/> Sectorized
	<input type="checkbox"/>	Internal	<input type="checkbox"/> Chip
			<input type="checkbox"/> PIFA
			<input type="checkbox"/> PCB
			<input type="checkbox"/> Metal
			<input type="checkbox"/> Others.....
Antenna Gain.....:	902~928MHz: 0.9 dBi		

1.3 Channel List

LoRa Working Frequency of Each Channel: (For 125kHz)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	902.3 MHz	02	902.5 MHz	03	902.7 MHz	04	902.9 MHz
05	903.1 MHz	06	903.3 MHz	07	903.5 MHz	08	903.7 MHz
09	903.9 MHz	10	904.1 MHz	11	904.3 MHz	12	904.5 MHz
13	904.7 MHz	14	904.9 MHz	15	905.1 MHz	16	905.3 MHz
17	905.5 MHz	18	905.7 MHz	19	905.9 MHz	20	906.1 MHz
21	906.3 MHz	22	906.5 MHz	23	906.7 MHz	24	906.9 MHz
25	907.1 MHz	26	907.3 MHz	27	907.5 MHz	28	907.7 MHz
29	907.9 MHz	30	908.1 MHz	31	908.3 MHz	32	908.5 MHz
33	908.7 MHz	34	908.9 MHz	35	909.1 MHz	36	909.3 MHz
37	909.5 MHz	38	909.7 MHz	39	909.9 MHz	40	910.1 MHz
41	910.3 MHz	42	910.5 MHz	43	910.7 MHz	44	910.9 MHz
45	911.1 MHz	46	911.3 MHz	47	911.5 MHz	48	911.7 MHz
49	911.9 MHz	50	912.1 MHz	51	912.3 MHz	52	912.5 MHz
53	912.7 MHz	54	912.9 MHz	55	913.1 MHz	56	913.3 MHz
57	913.5 MHz	58	913.7 MHz	59	913.9 MHz	60	914.1 MHz
61	914.3 MHz	62	914.5 MHz	63	914.7 MHz	64	914.9 MHz
LoRa Working Frequency of Each Channel: (For 500kHz)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
65	903 MHz	66	904.6 MHz	67	906.2 MHz	68	907.8 MHz
69	909.4 MHz	70	911 MHz	71	912.6 MHz	72	914.2 MHz

1.4 Power Setting

	LoRa 125kHz				LoRa 500kHz			
	Channel	Frequency	SF	Power setting	Channel	Frequency	SF	Power setting
Lowest Channel	CH01	902.3 MHz	10	20	CH65	903 MHz	12	20
Middle Channel	CH32	908.5 MHz	10	20	CH68	907.8 MHz	12	20
Highest Channel	CH64	914.9 MHz	10	20	CH72	914.2 MHz	12	20

Note: The General Description of the Item , antenna information, Channel List and power setting for the EUT in clause 1 are provided and confirmed by the client.

2 DESCRIPTION OF TEST SETUP

2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

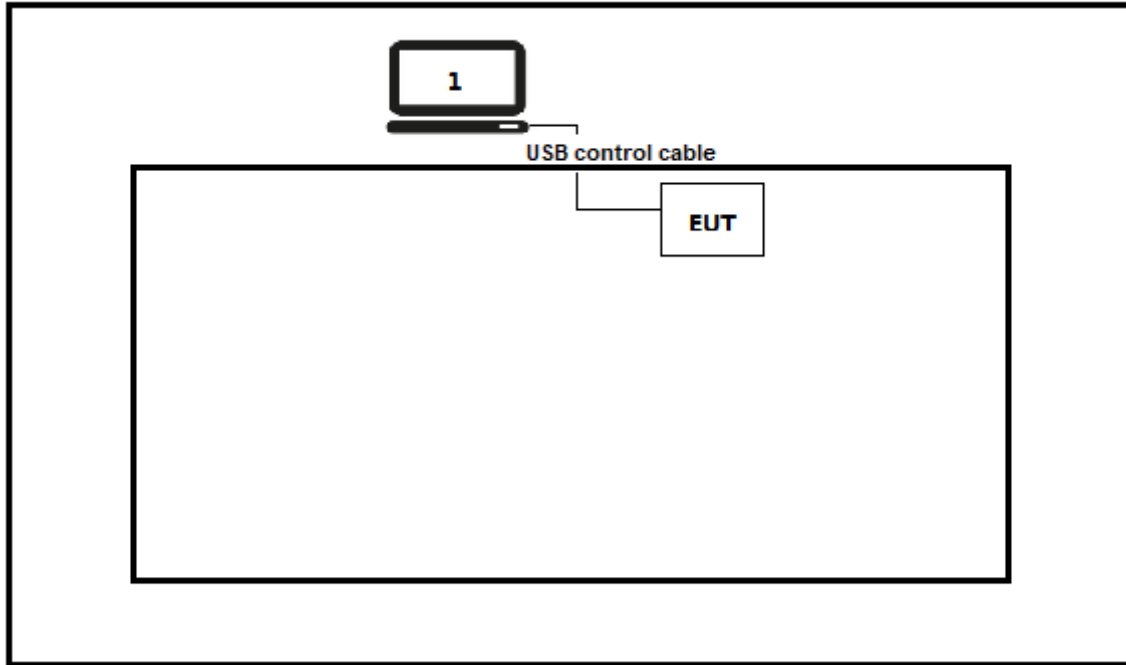
Test Mode For LoRa	Mode 1: Transmit by LoRa_125kHz
	Mode 2: Transmit by LoRa_500kHz

2.2 Auxiliary equipment / Test software for the EUT

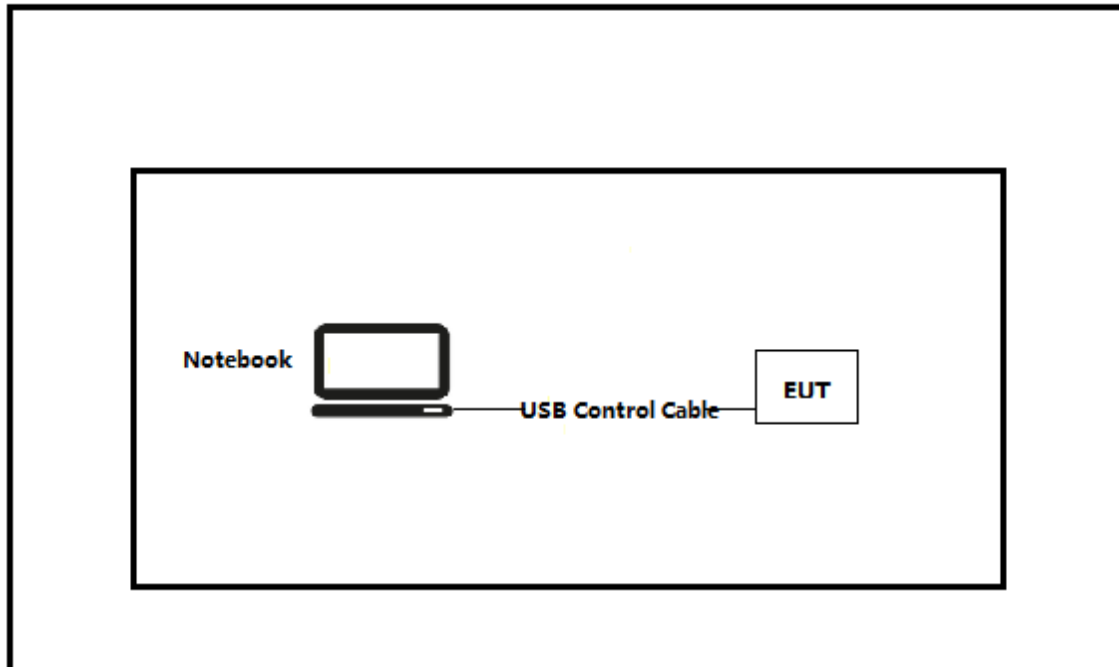
Auxiliary equipment	Type / Version	Manufacturer	Supplied by
Notebook	Think pad x220	Lenovo	Adapter
software	Type / Version	Manufacturer	Supplied by
MurataLoRaModuleTestTool	V0.0.01	N/A	N/A

2.3 Test Configuration / Block diagram used for tests

Test setup Diagram- AC Line Conducted Emission Test



Test setup Diagram- Conducted test



2.4 Testing process

1	Setup the EUT as shown in Section 2.3.
2	Execute the [MurataLoRaModuleTestTool] on the notebook.
3	Configure the test mode, the test channel, and the data rate.
4	Verify that the EUT works properly.

3 VERDICT SUMMARY SECTION

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

3.1 Standards

Standard	Year	Description
FCC CFR Title 47 Part 15 Subpart C Section 15.247	2022	Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 558074 D01 v05r02	2019	Guidance for performing compliance measurements on Digital Transmission System (DTS) operating under section 15.247
RSS-Gen Issue 5 Amendment 1	2019	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2	2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

3.2 Deviation(s) from the Standard(s) / Test Specification(s)

The following deviation(s) was / were made from the published requirements of the listed standards: N/A.

(Please define the deviations from the standard(s) if applicable)

3.3 Overview of results

For FCC

Requirement – Test case	Basic standard(s)	Verdict	Remark
Emissions in restricted frequency bands	FCC 15.247(b)(3)	PASS	---
Fundamental emission output power	FCC 15.247(d), FCC 15.209	PASS	---

For ISED

Requirement – Test case	Basic standard(s)	Verdict	Remark
Emissions in restricted frequency bands	RSS-Gen Issue 5 Section 8.9	PASS	---
Fundamental emission output power	RSS-247 Issue 2 Section 5.4(d)	PASS	---

3.4 Test Facility

USA	:	FCC Designation Number: CN1199
CA	:	ISED CAB identifier: CN0040

4 TEST RESULTS

4.1 Emissions in restricted frequency bands

VERDICT: PASS

4.1.1 Limit

Standard FCC Part 15 Subpart C Paragraph 15.207

Restricted Bands of operation

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
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
8.81425 – 8.81475	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	
13.36 – 13.41			

Restricted Bands of operation for IC

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

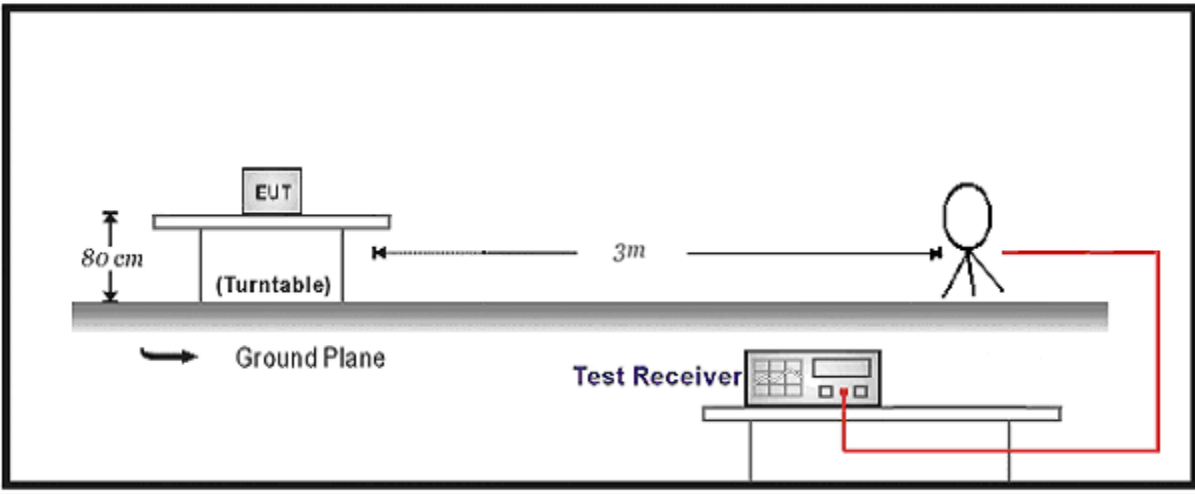
Restricted Band Emissions Limit			
Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009 - 0.49	2400/F(kHz)	48.5 – 13.8	300 _(Note 1)
0.49 - 1.705	24000/F(kHz)	33.8 - 23	30 _(Note 1)
1.705 - 30	30	29.5	30 _(Note 1)
30 - 88	100	40	3 _(Note 2)
88 - 216	150	43.5	3 _(Note 2)
216 - 960	200	46	3 _(Note 2)
Above 960	500	54	3 _(Note 2)

Note 1: At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

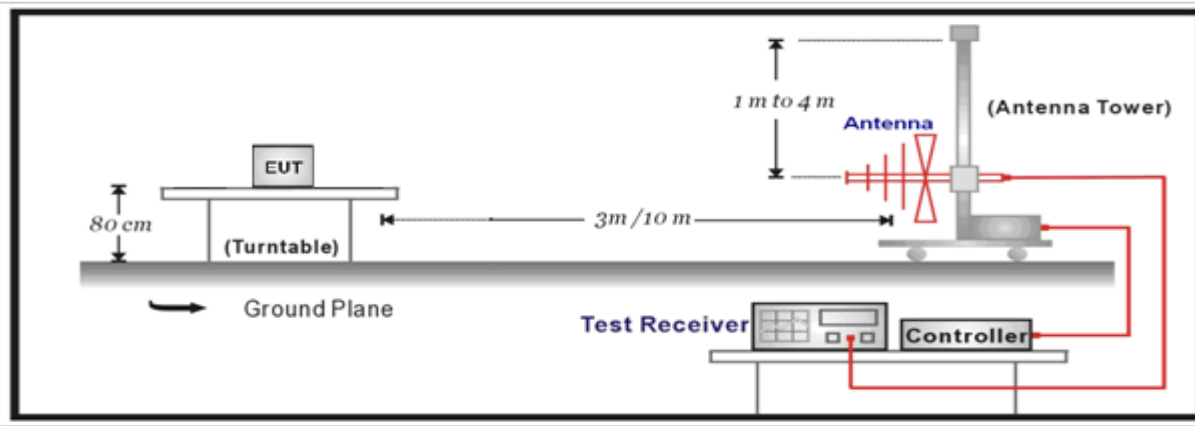
Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

4.1.2 Test Setup

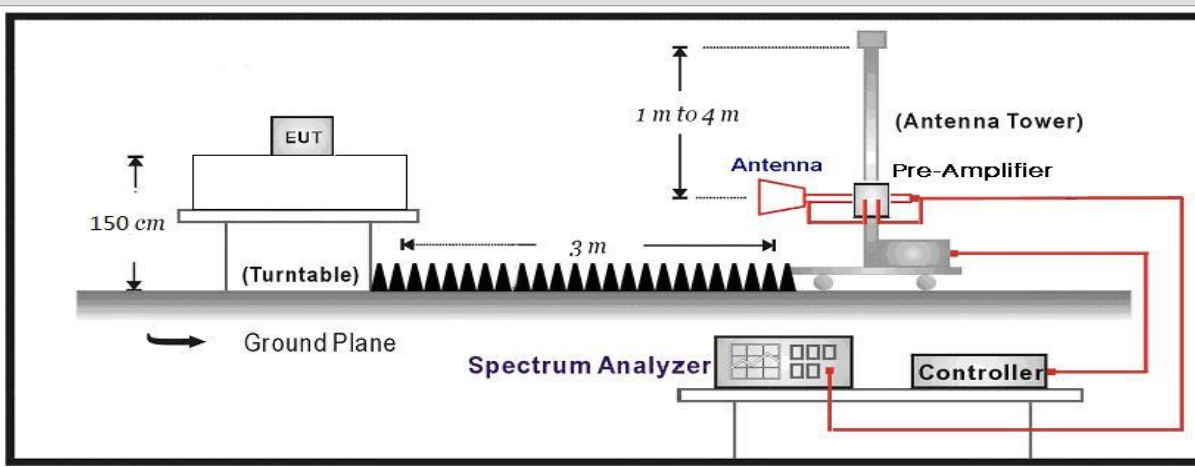
Below 30MHz Test Setup:



30MHz-1GHz Test Setup:



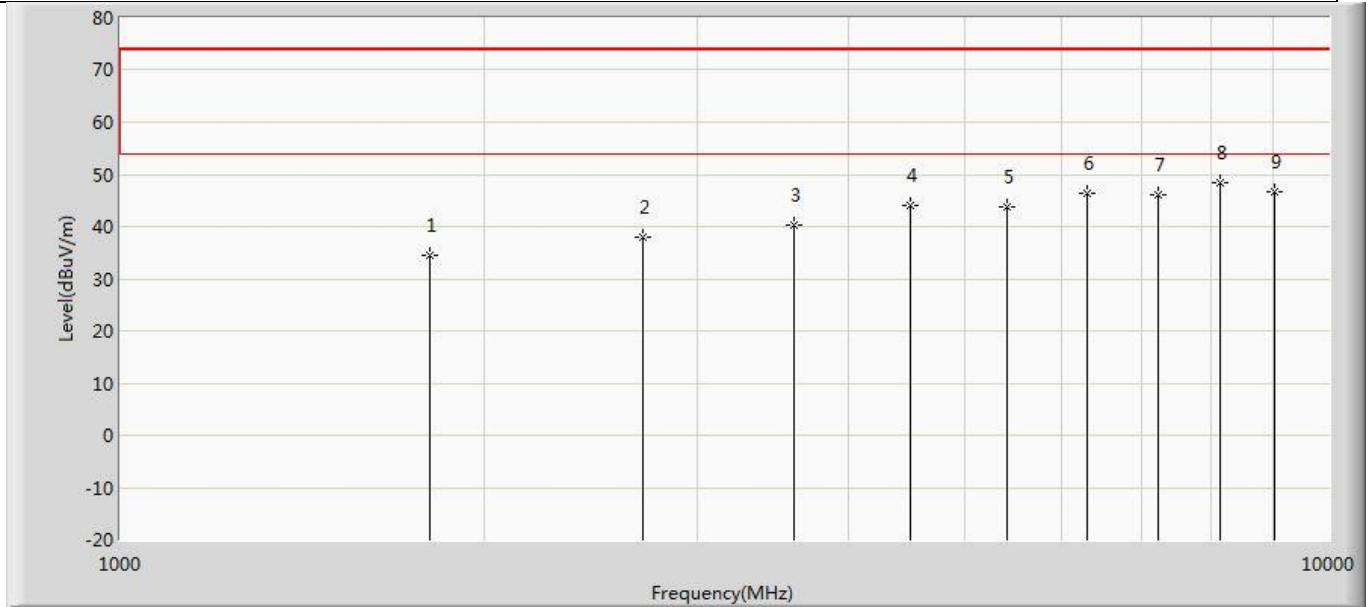
Above 1GHz Test Setup:



4.1.3 Test Procedure			
	References Rule	Chapter	Description
<input checked="" type="checkbox"/>	ANSI C63.10	11.12	Emissions in restricted frequency bands
	<input checked="" type="checkbox"/> ANSI C63.10	11.12.1	Radiated emission measurements
	<input checked="" type="checkbox"/> ANSI C63.10	11.12.2.7	Radiated spurious emission test
	<input checked="" type="checkbox"/> ANSI C63.10	6.4	Radiated emissions from unlicensed wireless devices below 30 MHz
	<input checked="" type="checkbox"/> ANSI C63.10	6.5	Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz
	<input checked="" type="checkbox"/> ANSI C63.10	6.6	Radiated emissions from unlicensed wireless devices above 1 GHz

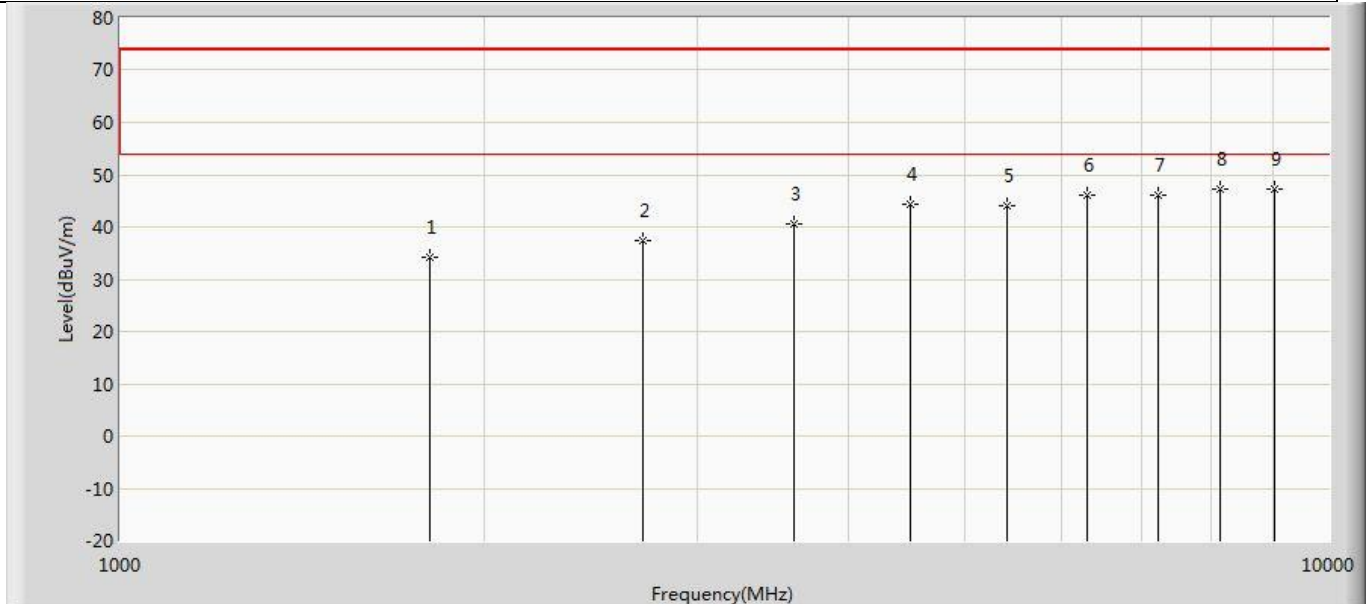
4.1.4 Test Data

Profile: 2260204R	Page No.: 13
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 1: Transmit by LoRa_125kHz at 902.3MHz	



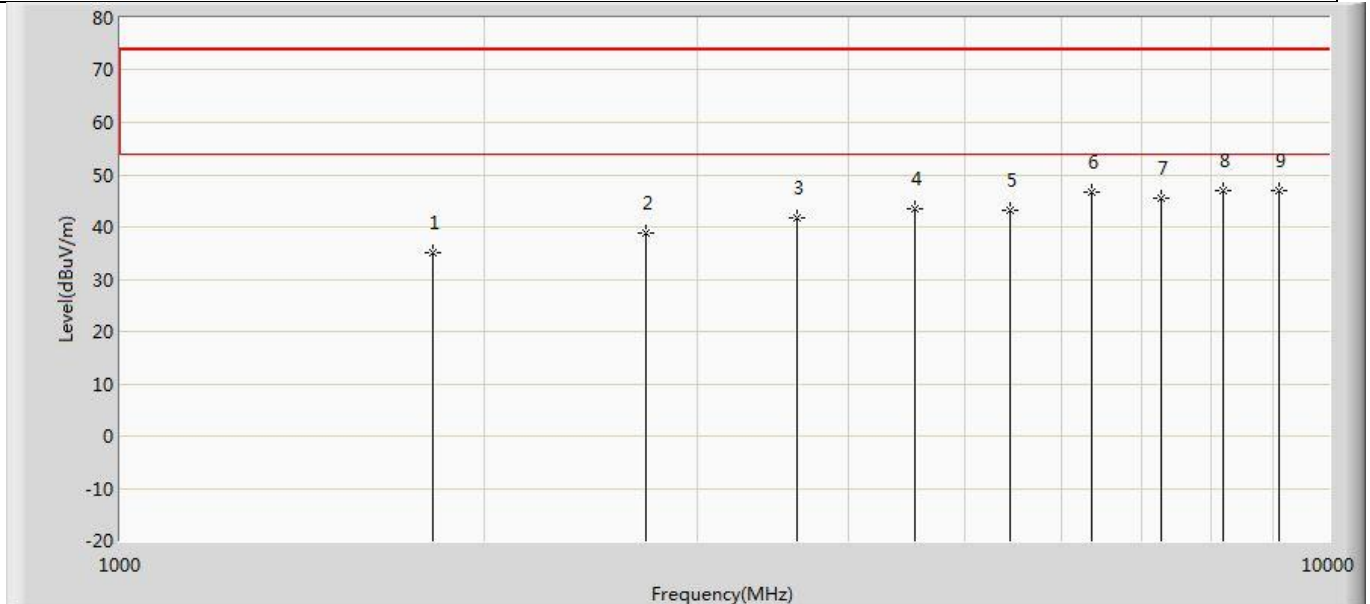
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1804.600	34.359	46.213	-39.641	74.000	-11.854	PK
2		2706.900	37.933	47.458	-36.067	74.000	-9.525	PK
3		3609.200	40.258	46.858	-33.742	74.000	-6.600	PK
4		4511.500	43.995	48.552	-30.005	74.000	-4.556	PK
5		5413.800	43.695	48.040	-30.305	74.000	-4.344	PK
6		6316.100	46.285	48.332	-27.715	74.000	-2.046	PK
7		7218.400	46.201	46.953	-27.799	74.000	-0.753	PK
8	*	8120.700	48.546	48.753	-25.454	74.000	-0.208	PK
9		9023.000	46.710	47.376	-27.290	74.000	-0.666	PK

Profile: 2260204R	Page No.: 14
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 1: Transmit by LoRa_125kHz at 902.3MHz	



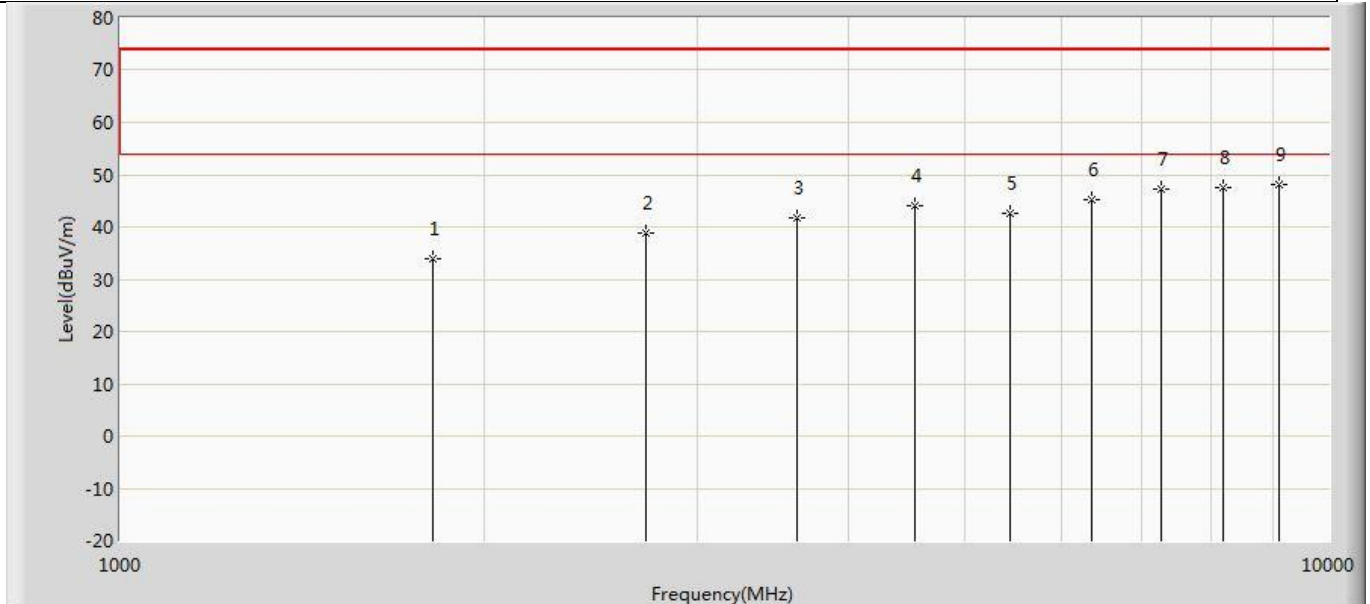
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1804.600	34.220	46.074	-39.780	74.000	-11.854	PK
2		2706.900	37.290	46.815	-36.710	74.000	-9.525	PK
3		3609.200	40.518	47.118	-33.482	74.000	-6.600	PK
4		4511.500	44.204	48.761	-29.796	74.000	-4.556	PK
5		5413.800	44.124	48.469	-29.876	74.000	-4.344	PK
6		6316.100	46.218	48.265	-27.782	74.000	-2.046	PK
7		7218.400	46.229	46.981	-27.771	74.000	-0.753	PK
8		8120.700	47.151	47.358	-26.849	74.000	-0.208	PK
9	*	9023.000	47.325	47.991	-26.675	74.000	-0.666	PK

Profile: 2260204R	Page No.: 17
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 1: Transmit by LoRa_125kHz at 908.5MHz	



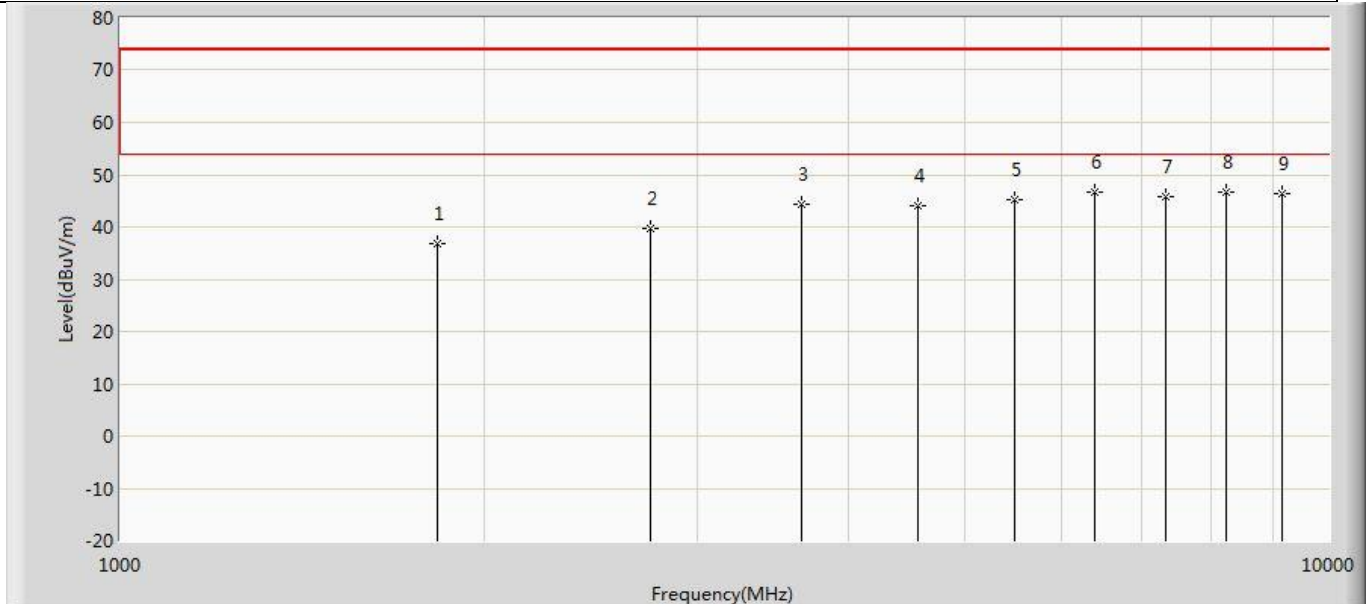
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1817.000	35.169	46.901	-38.831	74.000	-11.733	PK
2		2725.500	38.887	48.412	-35.113	74.000	-9.525	PK
3		3634.000	41.636	48.170	-32.364	74.000	-6.534	PK
4		4542.500	43.572	48.619	-30.428	74.000	-5.046	PK
5		5451.000	43.218	47.579	-30.782	74.000	-4.361	PK
6		6359.500	46.716	48.049	-27.284	74.000	-1.332	PK
7		7268.000	45.544	45.970	-28.456	74.000	-0.426	PK
8		8176.500	46.861	47.427	-27.139	74.000	-0.566	PK
9	*	9085.000	46.881	46.876	-27.119	74.000	0.005	PK

Profile: 2260204R	Page No.: 18
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 1: Transmit by LoRa_125kHz at 908.5MHz	



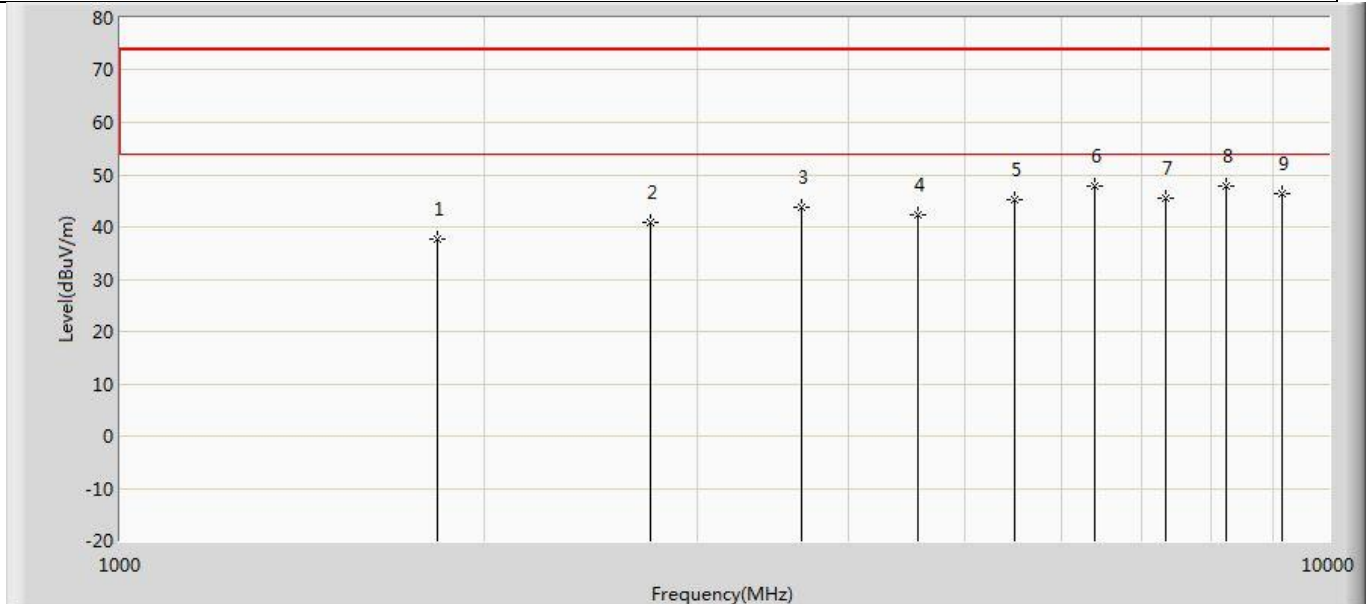
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1817.000	33.839	45.571	-40.161	74.000	-11.733	PK
2		2725.500	38.963	48.487	-35.037	74.000	-9.525	PK
3		3634.000	41.746	48.280	-32.254	74.000	-6.534	PK
4		4542.500	43.949	48.996	-30.051	74.000	-5.046	PK
5		5451.000	42.487	46.848	-31.513	74.000	-4.361	PK
6		6359.500	45.168	46.501	-28.832	74.000	-1.332	PK
7		7268.000	47.205	47.631	-26.795	74.000	-0.426	PK
8		8176.500	47.422	47.988	-26.578	74.000	-0.566	PK
9	*	9085.000	48.101	48.096	-25.899	74.000	0.005	PK

Profile: 2260204R	Page No.: 21
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 1: Transmit by LoRa_125kHz at 914.9MHz	



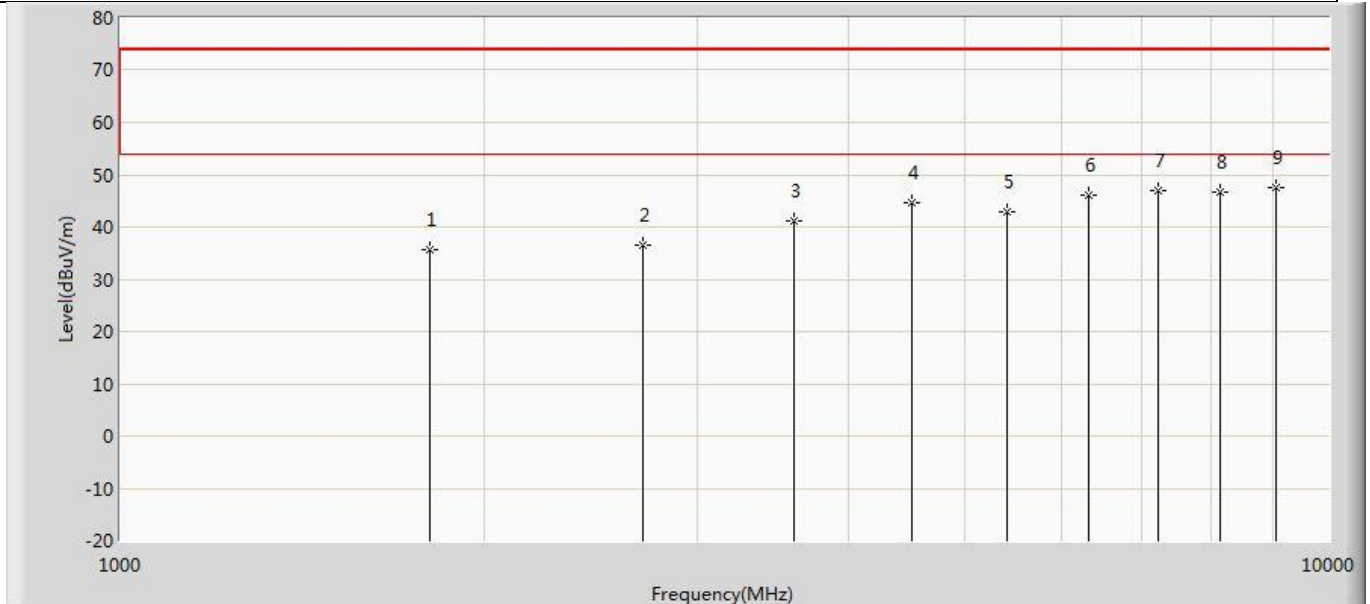
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1829.800	36.843	48.439	-37.157	74.000	-11.596	PK
2		2744.700	39.738	49.241	-34.262	74.000	-9.502	PK
3		3659.600	44.388	50.993	-29.612	74.000	-6.606	PK
4		4574.500	44.117	49.102	-29.883	74.000	-4.985	PK
5		5489.400	45.122	49.328	-28.878	74.000	-4.207	PK
6	*	6404.300	46.733	48.676	-27.267	74.000	-1.943	PK
7		7319.200	45.888	46.726	-28.112	74.000	-0.838	PK
8		8234.100	46.636	46.861	-27.364	74.000	-0.224	PK
9		9149.000	46.291	46.868	-27.709	74.000	-0.577	PK

Profile: 2260204R	Page No.: 22
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 1: Transmit by LoRa_125kHz at 914.9MHz	



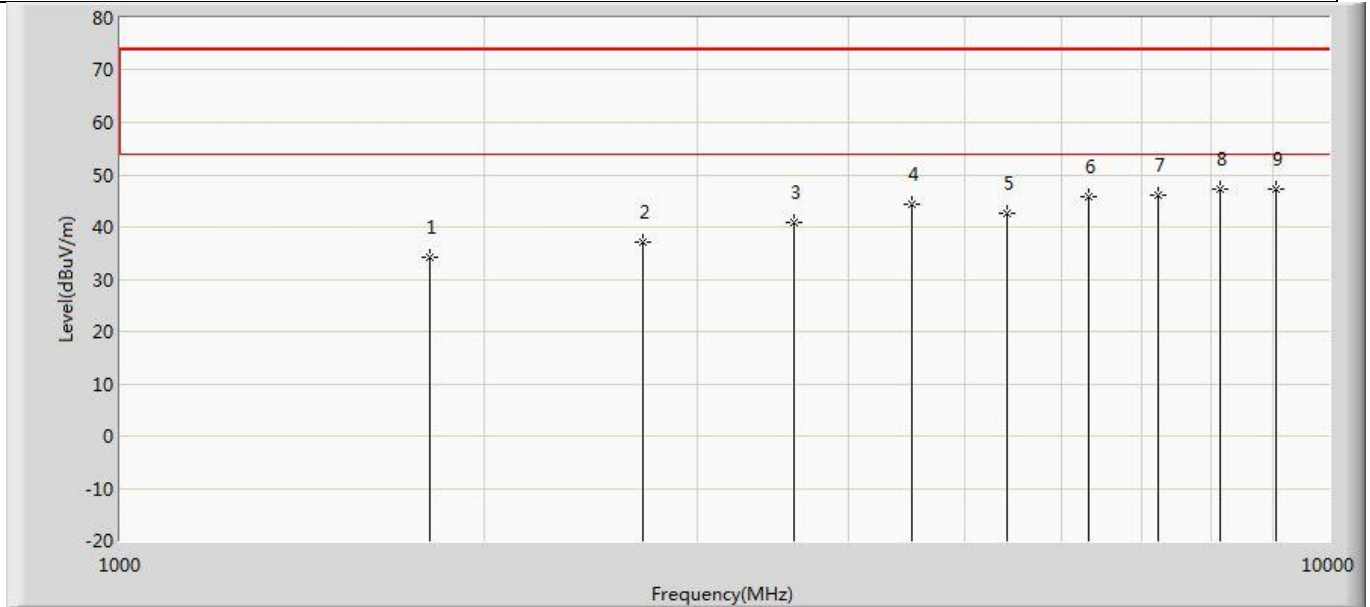
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1829.800	37.576	49.172	-36.424	74.000	-11.596	PK
2		2744.700	40.996	50.499	-33.004	74.000	-9.502	PK
3		3659.600	43.755	50.360	-30.245	74.000	-6.606	PK
4		4574.500	42.329	47.314	-31.671	74.000	-4.985	PK
5		5489.400	45.327	49.533	-28.673	74.000	-4.207	PK
6		6404.300	47.733	49.676	-26.267	74.000	-1.943	PK
7		7319.200	45.595	46.433	-28.405	74.000	-0.838	PK
8	*	8234.100	47.900	48.125	-26.100	74.000	-0.224	PK
9		9149.000	46.305	46.882	-27.695	74.000	-0.577	PK

Profile: 2260204R	Page No.: 15
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 2: Transmit by LoRa_500kHz at 903MHz	



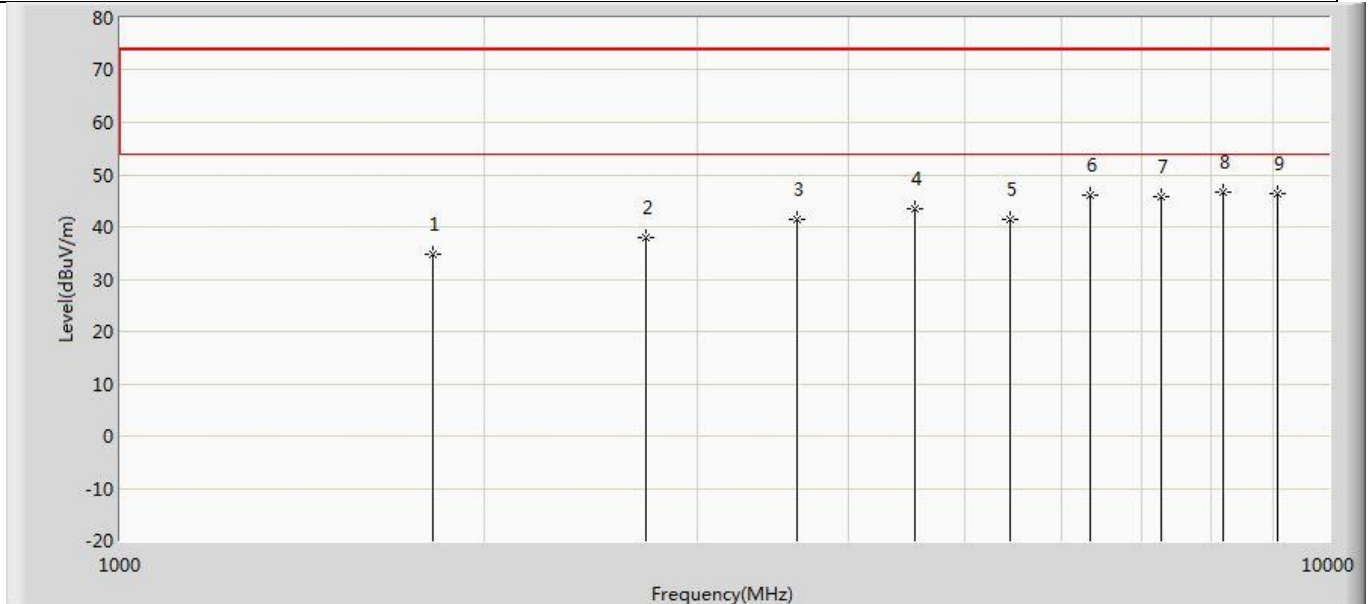
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1806.000	35.688	47.529	-38.312	74.000	-11.841	PK
2		2709.000	36.586	46.108	-37.414	74.000	-9.522	PK
3		3612.000	41.199	47.709	-32.801	74.000	-6.510	PK
4		4515.000	44.522	48.995	-29.478	74.000	-4.473	PK
5		5418.000	42.765	47.109	-31.235	74.000	-4.344	PK
6		6321.000	46.055	48.222	-27.945	74.000	-2.167	PK
7		7224.000	46.990	47.689	-27.010	74.000	-0.699	PK
8		8127.000	46.685	46.833	-27.315	74.000	-0.148	PK
9	*	9030.000	47.662	48.328	-26.338	74.000	-0.666	PK

Profile: 2260204R	Page No.: 16
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 2: Transmit by LoRa_500kHz at 903MHz	



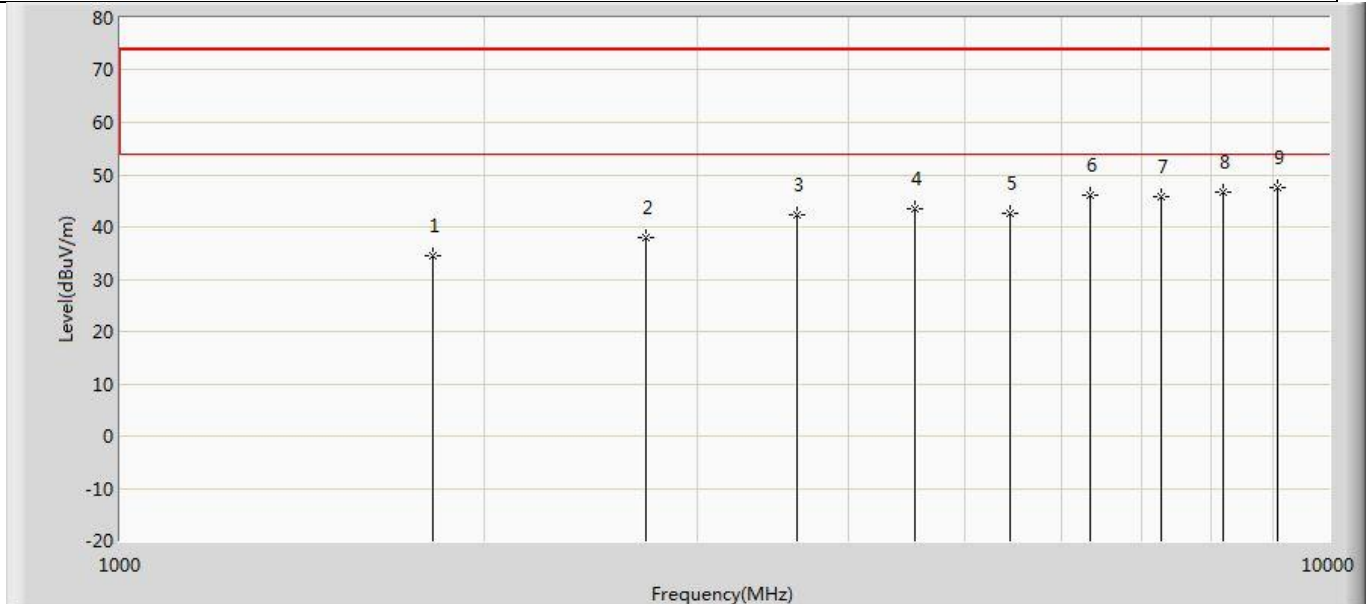
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1806.000	34.220	46.061	-39.780	74.000	-11.841	PK
2		2709.000	37.009	46.531	-36.991	74.000	-9.522	PK
3		3612.000	40.968	47.478	-33.032	74.000	-6.510	PK
4		4515.000	44.305	48.778	-29.695	74.000	-4.473	PK
5		5418.000	42.508	46.852	-31.492	74.000	-4.344	PK
6		6321.000	45.750	47.917	-28.250	74.000	-2.167	PK
7		7224.000	46.071	46.770	-27.929	74.000	-0.699	PK
8		8127.000	47.170	47.318	-26.830	74.000	-0.148	PK
9	*	9030.000	47.357	48.023	-26.643	74.000	-0.666	PK

Profile: 2260204R	Page No.: 19
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 2: Transmit by LoRa_500kHz at 907.8MHz	



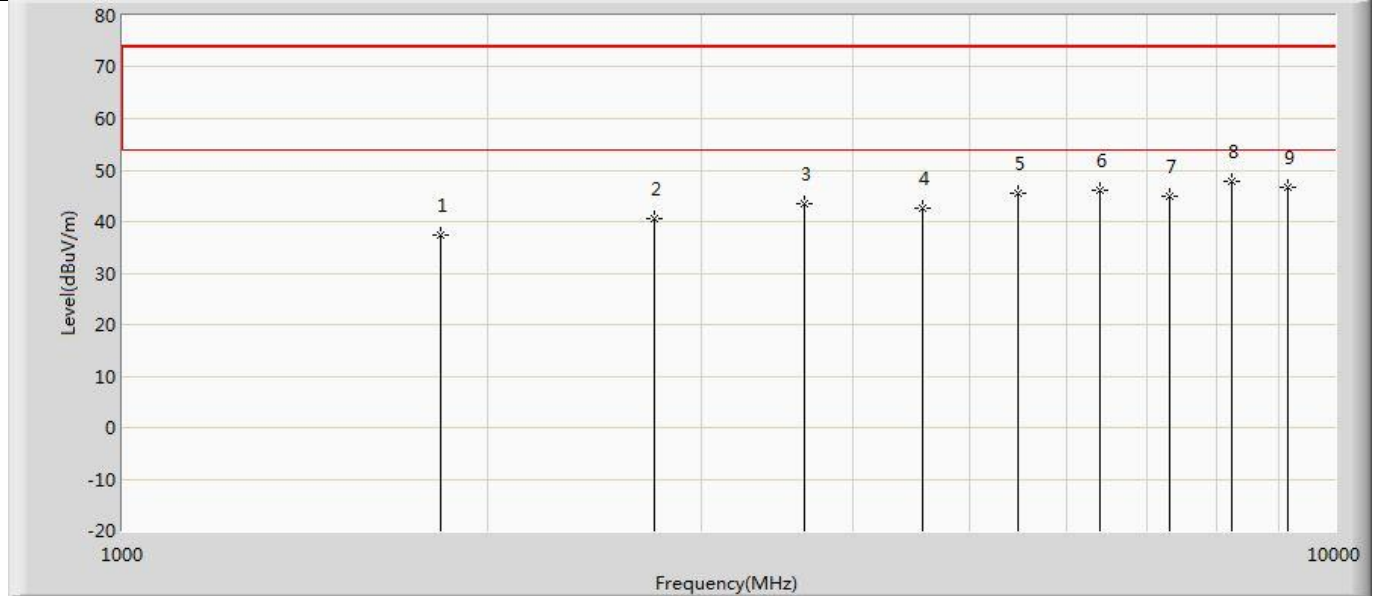
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1815.600	34.756	46.503	-39.244	74.000	-11.747	PK
2		2723.400	37.948	47.469	-36.052	74.000	-9.521	PK
3		3631.200	41.503	47.999	-32.497	74.000	-6.497	PK
4		4539.000	43.461	48.525	-30.539	74.000	-5.063	PK
5		5446.800	41.498	45.927	-32.502	74.000	-4.429	PK
6		6354.600	46.101	47.288	-27.899	74.000	-1.187	PK
7		7262.400	45.904	46.235	-28.096	74.000	-0.331	PK
8	*	8170.200	46.795	47.518	-27.205	74.000	-0.723	PK
9		9078.000	46.463	46.937	-27.537	74.000	-0.474	PK

Profile: 2260204R	Page No.: 20
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 2: Transmit by LoRa_500kHz at 907.8MHz	



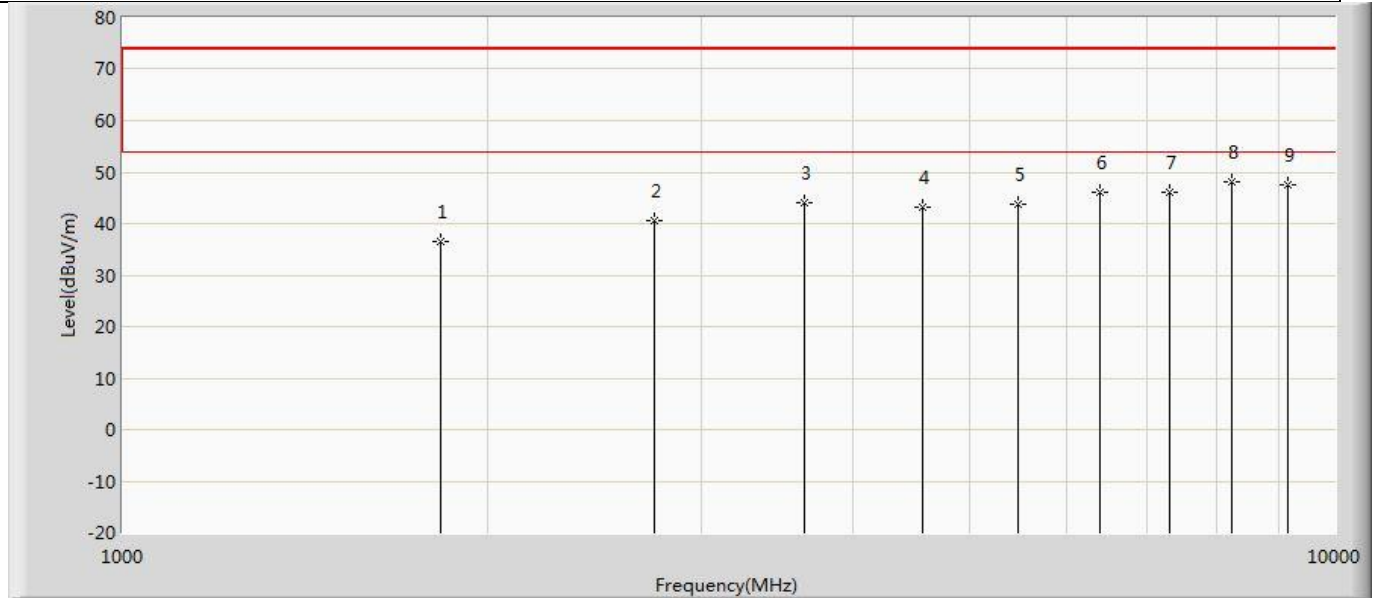
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1815.600	34.375	46.122	-39.625	74.000	-11.747	PK
2		2723.400	38.057	47.578	-35.943	74.000	-9.521	PK
3		3631.200	42.386	48.882	-31.614	74.000	-6.497	PK
4		4539.000	43.473	48.537	-30.527	74.000	-5.063	PK
5		5446.800	42.500	46.929	-31.500	74.000	-4.429	PK
6		6354.600	46.198	47.385	-27.802	74.000	-1.187	PK
7		7262.400	45.813	46.144	-28.187	74.000	-0.331	PK
8		8170.200	46.684	47.407	-27.316	74.000	-0.723	PK
9	*	9078.000	47.492	47.966	-26.508	74.000	-0.474	PK

Profile: 2260204R	Page No.: 23
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:37
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 2: Transmit by LoRa_500kHz at 914.2MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1828.400	37.341	48.952	-36.659	74.000	-11.611	PK
2		2742.600	40.523	50.033	-33.477	74.000	-9.510	PK
3		3656.800	43.368	49.984	-30.632	74.000	-6.616	PK
4		4571.000	42.655	47.650	-31.345	74.000	-4.995	PK
5		5485.200	45.443	49.675	-28.557	74.000	-4.232	PK
6		6399.400	46.082	47.781	-27.918	74.000	-1.698	PK
7		7313.600	44.877	45.574	-29.123	74.000	-0.697	PK
8	*	8227.800	47.931	47.671	-26.069	74.000	0.260	PK
9		9142.000	46.777	47.293	-27.223	74.000	-0.516	PK

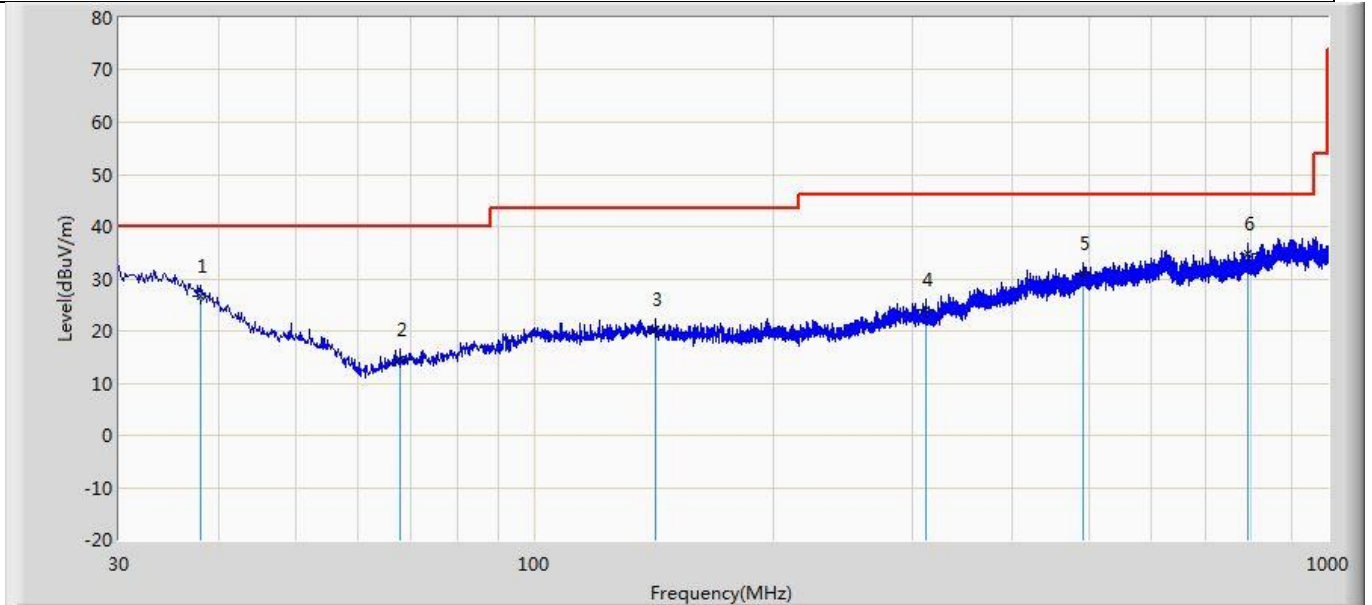
Profile: 2260204R	Page No.: 24
Engineer: Yu. Liu	
Site: AC5	Time: 2022/06/22 - 20:38
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 2: Transmit by LoRa_500kHz at 914.2MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1828.400	36.624	48.235	-37.376	74.000	-11.611	PK
2		2742.600	40.650	50.160	-33.350	74.000	-9.510	PK
3		3656.800	43.958	50.574	-30.042	74.000	-6.616	PK
4		4571.000	43.258	48.253	-30.742	74.000	-4.995	PK
5		5485.200	43.893	48.125	-30.107	74.000	-4.232	PK
6		6399.400	46.100	47.799	-27.900	74.000	-1.698	PK
7		7313.600	46.048	46.745	-27.952	74.000	-0.697	PK
8	*	8227.800	47.981	47.721	-26.019	74.000	0.260	PK
9		9142.000	47.624	48.140	-26.376	74.000	-0.516	PK

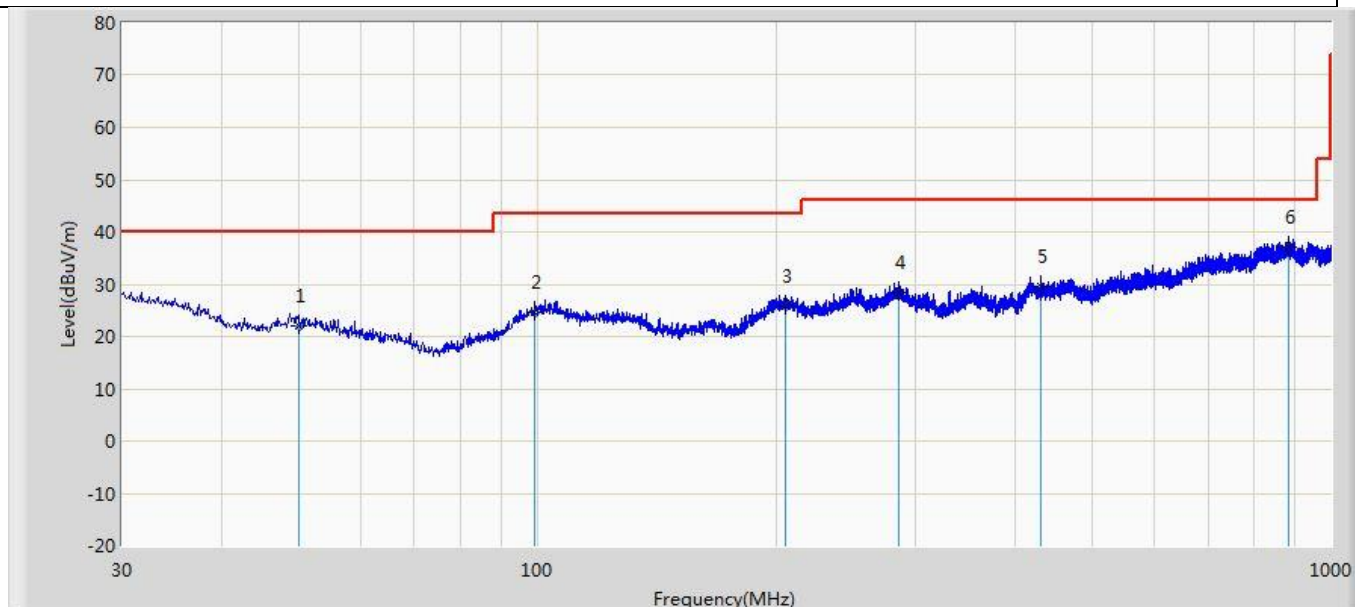
The worst case of Radiated Emission below 1GHz:

Profile: 2260204R	Page No.: 53
Engineer: Yu. Liu	
Site: AC2	Time: 2022/06/24 - 00:45
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Horizontal
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 1: Transmit by LoRa_125kHz at 902.3MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		38.002	26.615	2.464	-13.385	40.000	24.151	QP
2		67.830	14.395	3.568	-25.605	40.000	10.827	QP
3		142.399	20.400	3.194	-23.100	43.500	17.206	QP
4		311.300	24.183	3.109	-21.817	46.000	21.074	QP
5		491.114	30.946	2.689	-15.054	46.000	28.256	QP
6	*	793.390	34.755	4.489	-11.245	46.000	30.266	QP

Profile: 2260204R	Page No.: 54
Engineer: Yu. Liu	
Site: AC2	Time: 2022/06/24 - 00:46
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Vertical
EUT: LoRa Module	Power: DC 3.3V
Note: Mode 1: Transmit by LoRa_125kHz at 902.3MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		50.006	22.054	2.612	-17.946	40.000	19.442	QP
2		99.355	24.750	3.097	-18.750	43.500	21.654	QP
3		205.812	25.904	2.455	-17.596	43.500	23.449	QP
4		286.080	28.366	3.266	-17.634	46.000	25.100	QP
5		430.367	29.498	3.649	-16.502	46.000	25.849	QP
6	*	883.479	37.036	3.319	-8.964	46.000	33.717	QP

Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Factor(Probe+Cable-Amp).
4. The test frequency range 9kHz~30MHz, worst case are at least 6dB below the limits, therefore no data appear in the report.

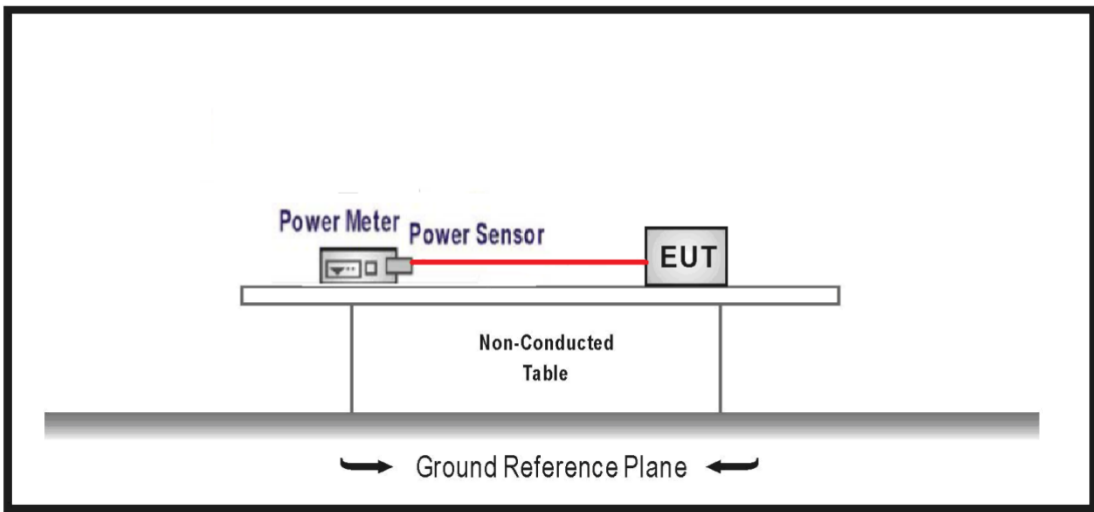
4.2 Fundamental emission output power	VERDICT: PASS
--	----------------------

4.2.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.247 (b)(3)	
<input checked="" type="checkbox"/> GTX < 6dBi	Pout ≤ 30dBm	
<input type="checkbox"/> GTX > 6dBi		
<input type="checkbox"/> Non-Fix point-point	Pout ≤ 30 - (GTX - 6)	
<input type="checkbox"/> Fix point-point	Pout ≤ 30 - [(GTX - 6)]/3	
<input type="checkbox"/> Point-to-multipoint	Pout ≤ 30 - (GTX - 6)	
<input type="checkbox"/> Overlap Beams	Pout ≤ 30 - [(GTX - 6)]/3	
<input type="checkbox"/> Aggregate power transmitted simultaneously on all beams	Pout ≤ 30 - [(GTX - 6)]/3	
<input type="checkbox"/> single directional beam	Pout ≤ 30 - [(GTX - 6)]/3 + 8dB	

Note 1 : GTX directional gain of transmitting antennas.
 Note 2 : Pout is maximum peak conducted output power .

4.2.2 Test Setup



4.2.3 Test Procedure				
	References Rule		Chapter	Description
<input checked="" type="checkbox"/>	ANSI C63.10		11.9	Fundamental emission output power
<input type="checkbox"/>	ANSI C63.10		11.9.1	Maximum peak conducted output power
	<input type="checkbox"/>	ANSI C63.10	11.9.1.1	RBW \geq DTS bandwidth
	<input type="checkbox"/>	ANSI C63.10	11.9.1.2	Integrated band power method
	<input type="checkbox"/>	ANSI C63.10	11.9.1.3	PKPM1 Peak power meter method
<input checked="" type="checkbox"/>	ANSI C63.10		11.9.2	Maximum conducted (average) output power
	<input type="checkbox"/>	ANSI C63.10	11.9.2.2	Measurement using a spectrum analyzer (SA)
		<input type="checkbox"/>	ANSI C63.10	11.9.2.2.2 Method AVGSA-1(Duty cycle \geq 98%)
		<input type="checkbox"/>	ANSI C63.10	11.9.2.2.3 Method AVGSA-1A(Duty cycle \geq 98%)
		<input type="checkbox"/>	ANSI C63.10	11.9.2.2.4 Method AVGSA-2(Duty cycle \leq 98%)
		<input type="checkbox"/>	ANSI C63.10	11.9.2.2.5 Method AVGSA-2A(Duty cycle \leq 98%)
		<input type="checkbox"/>	ANSI C63.10	11.9.2.2.4 Method AVGSA-3
		<input type="checkbox"/>	ANSI C63.10	11.9.2.2.5 Method AVGSA-3A
	<input checked="" type="checkbox"/>	ANSI C63.10	11.9.2.3	Measurement using a power meter (PM)
		<input checked="" type="checkbox"/>	ANSI C63.10	11.9.2.3.1 Method AVGPM
		<input type="checkbox"/>	ANSI C63.10	11.9.2.3.2 Method AVGPM-G

4.2.4 Test Data

Mode	Channel	Test Frequency (MHz)	Power Output (dBm)	Limit (dBm)	Result
Mode 1	01	902.3	18.52	≤30	Pass
	32	908.5	18.61	≤30	Pass
	64	914.9	18.57	≤30	Pass
Mode 2	65	903.0	17.73	≤30	Pass
	68	907.8	17.68	≤30	Pass
	72	914.2	17.71	≤30	Pass

5 TEST SETUP PHOTO AND EUT PHOTO

Remark: The test setup photo and EUT Photo please see appendix.

_____ The End _____