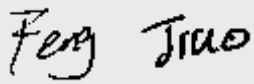
DEKRA Testing and Certification (Suzhou) Co., Ltd.
No.99 Hongye Rd., Suzhou Industrial Park, Suzhou, 215006, Jiangsu, China
TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098

Test report No:
23C0822R-RF-US-P06V01

FCC&ISED TEST REPORT

Product Name	LoRa+Wi-Fi+GNSS Module
Trademark	Murata
Model and /or type reference	LBAA0XV2DT
FCC ID	VPYLB2DT
IC	772C-LB2DT
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 RSS-Gen Issue 5 / RSS-247 Issue 3
Verdict Summary	IN COMPLIANCE
Tested by (name / position & signature)	Feng Jiao/ Project Engineer 
Approved by (name / position & signature)	Jack Zhang/ Manager 
Date of issue	2024-04-03
Report Version	V1.0
Report template No	Template_FCC 15.247-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.

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

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GENERAL CONDITIONS

Test Location	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China
Date(receive sample)	Feb. 02, 2024
Date (start test)	Feb. 03, 2024
Date (finish test)	Feb. 28, 2024

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.
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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
23C0822R-RF-US-P06V01	V1.0	Initial issue of report.	2024-04-03

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 FCC 15.247.
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, unless the specification, standard or customer have special requirements.
4. The test results presented in this report relate only to the object tested.
5. The test results relate only to the samples tested.
6. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
7. This report will not be used for social proof function in China market.
8. 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 Data Rate;
   - Chapter 1.4 Channel List;
   - Chapter 1.5 Power Setting

USED EQUIPMENT

AC Power Line Conducted Emission / TR1(Chamber details)

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EMI Test Receiver	R&S	ESCI	100906	2023.08.26	2024.08.25
Two-Line V-Network	R&S	ENV216	101044	2023.11.08	2024.11.07
Current Probe	R&S	EZ-17	100678	2023.11.02	2024.11.01
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2023.05.14	2024.05.13
50ohm Termination	Xinghu	N/A	N/A	2023.02.10	2024.02.09
Temperature/Humidity Meter	RTS	RTS-8S	TR1-TH	2023.07.06	2024.07.06
Coaxial Cable	Suhner	RG 223	TR1-C1	2023.05.14	2024.05.13
Dekra test software	Dekra	N/A	N/A	N/A	N/A

Conducted Test / TR8

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Wireless Connectivity Tester	R&S	CMW 270	102593	2023.05.20	2024.05.19
Coaxial Cable	N/A	N/A	2477	2023.06.08	2024.06.07
Coaxial Cable	N/A	N/A	2478	2023.06.08	2024.06.07
High and low temperature and fast temperature change test box	ASTUOD	ASTD-FBT-225K	N/A	2023.05.20	2024.05.19
Temperature/Humidity Meter	RTS	RTS-8S	RF08	2023.08.25	2024.08.24
Test system					
MAX Signal Analyzer	Keysight	N9010A	MY48030494	2023.11.08	2024.11.07
RF Control Unit	Tonscend	JS0806-2	22G8060594	2023.02.04 2024.02.06	2024.02.03 2025.02.05
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY61252529	2023.05.20	2024.05.19
Frequency extender for EXG or MXG	Keysight	N5182BX07	MY59362500	2023.05.20	2024.05.19
EXG-B MW Analog Signal Generator	Keysight	N5173B	MY61252566	2023.08.26	2024.08.25
Test Software	Tonscend	TS1120	JS1120-3	N/A	N/A

Radiated Emission(30MHz-1GHz) / AC2(Chamber details)

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EMI Test Receiver	R&S	ESCI	100573	2023.09.17	2024.09.16
Loop Antenna	R&S	HFH2-Z2E	101149	2023.04.25	2024.04.24
Bilog Antenna	Teseq GmbH	CBL6112D	27613	2023.09.13	2024.09.12
Temperature/Humidity Meter	RTS	RTS-8S	AC2-TH	2023.05.19	2024.05.18
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2023.05.21	2024.05.20
Dekra test software	Dekra	N/A	N/A	N/A	N/A

Radiated Emission (1GHz-40GHz) / AC5

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EXA Spectrum Analyzer	Keysight	N9020B	MY60112218	2023.11.08	2024.11.07
Pre-Amplifier	SKET	LNPA_0118G-45	SK2021090101	2023.05.14	2024.05.13
Preamplifier	CHENGYI	EMC184045SE	980263	2023.07.09	2024.07.08
DRG Horn	ETS-Lindgren	3117	00123988	2023.11.07	2024.11.06
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2023.05.31	2024.05.30
Filter Switch Box	MVE	MSW-F196	C070001S	2023.05.21	2024.05.20
Temperature/Humidity Meter	RTS	RTS-8S	AC5-TH	2023.05.19	2024.05.18
Coaxial Cable	TIMES	HF290A-NMNM-5.00M	651945-0001	2023.10.19	2024.10.18
Coaxial Cable	TIMES	HF290A-NMNM-6.00M	651946-0001	2023.10.19	2024.10.18
Coaxial Cable	TIMES	HF290A-NMNM-0.50M	651944-0001	2023.10.19	2024.10.18
Dekra test software	Dekra	N/A	N/A	N/A	N/A

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%. Uncertainties is complice with standard required as below.

Test item	Uncertainty
AC Power Line Conducted Emission	± 2.92 dB
Peak Power Output	± 1.13 dB
Radiated Emission(30MHz~1GHz)	Horizontal: 30MHz~200MHz: 4.60 dB 200MHz~1GHz: 4.10 dB Vertical: 30MHz~200MHz: 4.80 dB 200MHz~1GHz: 4.10 dB
Radiated Emission(1GHz~26.5GHz)	Horizontal: 1GHz~18GHz: 5.00 dB Vertical: 1GHz~18GHz: 4.80 dB Horizontal: 18GHz~40GHz: 4.70 dB Vertical: 18GHz~40GHz: 4.60 dB
RF antenna conducted test	± 1.13 dB
Radiated Emission Band Edge	± 5.00 dB
DTS Bandwidth	± 279 Hz
Occupied Bandwidth	± 279 Hz
Power Density	± 1.13 dB

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Product Name..... :	LoRa+Wi-Fi+GNSS Module
Model No. ..... :	LBAA0XV2DT
FCC ID..... :	VPYLB2DT
IC..... :	772C-LB2DT
Hardware Version ..... :	1.0
Software Version..... :	0x0307
Manufacturter..... :	Murata Manufacturing Co., Ltd.
Manufacturer Address..... :	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan
Factory ..... :	Murata Manufacturing Co., Ltd.
Factory Address..... :	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan

Wireless specifiction..... :	LoRa/FSK	
Operating frequency range(s) :	LoRa(CSS) 500kHz bandwidth: 902.5MHz~926.5MHz FSK 902.2MHz~927.8MHz	
Modulation ..... :	LoRa/FSK	
Number of channel..... :	LoRa(CSS): 31 FSK:129	
Data Rate ..... :	LoRa(CSS):2kbps FSK:50kbps	
Device category ..... :	☐	Fixed point-to-point
	☐	Emit multiple directional beams, simultaneously or sequentially
	☒	Other cases

Rated power supply .....:	Voltage and Frequency	
	☐	AC: 220 - 240 V, 50/60 Hz
	☐	AC: 100 - 240 V, 50/60 Hz
	☒	DC: 1.8 – 3.6V, Typical 3.3V
	☐	Battery:
	☐	USB
Mounting position.....:	☐	Table top equipment
	☐	Wall/Ceiling mounted equipment
	☐	Floor standing equipment
	☐	Hand-held equipment
	☒	Other: Module

1.2 Antenna Information

Antenna model / type number..... :	ignion NN03-310			
Antenna serial number ..... :	N/A			
Antenna Delivery ..... :	☒	1TX + 1RX		
	☐	2TX + 2RX		
	☐	Others:·····		
Antenna technology..... :	☒	SISO		
	☐	MIMO	☐	Basic
			☐	CDD
			☐	Sectorized
			☐	Beam-forming
Antenna Type..... :	☒	External	☐	Dipole
			☒	chip antenna
			☐	Sectorized
	☐	Internal	☐	PIFA
			☐	PCB
			☐	Metal Antenna
Antenna Gain..... :	0.3dBi			

1.3 Channel List

LoRa(CSS) 500kHz Bandwidth

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	902.5 MHz	02	903.3 MHz	03	904.1 MHz	04	904.9 MHz
05	905.7 MHz	06	906.5 MHz	07	907.3 MHz	08	908.1 MHz
09	908.9 MHz	10	909.7 MHz	11	910.5 MHz	12	911.3 MHz
13	912.1 MHz	14	912.9 MHz	15	913.7 MHz	16	914.5 MHz
17	915.3 MHz	18	916.1 MHz	19	916.9 MHz	20	917.7 MHz
21	918.5 MHz	22	919.3 MHz	23	920.1 MHz	24	920.9 MHz
25	921.7 MHz	26	922.5 MHz	27	923.3 MHz	28	924.1 MHz
29	924.9 MHz	30	925.7 MHz	31	926.5 MHz		

FSK

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	902.2 MHz	02	902.4 MHz	03	902.6 MHz	04	902.8 MHz
05	903 MHz	06	903.2 MHz	07	903.4 MHz	08	903.6 MHz
09	903.8 MHz	10	904 MHz	11	904.2 MHz	12	904.4 MHz
13	904.6 MHz	14	904.8 MHz	15	905 MHz	16	905.2 MHz
17	905.4 MHz	18	905.6 MHz	19	905.8 MHz	20	906 MHz
21	906.2 MHz	22	906.4 MHz	23	906.6 MHz	24	906.8 MHz
25	907 MHz	26	907.2 MHz	27	907.4 MHz	28	907.6 MHz
29	907.8 MHz	30	908 MHz	31	908.2 MHz	32	908.4 MHz
33	908.6 MHz	34	908.8 MHz	35	909 MHz	36	909.2 MHz
37	909.4 MHz	38	909.6 MHz	39	909.8 MHz	40	910 MHz
41	910.2 MHz	42	910.4 MHz	43	910.6 MHz	44	910.8 MHz
45	911 MHz	46	911.2 MHz	47	911.4 MHz	48	911.6 MHz
49	911.8 MHz	50	912 MHz	51	912.2 MHz	52	912.4 MHz
53	912.6 MHz	54	912.8 MHz	55	913 MHz	56	913.2 MHz
57	913.4 MHz	58	913.6 MHz	59	913.8 MHz	60	914 MHz
61	914.2 MHz	62	914.4 MHz	63	914.6 MHz	64	914.8 MHz
65	915 MHz	66	915.2 MHz	67	915.4 MHz	68	915.6 MHz
69	915.8 MHz	70	916 MHz	71	916.2 MHz	72	916.4 MHz
73	916.6 MHz	74	916.8 MHz	75	917 MHz	76	917.2 MHz
77	917.4 MHz	78	917.6 MHz	79	917.8 MHz	80	918 MHz
81	918.2 MHz	82	918.4 MHz	83	918.6 MHz	84	918.8 MHz
85	919 MHz	86	919.2 MHz	87	919.4 MHz	88	919.6 MHz
89	919.8 MHz	90	920 MHz	91	920.2 MHz	92	920.4 MHz
93	920.6 MHz	94	920.8 MHz	95	921 MHz	96	921.2 MHz
97	921.4 MHz	98	921.6 MHz	99	921.8 MHz	100	922 MHz
101	922.2 MHz	102	922.4 MHz	103	922.6 MHz	104	922.8 MHz
105	923 MHz	106	923.2 MHz	107	923.4 MHz	108	923.6 MHz
109	923.8 MHz	110	924 MHz	111	924.2 MHz	112	924.4 MHz
113	924.6 MHz	114	924.8 MHz	115	925 MHz	116	925.2 MHz
117	925.4 MHz	118	925.6 MHz	119	925.8 MHz	120	926 MHz
121	926.2 MHz	122	926.4 MHz	123	926.6 MHz	124	926.8 MHz
125	927 MHz	126	927.2 MHz	127	927.4 MHz	128	927.6 MHz
129	927.8 MHz						

1.4 Power Setting

Mode	Frequency（MHz）	Power Setting
Mode 1 LoRa CSS 500kHz bandwidth	902.5	22
	914.5	22
	926.5	22
Mode 2 FSK	902.2	22
	915	22
	927.8	22

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

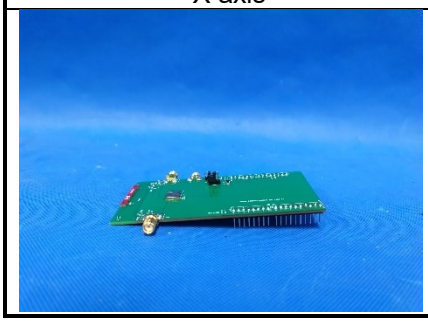
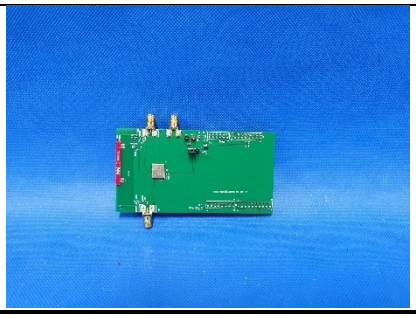
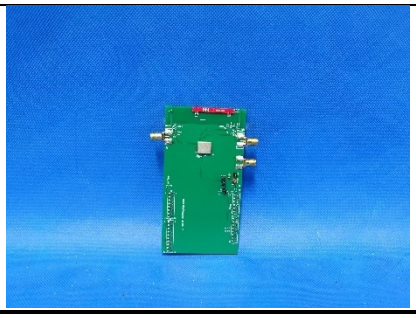
2 DESCRIPTION OF TEST SETUP

2.1 Operating mode(s) used for tests

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

Test Mode	Mode 1: Transmit by LoRa with CSS 500kHz bandwidth(902.5-926.5MHz)
	Mode 2: Transmit by LoRa with FSK(902.2-927.8MHz)

Note : For client device, radiated tests was verified over X, Y, Z axis, and shown the worst case Y axis on this report.

X axis	Y axis	Z axis
		

2.2 Support / Auxiliary equipment / unit / Test software for the EUT

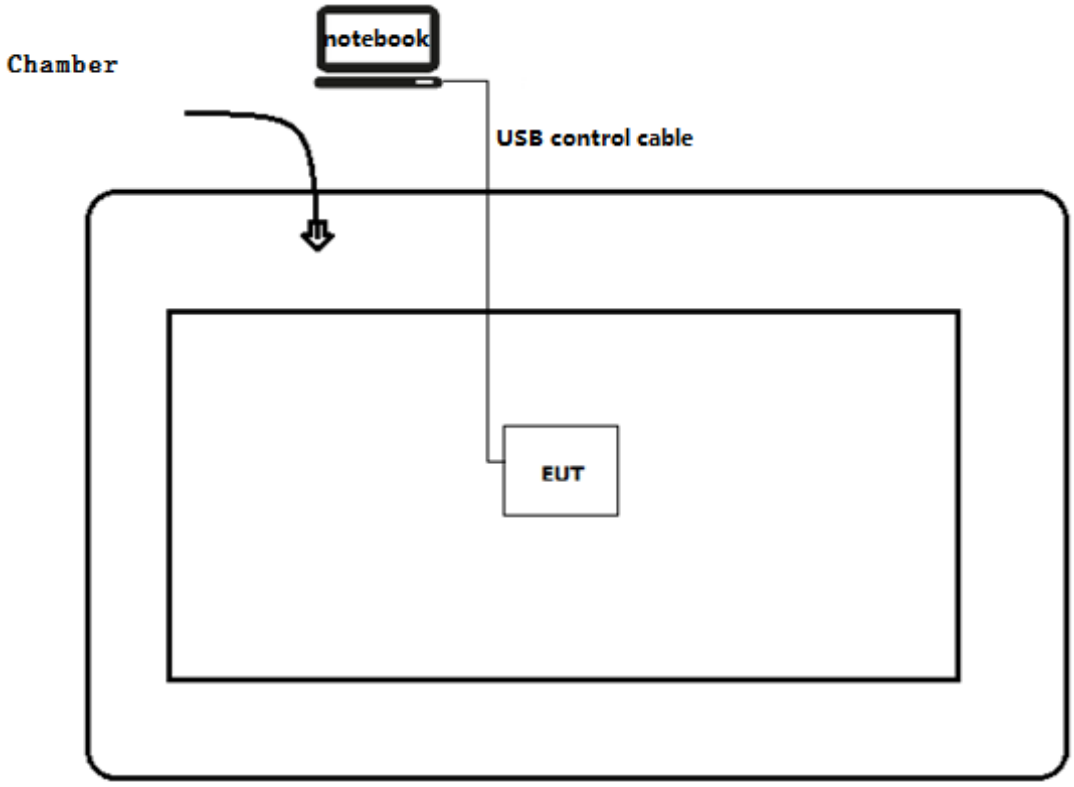
The EUT has been tested with the following auxiliary equipment / unit / software:

Auxiliary equipment	Type / Version	Manufacturer	Supplied by
Notebook	Think pad x280	Lenovo	Adapter
software	Type / Version	Manufacturer	Supplied by
SSCOM	5.13.1	N/A	N/A

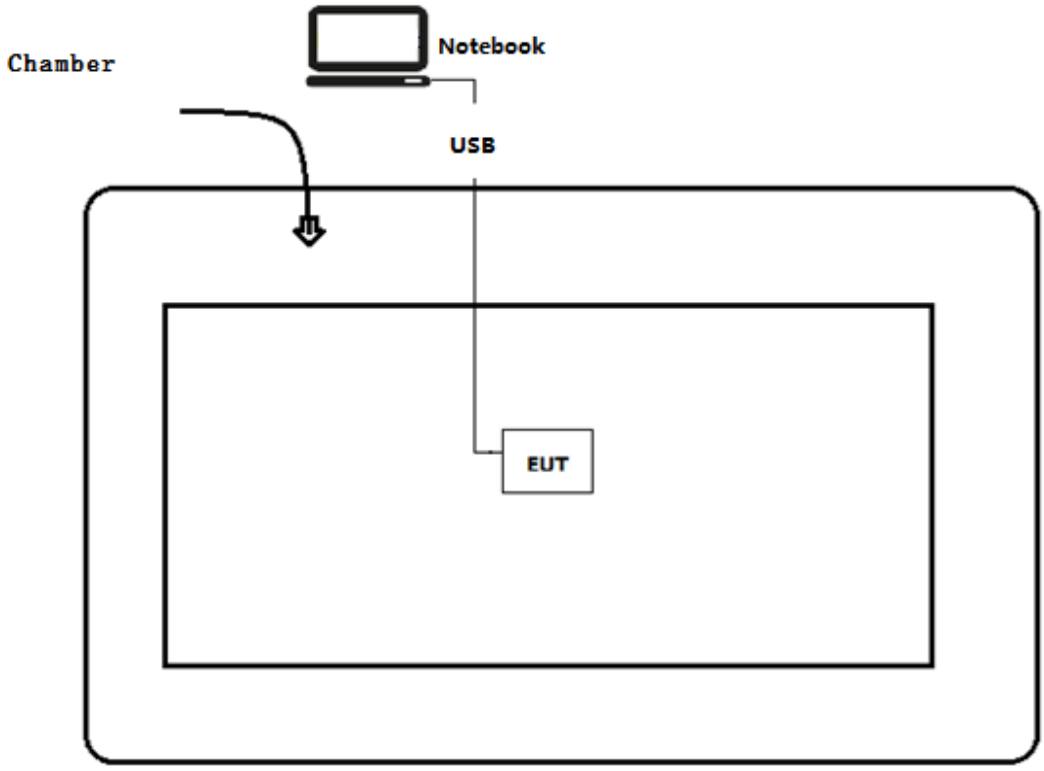
2.3 Test Configuration / Block diagram used for tests

The following test setup / configuration / block diagram has been used during the tests:

Test setup Diagram- Conducted test



Test setup Diagram- Radiated test



2.4 Testing process

1	Setup the EUT as shown in Section 2.3.
2	Run the software “SSCOM” on the notebook computer.
3	Open the serial port and enter the corresponding commands to configure the test mode, test channel, test power and 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	2020	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
RSS-Gen Issue 5 Amendment 1	2019	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 3	2023	Digital Transmission Systems (DTSs),Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

3.2 Overview of results

For FCC:

Requirement – Test case	Basic standard(s)	Verdict	Remark
AC Power Line Conducted Emission	FCC 15.207	N/A	---
Emissions in restricted frequency bands	FCC 15.247(d), 15.209	PASS	---
Emissions in non-restricted frequency bands	FCC 15.247(d)	PASS	---
Radiated Emission Band Edge	FCC 15.247(d), 15.209	N/A	---
Fundamental emission output power	FCC 15.247(b)(3)	PASS	---
DTS Bandwidth	FCC 15.247(a)(2)	PASS	---
20dB Bandwidth	FCC 15.247(a)(1)	PASS	---
Power Spectral Density	FCC 15.247(e)	PASS	---
Carrier Frequency Separation	FCC 15.247(a)(1)	PASS	---
Number of Hopping Frequencies	FCC 15.247(a)(1)(iii)	PASS	---
Time of Occupancy (Dwell Time)	FCC 15.247(a)(1)(iii)	PASS	---
Antenna Requirement	FCC 15.203	PASS	---

For ISED:

Requirement – Test case	Basic standard(s)	Verdict	Remark
AC Power Line Conducted Emission	RSS-Gen Issue 5 Section 8.8	N/A	---
Emissions in restricted frequency bands	RSS-Gen Issue 5 Section 8.9	PASS	---
Emissions in non-restricted frequency bands	RSS-247 Issue 3 Section A5.5	PASS	---
Radiated Emission Band Edge	RSS-247 Issue 3 Section A5.5	N/A	---
Fundamental emission output power	RSS-247 Issue 3 SectionA5.4(4)	PASS	---
DTS Bandwidth	RSS-Gen Issue 5 Section 6.6	PASS	---
20dB Bandwidth	RSS-247 Issue 3 Section A5.2(1)	PASS	---
Carrier Frequency Separation	RSS-247 Issue 3 Section 5.1	PASS	---
Number of Hopping Frequencies	RSS-247 Issue 3 Section 5.1	PASS	---
Time of Occupancy (Dwell Time)	RSS-247 Issue 3 Section 5.1	PASS	---
Power Spectral Density	RSS-247 Issue 3 Section A5.2(2)	PASS	---
Antenna Requirement	RSS-Gen Issue 5 Section 6.8	PASS	---

3.3 Test Facility

USA	**:**	**FCC Designation Number: CN1199**
Canada	**:**	**CAB identifier Number: CN0040**

4 TEST RESULTS

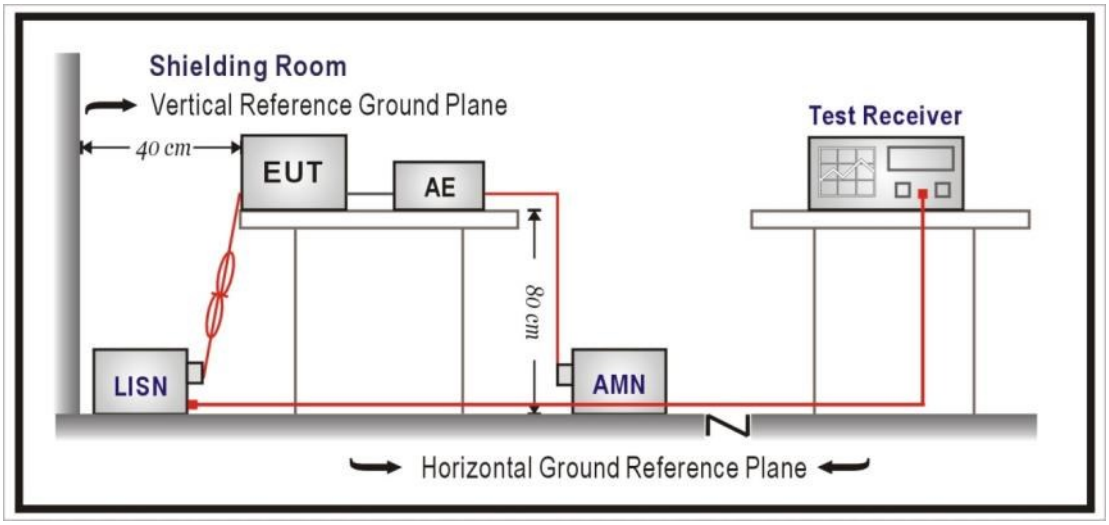
4.1 AC Power Line Conducted Emission	VERDICT: N/A

4.1.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.207	
Frequency range [MHz]	Limit: QP [dB(μV)[1)]]	Limit: AV [dB(μV) [1)]]
0,15 - 0,50	66 - 56 [2)]	56 - 46 [2)]
0,50 - 5,0	56	46
5,0 - 30	60	50

[1)] At the transition frequency, the lower limit applies.
[2)] The limit decreases linearly with the logarithm of the frequency.

4.1.2 Test Setup



4.1.3 Test Procedure

	References Rule	Chapter	Item
☒	ANSI C63.10-2013	6.2	Standard test method for ac power-line conducted emissions from unlicensed wireless devices

4.1.4 Test Data

N/A: The device is powered by DC, so the test item is not applicable.

4.2 Emissions in restricted frequency bands — VERDICT: PASS

4.2.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.205; 15.209

Restricted Bands of operation for FCC

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	Above 38.6
13.36 – 13.41	--	--	--

Restricted Bands of operation for ISED

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	--	--

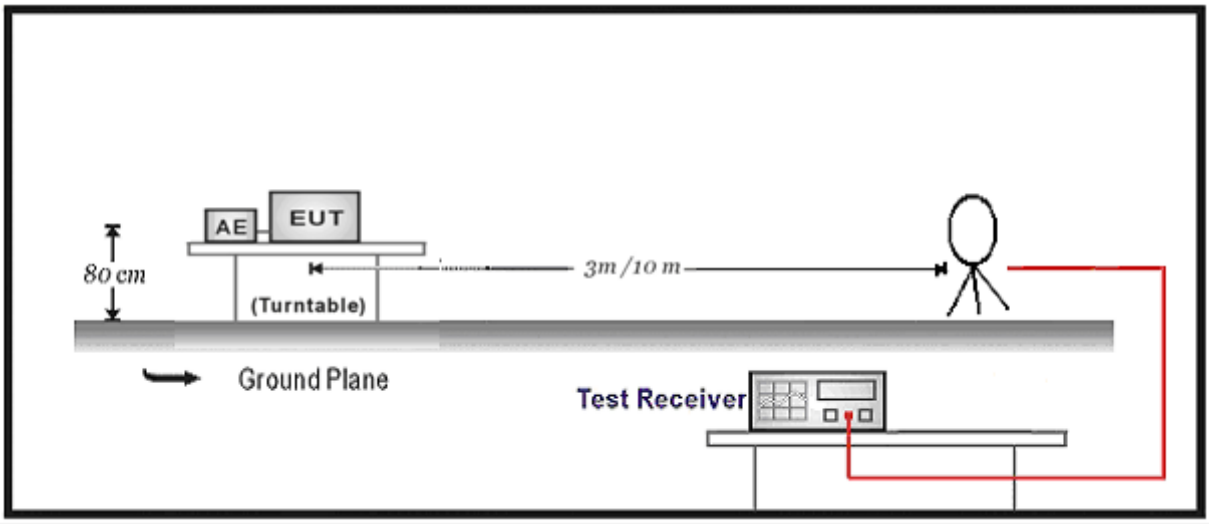
Restricted Band Emissions Limit			
Frequency (MHz)	Field strength (μV/m)	Field strength (dB μV/m)	Measurement distance (m)
0.009 - 0.49	2400/F(kHz)	48.5 – 13.8	300(Note 1)
0.49 - 1.705	24000/F(kHz)	33.8 - 23	30(Note 1)
1.705 - 30	30	29.5	30(Note 1)
30 - 88	100	40	3(Note 2)
88 - 216	150	43.5	3(Note 2)
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).

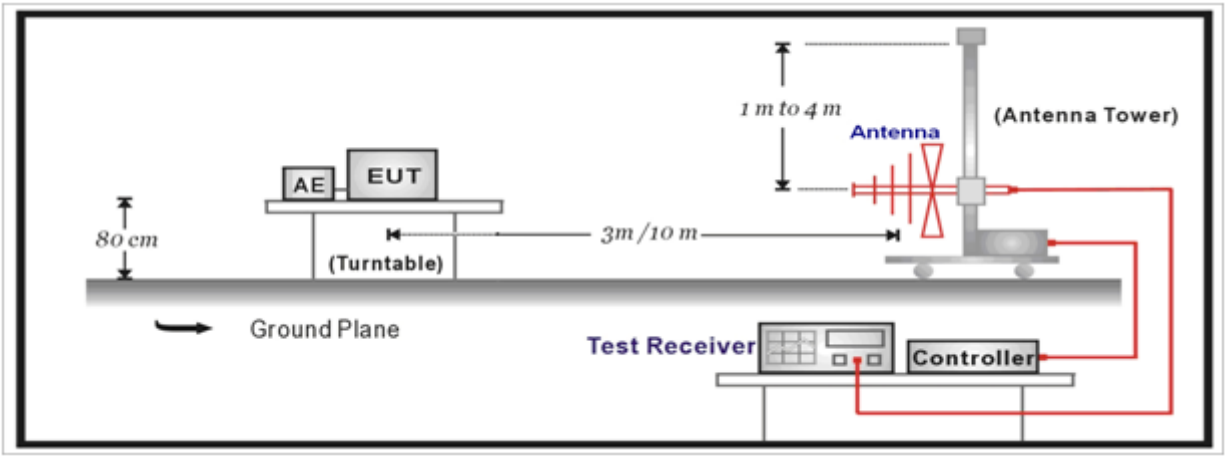
Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated 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).

4.2.2 Test Setup

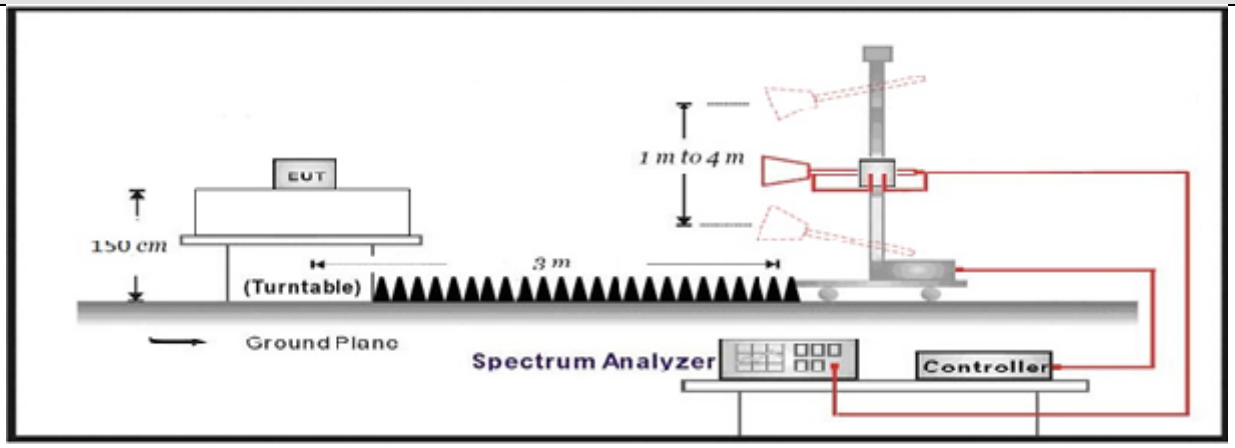
Below 30MHz Test Setup:



30MHz-1GHz Test Setup:



Above 1GHz Test Setup:

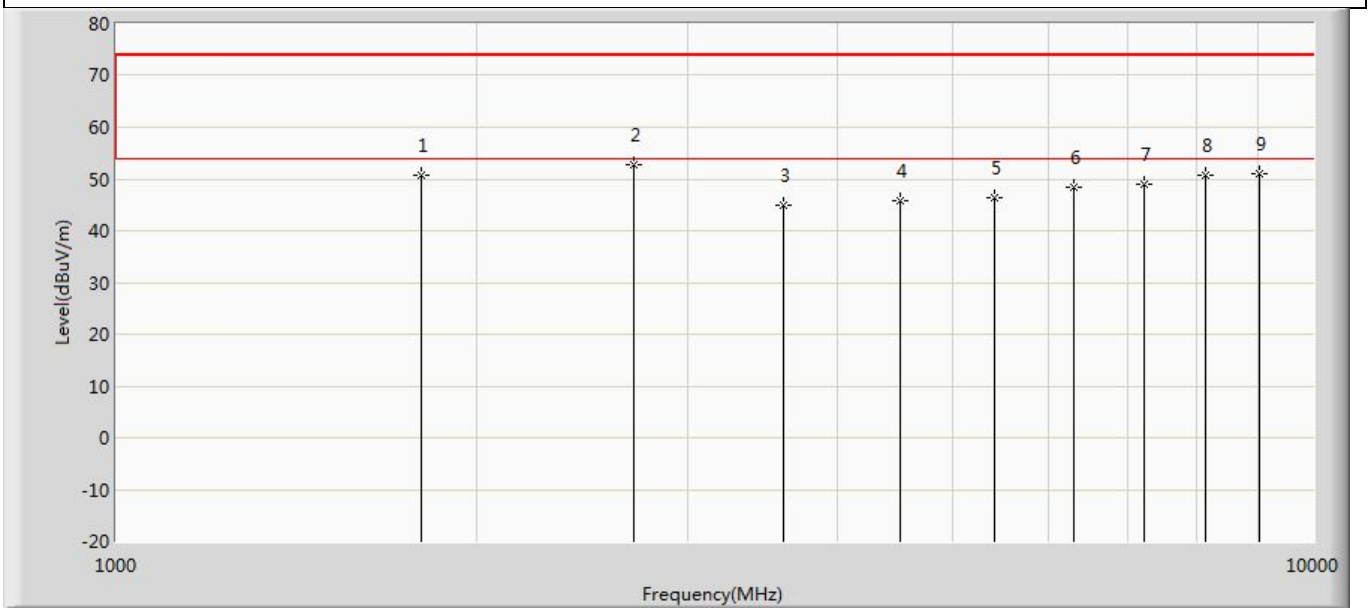


4.2.3 Test Procedure

	References Rule	Chapter	Description
☒	ANSI C63.10	11.12	Emissions in restricted frequency bands
	☒ ANSI C63.10	11.12.1	Radiated emission measurements
	☒ ANSI C63.10	6.3	Radiated spurious emission test
	☒ ANSI C63.10	6.4	Radiated emissions from unlicensed wireless devices below 30 MHz
	☒ ANSI C63.10	6.5	Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz
	☒ ANSI C63.10	6.6	Radiated emissions from unlicensed wireless devices above 1 GHz
	☐ ANSI C63.10	11.12.2	Antenna-port conducted measurements
	☐ ANSI C63.10	11.12.2.3	Quasi-peak measurement procedure
	☐ ANSI C63.10	11.12.2.4	Peak power measurement procedure
	☐ ANSI C63.10	11.12.2.5	Average power measurement procedures
	☐ ANSI C63.10	11.12.2.5.1	Trace averaging with continuous EUT transmission at full power
	☐ ANSI C63.10	11.12.2.5.2	Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction
	☐ ANSI C63.10	11.12.2.5.3	Reduced VBW averaging across ON and OFF times of the EUT transmissions with max hold

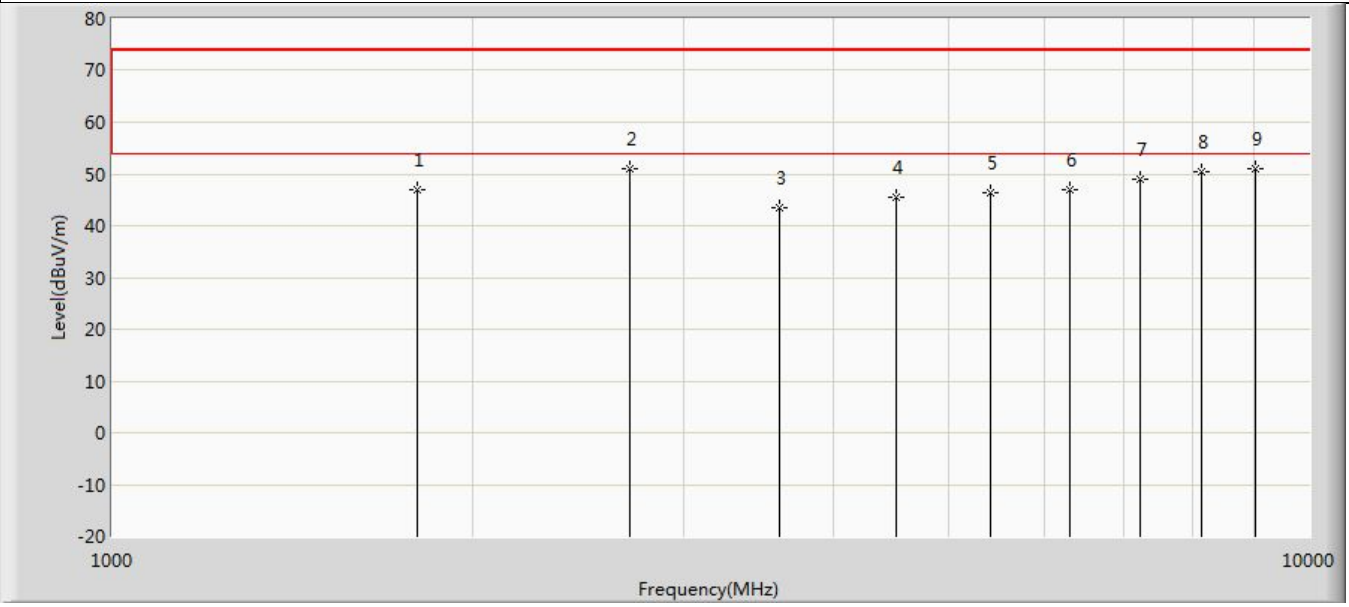
4.2.4 Test Data

Profile: 23C0822R	Page No.: 13
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:06
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 1:Transmit at 902.5MHz by LoRa CSS	



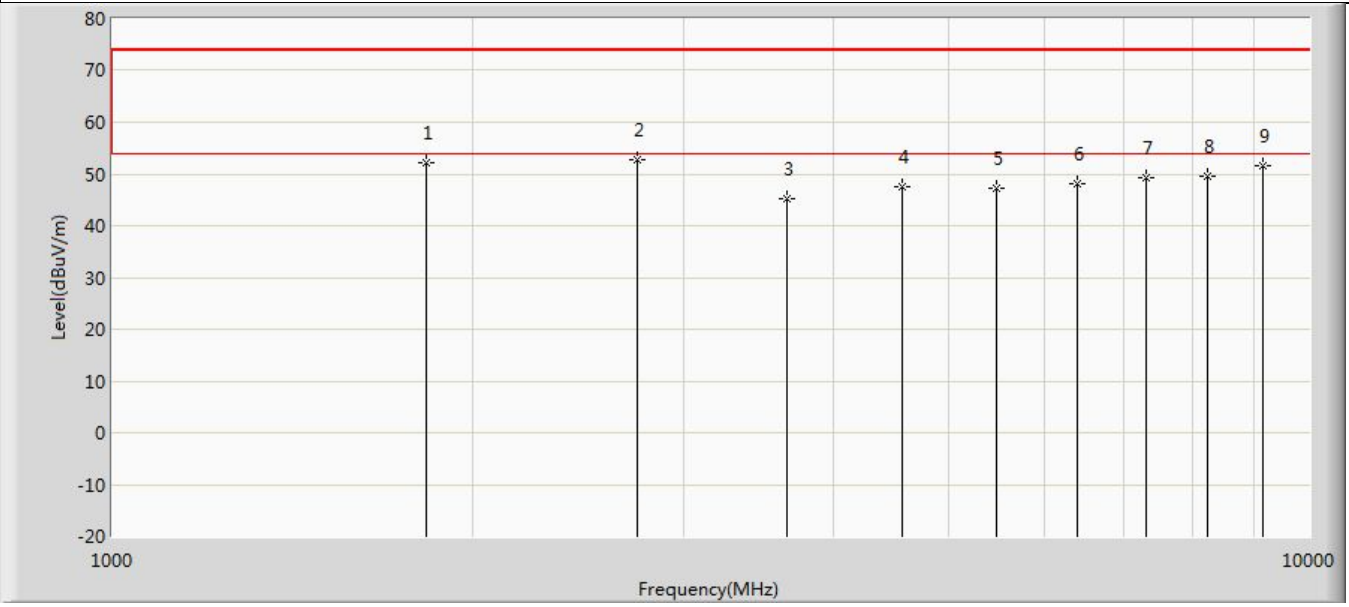
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1801.000	50.605	69.301	-23.395	74.000	-18.697	PK
2	*	2710.000	52.644	68.812	-21.356	74.000	-16.169	PK
3		3610.000	45.062	59.631	-28.938	74.000	-14.569	PK
4		4512.500	45.867	58.357	-28.133	74.000	-12.490	PK
5		5415.000	46.417	57.178	-27.583	74.000	-10.761	PK
6		6317.500	48.393	56.889	-25.607	74.000	-8.495	PK
7		7220.000	49.038	56.289	-24.962	74.000	-7.251	PK
8		8122.500	50.662	56.915	-23.338	74.000	-6.252	PK
9		9025.000	51.117	56.648	-22.883	74.000	-5.531	PK

Profile: 23C0822R	Page No.: 14
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:06
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 1:Transmit at 902.5MHz by LoRa CSS	



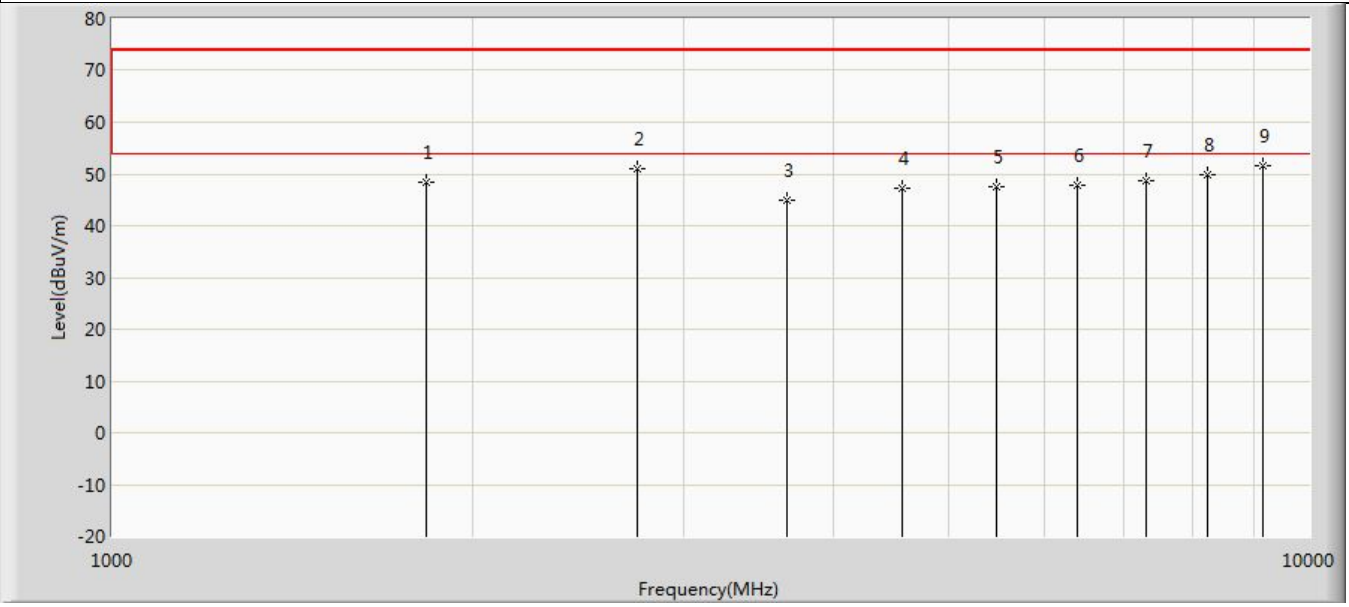
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1801.000	46.967	65.663	-27.033	74.000	-18.697	PK
2	*	2710.000	51.155	67.323	-22.845	74.000	-16.169	PK
3		3610.000	43.554	58.123	-30.446	74.000	-14.569	PK
4		4512.500	45.539	58.029	-28.461	74.000	-12.490	PK
5		5415.000	46.347	57.108	-27.653	74.000	-10.761	PK
6		6317.500	46.986	55.482	-27.014	74.000	-8.495	PK
7		7220.000	48.995	56.246	-25.005	74.000	-7.251	PK
8		8122.500	50.515	56.768	-23.485	74.000	-6.252	PK
9		9025.000	51.098	56.629	-22.902	74.000	-5.531	PK

Profile: 23C0822R	Page No.: 15
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:06
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 1:Transmit at 914.5MHz by LoRa CSS	



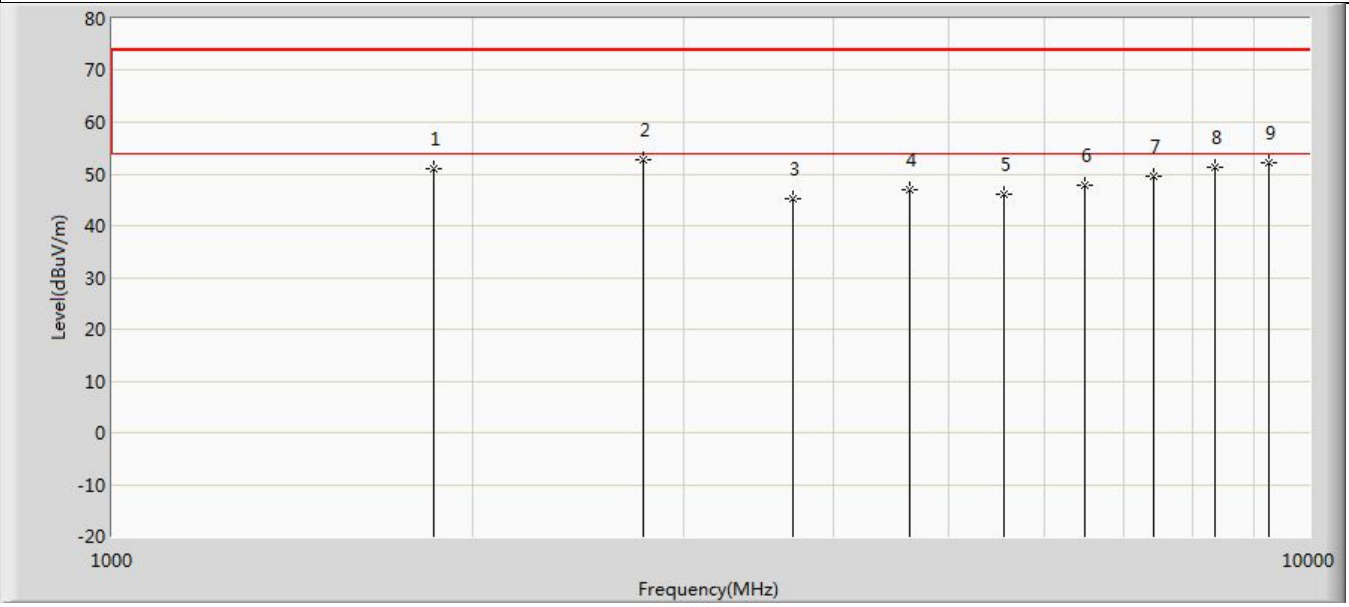
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1828.000	52.032	70.554	-21.968	74.000	-18.522	PK
2	*	2746.000	52.772	68.825	-21.228	74.000	-16.053	PK
3		3658.000	45.255	59.603	-28.745	74.000	-14.348	PK
4		4572.500	47.678	59.993	-26.322	74.000	-12.315	PK
5		5487.000	47.158	56.933	-26.842	74.000	-9.775	PK
6		6401.500	48.254	56.839	-25.746	74.000	-8.585	PK
7		7316.000	49.238	56.659	-24.762	74.000	-7.421	PK
8		8230.500	49.690	56.261	-24.310	74.000	-6.571	PK
9		9145.000	51.738	56.377	-22.262	74.000	-4.639	PK

Profile: 23C0822R	Page No.: 16
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 1:Transmit at 914.5MHz by LoRa CSS	



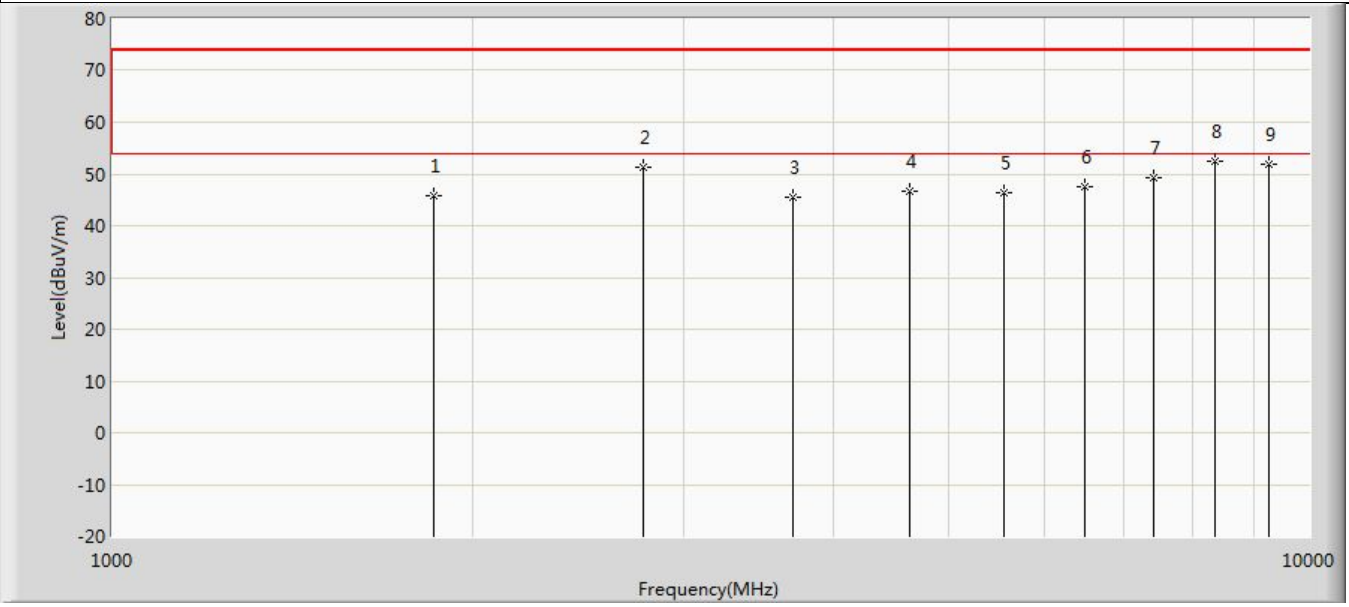
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1828.000	48.309	66.831	-25.691	74.000	-18.522	PK
2		2746.000	51.159	67.212	-22.841	74.000	-16.053	PK
3		3658.000	44.967	59.315	-29.033	74.000	-14.348	PK
4		4572.500	47.213	59.528	-26.787	74.000	-12.315	PK
5		5487.000	47.603	57.378	-26.397	74.000	-9.775	PK
6		6401.500	47.682	56.267	-26.318	74.000	-8.585	PK
7		7316.000	48.576	55.997	-25.424	74.000	-7.421	PK
8		8230.500	49.797	56.368	-24.203	74.000	-6.571	PK
9	*	9145.000	51.626	56.265	-22.374	74.000	-4.639	PK

Profile: 23C0822R	Page No.: 17
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 1:Transmit at 926.5MHz by LoRa CSS	



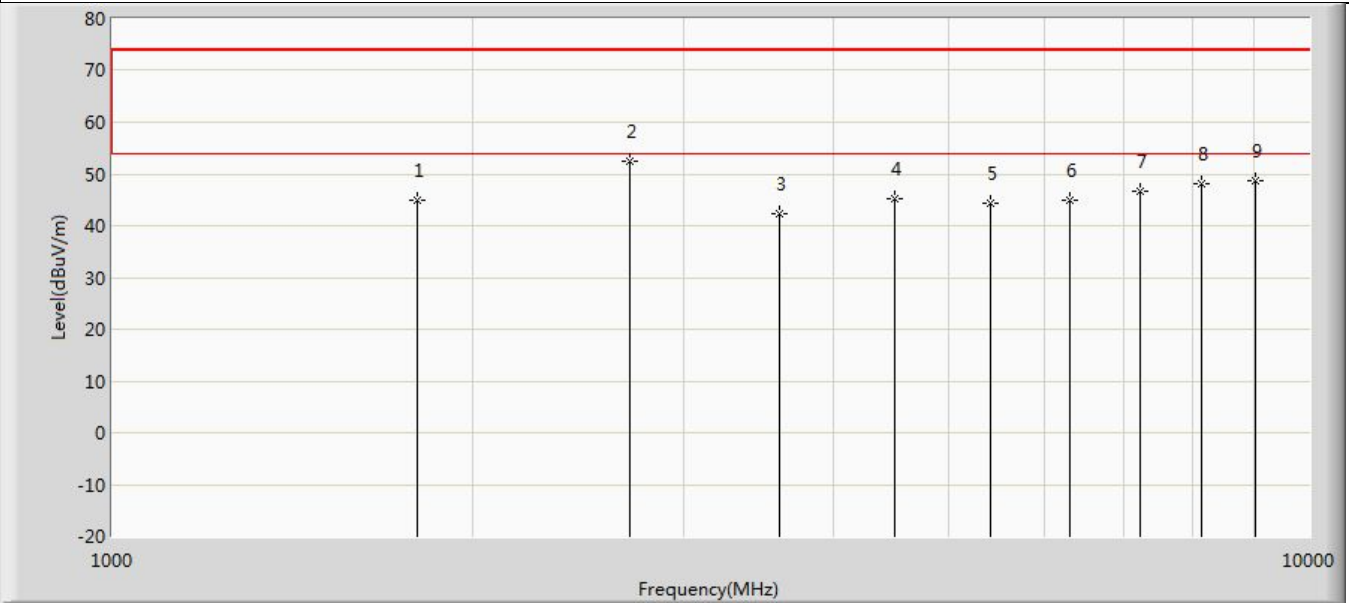
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1855.000	51.053	69.165	-22.947	74.000	-18.112	PK
2	*	2782.000	52.707	69.022	-21.293	74.000	-16.315	PK
3		3706.000	45.099	59.112	-28.901	74.000	-14.013	PK
4		4632.500	47.085	59.462	-26.915	74.000	-12.378	PK
5		5559.000	46.102	56.763	-27.898	74.000	-10.662	PK
6		6485.500	47.825	56.568	-26.175	74.000	-8.744	PK
7		7412.000	49.707	56.613	-24.293	74.000	-6.906	PK
8		8338.500	51.328	56.293	-22.672	74.000	-4.965	PK
9		9265.000	52.069	55.955	-21.931	74.000	-3.886	PK

Profile: 23C0822R	Page No.: 18
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 1:Transmit at 926.5MHz by LoRa CSS	



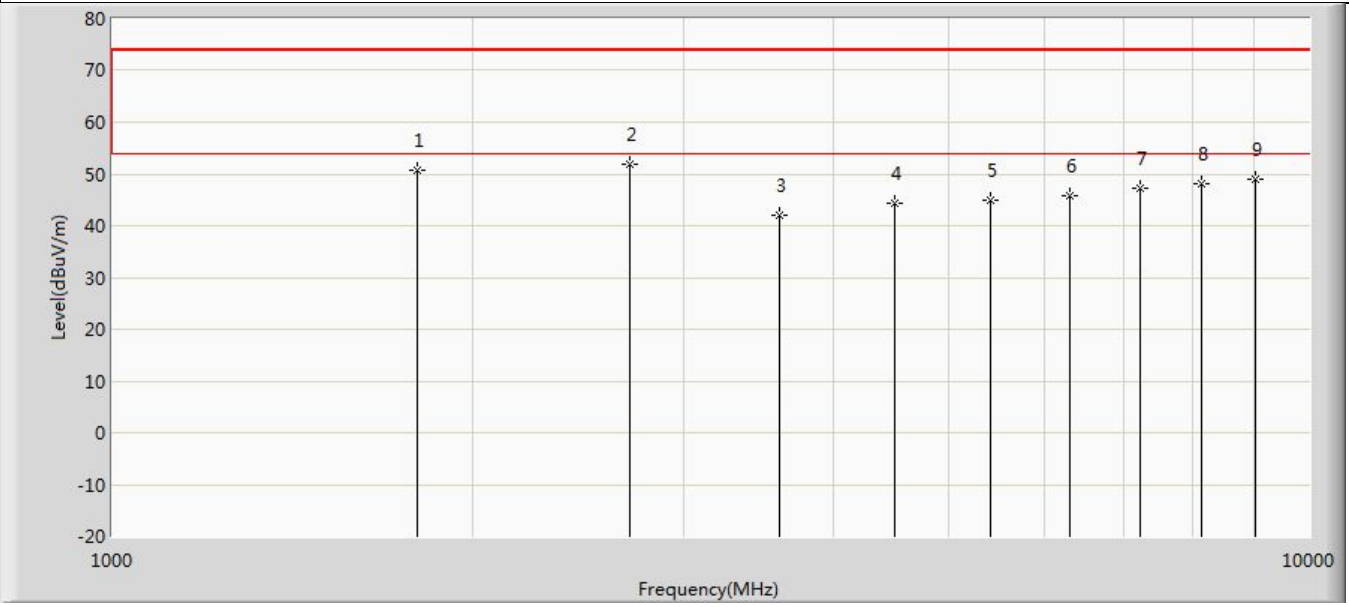
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1855.000	45.669	63.781	-28.331	74.000	-18.112	PK
2		2782.000	51.236	67.551	-22.764	74.000	-16.315	PK
3		3706.000	45.383	59.396	-28.617	74.000	-14.013	PK
4		4632.500	46.692	59.069	-27.308	74.000	-12.378	PK
5		5559.000	46.241	56.902	-27.759	74.000	-10.662	PK
6		6485.500	47.634	56.377	-26.366	74.000	-8.744	PK
7		7412.000	49.399	56.305	-24.601	74.000	-6.906	PK
8	*	8338.500	52.389	57.354	-21.611	74.000	-4.965	PK
9		9265.000	51.953	55.839	-22.047	74.000	-3.886	PK

Profile: 23C0822R	Page No.: 19
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 2:Transmit at 902.2MHz by FSK	



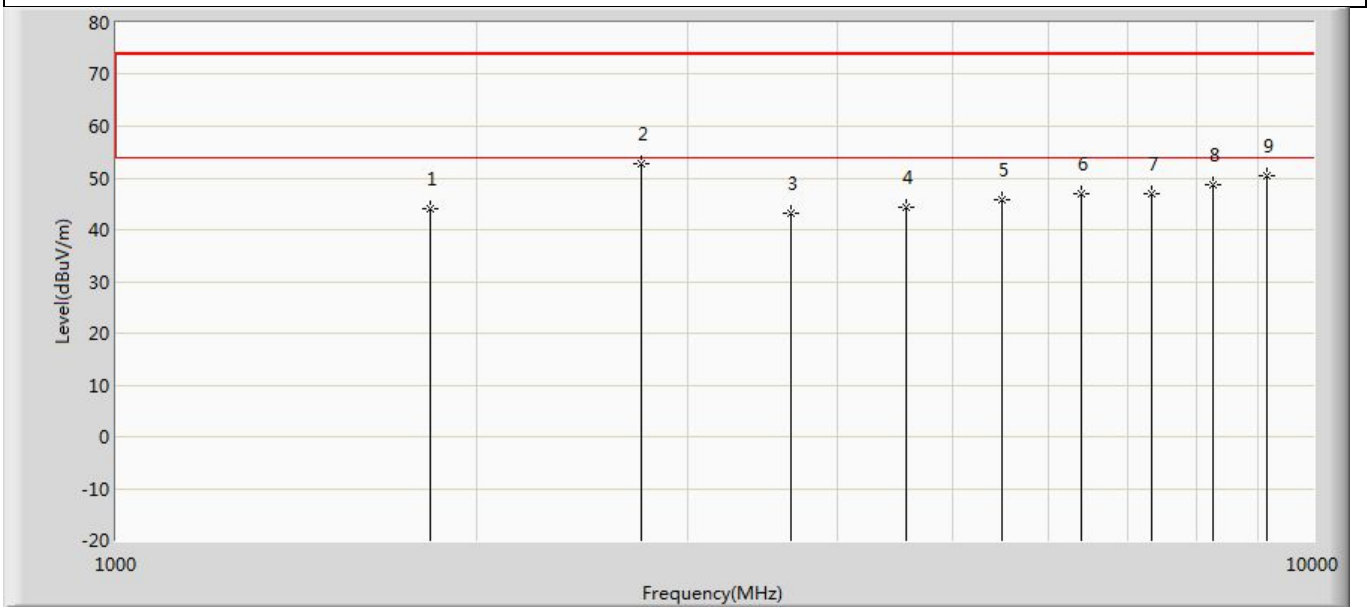
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1801.000	44.796	63.492	-29.204	74.000	-18.697	PK
2	*	2706.000	52.394	68.643	-21.606	74.000	-16.250	PK
3		3608.800	42.285	56.872	-31.715	74.000	-14.587	PK
4		4511.000	45.161	57.645	-28.839	74.000	-12.484	PK
5		5413.200	44.443	55.163	-29.557	74.000	-10.720	PK
6		6315.400	44.920	53.421	-29.080	74.000	-8.502	PK
7		7217.600	46.682	53.821	-27.318	74.000	-7.139	PK
8		8119.800	48.212	54.527	-25.788	74.000	-6.315	PK
9		9022.000	48.683	54.274	-25.317	74.000	-5.591	PK

Profile: 23C0822R	Page No.: 20
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 2:Transmit at 902.2MHz by FSK	



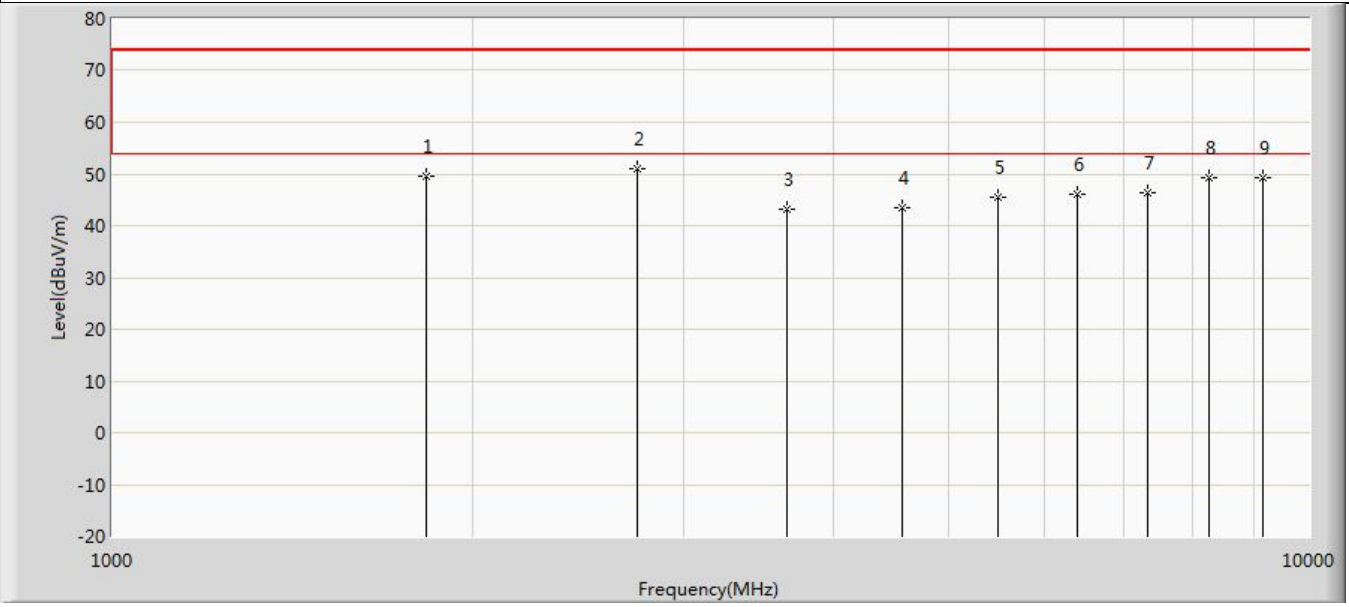
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1801.000	50.675	69.371	-23.325	74.000	-18.697	PK
2	*	2706.000	51.977	68.226	-22.023	74.000	-16.250	PK
3		3608.800	42.128	56.715	-31.872	74.000	-14.587	PK
4		4511.000	44.277	56.761	-29.723	74.000	-12.484	PK
5		5413.200	44.893	55.613	-29.107	74.000	-10.720	PK
6		6315.400	45.697	54.198	-28.303	74.000	-8.502	PK
7		7217.600	47.173	54.312	-26.827	74.000	-7.139	PK
8		8119.800	48.033	54.348	-25.967	74.000	-6.315	PK
9		9022.000	49.015	54.606	-24.985	74.000	-5.591	PK

Profile: 23C0822R	Page No.: 21
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 2:Transmit at 915MHz by FSK	



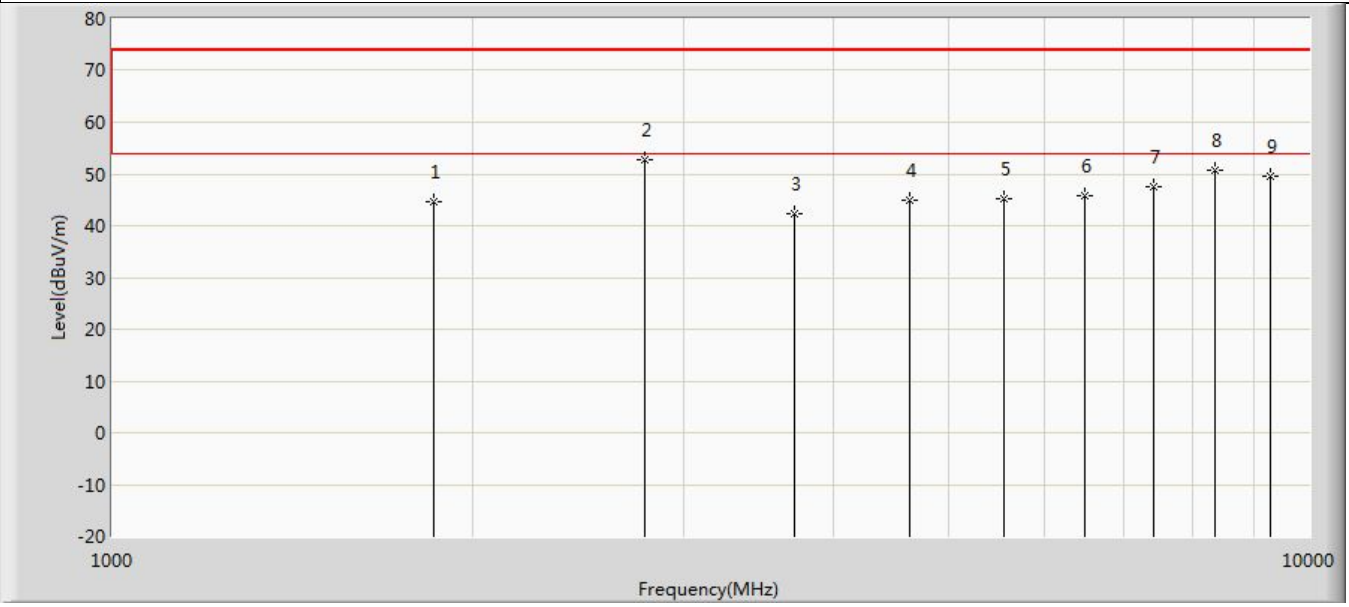
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1828.000	44.182	62.704	-29.818	74.000	-18.522	PK
2	*	2745.000	52.820	68.915	-21.180	74.000	-16.095	PK
3		3660.000	43.046	57.387	-30.954	74.000	-14.341	PK
4		4575.000	44.467	56.750	-29.533	74.000	-12.282	PK
5		5490.000	45.864	55.569	-28.136	74.000	-9.705	PK
6		6405.000	46.934	55.555	-27.066	74.000	-8.622	PK
7		7320.000	46.973	54.333	-27.027	74.000	-7.360	PK
8		8235.000	48.682	55.173	-25.318	74.000	-6.491	PK
9		9150.000	50.510	54.986	-23.490	74.000	-4.475	PK

Profile: 23C0822R	Page No.: 22
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 2:Transmit at 915MHz by FSK	



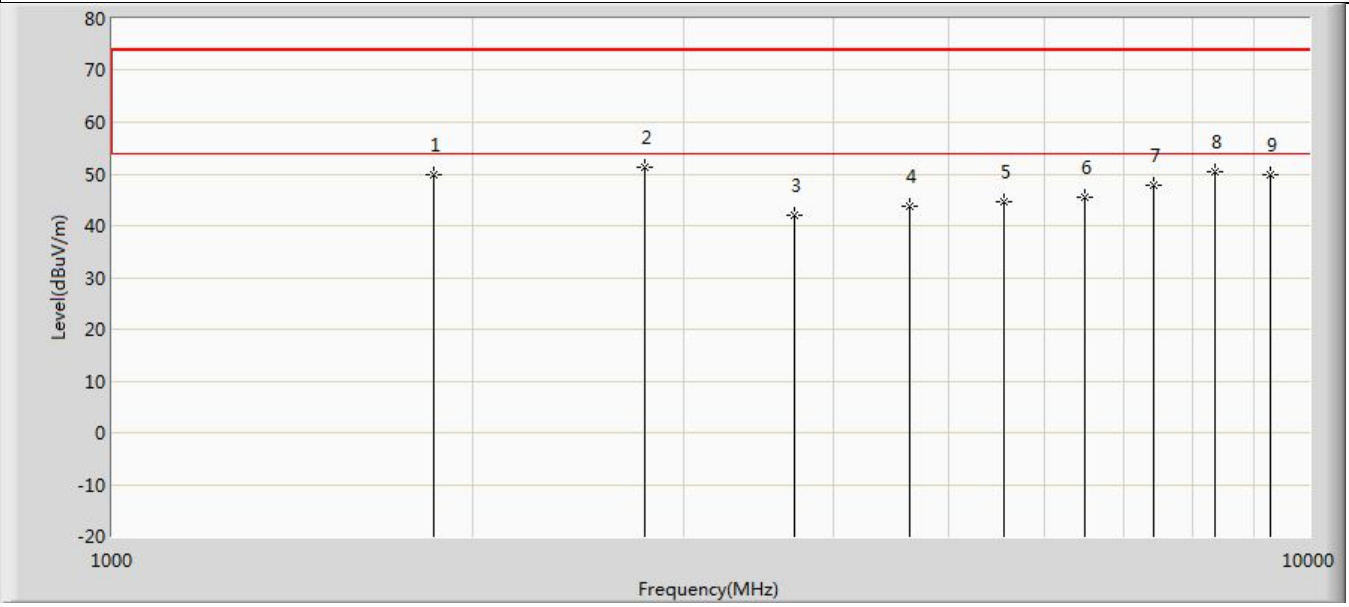
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1828.000	49.468	67.990	-24.532	74.000	-18.522	PK
2	*	2745.000	50.950	67.045	-23.050	74.000	-16.095	PK
3		3660.000	43.064	57.405	-30.936	74.000	-14.341	PK
4		4575.000	43.488	55.771	-30.512	74.000	-12.282	PK
5		5490.000	45.415	55.120	-28.585	74.000	-9.705	PK
6		6405.000	46.217	54.838	-27.783	74.000	-8.622	PK
7		7320.000	46.420	53.780	-27.580	74.000	-7.360	PK
8		8235.000	49.209	55.700	-24.791	74.000	-6.491	PK
9		9150.000	49.419	53.895	-24.581	74.000	-4.475	PK

Profile: 23C0822R	Page No.: 23
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 2:Transmit at 927.8MHz by FSK	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1855.000	44.560	62.672	-29.440	74.000	-18.112	PK
2	*	2783.400	52.747	69.082	-21.253	74.000	-16.335	PK
3		3711.200	42.424	56.412	-31.576	74.000	-13.988	PK
4		4639.000	44.874	57.273	-29.126	74.000	-12.399	PK
5		5566.800	45.104	55.387	-28.896	74.000	-10.283	PK
6		6494.600	45.666	54.306	-28.334	74.000	-8.641	PK
7		7422.400	47.544	54.573	-26.456	74.000	-7.029	PK
8		8350.200	50.651	55.256	-23.349	74.000	-4.605	PK
9		9278.000	49.638	53.761	-24.362	74.000	-4.123	PK

Profile: 23C0822R	Page No.: 24
Engineer: Pengcheng Yang	
Site: AC5	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: LoRa+Wi-Fi Scan+GNSS Module	Power: DC 3.3V
Note: Mode 2:Transmit at 927.8MHz by FSK	

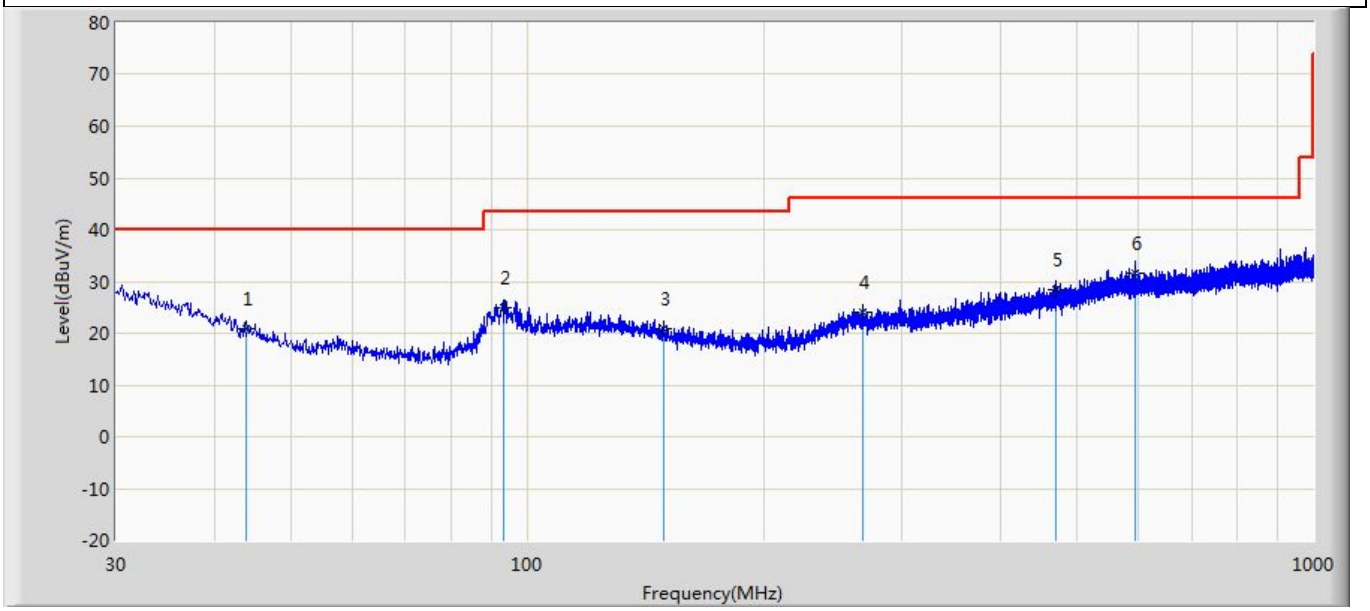


No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1855.000	49.958	68.070	-24.042	74.000	-18.112	PK
2	*	2783.400	51.188	67.523	-22.812	74.000	-16.335	PK
3		3711.200	42.113	56.101	-31.887	74.000	-13.988	PK
4		4639.000	43.856	56.255	-30.144	74.000	-12.399	PK
5		5566.800	44.497	54.780	-29.503	74.000	-10.283	PK
6		6494.600	45.526	54.166	-28.474	74.000	-8.641	PK
7		7422.400	47.922	54.951	-26.078	74.000	-7.029	PK
8		8350.200	50.317	54.922	-23.683	74.000	-4.605	PK
9		9278.000	49.859	53.982	-24.141	74.000	-4.123	PK

Remark	1. " * ", means this data is the worst emission level. 2. Measurement Level = Reading Level + Factor(Probe+Cable-Amp). 3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

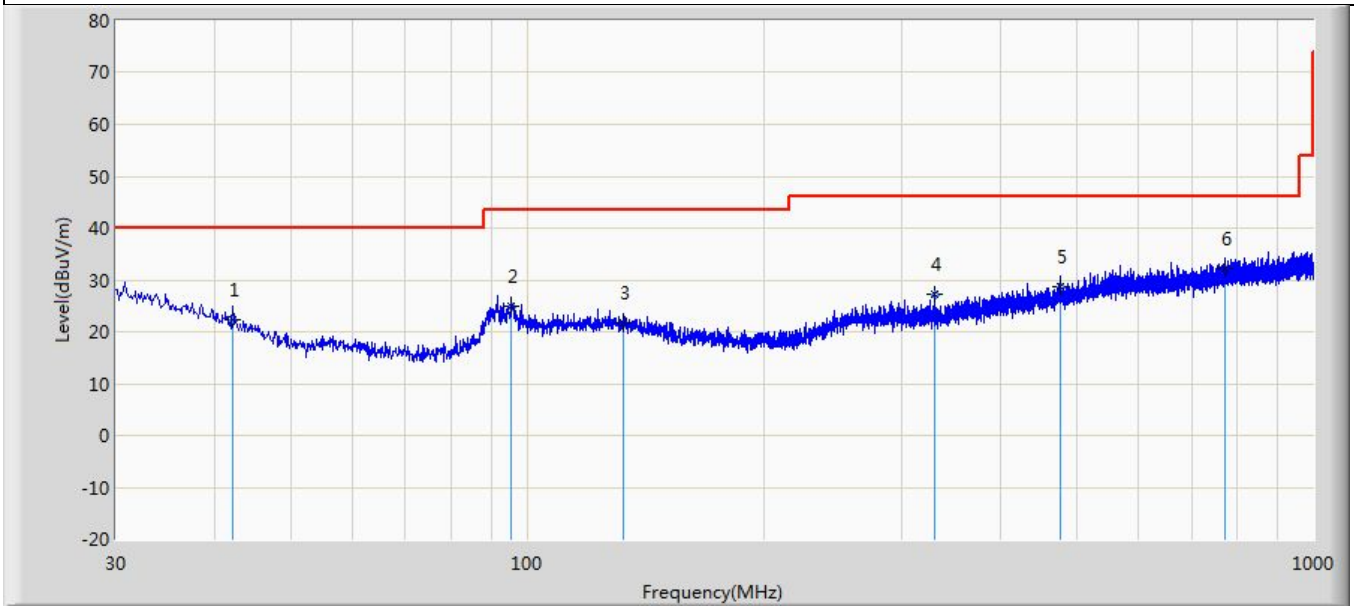
The worst case of Radiated Emission below 1GHz:

Profile: 23C0822R	Page No.: 60
Engineer: Pengchengyang	
Site: AC2	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Horizontal
EUT: LoRa+Wi-Fi+GNSS Module	Power: DC 3.3V
Note: Mode 1:Transmit at 926.5MHz by LoRa CSS	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		43.944	20.740	3.221	-19.260	40.000	17.519	QP
2		93.293	24.840	8.171	-18.660	43.500	16.669	QP
3		148.946	20.943	3.436	-22.557	43.500	17.507	QP
4		266.801	23.952	3.457	-22.048	46.000	20.495	QP
5		470.865	28.519	3.478	-17.481	46.000	25.041	QP
6	*	592.721	31.489	4.334	-14.511	46.000	27.155	QP

Profile: 23C0822R	Page No.: 61
Engineer: Pengchengyang	
Site: AC2	Time: 2024/02/27 - 15:07
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Vertical
EUT: LoRa+Wi-Fi+GNSS Module	Power: DC 3.3V
Note: Mode 1:Transmit at 926.5MHz by LoRa CSS	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		42.246	22.190	3.804	-17.810	40.000	18.386	QP
2		95.354	24.890	7.786	-18.610	43.500	17.104	QP
3		132.577	21.840	2.994	-21.660	43.500	18.846	QP
4		329.973	27.345	5.871	-18.655	46.000	21.475	QP
5		477.655	28.569	3.395	-17.431	46.000	25.174	QP
6	*	772.292	32.310	3.422	-13.690	46.000	28.887	QP

Remark	1. " * ", means this data is the worst emission level. 2. Measurement Level = Reading Level + Factor(Probe+Cable-Amp). 3. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary. 4. We tested all the modes and showed the worst mode in the report. 5. The test frequency range, 9KHz~30MHz, all is the noise base, therefore no data appear in the report.

4.3 Emissions in non-restricted frequency band	VERDICT: PASS

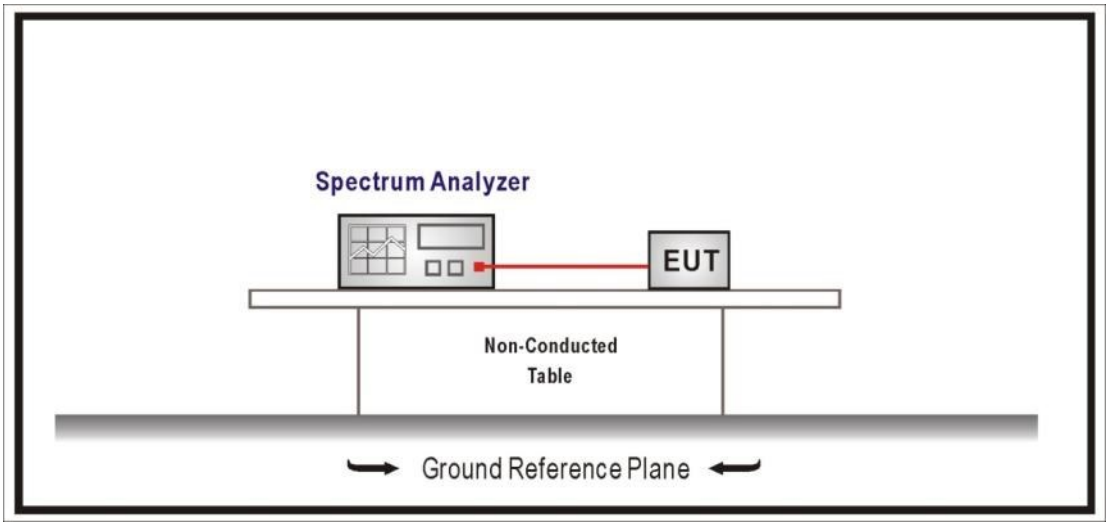
4.3.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.247(d)
RF Output power (Detection methods)	Limit(dB)
RF Output power(Average detector)	30dBc(Note1)
RF Output power(PK detector)	20dBc(Note2)

Note 1: If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

Note 2: If the maximum peak conducted output power procedure was used, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

4.3.2 Test Setup



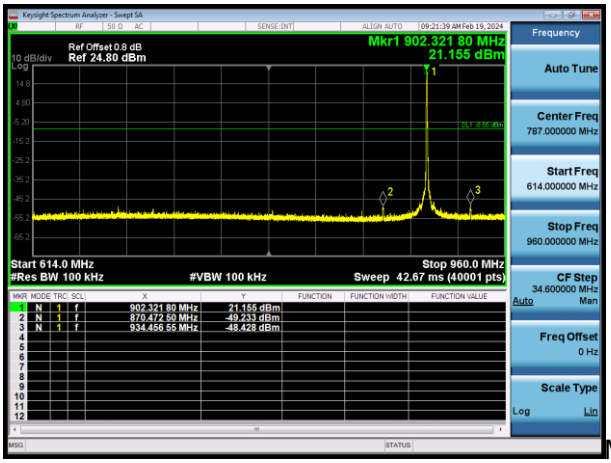
4.3.3 Test Procedure

References Rule			Chapter	Description
☒	ANSI C63.10		11.11	Emissions in non-restricted frequency bands
	☒	ANSI C63.10	11.11.1	General
	☒	ANSI C63.10	11.11.2	Reference level measurement
	☒	ANSI C63.10	11.11.3	Emission level measurement

4.3.4 Test Data

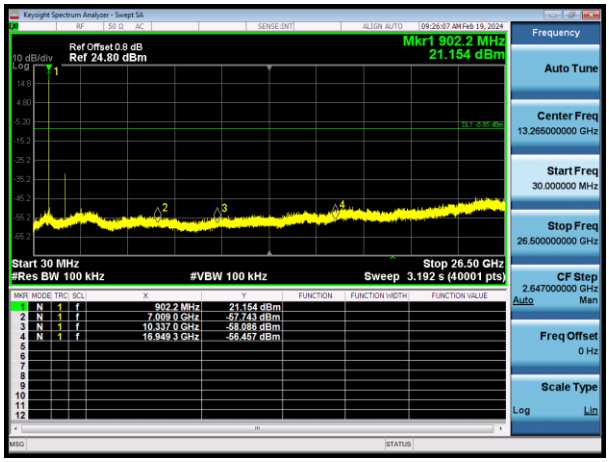
LoRa(CSS) 500kHz bandwidth

Channel01 902.5

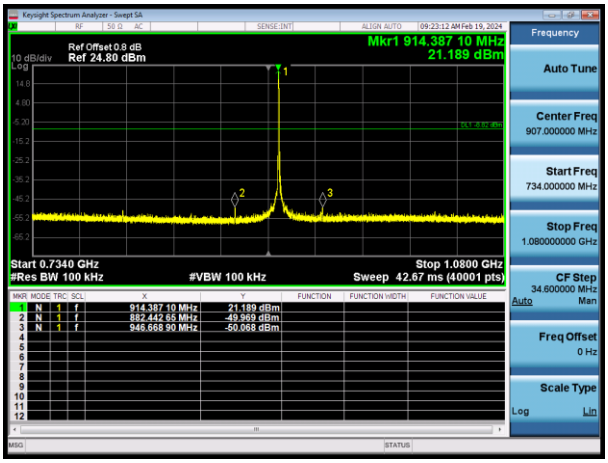


MHz

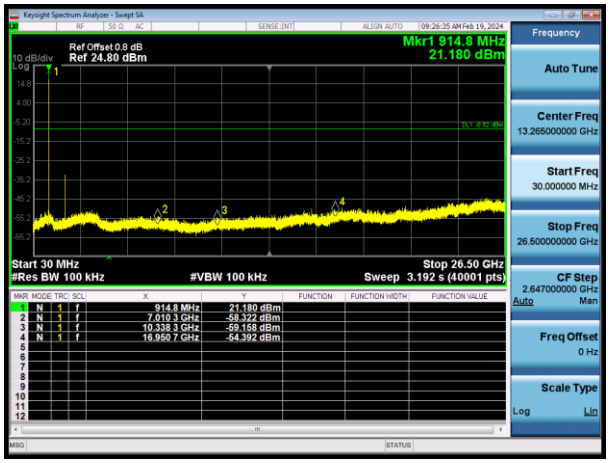
Channel01 902.5MHz



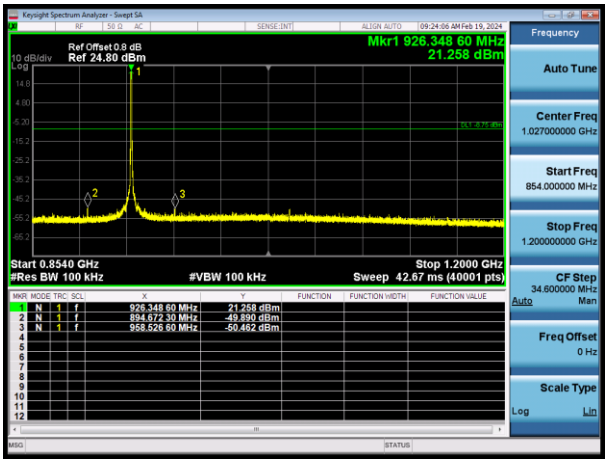
Channel16 914.5MHz



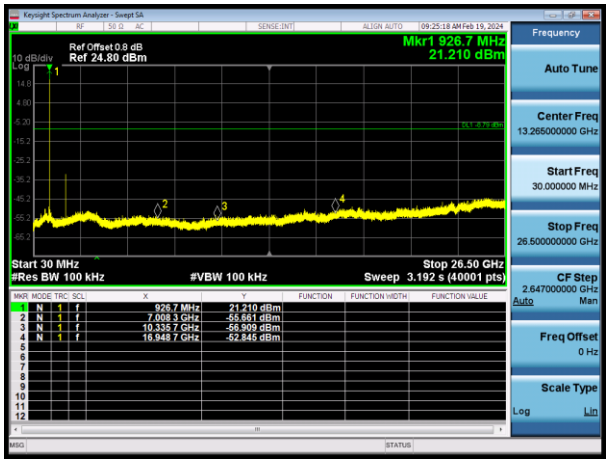
Channel16 914.5MHz



Channel31 926.5MHz

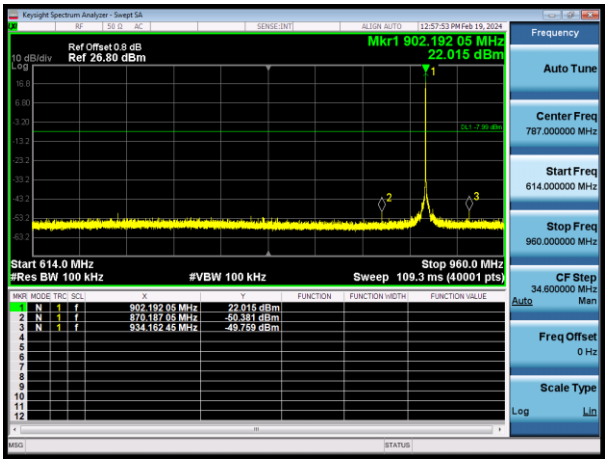


Channel31 926.5MHz

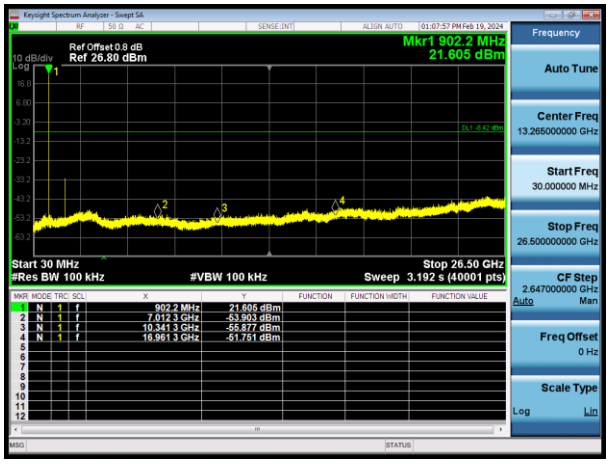


FSK

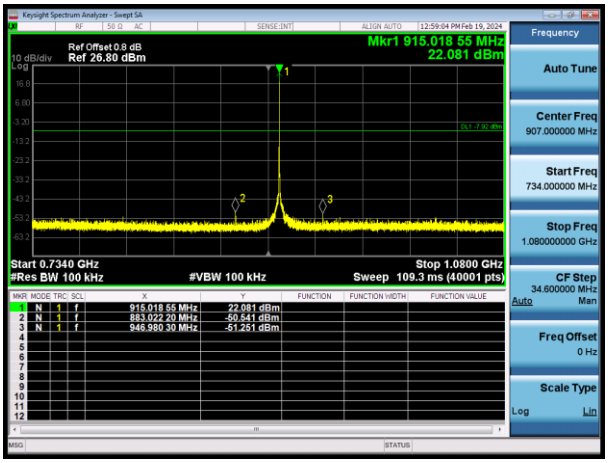
Channel01 902.2MHz



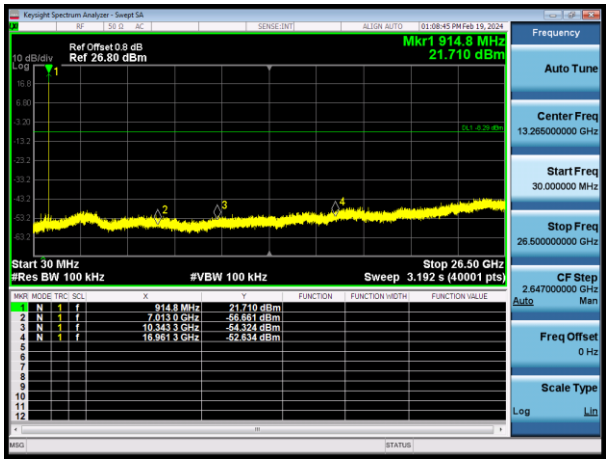
Channel01 902.2MHz



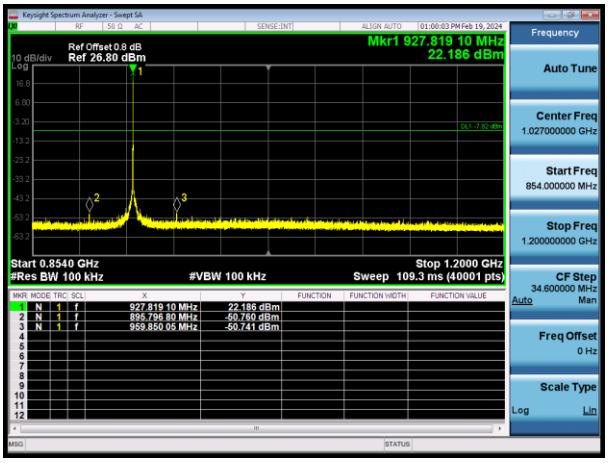
Channel65 915MHz



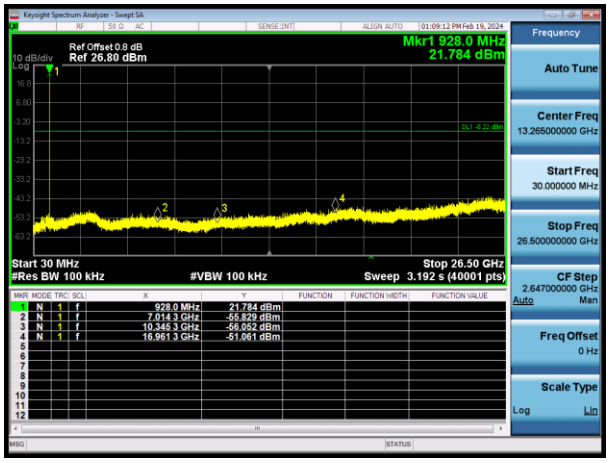
Channel65 915MHz

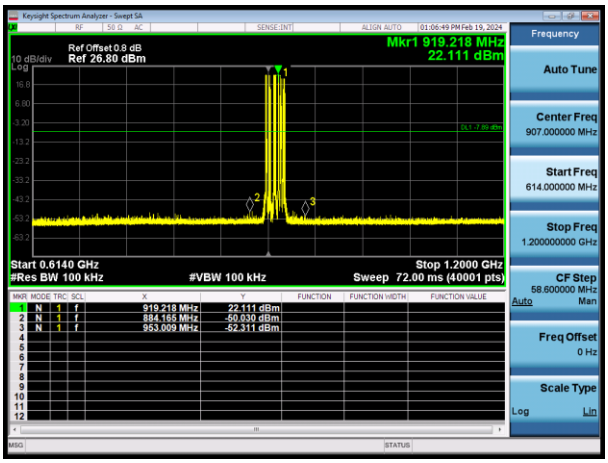
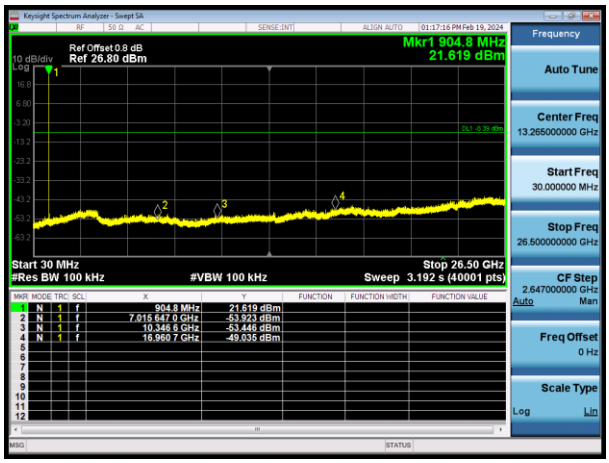


Channel129 927.8MHz



Channel129 927.8MHz



FHSS	FHSS
	

Ref Offset 0.8 dB
10 dB/div Ref 26.80 dBm
Mkr1 919.218 MHz
22.111 dBm
Start 0.6140 GHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 1.2000 GHz
Sweep 72.00 ms (40001 pts)
1 N 1 f 919.218 MHz 22.111 dBm
2 N 1 f 884.155 MHz -50.030 dBm
3 N 1 f 953.009 MHz -52.311 dBm
Frequency
Auto Tune
Center Freq 907.000000 MHz
Start Freq 614.000000 MHz
Stop Freq 1.200000000 GHz
CF Step 58.600000 MHz
Auto Man
Freq Offset 0 Hz
Scale Type
Log Lin

Ref Offset 0.8 dB
10 dB/div Ref 26.80 dBm
Mkr1 904.8 MHz
21.619 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 26.50 GHz
Sweep 3.192 s (40001 pts)
1 N 1 f 904.8 MHz 21.619 dBm
2 N 1 f 7.015 647 0 GHz -53.923 dBm
3 N 1 f 10.346 6 GHz -53.446 dBm
4 N 1 f 16.960 7 GHz -49.035 dBm
Frequency
Auto Tune
Center Freq 13.265000000 GHz
Start Freq 30.000000 MHz
Stop Freq 26.500000000 GHz
CF Step 2.647000000 GHz
Auto Man
Freq Offset 0 Hz
Scale Type
Log Lin

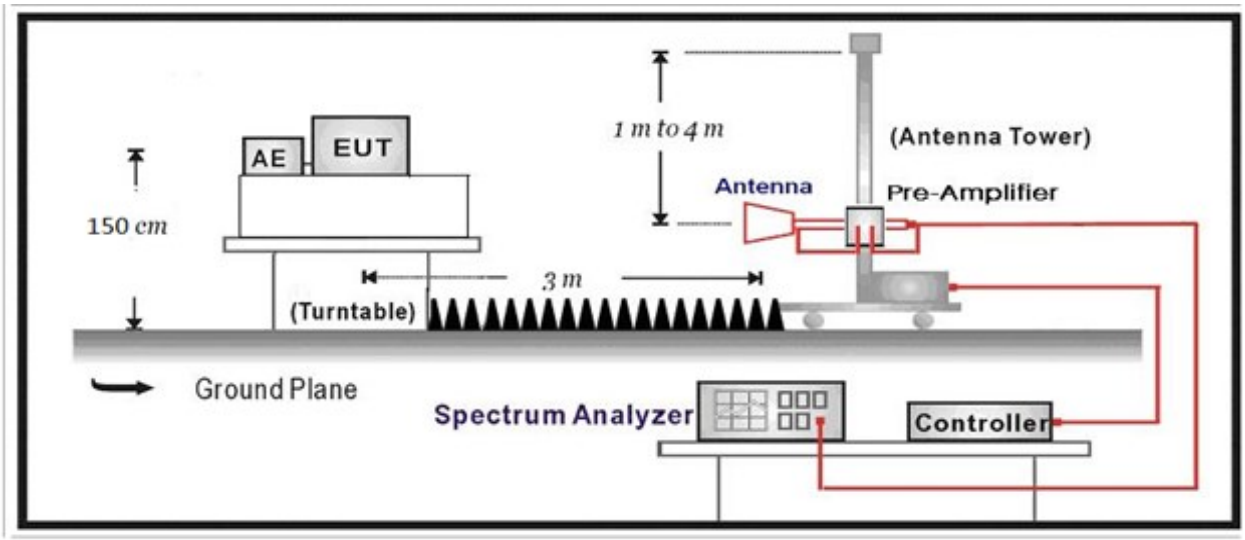
4.4 Radiated Emission Band Edge	VERDICT: N/A

4.4.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.247(d) , 15.205, 15.209			
Frequency bands (MHz)	Detector	Limit (dB μ V/m)	RBW (MHz)	Distance (m)
2310-2390 2483.5-2500	PK	74	1	3
	AV	54	1	3
Note: The field strength of emissions appearing within these frequency bands shall not exceed the limits.				

4.4.2 Test Setup

Above 1GHz Test Setup:



4.4.3 Test Procedure

	References Rule	Chapter	Description
☒	ANSI C63.10	6.10	Band-edge testing
	☒ ANSI C63.10	6.10.5	Restricted-band band-edge measurements
	☐ ANSI C63.10	6.10.6	Marker-delta method
☒	ANSI C63.10	11.12	Emissions in restricted frequency bands
	☒ ANSI C63.10	11.12.1	Radiated emission measurements
	☒ ANSI C63.10	6.3	Radiated spurious emission test
☐	ANSI C63.10	6.4	Radiated emissions from unlicensed wireless devices below 30 MHz
☐	ANSI C63.10	6.5	Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz
☒	ANSI C63.10	6.6	Radiated emissions from unlicensed wireless devices above 1 GHz
	☐ ANSI C63.10	11.12.2	Antenna-port conducted measurements
	☐ ANSI C63.10	11.12.2.3	Quasi-peak measurement procedure
	☐ ANSI C63.10	11.12.2.4	Peak power measurement procedure
	☐ ANSI C63.10	11.12.2.5	Average power measurement procedures
	☐ ANSI C63.10	11.12.2.5.1	Trace averaging with continuous EUT transmission at full power
	☐ ANSI C63.10	11.12.2.5.2	Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction
	☐ ANSI C63.10	11.12.2.5.3	Reduced VBW averaging across ON and OFF times of the EUT transmissions with max hold

4.4.4 Test Data

Remark	No restricted band in the range ± 2 channel bandwidths of the Band-edges of the specified emission band! (608 MHz – 614 MHz and 960 MHz – 1240 MHz).

4.5 6dB and 20dB Bandwidth	VERDICT: PASS

4.5.1 Limit

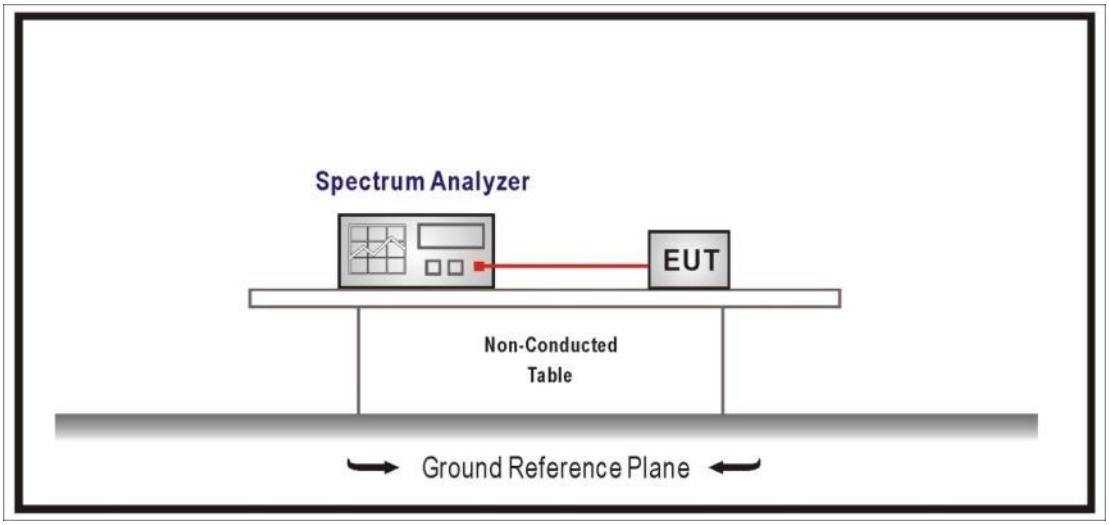
Standard	FCC Part 15 Subpart C Paragraph 15.247 (a)(1)(2)

(1) Systems using digital modulation techniques operate in the2400-2483.5 MHz .The minimum 6 dB bandwidth shall be at least 500 kHz
(2) For frequency hopping systems operating in 902-928 MHz band, the maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Standard	ANSI C63.10 Paragraph 6.7

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs. The occupied bandwidth should within the required frequency range.

4.5.2 Test Setup



4.5.3 Test Procedure

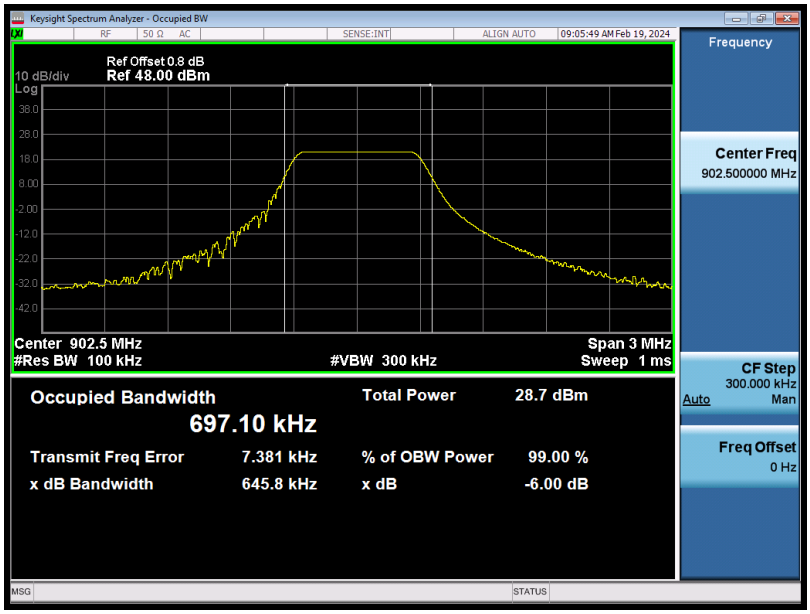
	Reference Rule		Chapter	Description
☒	ANSI C63.10		11.8	DTS bandwidth
	☐	ANSI C63.10	11.8.1	Option 1
	☒	ANSI C63.10	11.8.2	Option 2
☒	ANSI C63.10		6.9	Occupied bandwidth
	☐	ANSI C63.10	6.9.2	relative measurement procedure
	☒	ANSI C63.10	6.9.3	power bandwidth (99%) measurement procedure

4.5.4 Test Data

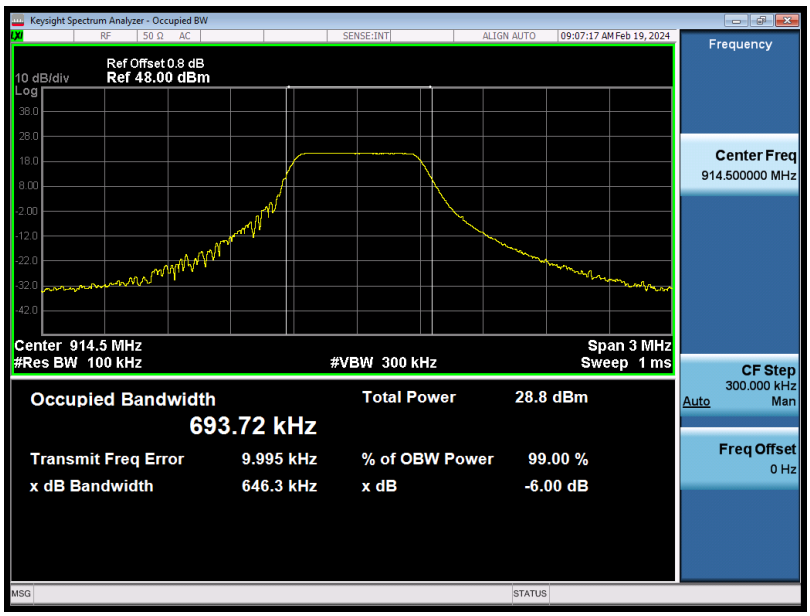
Mode	CH.	Test Freq. (MHz)	6dB Occupied Bandwidth (KHz)	Limit (kHz)	Result
1	01	902.5	645.8	⩾500	Pass
	16	914.5	646.3	⩾500	Pass
	31	926.5	646.7	⩾500	Pass

6dB Occupied Bandwidth

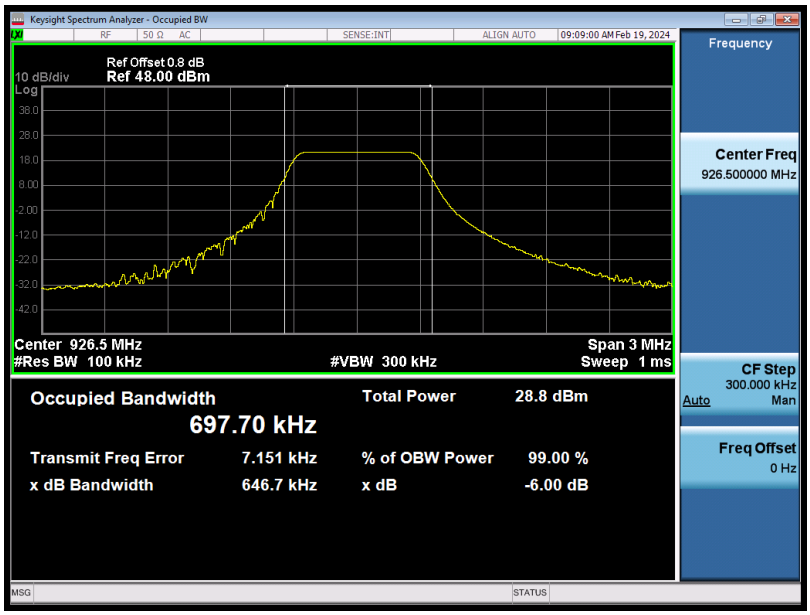
CH01 (902.5MHz)



CH16 (914.5MHz)



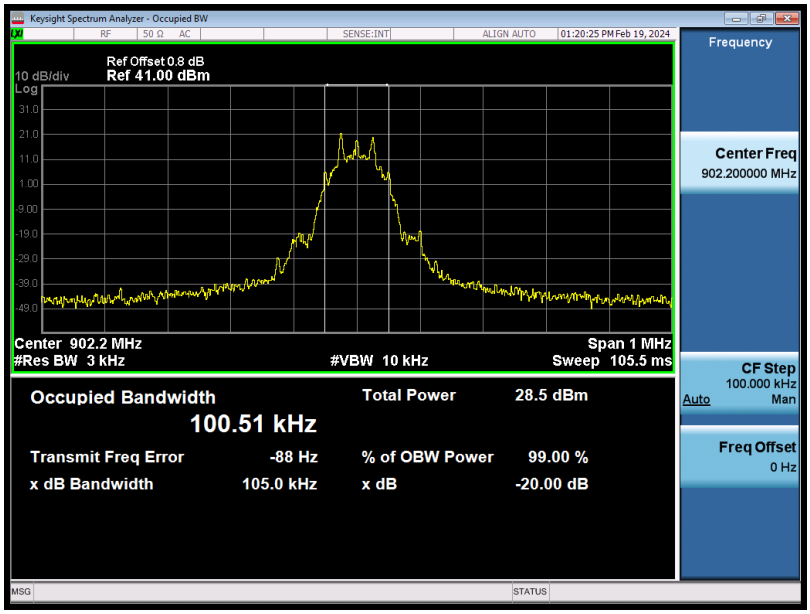
CH31 (926.5MHz)



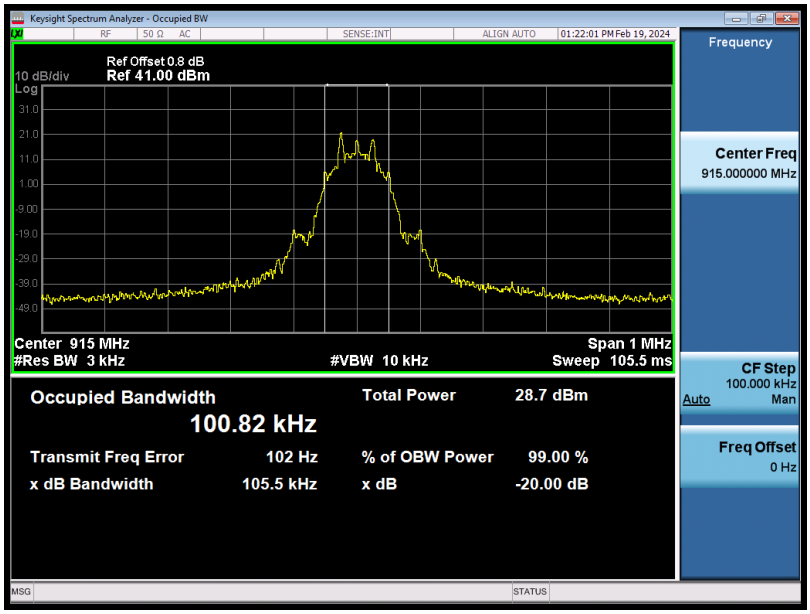
Mode	CH.	Test Freq. (MHz)	20dB Occupied Bandwidth (Hz)	Limit (kHz)	Result
2	01	902.2	105.0	⩽250	Pass
	65	915	105.5	⩽250	Pass
	129	927.8	105.9	⩽250	Pass

20dB Occupied Bandwidth

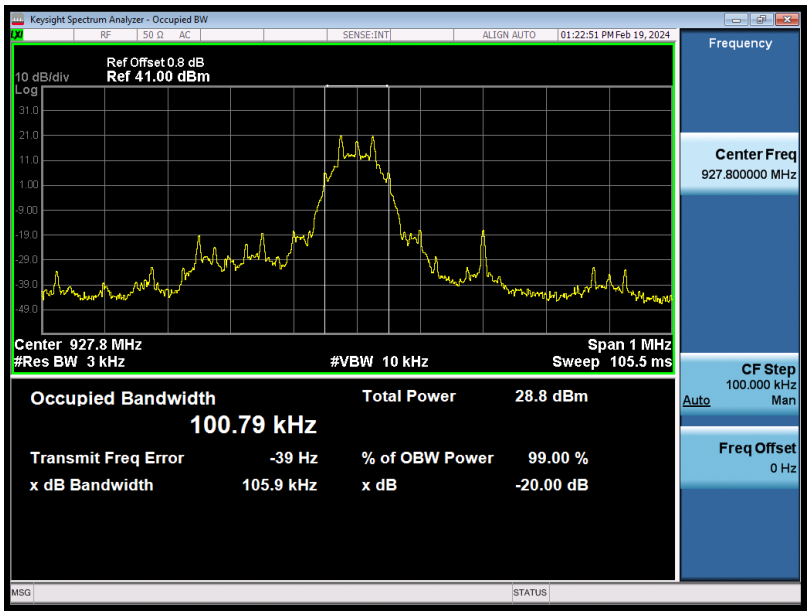
CH01 (902.2MHz)



CH65 (915MHz)



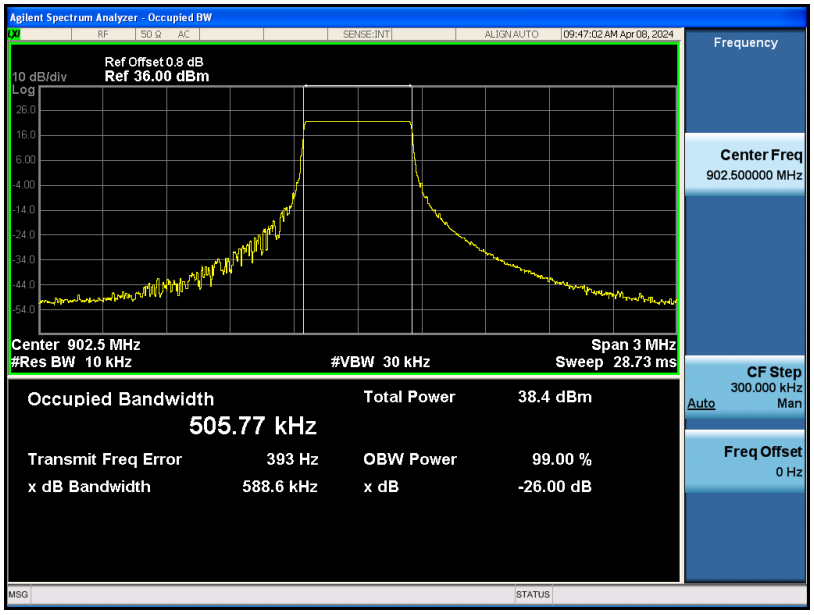
CH129 (927.8MHz)



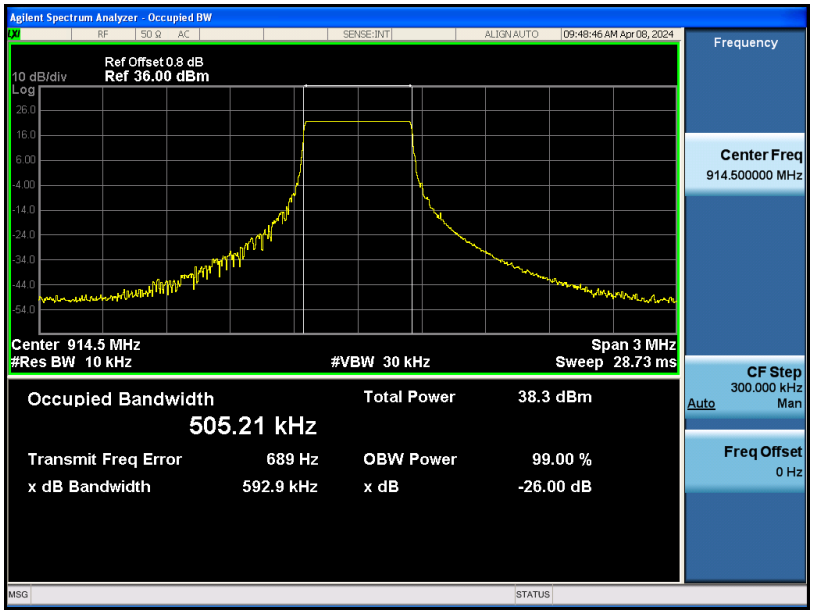
Mode	CH.	Test Freq. (MHz)	99% Occupied Bandwidth (kHz)	Limit	Result
1	01	902.5	505.77	Within frequency range	Pass
	16	914.5	505.21	Within frequency range	Pass
	31	926.5	504.58	Within frequency range	Pass
2	01	902.2	100.51	Within frequency range	Pass
	65	915	101.15	Within frequency range	Pass
	129	927.8	100.47	Within frequency range	Pass

99% Occupied Bandwidth

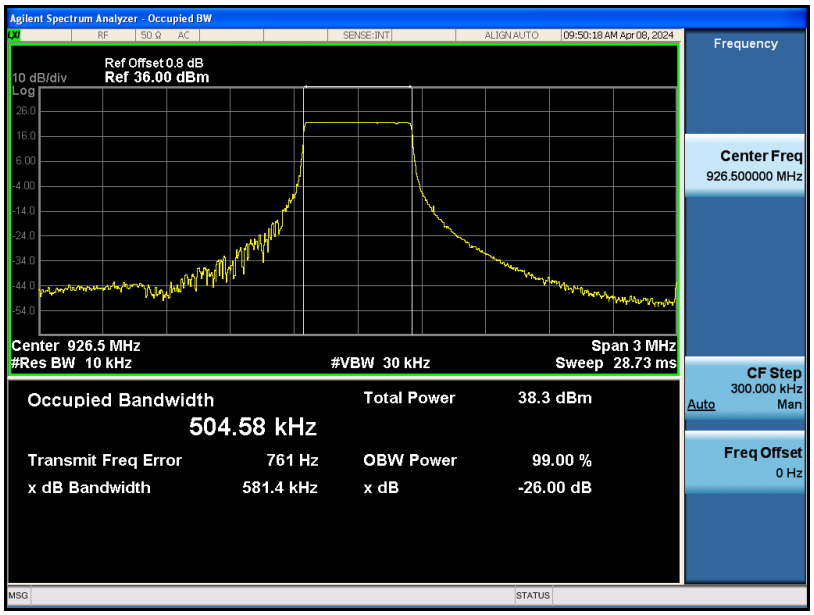
Mode 1 CH01 (902.5MHz)



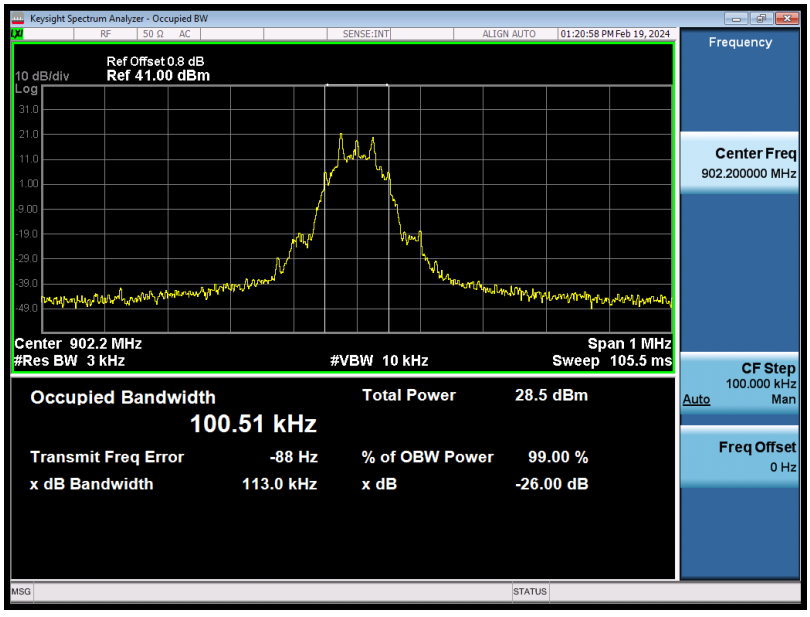
Mode 1 CH16 (914.5MHz)



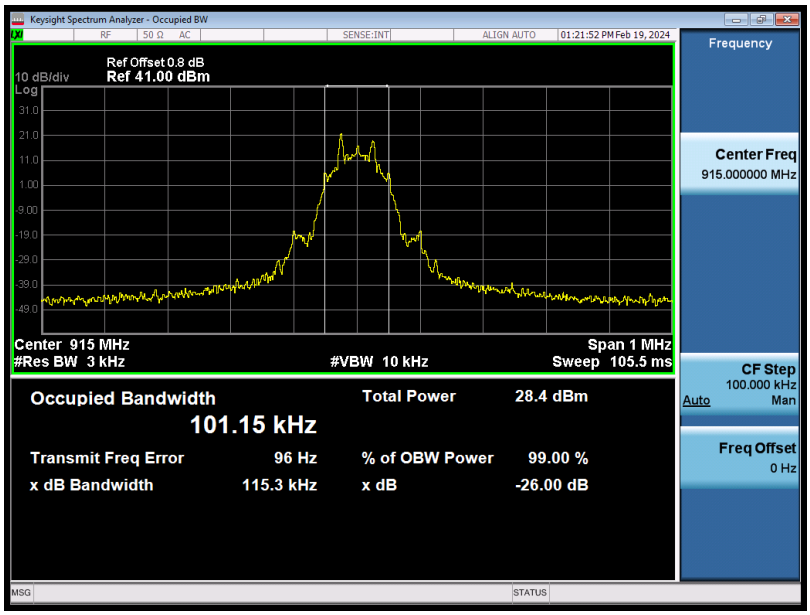
Mode 1 CH31 (926.5MHz)



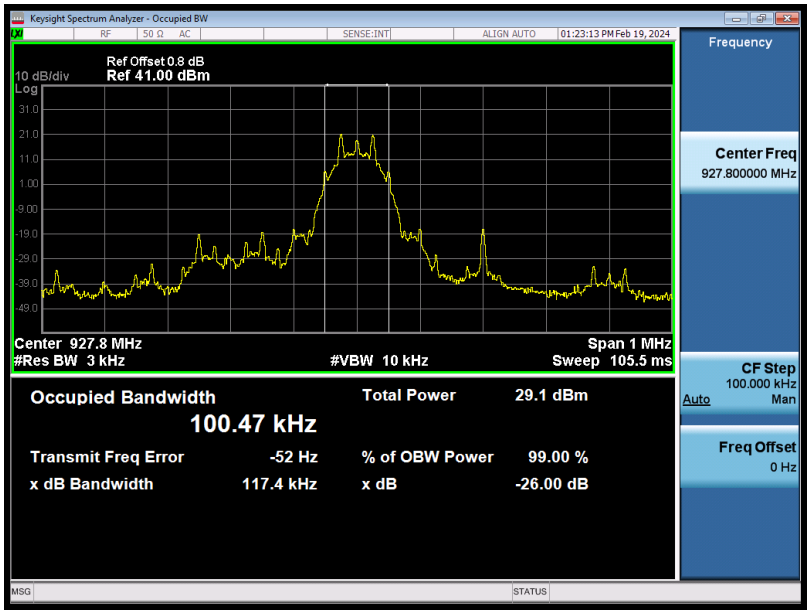
Mode 2 CH01 (902.2MHz)



Mode 2 CH65 (915MHz)



Mode 2 CH129 (927.8MHz)



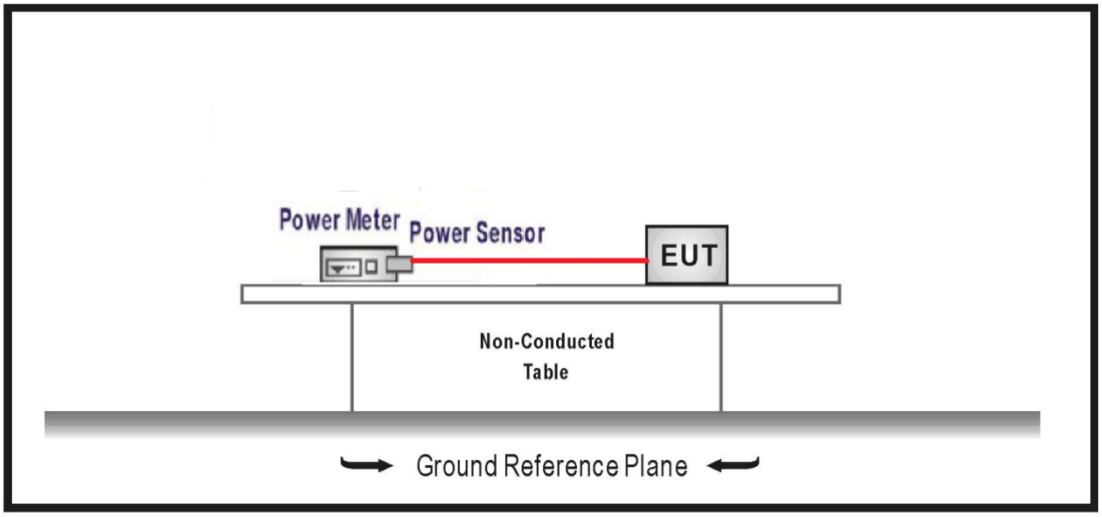
4.6 Fundamental emission output power — VERDICT: PASS

4.6.1 Limit

Standard			FCC Part 15 Subpart C Paragraph 15.247 (b)(3)
☒	GTX ＜6dBi		Pout≤30dBm
☐	GTX ＞6dBi		
	☐	Non-Fix point-point	Pout≤30-(GTX -6)
	☐	Fix point-point	Pout≤30-[(GTX-6)]/3
	☐	Point-to-multipoint	Pout≤30-(GTX-6)
	☐	Overlap Beams	Pout≤30-[(GTX-6)]/3
	☐	Aggregate power transmitted simultaneously on all beams	Pout≤30-[(GTX-6)]/3
	☐	single directional beam	Pout≤30-[(GTX-6)]/3+8dB
☒	For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels		

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

4.6.2 Test Setup



4.6.3 Test Procedure						
	References Rule				Chapter	Description
☒	ANSI C63.10				11.9	Fundamental emission output power
	☐	ANSI C63.10			11.9.1	Maximum peak conducted output power
		☐	ANSI C63.10		11.9.1.1	RBW ⩾ DTS bandwidth
		☐	ANSI C63.10		11.9.1.2	Integrated band power method
		☐	ANSI C63.10		11.9.1.3	PKPM1 Peak power meter method
	☒	ANSI C63.10			11.9.2	Maximum conducted (average) output power
		☒	ANSI C63.10		11.9.2.2	Measurement using a spectrum analyzer (SA)
			☐	ANSI C63.10	11.9.2.2.2	Method AVGSA-1(Duty cycle⩾98%)
			☐	ANSI C63.10	11.9.2.2.3	Method AVGSA-1A(Duty cycle⩾98%)
			☒	ANSI C63.10	11.9.2.2.4	Method AVGSA-2(Duty cycle⩽98%)
			☐	ANSI C63.10	11.9.2.2.5	Method AVGSA-2A(Duty cycle⩽98%)
			☐	ANSI C63.10	11.9.2.2.4	Method AVGSA-3
			☐	ANSI C63.10	11.9.2.2.5	Method AVGSA-3A
		☒	ANSI C63.10		11.9.2.3	Measurement using a power meter (PM)
			☒	ANSI C63.10	11.9.2.3.1	Method AVGPM
			☐	ANSI C63.10	11.9.2.3.2	Method AVGPM-G
☒	ANSI C63.10				7.8.5	Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices

4.6.4 Test Data

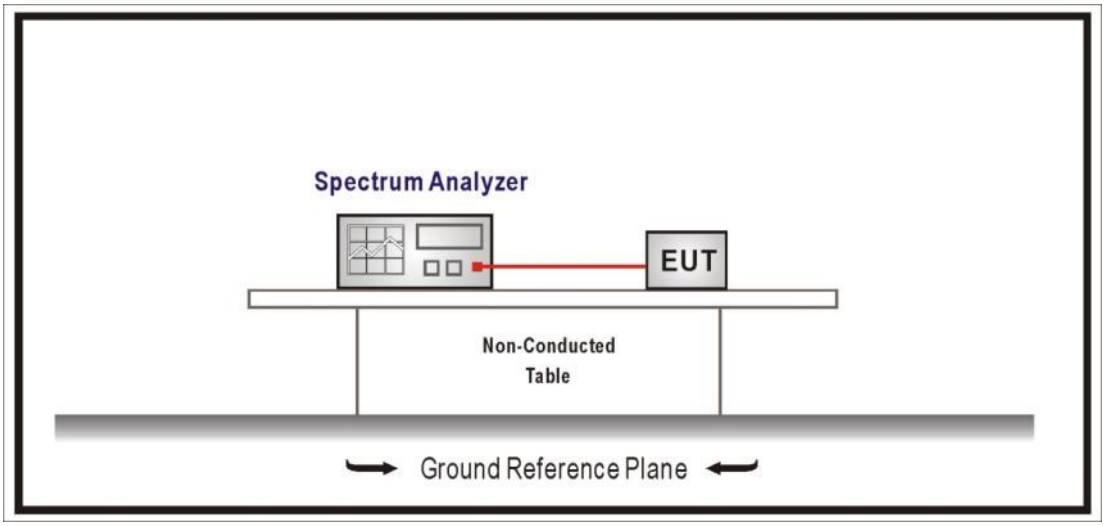
Mode	Channel	Test Frequency (MHz)	Output Power (dBm)	E.I.R.P (dBm)	Conducted Limit (dBm)	E.I.R.P Limit (dBm)	Result
1	01	902.5	21.67	21.97	30.00	36.00	Pass
	16	914.5	21.70	22	30.00	36.00	Pass
	31	926.5	21.77	22.07	30.00	36.00	Pass
2	01	902.2	21.66	21.96	30.00	36.00	Pass
	65	915	21.72	22.02	30.00	36.00	Pass
	129	927.8	21.79	22.09	30.00	36.00	Pass

Note:
1. E.I.R.P.= Output Power + Antenna Gain
2. Please refer to clause 1.2 for antenna gain.

4.7 Power Density	VERDICT: PASS

4.7.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 15.247 (e)
Power Spectral Density≤8dBm/3kHz	

4.7.2 Test Setup



4.7.3 Test Procedure

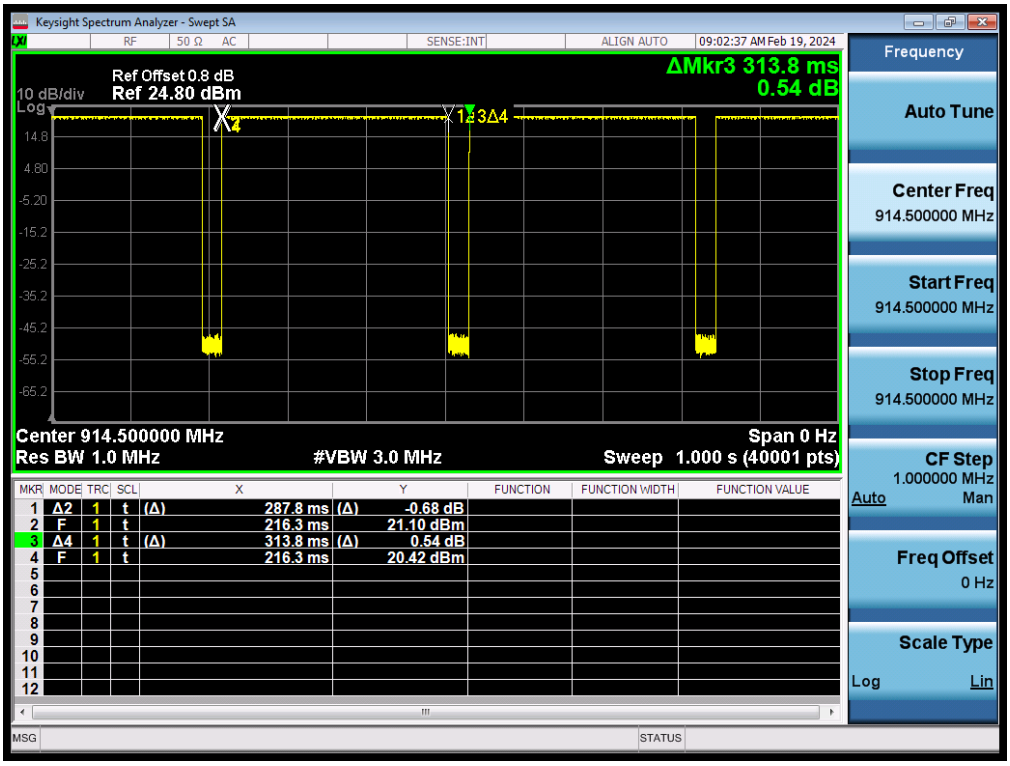
	References Rule		Chapter	Description
☒	ANSI C63.10		11.10	Maximum power spectral density level in the fundamental emission
	☐	ANSI C63.10	11.10.2	Method PKPSD (peak PSD)
	☐	ANSI C63.10	11.10.3	Method AVGPSD-1(Duty cycle≥98%)
	☐	ANSI C63.10	11.10.4	Method AVGPSD-1A(Duty cycle≥98%)
	☒	ANSI C63.10	11.10.5	Method AVGPSD-2(Duty cycle<98%)
	☐	ANSI C63.10	11.10.6	Method AVGPSD-2A(Duty cycle<98%)
	☐	ANSI C63.10	11.10.7	Method AVGPSD-3
	☐	ANSI C63.10	11.10.8	Method AVGPSD-3A

4.7.4 Test Data

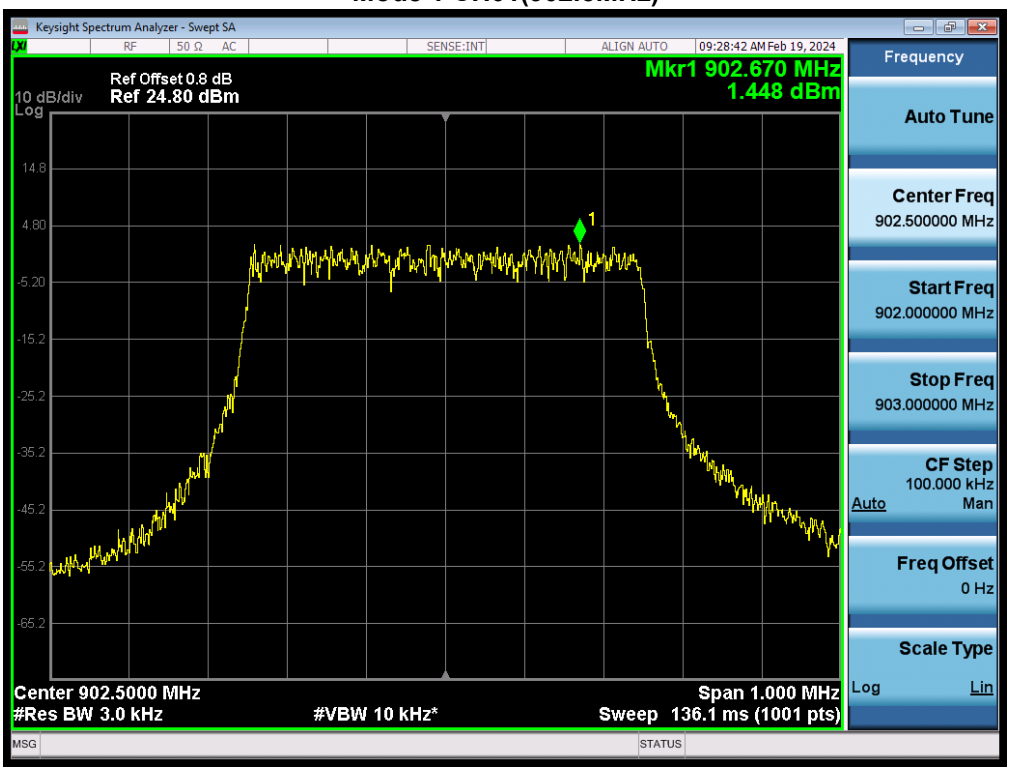
Mode	Channel	Test Frequency (MHz)	Reading level (dBm/3kHz)	Measurement PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
1	01	902.5	1.448	1.824	≤8	Pass
	16	914.5	1.364	1.740	≤8	Pass
	31	926.5	1.458	1.834	≤8	Pass

Note 1: Measurement PSD = Reading level + Duty factor

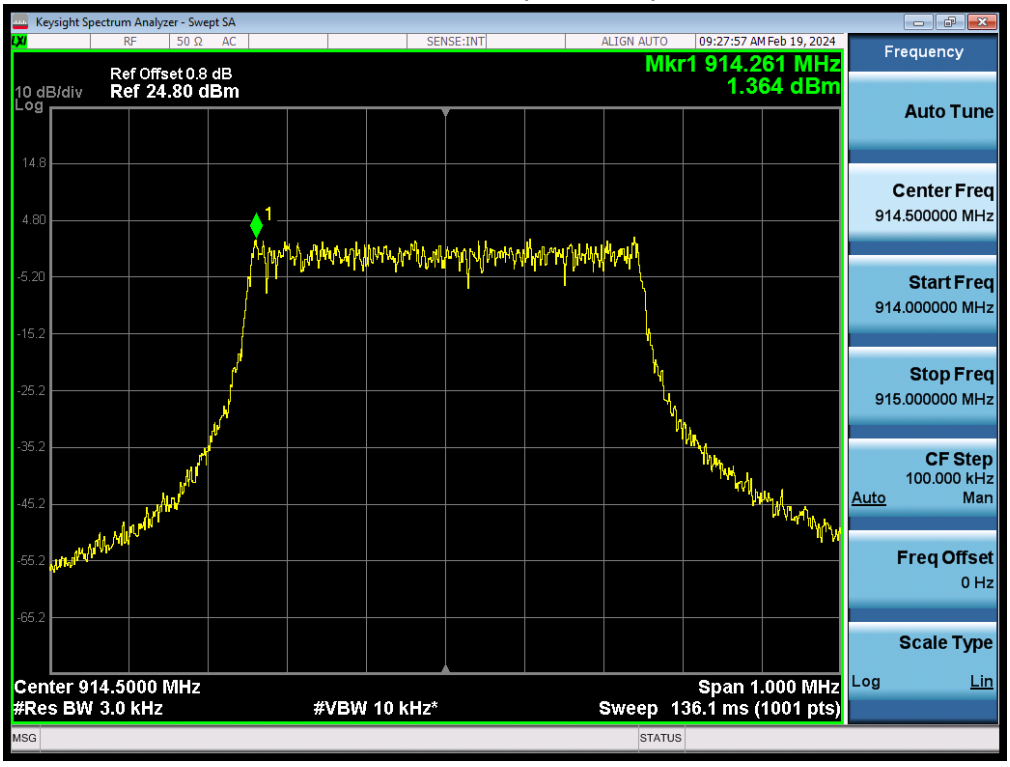
Mode 1 CH16(914.5MHz)



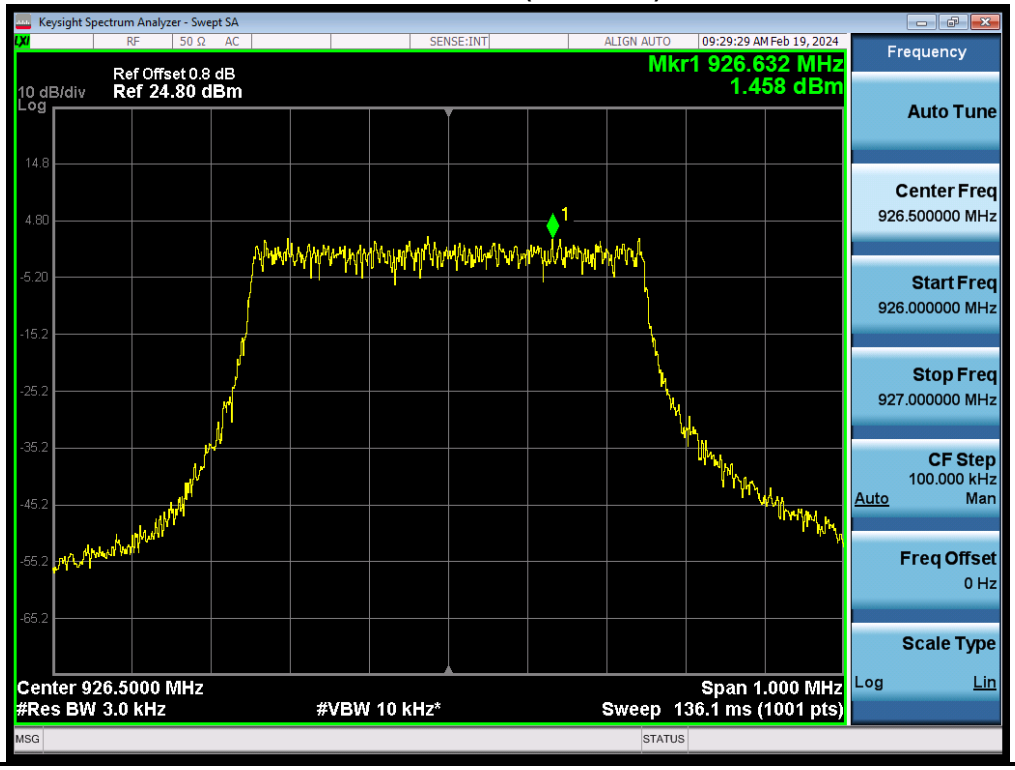
Mode 1 CH01(902.5MHz)



Mode 1 CH16(914.5MHz)



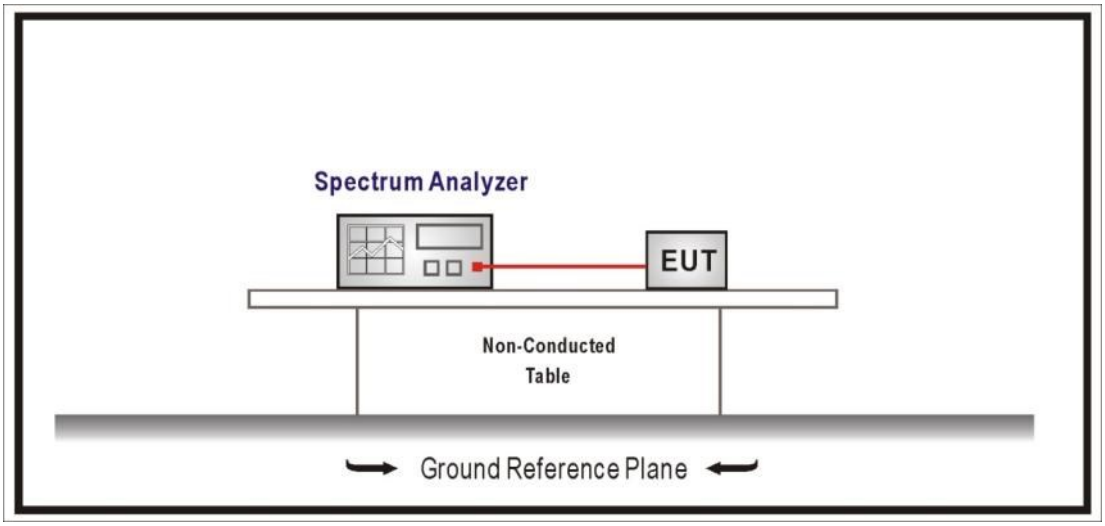
Mode 1 CH31(926.5MHz)



4.8 Carrier Frequency Separation	VERDICT: PASS

4.8.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 15.247(a)(1)
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.	

4.8.2 Test Setup



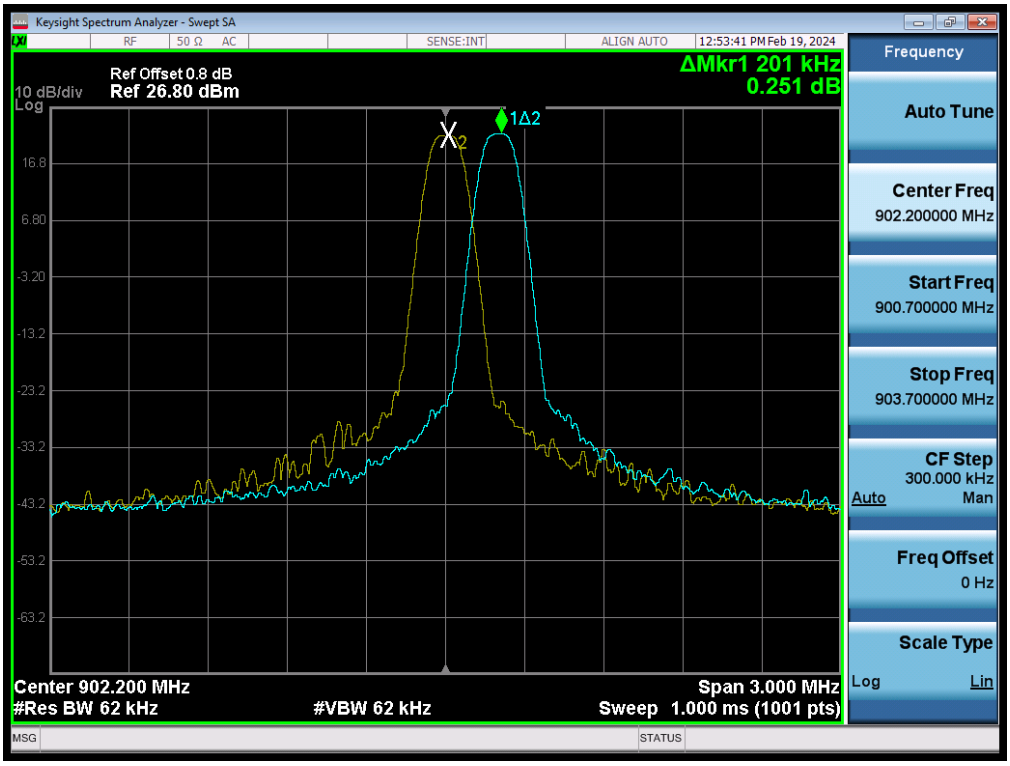
4.8.3 Test Procedure

	References Rule	Chapter	Description
☒	ANSI C63.10	7.8.2	Carrier frequency separation

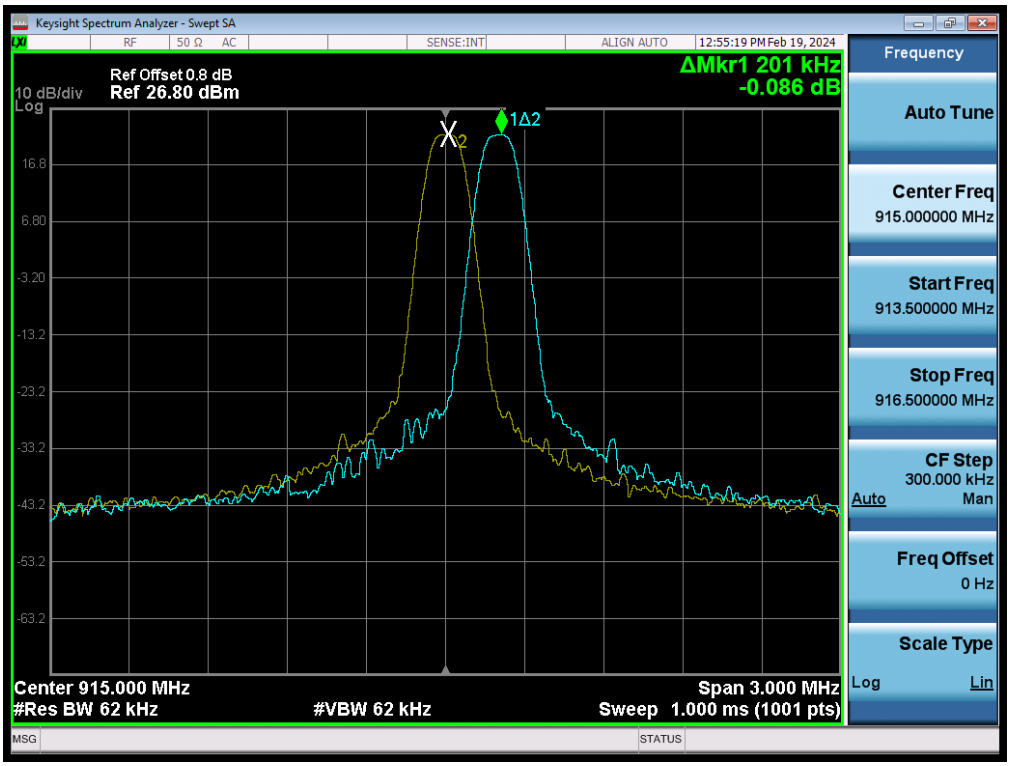
4.8.4 Test Data

Mode	Channel	Test Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
2	01	902.2	201	⩾105	Pass
	65	915	201	⩾105.5	Pass
	129	927.8	201	⩾105.9	Pass

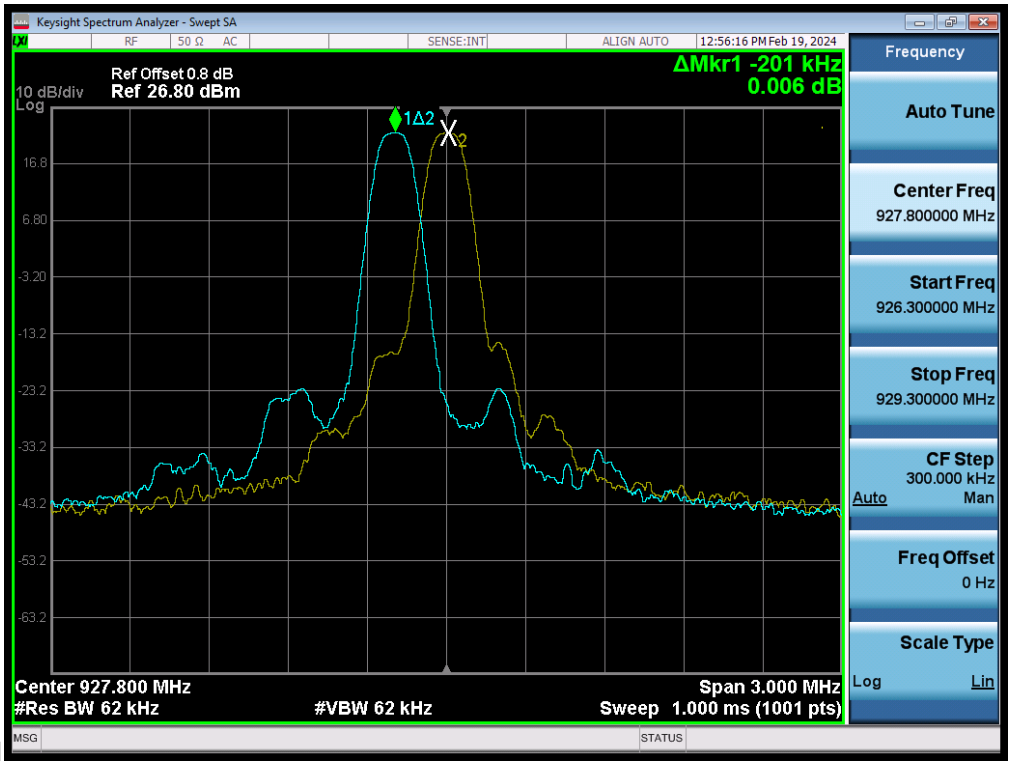
Channel 01 902.2MHz



Channel 65 915MHz



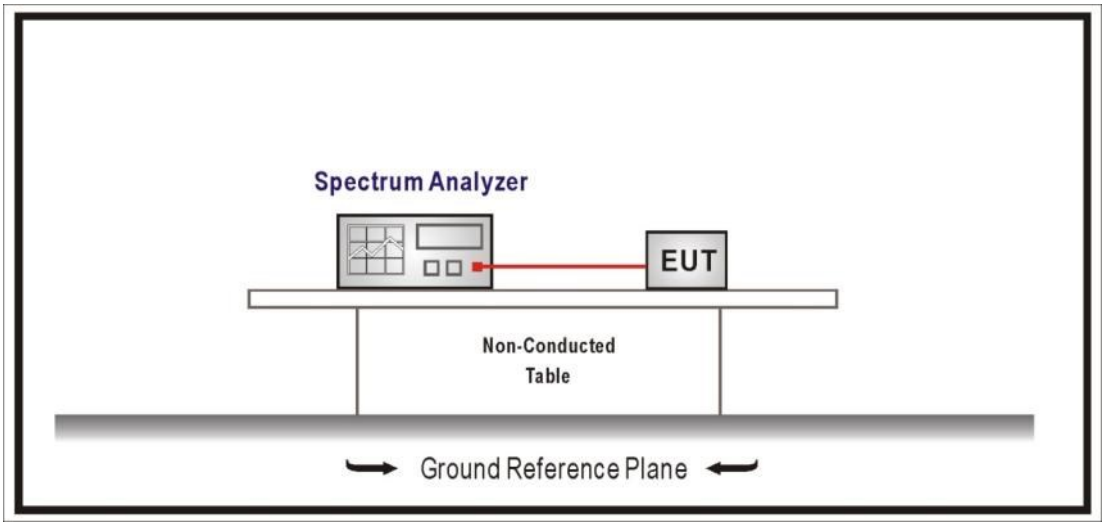
Channel 129 927.8MHz



4.9 Number of Hopping Frequencies	VERDICT: PASS

4.9.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 15.247 15.247(a)(1) (iii)
For frequency hopping systems operating in 902-928 MHz band, if the 20 dB bandwidth of the hopping channel is less than 250 kHz, shall use at least 50 hopping frequencies.	

4.9.2 Test Setup



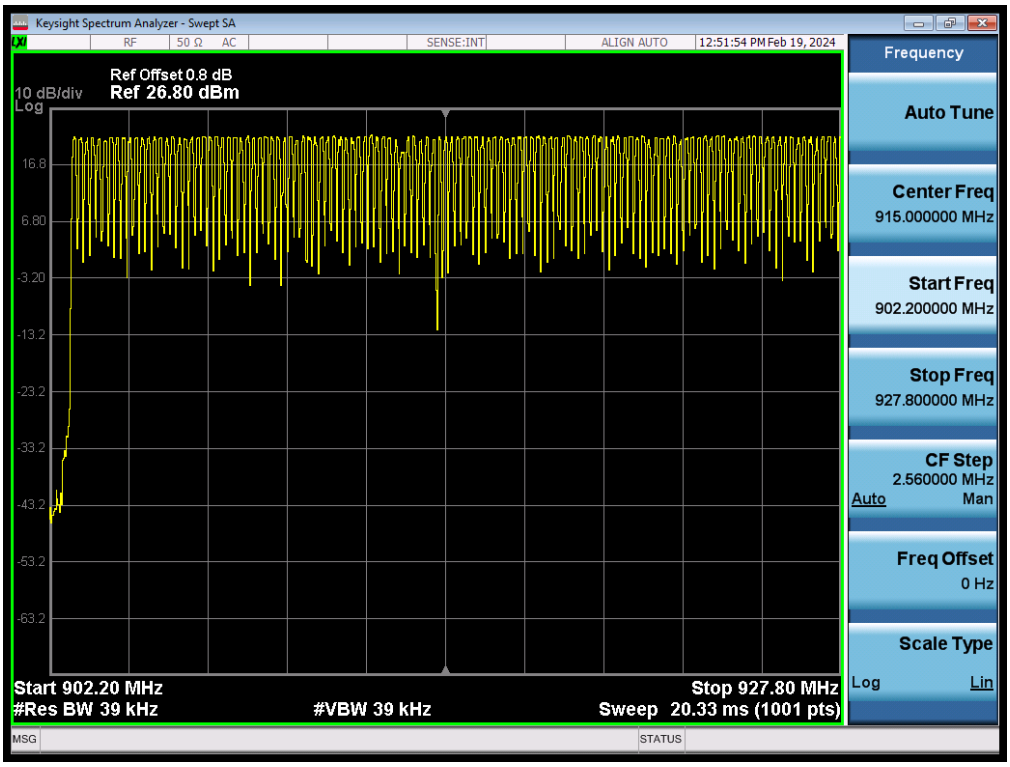
4.9.3 Test Procedure

	References Rule	Chapter	Description
☒	ANSI C63.10	7.8.3	Number of Hopping Frequencies

4.9.4 Test Data

Mode	Frequency Band	Number of Hopping Frequencies	Limit	Result
2	902~928MHz	129	50	Pass

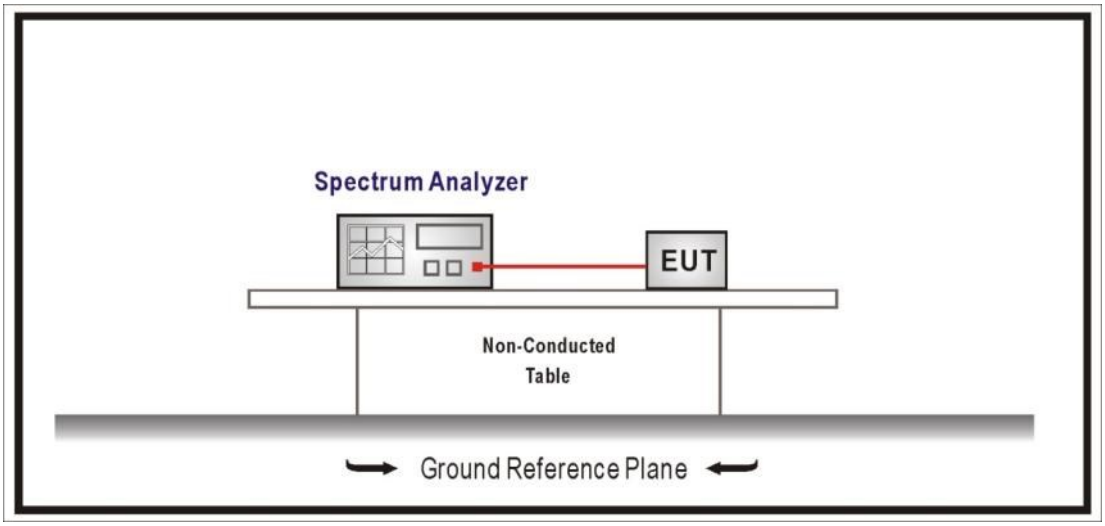
Model 1



4.10 Time of Occupancy (Dwell Time)	VERDICT: PASS

4.10.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 15.247(a)(1)(iii)
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period	

4.10.2 Test Setup



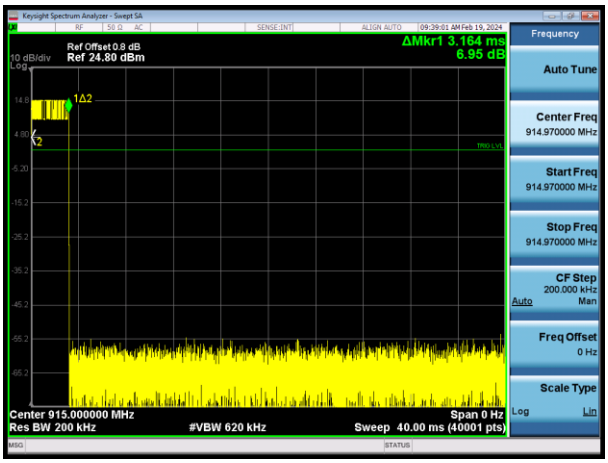
4.10.3 Test Procedure

	References Rule	Chapter	Description
☒	ANSI C63.10	7.8.4	Time of Occupancy (Dwell Time)

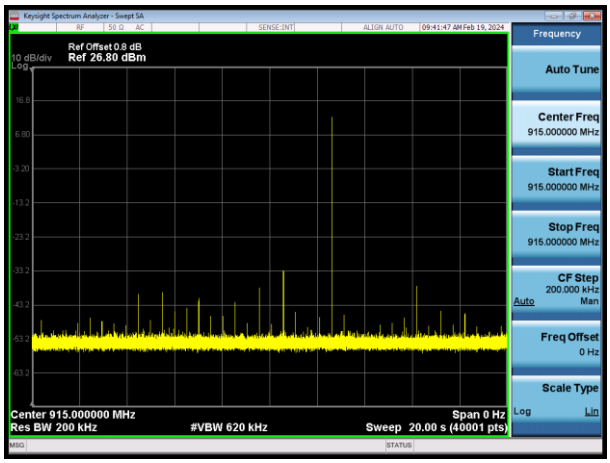
4.10.4 Test Data

Mode	Channel No.	Frequency (MHz)	Time of Occupancy (ms)	Limit (ms)	Result
2	65	915	3.164	⩽400	Pass

Model 1



Model 1



4.11 Antenna Requirement	VERDICT: PASS

4.11.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 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, or §15.221. 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.	

4.11.2 Antenna Connector Construction:	
☐	The use of a permanently attached antenna
☒	The antenna use of a unique coupling to the intentional radiator
☐	The use of a nonstandard antenna jack or electrical connector
☐	The antenna use standard connector with non-standard thread dimensions
Please refer to the attached document “Internal Photograph” to show the antenna connector.	

5 TEST SETUP PHOTO AND EUT PHOTO	VERDICT: PASS

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

The End