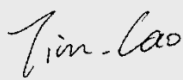





Test report No:
22B0213R-RF-US-P06V02

FCC&ISED TEST REPORT

Product Name	Geolocation Module
Trademark	Murata
Model and /or type reference	LBEU5ZZ1WL
FCC ID	VPYLB1WL
IC	772C-LB1WL
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 2
Verdict Summary	IN COMPLIANCE
Tested by (name / position & signature)	Tim Cao/ Project Manager 
Approved by (name / position & signature)	Jack Zhang/ Manager 
Date of issue	2023-01-09
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.

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)	Nov. 07, 2022
Date (start test)	Nov. 14, 2022
Date (finish test)	Dec. 13, 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
22B0213R-RF-US-P06V02	V1.0	Initial issue of report.	2023-01-09

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	100573	2022.09.17	2023.09.16
Two-Line V-Network	R&S	ENV216	101044	2022.03.12	2023.03.11
50ohm Termination	SHX	TF2	07081403	2022.08.27	2023.08.26
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	N/A	N/A
Temperature/Humidity Meter	RTS	RTS-8S	TR1-TH	2022.07.07	2023.07.06
Coaxial Cable	Suhner	RG 223	TR1-C2	2022.03.21	2023.03.20
Dekra test software	Dekra	-	-	-	-

RF conducted test / TR8(Chamber details)

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
MAX Signal Analyzer	Agilent	N9020A	MY49100159	2022.09.18	2023.09.17
MXA Signal Analyzer	Keysight	N9020A	MY56060147	2022.07.14	2023.07.13
Temperature/Humidity Meter	RTS	RTS-8S	RF08	2022.07.07	2023.07.06
Tonscend test software	Tonscend	-	-	-	-

Radiated Emission(30MHz-1GHz) / AC3(Chamber details)

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EMI Test Receiver	R&S	ESCI	100573	2022.09.17	2023.09.16
Loop Antenna	R&S	HFH2-Z2	833799/003	2022.04.15	2023.04.14
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2022.08.28	2023.08.27
Temperature/Humidity Meter	RTS	RTS-8S	AC3-TH	2022.07.07	2023.07.06
Coaxial Cable	Huber+Suhner	RG 214	AC3-C	2022.03.21	2023.03.20
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
Pre-Amplifier	SKET	LNPA_0118G-45	SK2021090101	2022.07.15	2023.07.14
Preamplifier	CHENGYI	EMC184045SE	980263	2022.05.21	2023.05.20
DRG Horn	ETS-Lindgren	3117	00123988	2022.11.01	2023.10.31
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2022.05.19	2023.05.18
Temperature/Humidity Meter	RTS	RTS-8S	AC5-TH	2022.07.07	2023.07.06
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2022.03.21	2023.03.20
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2022.03.21	2023.03.20
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2022.03.21	2023.03.20
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%. Uncertainties is comply 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..... :	Geolocation Module
Model No. :	LBEU5ZZ1WL
FCC ID..... :	VPYLB1WL
IC..... :	772C-LB1WL
Hardware Version	1.0
Software Version..... :	1.0
Manufacturer..... :	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 specification..... :	LoRa(DTS/FHSS/Hybrid)
Operating frequency range(s) :	LoRa(DTS) 500kHz bandwidth: 903MHz~914.2MHz LoRa(FHSS) 125kHz bandwidth: 902.3MHz~914.9MHz
Modulation	LoRa
Number of channel..... :	LoRa(DTS): 8 LoRa(FHSS): 64
Data Rate	DR0~4
Device category	<input type="checkbox"/> Fixed point-to-point <input type="checkbox"/> Emit multiple directional beams, simultaneously or sequentially <input checked="" type="checkbox"/> Other cases

Rated power supply	Voltage and Frequency	
	<input type="checkbox"/>	AC: 220 - 240 V, 50/60 Hz
	<input type="checkbox"/>	AC: 100 - 240 V, 50/60 Hz
	<input checked="" type="checkbox"/>	DC: 3.0 – 3.3V, Typical 3.3V
	<input type="checkbox"/>	Battery:
	<input type="checkbox"/>	USB
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: Module

1.2 Antenna Information

Antenna model / type number.....:	ANT-SS900		
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"/> Basic
			<input type="checkbox"/> CDD
			<input type="checkbox"/> Sectorized
			<input type="checkbox"/> Beam-forming
Antenna Type.....:	<input checked="" type="checkbox"/>	External	<input type="checkbox"/> Dipole
			<input checked="" type="checkbox"/> Whip
			<input type="checkbox"/> Sectorized
	<input type="checkbox"/>	Internal	<input type="checkbox"/> PIFA
			<input type="checkbox"/> PCB
			<input type="checkbox"/> Metal Antenna
Antenna Gain.....:	0 dBi		

1.3 Channel List

LoRa(FHSS) 125kHz Bandwidth

Channel NO.	Frequency (MHz)	Channel NO.	Frequency (MHz)	Channel NO.	Frequency (MHz)	Channel NO.	Frequency (MHz)
0	902.3	1	902.5	2	902.7	3	902.9
4	903.1	5	903.3	6	903.5	7	903.7
8	903.9	9	904.1	10	904.3	11	904.5
12	904.7	13	904.9	14	905.1	15	905.3
16	905.5	17	905.7	18	905.9	19	906.1
20	906.3	21	906.5	22	906.7	23	906.9
24	907.1	25	907.3	26	907.5	27	907.7
28	907.9	29	908.1	39	908.3	31	908.5
32	908.7	33	908.9	34	909.1	35	909.3
36	909.5	37	909.7	38	909.9	39	910.1
40	910.3	41	910.5	42	910.7	43	910.9
44	911.1	45	911.3	46	911.5	47	911.7
48	911.9	49	912.1	50	912.3	51	912.5
52	912.7	53	912.9	54	913.1	55	913.3
56	913.5	57	913.7	58	913.9	59	914.1
60	914.3	61	914.5	62	914.7	63	914.9

LoRa(DTS) 500kHz Bandwidth

Channel NO.	Frequency (MHz)	Channel NO.	Frequency (MHz)	Channel NO.	Frequency (MHz)	Channel NO.	Frequency (MHz)
64	903	65	904.6	66	906.2	67	907.8
68	909.4	69	911	70	912.6	71	914.2

1.4 Power Setting

Mode	Frequency (MHz)	Power Setting
Mode 1 LoRa FHSS 125kHz bandwidth	902.3	22
	908.5	22
	914.9	22
Mode 2 LoRa DTS 500kHz bandwidth	903.0	22
	907.8	22
	914.2	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.

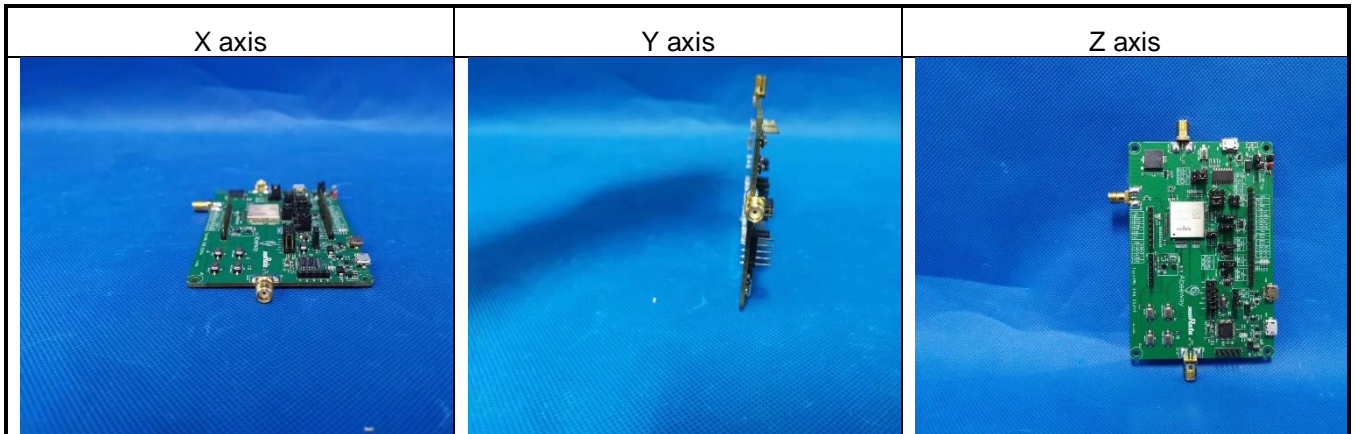
2 DESCRIPTION OF TEST SETUP

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 FHSS 125kHz bandwidth(902.3-914MHz).
	Mode 2: Transmit by LoRa with DTS 500kHz bandwidth(903-914.2MHz)

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



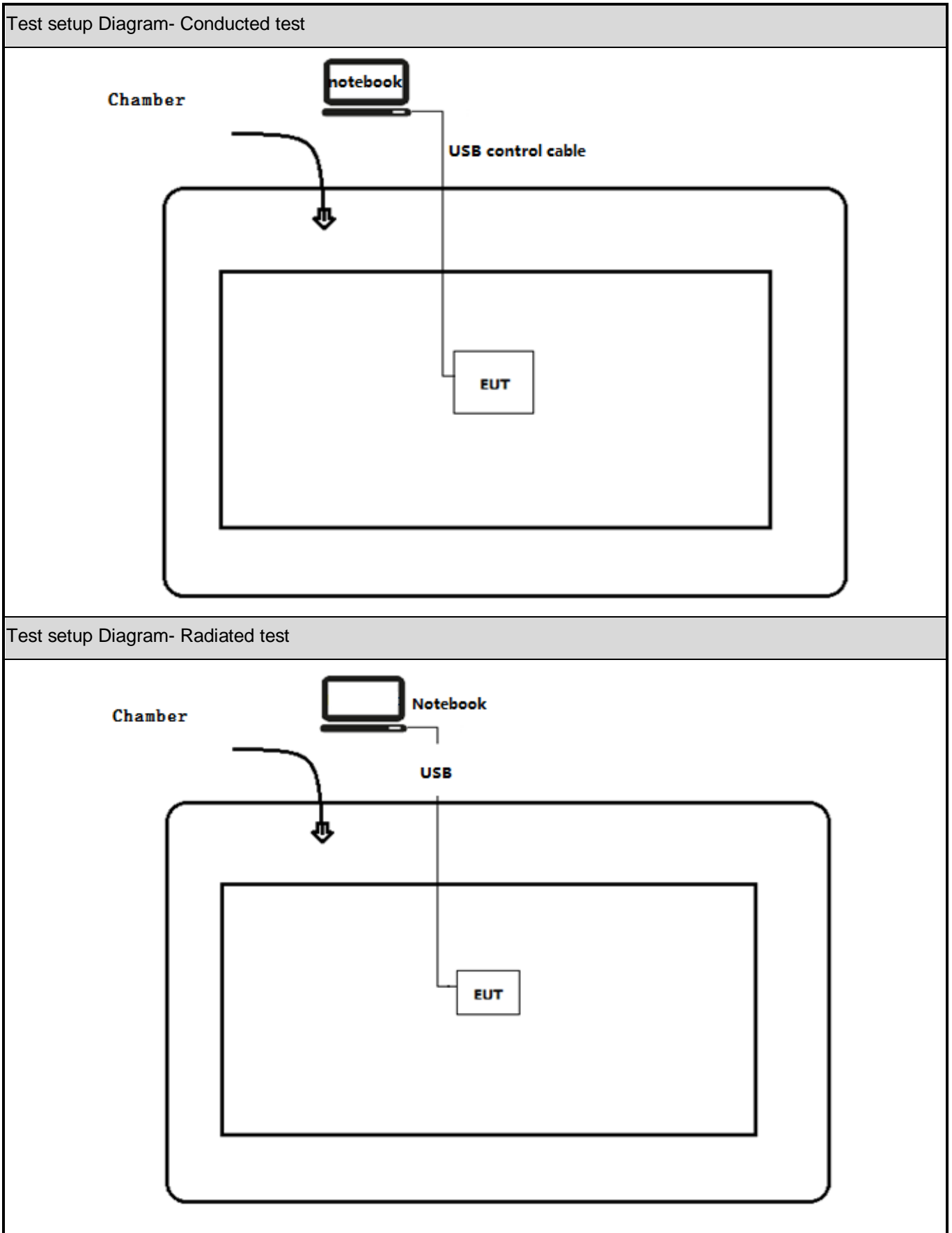
2.2 Support / Auxiliary equipment / unit / Test software for the EUT

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:



2.4 Testing process

1	Setup the EUT as shown in Section 2.4.
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 2	2017	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 ISSED:

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 2 Section A5.5	PASS	---
Radiated Emission Band Edge	RSS-247 Issue 2 Section A5.5	N/A	---
Fundamental emission output power	RSS-247 Issue 2 Section A5.4(4)	PASS	---
DTS Bandwidth	RSS-Gen Issue 5 Section 6.6	PASS	---
20dB Bandwidth	RSS-247 Issue 2 Section A5.2(1)	PASS	---
Carrier Frequency Separation	RSS-247 Issue 2 Section 5.1	PASS	---
Number of Hopping Frequencies	RSS-247 Issue 2 Section 5.1	PASS	---
Time of Occupancy (Dwell Time)	RSS-247 Issue 2 Section 5.1	PASS	---
Power Spectral Density	RSS-247 Issue 2 Section A5.2(2)	PASS	---
Antenna Requirement	RSS-Gen Issue 5 Section 6.8	PASS	---

3.3 Test Facility

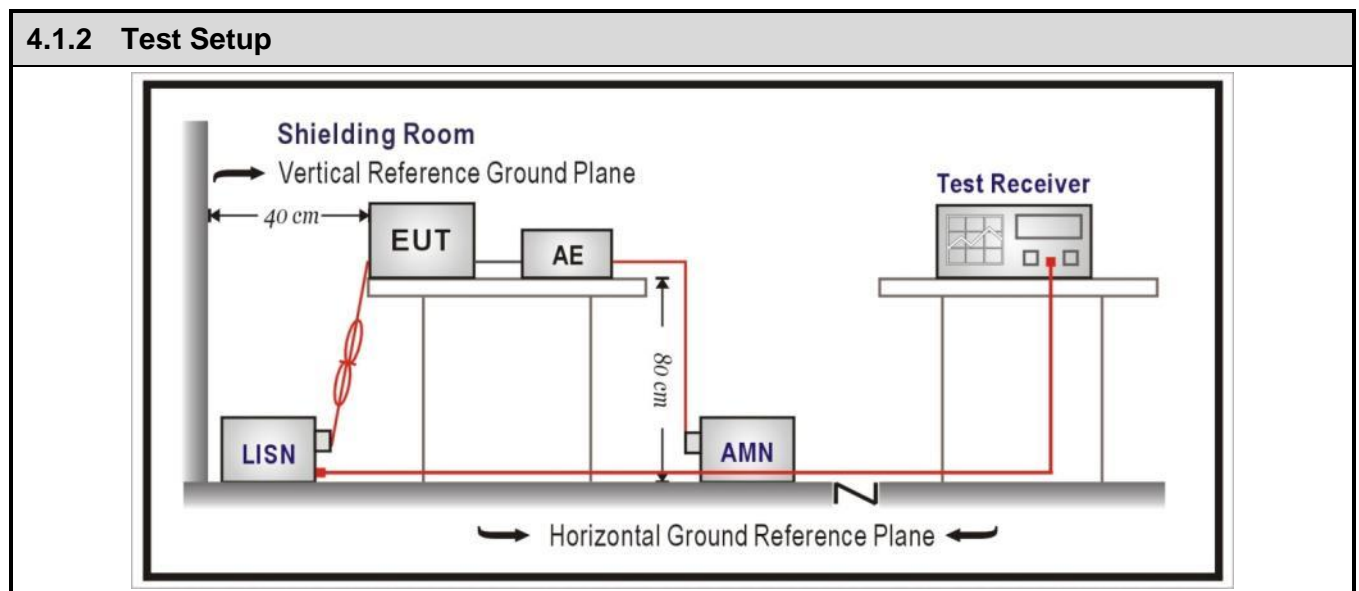
USA : **FCC Designation Number: CN1199**

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.		



4.1.3 Test Procedure			
	References Rule	Chapter	Item
<input checked="" type="checkbox"/>	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 ISSED			
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	--	--

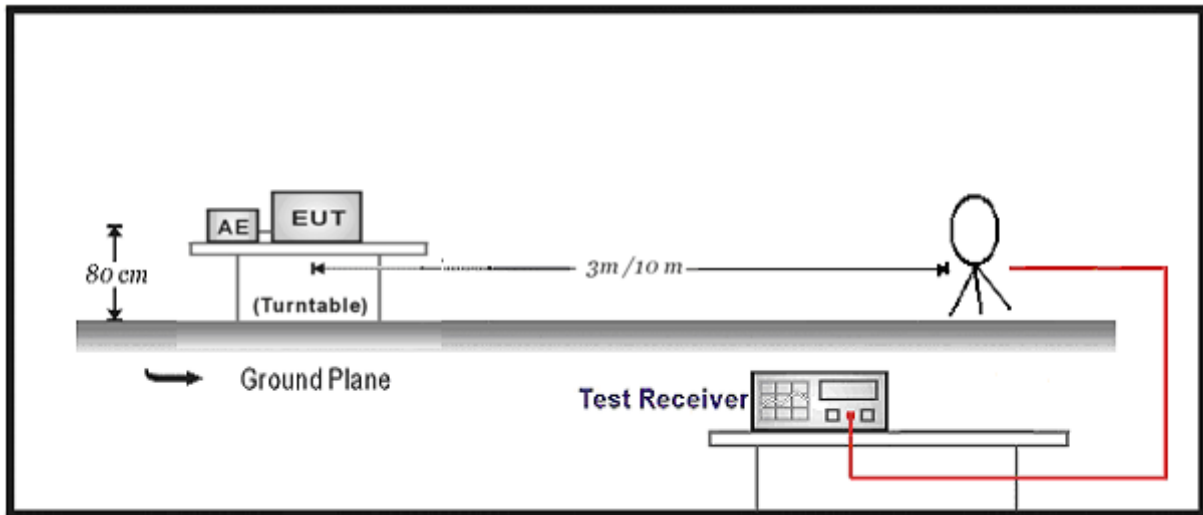
Restricted Band Emissions Limit			
Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Field strength ($\text{dB}\mu\text{V}/\text{m}$)	Measurement distance (m)
0.009 - 0.49	2400/F(kHz)	48.5 - 13.8	300 _(Note 1)
0.49 - 1.705	24000/F(kHz)	33.8 - 23	30 _(Note 1)
1.705 - 30	30	29.5	30 _(Note 1)
30 - 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).

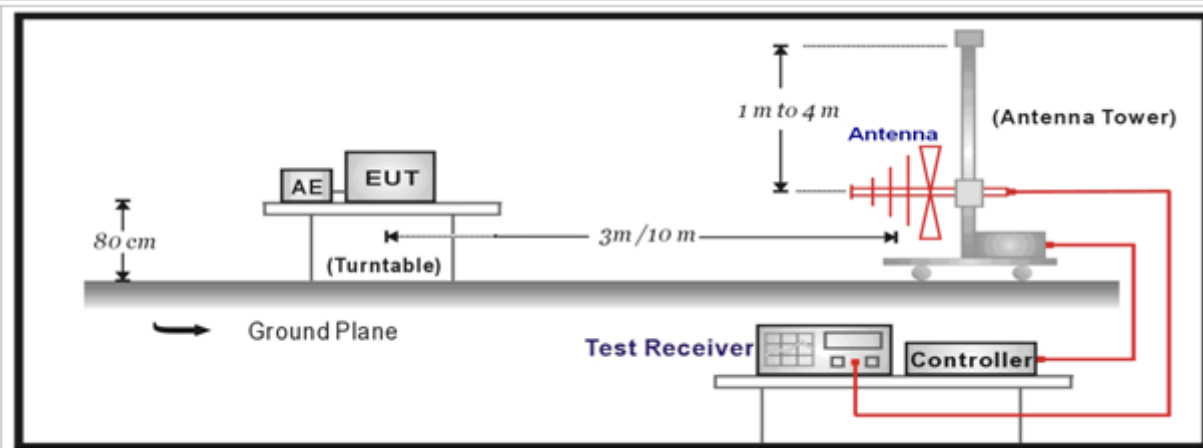
Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated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

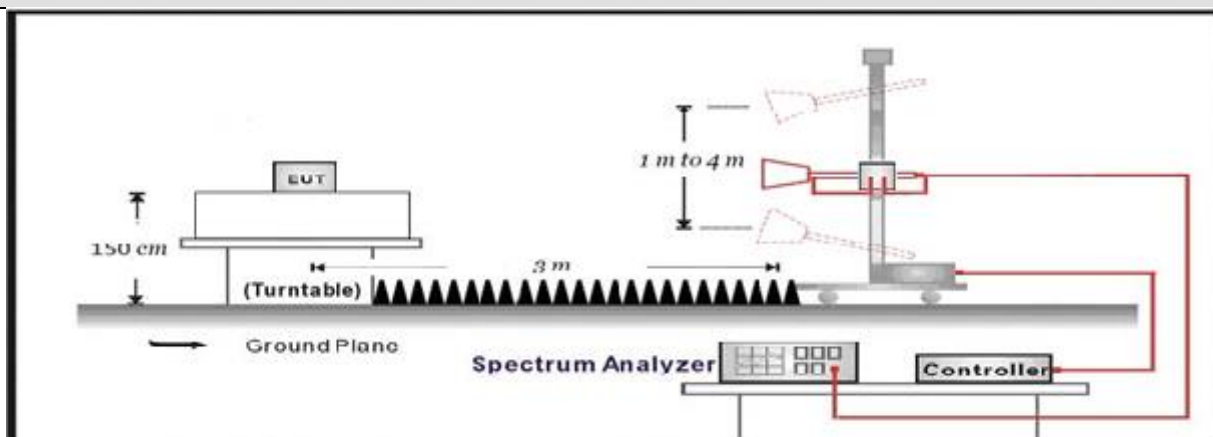
Below 30MHz Test Setup:



30MHz-1GHz Test Setup:



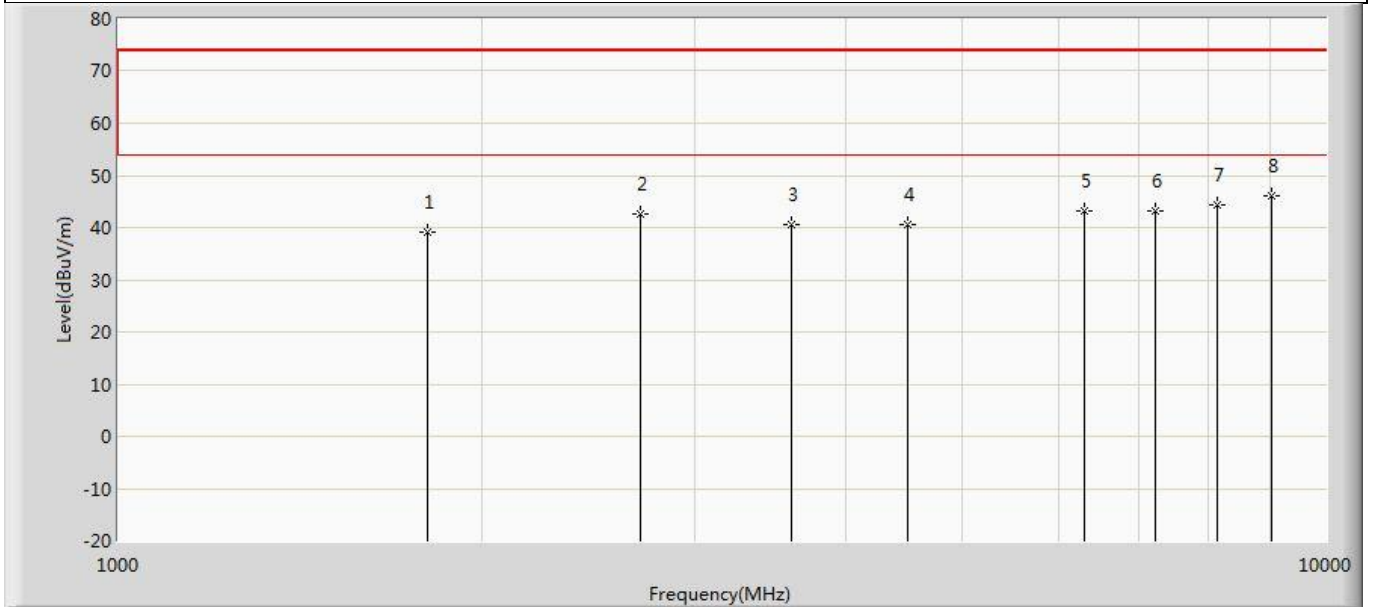
Above 1GHz Test Setup:



4.2.3 Test Procedure			
	References Rule	Chapter	Description
<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	6.3	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
	<input type="checkbox"/> ANSI C63.10	11.12.2	Antenna-port conducted measurements
	<input type="checkbox"/> ANSI C63.10	11.12.2.3	Quasi-peak measurement procedure
	<input type="checkbox"/> ANSI C63.10	11.12.2.4	Peak power measurement procedure
	<input type="checkbox"/> ANSI C63.10	11.12.2.5	Average power measurement procedures
	<input type="checkbox"/> ANSI C63.10	11.12.2.5.1	Trace averaging with continuous EUT transmission at full power
	<input type="checkbox"/> ANSI C63.10	11.12.2.5.2	Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction
	<input type="checkbox"/> ANSI C63.10	11.12.2.5.3	Reduced VBW averaging across ON and OFF times of the EUT transmissions with max hold

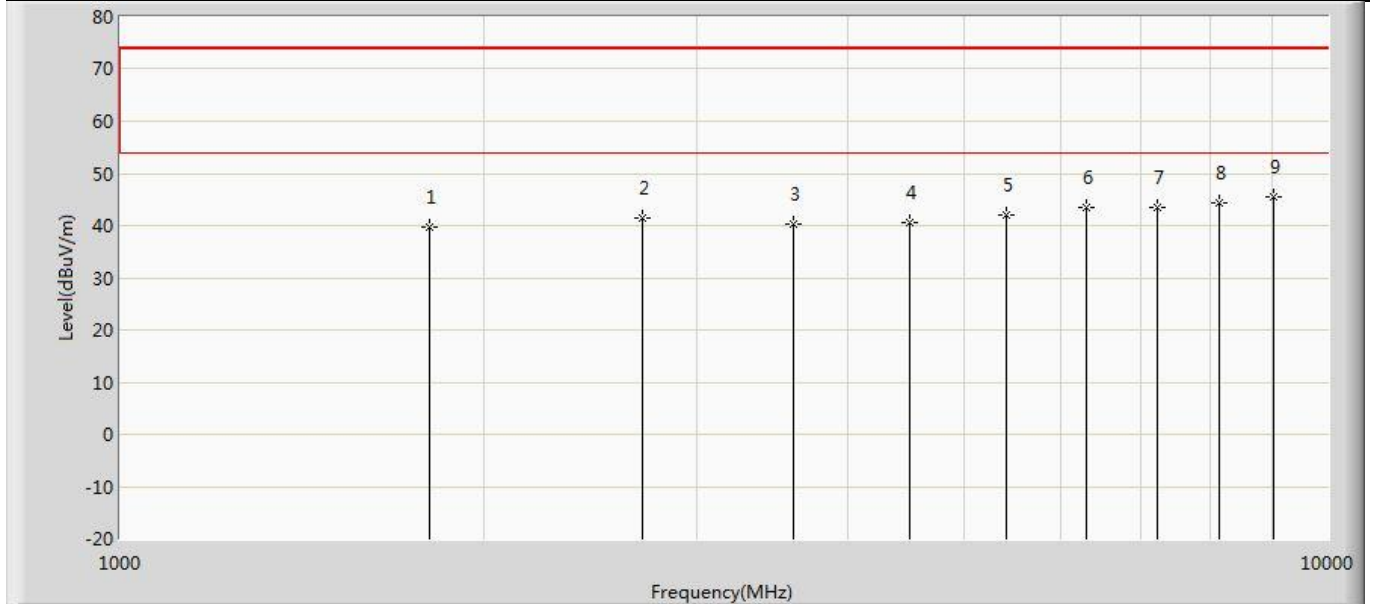
4.2.4 Test Data

Profile: 22B0213R	Page No.: 53
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:56
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode1:Transmit at 902.3MHz by LoRa 125kHz bandwidth	



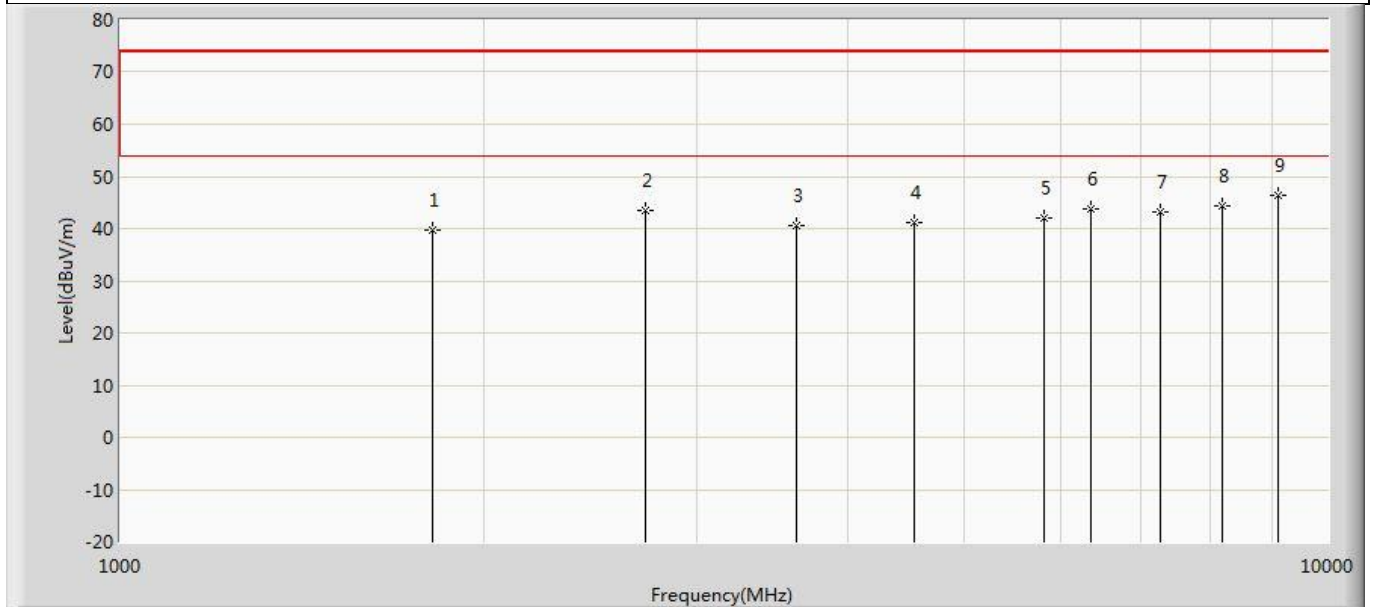
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1804.600	39.260	58.529	-34.740	74.000	-19.269	PK
2		2706.900	42.620	59.898	-31.380	74.000	-17.277	PK
3		3609.200	40.490	57.395	-33.510	74.000	-16.905	PK
4		4511.500	40.525	55.907	-33.475	74.000	-15.382	PK
5		6316.100	43.136	54.224	-30.864	74.000	-11.089	PK
6		7218.400	43.151	54.061	-30.849	74.000	-10.909	PK
7		8120.700	44.420	54.967	-29.580	74.000	-10.547	PK
8	*	9023.000	46.169	55.562	-27.831	74.000	-9.392	PK

Profile: 22B0213R	Page No.: 54
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode1:Transmit at 902.3MHz by LoRa 125kHz bandwidth	



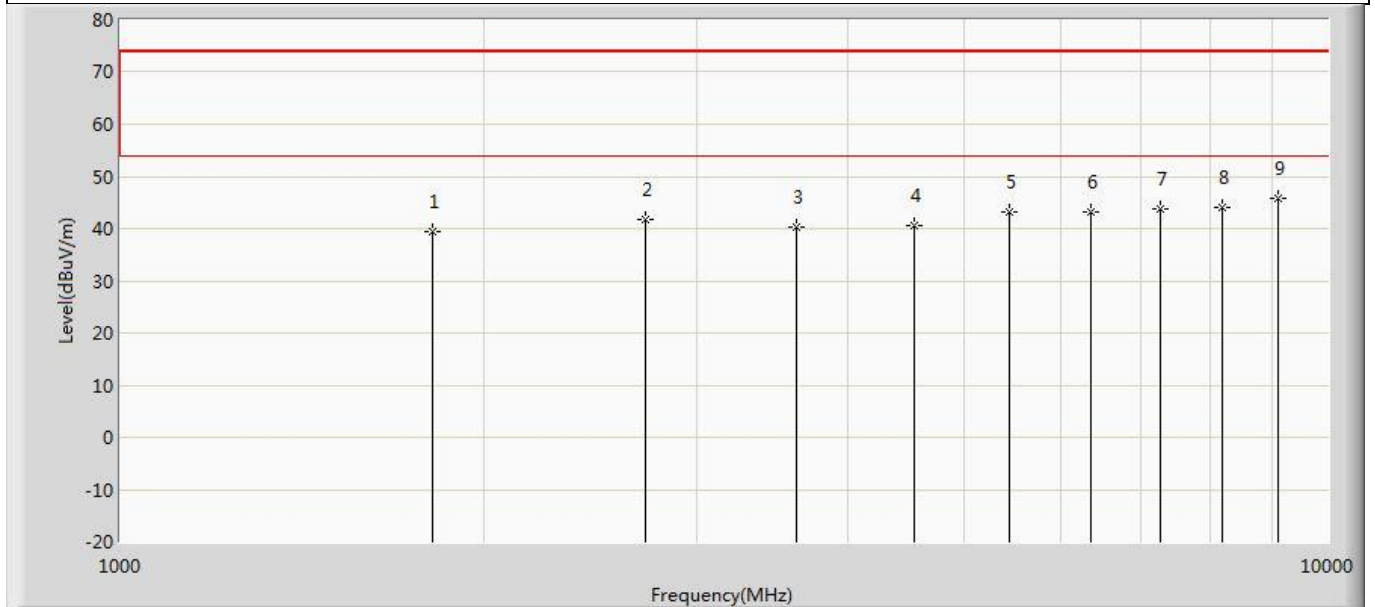
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1804.600	39.597	58.866	-34.403	74.000	-19.269	PK
2		2706.900	41.441	58.719	-32.559	74.000	-17.277	PK
3		3609.200	40.405	57.310	-33.595	74.000	-16.905	PK
4		4511.500	40.521	55.903	-33.479	74.000	-15.382	PK
5		5413.800	42.016	55.323	-31.984	74.000	-13.307	PK
6		6316.100	43.535	54.623	-30.465	74.000	-11.089	PK
7		7218.400	43.547	54.457	-30.453	74.000	-10.909	PK
8		8120.700	44.456	55.003	-29.544	74.000	-10.547	PK
9	*	9023.000	45.621	55.014	-28.379	74.000	-9.392	PK

Profile: 22B0213R	Page No.: 55
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode1:Transmit at 908.5MHz by LoRa 125kHz bandwidth	



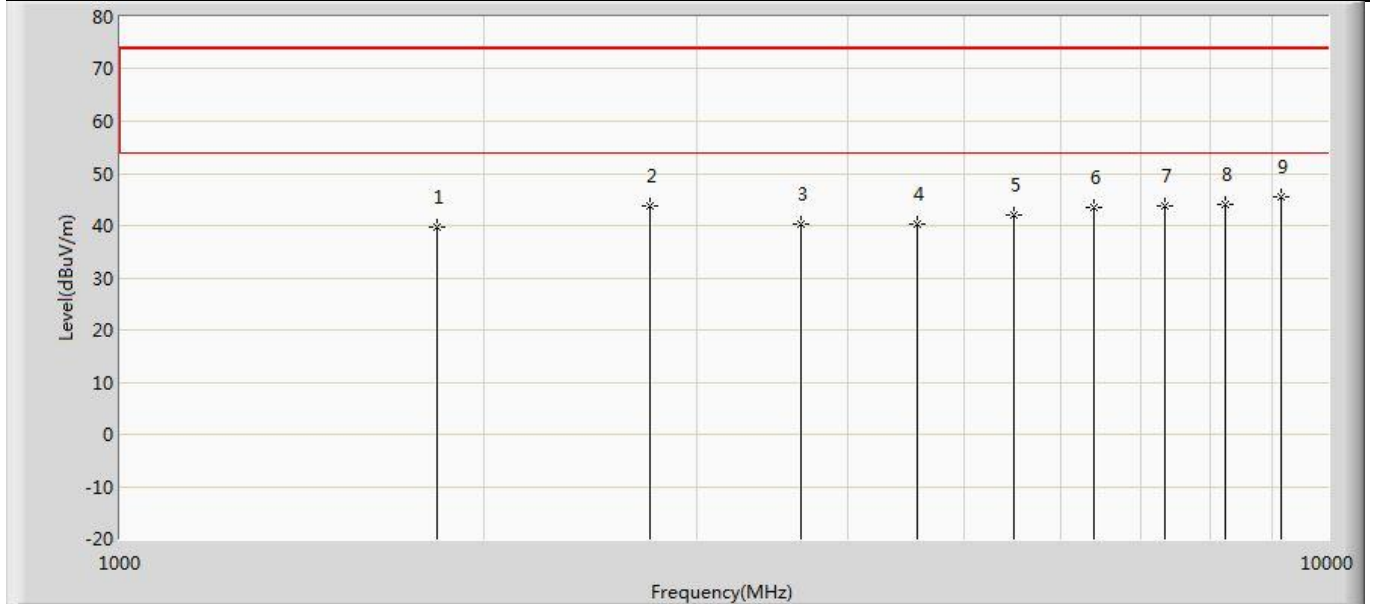
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1817.000	39.566	58.792	-34.434	74.000	-19.226	PK
2		2725.500	43.617	61.036	-30.383	74.000	-17.418	PK
3		3634.000	40.584	57.364	-33.416	74.000	-16.779	PK
4		4542.500	41.185	56.544	-32.815	74.000	-15.359	PK
5		5825.000	42.062	54.268	-31.938	74.000	-12.206	PK
6		6359.500	43.835	55.158	-30.165	74.000	-11.323	PK
7		7268.000	43.267	54.052	-30.733	74.000	-10.785	PK
8		8176.500	44.237	55.028	-29.763	74.000	-10.791	PK
9	*	9085.000	46.252	55.497	-27.748	74.000	-9.246	PK

Profile: 22B0213R	Page No.: 56
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode1:Transmit at 908.5MHz by LoRa 125kHz bandwidth	



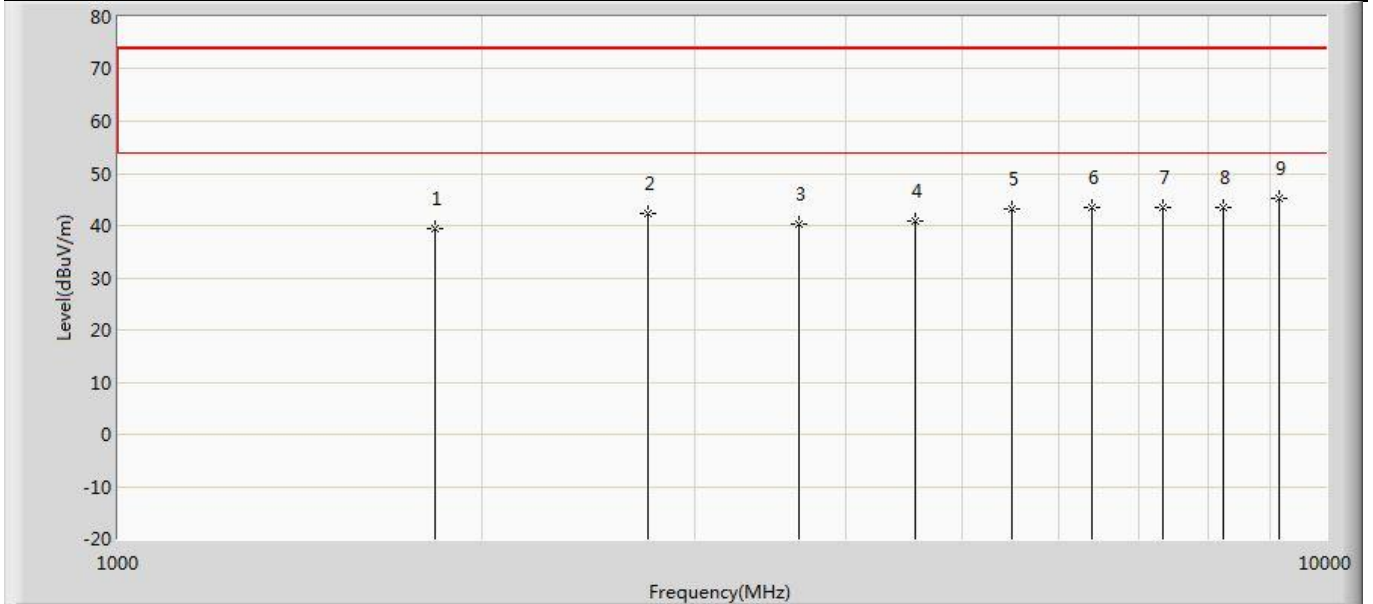
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1817.000	39.420	58.646	-34.580	74.000	-19.226	PK
2		2725.500	41.684	59.103	-32.316	74.000	-17.418	PK
3		3634.000	40.258	57.038	-33.742	74.000	-16.779	PK
4		4542.500	40.555	55.914	-33.445	74.000	-15.359	PK
5		5451.000	43.078	56.324	-30.922	74.000	-13.245	PK
6		6359.500	43.309	54.632	-30.691	74.000	-11.323	PK
7		7268.000	43.737	54.522	-30.263	74.000	-10.785	PK
8		8176.500	43.973	54.764	-30.027	74.000	-10.791	PK
9	*	9085.000	45.703	54.948	-28.297	74.000	-9.246	PK

Profile: 22B0213R	Page No.: 57
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode1:Transmit at 914.9MHz by LoRa 125kHz bandwidth	



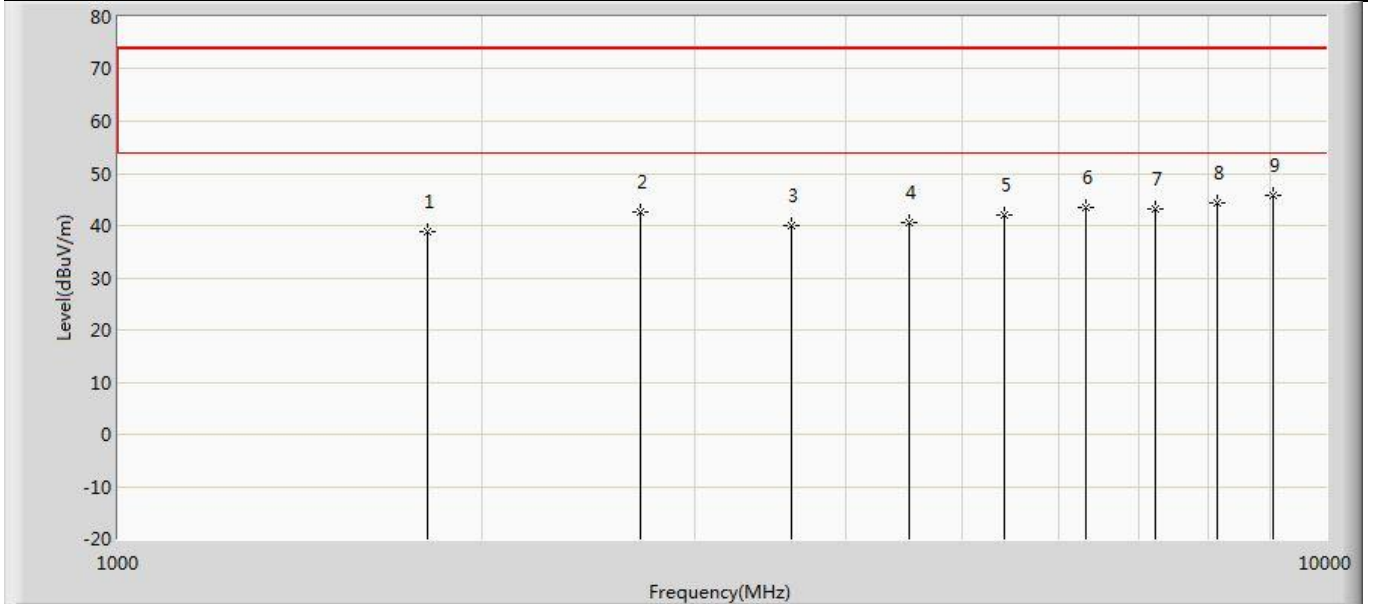
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1829.800	39.842	58.912	-34.158	74.000	-19.069	PK
2		2744.700	43.700	61.122	-30.300	74.000	-17.422	PK
3		3659.600	40.347	57.025	-33.653	74.000	-16.678	PK
4		4574.500	40.210	55.567	-33.790	74.000	-15.356	PK
5		5489.400	42.153	55.364	-31.847	74.000	-13.211	PK
6		6404.300	43.374	54.659	-30.626	74.000	-11.285	PK
7		7319.200	43.685	54.551	-30.315	74.000	-10.866	PK
8		8234.100	44.052	54.787	-29.948	74.000	-10.735	PK
9	*	9149.000	45.584	54.698	-28.416	74.000	-9.114	PK

Profile: 22B0213R	Page No.: 58
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode1:Transmit at 914.9MHz by LoRa 125kHz bandwidth	



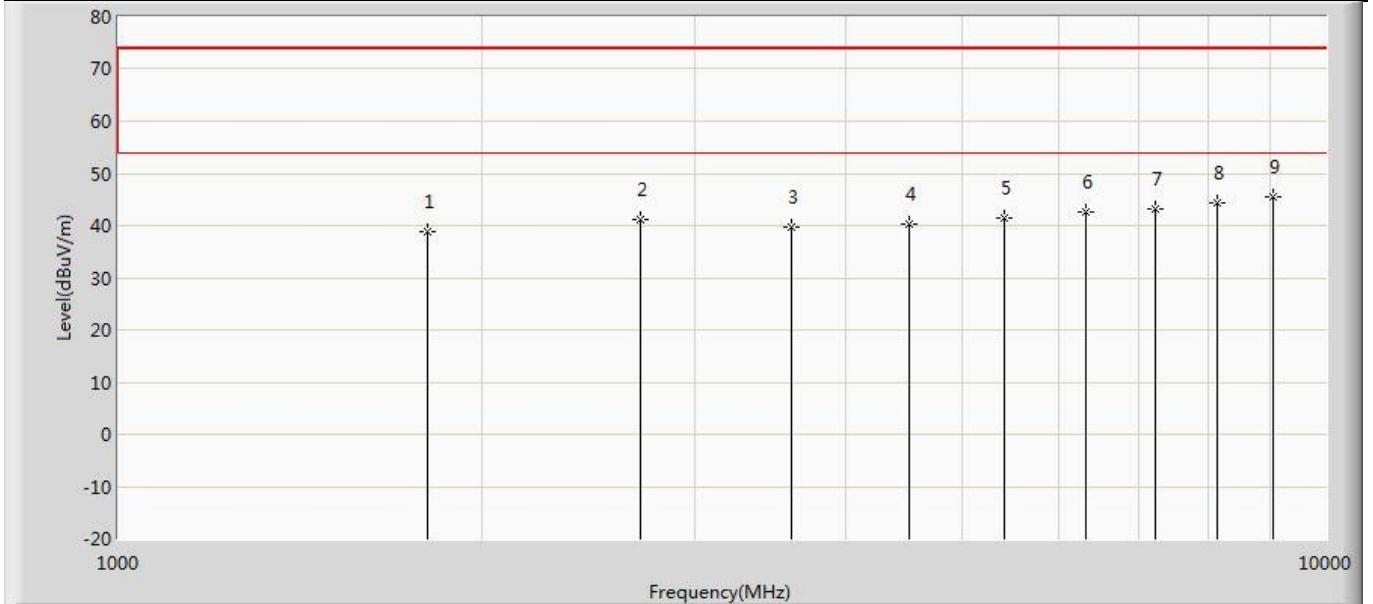
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1829.800	39.538	58.608	-34.462	74.000	-19.069	PK
2		2744.700	42.428	59.850	-31.572	74.000	-17.422	PK
3		3659.600	40.260	56.938	-33.740	74.000	-16.678	PK
4		4574.500	41.002	56.359	-32.998	74.000	-15.356	PK
5		5489.400	43.250	56.461	-30.750	74.000	-13.211	PK
6		6404.300	43.526	54.811	-30.474	74.000	-11.285	PK
7		7319.200	43.465	54.331	-30.535	74.000	-10.866	PK
8		8234.100	43.623	54.358	-30.377	74.000	-10.735	PK
9	*	9149.000	45.209	54.323	-28.791	74.000	-9.114	PK

Profile: 22B0213R	Page No.: 59
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode 2:Transmit at 903MHz by LoRa 500kHz bandwidth	



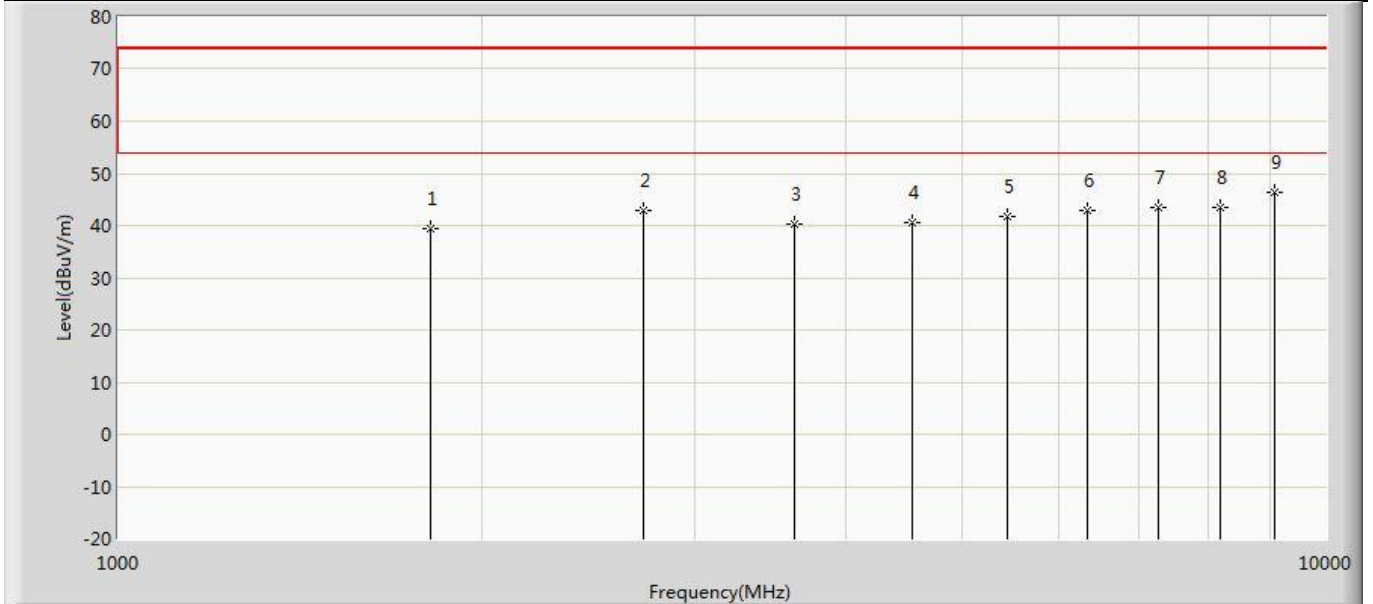
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1806.000	38.973	58.238	-35.027	74.000	-19.265	PK
2		2709.000	42.703	60.000	-31.297	74.000	-17.298	PK
3		3612.000	40.112	57.015	-33.888	74.000	-16.903	PK
4		4515.000	40.485	55.843	-33.515	74.000	-15.358	PK
5		5418.000	41.967	55.249	-32.033	74.000	-13.282	PK
6		6321.000	43.415	54.380	-30.585	74.000	-10.965	PK
7		7224.000	43.051	53.974	-30.949	74.000	-10.922	PK
8		8127.000	44.241	54.838	-29.759	74.000	-10.597	PK
9	*	9030.000	45.911	55.301	-28.089	74.000	-9.390	PK

Profile: 22B0213R	Page No.: 60
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode 2:Transmit at 903MHz by LoRa LoRa 500kHz bandwidth	



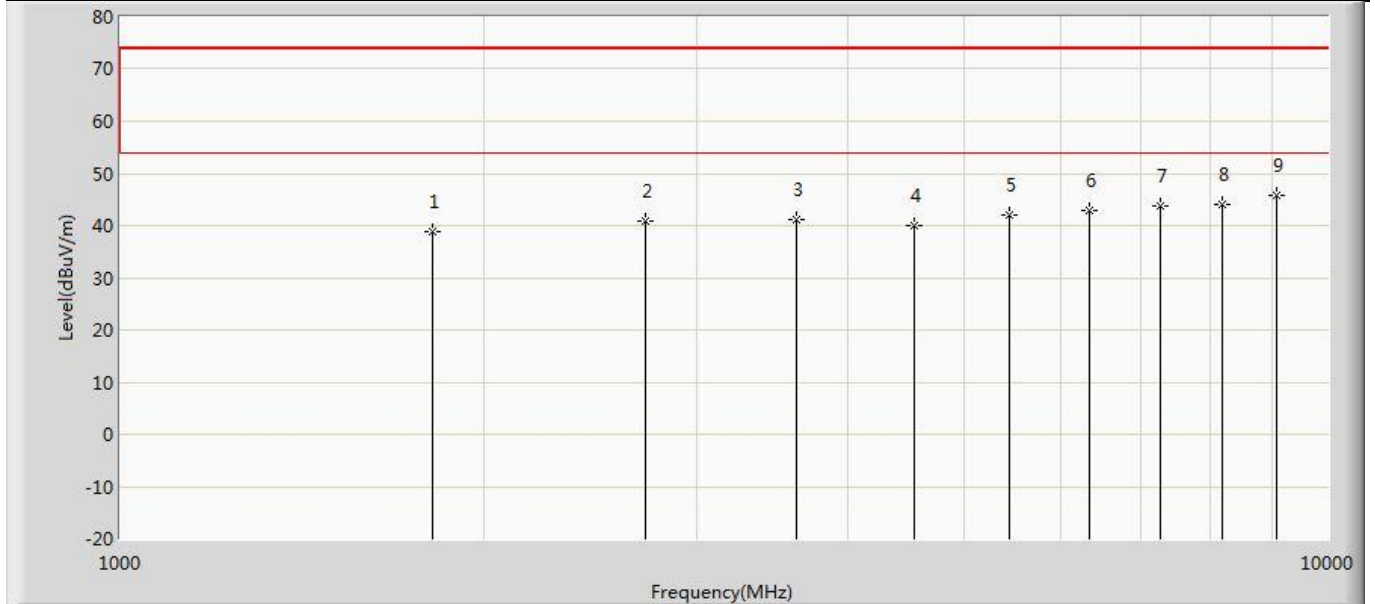
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1806.000	38.801	58.066	-35.199	74.000	-19.265	PK
2		2709.000	41.043	58.340	-32.957	74.000	-17.298	PK
3		3612.000	39.781	56.684	-34.219	74.000	-16.903	PK
4		4515.000	40.261	55.619	-33.739	74.000	-15.358	PK
5		5418.000	41.334	54.616	-32.666	74.000	-13.282	PK
6		6321.000	42.723	53.688	-31.277	74.000	-10.965	PK
7		7224.000	43.134	54.057	-30.866	74.000	-10.922	PK
8		8127.000	44.326	54.923	-29.674	74.000	-10.597	PK
9	*	9030.000	45.485	54.875	-28.515	74.000	-9.390	PK

Profile: 22B0213R	Page No.: 61
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode 2:Transmit at 907.8MHz by LoRa 500kHz bandwidth	



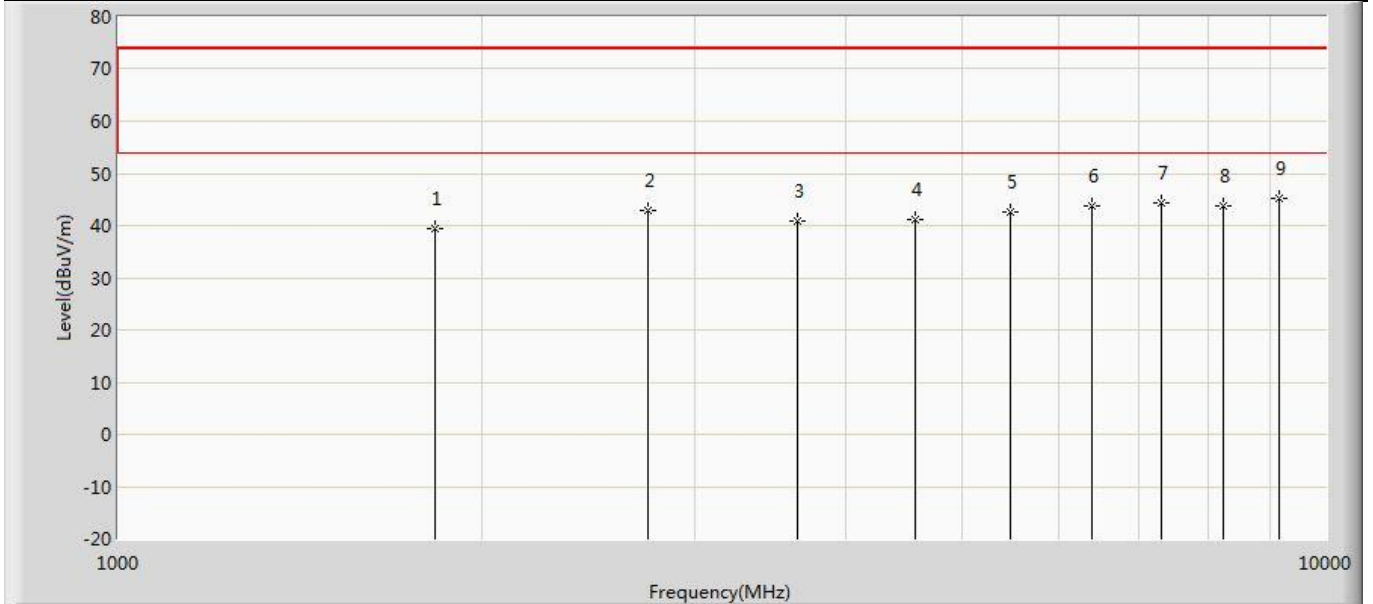
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1815.600	39.439	58.679	-34.561	74.000	-19.240	PK
2		2723.400	42.910	60.317	-31.090	74.000	-17.407	PK
3		3631.200	40.196	56.996	-33.804	74.000	-16.800	PK
4		4539.000	40.471	55.868	-33.529	74.000	-15.398	PK
5		5446.800	41.719	54.956	-32.281	74.000	-13.237	PK
6		6354.600	42.931	54.229	-31.069	74.000	-11.298	PK
7		7262.400	43.458	54.176	-30.542	74.000	-10.718	PK
8		8170.200	43.603	54.382	-30.397	74.000	-10.779	PK
9	*	9078.000	46.265	55.475	-27.735	74.000	-9.210	PK

Profile: 22B0213R	Page No.: 62
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode 2:Transmit at 907.8MHz by LoRa 500kHz bandwidth	



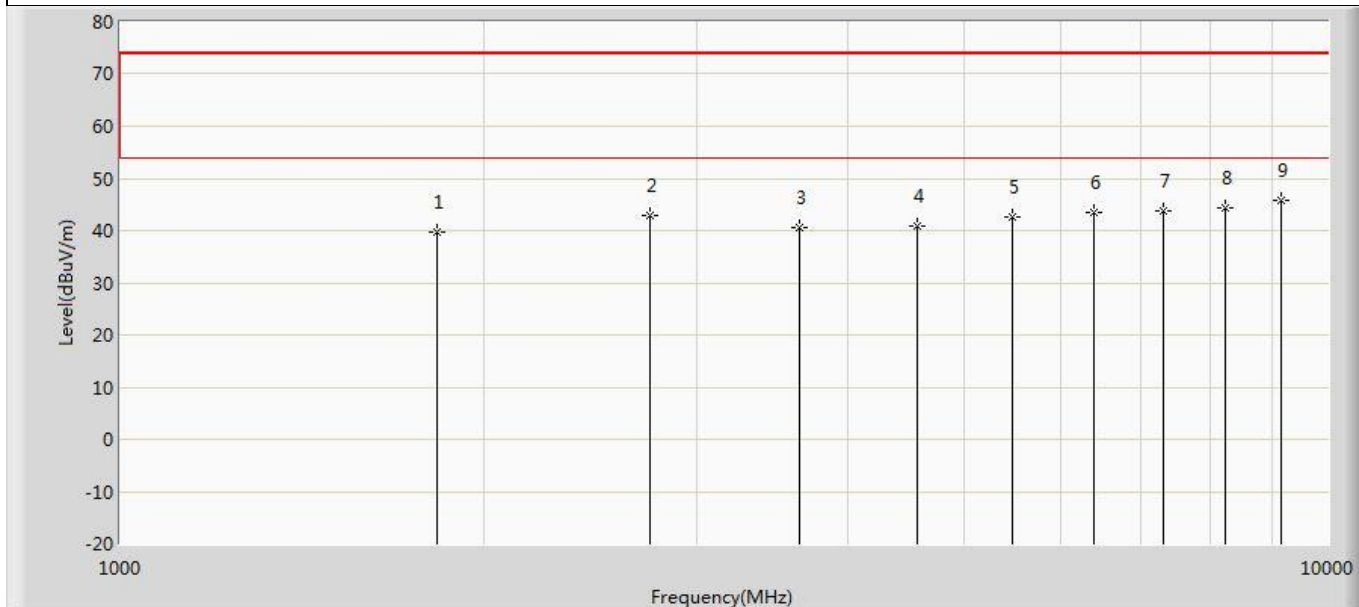
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1815.600	38.971	58.211	-35.029	74.000	-19.240	PK
2		2723.400	40.873	58.280	-33.127	74.000	-17.407	PK
3		3631.200	41.050	57.850	-32.950	74.000	-16.800	PK
4		4539.000	40.045	55.442	-33.955	74.000	-15.398	PK
5		5446.800	41.933	55.170	-32.067	74.000	-13.237	PK
6		6354.600	42.940	54.238	-31.060	74.000	-11.298	PK
7		7262.400	43.827	54.545	-30.173	74.000	-10.718	PK
8		8170.200	44.101	54.880	-29.899	74.000	-10.779	PK
9	*	9078.000	45.662	54.872	-28.338	74.000	-9.210	PK

Profile: 22B0213R	Page No.: 63
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Horizontal
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode 2:Transmit at 914.2MHz by LoRa 500kHz bandwidth	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1828.400	39.424	58.511	-34.576	74.000	-19.087	PK
2		2742.600	43.040	60.471	-30.960	74.000	-17.431	PK
3		3656.800	40.752	57.458	-33.248	74.000	-16.706	PK
4		4571.000	41.022	56.377	-32.978	74.000	-15.355	PK
5		5485.200	42.509	55.748	-31.491	74.000	-13.238	PK
6		6399.400	43.664	54.985	-30.336	74.000	-11.320	PK
7		7313.600	44.221	55.073	-29.779	74.000	-10.851	PK
8		8227.800	43.909	54.626	-30.091	74.000	-10.716	PK
9	*	9142.000	45.352	54.478	-28.648	74.000	-9.127	PK

Profile: 22B0213R	Page No.: 64
Engineer: Yu Liu	
Site: AC5	Time: 2022/12/02 - 01:57
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)2022	Polarity: Vertical
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode 2:Transmit at 914.2MHz by LoRa 500kHz bandwidth	

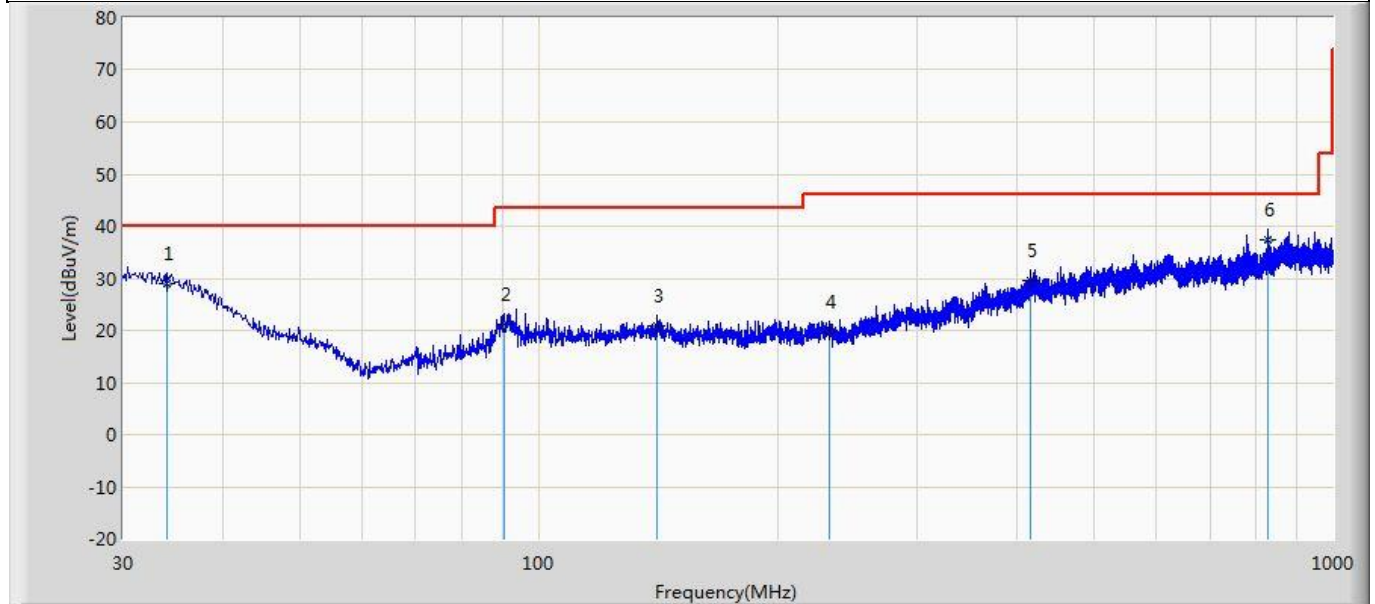


No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1828.400	39.624	58.711	-34.376	74.000	-19.087	PK
2		2742.600	42.877	60.308	-31.123	74.000	-17.431	PK
3		3656.800	40.467	57.173	-33.533	74.000	-16.706	PK
4		4571.000	40.869	56.224	-33.131	74.000	-15.355	PK
5		5485.200	42.615	55.854	-31.385	74.000	-13.238	PK
6		6399.400	43.538	54.859	-30.462	74.000	-11.320	PK
7		7313.600	43.713	54.565	-30.287	74.000	-10.851	PK
8		8227.800	44.231	54.948	-29.769	74.000	-10.716	PK
9	*	9142.000	45.794	54.920	-28.206	74.000	-9.127	PK

Remark	<p>1. " * ", means this data is the worst emission level.</p> <p>2. Measurement Level = Reading Level + Factor(Probe+Cable-Amp).</p> <p>3. The test frequency range, 9kHz~30MHz is at least 6dB below the limits, therefore no data appear in the report.</p> <p>4. 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.</p>
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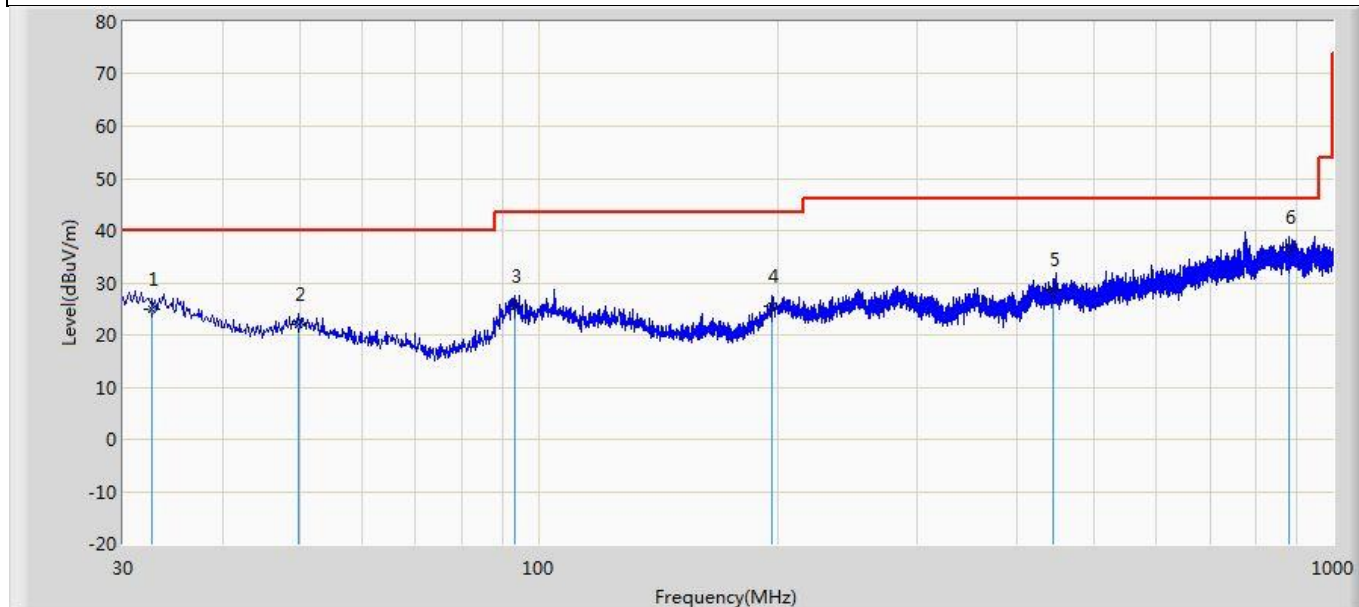
The worst case of Radiated Emission below 1GHz:

Profile: 22B0213R	Page No.: 60
Engineer: Yu Liu	
Site: AC2	Time: 2022/11/30 - 21:06
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Horizontal
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode 2: Transmit at 914.2MHz by LoRa 500kHz bandwidth	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		34.123	29.025	1.965	-10.975	40.000	27.060	QP
2		90.382	21.258	7.631	-22.242	43.500	13.626	QP
3		141.065	20.813	3.550	-22.687	43.500	17.263	QP
4		232.488	19.806	1.844	-26.194	46.000	17.962	QP
5		415.575	29.617	3.171	-16.383	46.000	26.446	QP
6	*	828.674	37.466	5.740	-8.534	46.000	31.726	QP

Profile: 22B0213R	Page No.: 61
Engineer: Yu Liu	
Site: AC2	Time: 2022/11/30 - 21:09
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: AC2_3M(30-1000M)	Polarity: Vertical
EUT: Geolocation Module	Power: DC 3.3V
Note: Mode 2: Transmit at 914.2MHz by LoRa 500kHz bandwidth	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		32.546	25.039	1.830	-14.961	40.000	23.210	QP
2		49.885	22.049	2.613	-17.951	40.000	19.436	QP
3		93.171	25.418	6.659	-18.082	43.500	18.759	QP
4		196.961	25.453	2.745	-18.047	43.500	22.708	QP
5		444.069	28.753	2.754	-17.247	46.000	25.999	QP
6	*	879.963	36.849	3.421	-9.151	46.000	33.428	QP

Remark	<p>1. " * ", means this data is the worst emission level.</p> <p>2. Measurement Level = Reading Level + Factor(Probe+Cable-Amp).</p> <p>3. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.</p>
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4.3 Emissions in non-restricted frequency band	VERDICT: PASS
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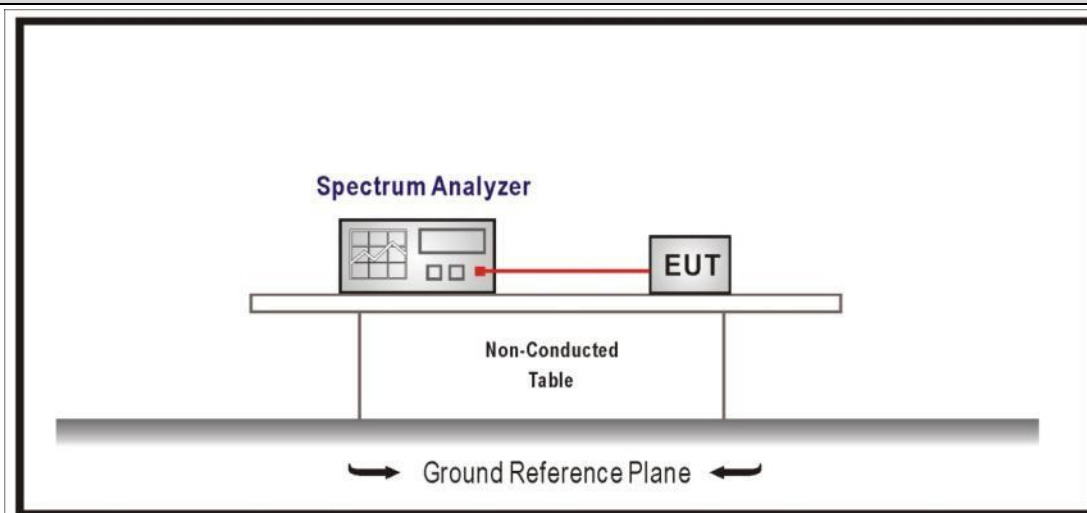
4.3.1 Limit

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

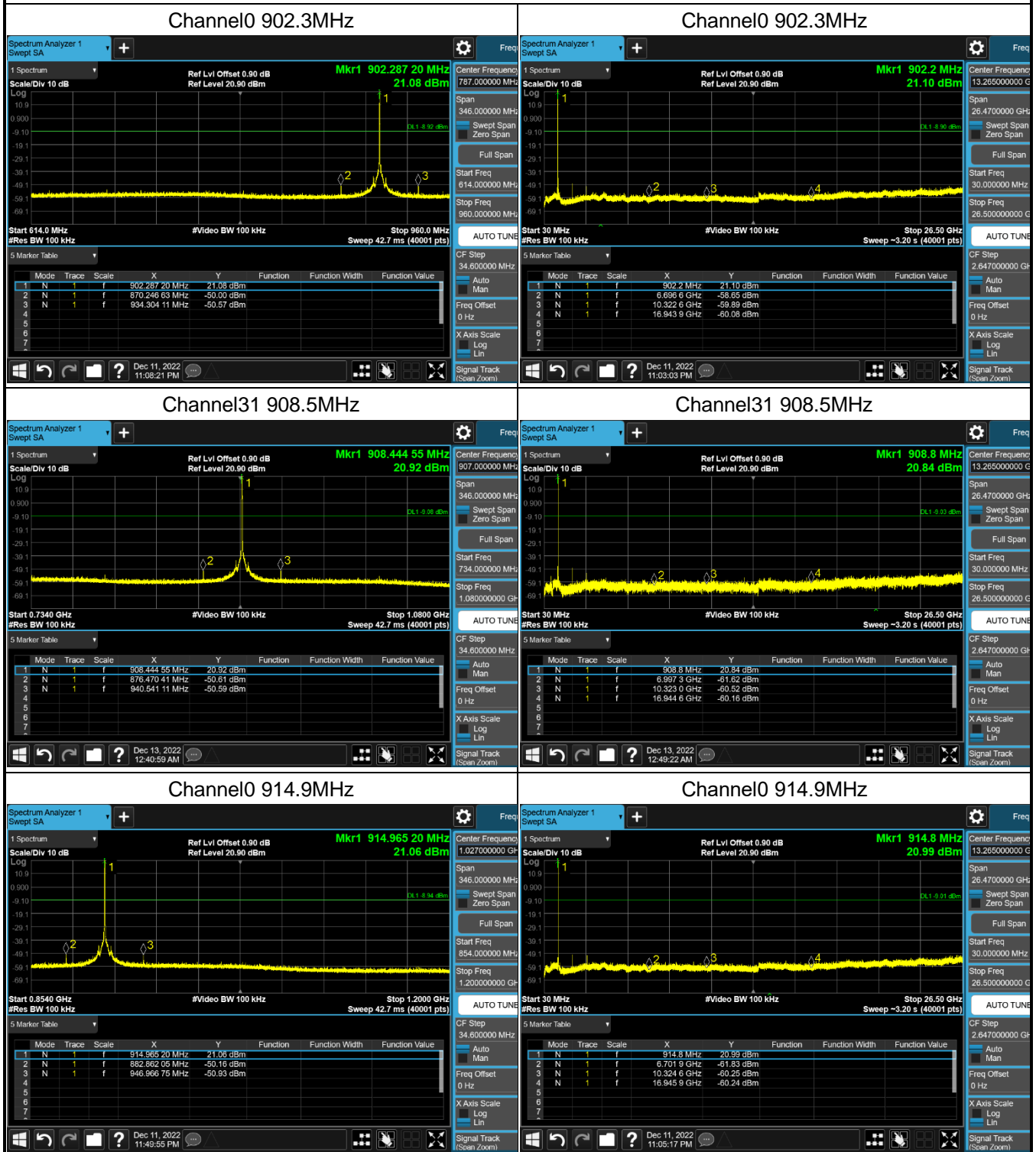


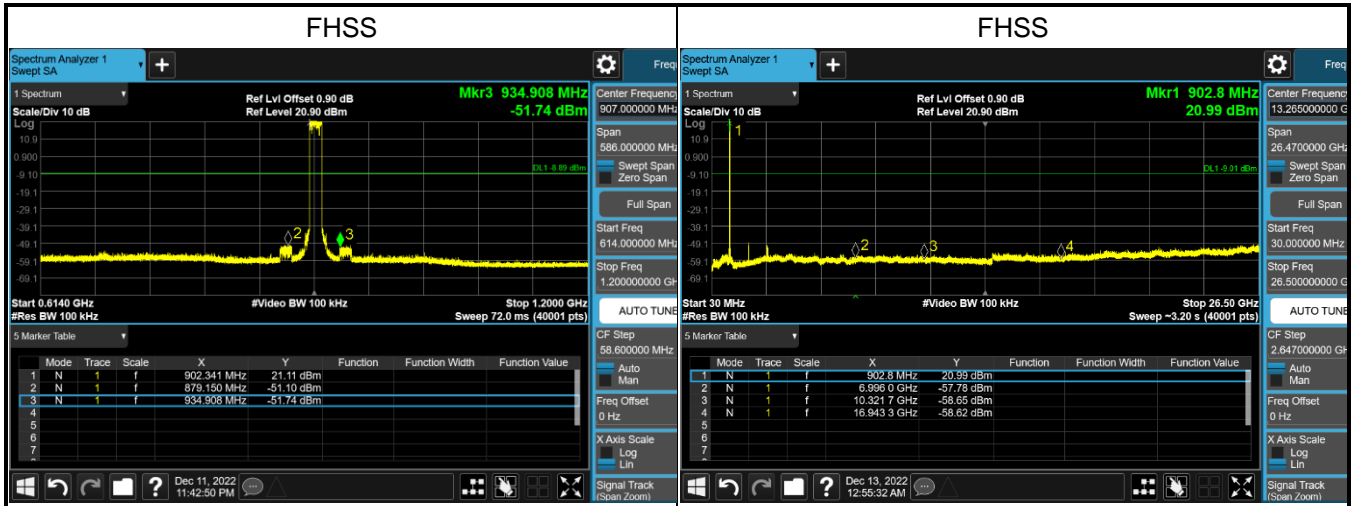
4.3.3 Test Procedure

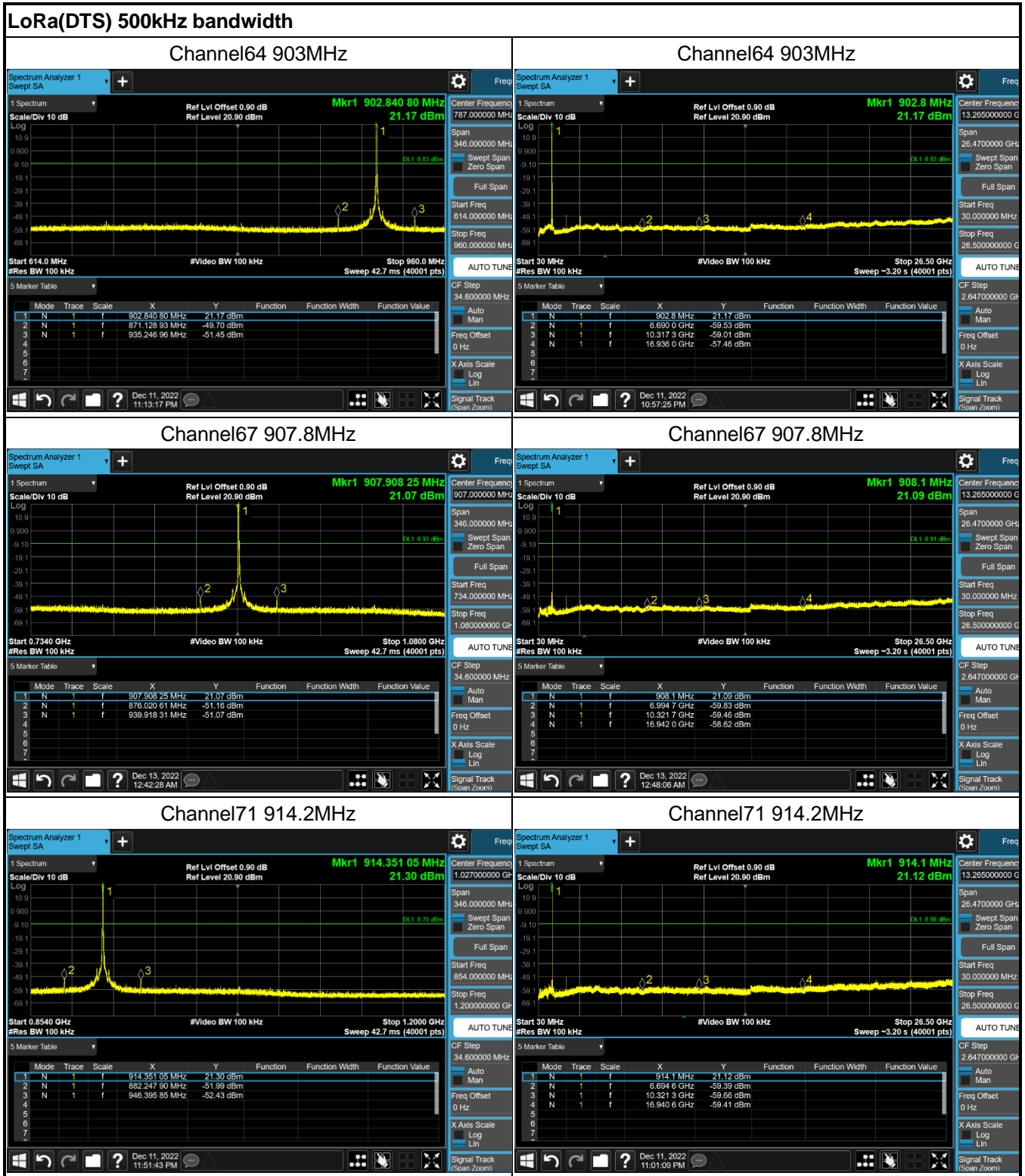
References Rule	Chapter	Description
<input checked="" type="checkbox"/> ANSI C63.10	11.11	Emissions in non-restricted frequency bands
<input checked="" type="checkbox"/> ANSI C63.10	11.11.1	General
<input checked="" type="checkbox"/> ANSI C63.10	11.11.2	Reference level measurement
<input checked="" type="checkbox"/> ANSI C63.10	11.11.3	Emission level measurement

4.3.4 Test Data

LoRa(FHSS) 125kHz bandwidth







4.4 Radiated Emission Band Edge	VERDICT: N/A
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4.4.1 Limit

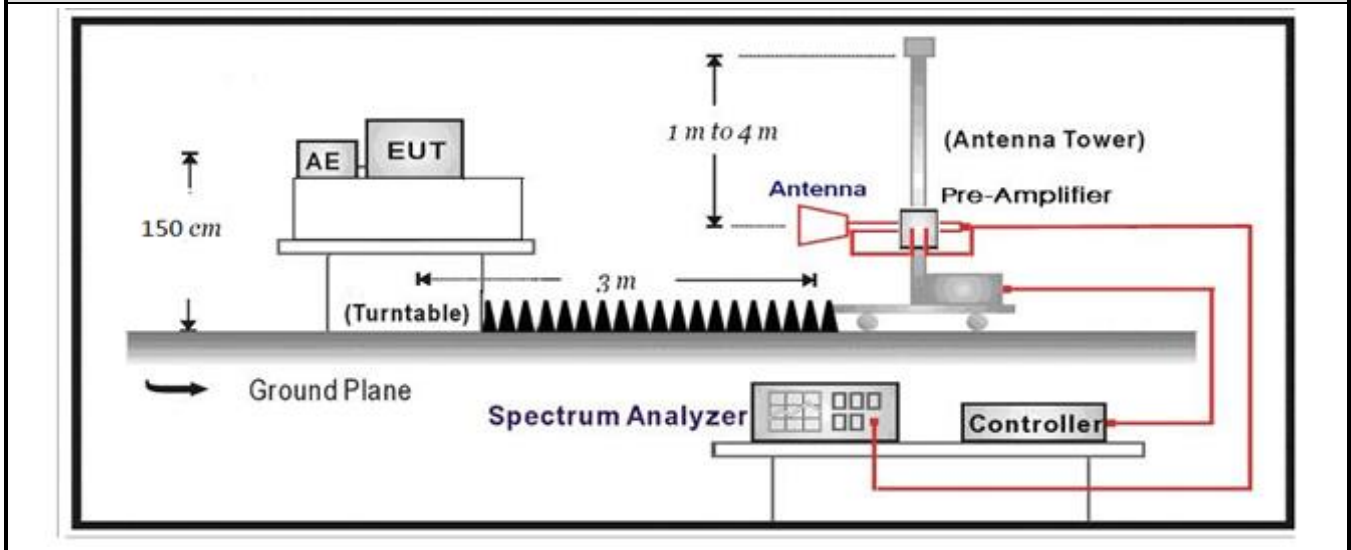
Standard FCC Part 15 Subpart C Paragraph 15.247(d) , 15.205, 15.209

Frequency bands (MHz)	Detector	Limit (dB μ V/m)	RBW (MHz)	Distance (m)
2310-2390	PK	74	1	3
2483.5-2500	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
<input checked="" type="checkbox"/>	ANSI C63.10	6.10	Band-edge testing
	<input checked="" type="checkbox"/> ANSI C63.10	6.10.5	Restricted-band band-edge measurements
	<input type="checkbox"/> ANSI C63.10	6.10.6	Marker-delta method
<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	6.3	Radiated spurious emission test
<input type="checkbox"/>	ANSI C63.10	6.4	Radiated emissions from unlicensed wireless devices below 30 MHz
<input 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
	<input type="checkbox"/> ANSI C63.10	11.12.2	Antenna-port conducted measurements
	<input type="checkbox"/> ANSI C63.10	11.12.2.3	Quasi-peak measurement procedure
	<input type="checkbox"/> ANSI C63.10	11.12.2.4	Peak power measurement procedure
	<input type="checkbox"/> ANSI C63.10	11.12.2.5	Average power measurement procedures
	<input type="checkbox"/> ANSI C63.10	11.12.2.5.1	Trace averaging with continuous EUT transmission at full power
	<input type="checkbox"/> ANSI C63.10	11.12.2.5.2	Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction
	<input type="checkbox"/> 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).
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4.5 6dB and 20dB Bandwidth	VERDICT: PASS
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4.5.1 Limit

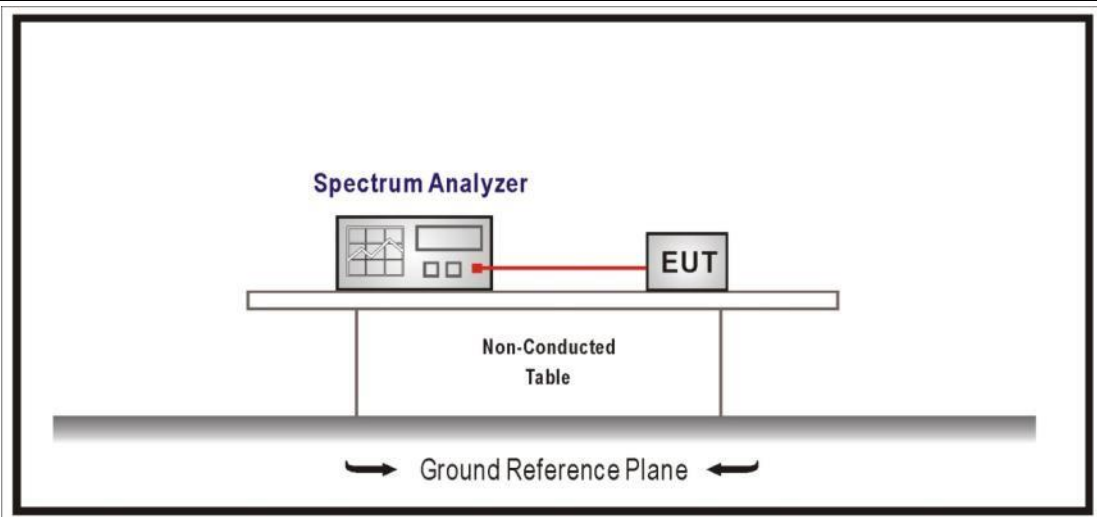
Standard	FCC Part 15 Subpart C Paragraph 15.247 (a)(1)(2)
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- (1) Systems using digital modulation techniques operate in the 2400-2483.5 MHz. The minimum 6 dB bandwidth shall be at least 500 kHz
- (2) For frequency hopping systems operating in 902-928 MHz band, the maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Standard	ANSI C63.10 Paragraph 6.7
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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 be within the required frequency range.

4.5.2 Test Setup



4.5.3 Test Procedure

	Reference Rule	Chapter	Description
<input checked="" type="checkbox"/>	ANSI C63.10	11.8	DTS bandwidth
<input type="checkbox"/>	ANSI C63.10	11.8.1	Option 1
<input checked="" type="checkbox"/>	ANSI C63.10	11.8.2	Option 2
<input checked="" type="checkbox"/>	ANSI C63.10	6.9	Occupied bandwidth
<input type="checkbox"/>	ANSI C63.10	6.9.2	relative measurement procedure
<input checked="" type="checkbox"/>	ANSI C63.10	6.9.3	power bandwidth (99%) measurement procedure

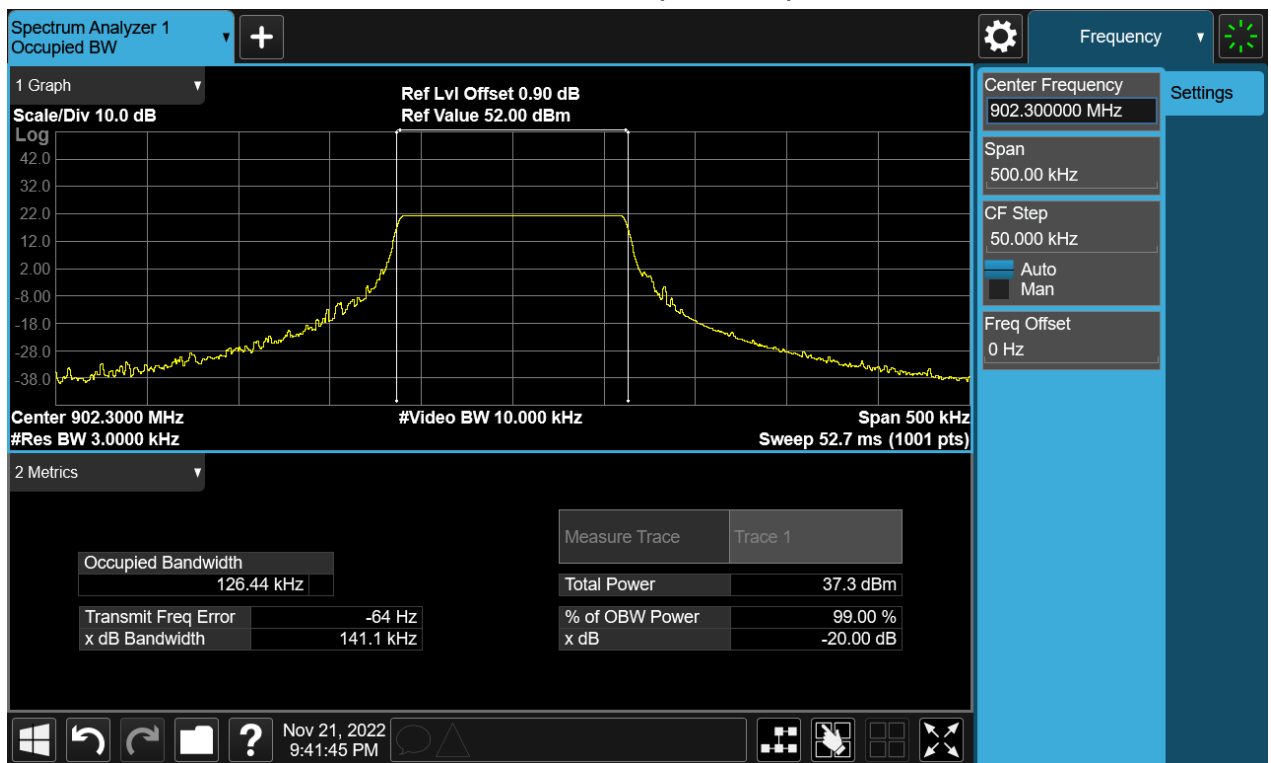
4.5.4 Test Data

Mode	CH.	Test Freq. (MHz)	20dB Occupied Bandwidth (kHz)	Limit (kHz)	Result
1	00	902.3	141.1	≤500	Pass
	31	908.5	139.0	≤500	Pass
	63	914.9	139.5	≤500	Pass

Note : The worst case of Occupied Bandwidth as below in next page:

20dB Occupied Bandwidth

Mode 1 CH00 (902.3MHz)

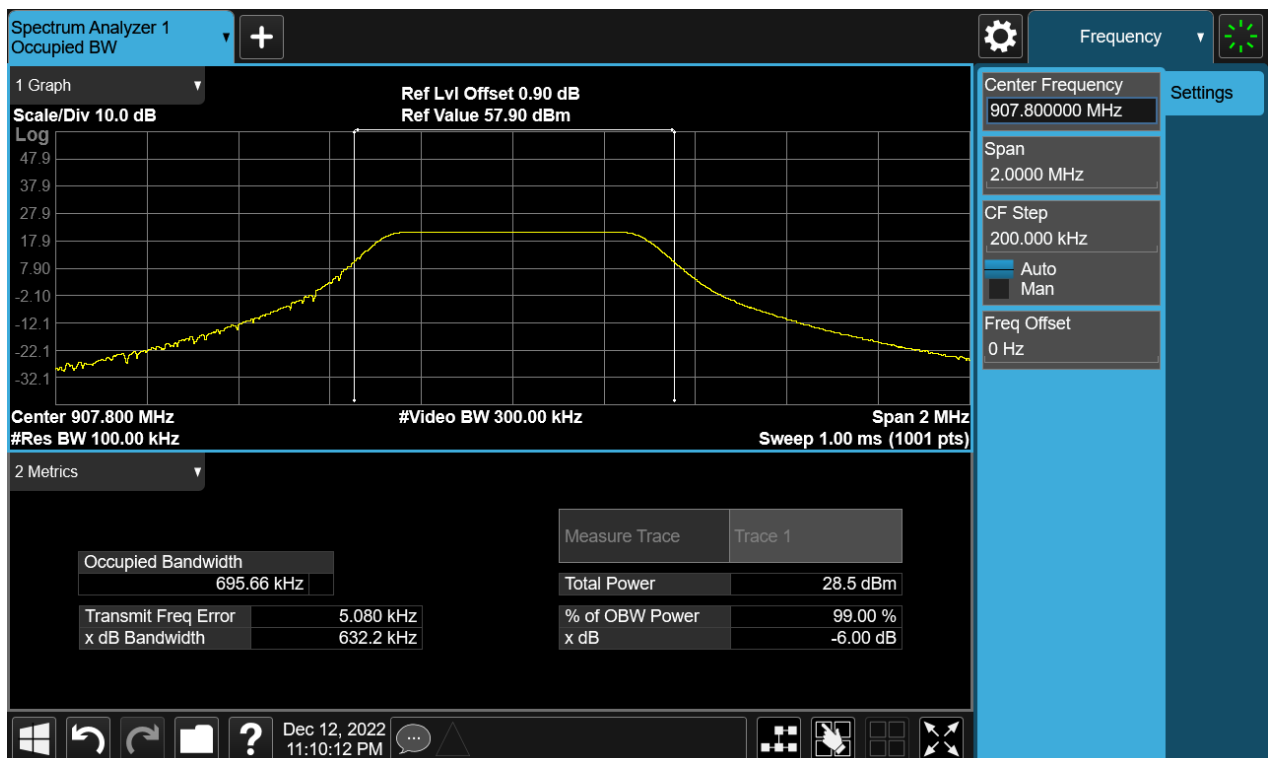


Mode	CH.	Test Freq. (MHz)	6dB Occupied Bandwidth (KHz)	Limit (kHz)	Result
2	64	903	635.3	≥500	Pass
	67	907.8	632.2	≥500	Pass
	71	914.2	635.9	≥500	Pass

Note : The worst case of Occupied Bandwidth as below in next page:

6dB Occupied Bandwidth

Mode 2 CH67 (907.8MHz)

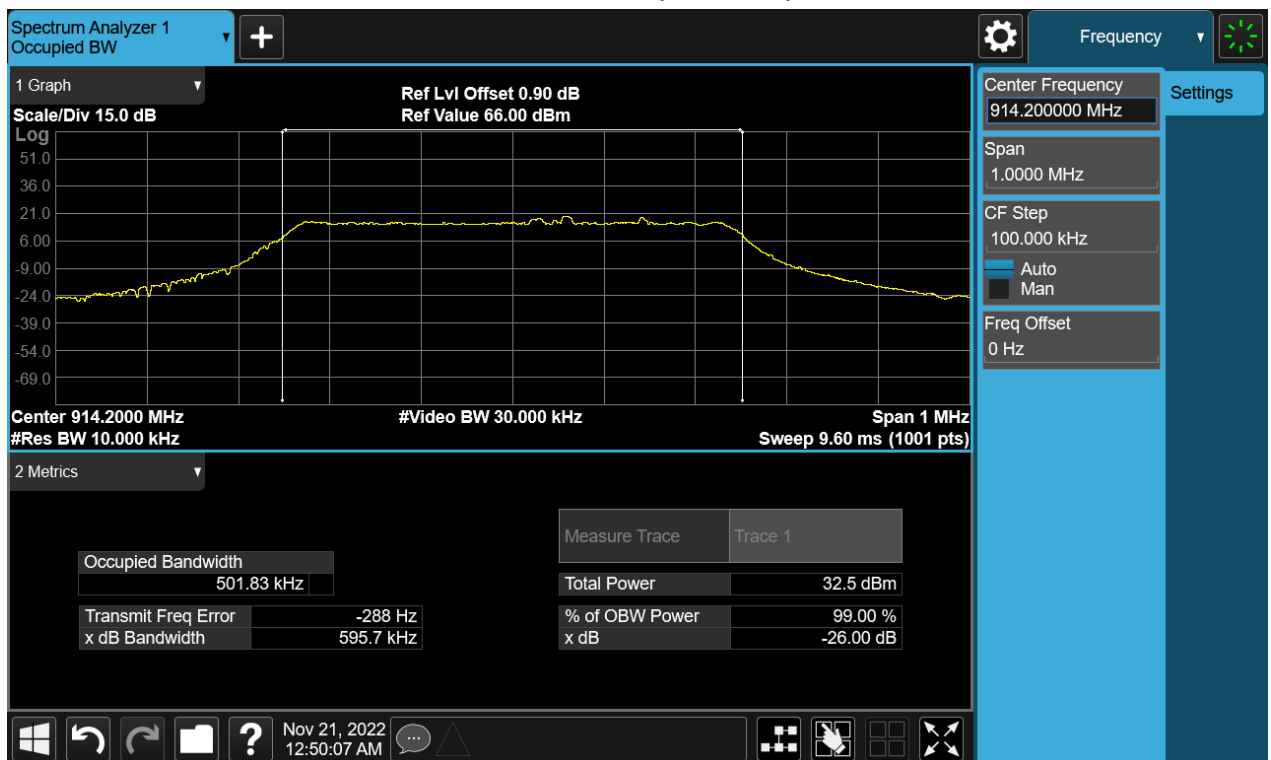


Mode	CH.	Test Freq. (MHz)	99% Occupied Bandwidth (kHz)	Limit	Result
1	00	902.3	126.13	Within frequency range	Pass
	31	908.5	126.32	Within frequency range	Pass
	63	914.9	126.06	Within frequency range	Pass
2	64	903.0	501.55	Within frequency range	Pass
	67	907.8	501.20	Within frequency range	Pass
	71	914.2	501.83	Within frequency range	Pass

Note : The worst case of Occupied Bandwidth as below in next page:

99% Occupied Bandwidth

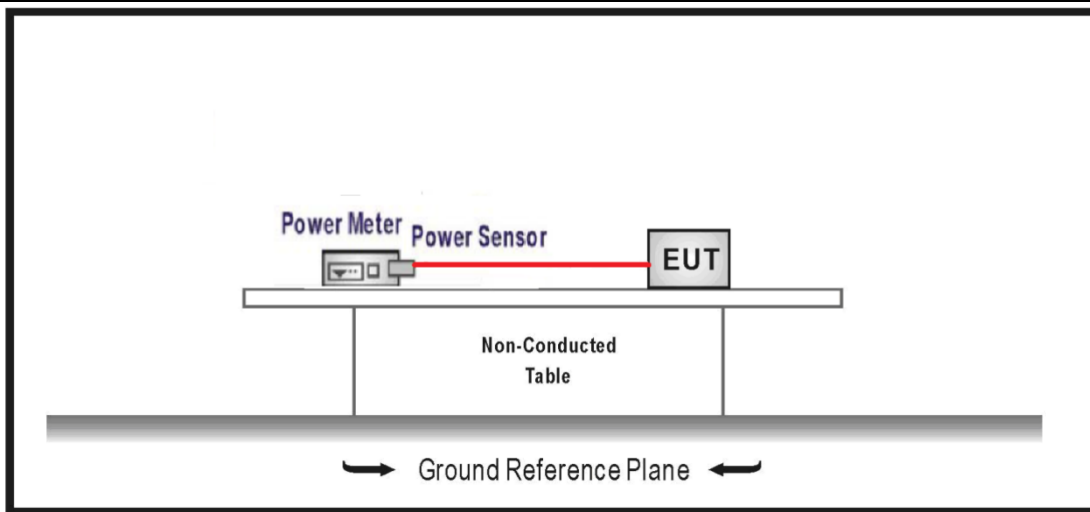
Mode 2 CH71 (914.2MHz)



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

4.6.1 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	
<input checked="" type="checkbox"/>	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
<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 checked="" 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 checked="" 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
<input checked="" type="checkbox"/>	ANSI C63.10		7.8.5	Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices

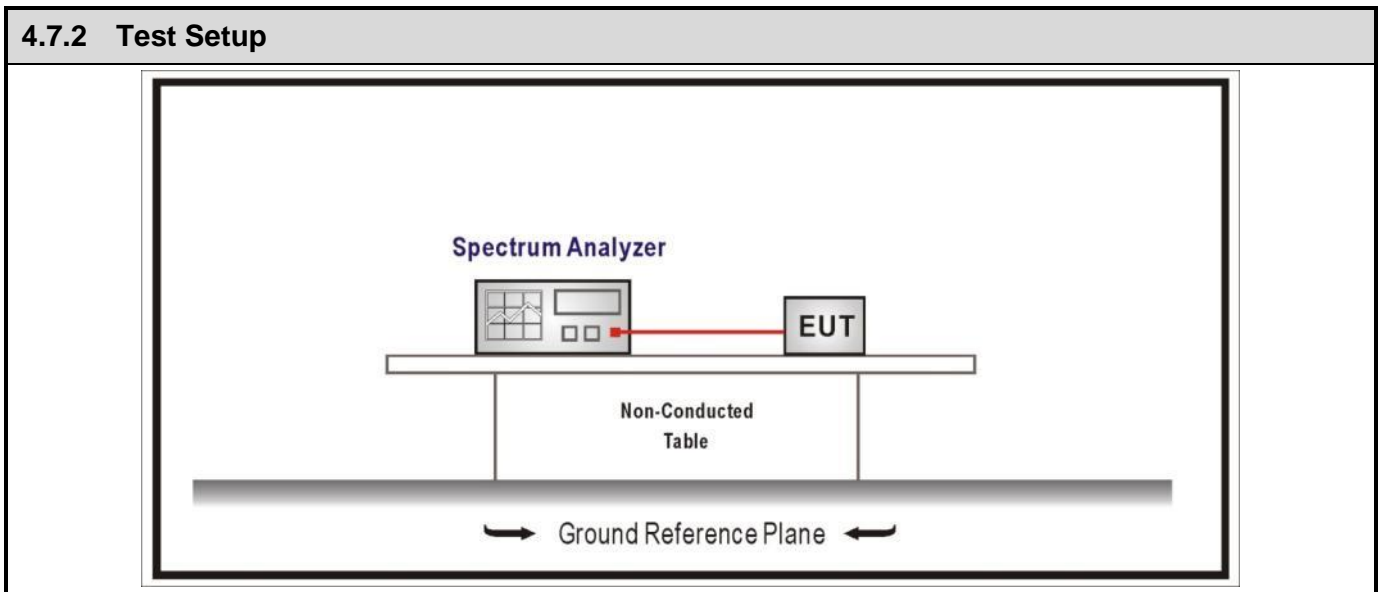
4.6.4 Test Data							
Mode	Channel	Test Frequency (MHz)	Output Power (dBm)	E.I.R.P (dBm)	Conducted Limit (dBm)	E.I.R.P Limit (dBm)	Result
1	00	902.3	20.94	20.94	30.00	36.00	Pass
	31	908.5	20.92	20.92	30.00	36.00	Pass
	63	914.9	20.89	20.89	30.00	36.00	Pass
2	64	903.0	20.98	20.98	30.00	36.00	Pass
	67	907.8	20.93	20.93	30.00	36.00	Pass
	71	914.2	20.90	20.90	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
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4.7.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 15.247 (e)
Power Spectral Density $\leq 8\text{dBm}/3\text{kHz}$	



4.7.3 Test Procedure

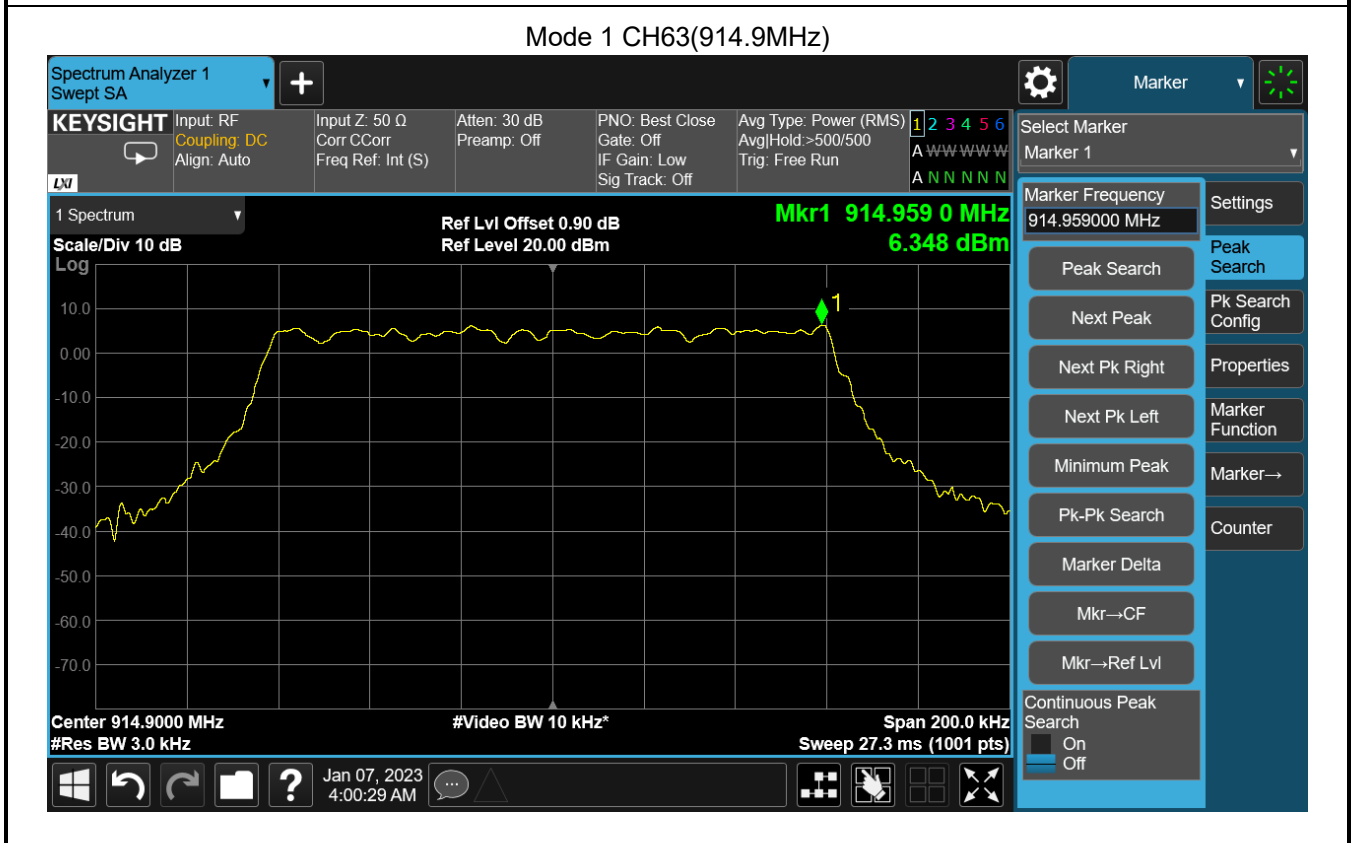
	References Rule	Chapter	Description
<input checked="" type="checkbox"/>	ANSI C63.10	11.10	Maximum power spectral density level in the fundamental emission
<input type="checkbox"/>	ANSI C63.10	11.10.2	Method PKPSD (peak PSD)
<input type="checkbox"/>	ANSI C63.10	11.10.3	Method AVGPSD-1(Duty cycle $\geq 98\%$)
<input type="checkbox"/>	ANSI C63.10	11.10.4	Method AVGPSD-1A(Duty cycle $\geq 98\%$)
<input checked="" type="checkbox"/>	ANSI C63.10	11.10.5	Method AVGPSD-2(Duty cycle $< 98\%$)
<input type="checkbox"/>	ANSI C63.10	11.10.6	Method AVGPSD-2A(Duty cycle $< 98\%$)
<input type="checkbox"/>	ANSI C63.10	11.10.7	Method AVGPSD-3
<input type="checkbox"/>	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	00	902.3	6.274	6.549	≤8	Pass
	31	908.5	6.229	6.504	≤8	Pass
	63	914.9	6.348	6.623	≤8	Pass
2	64	903.0	-5.703	0.807	≤8	Pass
	67	907.8	-5.192	1.318	≤8	Pass
	71	914.2	-5.325	1.185	≤8	Pass

Note 1: Measurement PSD = Reading level + Duty factor

Note 2: The worst data as below:

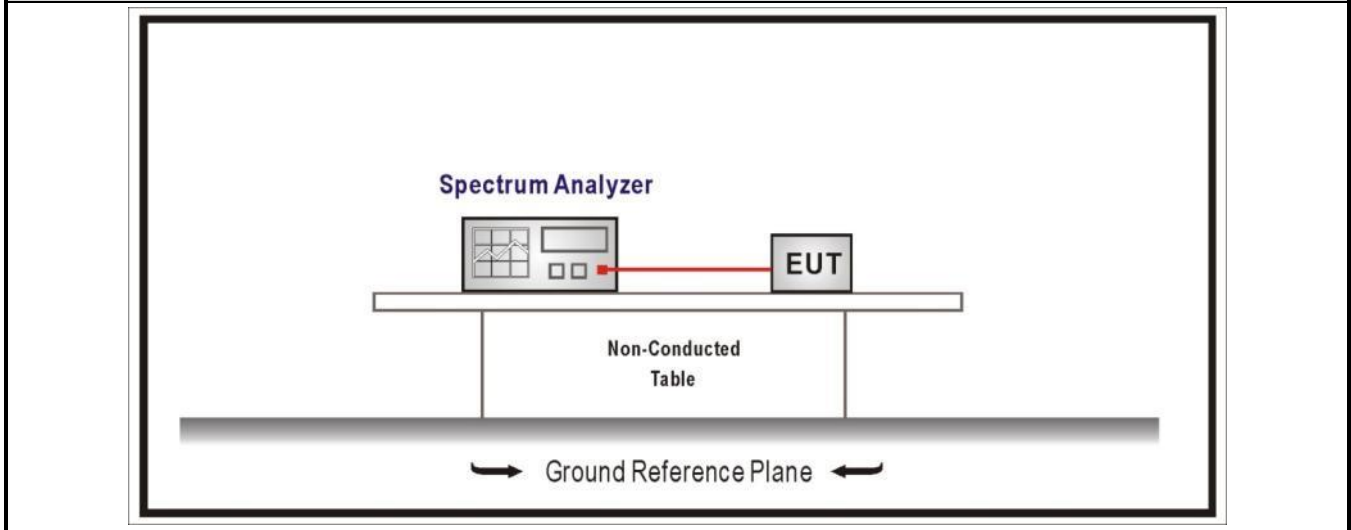


4.8 Carrier Frequency Separation	VERDICT: PASS
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4.8.1 Limit:

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

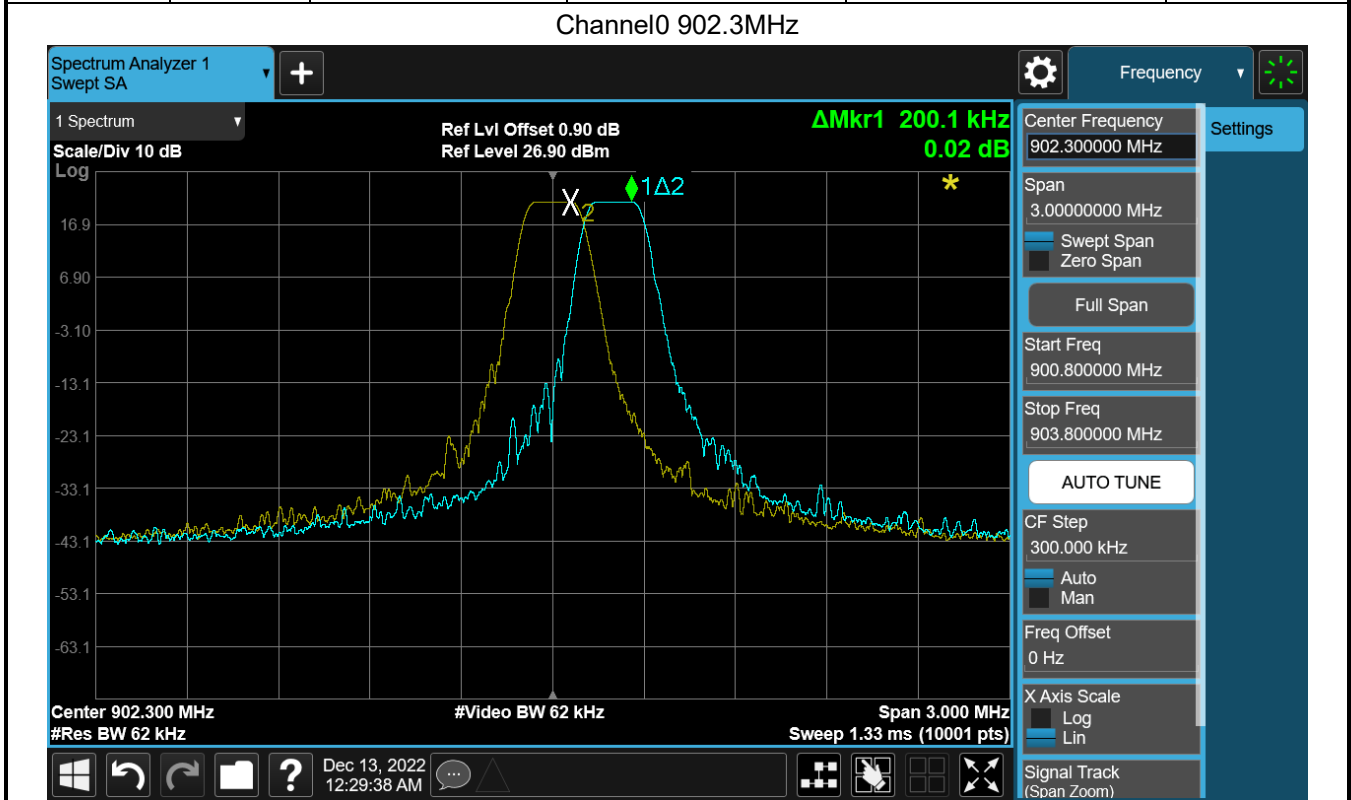


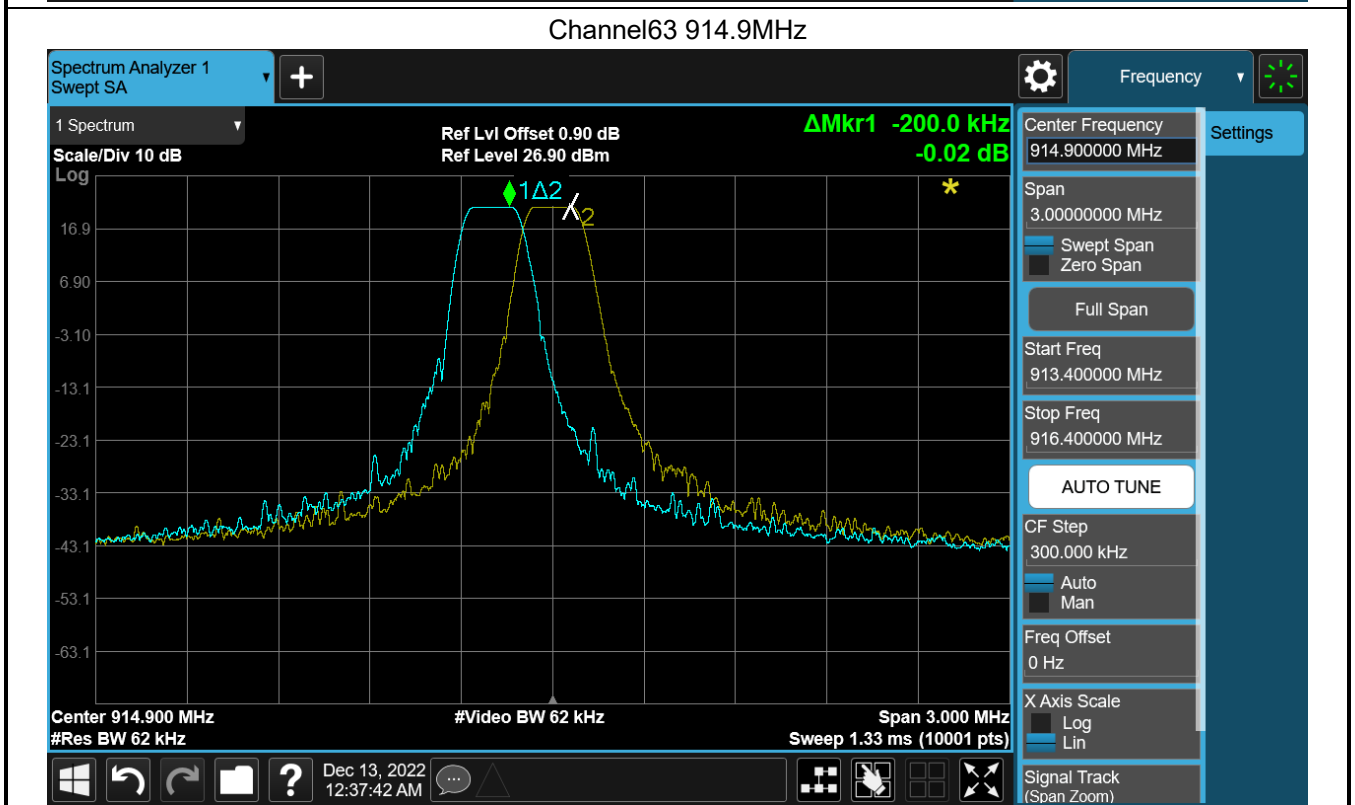
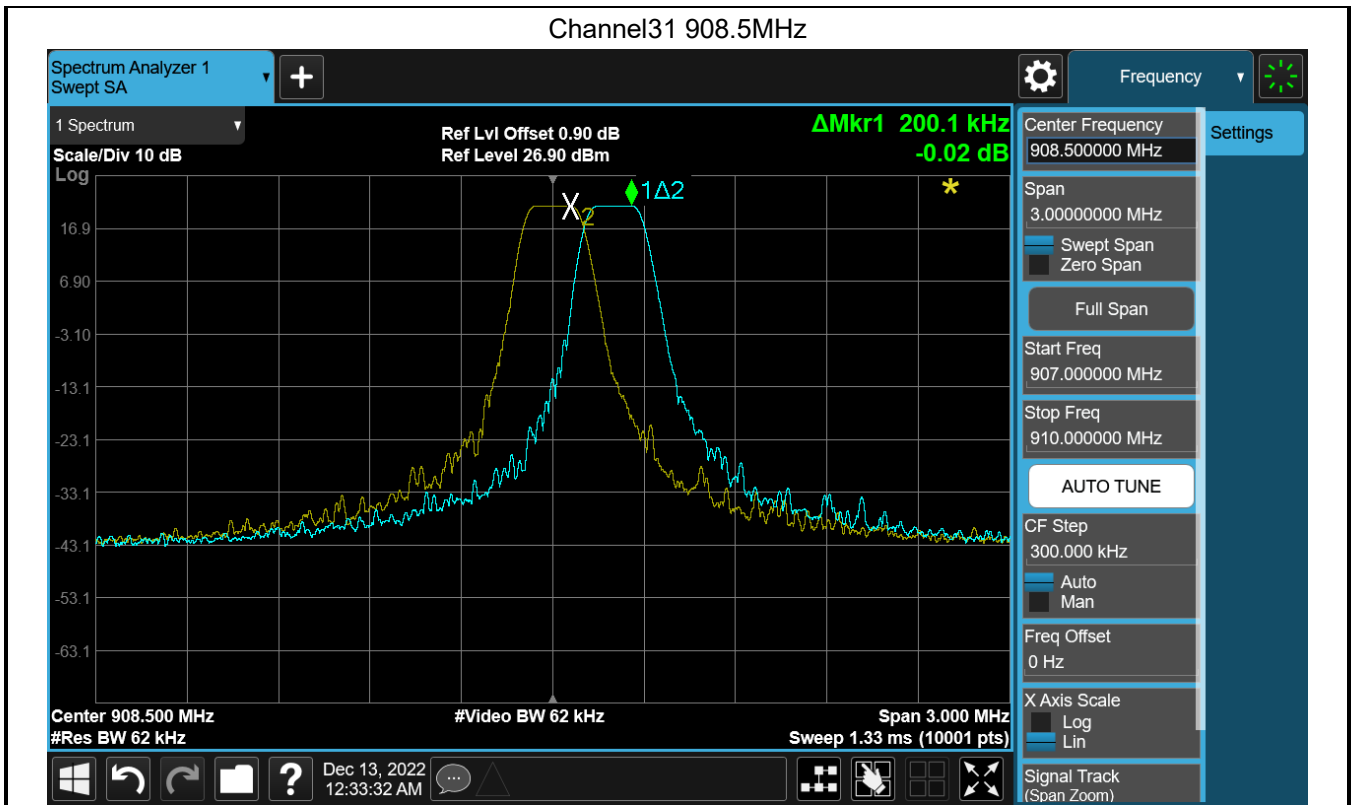
4.8.3 Test Procedure

	References Rule	Chapter	Description
<input checked="" type="checkbox"/>	ANSI C63.10	7.8.2	Carrier frequency separation

4.8.4 Test Data

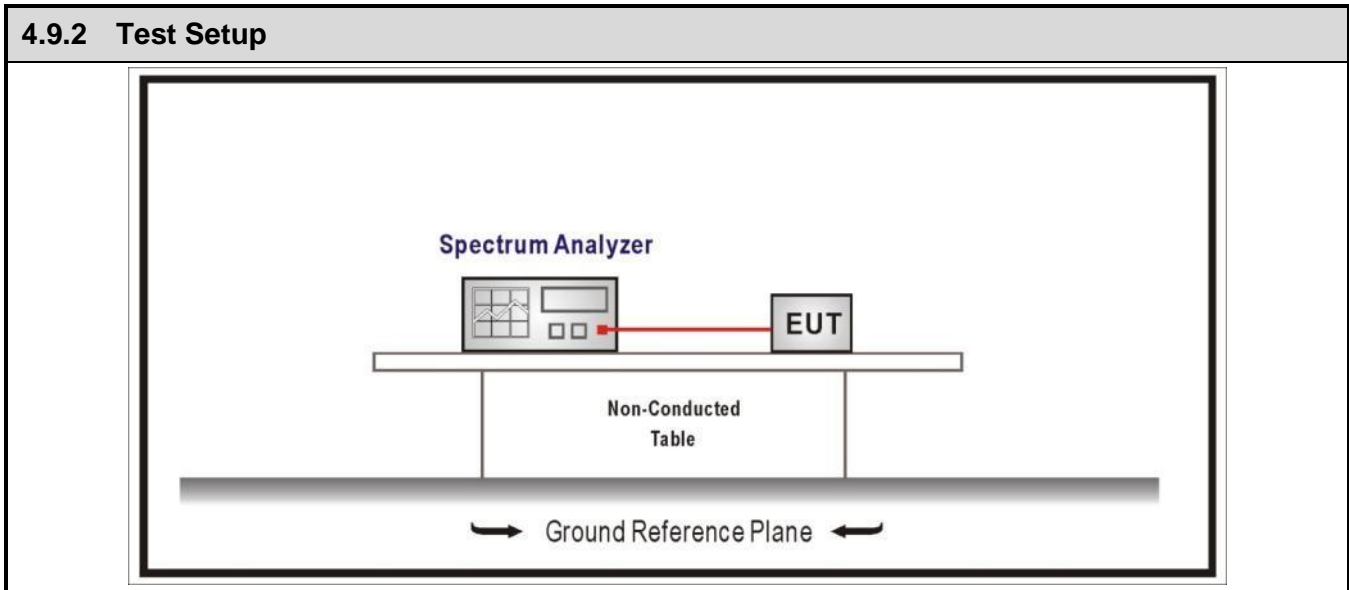
Mode	Channel	Test Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
1	00	902.3	200.1	≥ 141.1	Pass
	31	908.5	200.1	≥ 139.0	Pass
	63	914.9	200	≥ 139.5	Pass





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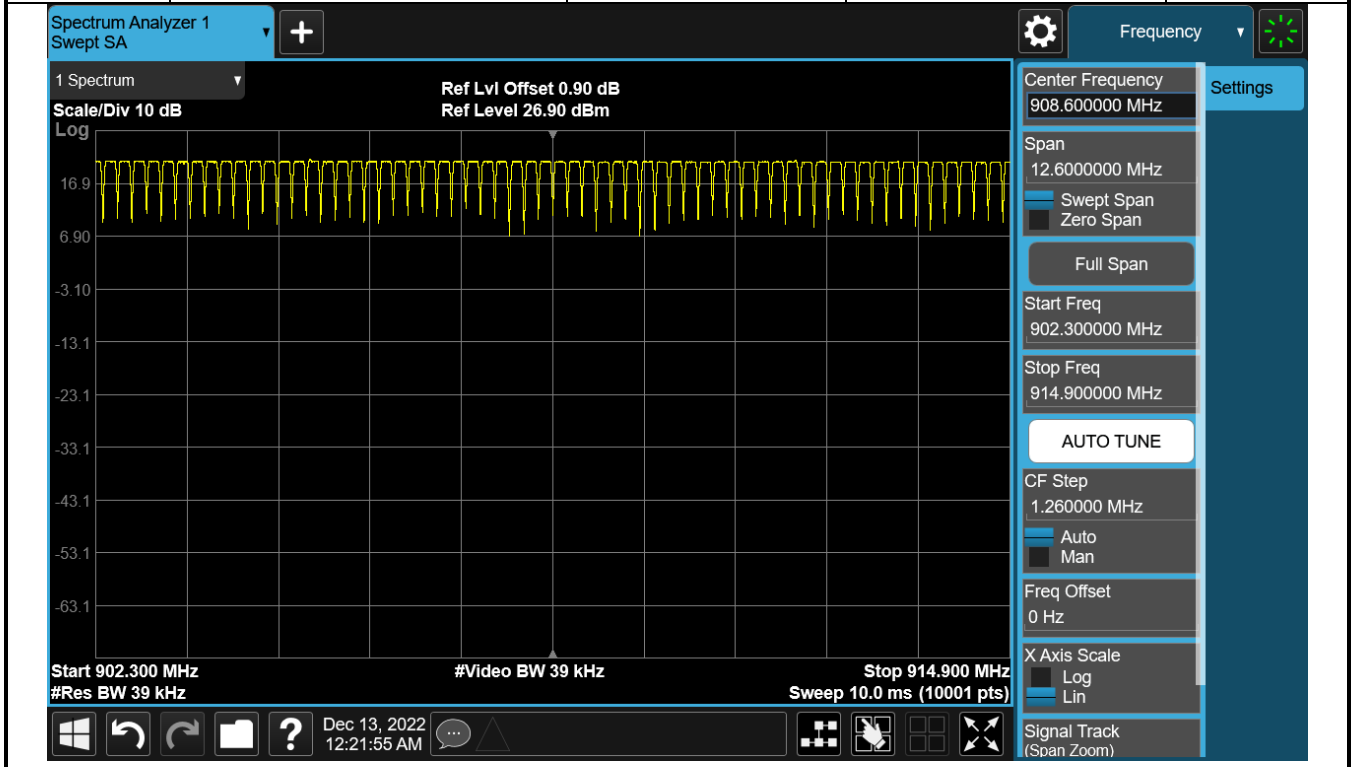
4.9.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 15.247 15.247(a)(1) (iii)
For frequency hopping systems operating in 902-928 MHz band, if the 20 dB bandwidth of the hopping channel is less than 250 kHz, shall use at least 50 hopping frequencies.	



4.9.3 Test Procedure			
	References Rule	Chapter	Description
<input checked="" type="checkbox"/>	ANSI C63.10	7.8.3	Number of Hopping Frequencies

4.9.4 Test Data

Mode	Frequency Band	Number of Hopping Frequencies	Limit	Result
1	902~928MHz	64	50	Pass

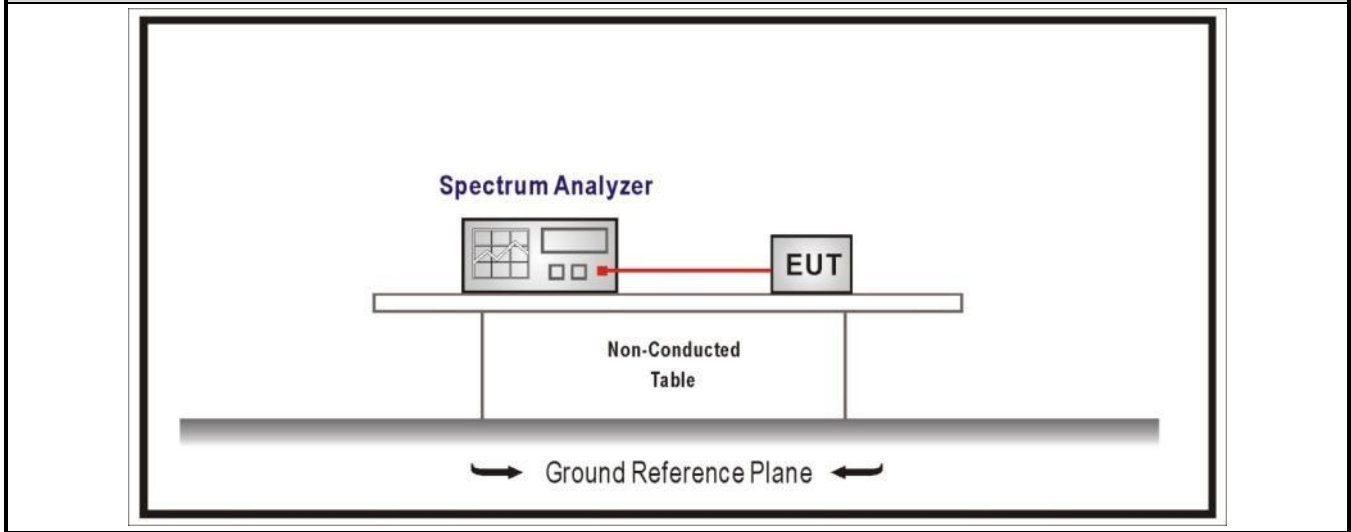


4.10 Time of Occupancy (Dwell Time)	VERDICT: PASS
--	----------------------

4.10.1 Limit:

Standard	FCC Part 15 Subpart C Paragraph 15.247(a)(1)(iii)
<p>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</p>	

4.10.2 Test Setup

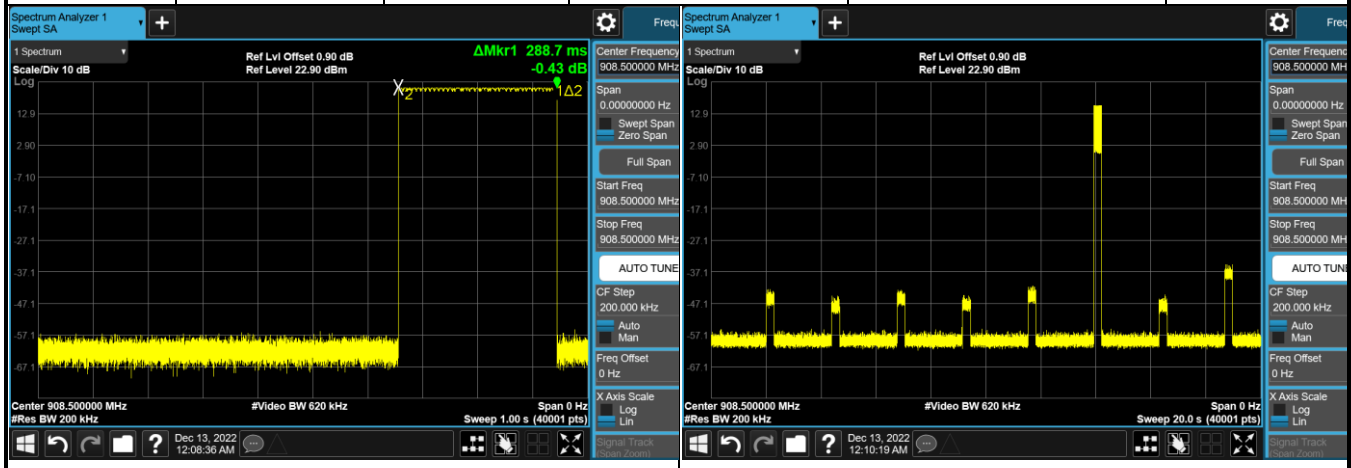


4.10.3 Test Procedure

	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
1	36	98.5	288.7	≤400	Pass



4.11 Antenna Requirement	VERDICT: PASS
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4.11.1 Limit:	
Standard	FCC Part 15 Subpart C Paragraph 15.203
<p>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.</p> <p>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.</p>	

4.11.2 Antenna Connector Construction:	
<input type="checkbox"/>	The use of a permanently attached antenna
<input type="checkbox"/>	The antenna use of a unique coupling to the intentional radiator
<input type="checkbox"/>	The use of a nonstandard antenna jack or electrical connector
<input checked="" type="checkbox"/>	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
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Remark: The test setup photo and EUT Photo please see appendix.

_____ The End _____