

FCC Test Report

Client Name : EcoFlow Inc.

Client Address : Plant A202, Founder Technology Industrial
Park, Shiyan Sub-district, Bao'an District
Shenzhen, Guangdong 518000 China

Product Name : Robotic Lawnmower

Report Date : Dec. 29, 2022

Shenzhen Anbotek Compliance Laboratory Limited



Shenzhen Anbotek Compliance Laboratory Limited

Address: 1/F., Building D, Sogood Science and Technology Park, Sanwei Community,
Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel: (86) 0755-26066440 Fax: (86) 0755-26014772 Email: service@anbotek.com

Code: AB-RF-05-b



Hotline

400-003-0500

www.anbotek.com.cn



Contents

1. General Information	5
1.1. Client Information	5
1.2. Description of Device (EUT)	5
1.3. Auxiliary Equipment Used During Test	6
1.4. Description of Test Modes	6
1.6. Description Of Test Setup	7
1.7. Test Equipment List	8
1.8. Measurement Uncertainty	9
1.9. Description of Test Facility	9
2. Summary of Test Results	10
3. Conducted Emission Test	11
3.1. Test Standard and Limit	11
3.2. Test Setup	11
3.3. Test Procedure	11
3.4. Test Data	11
4. Radiation Spurious Emission and Band Edge	14
4.1. Test Standard and Limit	14
4.2. Test Setup	14
4.3. Test Procedure	15
4.4. Test Data	16
5. Maximum Peak Output Power Test	22
5.1. Test Standard and Limit	22
5.2. Test Setup	22
5.3. Test Procedure	22
5.4. Test Data	22
6. 20DB Occupy Bandwidth Test	25
6.1. Test Standard	25
6.2. Test Setup	25
6.3. Test Procedure	25
6.4. Test Data	25
7. Carrier Frequency Separation Test	28
7.1. Test Standard and Limit	28
7.2. Test Setup	28
7.3. Test Procedure	28
7.4. Test Data	28
8. Number of Hopping Channel Test	30
8.1. Test Standard and Limit	30
8.2. Test Setup	30



8.3. Test Procedure	30
8.4. Test Data	30
9. Dwell Time Test	32
9.1. Test Standard and Limit	32
9.2. Test Setup	32
9.3. Test Procedure	32
9.4. Test Data	32
10. 100kHz Bandwidth of Frequency Band Edge Requirement	34
10.1. Test Standard and Limit	34
10.2. Test Setup	34
10.3. Test Procedure	34
10.4. Test Data	34
11. Antenna Requirement	39
11.1. Test Standard and Requirement	39
11.2. Antenna Connected Construction	39
APPENDIX I -- TEST SETUP PHOTOGRAPH	40
APPENDIX II -- EXTERNAL PHOTOGRAPH	42
APPENDIX III -- INTERNAL PHOTOGRAPH	42



TEST REPORT

Applicant : EcoFlow Inc.
Manufacturer : EcoFlow Inc.
Product Name : Robotic Lawnmower
Model No. : EFH100
Trade Mark : 
Rating(s) : Input: 36V $\overline{=}$ (with DC 21.6V, 13800mAh Battery inside)
Test Standard(s) : FCC Part15 Subpart C, Section 15.247
Test Method(s) : ANSI C63.10: 2020

The device described above is tested by Shenzhen Anbotech Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotech Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotech Compliance Laboratory Limited.

Date of receipt

Jun. 09, 2022

Date of Test

Jun. 09~Dec. 22, 2022

Prepared by

Tu Tu Hong

(TuTu Hong)

Approved & Authorized Signer

Kingkong Jin

(Kingkong Jin)



1. General Information

1.1. Client Information

Applicant	:	EcoFlow Inc.
Address	:	Plant A202, Founder Technology Industrial Park, Shiyan Sub-district, Bao'an District Shenzhen, Guangdong 518000 China
Manufacturer	:	EcoFlow Inc.
Address	:	Plant A202, Founder Technology Industrial Park, Shiyan Sub-district, Bao'an District Shenzhen, Guangdong 518000 China

1.2. Description of Device (EUT)

Product Name	:	Robotic Lawnmower
Model No.	:	EFH100
Trade Mark	:	
Test Power Supply	:	Voltage of EUT: DC 21.6V Output to RF Module: DC 3.3V
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	N.A.
RF Specification		
Support Technology	:	☒ LoRa
Operation Mode	:	☐ DSSS ☒ FHSS
Support Bandwidth	:	☒ 125KHz ☐ 250KHz ☐ 500KHz
Operation Frequency	:	902~928MHz
Number of Channel	:	127 Channels
Modulation Type	:	LoRa Chirp Spread Spectrum
Antenna Type	:	FPC antenna
Antenna Gain(Peak)	:	0.93 dBi
Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.		



1.3. Auxiliary Equipment Used During Test

Adapter:	:	Model: KT180A3600500US Input: 120V~60Hz 2.5A Output: 36V= 5.0A 180.0W
BL262TH9	:	Model: BL262TH9 Input: 36.0=

1.4. Description of Test Modes

The system was configured for testing in testing mode, which was provided by manufacturer.

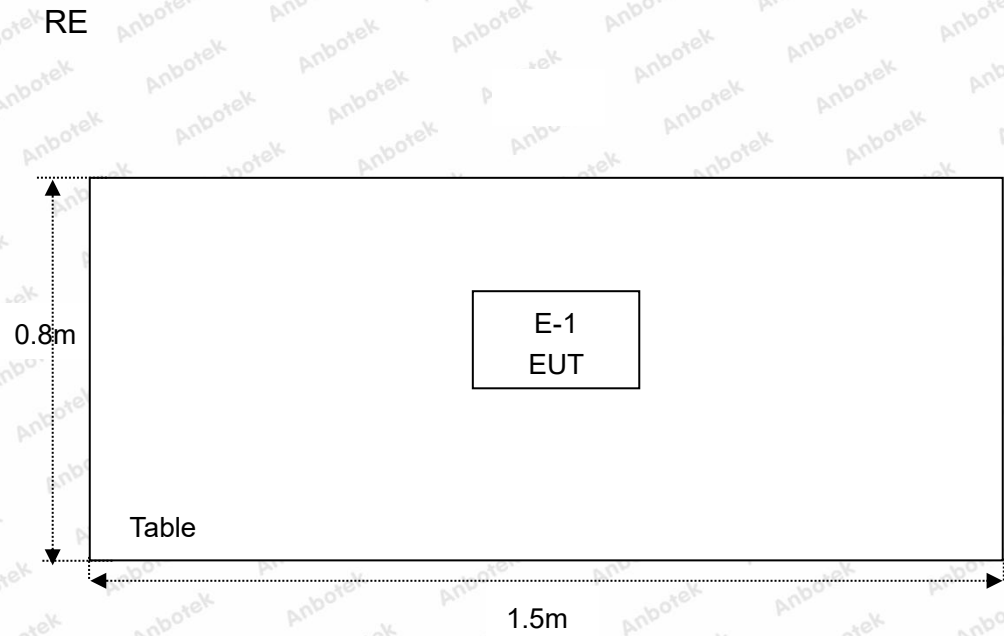
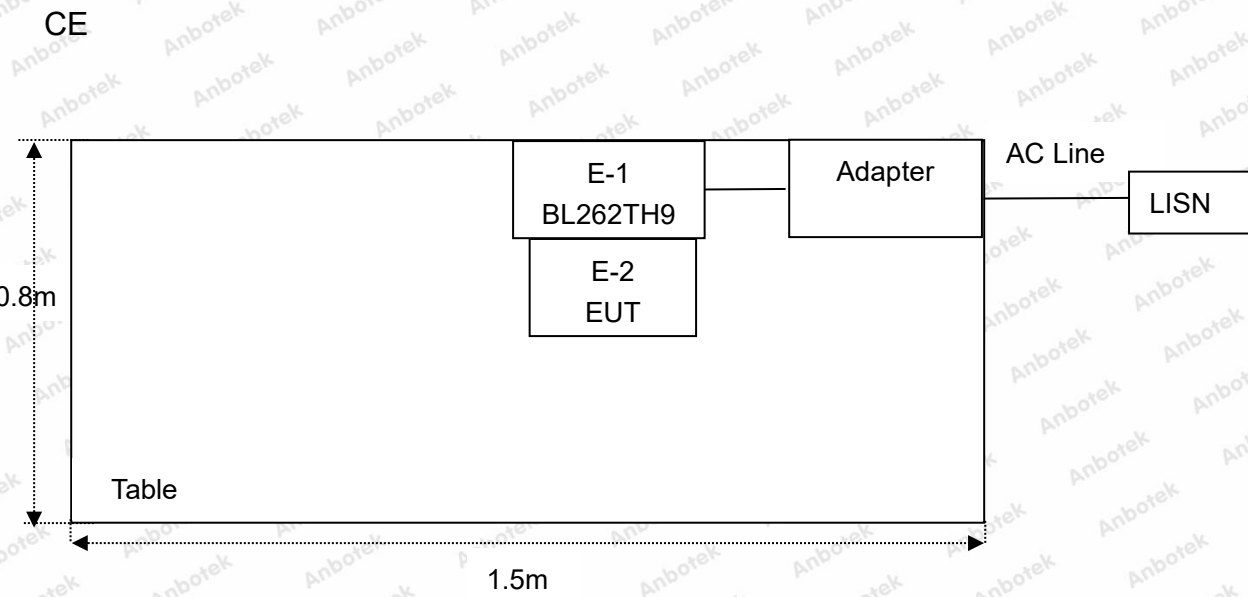
For LoRa mode, Detailed Frequency as below:

Channel I	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.4	33	908.8	65	915.2	97	921.6
2	902.6	34	909.0	66	915.4	98	921.8
3	902.8	35	909.2	67	915.6	99	922.0
4	903.0	36	909.4	68	915.8	100	922.2
5	903.2	37	909.6	69	916.0	101	922.4
6	903.4	38	909.8	70	916.2	102	922.6
7	903.6	39	910.0	71	916.4	103	922.8
8	903.8	40	910.2	72	916.6	104	923.0
9	904.0	41	910.4	73	916.8	105	923.2
10	904.2	42	910.6	74	917.0	106	923.4
11	904.4	43	910.8	75	917.2	107	923.6
12	904.6	44	911.0	76	917.4	108	923.8
13	904.8	45	911.2	77	917.6	109	924.0
14	905.0	46	911.4	78	917.8	110	924.2
15	905.2	47	911.6	79	918.0	111	924.4
16	905.4	48	911.8	80	918.2	112	924.6
17	905.6	49	912.0	81	918.4	113	924.8
18	905.8	50	912.2	82	918.6	114	925.0
19	906.0	51	912.4	83	918.8	115	925.2
20	906.2	52	912.6	84	919.0	116	925.4
21	906.4	53	912.8	85	919.2	117	925.6
22	906.6	54	913.0	86	919.4	118	925.8
23	906.8	55	913.2	87	919.6	119	926.0
24	907.0	56	913.4	88	919.8	120	926.2
25	907.2	57	913.6	89	920.0	121	926.4
26	907.4	58	913.8	90	920.2	122	926.6
27	907.6	59	914.0	91	920.4	123	926.8
28	907.8	60	914.2	92	920.6	124	927.0
29	908.0	61	914.4	93	920.8	125	927.2
30	908.2	62	914.6	94	921.0	126	927.4
31	908.4	63	914.8	95	921.2	127	927.6
32	908.6	64	915.0	96	921.4		

Note: 1. Note: EUT was tested with Channel 1, 64 and 127.



1.6. Description Of Test Setup



1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Oct. 23, 2022	1 Year
2.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul. 05, 2022	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 13, 2022	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 23, 2022	1 Year
5.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 22, 2022	1 Year
6.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 13, 2022	1 Year
7.	EMI Preamplifier	SKET Electronic	LNPA-0118G -45	SKET-PA-002	Oct. 13, 2022	1 Year
8.	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D	02555	Oct. 16, 2022	3 Year
9.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Oct. 23, 2022	1 Year
10.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 23, 2022	1 Year
11.	Horn Antenna	A-INFO	LB-180400-K F	J211060628	Oct. 23, 2022	1 Year
12.	Pre-amplifier	SONOMA	310N	186860	Oct. 23, 2022	1 Year
13.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
14.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 13, 2022	1 Year
15.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 13, 2022	1 Year
16.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 13, 2022	1 Year
17.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2022	1 Year
18.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80 B	N/A	Oct. 19, 2022	1 Year



1.8. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
	:	Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.9. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 184111

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111.

ISED-Registration No.: 8058A

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotech Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102



2. Summary of Test Results

Standard Section	Test Item	Result
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.247(b)(2)	Conducted Peak Output Power	PASS
15.247(a)(1)(i)	20dB Occupied Bandwidth	PASS
15.247(a)(1)	Carrier Frequencies Separation	PASS
15.247(a)(1)(i)	Hopping Channel Number	PASS
15.247(a)(1)(i), 15.247(f)	Dwell Time	PASS
15.247(d)	Band Edge	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

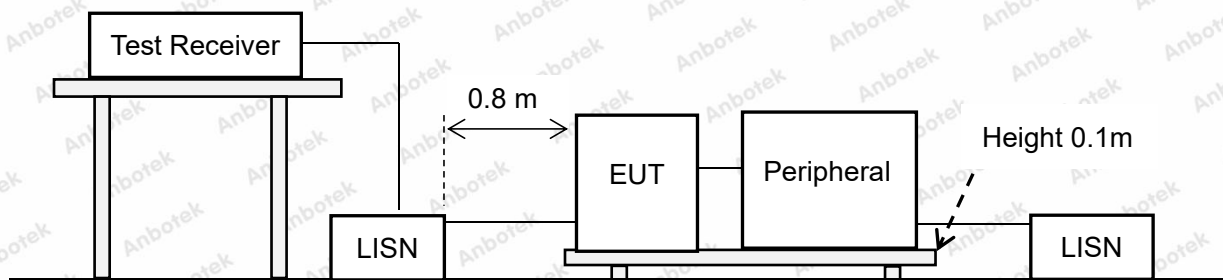


3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBUV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50
Remark: (1) *Decreasing linearly with logarithm of the frequency. (2) The lower limit shall apply at the transition frequency.			

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10: 2020 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

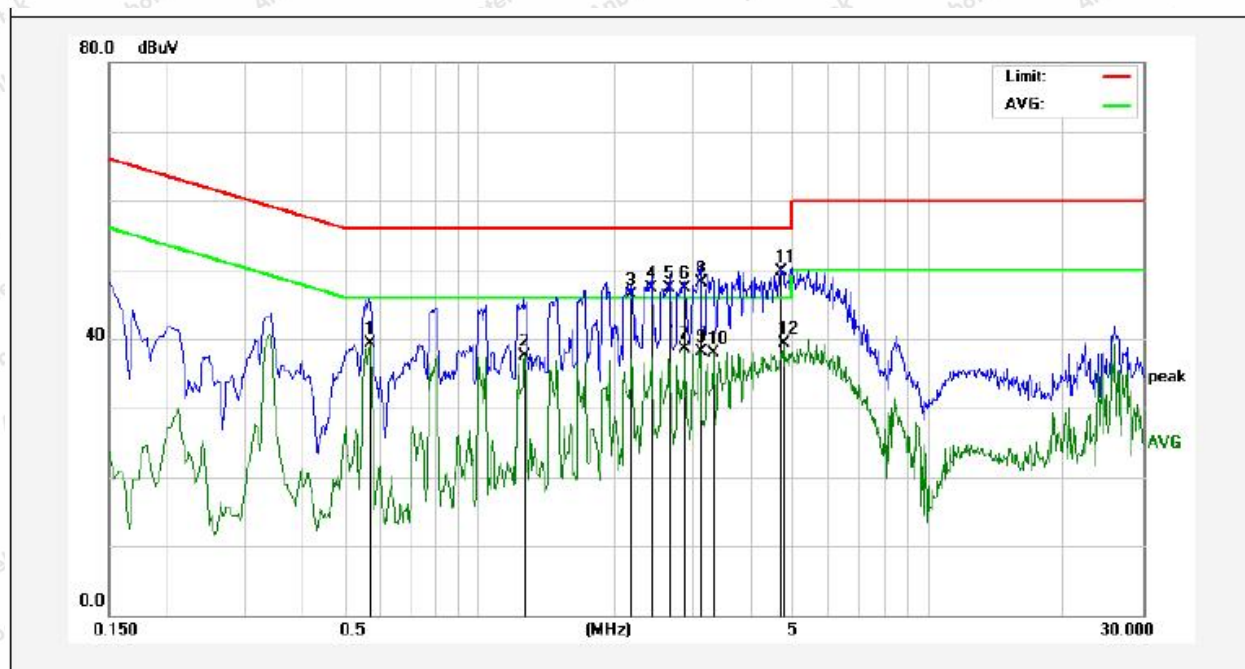
During the test, pre-scan all the modes, and found CH01 (TX) which is the worst case, only the worst case is recorded in the report.

Please to see the following pages.



Conducted Emission Test Data

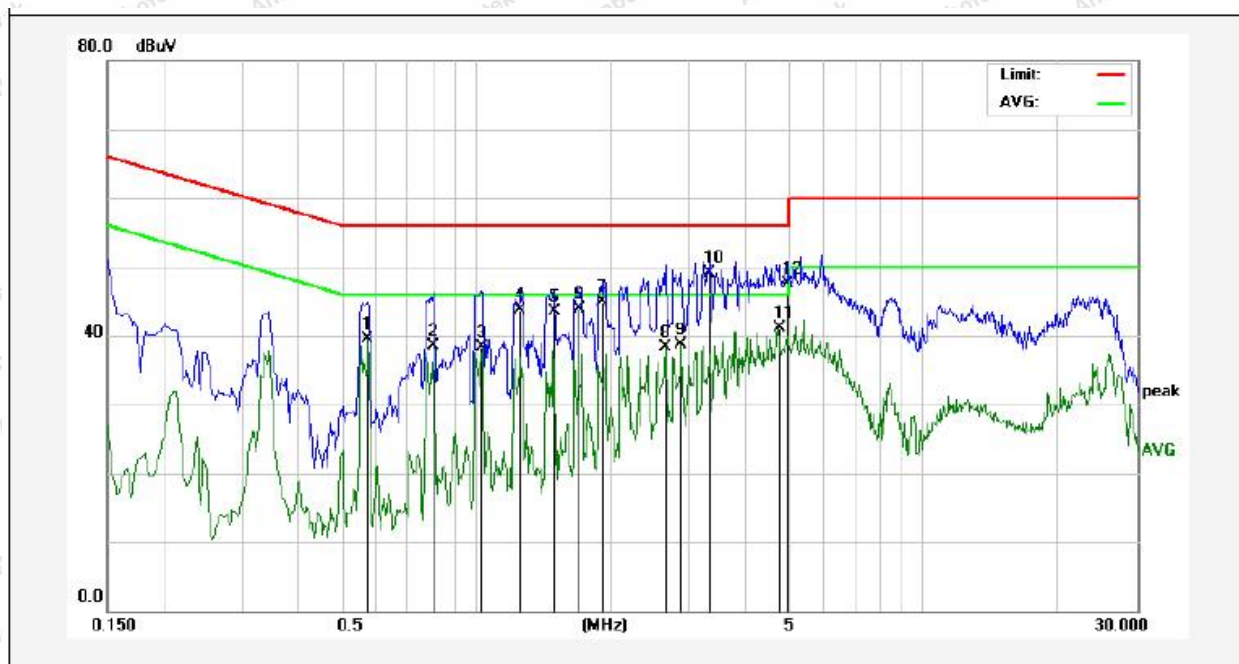
Test Site: 1# Shielded Room
 Operating Condition: CH01
 Test Specification: AC 120V, 60Hz from adapter of BL262TH9
 Comment: Live Line
 Tem.: 22.8℃ Hum.: 50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.5740	29.52	9.85	39.37	46.00	-6.63	AVG	
2	1.2660	27.68	9.85	37.53	46.00	-8.47	AVG	
3	2.1860	36.42	9.86	46.28	56.00	-9.72	QP	
4	2.4180	37.47	9.88	47.35	56.00	-8.65	QP	
5	2.6500	37.42	9.91	47.33	56.00	-8.67	QP	
6	2.8780	37.36	9.93	47.29	56.00	-8.71	QP	
7	2.8780	28.59	9.93	38.52	46.00	-7.48	AVG	
8	3.1099	38.24	9.93	48.17	56.00	-7.83	QP	
9	3.1099	28.26	9.93	38.19	46.00	-7.81	AVG	
10	3.3380	27.97	9.91	37.88	46.00	-8.12	AVG	
11	4.7140	39.94	9.79	49.73	56.00	-6.27	QP	
12	4.7540	29.50	9.78	39.28	46.00	-6.72	AVG	



Test Site: 1# Shielded Room
 Operating Condition: CH01
 Test Specification: AC 120V, 60Hz from adapter of BL262TH9
 Comment: Neutral Line
 Tem.: 22.8℃ Hum.: 50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.5740	29.59	9.85	39.44	46.00	-6.56	AVG	
2	0.8059	28.74	9.84	38.58	46.00	-7.42	AVG	
3	1.0339	28.37	9.85	38.22	46.00	-7.78	AVG	
4	1.2620	33.92	9.85	43.77	56.00	-12.23	QP	
5	1.4980	33.68	9.84	43.52	56.00	-12.48	QP	
6	1.7060	34.12	9.85	43.97	56.00	-12.03	QP	
7	1.9140	35.13	9.85	44.98	56.00	-11.02	QP	
8	2.6500	28.48	9.91	38.39	46.00	-7.61	AVG	
9	2.8780	28.71	9.93	38.64	46.00	-7.36	AVG	
10	3.3420	39.18	9.91	49.09	56.00	-6.91	QP	
11	4.7220	31.29	9.79	41.08	46.00	-4.92	AVG	
12	4.9779	37.72	9.76	47.48	56.00	-8.52	QP	



4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209 and 15.205				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz~1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz~30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1) The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

4.2. Test Setup

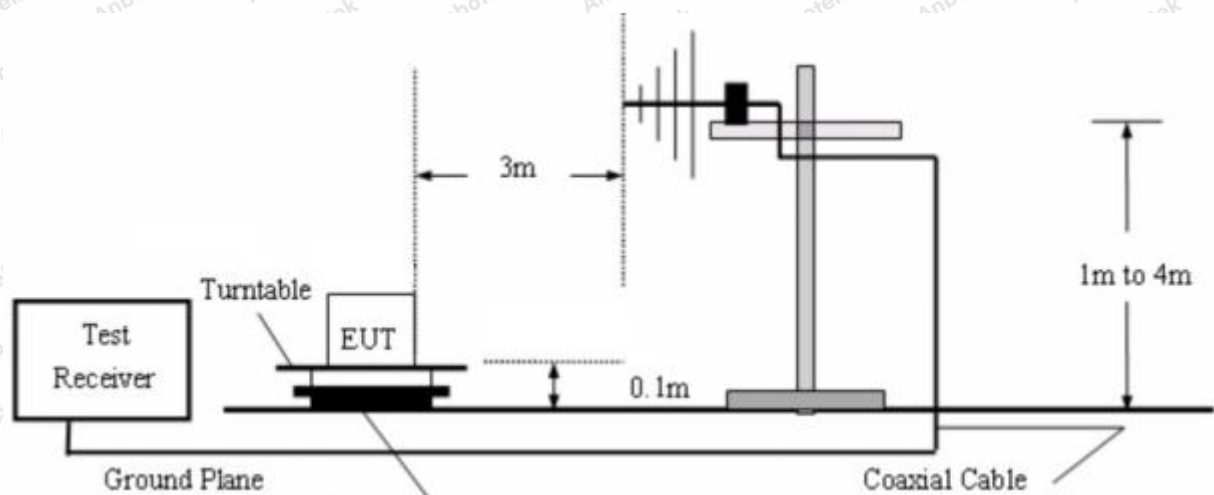


Figure 1. 30MHz to 1GHz



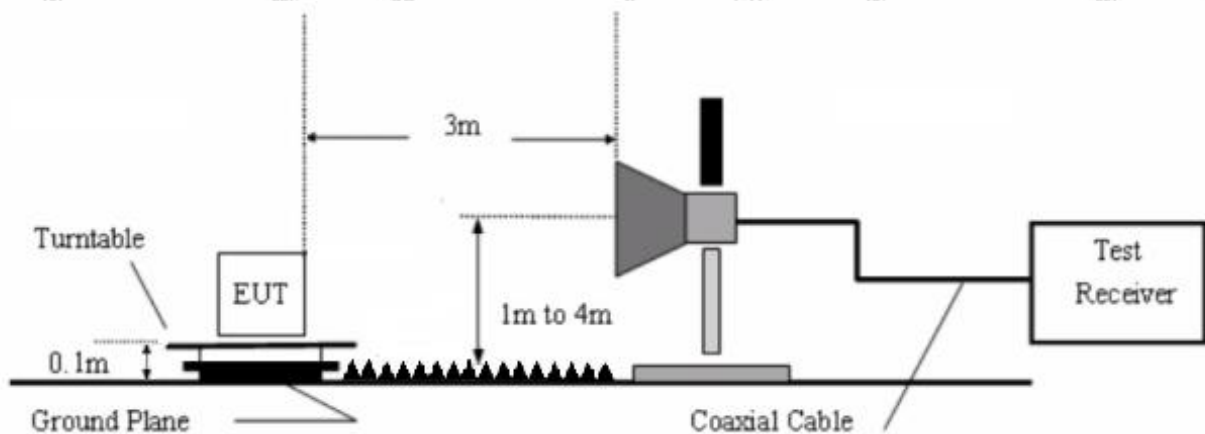


Figure 2. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.1m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 0.1m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For the radiated emission test above 1GHz:

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

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW =300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz, Set the spectrum analyzer as:



RBW =1MHz, VBW =1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW =1MHz, VBW =10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, pre-scan all the modes, only the worst case is recorded in the report.



Test Results (30~1000MHz)

Test Mode: CH01
Power Source: DC 21.6V
Polarization: Vertical
Temp.(°C)/Hum.(%RH): 24.3°C/49%RH

Fundamental of Lora

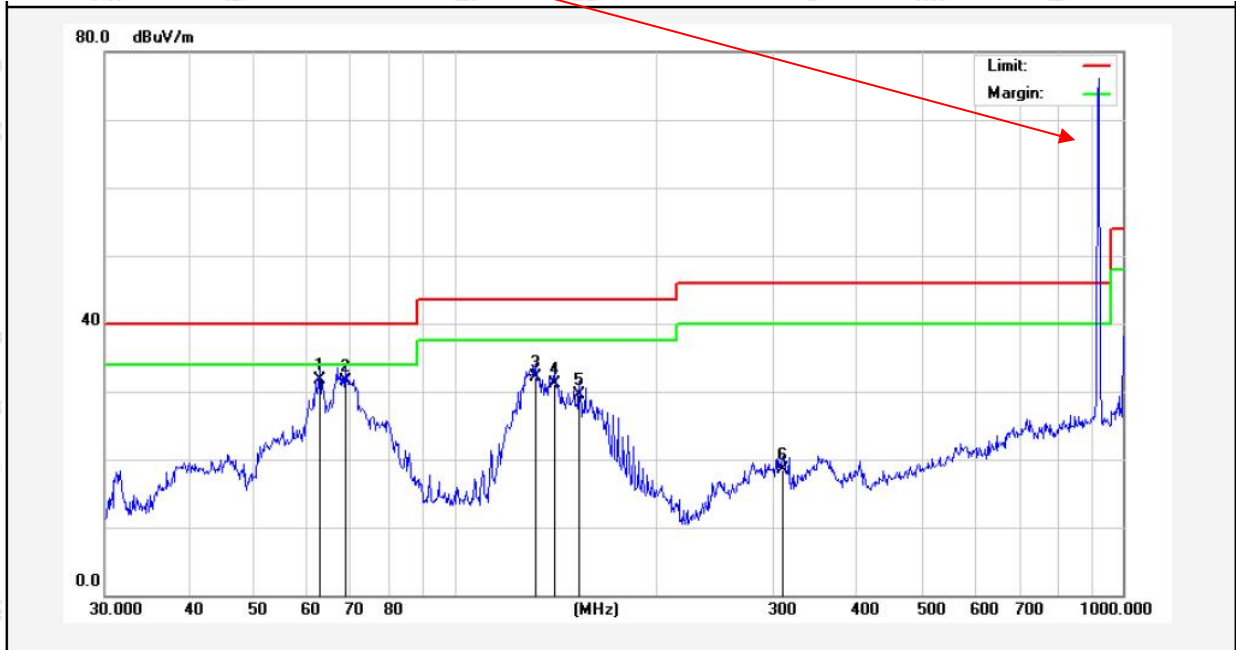


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	66.7325	45.45	-19.54	25.91	40.00	-14.09	QP			
2	89.2762	38.40	-17.71	20.69	43.50	-22.81	QP			
3	141.8262	49.48	-22.17	27.31	43.50	-16.19	QP			
4	151.0663	47.39	-22.05	25.34	43.50	-18.16	QP			
5	346.8091	37.10	-15.08	22.02	46.00	-23.98	QP			
6	403.2500	35.85	-14.39	21.46	46.00	-24.54	QP			



Test Mode: CH01
Power Source: DC 21.6V
Polarization: Horizontal
Temp.(°C)/Hum.(%RH): 24.3°C/49%RH

Fundamental of Lora



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	62.8708	50.35	-18.55	31.80	40.00	-8.20	QP			
2	68.6310	52.97	-21.46	31.51	40.00	-8.49	QP			
3	132.2204	54.65	-22.62	32.03	43.50	-11.47	QP			
4	141.3298	54.11	-23.04	31.07	43.50	-12.43	QP			
5	153.7384	52.77	-23.29	29.48	43.50	-14.02	QP			
6	309.9977	35.45	-16.92	18.53	46.00	-27.47	QP			



Test Results (1GHz-25GHz)

Test Mode: CH01					Test channel: Lowest				
Frequency (MHz)	Antenna Pol.	Reading (dBuV/m)	Cable Loss (dB)	Ant Factor (dB)	Amplifier (dB)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Det. Mode
1805.5000	H	44.10	7.39	28.73	26.31	53.91	74	-20.09	PK
1805.5000	H	36.04	7.39	28.73	26.31	45.85	54	-8.15	AV
2708.2500	H	41.60	8.10	29.71	27.01	52.40	74	-21.60	PK
2708.2500	H	35.07	8.10	29.71	27.01	45.87	54	-8.13	AV
3611.0000	H	--	--	--	--	--	--	--	PK
3611.0000	H	--	--	--	--	--	--	--	AV
1805.5000	V	44.15	7.39	28.73	26.31	53.96	74	-20.04	PK
1805.5000	V	34.79	7.39	28.73	26.31	44.60	54	-9.40	AV
2708.2500	V	41.99	8.10	29.71	27.01	52.79	74	-21.21	PK
2708.2500	V	33.87	8.10	29.71	27.01	44.67	54	-9.33	AV
3611.0000	V	--	--	--	--	--	--	--	PK
3611.0000	V	--	--	--	--	--	--	--	AV

Test Mode: CH32					Test channel: Middle				
Frequency (MHz)	Antenna Pol.	Reading (dBuV/m)	Cable Loss (dB)	Ant Factor (dB)	Amplifier (dB)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Det. Mode
1830.5000	H	47.50	7.41	28.72	26.31	57.32	74	-16.68	PK
1830.5000	H	36.80	7.41	28.72	26.31	46.62	54	-7.38	AV
2745.7500	H	46.97	8.11	29.71	27.01	57.78	74	-16.22	PK
2745.7500	H	35.09	8.11	29.71	27.01	45.90	54	-8.10	AV
3661.0000	H	--	--	--	--	--	--	--	PK
3661.0000	H	--	--	--	--	--	--	--	AV
1830.5000	V	46.53	7.41	28.72	26.31	56.35	74	-17.65	PK
1830.5000	V	36.65	7.41	28.72	26.31	46.47	54	-7.53	AV
2745.7500	V	45.25	8.11	29.71	27.01	56.06	74	-17.94	PK
2745.7500	V	35.13	8.11	29.71	27.01	45.94	54	-8.06	AV
3661.0000	V	--	--	--	--	--	--	--	PK
3661.0000	V	--	--	--	--	--	--	--	AV



Test Mode: CH64					Test channel: High				
Frequency (MHz)	Antenna Pol.	Reading (dBuV/m)	Cable Loss (dB)	Ant Factor (dB)	Amplifier (dB)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Det. Mode
1854.5000	H	47.14	7.43	28.69	26.31	56.95	74	-17.05	PK
1854.5000	H	35.45	7.43	28.69	26.31	45.26	54	-8.74	AV
2781.7500	H	46.86	8.15	29.84	27.01	57.84	74	-16.16	PK
2781.7500	H	35.84	8.15	29.84	27.01	46.82	54	-7.18	AV
3709.0000	H	--	--	--	--	--	--	--	PK
3709.0000	H	--	--	--	--	--	--	--	AV
1854.5000	V	46.20	7.43	28.69	26.31	56.01	74	-17.99	PK
1854.5000	V	36.39	7.43	28.69	26.31	46.20	54	-7.80	AV
2781.7500	V	46.00	8.15	29.84	27.01	56.98	74	-17.02	PK
2781.7500	V	34.66	8.15	29.84	27.01	45.64	54	-8.36	AV
3709.0000	V	--	--	--	--	--	--	--	PK
3709.0000	V	--	--	--	--	--	--	--	AV

Remark:

1. Level = Reading + Ant Factor + Cable Loss – Amplifier

2. “--” means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.



Radiated Band Edge:

Frequency (MHz)	Read Level (dBuV/m)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Det.
902.0000	42.46	22.45	4.48	31.33	38.06	46.00	-7.94	H	QP
928.0000	39.68	22.59	4.54	31.35	35.46	46.00	-10.54	H	QP
902.0000	42.42	22.45	4.48	31.33	38.02	46.00	-7.98	V	QP
928.0000	40.09	22.59	4.54	31.35	35.87	46.00	-10.13	V	QP

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamp Factor

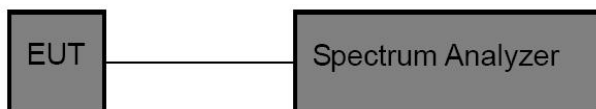


5. Maximum Peak Output Power Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(1)
Test Limit	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, as permitted under paragraph (a)(1)(i) of this section.

5.2. Test Setup



5.3. Test Procedure

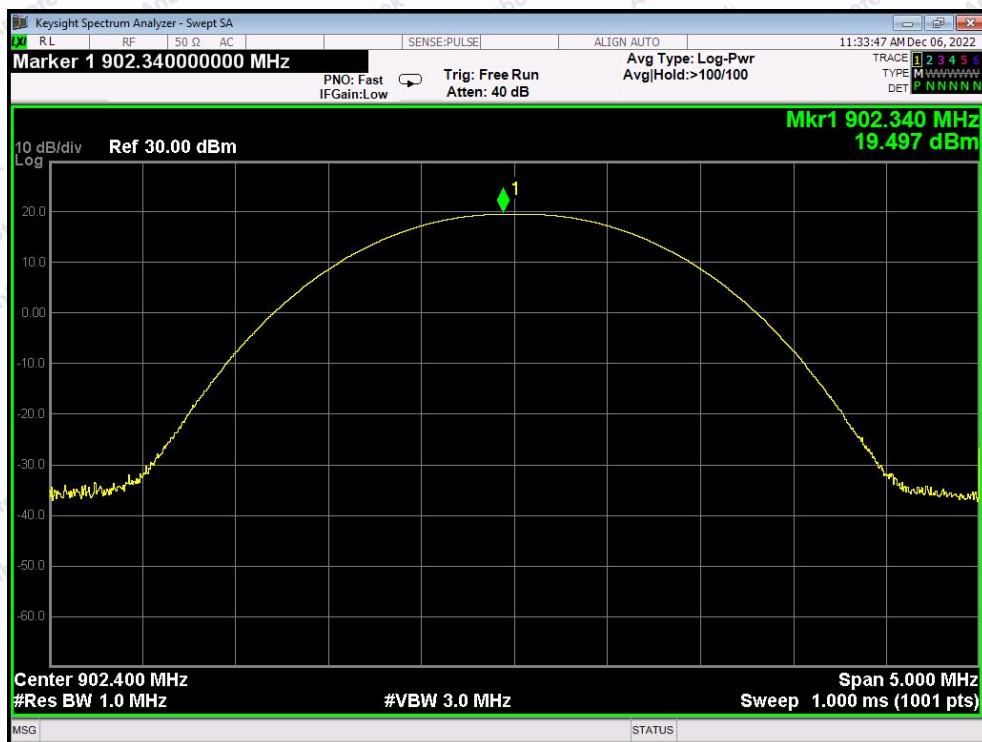
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above,
2. Spectrum Setting:
 - RBW > the 20 dB bandwidth of the emission being measured
 - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
 - VBW ≥ RBW
 - Sweep = auto
 - Detector function = peak
 - Trace = max hold

5.4. Test Data

Test Item	: Max. peak output power	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3.3V	Temperature	: 23.6° C
Test Result	: PASS	Humidity	: 49 %

Channel Frequency (MHz)	Peak Power output (dBm)	Limit (dBm)	Results
902.4	19.497	30.00	PASS
915.0	19.547	30.00	PASS
927.6	19.755	30.00	PASS



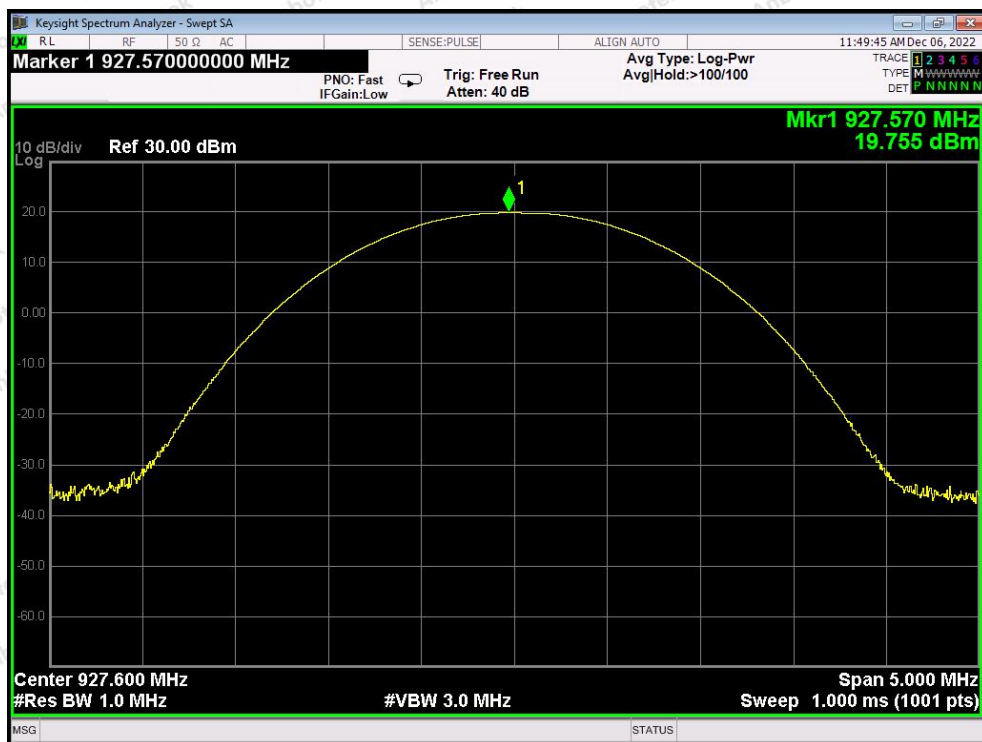


CH: Low



CH: Middle





CH: High

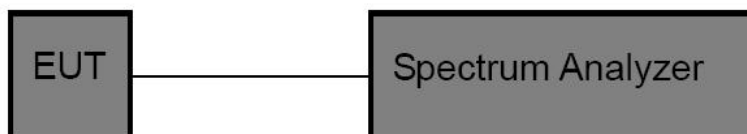


6. 20DB Occupy Bandwidth Test

6.1. Test Standard

Test Standard	FCC Part15 C Section 15.247 (a)(1)(i)
Limit	Less than 250KHz

6.2. Test Setup



6.3. Test Procedure

Using the following spectrum analyzer settings:

1. Span= approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel.
2. Set the RBW = 3 kHz.
3. Set the VBW = 10 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

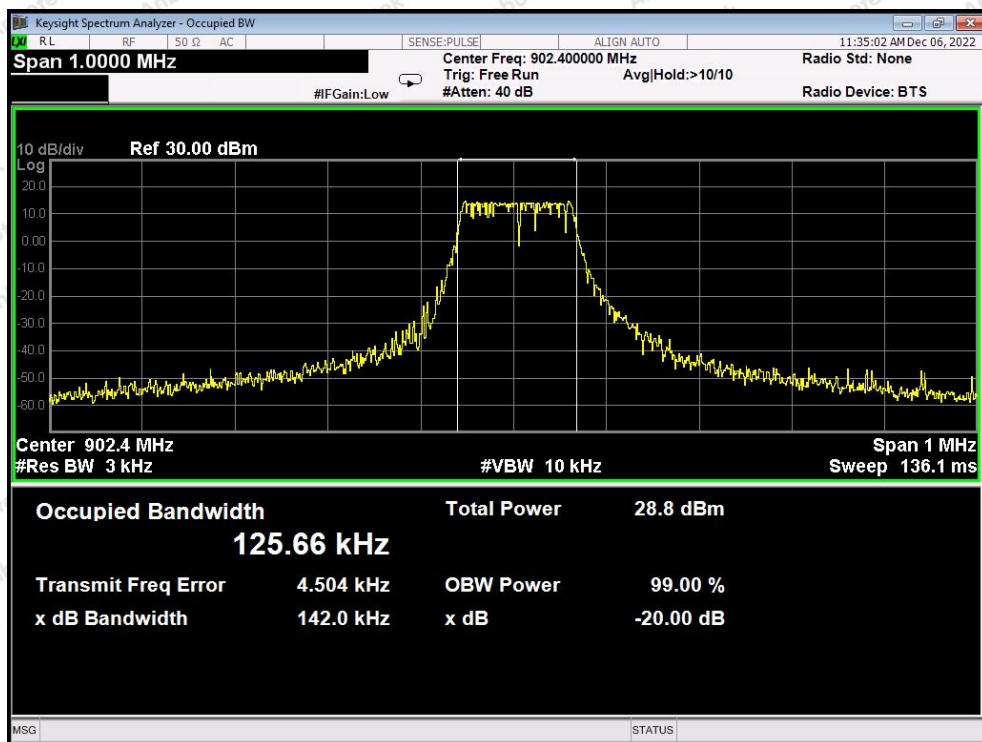
6.4. Test Data

Test Item	:	20dB BW
Test Voltage	:	DC 3.3V
Test Result	:	PASS

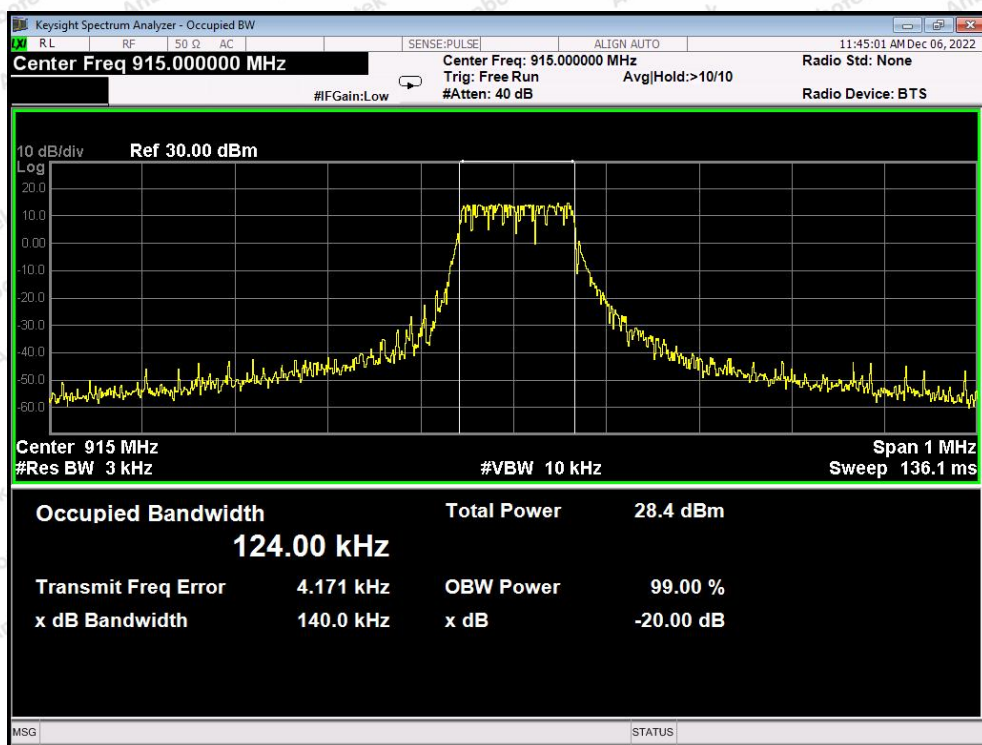
Test Mode	:	CH Low ~ CH High
Temperature	:	23.6° C
Humidity	:	49 %

Channel	Frequency(MHz)	20dB Down BW(kHz)	Limit(KHz)	Results
Low	902.4	142.0	≤250	PASS
Middle	915.0	140.0	≤250	PASS
High	927.6	142.6	≤250	PASS



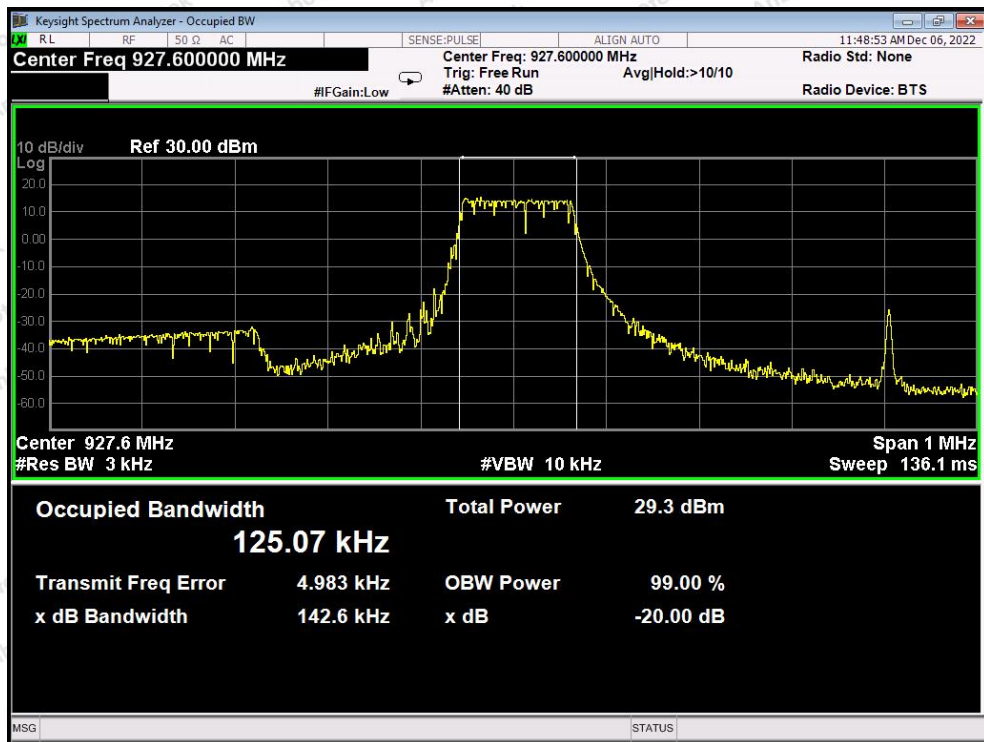


CH: Low



CH: Middle





CH: High

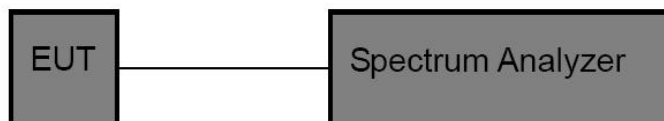


7. Carrier Frequency Separation Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)
Test Limit	> 25 kHz or the 20 dB bandwidth whichever is greater.

7.2. Test Setup



7.3. Test Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer settings:

1. Span= Wide enough to capture the peaks of two adjacent channels
2. Set the RBW = 10 kHz.
3. Set the VBW = 30 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

7.4. Test Data

Test Item	:	Frequency Separation
Test Voltage	:	DC 3.3V
Test Result	:	PASS

Test Mode	:	Hopping
Temperature	:	23.6° C
Humidity	:	49 %



Mode	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Result
Hopping	921.0	200	142.6	PASS



Hopping

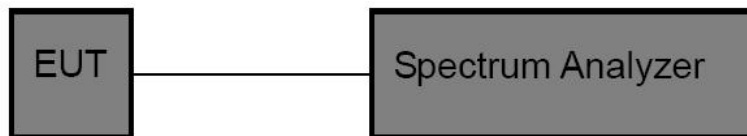


8. Number of Hopping Channel Test

8.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247(a)(1)(i)
Test Limit	≥ 50 channels for 20 dB bandwidth less than 250KHz ≥ 25 channels for 20 dB bandwidth greater than 250KHz

8.2. Test Setup



8.3. Test Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = 100kHz.
3. Set the VBW = 300kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

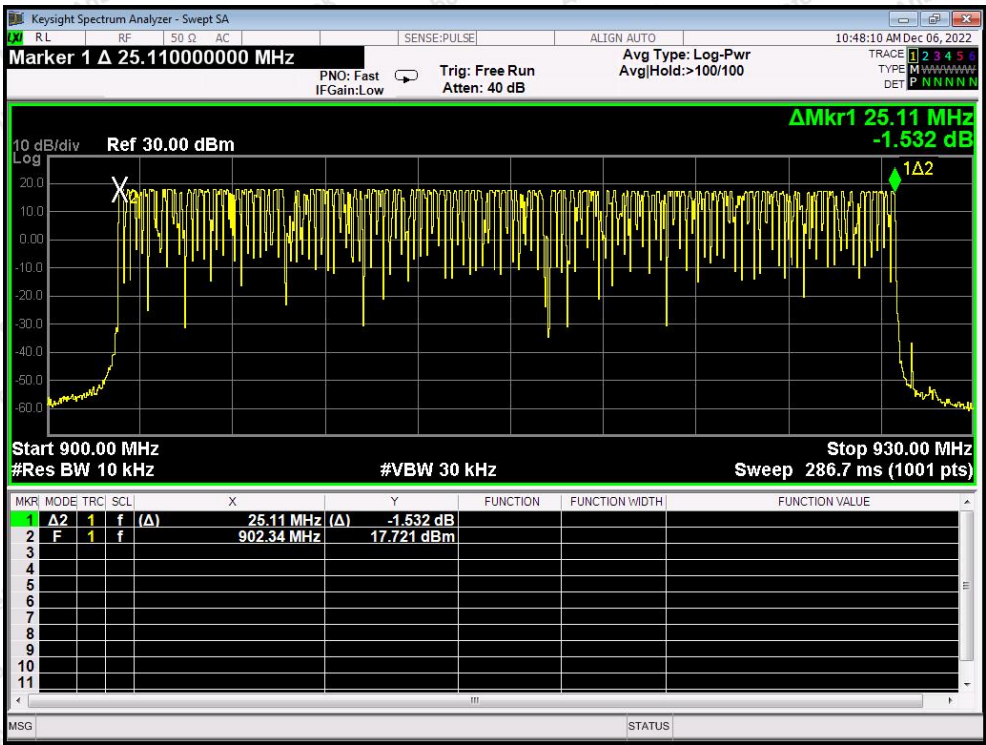
8.4. Test Data

Test Item	: Number of Hopping Frequency
Test Voltage	: DC 3.3V
Test Result	: PASS

Test Mode	: Hopping
Temperature	: 23.6° C
Humidity	: 49 %



Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel
902-928MHz	127	≥ 50



Hopping

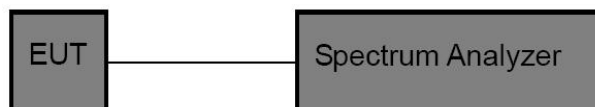


9. Dwell Time Test

9.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247(a)(1)(i), 15.247(f)
Test Limit	15.247(a)(1)(i): 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; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. 15.247(f): For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

9.2. Test Setup



9.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span= zero span, centered on a hopping channel
2. Set the RBW = 100 KHz.
3. Set the VBW = 300 KHz.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

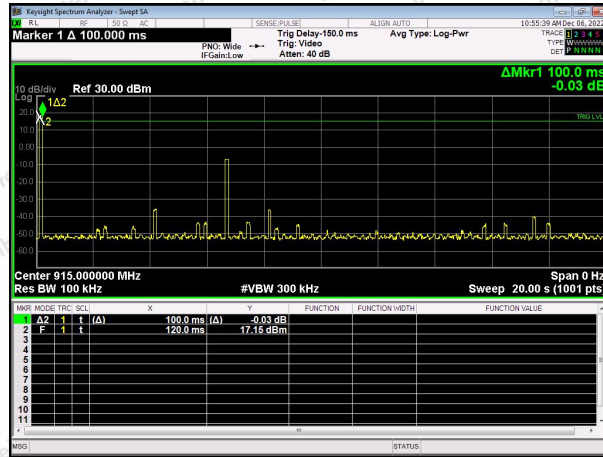
9.4. Test Data

Test Item	:	Time of Occupancy
Test Voltage	:	DC 3.3V
Test Result	:	PASS

Test Mode	:	Hopping
Temperature	:	23.6° C
Humidity	:	49 %

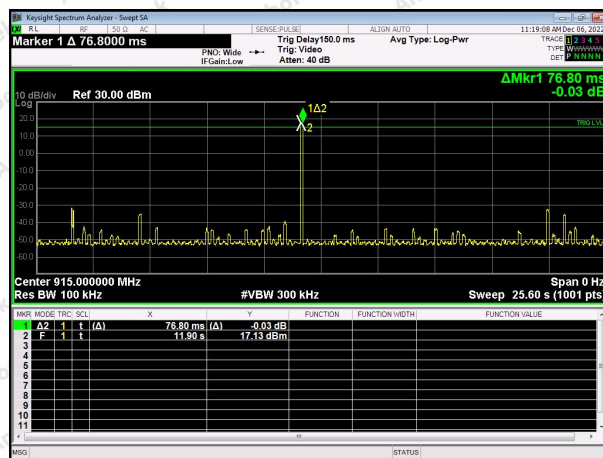


Requirement	Pulse width (ms)	Observe Period(s)	Dwell time (ms)	Limit (s)	Result
15.247(a)(1)(i)	100.00	20.00	100.00	0.40	PASS



Hopping

Requirement	Pulse width (ms)	Observe Period(s)	Dwell time (ms)	Limit (s)	Result
15.247(f)	76.8	25.60	76.8	0.40	PASS



Hopping

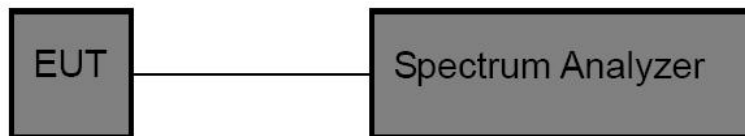


10. 100kHz Bandwidth of Frequency Band Edge Requirement

10.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (d)
Test Limit	in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

10.2. Test Setup



10.3. Test Procedure

The EUT must have its hopping/Non-hopping function enabled. Using the following spectrum analyzer setting:

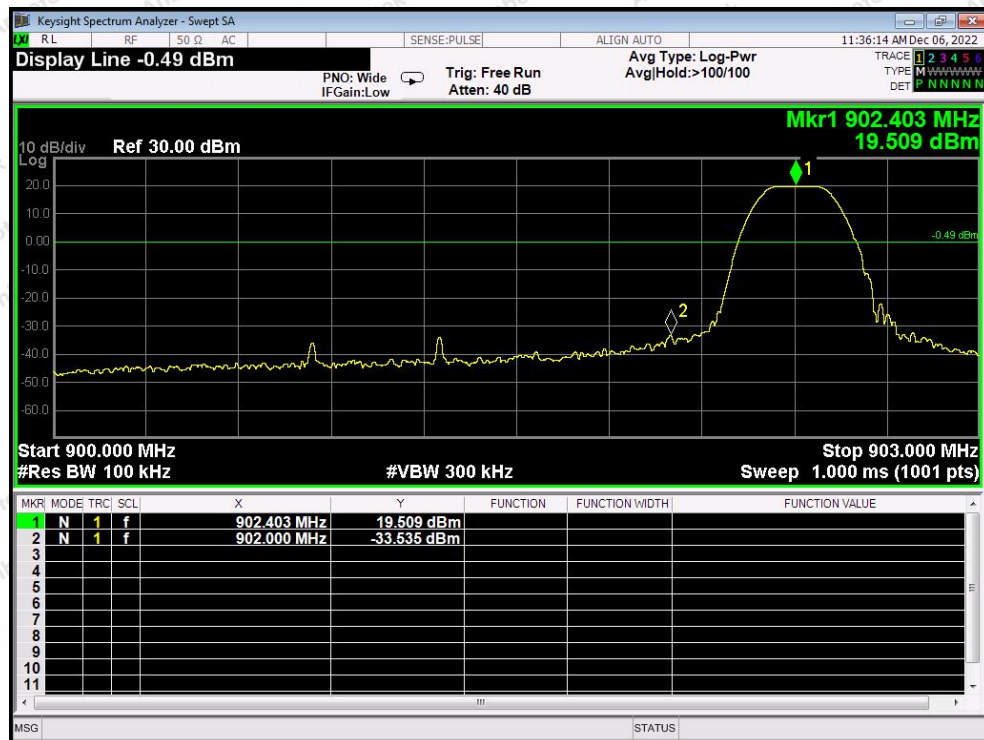
1. Set the RBW = 100kHz.
2. Set the VBW = 300kHz.
3. Sweep time = auto couple.
4. Detector function = peak.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.

10.4. Test Data

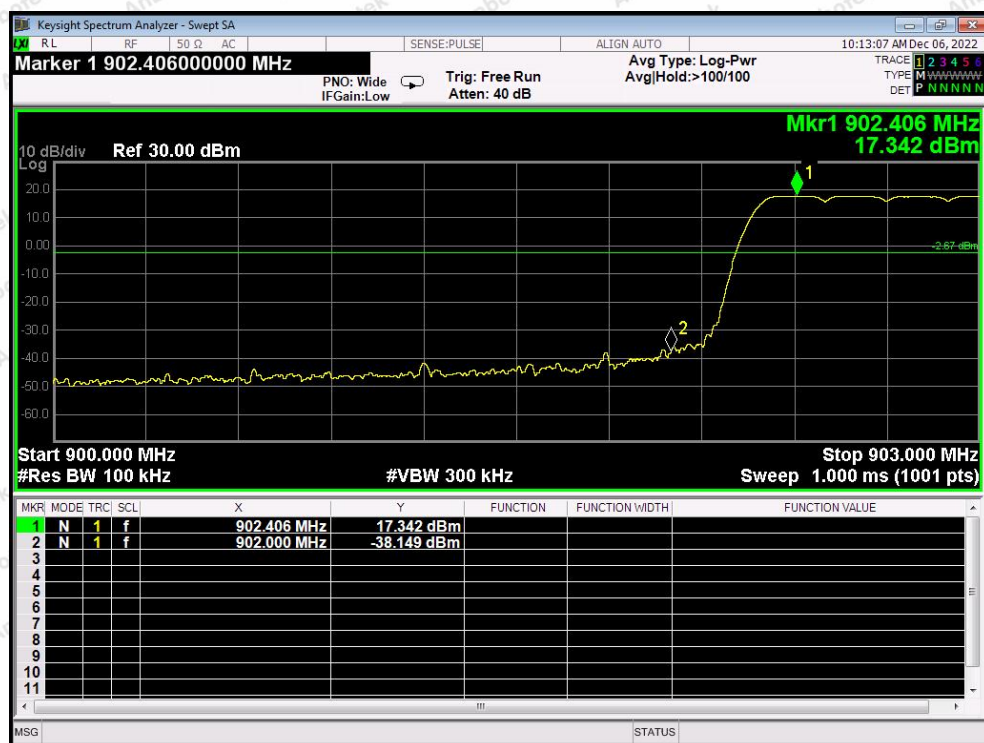
Test Item : Band edge
Test Voltage : DC 3.3V
Test Result : PASS

Test Mode : CH Low, CH High
Temperature : 23.6° C
Humidity : 49 %



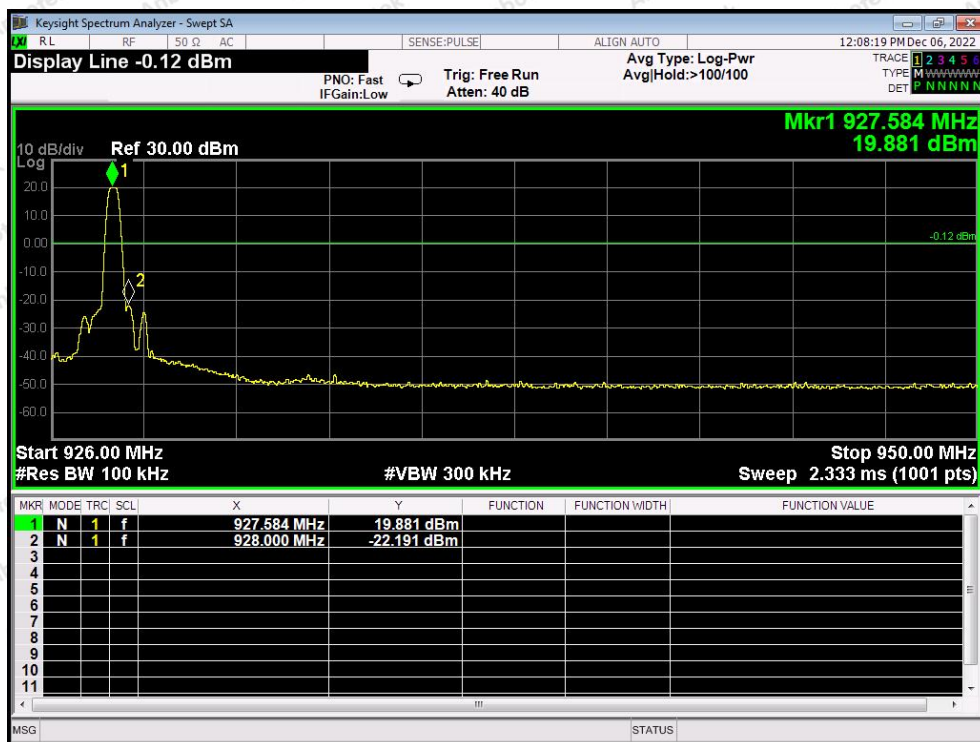


For Low channel Non-Hopping Mode

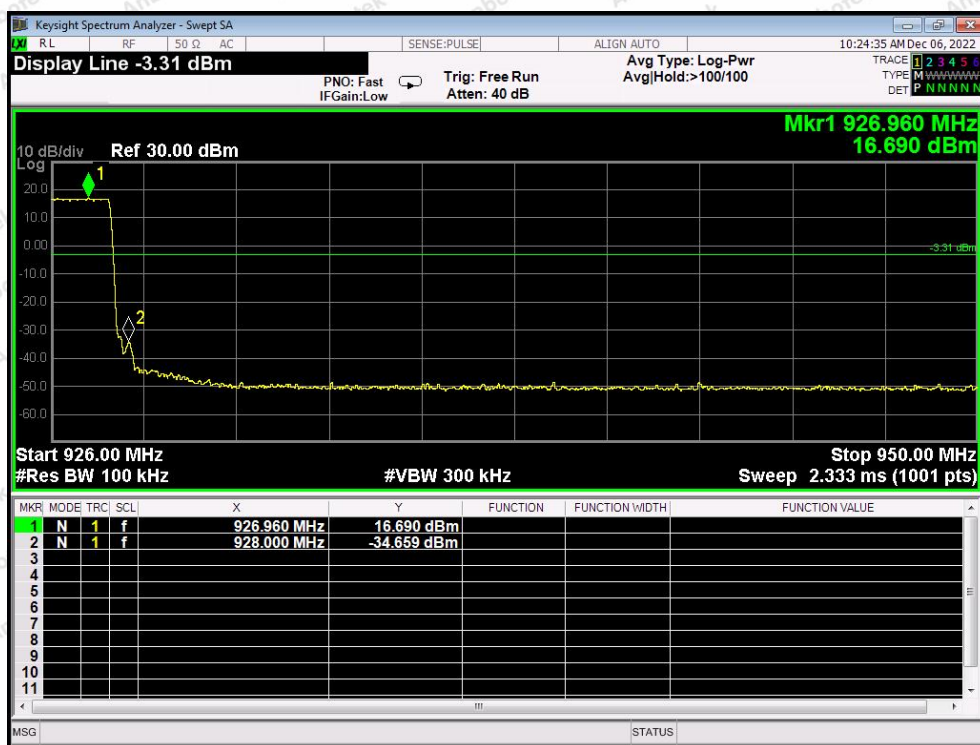


For Low channel Hopping Mode





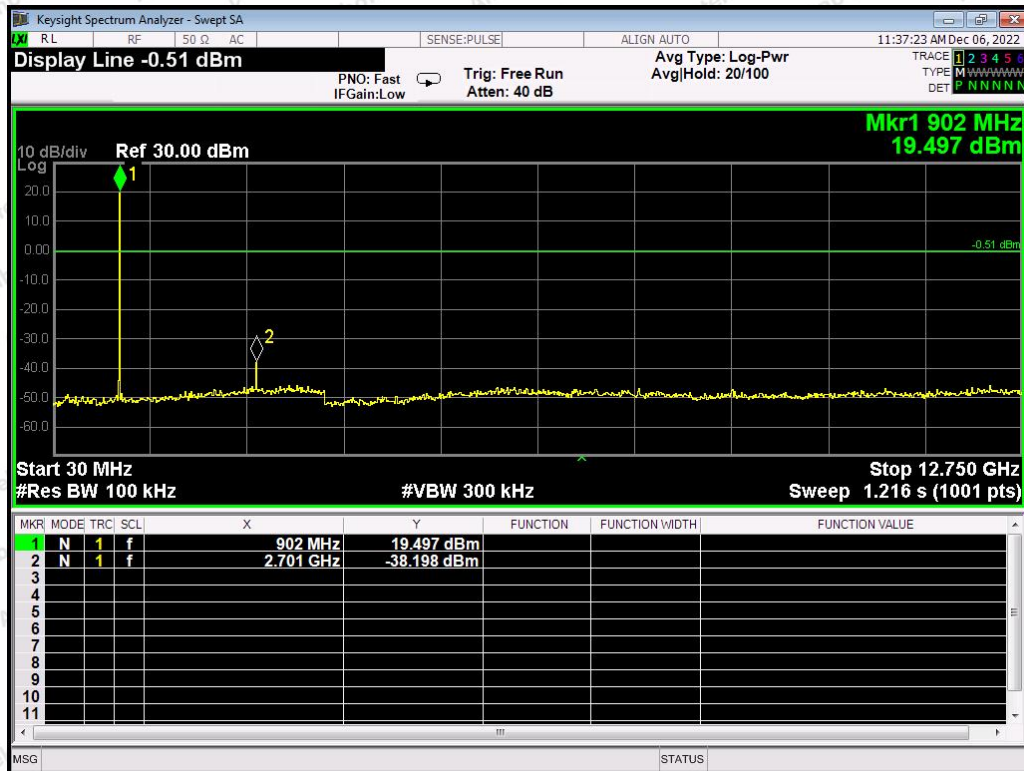
For High channel Non-Hopping Mode



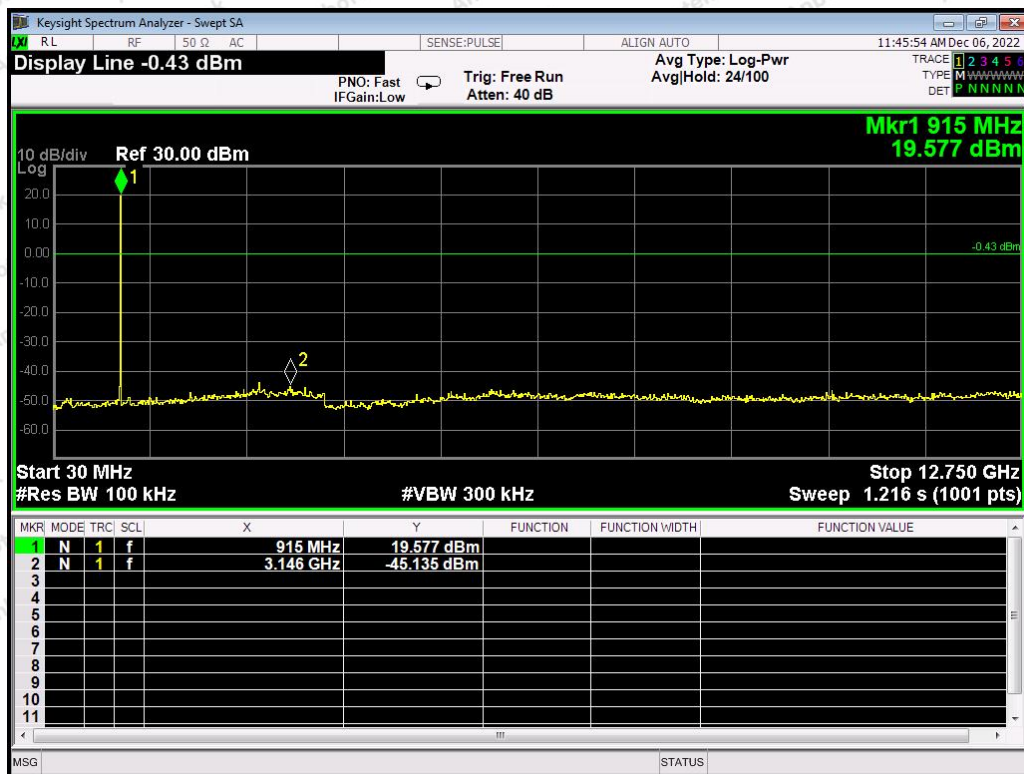
For High channel Hopping Mode



Conducted Emission Method

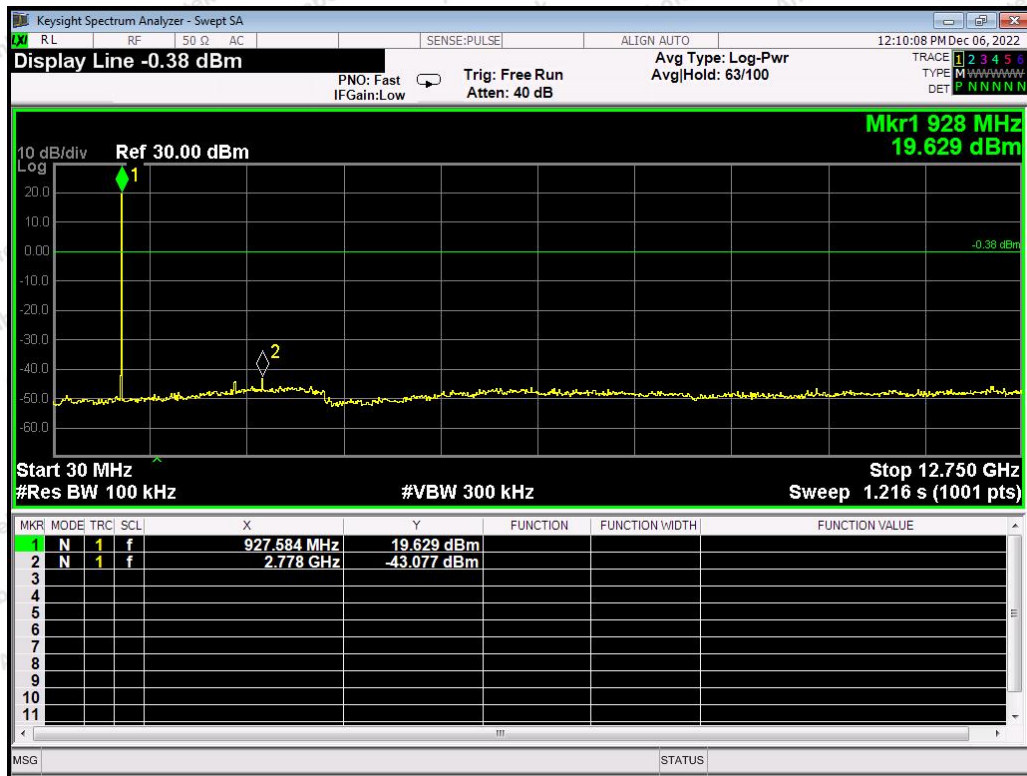


CH: Low



CH: Middle





CH: High



11. Antenna Requirement

11.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /247(c)
Requirement	1) 15.203 requirement: 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, 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. 2) 15.247(c) (1)(i) requirement: Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

11.2. Antenna Connected Construction

The antenna is a FPC antenna which permanently attached, and the best case gain of the antenna is 0.93 dBi. It complies with the standard requirement.

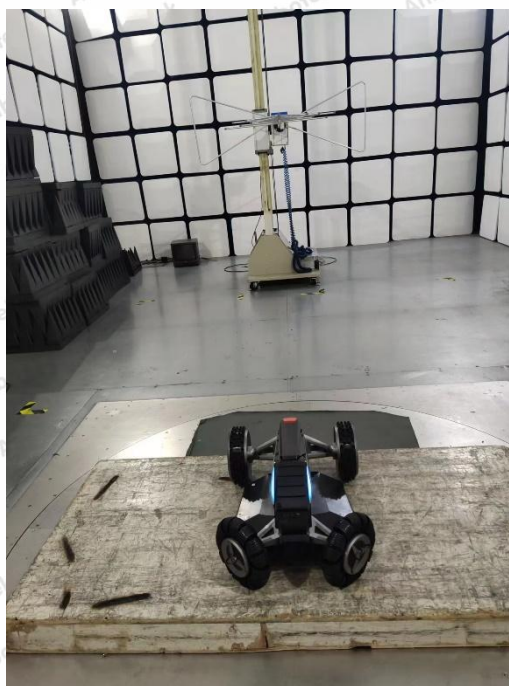


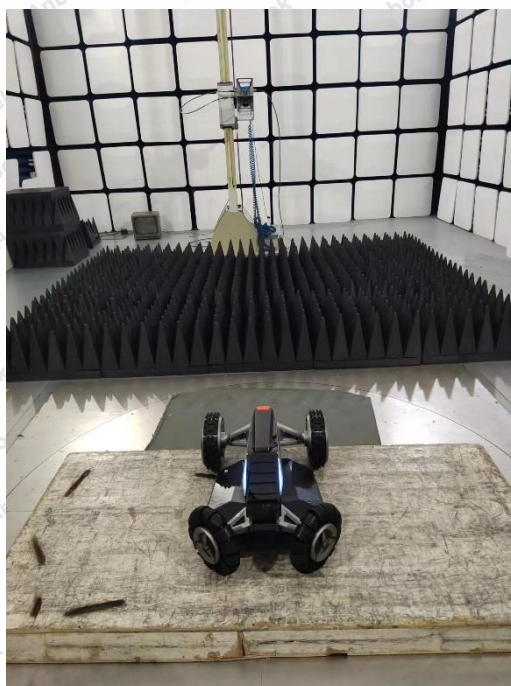
APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Conducted Emission Measurement



Photo of Radiation Spurious Emission Test





APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to the test report 18220WC20122601.

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to the test report 18220WC20122601.

----- End of Report -----

