FCC Test Report

Client Name	:	**Winnix Technologies Co.,Limited**
Client Address	:	**4/F R2-B Building,Hi-tech Park,NanShan District, Shenzhen, Guangdong, China**
Product Name	:	**Integrated UHF RFID Reader**
Report Date	:	**Jan. 17, 2023**

Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant	:	Winnix Technologies Co.,Limited
Manufacturer	:	Winnix Technologies Co.,Limited.
Product Name	:	Integrated UHF RFID Reader
Model No.	:	HYR860\HYR860A
Trade Mark	:	N.A.
Rating(s)	:	Input: 12V⎓2A
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 Anbotek 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 Anbotek 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 Anbotek Compliance Laboratory Limited.

Date of receipt	Nov. 28, 2022
Date of Test	Nov. 28, 2022~ Jan. 11, 2023
Prepared by	Nian xiu Chen (Nianxiu Chen)
Approved & Authorized Signer	Kingkong Jin (Kingkong Jin)

Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Jan. 17, 2023

1. General Information

1.1. Client Information

Applicant	:	Winnix Technologies Co.,Limited
Address	:	4/F R2-B Building,Hi-tech Park,NanShan District, Shenzhen, Guangdong, China
Manufacturer	:	Winnix Technologies Co.,Limited.
Address	:	Room 635, MingYou Industrial products exhibition center B, No.168Baoyuan Road, Xixiang, Bao'an District, Shenzhen, China.
Factory	:	Winnix Technologies Co.,Limited.
Address	:	Room 635, MingYou Industrial products exhibition center B, No.168Baoyuan Road, Xixiang, Bao'an District, Shenzhen, China.

1.2. Description of Device (EUT)

Product Name	:	Integrated UHF RFID Reader
Model No.	:	HYR860, HYR860A (Note: All samples are the same except the model number, so we prepare "HYR860" for test only.)
Trade Mark	:	N.A.
Test Power Supply	:	AC 120V, 60Hz for Adapter
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	Model: G0957C-120-300 Input: 100-240V~ 1A MAX 50/60Hz Output: 12V⎓ 3A
RF Specification		
Support Technology	:	☒ LoRa
Operation Mode	:	☐ DSSS ☒ FHSS
Support Bandwidth	:	☐ 125KHz ☐ 250KHz ☒ 500KHz
Operation Frequency	:	902.75~927.25MHz
Number of Channel	:	50 Channels
Modulation Type	:	ASK
Antenna Type	:	External Antenna
Antenna Gain(Peak)	:	8.5 dBi(Provided by customer)
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

Description	Rating(s)
MacBook Air	Model: A1466 Input: 14.85V/3.05A CMIIT ID:C02HXB48DRVC

1.4. Description of Test Modes

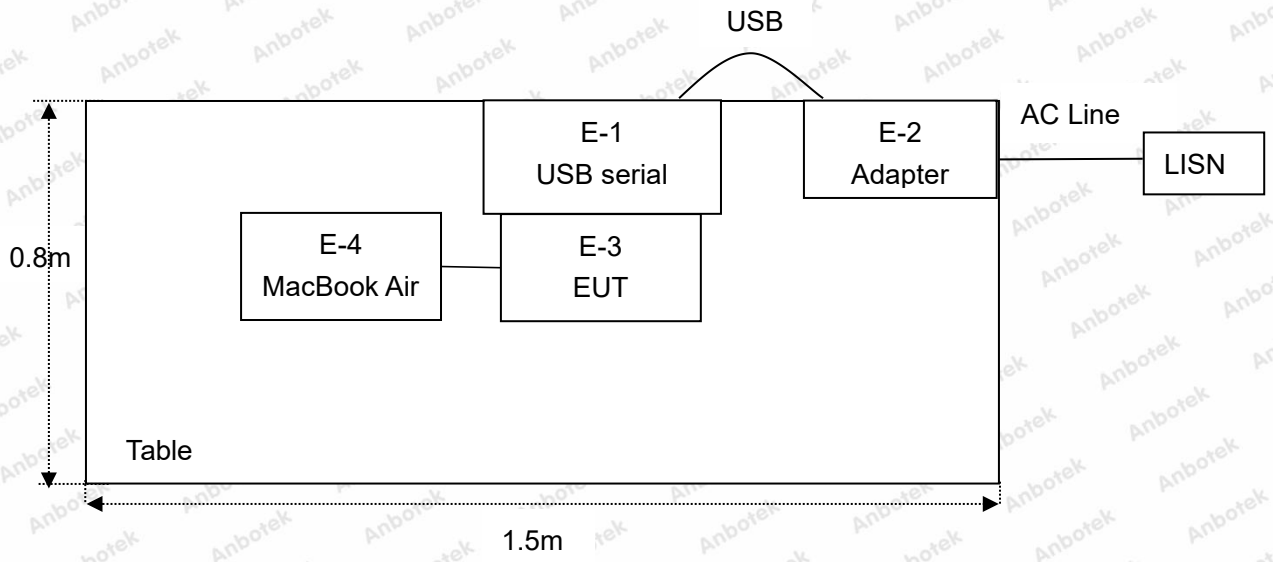
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	**902.75**	02	903.25	03	903.75	04	904.25	05	904.75
06	905.25	07	905.75	08	906.25	09	906.75	10	907.25
11	907.75	12	908.25	13	908.75	14	909.25	15	909.75
16	910.25	17	910.75	18	911.25	19	911.75	20	912.25
21	912.75	22	913.25	23	913.75	24	914.25	**25**	**914.75**
26	915.25	27	915.75	28	916.25	29	916.75	30	917.25
31	917.75	32	918.25	33	918.75	34	919.25	35	919.75
36	920.25	37	920.75	38	921.25	39	921.75	40	922.25
41	922.75	42	923.25	43	923.75	44	924.25	45	924.75
46	925.25	47	925.75	48	926.25	49	926.75	**50**	**927.25**

Note:

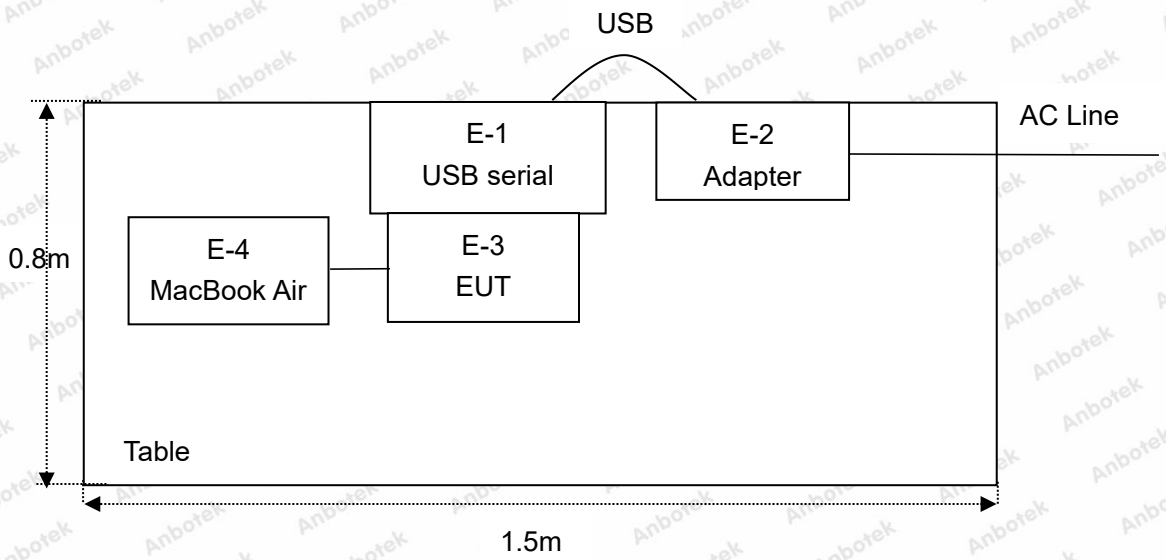
1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT was tested with Channel 1, 25 and 50.

1.5. Description Of Test Setup

CE



RE



1.6. 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-KF	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-KHWS80B	N/A	Nov. 01, 2021	1 Year

1.7. Measurement Uncertainty

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

1.8. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotek 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 Anbotek 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 Anbotek 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

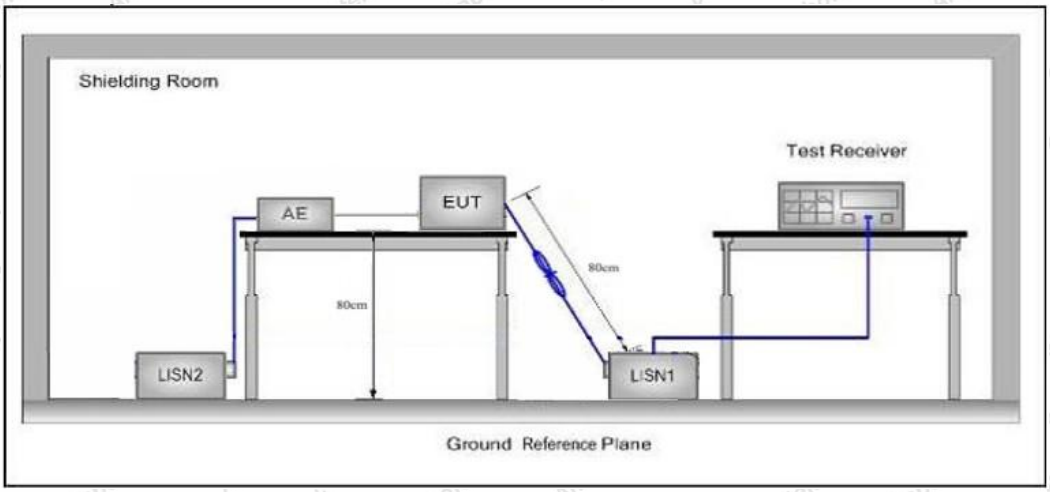
Standard Section	Test Item	Result
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.247(b)(2)	Conducted Peak Output Power	PASS
15.247(a)(1)(i)	20dB Occupied Bandwidth	PASS
15.247(a)(1)	Carrier Frequencies Separation	PASS
15.247(a)(1)(i)	Hopping 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

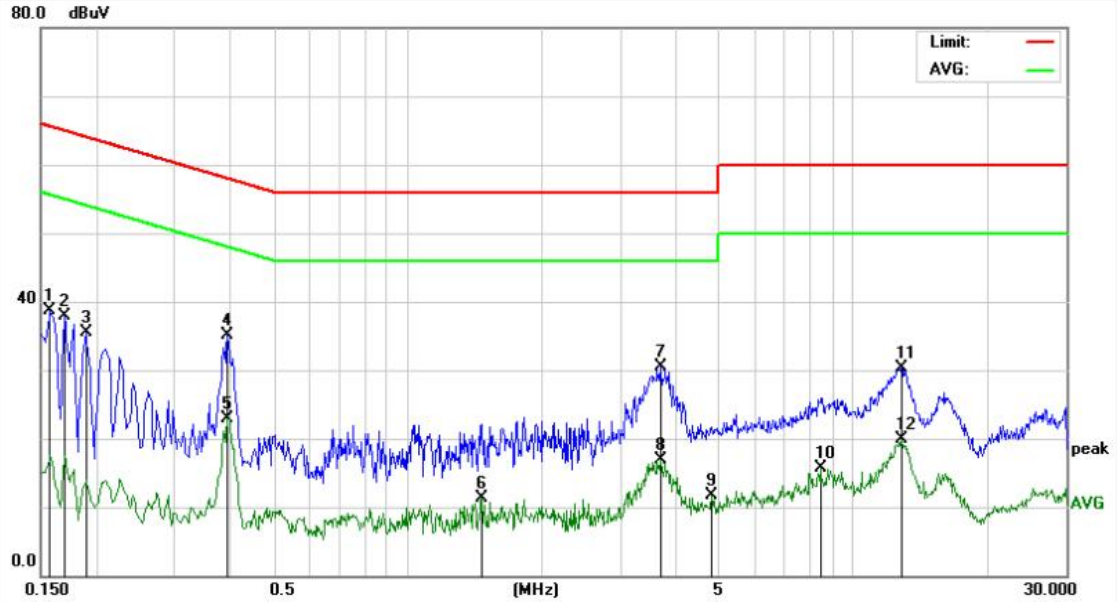
During the test, pre-scan all modes, only the worst case is recorded in the report.

AC conducted emission pre-test at both at AC 120V/60Hz and AC 240V/60Hz modes, recorded worst case AC 120V/60Hz.

Please to see the following pages.

Conducted Emission Test Data

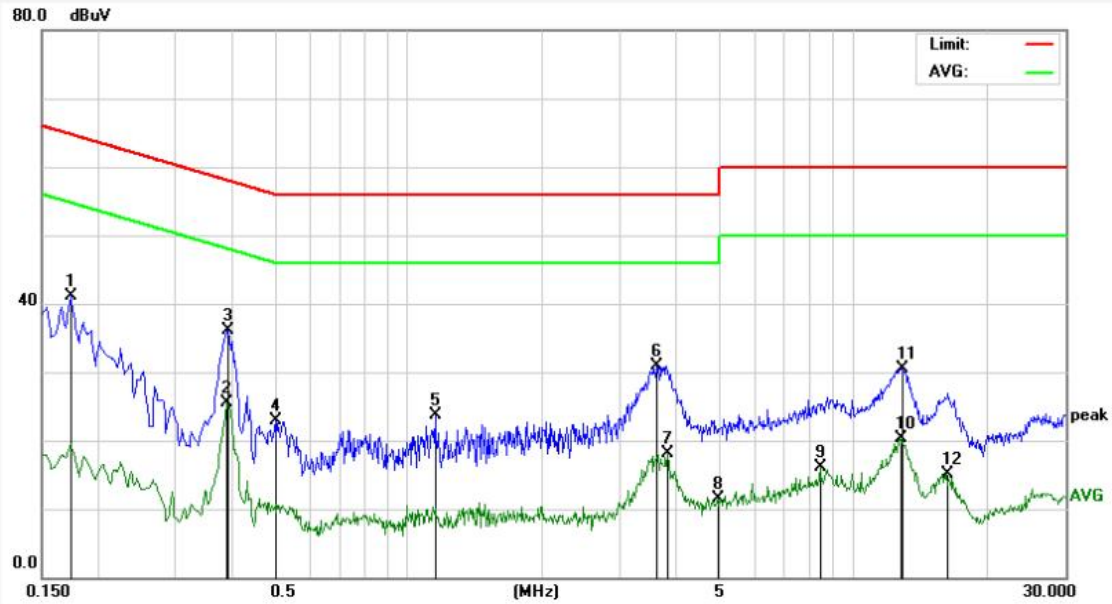
Test Site:	1# Shielded Room
Operating Condition:	Mid CH (914.75MHz)
Test Specification:	AC 120V, 60Hz for Adapter
Comment:	Live Line
Temp.(℃)/Hum.(%RH):	23.9℃/45%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1580	28.91	9.83	38.74	65.56	-26.82	QP	
2	0.1700	28.02	9.83	37.85	64.96	-27.11	QP	
3	0.1900	25.71	9.83	35.54	64.03	-28.49	QP	
4	0.3940	25.35	9.81	35.16	57.98	-22.82	QP	
5	0.3940	13.19	9.81	23.00	47.98	-24.98	AVG	
6	1.4700	1.41	9.84	11.25	46.00	-34.75	AVG	
7	3.6900	20.56	9.85	30.41	56.00	-25.59	QP	
8	3.6900	7.14	9.85	16.99	46.00	-29.01	AVG	
9	4.8180	1.86	9.85	11.71	46.00	-34.29	AVG	
10	8.4379	5.84	9.92	15.76	50.00	-34.24	AVG	
11	12.8220	20.20	10.09	30.29	60.00	-29.71	QP	
12	12.8220	9.74	10.09	19.83	50.00	-30.17	AVG	

Conducted Emission Test Data

Test Site:	1# Shielded Room
Operating Condition:	Mid CH (914.75MHz)
Test Specification:	AC 120V, 60Hz for Adapter
Comment:	Neutral Line
Temp.(℃)/Hum.(%RH):	23.9℃/45%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1740	31.20	9.83	41.03	64.76	-23.73	QP	
2	0.3899	15.61	9.81	25.42	48.06	-22.64	AVG	
3	0.3940	26.38	9.81	36.19	57.98	-21.79	QP	
4	0.5020	13.04	9.85	22.89	56.00	-33.11	QP	
5	1.1500	13.89	9.85	23.74	56.00	-32.26	QP	
6	3.6300	20.97	9.85	30.82	56.00	-25.18	QP	
7	3.8220	8.16	9.85	18.01	46.00	-27.99	AVG	
8	4.9620	1.58	9.85	11.43	46.00	-34.57	AVG	
9	8.4379	6.24	9.92	16.16	50.00	-33.84	AVG	
10	12.7780	10.31	10.09	20.40	50.00	-29.60	AVG	
11	12.9020	20.38	10.10	30.48	60.00	-29.52	QP	
12	16.1620	4.98	10.21	15.19	50.00	-34.81	AVG	

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

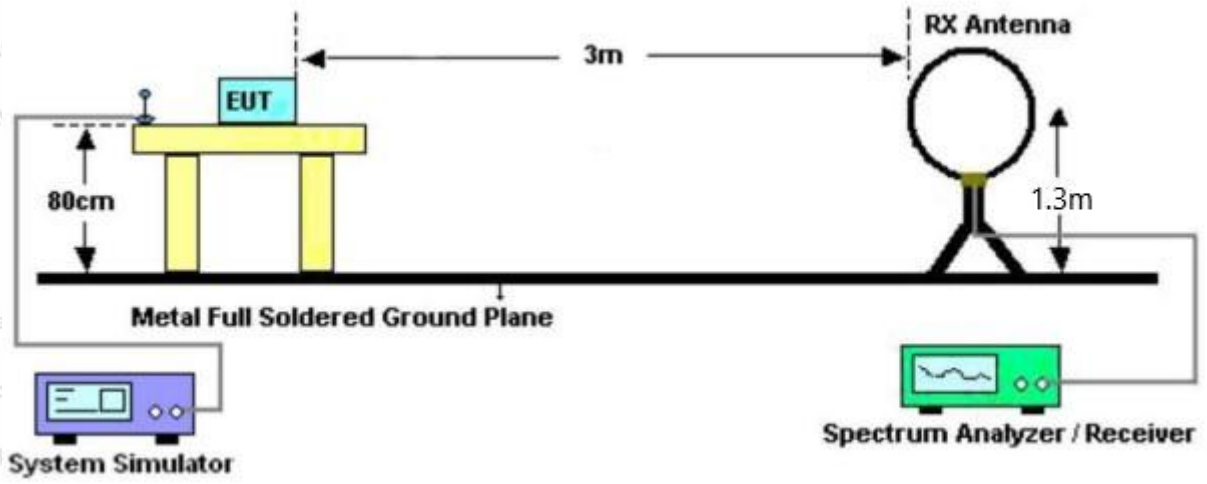


Figure 1. Below 30MHz

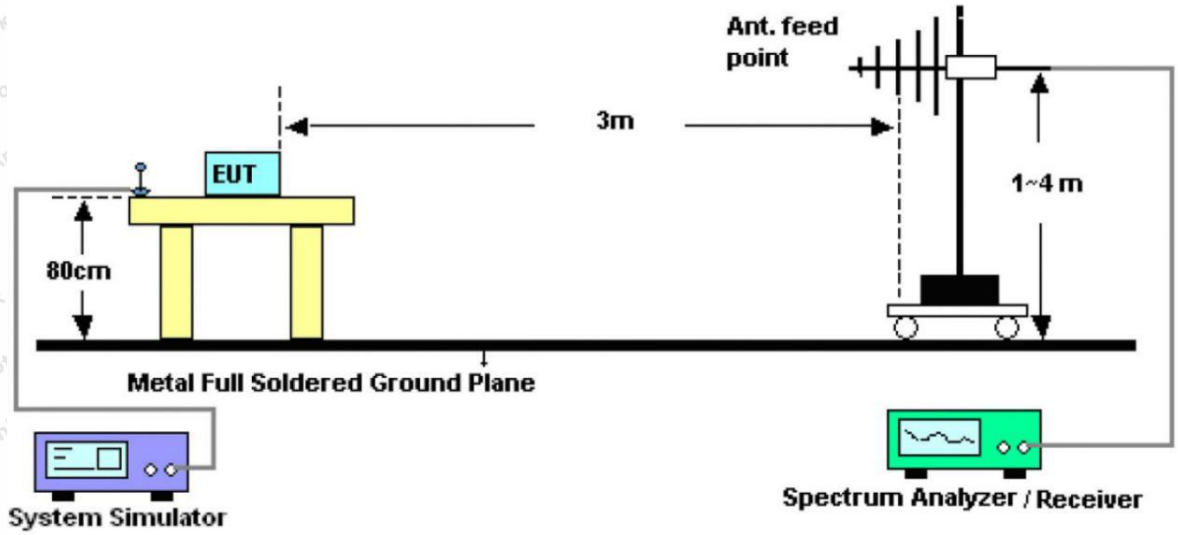


Figure 2. 30MHz to 1GHz

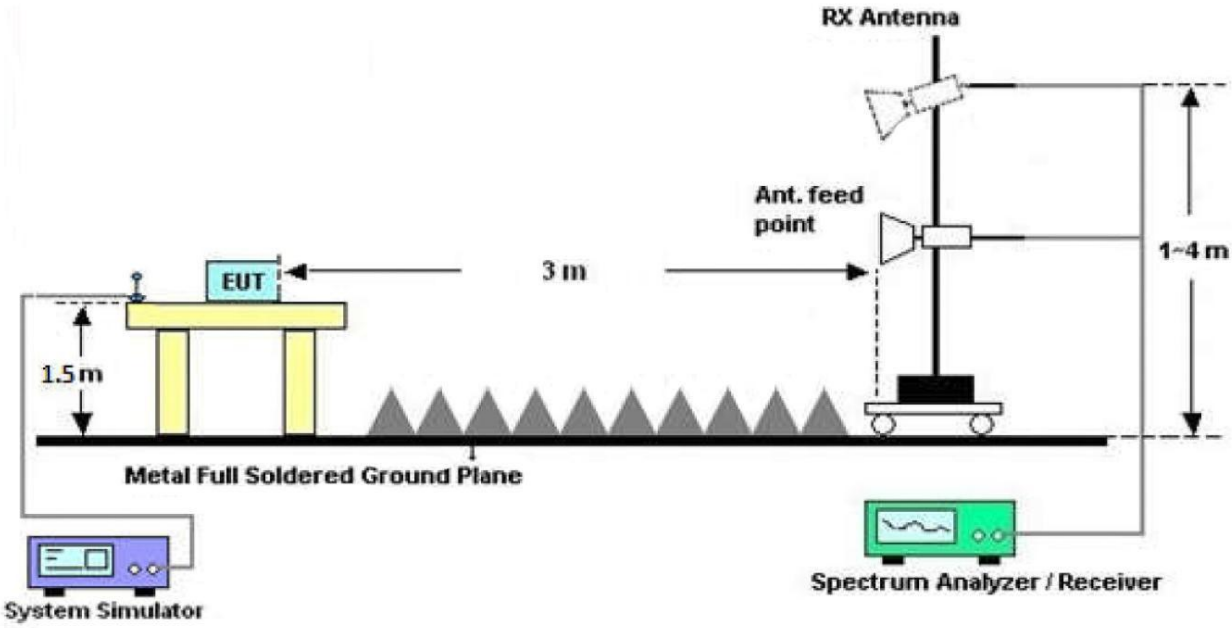


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m 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 modes, only the worst case is recorded in the report.

Test Results (30~1000MHz)

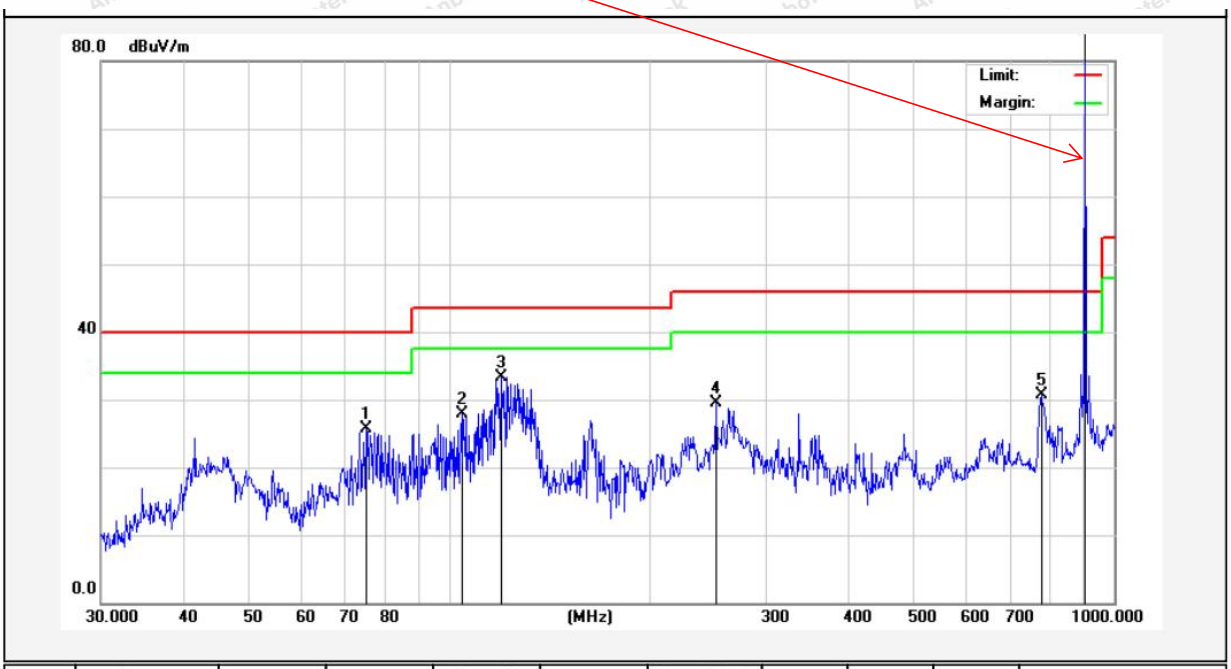
Test Mode: Mid CH (914.75MHz)

Power Source: AC 120V, 60Hz for Adapter

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 24.1℃/48%RH

Fundamental



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	75.1822	47.71	-22.04	25.67	40.00	-14.33	QP			
2	104.9033	50.12	-22.22	27.90	43.50	-15.60	QP			
3	119.8555	57.21	-23.94	33.27	43.50	-10.23	QP			
4	252.0627	50.82	-21.31	29.51	46.00	-16.49	QP			
5	776.8777	39.35	-8.71	30.64	46.00	-15.36	QP			
6	903.3093	117.45	-6.19	111.26	/	/	QP			

Test Results (30~1000MHz)

Test Mode: Mid CH (914.75MHz)

Power Source: AC 120V, 60Hz for Adapter

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 24.1℃/48%RH

Fundamental

No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	50.4089	44.72	-15.92	28.80	40.00	-11.20	QP			
2	87.1117	46.07	-18.13	27.94	40.00	-12.06	QP			
3	130.8369	56.90	-21.52	35.38	43.50	-8.12	QP			
4	492.4685	37.45	-12.45	25.00	46.00	-21.00	QP			
5	771.4486	44.01	-8.82	35.19	46.00	-10.81	QP			
6	903.3094	117.34	-6.19	111.15	/	/	QP			

Test Results (1GHz-25GHz)

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
1805.0050	H	43.59	7.39	28.73	26.31	53.40	74	-20.60	PK
1805.0050	H	40.80	7.39	28.73	26.31	50.61	54	-3.39	AV
2705.5430	H	36.08	8.10	29.71	27.01	46.88	74	-27.12	PK
2705.5430	H	32.60	8.10	29.71	27.01	43.40	54	-10.60	AV
3611.0000	H	--	--	--	--	--	--	--	PK
3611.0000	H	--	--	--	--	--	--	--	AV
1805.0050	V	43.81	7.39	28.73	26.31	53.62	74	-20.38	PK
1805.0050	V	41.24	7.39	28.73	26.31	51.05	54	-2.95	AV
2705.5430	V	34.83	8.10	29.71	27.01	45.63	74	-28.37	PK
2705.5430	V	31.55	8.10	29.71	27.01	42.35	54	-11.65	AV
3611.0000	V	--	--	--	--	--	--	--	PK
3611.0000	V	--	--	--	--	--	--	--	AV

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
1825.1250	H	43.45	7.41	28.72	26.31	53.27	74	-20.73	PK
1825.1250	H	41.00	7.41	28.72	26.31	50.82	54	-3.18	AV
2744.7500	H	35.71	8.11	29.71	27.01	46.52	74	-27.48	PK
2744.7500	H	34.95	8.11	29.71	27.01	45.76	54	-8.24	AV
3659.0000	H	--	--	--	--	--	--	--	PK
3659.0000	H	--	--	--	--	--	--	--	AV
1825.1250	V	44.27	7.41	28.72	26.31	54.09	74	-19.91	PK
1825.1250	V	42.27	7.41	28.72	26.31	52.09	54	-1.91	AV
2744.7500	V	34.42	8.11	29.71	27.01	45.23	74	-28.77	PK
2744.7500	V	33.11	8.11	29.71	27.01	43.92	54	-10.08	AV
3659.0000	V	--	--	--	--	--	--	--	PK
3659.0000	V	--	--	--	--	--	--	--	AV

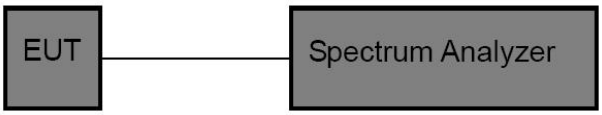
Test channel: High									
Frequency (MHz)	Antenna Pol.	Reading (dBuV/m)	Cable Loss (dB)	Ant Factor (dB)	Amplifier (dB)	Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Det. Mode
1854.5420	H	43.69	7.43	28.69	26.31	53.50	74	-20.50	PK
1854.5420	H	41.70	7.43	28.69	26.31	51.51	54	-2.49	AV
2781.7500	H	36.54	8.15	29.84	27.01	47.52	74	-26.48	PK
2781.7500	H	35.77	8.15	29.84	27.01	46.75	54	-7.25	AV
3709.0000	H	--	--	--	--	--	--	--	PK
3709.0000	H	--	--	--	--	--	--	--	AV
1854.5000	V	43.62	7.43	28.69	26.31	53.43	74	-20.57	PK
1854.5000	V	40.49	7.43	28.69	26.31	50.30	54	-3.70	AV
2781.7500	V	36.32	8.15	29.84	27.01	47.30	74	-26.70	PK
2781.7500	V	34.16	8.15	29.84	27.01	45.14	54	-8.86	AV
3709.0000	V	--	--	--	--	--	--	--	PK
3709.0000	V	--	--	--	--	--	--	--	AV

5. Maximum Peak Output Power Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(2)
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



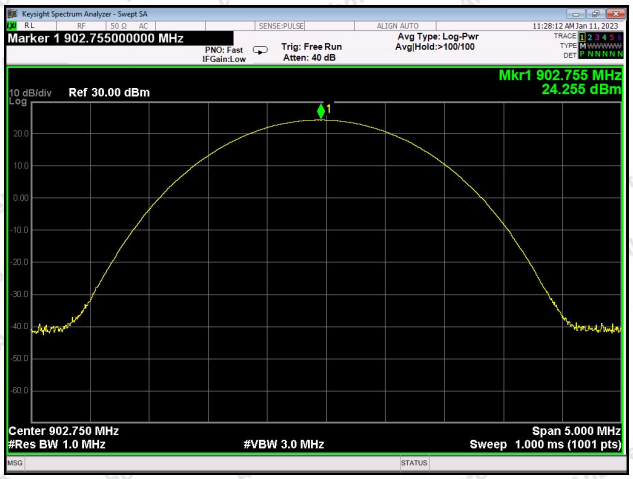
5.3. Test Procedure

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

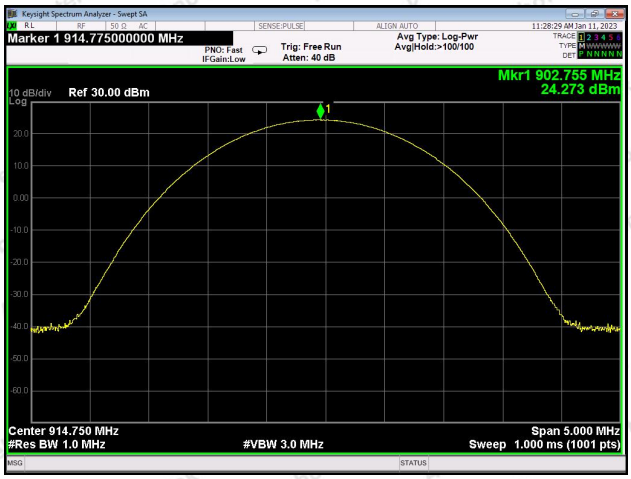
5.4. Test Data

Test Item	:	Max. peak output power	Test Mode	:	CH Low ~ CH High
Test Voltage	:	AC 120V, 60Hz for Adapter	Temperature	:	23.6° C
Test Result	:	PASS	Humidity	:	49 %

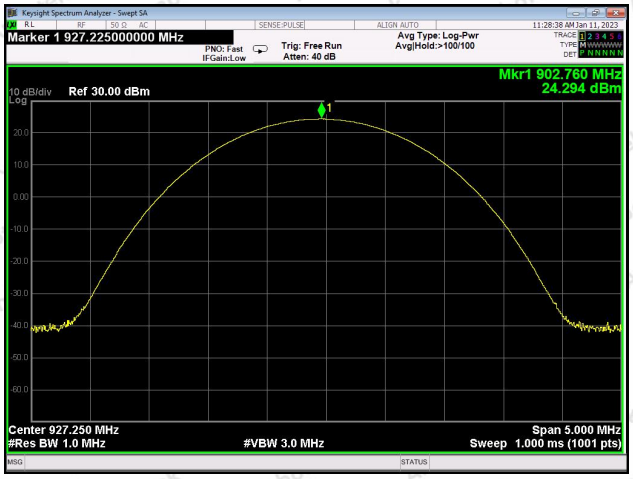
Test Channel	Peak Power output (dBm)	Limit (dBm)	Results
Low	24.255	27.50	PASS
Middle	24.273	27.50	PASS
High	24.294	27.50	PASS



Low Channel



Mid Channel



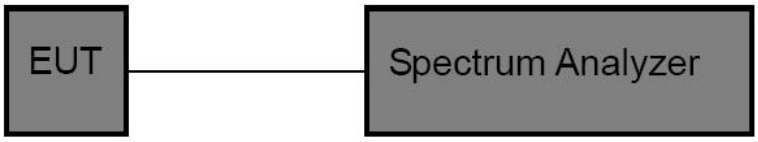
High Channel

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

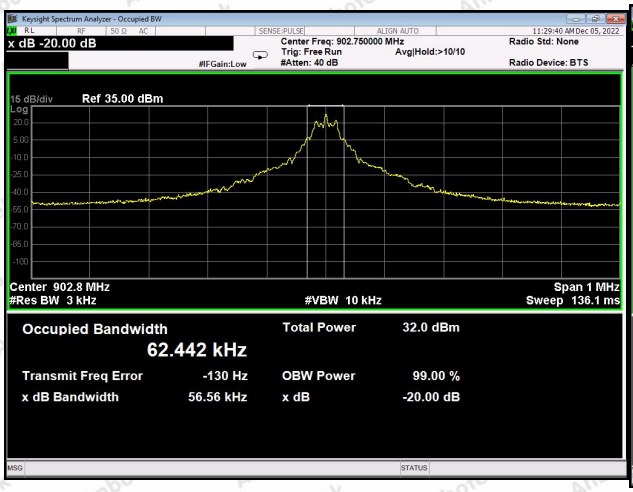
Using the following spectrum analyzer settings:

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

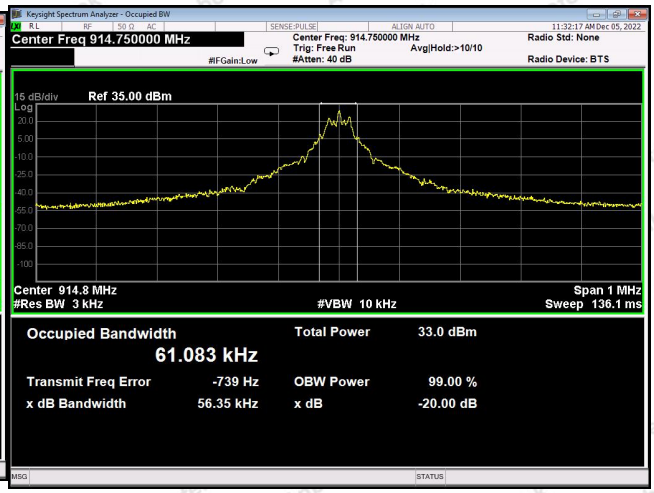
6.4. Test Data

Test Item	:	20dB BW	Test Mode	:	CH Low ~ CH High
Test Voltage	:	AC 120V, 60Hz for Adapter	Temperature	:	23.6℃
Test Result	:	PASS	Humidity	:	53 %

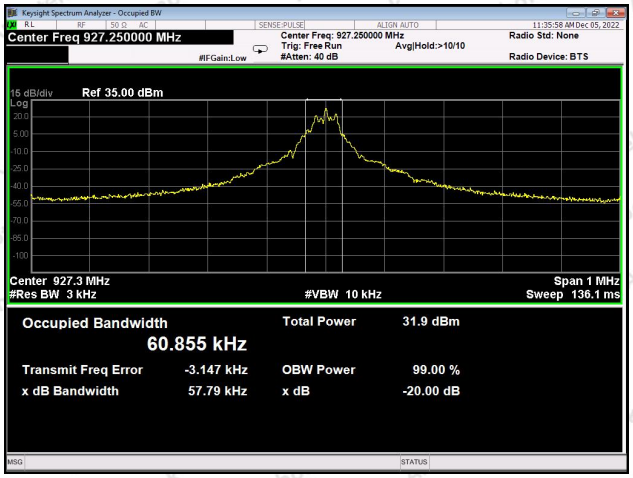
Test Channel	Bandwidth (kHz)	Limit (kHz)	Results
Low	56.56	≤250	PASS
Middle	56.35	≤250	PASS
High	57.79	≤250	PASS



Low Channel



Mid Channel



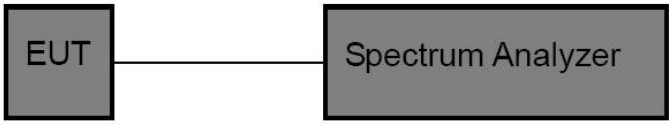
High Channel

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

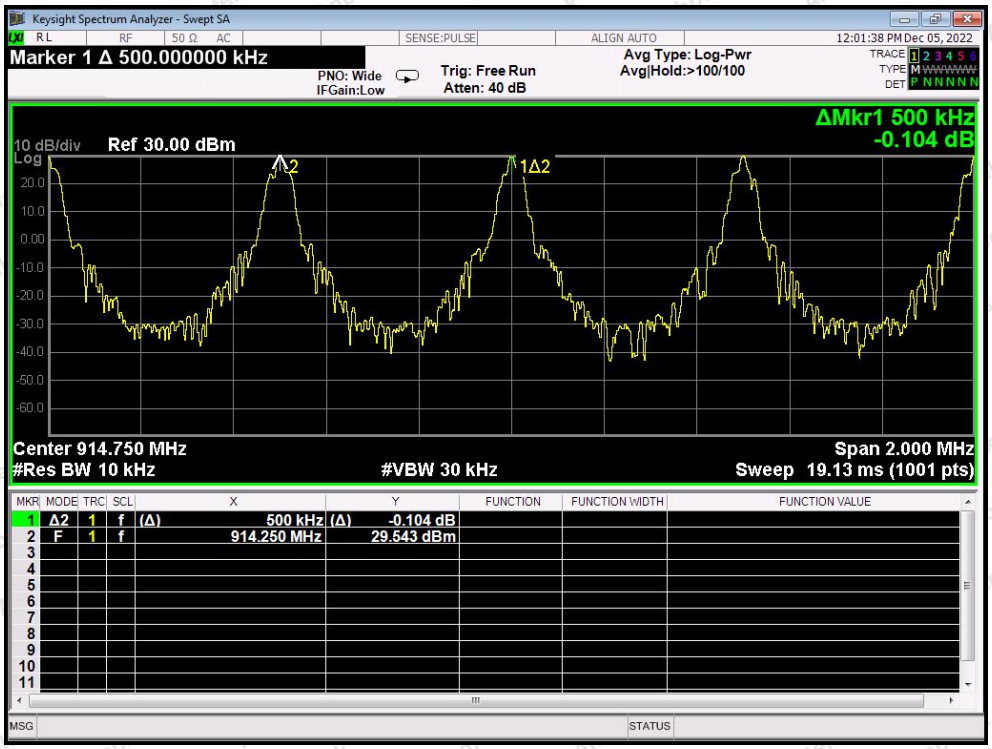
The EUT must have its hopping function enabled. Using the following spectrum analyzer settings:

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

7.4. 7.4. Test Data

Test Item	:	Frequency Separation	Test Mode	:	Hopping
Test Voltage	:	AC 120V, 60Hz for Adapter	Temperature	:	23.6°C
Test Result	:	PASS	Humidity	:	49 %

Mode	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Result
Hopping	914.25	500	57.79	PASS


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 500.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:01:38 PM Dec 05, 2022
ΔMkr1 500 kHz
-0.104 dB
10 dB/div
Ref 30.00 dBm
Center 914.750 MHz
#Res BW 10 kHz
#VBW 30 kHz
Span 2.000 MHz
Sweep 19.13 ms (1001 pts)
1 Δ2 1 f (Δ) 500 kHz (Δ) -0.104 dB
2 F 1 f 914.250 MHz 29.543 dBm

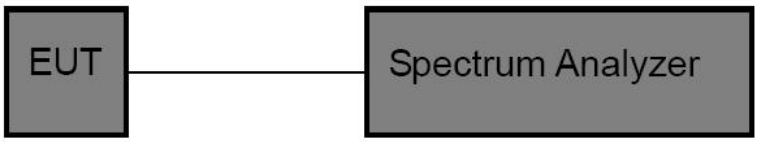
Hopping

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

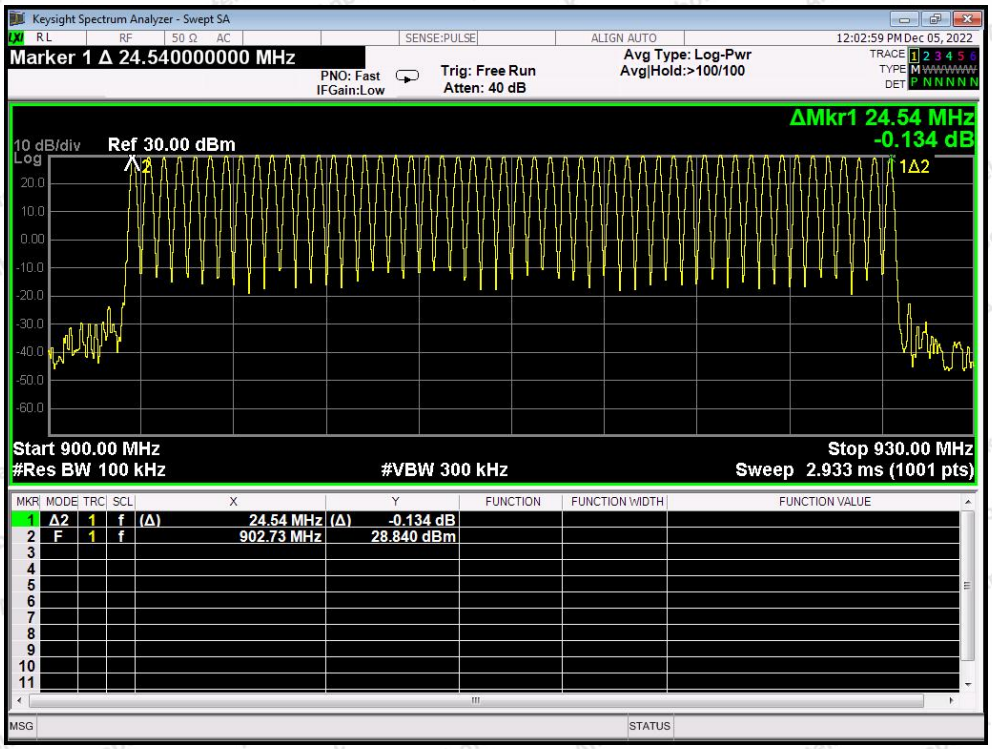
The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. Set the VBW ≥ RBW.
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 Mode	:	Hopping
Test Voltage	:	AC 120V, 60Hz for Adapter	Temperature	:	23.6° C
Test Result	:	PASS	Humidity	:	49 %

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


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 24.540000000 MHz
Avg Type: Log-Pwr
Avg|Hold:>100/100
Trig: Free Run
Atten: 40 dB
PNO: Fast
IFGain:Low
12:02:59 PM Dec 05, 2022
ΔMkr1 24.54 MHz
-0.134 dB
10 dB/div
Ref 30.00 dBm
Start 900.00 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 930.00 MHz
Sweep 2.933 ms (1001 pts)
1 Δ2 1 f (Δ) 24.54 MHz (Δ) -0.134 dB
2 F 1 f 902.73 MHz 28.840 dBm

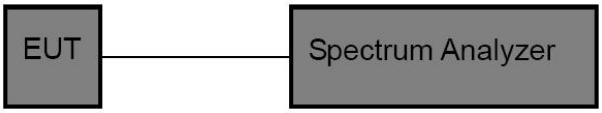
Hopping

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

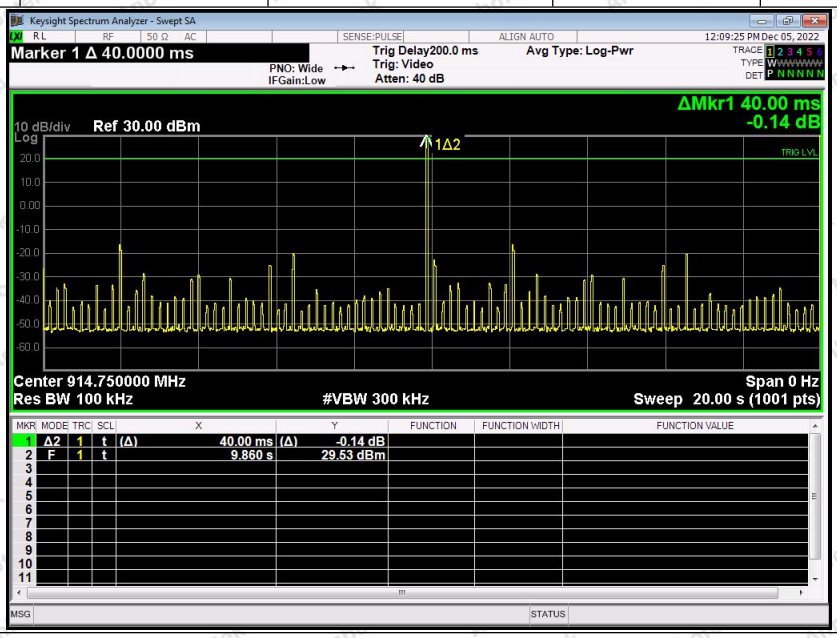
The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

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

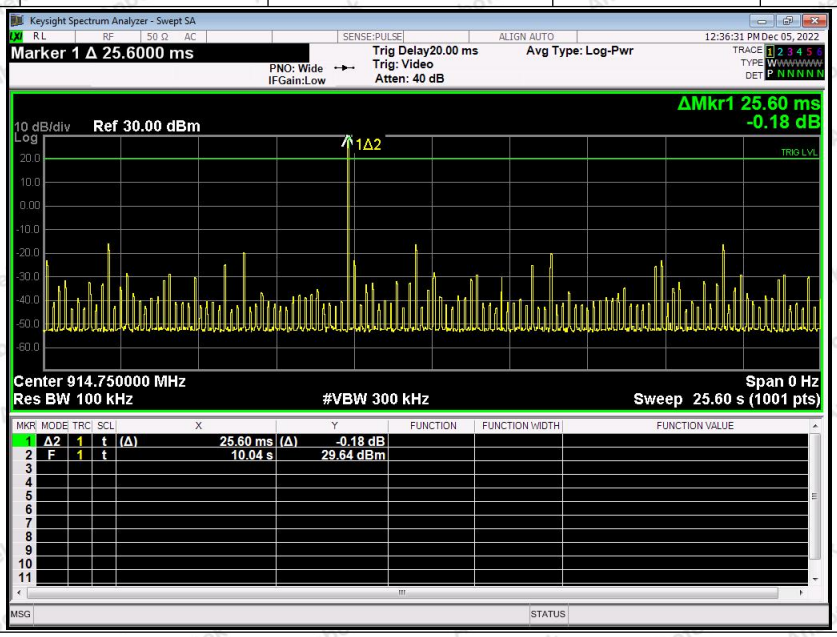
Test Item	:	Time of Occupancy	Test Mode	:	Hopping
Test Voltage	:	AC 120V, 60Hz for Adapter	Temperature	:	23.6° C
Test Result	:	PASS	Humidity	:	49 %

Requirement	Pulse width (ms)	Observe Period(s)	Dwell time (ms)	Limit (s)	Result
15.247(a)(1)(i)	40.00	20.00	40.00	0.40	PASS



Hopping

Requirement	Pulse width (ms)	Observe Period(s)	Dwell time (ms)	Limit (s)	Result
15.247(f)	25.6	25.60	25.6	0.40	PASS



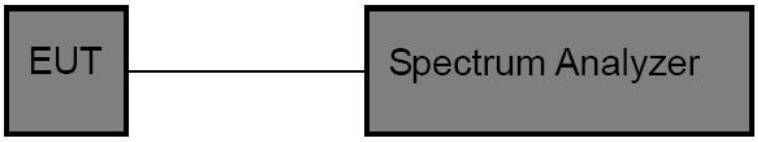
Hopping

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 in 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

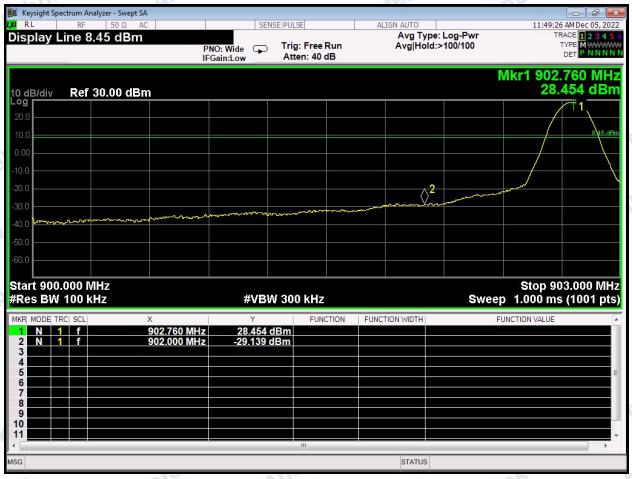
The EUT must have its hopping/Non-hopping function enabled. Using the following spectrum analyzer setting:

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.

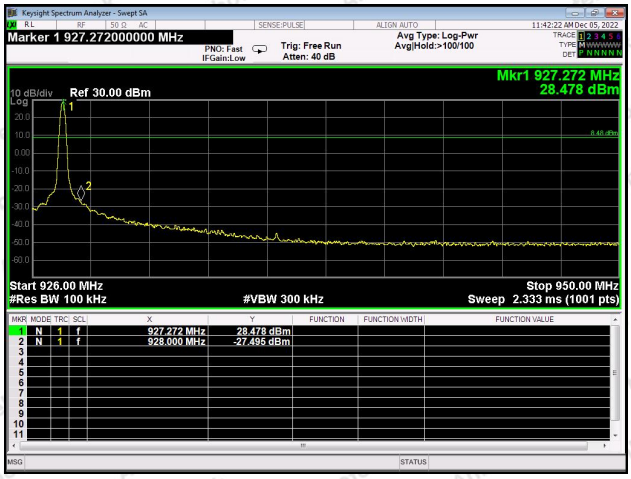
10.4. Test Data

Test Item	:	Band edge	Test Mode	:	CH Low, CH High
Test Voltage	:	AC 120V, 60Hz for Adapter	Temperature	:	23.6° C
Test Result	:	PASS	Humidity	:	49 %

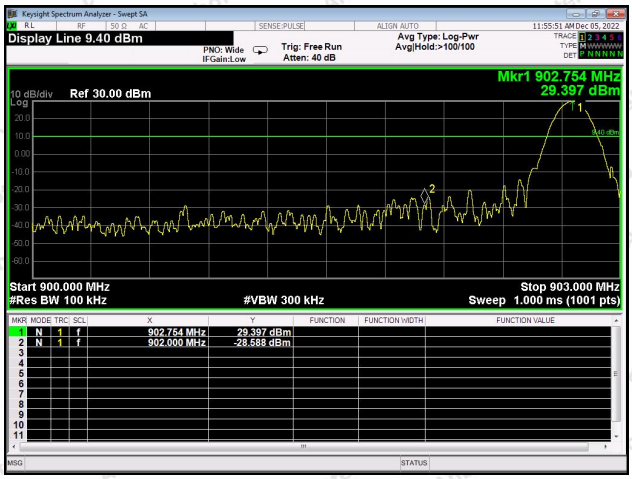
Band edge measurements



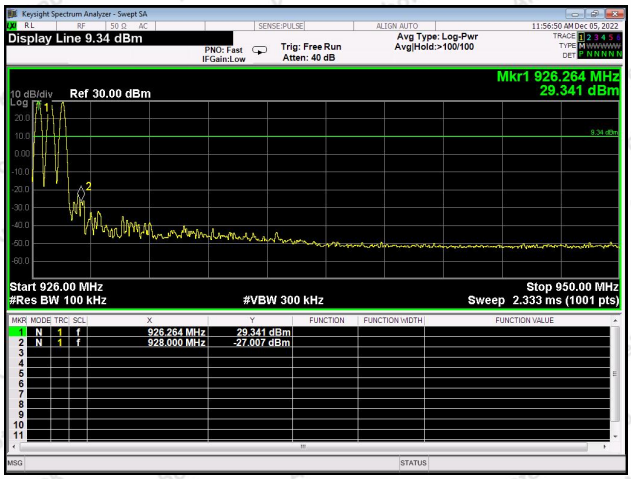
For Low channel Non-Hopping Mode



For High channel Non-Hopping Mode

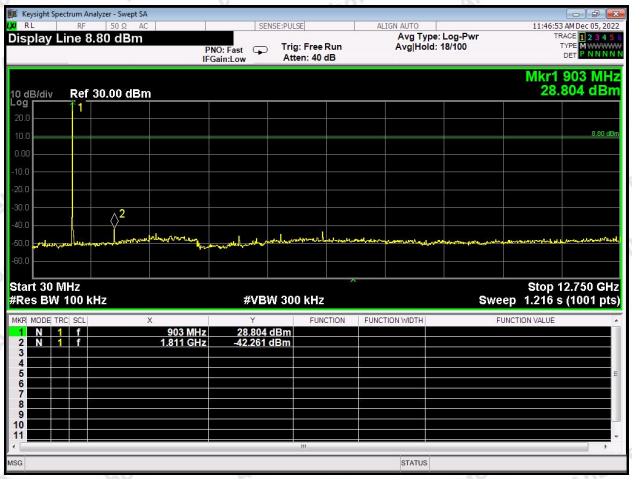


For Low channel Hopping Mode

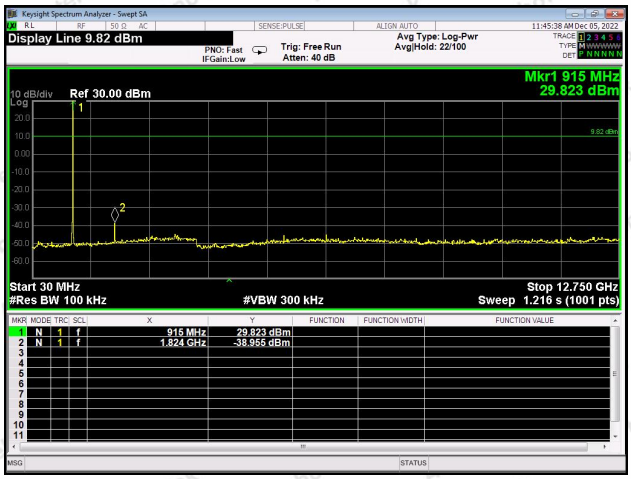


For High channel Hopping Mode

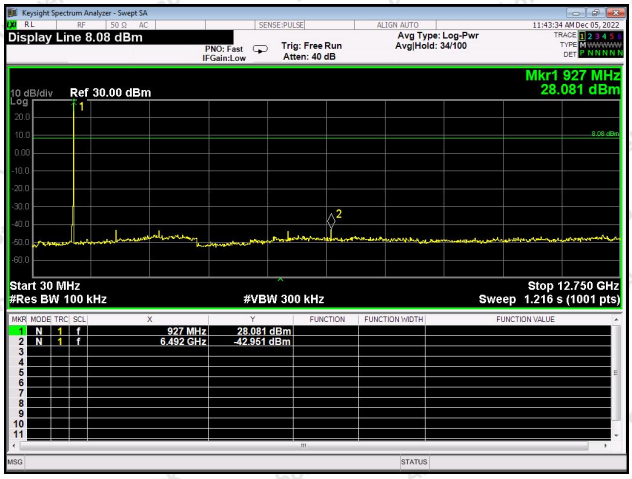
Conducted Emission Method



Low Channel



Mid Channel



High Channel

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 External Antenna which permanently attached, and the best case gain of the antenna is 8.5dBi. It complies with the standard requirement.

APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

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