



FCC TEST REPORT

FCC ID:2BA35-REBO-P-S-1

Report Number: ZKT-2305263907E
Date of Test..... May. 26, 2023- Jun. 05, 2023
Date of issue.....: Jun. 05, 2023
Total number of pages 48
Test Result: PASS

Testing Laboratory.....: Shenzhen ZKT Technology Co., Ltd.
Address: 1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China

Applicant's name: Shenwei Ruowo (Suzhou) Technology Co., LTD
Address: No. 116 Chengyang Road, Chengyang Street, Xiangcheng District, Suzhou City, Jiangsu Province

Manufacturer's name: Shenwei Ruowo (Suzhou) Technology Co., LTD
Address: No. 116 Chengyang Road, Chengyang Street, Xiangcheng District, Suzhou City, Jiangsu Province

Test specification:
Standard: FCC CFR Title 47 Part 15 Subpart C Section 15.247
ANSI C63.10:2013
Test procedure: /
Non-standard test method: N/A

Test Report Form No.: TRF-EL-112_V0
Test Report Form(s) Originator: ZKT Testing
Master TRF: Dated: 2021-04-22

This device described above has been tested by ZKT, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
This report shall not be reproduced except in full, without the written approval of ZKT, this document may be altered or revised by ZKT, personal only, and shall be noted in the revision of the document.

Product name.....: ReboCap
Trademark: REBOCAP
Model/Type reference: reboCap tracker
reboCap receiver
Adapter:
Ratings.....: Model:GQ24-120200-CU
Input:100-240V~50/60Hz 1.0A Max
Output:12V---2.0A



Testing procedure and testing location:

Testing Laboratory: Shenzhen ZKT Technology Co., Ltd.

Address.....: 1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China

Tested by (name + signature).....: Tom Zou

Tom Zou

Reviewer (name + signature).....: Jackson Fang

Jackson Fang

Approved (name + signature).....: Lake Xie





Table of Contents

	Page
1. VERSION	5
2. TEST SUMMARY	6
2.1 TEST FACILITY	7
2.2 MEASUREMENT UNCERTAINTY	7
3. GENERAL INFORMATION	8
3.1 GENERAL DESCRIPTION OF EUT	8
3.2 Test Setup Configuration	9
3.3 Support Equipment	9
3.4 Test Mode	10
3.5 EQUIPMENTS LIST FOR ALL TEST ITEMS	11
4. EMC EMISSION TEST	13
4.1 Conducted emissions	13
4.1.1 POWER LINE CONDUCTED EMISSION Limits	13
4.1.2 TEST PROCEDURE	13
4.1.3 DEVIATION FROM TEST STANDARD	13
4.1.4 TEST SETUP	13
4.1.5 EUT OPERATING CONDITIONS	14
4.1.6 Test Result	14
4.2 Radiated emissions	17
4.2.1 Radiated Emission Limits	17
4.2.2 TEST PROCEDURE	17
4.2.3 DEVIATION FROM TEST STANDARD	18
4.2.4 TEST SETUP	18
4.2.5 EUT OPERATING CONDITIONS	19
4.2.6 TEST RESULTS	20
5. RADIATED BAND EMISSION MEASUREMENT	25
5.1 Test Requirement:	25
5.2 TEST PROCEDURE	25
5.3 DEVIATION FROM TEST STANDARD	26
5.4 TEST SETUP	26
5.5 EUT OPERATING CONDITIONS	26
5.6 TEST RESULT	27
6. CONDUCTED BAND EDGE AND SPURIOUS EMISSION	28
6.1 Limit	28
6.2 Test Setup	28
6.3 Test procedure	28
6.4 DEVIATION FROM STANDARD	28
6.5 Test Result	29
7. 20DB&99% BANDWIDTH	34
7.1 Test Setup	34
7.2 Limit	34
7.3 Test procedure	34
7.4 DEVIATION FROM STANDARD	34



7.5 Test Result	34
8. MAXIMUM PEAK OUTPUT POWER	37
8.1 Block Diagram Of Test Setup	37
8.2 Limit	37
8.3 Test procedure	37
8.4 DEVIATION FROM STANDARD	37
8.5 Test Result	37
9. HOPPING CHANNEL SEPARATION	40
9.1 Test Setup	40
9.2 Test procedure	40
9.3 DEVIATION FROM STANDARD	40
9.4 Test Result	41
10. NUMBER OF HOPPING FREQUENCY	42
10.1 Test Setup	42
10.2 Test procedure	42
10.3 DEVIATION FROM STANDARD	42
10.4 Test Result	43
11. DWELL TIME	44
11.1 Test Setup	44
11.2 Test procedure	44
11.3 DEVIATION FROM STANDARD	44
11.4 Test Result	45
12. ANTENNA REQUIREMENT	47
13. TEST SETUP PHOTO	48
14. EUT CONSTRUCTIONAL DETAILS	48



1. VERSION

Report No.	Version	Description	Approved
ZKT-2305263907E	Rev.01	Initial issue of report	Jun. 05, 2023



2. TEST SUMMARY

Test procedures according to the technical standards:

FCC Part15 (15.247) , Subpart C			
Standard Section	Test Item	Result	Remark
15.203/15.247 (c)	Antenna Requirement	PASS	
15.207	AC Power Line Conducted Emission	PASS	
15.247 (b)(1)	Conducted Peak Output Power	PASS	
15.247 (a)(1)	20dB Occupied Bandwidth 99% OCB	PASS	
15.247 (a)(1)	Carrier Frequencies Separation	PASS	
15.247 (a)(1)(iii)	Hopping Channel Number	PASS	
15.247 (a)(1)(iii)	Dwell Time	PASS	
15.205/15.209	Radiated Emission and Restricted Band	PASS	
15.247(d)	Conducted Unwanted emissions and Band Edge	PASS	

NOTE:

(1) "N/A" denotes test is not applicable in this Test Report



2.1 TEST FACILITY

Shenzhen ZKT Technology Co., Ltd.
Add. : 1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street,
Bao'an District, Shenzhen, China

FCC Test Firm Registration Number: 692225
Designation Number: CN1299
IC Registered No.: 27033
Designation Number: CN0110

2.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

No.	Item	Uncertainty
1	3m chamber Radiated spurious emission(9KHz-30MHz)	U=4.5dB
2	3m chamber Radiated spurious emission(30MHz-1GHz)	U=4.8dB
3	3m chamber Radiated spurious emission(1GHz-6GHz)	U=4.9dB
4	3m chamber Radiated spurious emission(6GHz-40GHz)	U=5.0dB
5	Conducted disturbance	U=3.2dB
6	RF Band Edge	U=1.68dB
7	RF power conducted	U=1.86dB
8	RF conducted Spurious Emission	U=2.2dB
9	RF Occupied Bandwidth	U=1.8dB
10	RF Power Spectral Density	U=1.75dB
11	humidity uncertainty	U=5.3%
12	Temperature uncertainty	U=0.59°C



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Product Name:	Rebocap
Model No.:	rebocap tracker rebocap receiver
Model Different.:	All the model are the same circuit and RF module, the transmitter can transmit and receive, and the receiver can transmit and receive, the different are for model names.
Sample ID	ZKT-2305263907E
Sample(s) Status:	Engineer sample
Channel numbers:	40
Operation Frequency:	2402MHz~2480MHz
Modulation technology:	FHSS
Antenna Type:	PCB antenna
Antenna gain:	-0.58dBi
Power supply:	Adapter: Model:GQ24-120200-CU Input:100-240V~50/60Hz 1.0A Max Output:12V $\overline{\text{---}}$ 2.0A

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402 MHz	11	2422 MHz	21	2442 MHz	31	2462 MHz
2	2404 MHz	12	2424 MHz	22	2444 MHz	32	2464 MHz
3	2406 MHz	13	2426 MHz	23	2446 MHz	33	2466 MHz
4	2408 MHz	14	2428 MHz	24	2448 MHz	34	2468 MHz
5	2410 MHz	15	2430 MHz	25	2450 MHz	35	2470 MHz
6	2412 MHz	16	2432 MHz	26	2452 MHz	36	2472 MHz
7	2414 MHz	17	2434 MHz	27	2454 MHz	37	2474 MHz
8	2416 MHz	18	2436 MHz	28	2456 MHz	38	2476 MHz
9	2418 MHz	19	2438 MHz	29	2458 MHz	39	2478 MHz
10	2420 MHz	20	2440 MHz	30	2460 MHz	40	2480 MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Test channel	Frequency
The lowest channel	2402MHz
The middle channel	2440MHz
The Highest channel	2480MHz



3.2 Test Setup Configuration

Conducted Emission

DC Line

Radiated Emission

Conducted Spurious

3.3 Support Equipment

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	rebocap	REBOCAP	rebocap tracker	N/A	EUT
A-1	Adapter	N/A	GQ24-120200-CU	N/A	Auxiliary

Item	Shielded Type	Ferrite Core	Length	Note

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.



3.4 Test Mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.	

Test Software	EMI_TEST_v2.1
Power level setup	<7dBm



3.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Firmware Version	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	KEYSIGHT	9020A	MY55370835	A.17.05	Oct. 28, 2022	Oct. 27, 2023
2	Spectrum Analyzer (10kHz-39.9GHz)	R&S	FSV40-N	100363	1.71 SP2	Oct. 28, 2022	Oct. 27, 2023
3	EMI Test Receiver (9kHz-7GHz)	R&S	ESCI7	101169	4.32	Oct. 28, 2022	Oct. 27, 2023
4	Bilog Antenna (30MHz-1500MHz)	Schwarzbeck	VULB9168	N/A	N/A	Nov. 02, 2022	Nov. 01, 2023
5	Horn Antenna (1GHz-18GHz)	Agilent	AH-118	071145	N/A	Nov. 01, 2022	Oct. 31, 2023
6	Horn Antenna (15GHz-40GHz)	A.H.System	SAS-574	588	N/A	Oct. 28, 2022	Oct. 27, 2023
7	Loop Antenna	TESEQ	HLA6121	58357	N/A	Nov. 01, 2022	Oct. 31, 2023
8	Amplifier (30-1000MHz)	EM Electronics	EM330 Amplifier	060747	N/A	Nov. 15, 2022	Nov. 14, 2023
9	Amplifier (1GHz-26.5GHz)	Agilent	8449B	3008A00315	N/A	Oct. 28, 2022	Oct. 27, 2023
10	Amplifier (500MHz-40GHz)	全聚达	DLE-161	097	N/A	Oct. 28, 2022	Oct. 27, 2023
11	Test Cable	N/A	R-01	N/A	N/A	Oct. 28, 2022	Oct. 27, 2023
12	Test Cable	N/A	R-02	N/A	N/A	Oct. 28, 2022	Oct. 27, 2023
13	Test Cable	N/A	R-03	N/A	N/A	Oct. 28, 2022	Oct. 27, 2023
14	Test Cable	N/A	RF-01	N/A	N/A	Oct. 28, 2022	Oct. 27, 2023
15	Test Cable	N/A	RF-02	N/A	N/A	Oct. 28, 2022	Oct. 27, 2023
16	Test Cable	N/A	RF-03	N/A	N/A	Oct. 28, 2022	Oct. 27, 2023
17	ESG Signal Generator	Agilent	E4421B	N/A	B.03.84	Oct. 21, 2022	Oct. 20, 2023
18	Signal Generator	Agilent	N5182A	N/A	A.01.87	Oct. 21, 2022	Oct. 20, 2023
19	Magnetic Field Probe Tester	Narda	ELT-400	0-0344	N/A	Nov. 15, 2022	Nov. 14, 2023
20	Wideband Radio Communication Test	R&S	CMW500	106504	V 3.7.22	Oct. 28, 2022	Oct. 27, 2023
21	MWRF Power Meter Test system	MW	MW100-RF CB	N/A	N/A	Oct. 21, 2022	Oct. 20, 2023
22	D.C. Power Supply	LongWei	TPR-6405D	N/A	N/A	\	\
23	EMC Software	Frad	EZ-EMC	Ver.EMC-CO N 3A1.1	N/A	\	\
24	RF Software	MW	MTS8310	V2.0.0.0	N/A	\	\
25	Turntable	MF	MF-7802BS	N/A	N/A	\	\
26	Antenna tower	MF	MF-7802BS	N/A	N/A	\	\



Conducted emissions Test

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Firmware Version	Last calibration	Calibrated until
1	LISN	R&S	ENV216	101471	N/A	Oct. 21, 2022	Oct. 20, 2023
2	LISN	CYBERTEK	EM5040A	E185040014 g	N/A	Oct. 21, 2022	Oct. 20, 2023
3	Test Cable	N/A	C-01	N/A	N/A	Oct. 21, 2022	Oct. 20, 2023
4	Test Cable	N/A	C-02	N/A	N/A	Oct. 21, 2022	Oct. 20, 2023
5	Test Cable	N/A	C-03	N/A	N/A	Oct. 21, 2022	Oct. 20, 2023
6	EMI Test Receiver	R&S	ESC13	101393	4.42 SP3	Oct. 28, 2022	Oct. 27, 2023
7	Triple-Loop Antenna	N/A	RF300	N/A	N/A	Oct. 28, 2022	Oct. 27, 2023
8	Absorbing Clamp	DZ	ZN23201	15034	N/A	Oct. 31, 2022	Oct. 30, 2023
9	EMC Software	Frad	EZ-EMC	Ver.EMC-CO N 3A1.1	N/A	\	\



4. EMC EMISSION TEST

4.1 Conducted emissions

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto

4.1.1 POWER LINE CONDUCTED EMISSION Limits

FREQUENCY (MHz)	Limit (dBuV)		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

(1) *Decreases with the logarithm of the frequency.

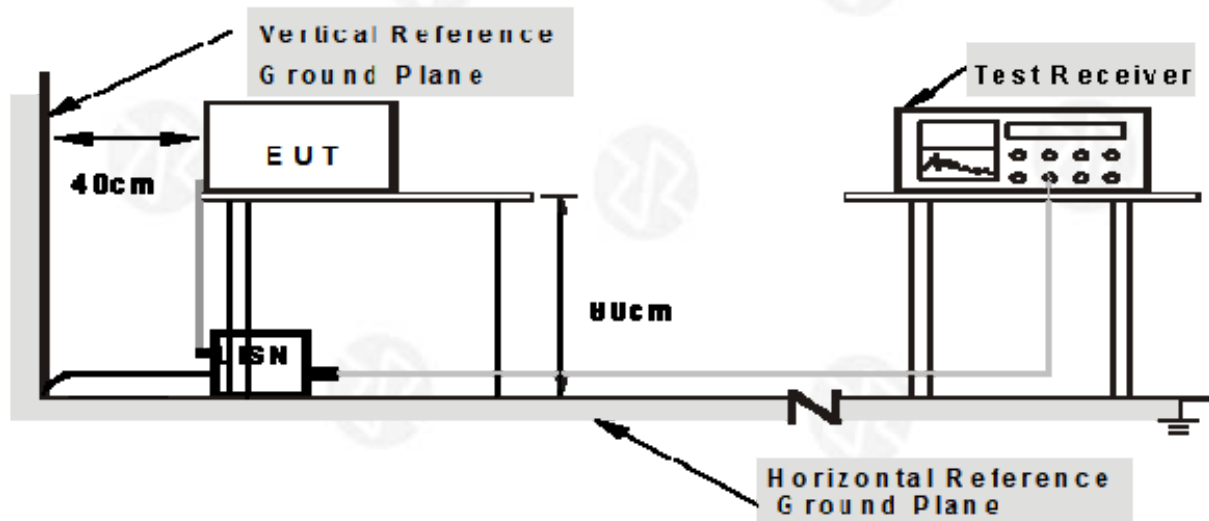
4.1.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.3 DEVIATION FROM TEST STANDARD

No deviation

4.1.4 TEST SETUP



**Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes**

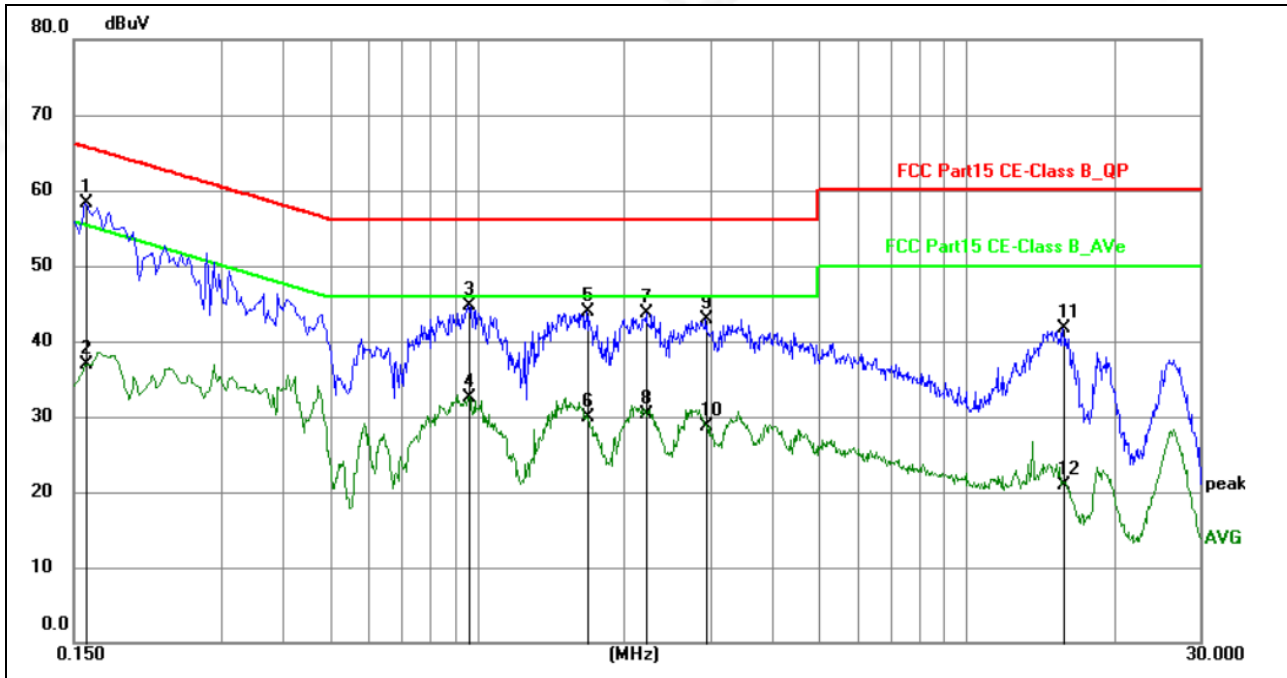
4.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

4.1.6 Test Result



Temperature :	26°C	Relative Humidity:	54%
Pressure :	101kPa	Phase :	L
Test Voltage :	AC 120V/60Hz		



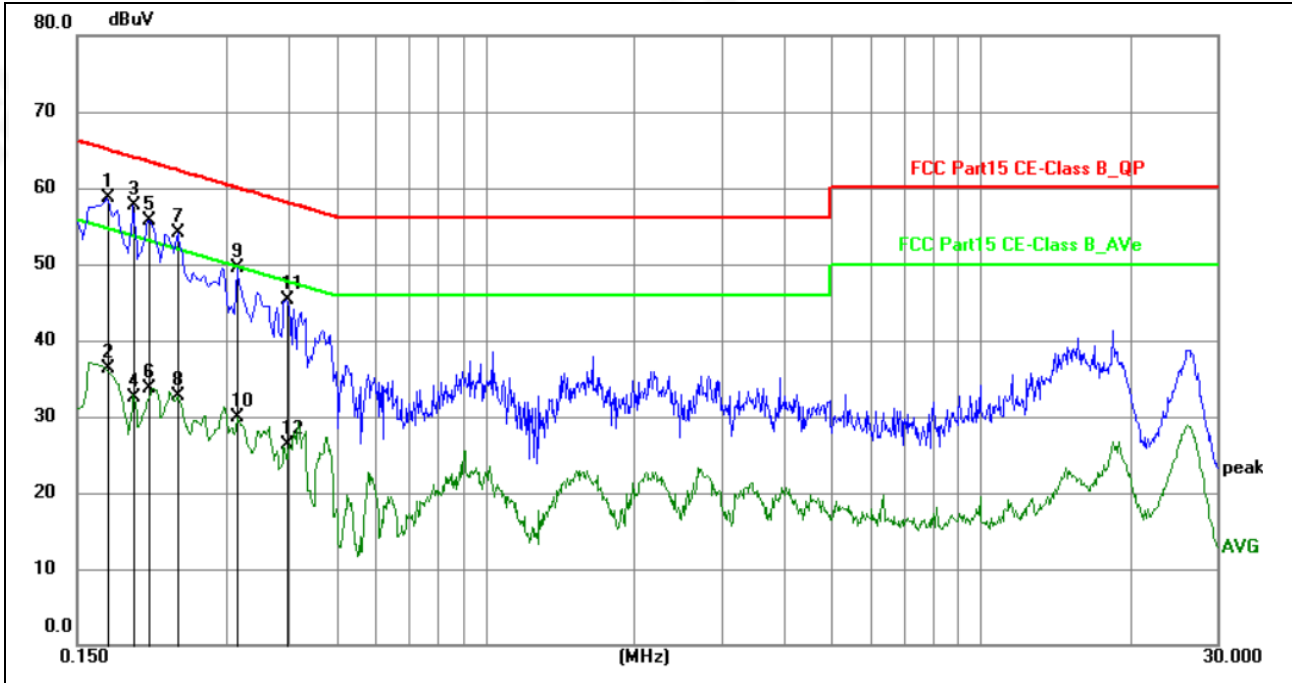
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1590	45.57	12.81	58.38	65.52	-7.14	QP	P	
2	0.1590	24.14	12.81	36.95	55.52	-18.57	AVG	P	
3	0.9600	34.31	10.45	44.76	56.00	-11.24	QP	P	
4	0.9600	21.96	10.45	32.41	46.00	-13.59	AVG	P	
5	1.6754	33.60	10.27	43.87	56.00	-12.13	QP	P	
6	1.6754	19.58	10.27	29.85	46.00	-16.15	AVG	P	
7	2.2244	33.63	10.13	43.76	56.00	-12.24	QP	P	
8	2.2244	20.17	10.13	30.30	46.00	-15.70	AVG	P	
9	2.9310	33.02	9.96	42.98	56.00	-13.02	QP	P	
10	2.9310	18.84	9.96	28.80	46.00	-17.20	AVG	P	
11	15.7290	32.46	9.26	41.72	60.00	-18.28	QP	P	
12	15.7290	11.74	9.26	21.00	50.00	-29.00	AVG	P	

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Measurement Level = Reading level + Correct Factor



Temperature :	26°C	Relative Humidity:	54%
Pressure :	101kPa	Phase :	N
Test Voltage :	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1725	46.24	12.51	58.75	64.84	-6.09	QP	P	
2	0.1725	23.70	12.51	36.21	54.84	-18.63	AVG	P	
3	0.1949	45.60	12.03	57.63	63.83	-6.20	QP	P	
4	0.1949	20.45	12.03	32.48	53.83	-21.35	AVG	P	
5	0.2085	43.92	11.88	55.80	63.26	-7.46	QP	P	
6	0.2085	21.79	11.88	33.67	53.26	-19.59	AVG	P	
7	0.2400	42.44	11.73	54.17	62.10	-7.93	QP	P	
8	0.2400	21.01	11.73	32.74	52.10	-19.36	AVG	P	
9	0.3165	38.11	11.39	49.50	59.80	-10.30	QP	P	
10	0.3165	18.48	11.39	29.87	49.80	-19.93	AVG	P	
11	0.3975	34.35	11.01	45.36	57.91	-12.55	QP	P	
12	0.3975	15.29	11.01	26.30	47.91	-21.61	AVG	P	

Notes:
 1. An initial pre-scan was performed on the line and neutral lines with peak detector.
 2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
 3. Measurement Level = Reading level + Correct Factor



4.2 Radiated emissions

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	Quasi-peak	200Hz	MX5Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average

4.2.1 Radiated Emission Limits

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

4.2.2 TEST PROCEDURE

Below 1GHz test procedure as below:

- a. The EUT was placed on the top of a rotating table 0.1 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.



- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

- g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
- h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel

Note:

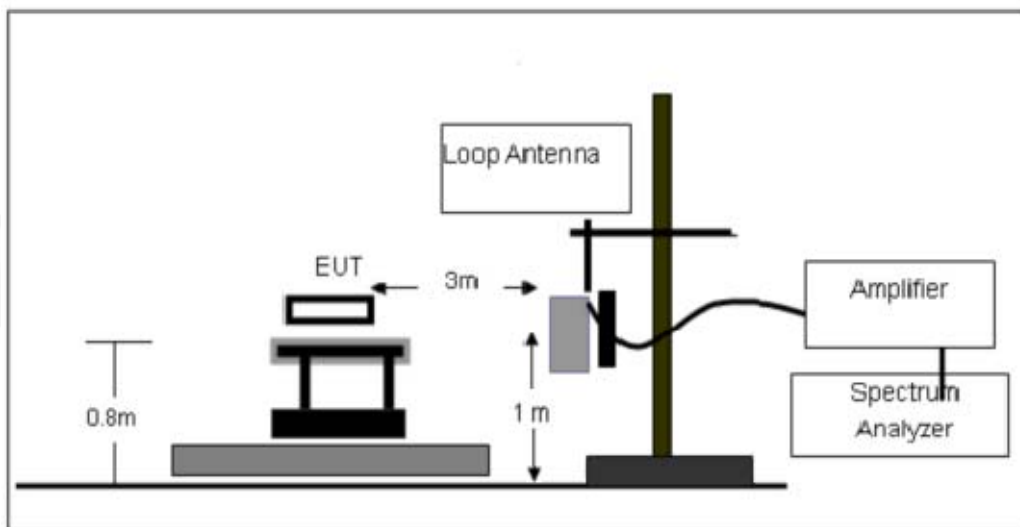
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

4.2.3 DEVIATION FROM TEST STANDARD

No deviation

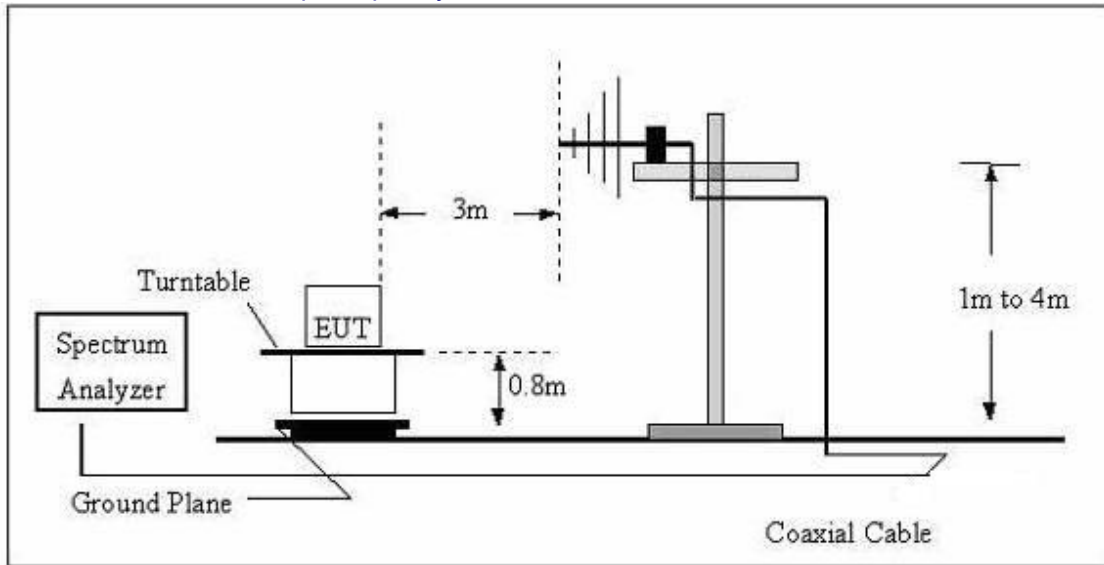
4.2.4 TEST SETUP

(A) Radiated Emission Test-Up Frequency Below 30MHz

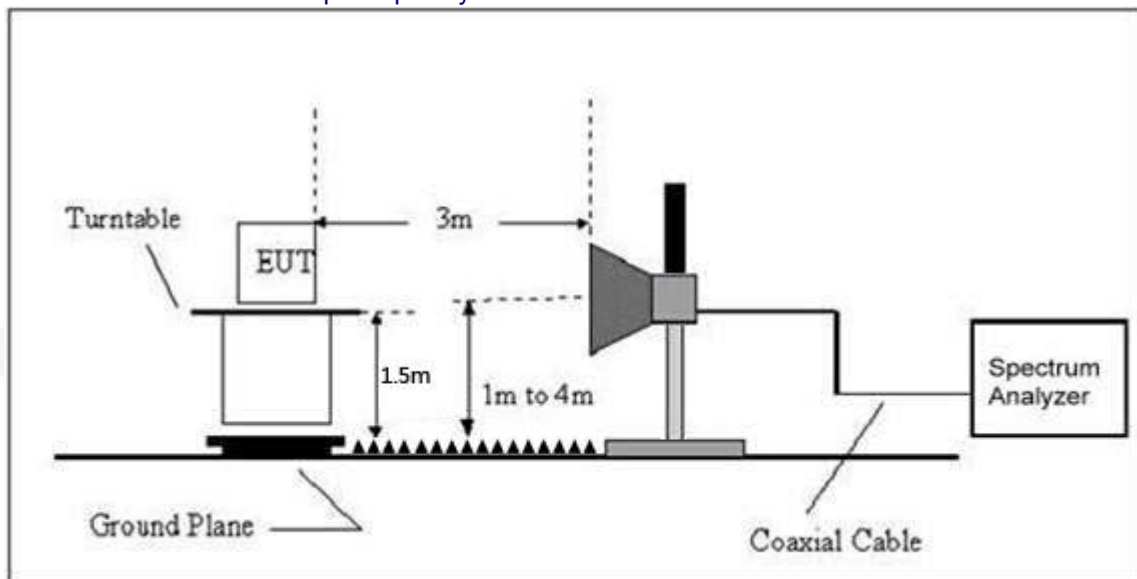




(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



4.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



4.2.6 TEST RESULTS

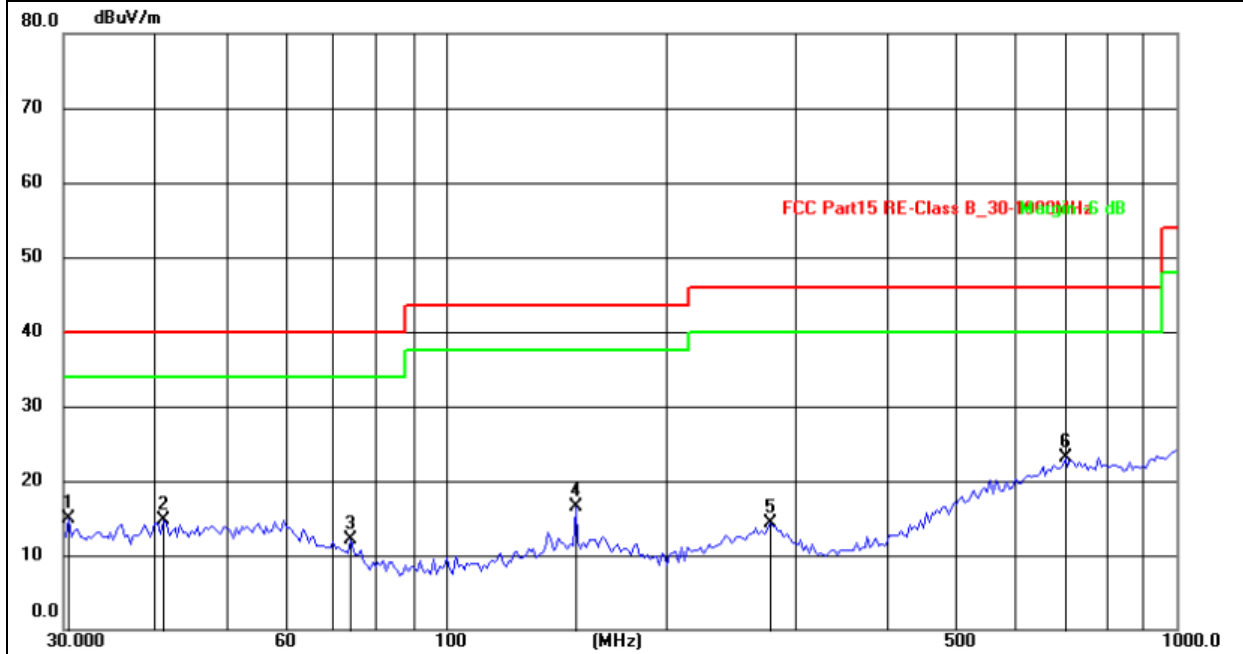
Between 9KHz – 30MHz

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o) & RSS-Gen 6.13, the test result no need to reported.



Between 30MHz – 1GHz

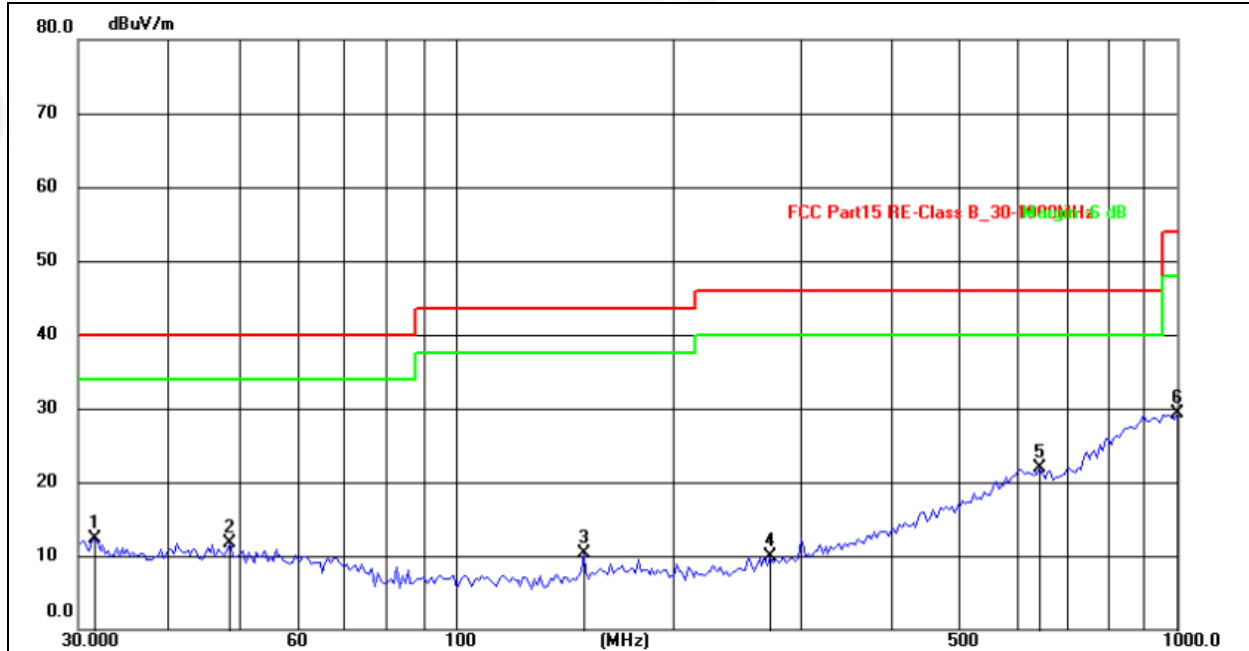
Temperature:	26°C	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	30.5306	29.17	-14.29	14.88	40.00	-25.12	QP
2	41.1320	28.79	-14.12	14.67	40.00	-25.33	QP
3	74.0052	29.98	-17.93	12.05	40.00	-27.95	QP
4	150.5377	33.11	-16.54	16.57	43.50	-26.93	QP
5	278.0668	28.80	-14.46	14.34	46.00	-31.66	QP
6	704.2261	29.79	-6.72	23.07	46.00	-22.93	QP



Temperature:	26°C	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	31.6201	30.43	-18.17	12.26	40.00	-27.74	QP
2	48.5866	28.84	-17.23	11.61	40.00	-28.39	QP
3	150.5377	30.88	-20.54	10.34	43.50	-33.16	QP
4	273.2340	29.16	-19.19	9.97	46.00	-36.03	QP
5	645.1194	29.56	-7.72	21.84	46.00	-24.16	QP
6	1000.0000	29.51	-0.22	29.29	54.00	-24.71	QP

Remarks:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. The test data shows only the worst case 2402MHz mode



1GHz~25GHz

FHSS

Polar (H/V)	Frequency	Meter Reading	Pre-amplifier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
Low Channel:2402MHz									
V	4804.00	52.72	30.55	5.77	24.66	52.60	74.00	-21.40	Pk
V	4804.00	43.89	30.55	5.77	24.66	43.77	54.00	-10.23	AV
V	7206.00	52.49	30.33	6.32	24.55	53.03	74.00	-20.97	Pk
V	7206.00	43.24	30.33	6.32	24.55	43.78	54.00	-10.22	AV
V	9608.00	54.67	30.85	7.45	24.69	55.96	74.00	-18.04	Pk
V	9608.00	43.30	30.85	7.45	24.69	44.59	54.00	-9.41	AV
V	12010.00	50.43	31.02	8.99	25.57	53.97	74.00	-20.03	Pk
V	12010.00	43.56	31.02	8.99	25.57	47.10	54.00	-6.90	AV
H	4804.00	53.76	30.55	5.77	24.66	53.64	74.00	-20.36	Pk
H	4804.00	43.74	30.55	5.77	24.66	43.62	54.00	-10.38	AV
H	7206.00	51.23	30.33	6.32	24.55	51.77	74.00	-22.23	Pk
H	7206.00	43.70	30.33	6.32	24.55	44.24	54.00	-9.76	AV
H	9608.00	52.07	30.85	7.45	24.69	53.36	74.00	-20.64	Pk
H	9608.00	43.01	30.85	7.45	24.69	44.30	54.00	-9.70	AV
H	12010.00	50.70	31.02	8.99	25.57	54.24	74.00	-19.76	Pk
H	12010.00	43.26	31.02	8.99	25.57	46.80	54.00	-7.20	AV

Polar (H/V)	Frequency	Meter Reading	Pre-amplifier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
Middle Channel:2440MHz									
V	4880.00	53.47	30.55	5.77	24.66	53.35	74.00	-20.65	Pk
V	4880.00	43.65	30.55	5.77	24.66	43.53	54.00	-10.47	AV
V	7320.00	51.31	30.33	6.32	24.55	51.85	74.00	-22.15	Pk
V	7320.00	43.77	30.33	6.32	24.55	44.31	54.00	-9.69	AV
V	9760.00	51.02	30.85	7.45	24.69	52.31	74.00	-21.69	Pk
V	9760.00	43.36	30.85	7.45	24.69	44.65	54.00	-9.35	AV
V	12200.00	51.91	31.02	8.99	25.57	55.45	74.00	-18.55	Pk
V	12200.00	43.77	31.02	8.99	25.57	47.31	54.00	-6.69	AV
H	4880.00	50.85	30.55	5.77	24.66	50.73	74.00	-23.27	Pk
H	4880.00	43.49	30.55	5.77	24.66	43.37	54.00	-10.63	AV
H	7320.00	51.20	30.33	6.32	24.55	51.74	74.00	-22.26	Pk
H	7320.00	43.91	30.33	6.32	24.55	44.45	54.00	-9.55	AV
H	9760.00	52.53	30.85	7.45	24.69	53.82	74.00	-20.18	Pk
H	9760.00	43.65	30.85	7.45	24.69	44.94	54.00	-9.06	AV
H	12200.00	53.73	31.02	8.99	25.57	57.27	74.00	-16.73	Pk
H	12200.00	43.88	31.02	8.99	25.57	47.42	54.00	-6.58	AV



Polar (H/V)	Frequency	Meter Reading	Pre-amplifier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
High Channel:2480MHz									
V	4960.00	53.00	30.55	5.77	24.66	52.88	74.00	-21.12	Pk
V	4960.00	43.71	30.55	5.77	24.66	43.59	54.00	-10.41	AV
V	7440.00	53.61	30.33	6.32	24.55	54.15	74.00	-19.85	Pk
V	7440.00	43.04	30.33	6.32	24.55	43.58	54.00	-10.42	AV
V	9920.00	53.88	30.85	7.45	24.69	55.17	74.00	-18.83	Pk
V	9920.00	43.08	30.85	7.45	24.69	44.37	54.00	-9.63	AV
V	12400.00	53.81	31.02	8.99	25.57	57.35	74.00	-16.65	Pk
V	12400.00	43.38	31.02	8.99	25.57	46.92	54.00	-7.08	AV
H	4960.00	51.90	30.55	5.77	24.66	51.78	74.00	-22.22	Pk
H	4960.00	43.26	30.55	5.77	24.66	43.14	54.00	-10.86	AV
H	7440.00	50.44	30.33	6.32	24.55	50.98	74.00	-23.02	Pk
H	7440.00	43.49	30.33	6.32	24.55	44.03	54.00	-9.97	AV
H	9920.00	51.03	30.85	7.45	24.69	52.32	74.00	-21.68	Pk
H	9920.00	44.00	30.85	7.45	24.69	45.29	54.00	-8.71	AV
H	12400.00	54.68	31.02	8.99	25.57	58.22	74.00	-15.78	Pk
H	12400.00	43.33	31.02	8.99	25.57	46.87	54.00	-7.13	AV

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



5. RADIATED BAND EMISSION MEASUREMENT

5.1 Test Requirement:

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Average	1MHz	3MHz	Average

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

5.2 TEST PROCEDURE

Above 1GHz test procedure as below:

- a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel,the Highest channel

Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

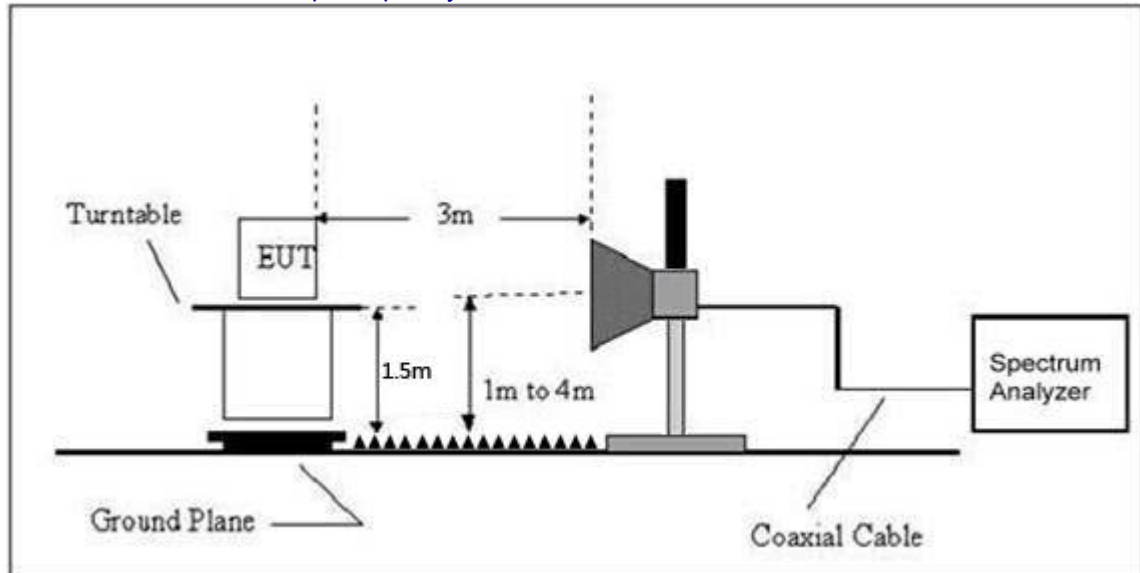


5.3 DEVIATION FROM TEST STANDARD

No deviation

5.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



5.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



5.6 TEST RESULT

	Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission level (dBuV/m)	Limit (dBuV/m)	Detector Type	Result
FHSS	Low Channel: 2402MHz									
	H	2390.00	54.35	30.22	4.85	23.98	52.96	74.00	PK	PASS
	H	2390.00	44.90	30.22	4.85	23.98	43.51	54.00	AV	PASS
	H	2400.00	54.35	30.22	4.85	23.98	52.96	74.00	PK	PASS
	H	2400.00	44.81	30.22	4.85	23.98	43.42	54.00	AV	PASS
	V	2390.00	53.90	30.22	4.85	23.98	52.51	74.00	PK	PASS
	V	2390.00	44.24	30.22	4.85	23.98	42.85	54.00	AV	PASS
	V	2400.00	53.03	30.22	4.85	23.98	51.64	74.00	PK	PASS
	V	2400.00	44.62	30.22	4.85	23.98	43.23	54.00	AV	PASS
	High Channel: 2480MHz									
	H	2483.50	53.30	30.22	4.85	23.98	51.91	74.00	Pk	PASS
	H	2483.50	44.11	30.22	4.85	23.98	42.72	54.00	AV	PASS
	H	2500.00	53.49	30.22	4.85	23.98	52.10	74.00	Pk	PASS
	H	2500.00	44.92	30.22	4.85	23.98	43.53	54.00	AV	PASS
	V	2483.50	54.40	30.22	4.85	23.98	53.01	74.00	Pk	PASS
	V	2483.50	44.16	30.22	4.85	23.98	42.77	54.00	AV	PASS
	V	2500.00	53.17	30.22	4.85	23.98	51.78	74.00	Pk	PASS
	V	2500.00	44.97	30.22	4.85	23.98	43.58	54.00	AV	PASS
Remark:										
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit										



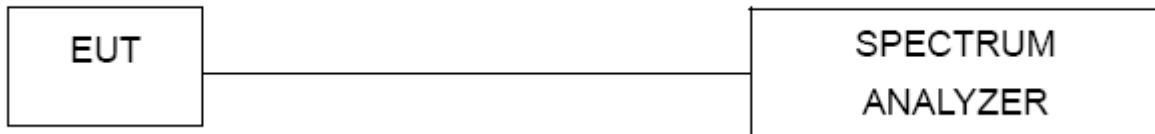
6. CONDUCTED BAND EDGE AND SPURIOUS EMISSION

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074 D0115.247 Meas Guidancev05r02

6.1 Limit

Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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) (see §15.205(c)).

6.2 Test Setup



6.3 Test procedure

Using the following spectrum analyzer setting:

- A) Set the RBW = 100KHz.
- B) Set the VBW = 300KHz.
- C) Sweep time = auto couple.
- D) Detector function = peak.
- E) Trace mode = max hold.
- F) Allow trace to fully stabilize.

6.4 DEVIATION FROM STANDARD

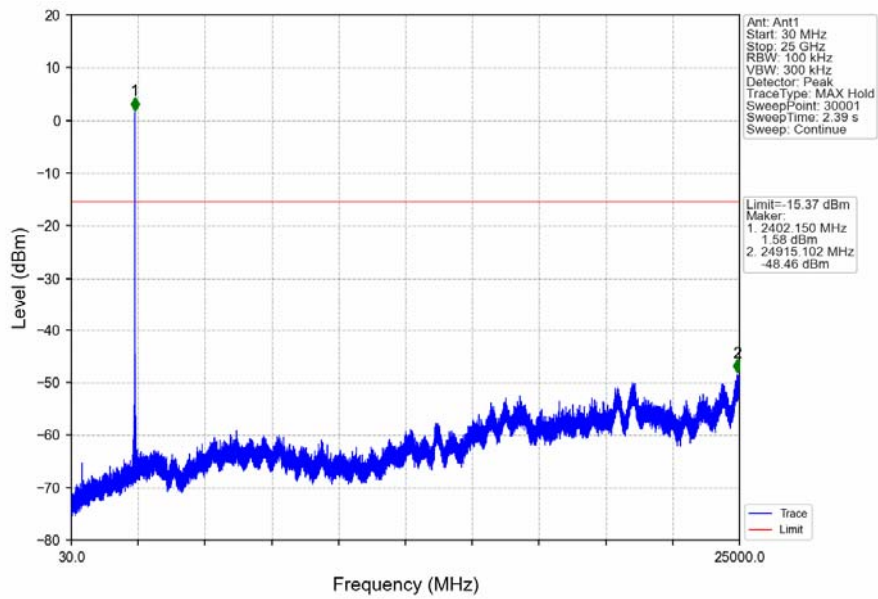
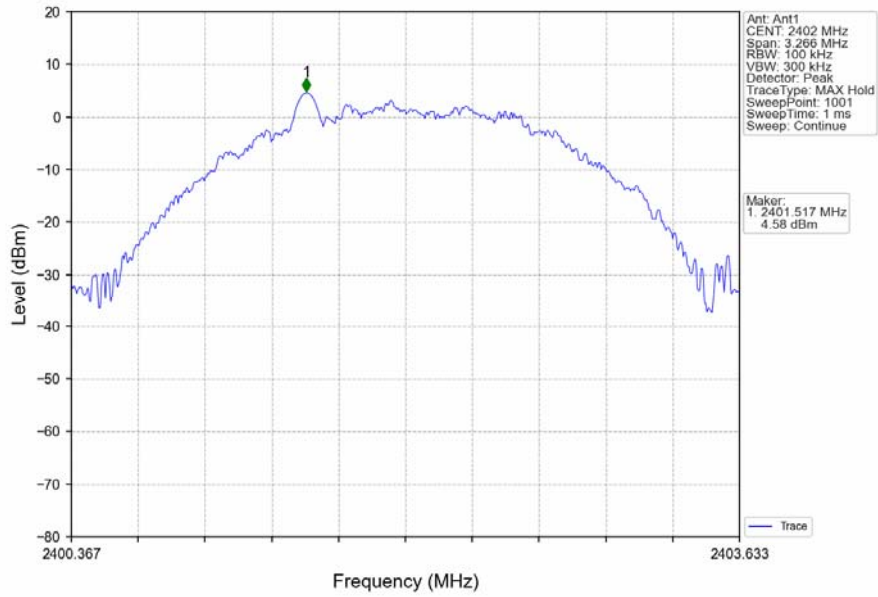
No deviation.



6.5 Test Result

FHSS mode:

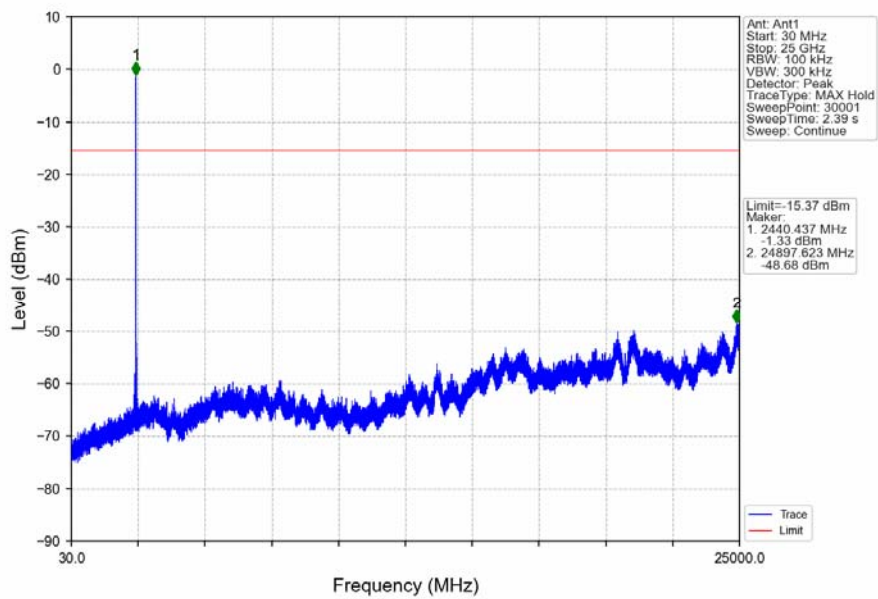
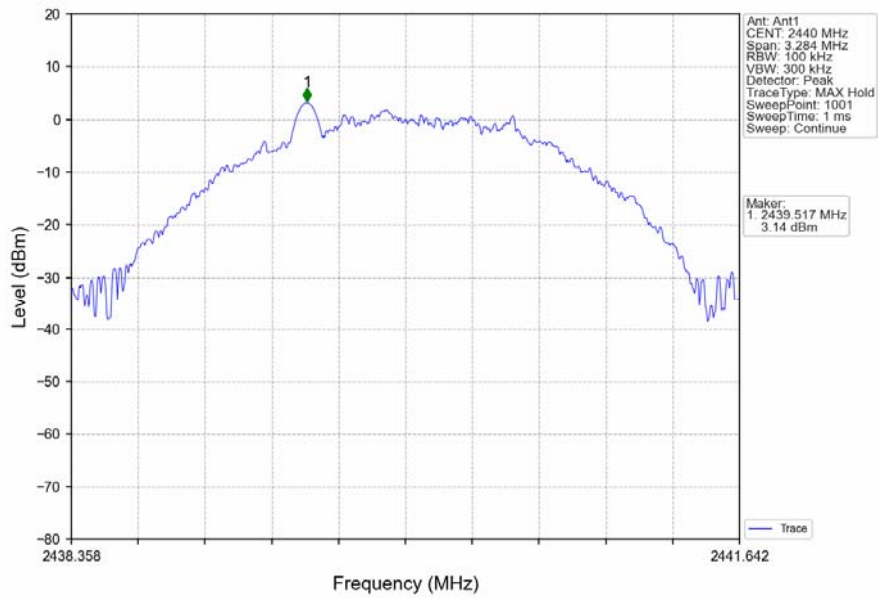
Test channel:	Lowest channel
---------------	----------------



30MHz~26.5GHz



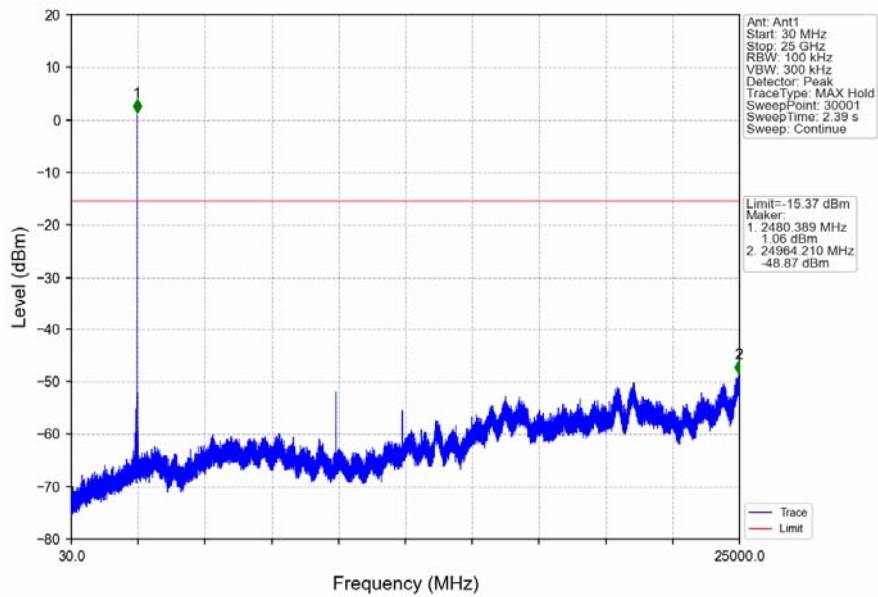
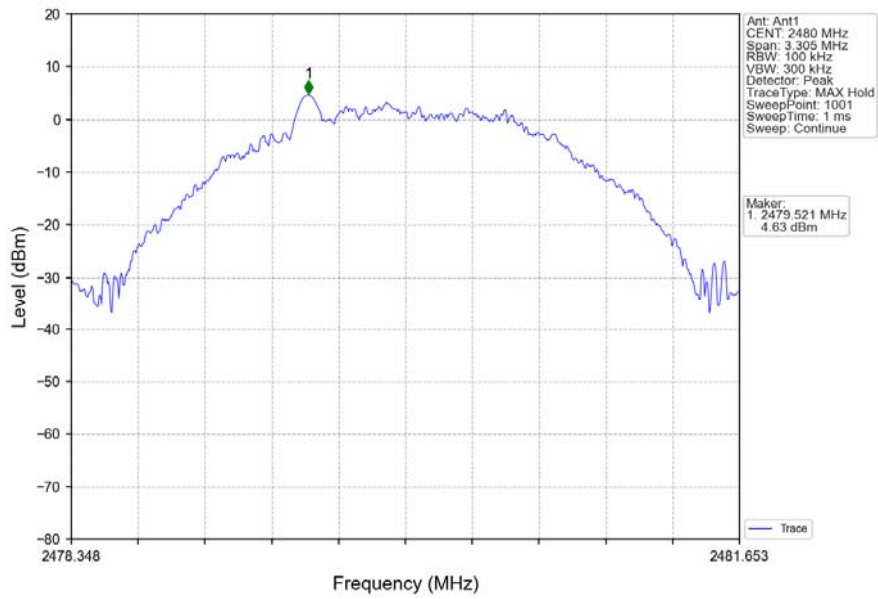
Test channel: Middle channel



30MHz~26.5GHz



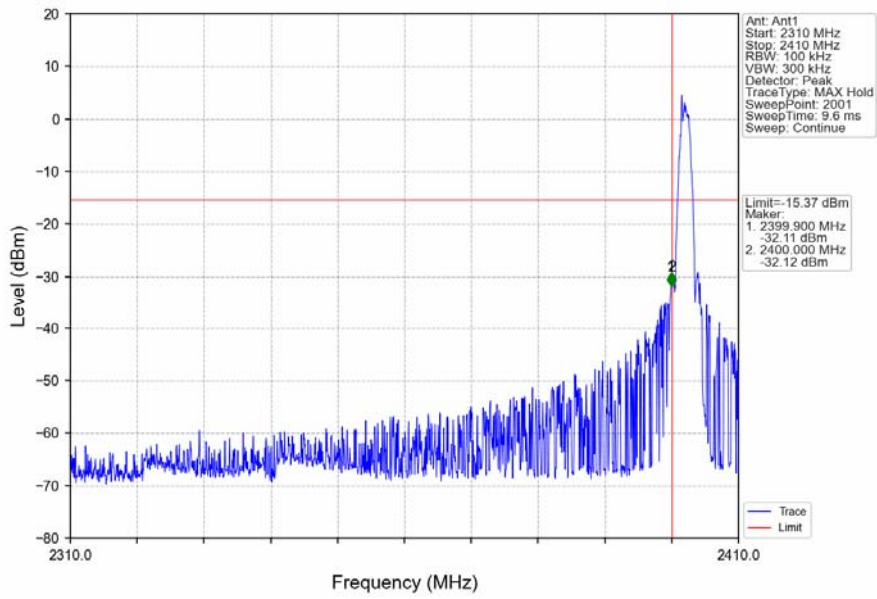
Test channel: Highest channel



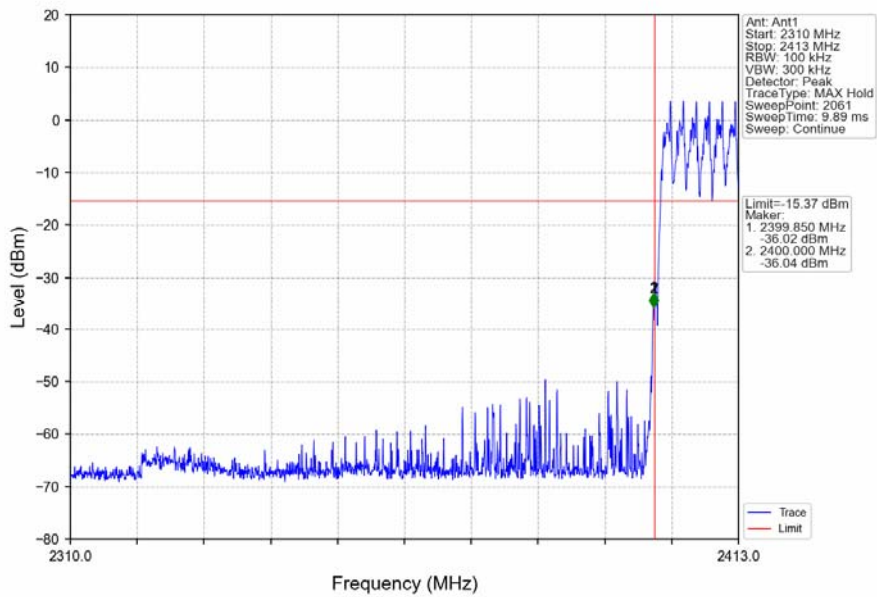
30MHz~26.5GHz



FHSS No-hopping Band edge-left side

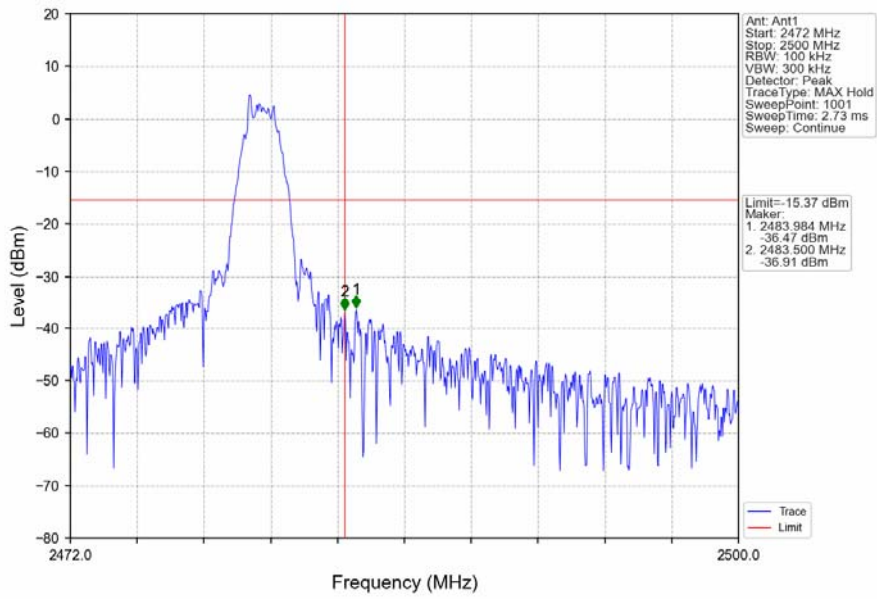


FHSS Hopping Band edge-left side

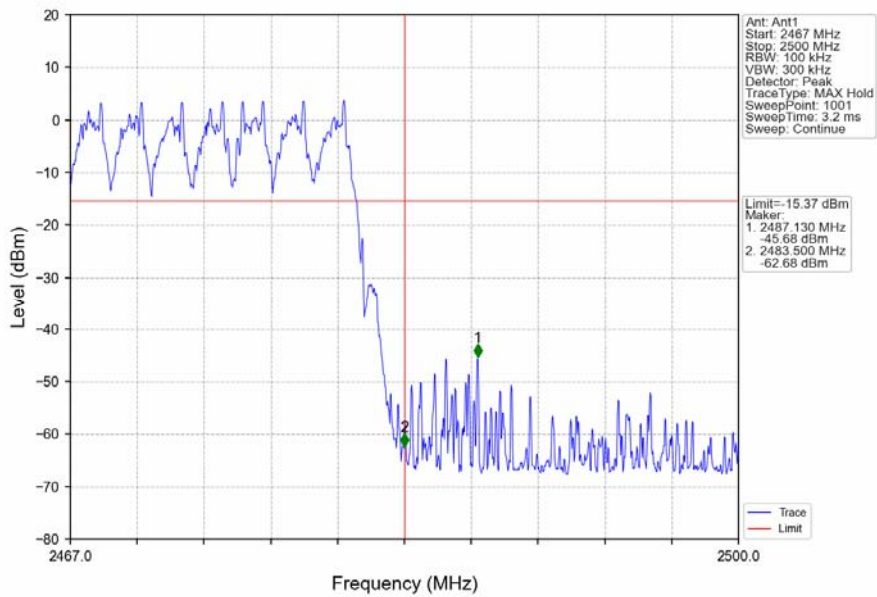




FHSS No-hopping Band edge-right side



FHSS Hopping Band edge-right side

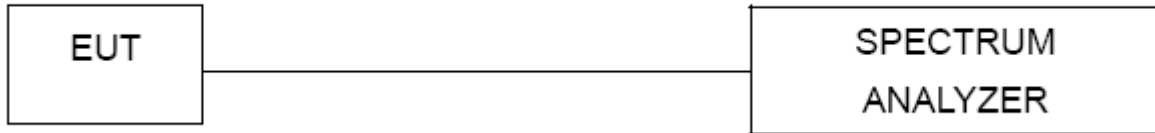




7. 20DB&99% BANDWIDTH

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013

7.1 Test Setup



7.2 Limit

N/A

7.3 Test procedure

1. Set RBW = 62 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.4 DEVIATION FROM STANDARD

No deviation.

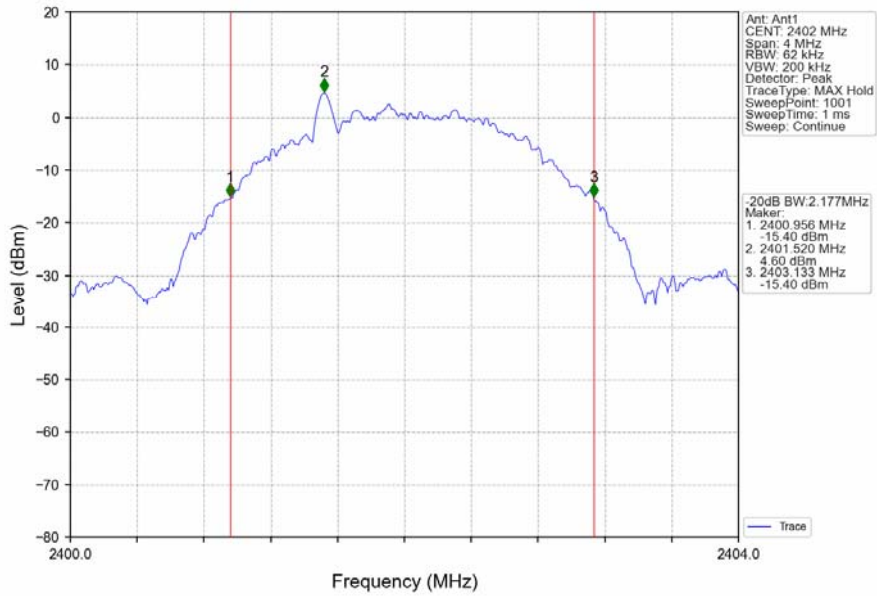
7.5 Test Result

Mode	Test channel	20dB Emission Bandwidth (MHz)	Result
FHSS	Lowest	2.177	Pass
	Middle	2.189	
	Highest	2.203	



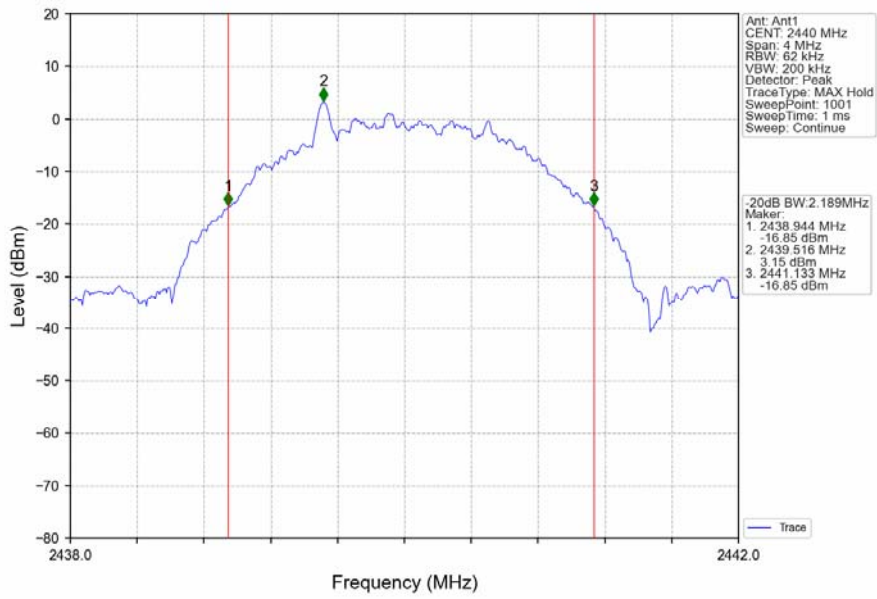
Test plots

FHSS Low Channel

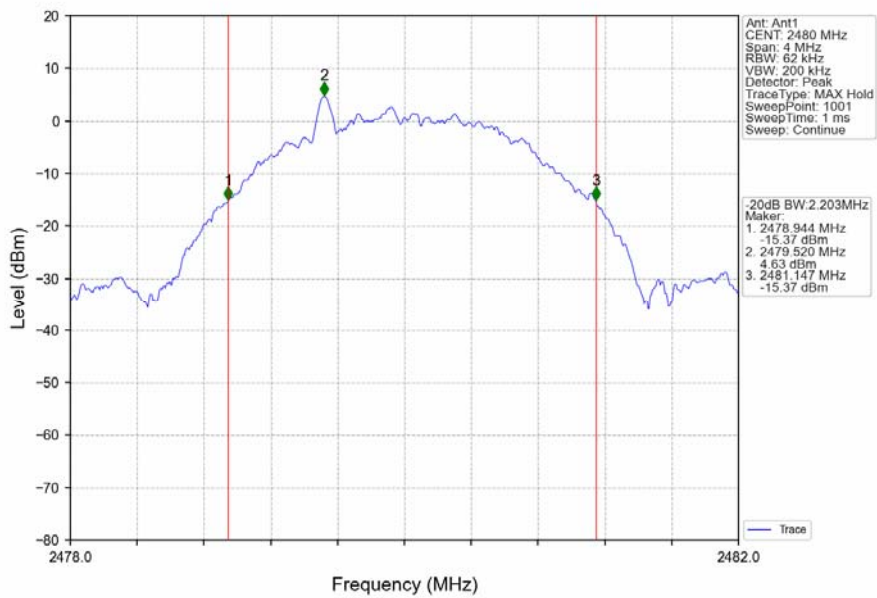




FHSS Middle Channel



FHSS High Channel





8. Maximum Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Limit:	FSHH:30 dBm

8.1 Block Diagram Of Test Setup



8.2 Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W.

8.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW =3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

8.4 DEVIATION FROM STANDARD

No deviation.

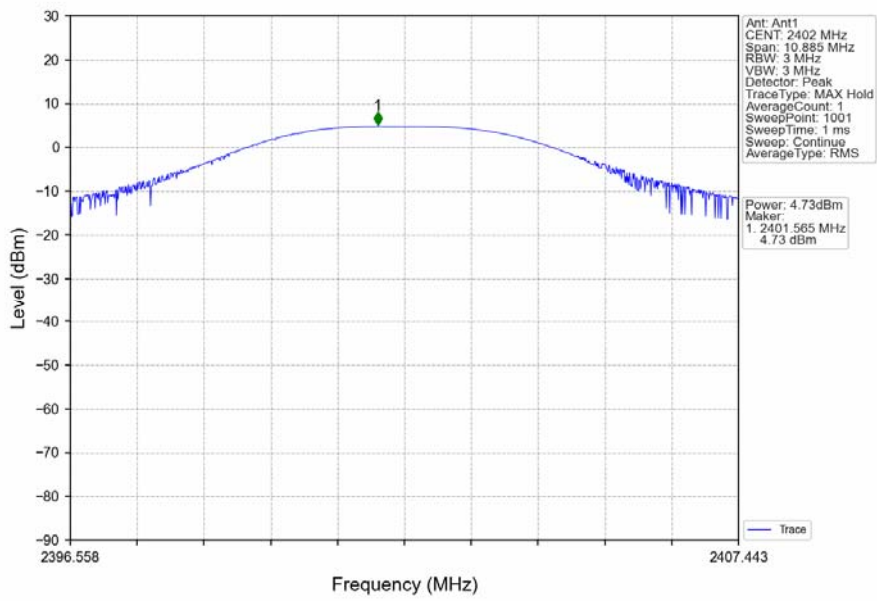
8.5 Test Result

Mode	Test channel	Peak Output Power (dBm)	FCC Limit (dBm)	Result
FHSS	Lowest	4.73	30.00	Pass
	Middle	3.27		
	Highest	4.76		

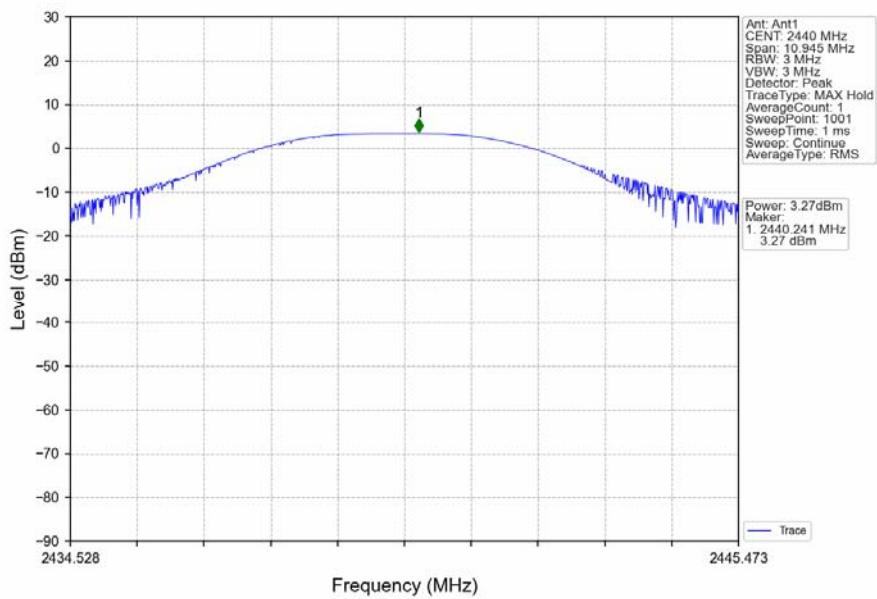
Test plots



GFSK Low Channel

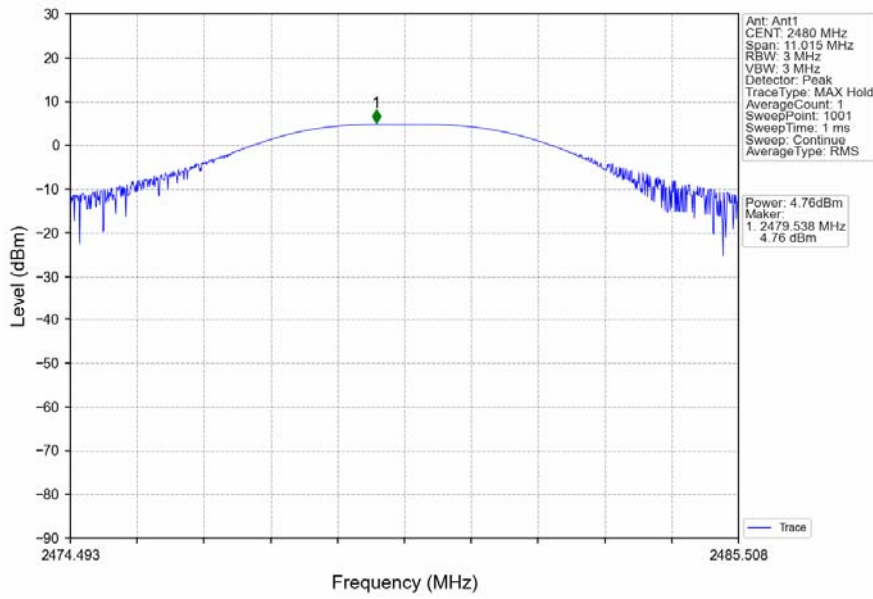


FHSS Middle Channel





FHSS High Channel





9. HOPPING CHANNEL SEPARATION

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=620KHz, VBW=620KHz, detector=Peak
Limit:	FSHH: 2/3 of the 20dB bandwidth

9.1 Test Setup



9.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 620kHz. VBW = 620kHz , Span = 4.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

9.3 DEVIATION FROM STANDARD

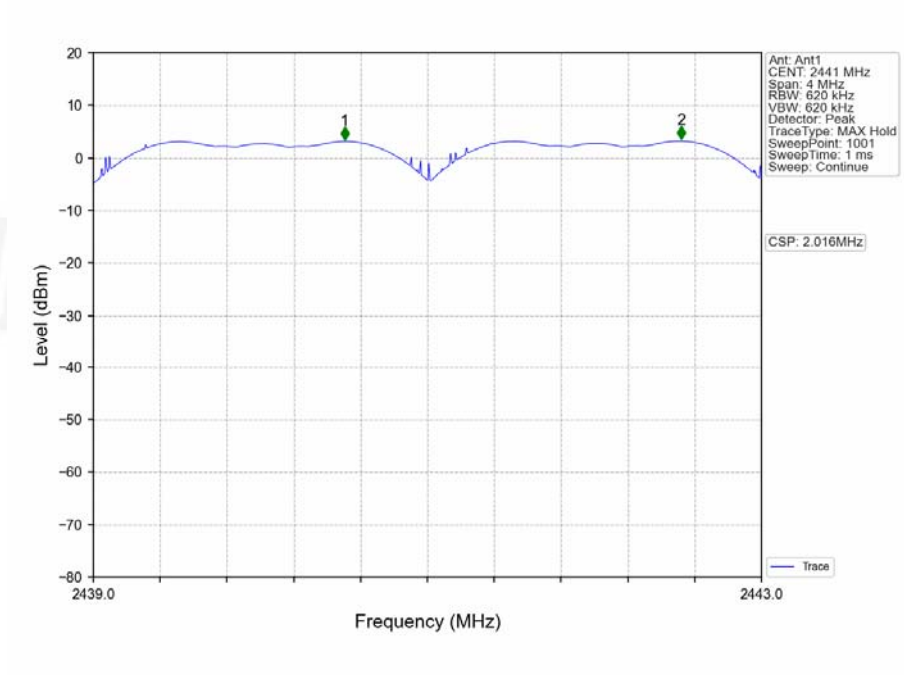
No deviation.



9.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
FHSS	Low	2.016	1.469	PASS

Test plots
FHSS Middle Channel

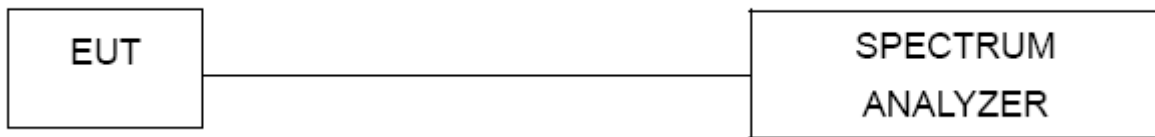




10.NUMBER OF HOPPING FREQUENCY

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=620kHz, VBW=620kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels

10.1 Test Setup



10.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 620kHz. VBW = 620kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

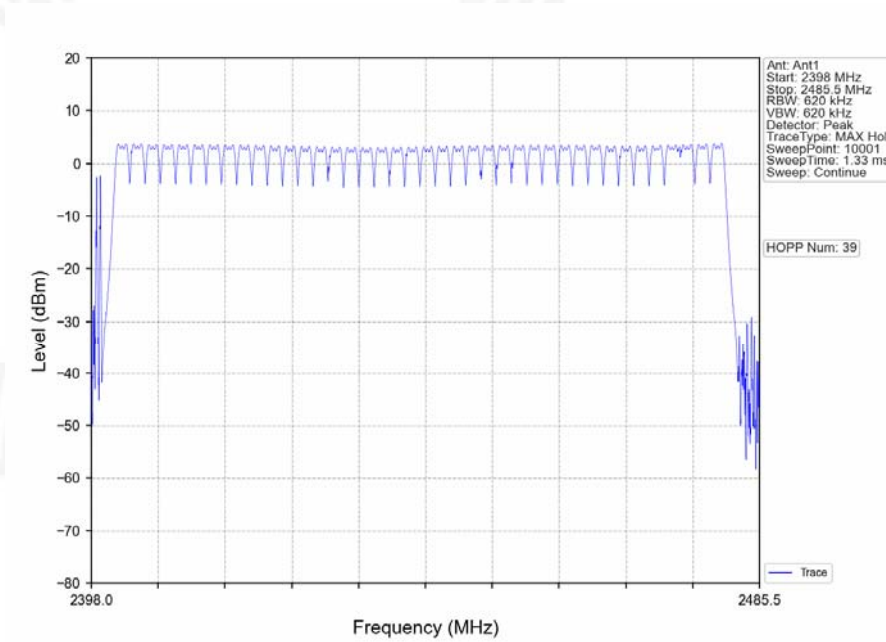
10.3 DEVIATION FROM STANDARD

No deviation.



10.4 Test Result

Test Plots:
79 Channels in total
FHSS





11. DWELL TIME

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1.8MHz, VBW=1.8MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second

11.1 Test Setup



11.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0Hz;
3. Set RBW = 1.8MHz and VBW = 1.8MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH1 packet transmitting.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

11.3 DEVIATION FROM STANDARD

No deviation.



11.4 Test Result

FHSS mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2440MHz	DH1	378.081	400	Pass

Remarks:

The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

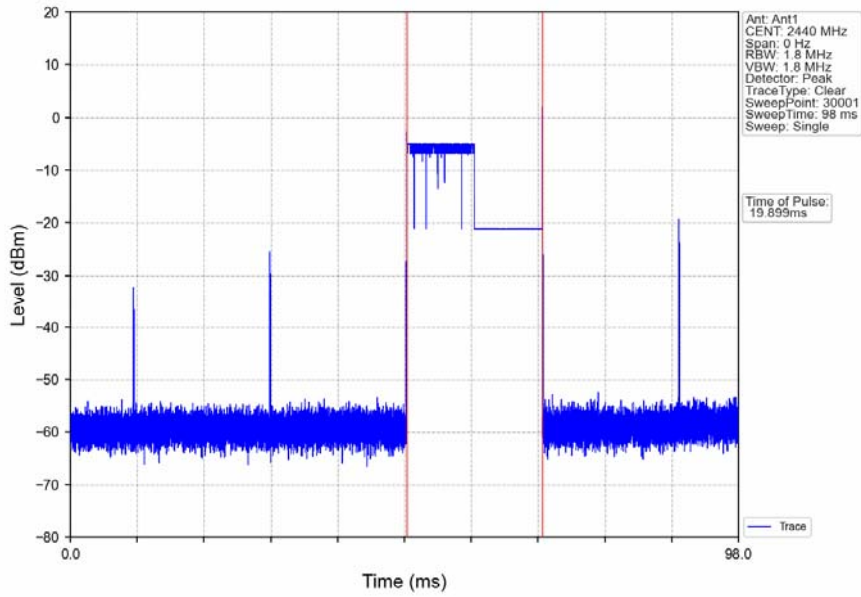
Test channel: as blow

CH:2440MHz time slot= $19.899(\text{ms}) \times (1600 / (2 \times 79)) \times 31.6 = 378.081\text{ms}$



Test Plots

FHSS 2440MHz





12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
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.	
15.247(c) (1)(i) requirement: (i) 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 6dBi.	
EUT Antenna:	
The antenna is PCB antenna, the best case gain of the antennas is -0.58dBi, reference to the appendix II for details	



13. Test Setup Photo

Reference to the appendix I for details.

14. EUT Constructional Details

Reference to the appendix II for details.

***** END OF REPORT *****