

FCC Test Report

Applicant : **GODOX PHOTO EQUIPMENT CO.,LTD**

Address : **1st to 4th Floor, Building 2/1st to 4th Floor,
Building 4 ,Yaochuan Industrial Zone,
Tangwei Community, Fuhai Street, Baoan
District, Shenzhen, 518103 China**

Product Name : **Wireless Lavalier Microphone System
(Receiver)**

Report Date : **Sept. 15, 2023**

Shenzhen Anbotek Compliance Laboratory Limited



Contents

1. General Information	7
1.1. Client Information	7
1.2. Description of Device (EUT)	7
1.3. Auxiliary Equipment Used During Test	8
1.4. Description of Test Configuration	8
1.5. Description Of Test Setup	9
1.6. Test Equipment List	10
1.7. Measurement Uncertainty	11
1.8. Description of Test Facility	11
1.9. Disclaimer	12
2. Summary of Test Results	13
3. Conducted Emission Test	14
3.1. Test Standard and Limit	14
3.2. Test Setup	14
3.3. Test Procedure	14
3.4. Test Data	14
4. Radiation Spurious Emission and Band Edge	17
4.1. Test Standard and Limit	17
4.2. Test Setup	17
4.3. Test Procedure	18
4.4. Test Data	19
5. Maximum Peak Output Power Test	27
5.1. Test Standard and Limit	27
5.2. Test Setup	27
5.3. Test Procedure	27
5.4. Test Data	27
6. 20DB Occupy Bandwidth Test	28
6.1. Test Standard	28
6.2. Test Setup	28
6.3. Test Procedure	28
6.4. Test Data	28
7. Carrier Frequency Separation Test	29
7.1. Test Standard and Limit	29
7.2. Test Setup	29
7.3. Test Procedure	29
7.4. Test Data	29
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	31
9.1. Test Standard and Limit	31
9.2. Test Setup	31
9.3. Test Procedure	31
9.4. Test Data	31
10. 100kHz Bandwidth of Frequency Band Edge Requirement	32
10.1. Test Standard and Limit	32
10.2. Test Setup	32
10.3. Test Procedure	32
10.4. Test Data	32
11. Antenna Requirement	33
11.1. Test Standard and Requirement	33
11.2. Antenna Connected Construction	33
APPENDIX I -- TEST SETUP PHOTOGRAPH	34
APPENDIX II -- EXTERNAL PHOTOGRAPH	36
APPENDIX III -- INTERNAL PHOTOGRAPH	40
Appendix Test Data	43
Appendix A: 20dB Emission Bandwidth	43
Test Result	43
Test Graphs	44
Appendix B: Occupied Channel Bandwidth	46
Test Result	46
Test Graphs	47
Appendix C: Maximum conducted output power	49
Test Result Peak	49
Test Graphs	50
Appendix D: Carrier frequency separation	52
Test Result	52
Test Graphs	53
Appendix E: Time of occupancy	54
Test Result	54
Test Graphs	55
Appendix F: Number of hopping channels	56
Test Result	56
Test Graphs	57
Appendix G: Band edge measurements	58
Test Result	58



Test Graphs	59
Appendix H: Conducted Spurious Emission	61
Test Result	61
Test Graphs	62
Appendix I: Duty Cycle	67
Test Result	67
Test Graphs	68



TEST REPORT

Applicant : GODOX PHOTO EQUIPMENT CO.,LTD
Manufacturer : GODOX Photo Equipment Co.,Ltd.
Product Name : Wireless Lavalier Microphone System (Receiver)
Test Model No. : WEC RX
Reference Model No. : N/A
Trade Mark : 
Rating(s) : Input: 5V $\overline{\text{--}}$ 200mA
Li-ion Battery: DC 3.8V, 200mAh
Test Standard(s) : FCC Part15 Subpart C, Section 15.247
Test Method(s) : ANSI C63.10

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

Jul. 31, 2023

Date of Test

Jul. 31 ~ Sept. 14, 2023

Prepared by



(TuTu Hong)

Approved & Authorized Signer



(Edward Pan)



Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Sept. 15, 2023



1. General Information

1.1. Client Information

Applicant	:	GODOX PHOTO EQUIPMENT CO.,LTD
Address	:	1st to 4th Floor, Building 2/1st to 4th Floor, Building 4 ,Yaochuan Industrial Zone, Tangwei Community, Fuhai Street, Baoan District, Shenzhen, 518103 China
Manufacturer	:	GODOX Photo Equipment Co.,Ltd.
Address	:	4th Floor of Building 1, 1st to 4 th Floor of Building 2, 4th Floor of Building 3,1st to 4th Floor of Building 4, Yaochuan Industrial Zone, Tangwei Community, Fuhai Street, Bao'an District, Shenzhen 518103,China
Factory	:	GODOX Photo Equipment Co.,Ltd.
Address	:	4th Floor of Building 1, 1st to 4 th Floor of Building 2, 4th Floor of Building 3,1st to 4th Floor of Building 4, Yaochuan Industrial Zone, Tangwei Community, Fuhai Street, Bao'an District, Shenzhen 518103,China

1.2. Description of Device (EUT)

Product Name	:	Wireless Lavalier Microphone System (Receiver)
Test Model No.	:	WEC RX
Reference Model No.	:	N/A
Trade Mark	:	
Test Power Supply	:	AC 120V/60Hz for Adapter/DC 3.8V battery inside
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	N/A
RF Specification		
Operation Mode	:	☐ DSSS ☒ FHSS
Operation Frequency	:	2402~2480 MHz
Number of Channel	:	79 Channels
Modulation Type	:	GFSK
Antenna Type	:	Ceramic Antenna
Antenna Gain(Peak)	:	1.33dBi
Remark: 1) All of the RF specification are provided by customer. 2) 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)
Adapter	Model: MDY-11-EX Input: 100-240VAC,50-60Hz, 0.7A Output: 5V $\equiv$ 3A,9V $\equiv$ 3A,12V $\equiv$ 2.25A,20V $\equiv$ 1.35A,11V $\equiv$ 3A

1.4. Description of Test Configuration

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	2402	18	2419	35	2436	52	2453	69	2470
02	2403	19	2420	36	2437	53	2454	70	2471
03	2404	20	2421	37	2438	54	2455	71	2472
04	2405	21	2422	38	2439	55	2456	72	2473
05	2406	22	2423	39	2440	56	2457	73	2474
06	2407	23	2424	40	2441	57	2458	74	2475
07	2408	24	2425	41	2442	58	2459	75	2476
08	2409	25	2426	42	2443	59	2460	76	2477
09	2410	26	2427	43	2444	60	2461	77	2478
10	2411	27	2428	44	2445	61	2462	78	2479
11	2412	28	2429	45	2446	62	2463	79	2480
12	2413	29	2430	46	2447	63	2464		
13	2414	30	2431	47	2448	64	2465		
14	2415	31	2432	48	2449	65	2466		
15	2416	32	2433	49	2450	66	2467		
16	2417	33	2434	50	2451	67	2468		
17	2418	34	2435	51	2452	68	2469		

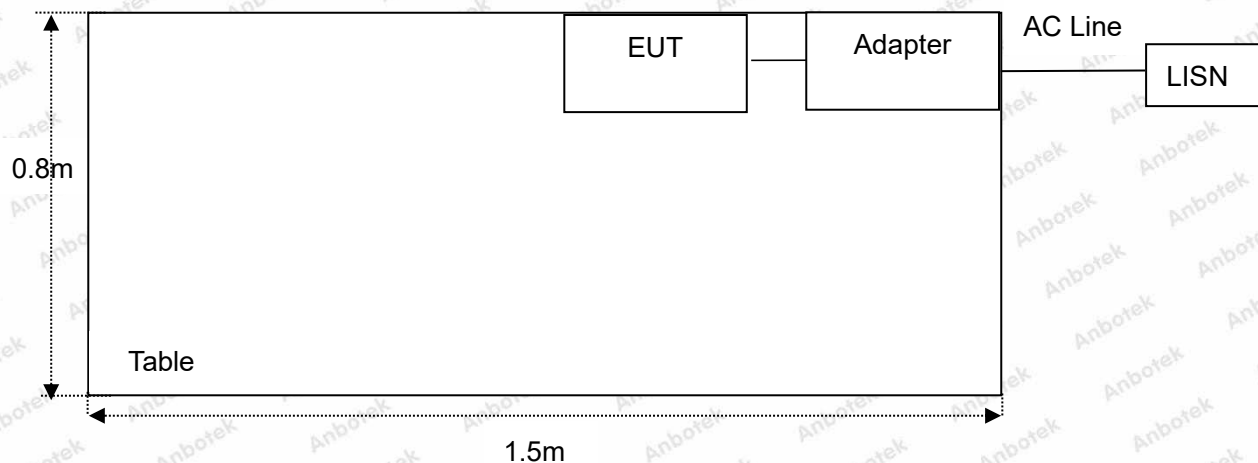
Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT was tested with channel 01, 40 and 79.

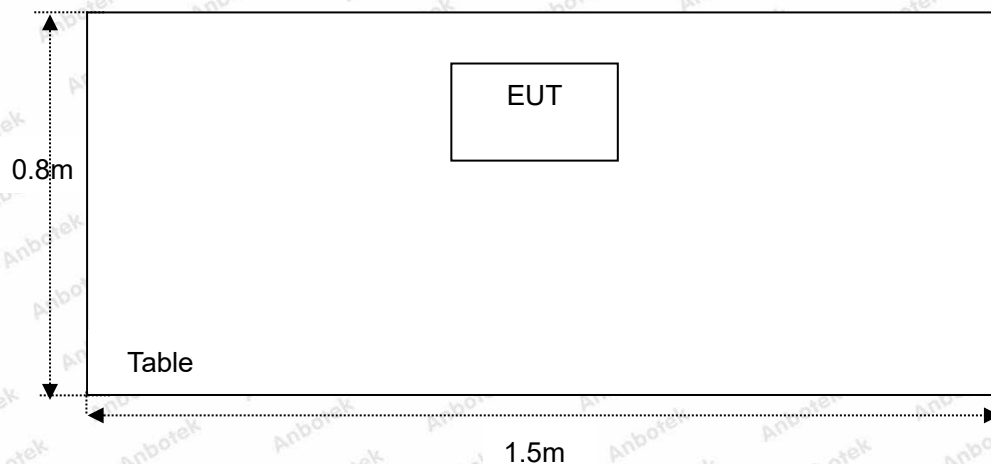


1.5. Description Of Test Setup

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, 2023	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.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 13, 2022	1 Year
6.	EMI Preamplifier	SKET Electronic	LNPA-0118G-45	SKET-PA-002	Oct. 13, 2022	1 Year
7.	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D	02555	Oct. 16, 2022	3 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	345	Oct. 23, 2022	3 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 23, 2022	1 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Oct. 23, 2022	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Oct. 23, 2022	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 13, 2022	1 Year
14.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 13, 2022	1 Year
15.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 13, 2022	1 Year
16.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2022	1 Year
17.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Oct. 19, 2022	1 Year
18.	Power Meter	Agilent	N1914A	MY50001102	Oct.26, 2022	1 Year



1.7. Measurement Uncertainty

Parameter	Uncertainty
Conducted emissions (AMN 150kHz~30MHz)	3.8dB
Occupied Bandwidth	925Hz
Conducted Output Power	0.76dB
Conducted Spurious Emission	1.24dB
Radiated spurious emissions (Below 30MHz)	3.53dB
Radiated spurious emissions (30MHz~1GHz)	Horizontal: 3.92dB; Vertical: 4.52dB
Radiated spurious emissions (above 1GHz)	1G-6GHz: 4.78dB; 6G-18GHz: 4.88dB 18G-40GHz: 5.68dB
The measurement uncertainty and decision risk evaluated according to AB/WI-RF-F-032. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

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



1.9. Disclaimer

1. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
2. The test report is invalid if there is any evidence and/or falsification.
3. The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
4. This document may not be altered or revised in any way unless done so by Anbotech and all revisions are duly noted in the revisions section.
5. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
6. The authenticity of the information provided by the customer is the responsibility of the customer and the laboratory is not responsible for its authenticity.

The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.



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)(1)	Conducted Peak Output Power	PASS
15.247(a)(1)	20dB Occupied Bandwidth	PASS
15.247(a)(1)	Carrier Frequencies Separation	PASS
15.247(a)(1)(iii)	Number of Hopping Channel	PASS
15.247(a)(1)(iii)	Dwell Time	PASS
15.247(d)	Band Edge	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		



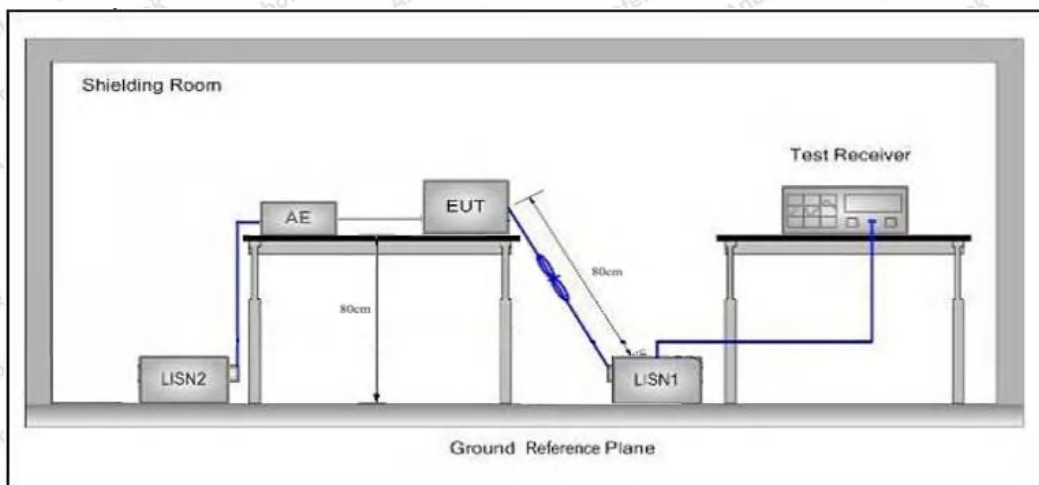
3. Conducted Emission Test

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 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

PASS

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

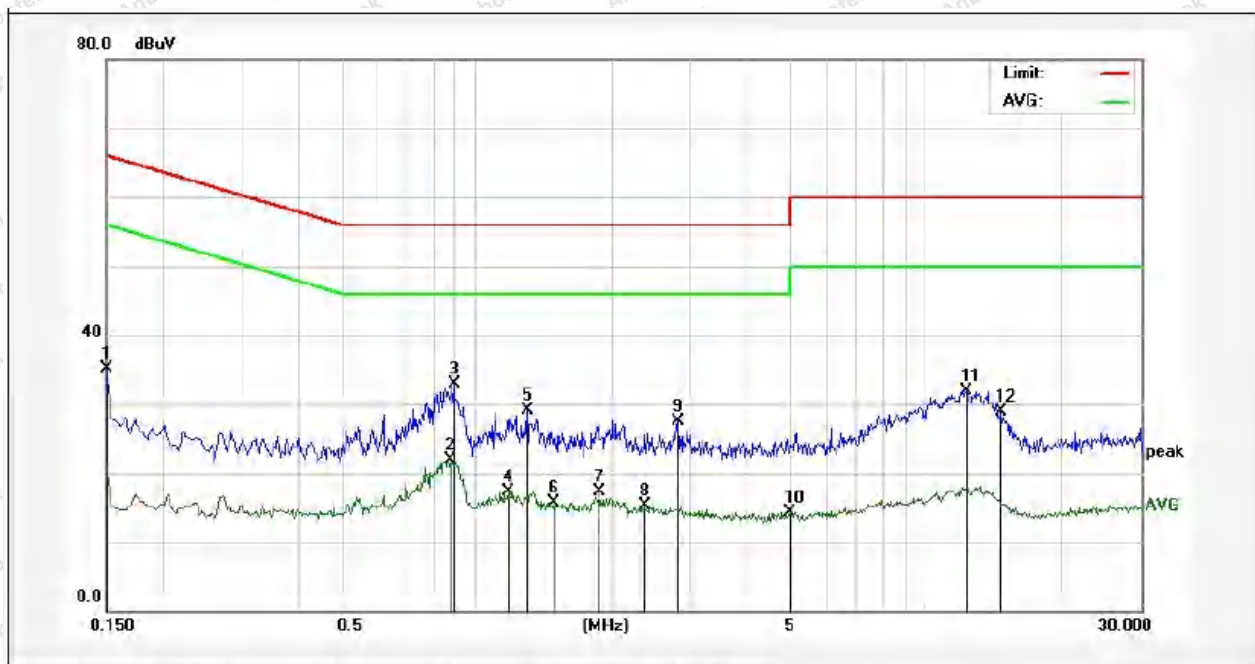
AC conducted emission pre-test at both at AC 120V/60Hz and AC 240V/60Hz modes, recorded worst case AC 120V/60Hz.

Please to see the following pages.



Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: Low CH (2402MHz)
Test Specification: AC 120V/60Hz for Adapter
Comment: Live Line
Temp.(°C)/Hum.(%RH): 20.4°C/57%RH

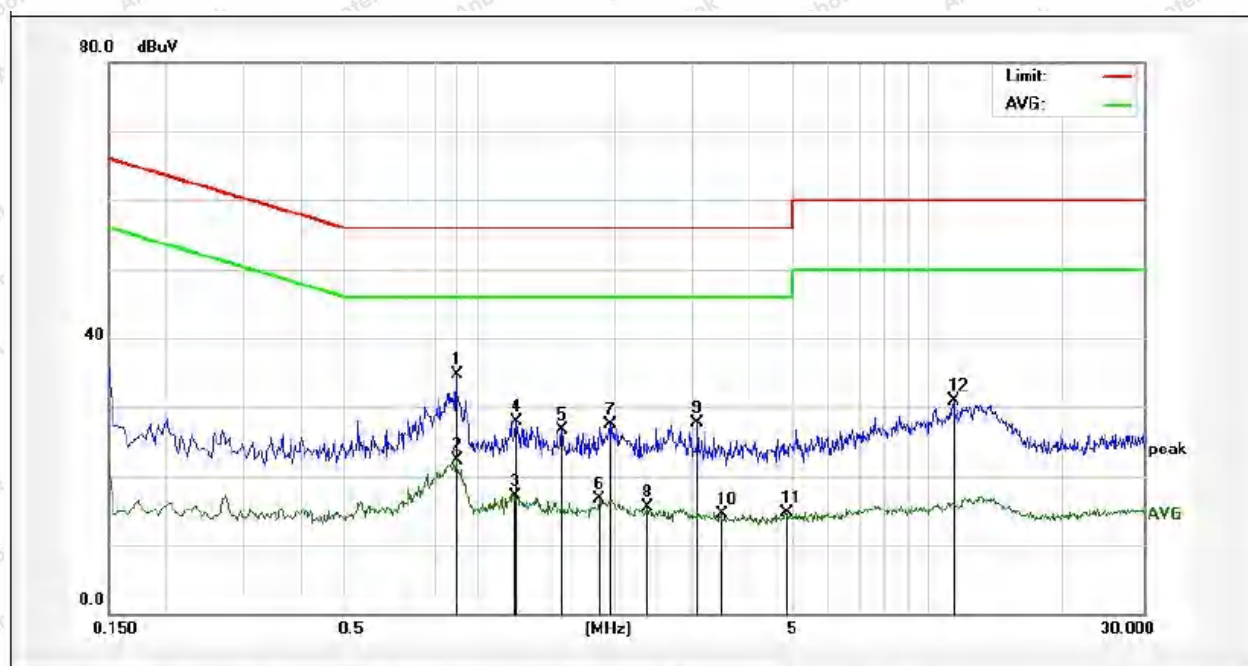


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	18.40	16.65	35.05	65.99	-30.94	QP	
2	0.8740	4.45	17.52	21.97	46.00	-24.03	AVG	
3	0.8900	15.42	17.53	32.95	56.00	-23.05	QP	
4	1.1740	-0.31	17.56	17.25	46.00	-28.75	AVG	
5	1.2980	11.48	17.57	29.05	56.00	-26.95	QP	
6	1.4860	-1.78	17.57	15.79	46.00	-30.21	AVG	
7	1.8820	-0.29	17.55	17.26	46.00	-28.74	AVG	
8	2.3620	-2.22	17.58	15.36	46.00	-30.64	AVG	
9	2.8100	9.82	17.61	27.43	56.00	-28.57	QP	
10	4.9780	-3.06	17.41	14.35	46.00	-31.65	AVG	
11	12.2580	14.28	17.65	31.93	60.00	-28.07	QP	
12	14.7340	11.13	17.77	28.90	60.00	-31.10	QP	



Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: Low CH (2402MHz)
Test Specification: AC 120V/60Hz for Adapter
Comment: Neutral Line
Temp.(°C)/Hum.(%RH): 20.4°C/57%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.8900	17.10	17.53	34.63	56.00	-21.37	QP	
2	0.8900	4.71	17.53	22.24	46.00	-23.76	AVG	
3	1.2059	-0.39	17.56	17.17	46.00	-28.83	AVG	
4	1.2140	10.26	17.56	27.82	56.00	-28.18	QP	
5	1.5339	9.11	17.56	26.67	56.00	-29.33	QP	
6	1.8500	-0.94	17.55	16.61	46.00	-29.39	AVG	
7	1.9580	10.04	17.55	27.59	56.00	-28.41	QP	
8	2.3820	-2.06	17.58	15.52	46.00	-30.48	AVG	
9	3.0660	10.17	17.61	27.78	56.00	-28.22	QP	
10	3.4700	-3.10	17.58	14.48	46.00	-31.52	AVG	
11	4.8100	-2.82	17.43	14.61	46.00	-31.39	AVG	
12	11.3460	13.30	17.61	30.91	60.00	-29.09	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

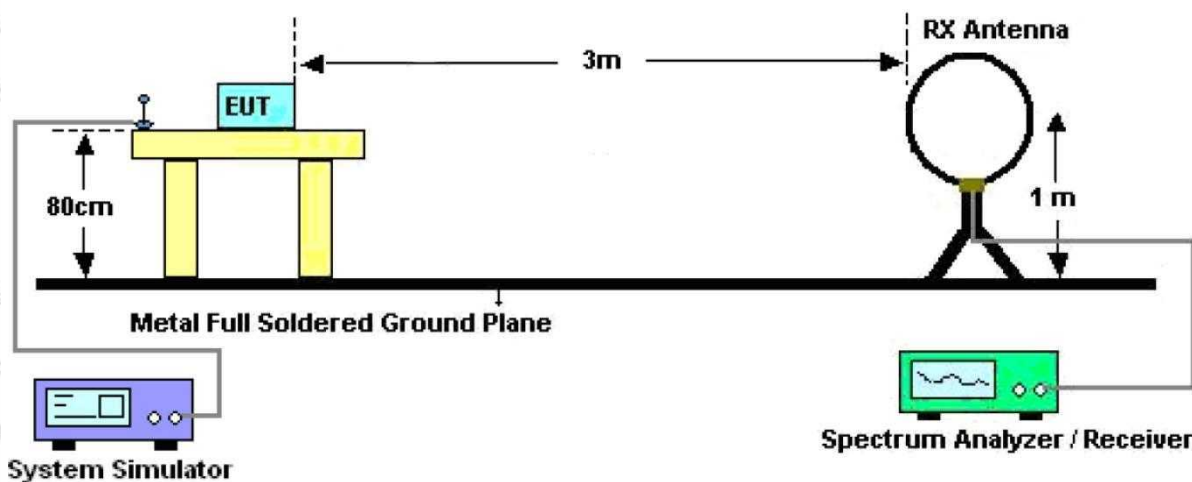


Figure 1. Below 30MHz



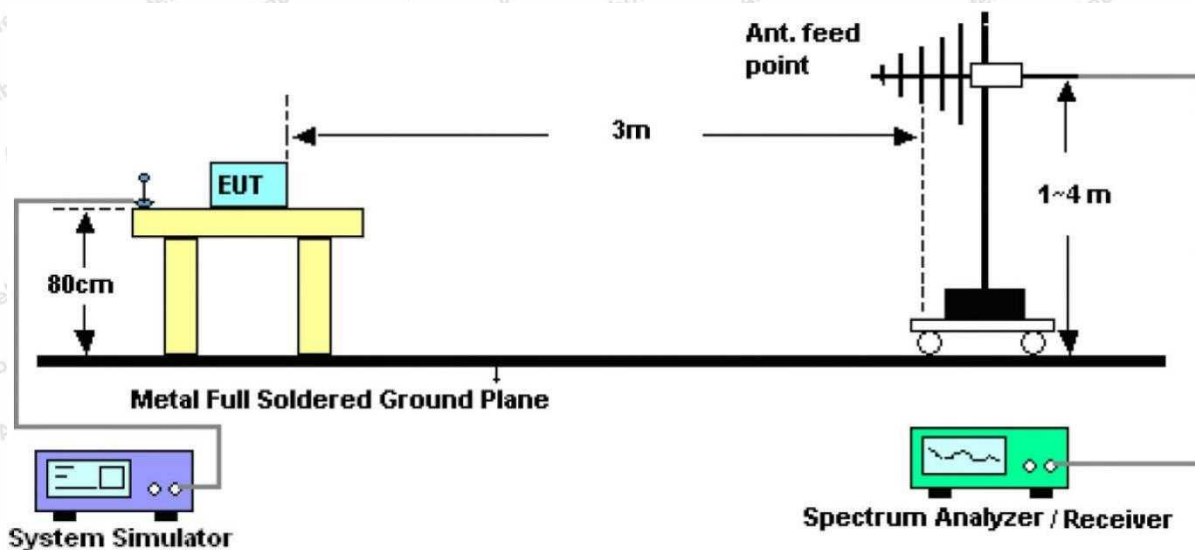


Figure 2. 30MHz to 1GHz

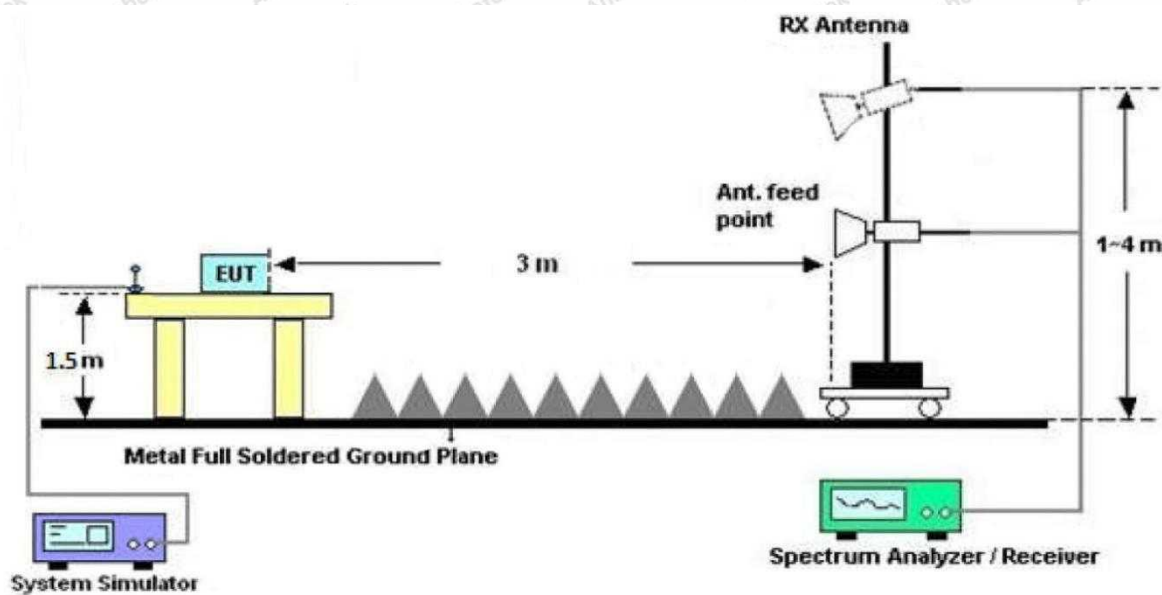


Figure 3. Above 1 GHz

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 = 120kHz, 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.

For average measurement: use duty cycle correction factor method (DCCF)

Average level = Peak level + DCCF

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.



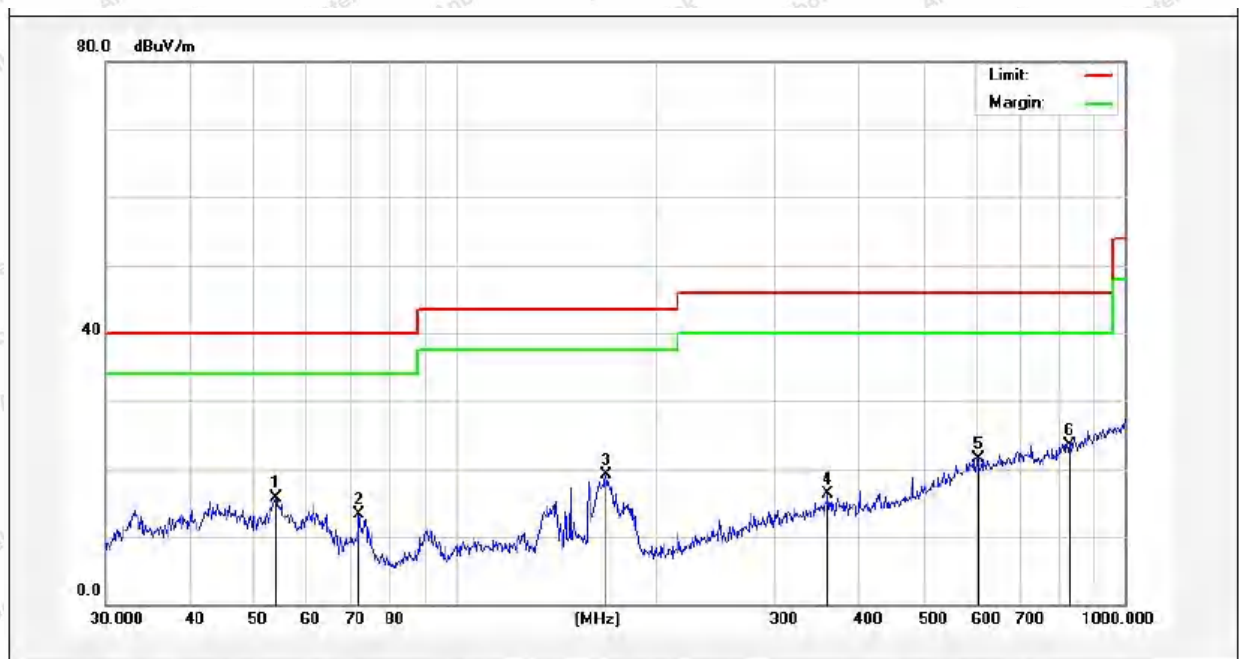
Test Results (30~1000MHz)

Test Mode: Low CH (2402MHz)

Power Source: DC 3.8V battery inside

Polarization: Vertical

Temp.(°C)/Hum.(%RH): 24.6°C/49%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	53.8818	32.84	-17.21	15.63	40.00	-24.37	QP			
2	71.8320	33.29	-19.94	13.35	40.00	-26.65	QP			
3	167.8243	40.30	-21.23	19.07	43.50	-24.43	QP			
4	360.4476	31.16	-14.88	16.28	46.00	-29.72	QP			
5	603.5392	32.13	-10.53	21.60	46.00	-24.40	QP			
6	827.4934	31.29	-7.83	23.46	46.00	-22.54	QP			



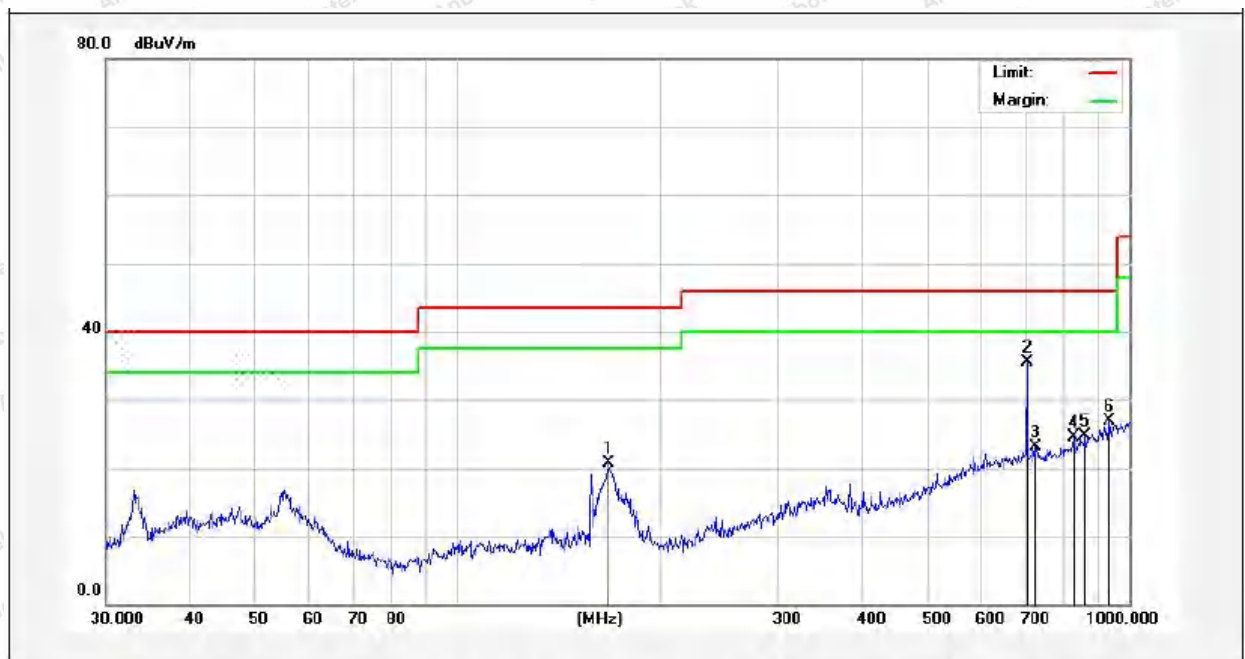
Test Results (30~1000MHz)

Test Mode: Low CH (2402MHz)

Power Source: DC 3.8V battery inside

Polarization: Horizontal

Temp.(°C)/Hum.(%RH): 24.6°C/49%RH



No.	Freq. (MHz)	Reading (dBUV)	Factor (dB/m)	Result (dBUV/m)	Limit (dBUV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	167.8243	44.40	-23.69	20.71	43.50	-22.79	QP			
2	704.2261	45.45	-9.86	35.59	46.00	-10.41	QP			
3	726.8052	32.75	-9.56	23.19	46.00	-22.81	QP			
4	827.4934	32.30	-7.83	24.47	46.00	-21.53	QP			
5	860.0352	31.91	-7.24	24.67	46.00	-21.33	QP			
6	935.5463	32.63	-5.81	26.82	46.00	-19.18	QP			



Test Results (1GHz-25GHz)

Test channel: Lowest						
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	29.73	15.27	45.00	74.00	-29.00	Vertical
7206.00	30.84	18.09	48.93	74.00	-25.07	Vertical
9608.00	38.01	23.76	61.77	74.00	-12.23	Vertical
12010.00	*			74.00		Vertical
14412.00	*			74.00		Vertical
4804.00	30.08	15.27	45.35	74.00	-28.65	Horizontal
7206.00	30.71	18.09	48.80	74.00	-25.20	Horizontal
9608.00	35.89	23.76	59.65	74.00	-14.35	Horizontal
12010.00	*			74.00		Horizontal
14412.00	*			74.00		Horizontal
Average value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
4804.00	19.11	15.27	34.38	54.00	-19.62	Vertical
7206.00	19.87	18.09	37.96	54.00	-16.04	Vertical
9608.00	29.23	23.76	52.99	54.00	-1.01	Vertical
12010.00	*			54.00		Vertical
14412.00	*			54.00		Vertical
4804.00	18.43	15.27	33.70	54.00	-20.30	Horizontal
7206.00	19.77	18.09	37.86	54.00	-16.14	Horizontal
9608.00	28.94	23.76	52.70	54.00	-1.30	Horizontal
12010.00	*			54.00		Horizontal
14412.00	*			54.00		Horizontal



Test Results (1GHz-25GHz)

Test channel: Middle						
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4882.00	29.75	15.42	45.17	74.00	-28.83	Vertical
7323.00	30.69	18.02	48.71	74.00	-25.29	Vertical
9764.00	37.22	23.80	61.02	74.00	-12.98	Vertical
12205.00	*			74.00		Vertical
14646.00	*			74.00		Vertical
4882.00	29.78	15.42	45.20	74.00	-28.80	Horizontal
7323.00	30.70	18.02	48.72	74.00	-25.28	Horizontal
9764.00	35.33	23.80	59.13	74.00	-14.87	Horizontal
12205.00	*			74.00		Horizontal
14646.00	*			74.00		Horizontal
Average value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
4882.00	18.84	15.42	34.26	54.00	-19.74	Vertical
7323.00	19.97	18.02	37.99	54.00	-16.01	Vertical
9764.00	29.09	23.80	52.89	54.00	-1.11	Vertical
12205.00	*			54.00		Vertical
14646.00	*			54.00		Vertical
4882.00	18.34	15.42	33.76	54.00	-20.24	Horizontal
7323.00	19.33	18.02	37.35	54.00	-16.65	Horizontal
9764.00	26.45	23.80	50.25	54.00	-3.75	Horizontal
12205.00	*			54.00		Horizontal
14646.00	*			54.00		Horizontal



Test Results (1GHz-25GHz)

Test channel: Highest						
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	30.02	15.58	45.60	74.00	-28.40	Vertical
7440.00	30.70	17.93	48.63	74.00	-25.37	Vertical
9920.00	37.77	23.83	61.60	74.00	-12.40	Vertical
12400.00	*			74.00		Vertical
14880.00	*			74.00		Vertical
4960.00	29.85	15.58	45.43	74.00	-28.57	Horizontal
7440.00	30.73	17.93	48.66	74.00	-25.34	Horizontal
9920.00	35.01	23.83	58.84	74.00	-15.16	Horizontal
12400.00	*			74.00		Horizontal
14880.00	*			74.00		Horizontal
Average value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
4960.00	19.96	15.58	35.54	54.00	-18.46	Vertical
7440.00	20.98	17.93	38.91	54.00	-15.09	Vertical
9920.00	27.64	23.83	51.47	54.00	-2.53	Vertical
12400.00	*			54.00		Vertical
14880.00	*			54.00		Vertical
4960.00	19.78	15.58	35.36	54.00	-18.64	Horizontal
7440.00	20.70	17.93	38.63	54.00	-15.37	Horizontal
9920.00	27.35	23.83	51.18	54.00	-2.82	Horizontal
12400.00	*			54.00		Horizontal
14880.00	*			54.00		Horizontal

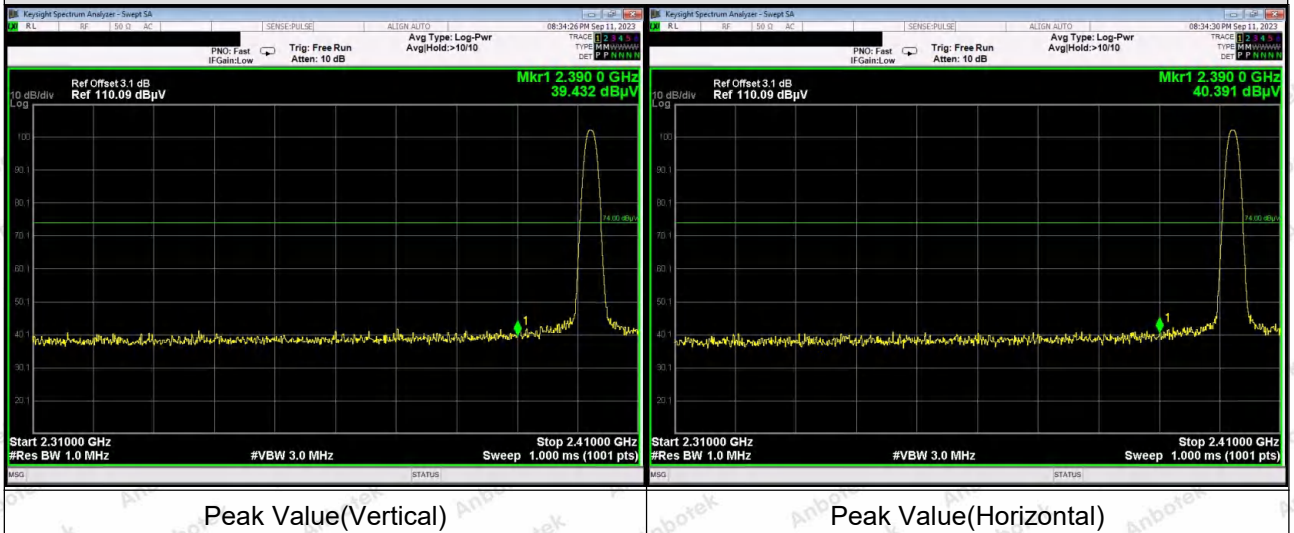
Remark:

1. Result = Reading + Factor
2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

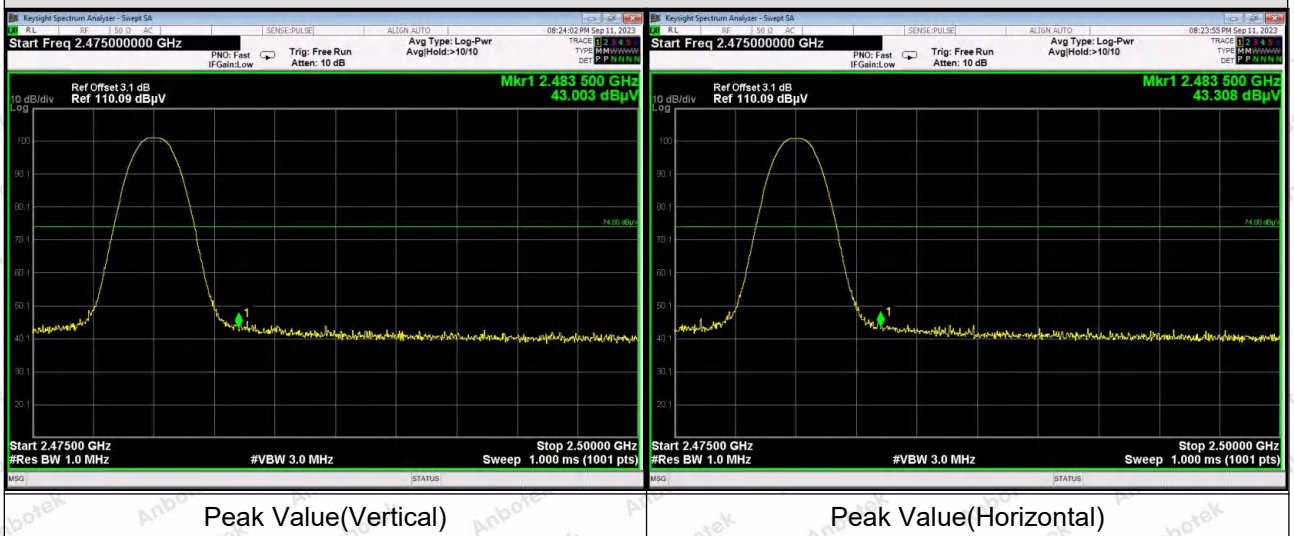


Radiated Band Edge:

Test Mode: Lowest



Test Mode: Highest



Average:

Test Channel	Peak Value (dBuV/m)	DCCF	Average Value (dBuV/m)	Limit (dBuV/m)	Polarization	Verdict
Lowest	39.432	-2.32	37.109	54.00	Vertical	Pass
	40.391	-2.32	38.068	54.00	Horizontal	Pass
Highest	43.003	-2.33	40.673	54.00	Vertical	Pass
	43.308	-2.33	40.978	54.00	Horizontal	Pass

Remark:

1. $DCCF=20\log(\text{Duty Cycle})$
2. $\text{Average Value}=\text{Peak Value}+DCCF$

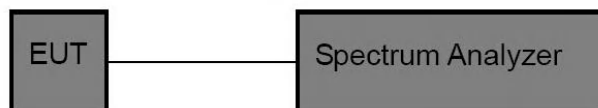


5. Maximum Peak Output Power Test

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 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.

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

Pass

Please refer to Appendix C of the Appendix Test Data.

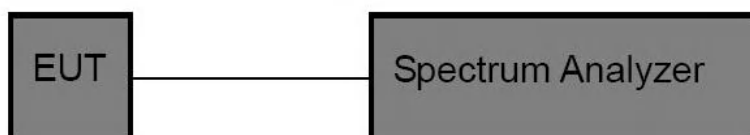


6. 20DB Occupy Bandwidth Test

6.1. Test Standard

Test Standard	FCC Part15 C Section 15.247 (a)(1)
---------------	------------------------------------

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 $\geq 1\%$ of the 20 dB bandwidth.
3. Set the VBW $\geq$ 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

Pass

Please refer to Appendix A of the Appendix Test Data.

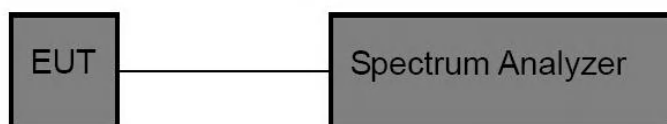


7. Carrier Frequency Separation Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)
Test Limit	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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 $\geq$ RBW.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

7.4. Test Data

Pass

Please refer to Appendix D of the Appendix Test Data.

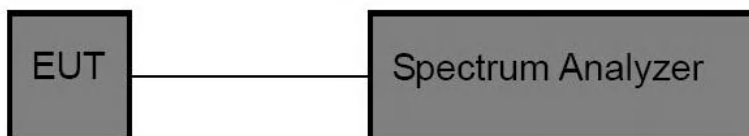


8. Number of Hopping Channel Test

8.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Limit	>15 channels

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 $\geq$ 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

Pass

Please refer to Appendix F of the Appendix Test Data.

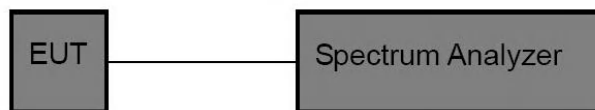


9. Dwell Time Test

9.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Limit	0.4 s

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 = 1 MHz.
3. Set the VBW $\geq$ RBW.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = peak.
6. Trace mode = clear write.

9.4. Test Data

Pass

Please refer to Appendix E of the Appendix Test Data.

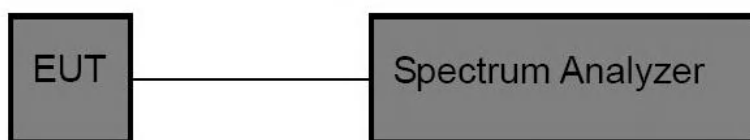


10. 100kHz Bandwidth of Frequency Band Edge Requirement

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

Pass

Please refer to Appendix G & Appendix H of the Appendix Test Data.



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 Ceramic Antenna which permanently attached, and the best case gain of the antenna is 1.33dBi. It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Conducted Emission at AC power line

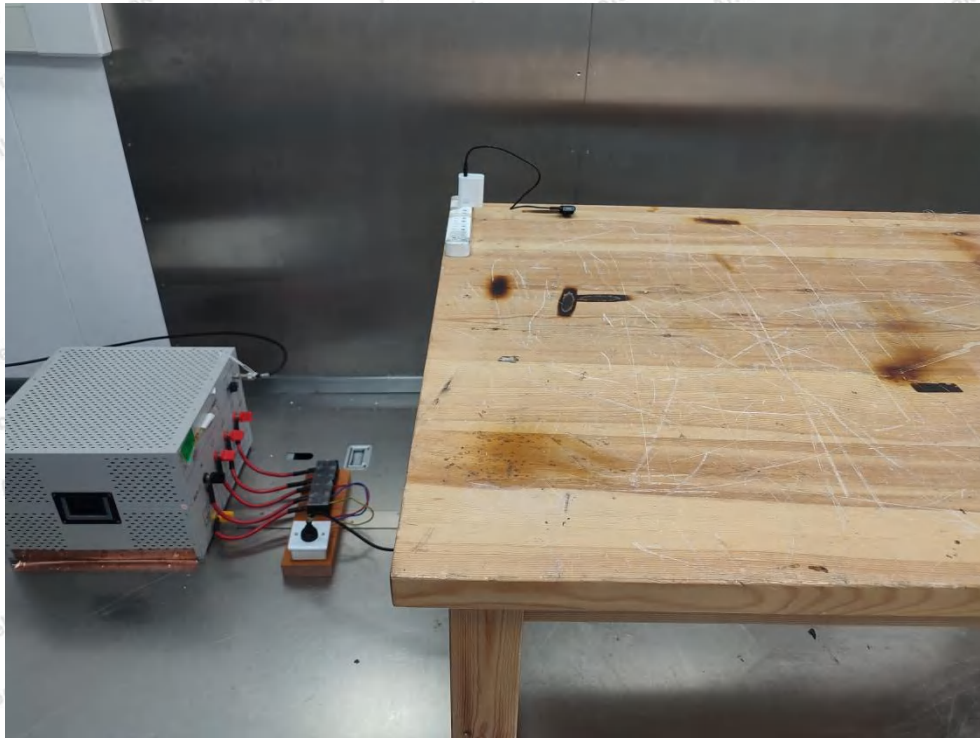


Photo of Radiation Emission Test (below 1GHz)



Photo of Radiation Emission Test (above 1GHz)



APPENDIX II -- EXTERNAL PHOTOGRAPH



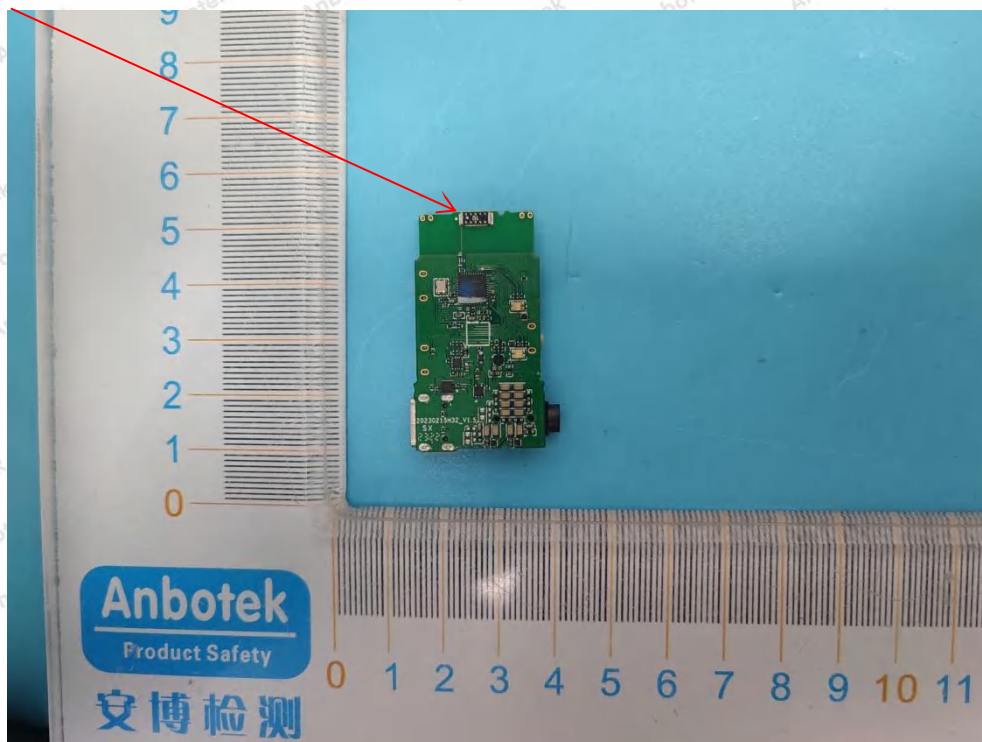


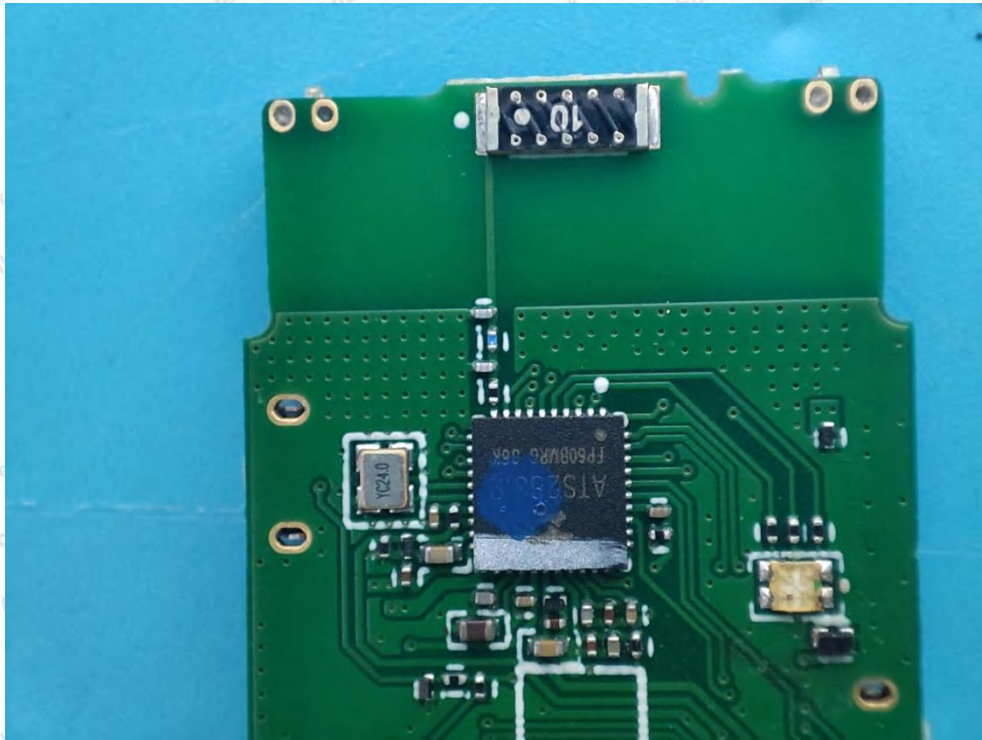


APPENDIX III -- INTERNAL PHOTOGRAPH



ANT





Appendix Test Data

Report No.:	18220WC301614	Test Sample No.:	1-2-2
Start Test Date:	2023.08.14	Finish Test Date:	2023.09.12
Test Engineer:	Hayman Chen	Auditor:	Rock Luo
Temperature:	25.4℃	Relative Humidity:	48%
Pressure:	102 kPa		

Appendix A: 20dB Emission Bandwidth

Test Result

TestMode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
2.4G	Ant1	2402	0.945	2401.541	2402.486	---	---
		2441	0.939	2440.544	2441.483	---	---
		2480	0.987	2479.517	2480.504	---	---



Test Graphs

2.4G_Ant1_2402



2.4G_Ant1_2441



2.4G_Ant1_2480





Appendix B: Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
2.4G	Ant1	2402	0.90646	2401.5533	2402.4597	---	---
		2441	0.88175	2440.5637	2441.4455	---	---
		2480	0.89682	2479.5593	2480.4561	---	---



Test Graphs





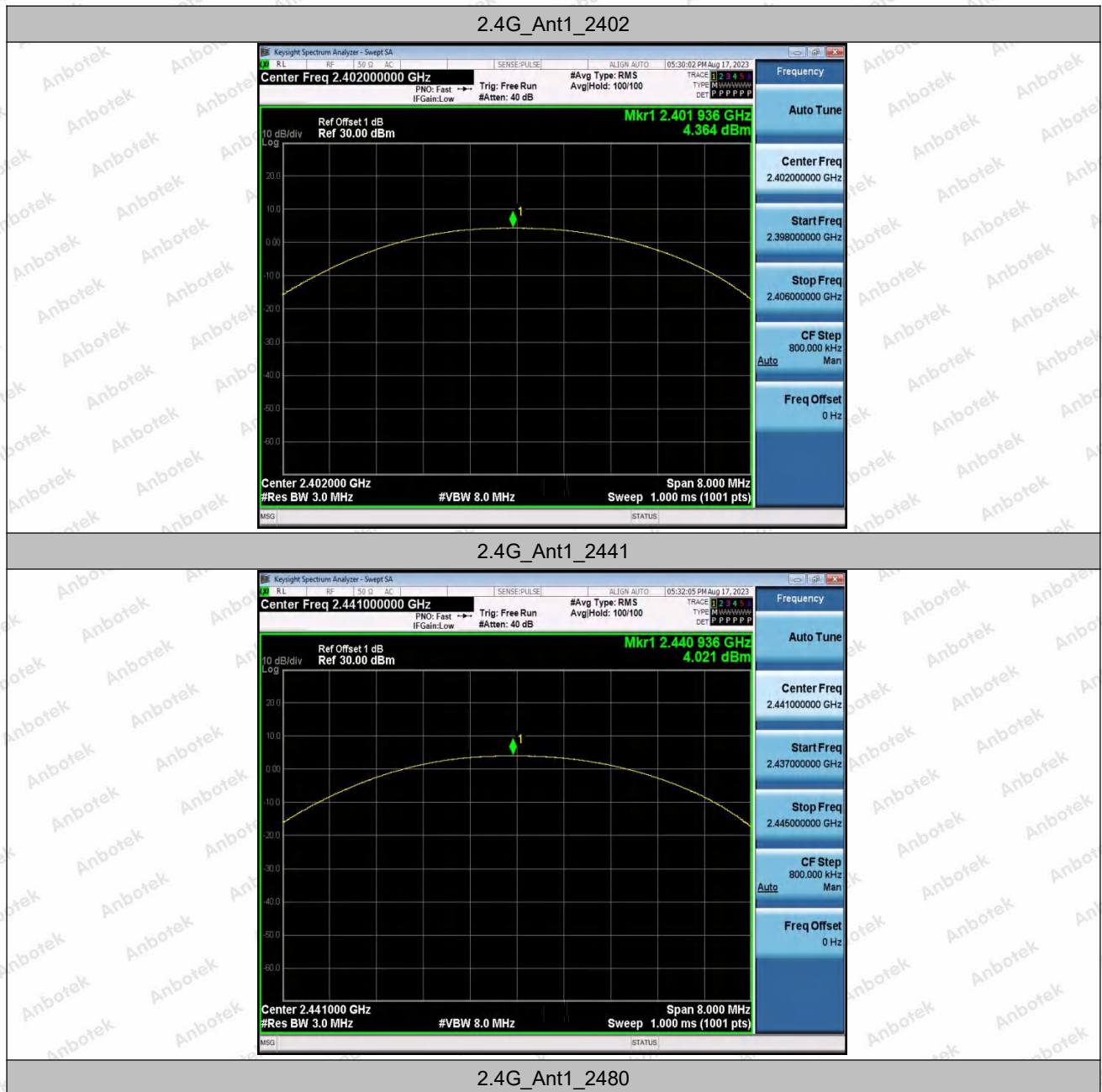
Appendix C: Maximum conducted output power

Test Result Peak

Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	Verdict
2.4G	Ant1	2402	4.36	≤20.97	PASS
		2441	4.02	≤20.97	PASS
		2480	3.62	≤20.97	PASS



Test Graphs





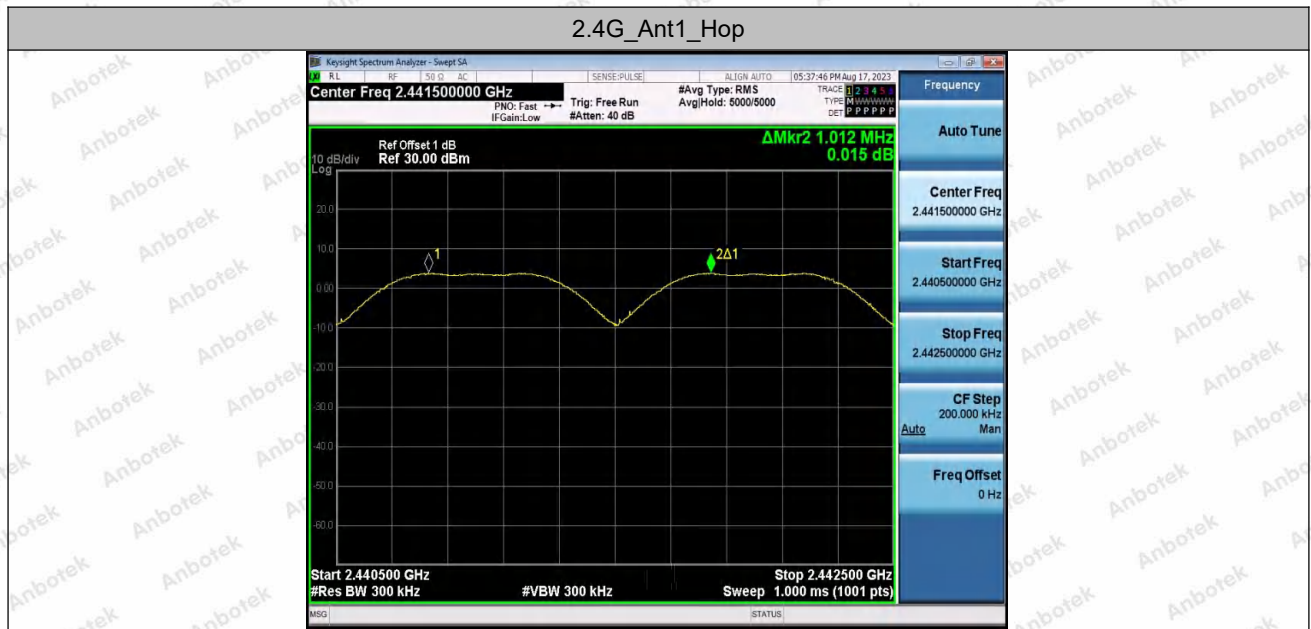
Appendix D: Carrier frequency separation

Test Result

TestMode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
2.4G	Ant1	Hop	1.012	≥0.987	PASS



Test Graphs



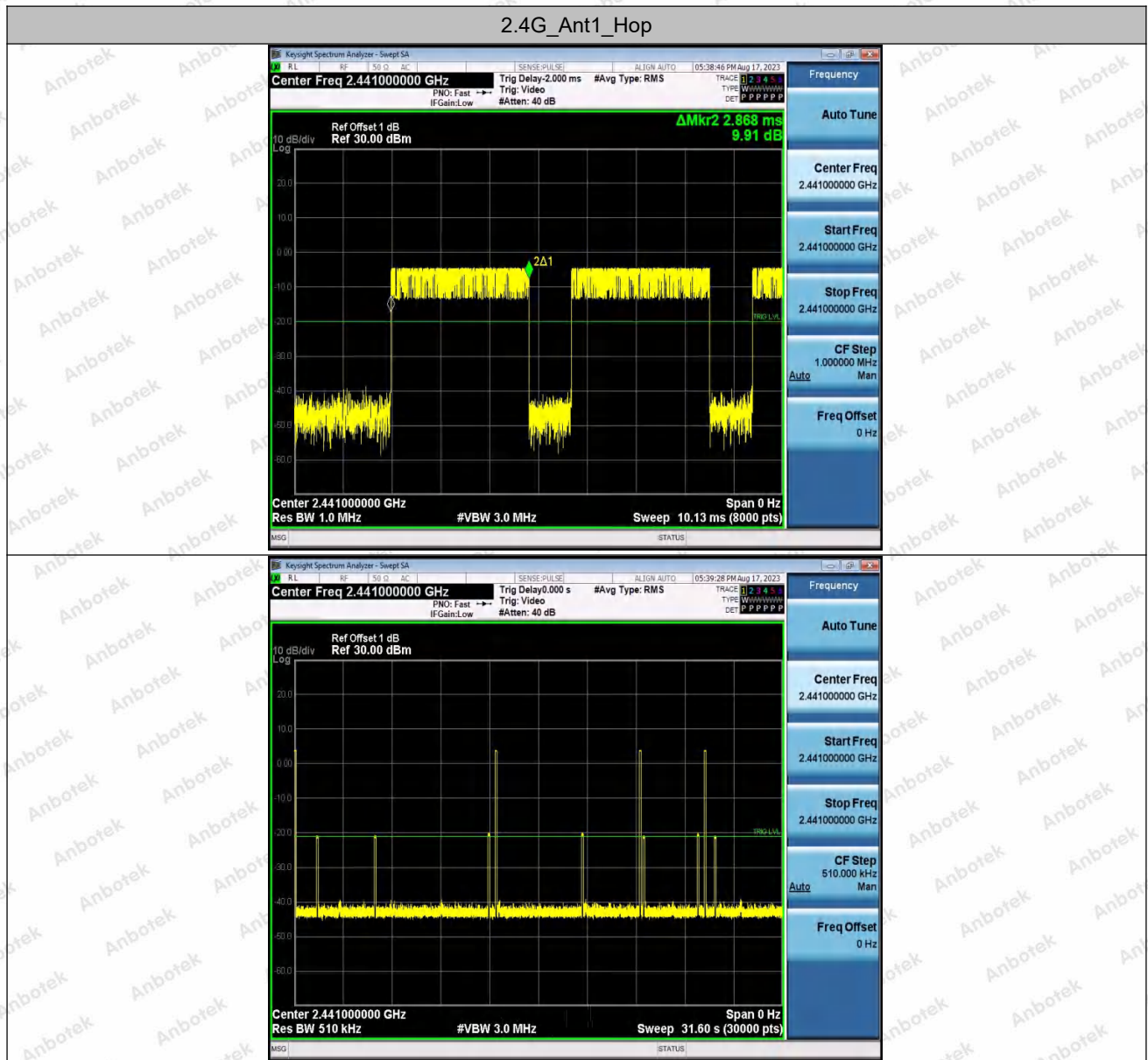
Appendix E: Time of occupancy

Test Result

TestMode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
2.4G	Ant1	Hop	2.868	4	0.011	≤0.4	PASS



Test Graphs



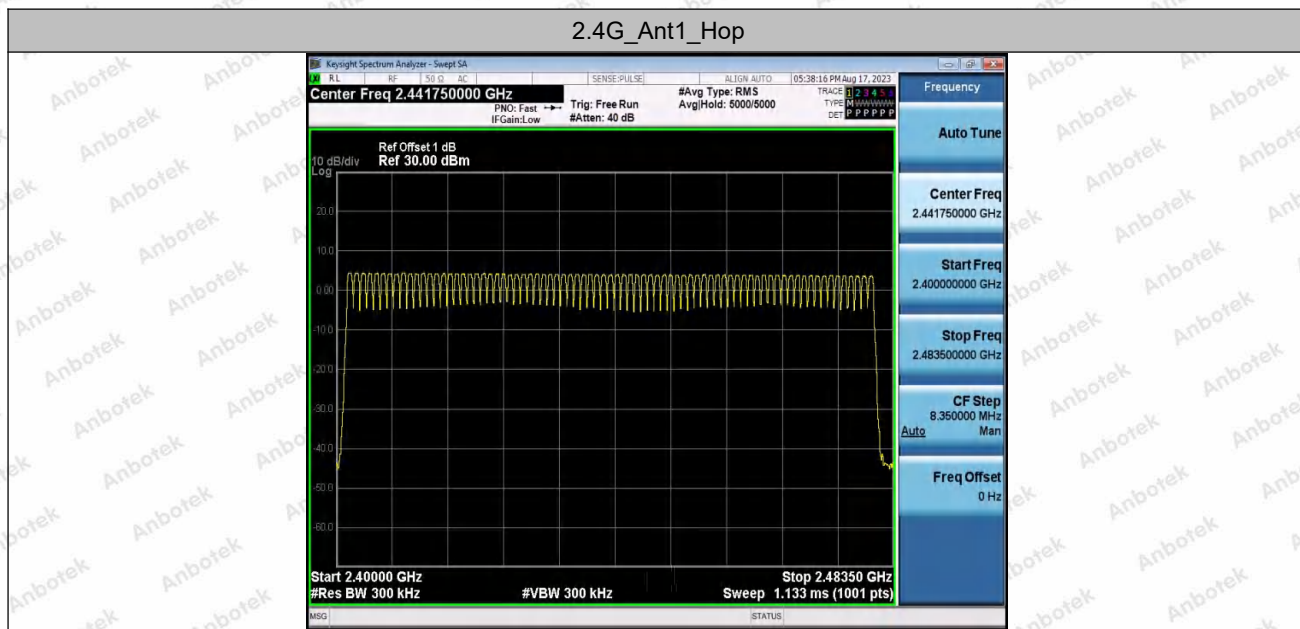
Appendix F: Number of hopping channels

Test Result

TestMode	Antenna	Frequency[MHz]	Result[Num]	Limit[Num]	Verdict
2.4G	Ant1	Hop	79	≥15	PASS



Test Graphs



Appendix G: Band edge measurements

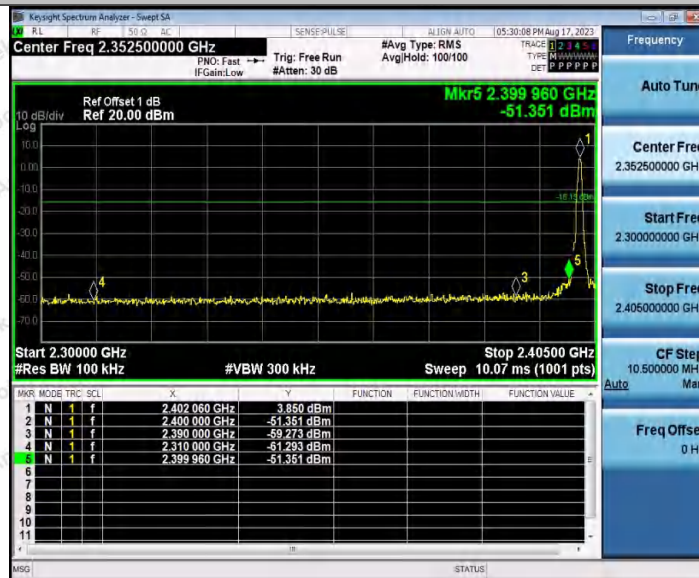
Test Result

TestMode	Antenna	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
2.4G	Ant1	Low	2402	3.85	-51.35	≤-16.15	PASS
		High	2480	3.02	-54.25	≤-16.98	PASS
		Low	Hop_2402	3.53	-56.23	≤-16.47	PASS
		High	Hop_2480	3.50	-56.68	≤-16.5	PASS

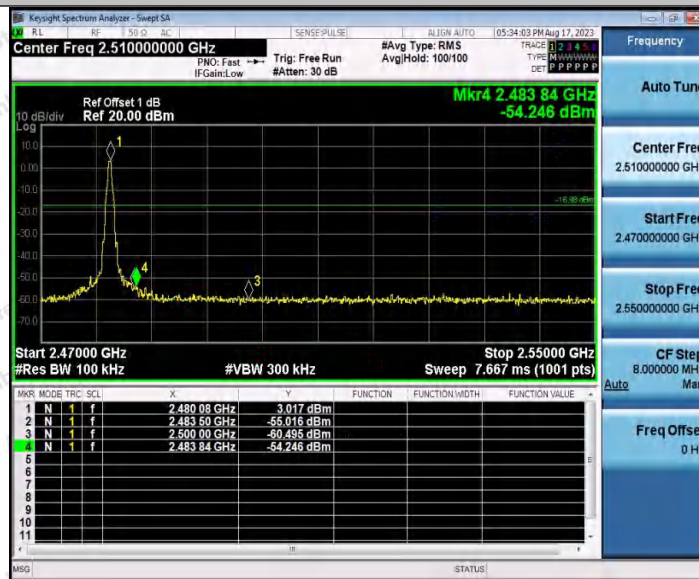


Test Graphs

2.4G_Ant1_Low_2402



2.4G_Ant1_High_2480



2.4G_Ant1_Low_Hop_2402





Appendix H: Conducted Spurious Emission

Test Result

TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
2.4G	Ant1	2402	Reference	4.08	4.08	---	PASS
			30~1000	4.08	-69.34	≤-15.92	PASS
			1000~26500	4.08	-28.94	≤-15.92	PASS
		2441	Reference	1.94	1.94	---	PASS
			30~1000	1.94	-69.26	≤-18.06	PASS
			1000~26500	1.94	-30.51	≤-18.06	PASS
		2480	Reference	1.54	1.54	---	PASS
			30~1000	1.54	-69.44	≤-18.46	PASS
			1000~26500	1.54	-33.51	≤-18.46	PASS

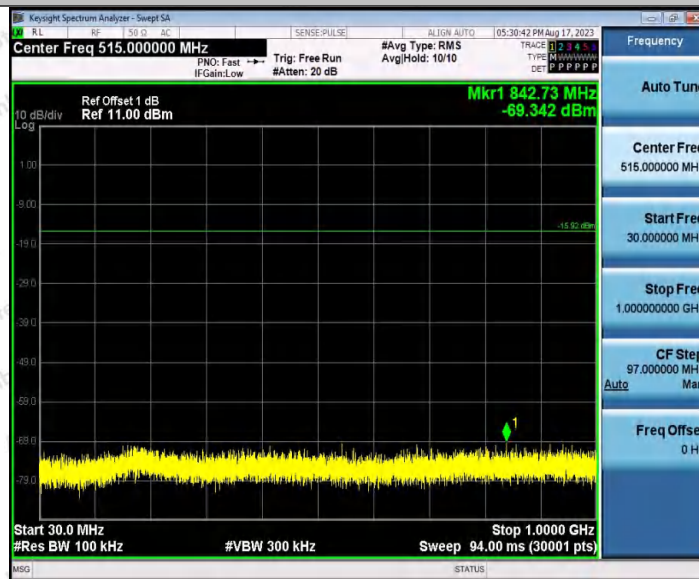


Test Graphs

2.4G_Ant1_2402_0~Reference

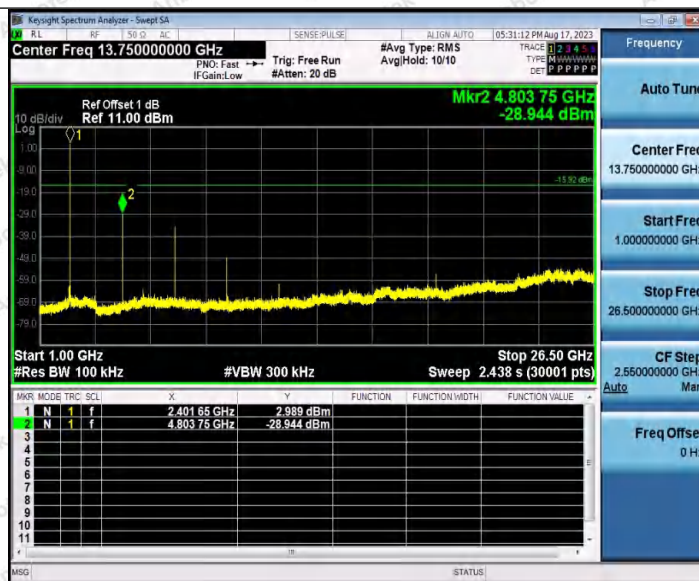


2.4G_Ant1_2402_30~1000



2.4G_Ant1_2402_1000~26500





2.4G_Ant1_2441_0~Reference

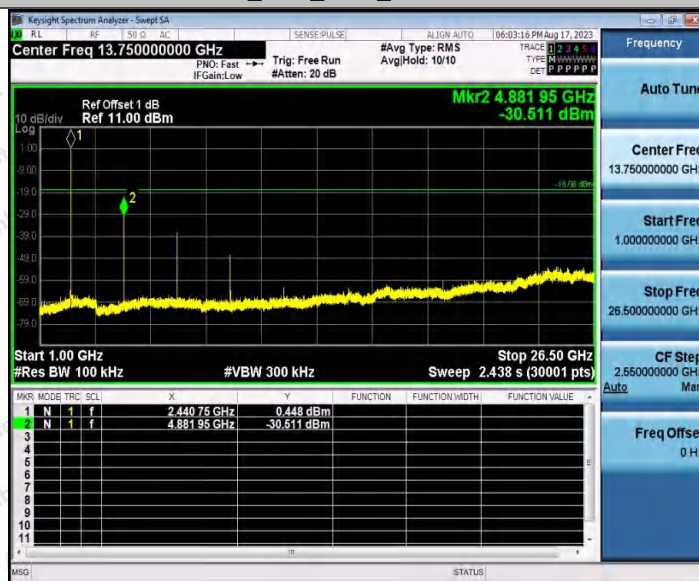


2.4G_Ant1_2441_30~1000





2.4G_Ant1_2441_1000~26500



2.4G_Ant1_2480_0~Reference



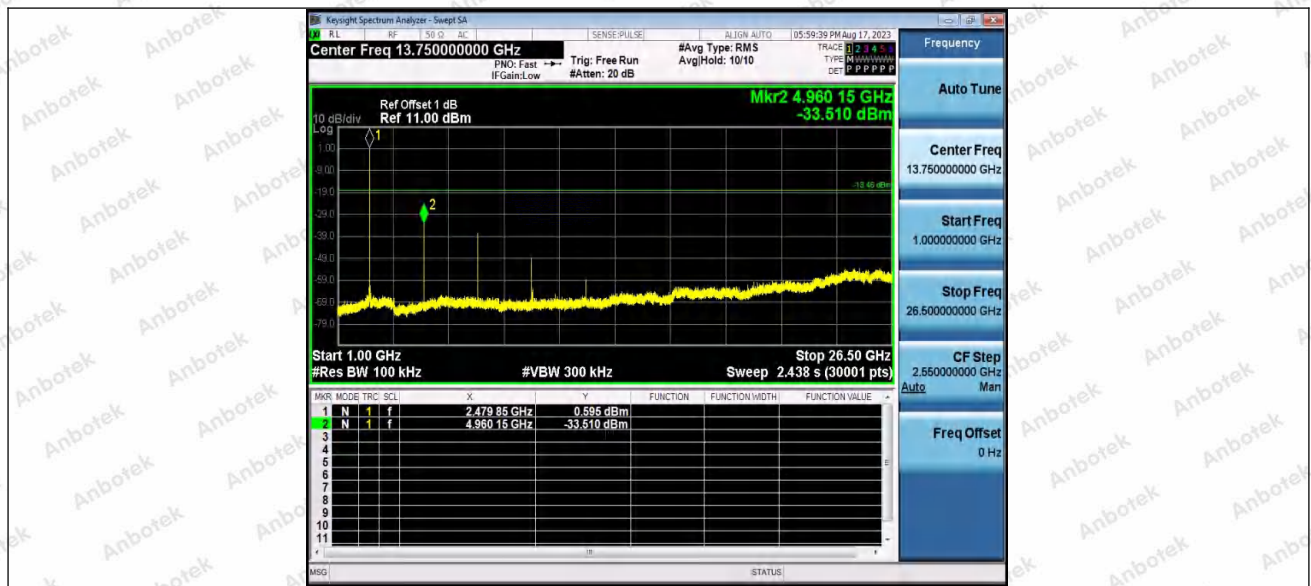


2.4G_Ant1_2480_30~1000



2.4G_Ant1_2480_1000~26500





Appendix I: Duty Cycle

Test Result

TestMode	Antenna	Frequency[MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
2.4G	Ant1	2402	2.87	3.75	76.53	1.16
		2441	2.87	3.75	76.53	1.16
		2480	2.86	3.74	76.47	1.17

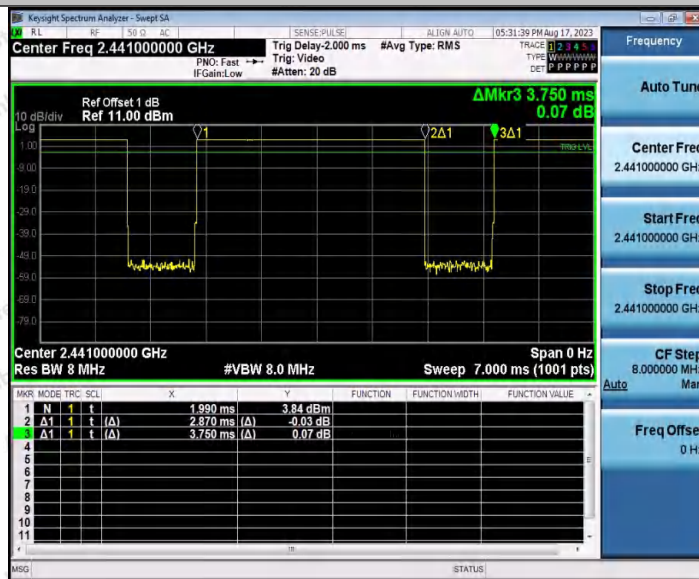


Test Graphs

2.4G_Ant1_2402

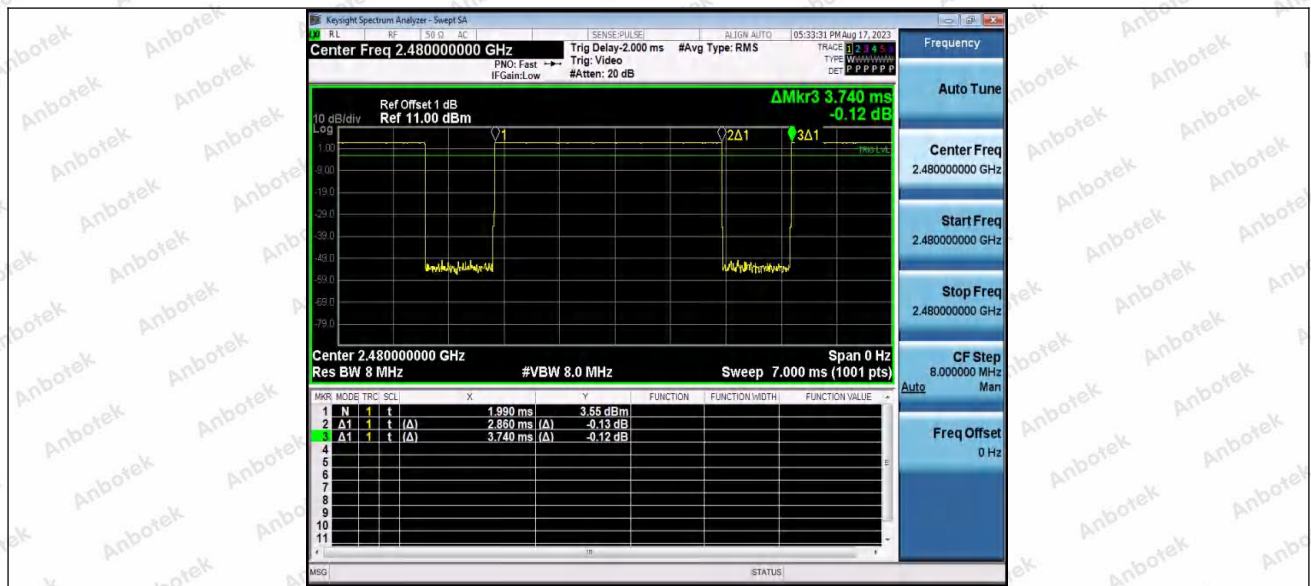


2.4G_Ant1_2441



2.4G_Ant1_2480





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

