FCC Test Report

Applicant	:	**Shenzhen Bolong Technology Co., Ltd.**
Address	:	**Youth Pioneer Park,Jianshe East Road, Longhua Street,Longhua District,shenzhen, China**
Product Name	:	**Smart Q Wake Up Light**
Report Date	:	**Aug. 02, 2023**

Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant	:	Shenzhen Bolong Technology Co., Ltd.
Manufacturer	:	Shenzhen Bolong Technology Co., Ltd.
Product Name	:	Smart Q Wake Up Light
Model No.	:	BL-HXD03
Trade Mark	:	BL
Rating(s)	:	Input: 5V⎓ 2A(DC 3.6V with "LIR2032" battery inside)
Test Standard(s)	:	**FCC Part15 Subpart C, Section 15.247**
Test Method(s)	:	**ANSI C63.10: 2020**

The device described above is tested by Shenzhen 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	Jun. 30, 2023
Date of Test	Jun. 30~Jul. 11, 2023
Prepared by	(TuTu Hong)
Approved & Authorized Signer	(Kingkong Jin)

Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Aug. 02, 2023

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1. General Information

1.1. Client Information

Applicant	:	Shenzhen Bolong Technology Co., Ltd.
Address	:	Youth Pioneer Park,Jianshe East Road, Longhua Street,Longhua District,shenzhen, China
Manufacturer	:	Shenzhen Bolong Technology Co., Ltd.
Address	:	Youth Pioneer Park,Jianshe East Road, Longhua Street,Longhua District,shenzhen, China
Factory	:	Shenzhen Bolong Technology Co., Ltd.
Address	:	Youth Pioneer Park,Jianshe East Road, Longhua Street,Longhua District,shenzhen, China

1.2. Description of Device (EUT)

Product Name	:	Smart Q Wake Up Light
Model No.	:	BL-HXD03
Trade Mark	:	BL
Test Power Supply	:	AC 120V, 60Hz for adapter/DC 3.6V battery inside
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	N/A
RF Specification		
Operation Mode	:	☒ BT BDR ☒ BT EDR
Operation Frequency	:	2402~2480MHz
Number of Channel	:	79 Channels
Modulation Type	:	GFSK, π/4-DQPSK, 8-DPSK
Antenna Type	:	PCB Antenna
Antenna Gain(Peak)	:	-0.58 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)
Adapter	Model: MDY-11-EX Input: 100-240VAC,50-60Hz, 0.7A Output: 5V⎓ 3A,9V⎓ 3A,12V⎓ 2.25A,20V⎓ 1.35A,11V⎓ 3A

1.4. Description of Test Configuration

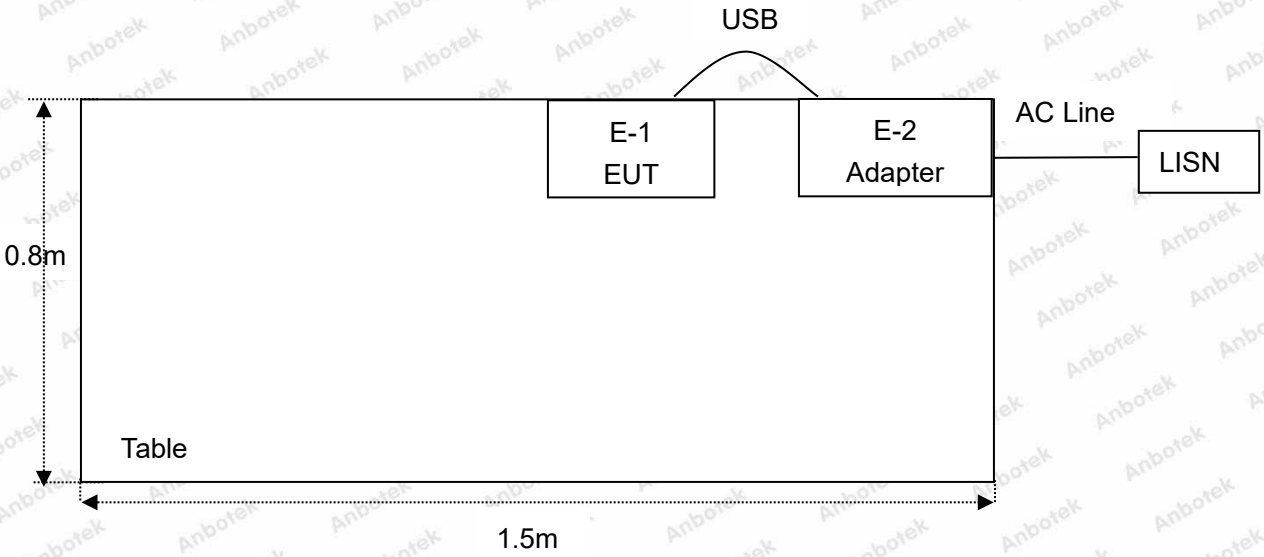
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
00	**2402**	17	2419	34	2436	51	2453	68	2470
01	2403	18	2420	35	2437	52	2454	69	2471
02	2404	19	2421	36	2438	53	2455	70	2472
03	2405	20	2422	37	2439	54	2456	71	2473
04	2406	21	2423	38	2440	55	2457	72	2474
05	2407	22	2424	**39**	**2441**	56	2458	73	2475
06	2408	23	2425	40	2442	57	2459	74	2476
07	2409	24	2426	41	2443	58	2460	75	2477
08	2410	25	2427	42	2444	59	2461	76	2478
09	2411	26	2428	43	2445	60	2462	77	2479
10	2412	27	2429	44	2446	61	2463	**78**	**2480**
11	2413	28	2430	45	2447	62	2464		
12	2414	29	2431	46	2448	63	2465		
13	2415	30	2432	47	2449	64	2466		
14	2416	31	2433	48	2450	65	2467		
15	2417	32	2434	49	2451	66	2468		
16	2418	33	2435	50	2452	67	2469		

Note:

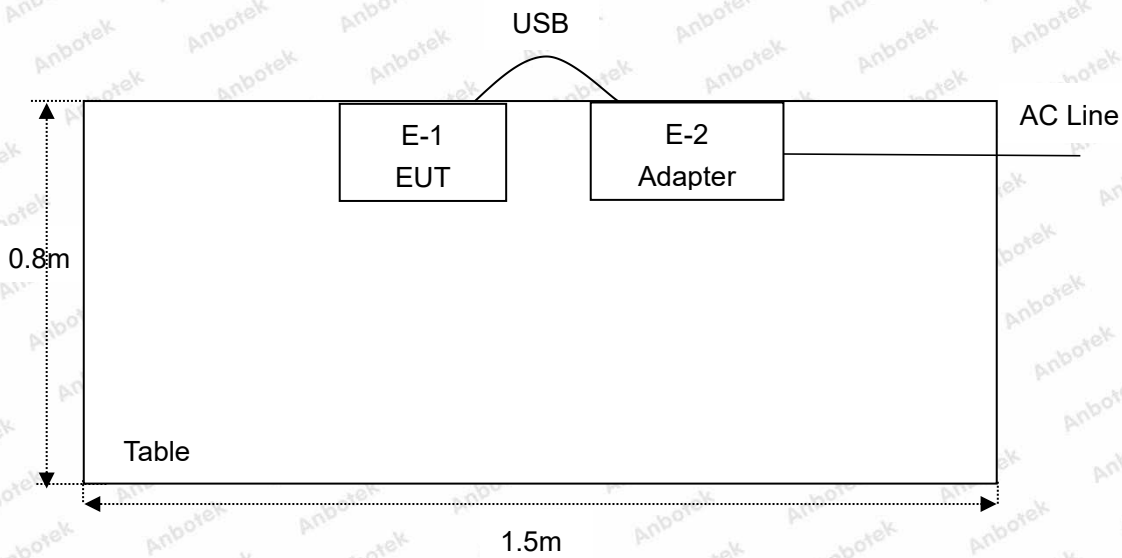
1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT was tested with channel 0, 39 and 78.

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.	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	345	Oct. 23, 2022	3 Year
10.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 23, 2022	1 Year
11.	Horn Antenna	A-INFO	LB-180400-K F	J211060628	Oct. 23, 2022	1 Year
12.	Pre-amplifier	SONOMA	310N	186860	Oct. 23, 2022	1 Year
13.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
14.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 13, 2022	1 Year
15.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 13, 2022	1 Year
16.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 13, 2022	1 Year
17.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2022	1 Year
18.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80 B	N/A	Oct. 19, 2022	1 Year
19.	Power Meter	Agilent	N1914A	MY50001102	Oct.26, 2022	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

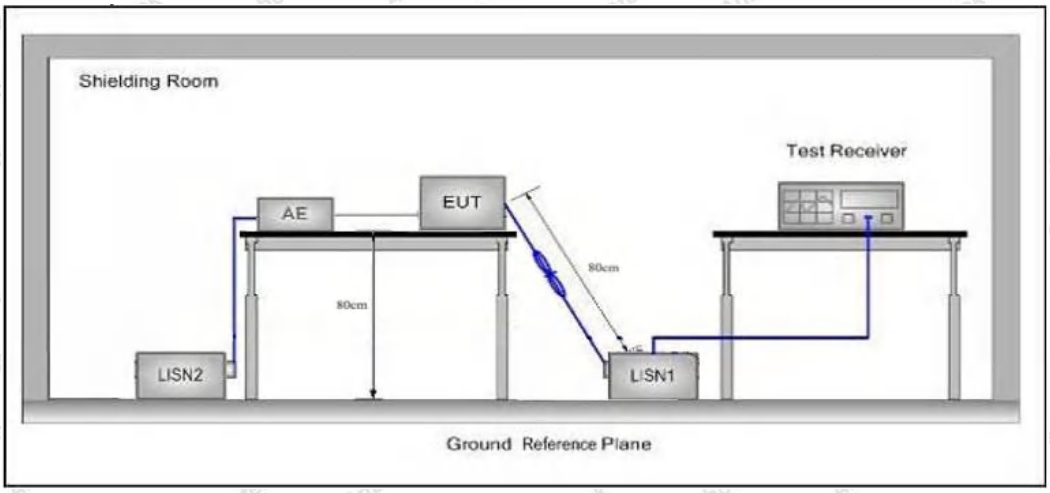
Standard Section	Test Item	Result
15.203/15.247(c)	Antenna Requirement	PASS
15.207	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.247(b)(1)	Conducted Peak Output Power	PASS
15.247(a)(1)	20dB Occupied Bandwidth	PASS
15.247(a)(1)	Carrier Frequencies Separation	PASS
15.247(a)(1)(iii)	Number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

PASS

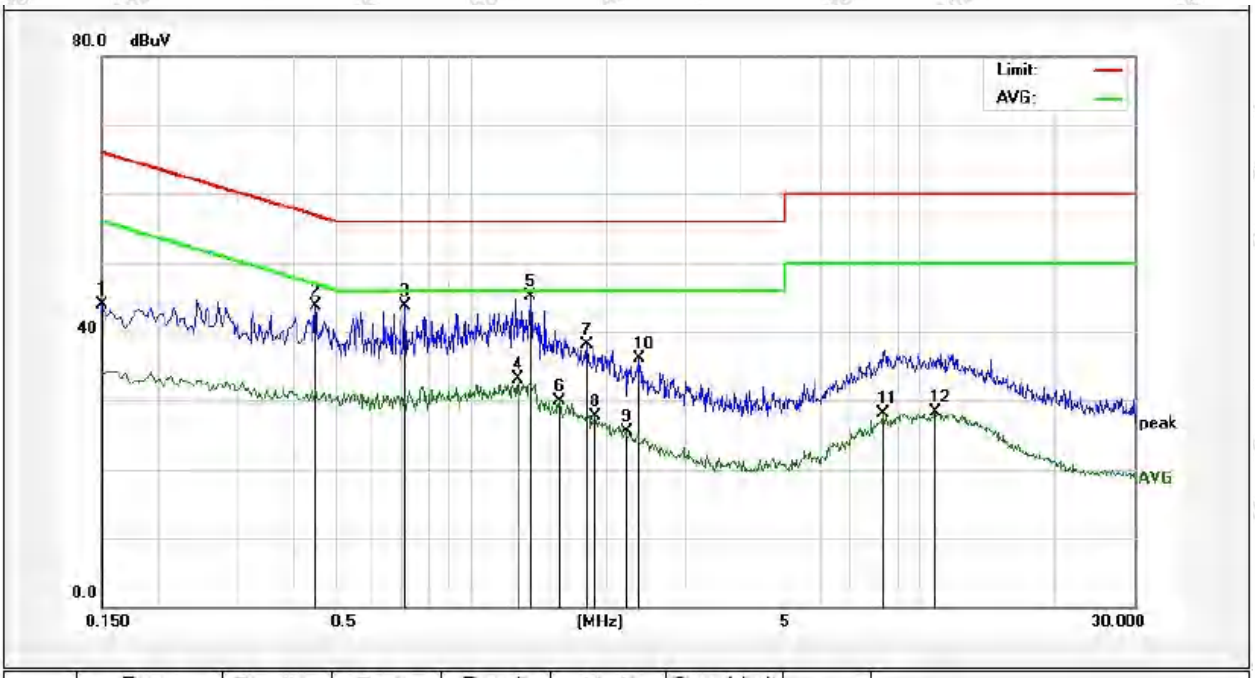
During the test, pre-scan all modes, only the worst case is recorded in the report.

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: 8-DPSK(2480MHz)
Test Specification: AC 120V, 60Hz for adapter
Comment: Live Line
Temp.(℃)/Hum.(%RH): 22.1℃/52%RH

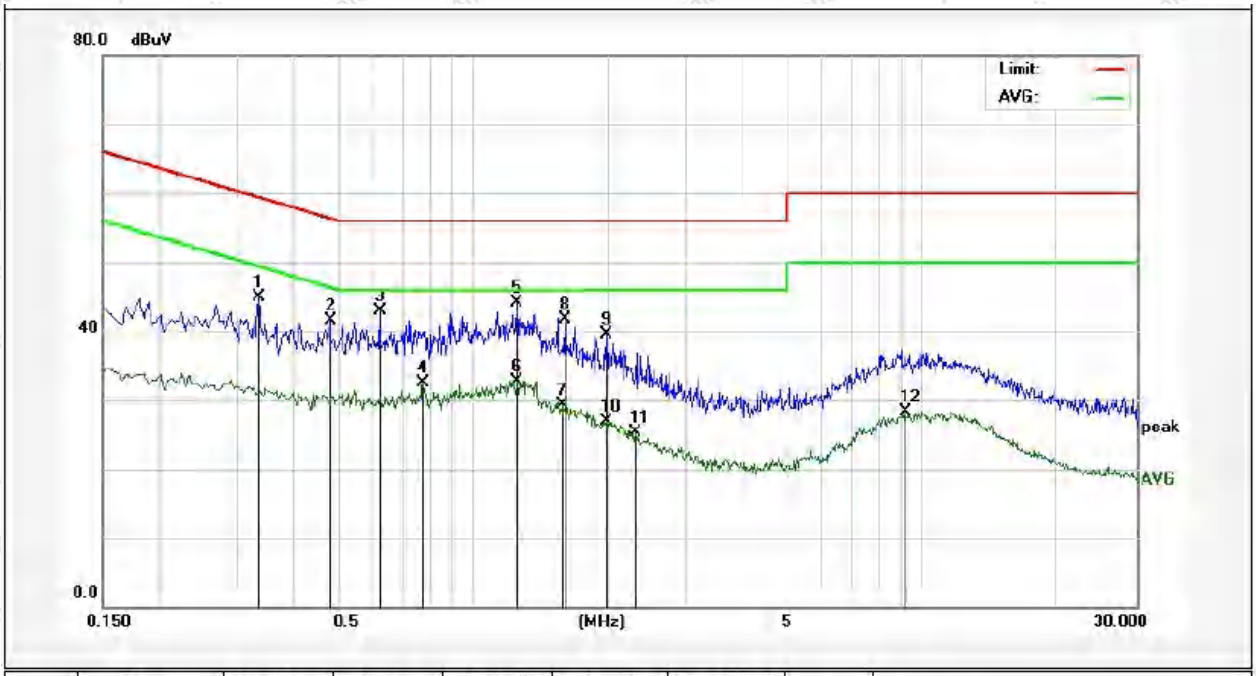


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1500	24.09	19.82	43.91	65.99	-22.08	QP	
2	0.4500	23.92	19.83	43.75	56.87	-13.12	QP	
3	0.7140	23.80	19.87	43.67	56.00	-12.33	QP	
4	1.2740	13.26	19.84	33.10	46.00	-12.90	AVG	
5	1.3580	25.28	19.84	45.12	56.00	-10.88	QP	
6	1.5740	9.99	19.84	29.83	46.00	-16.17	AVG	
7	1.8180	18.28	19.84	38.12	56.00	-17.88	QP	
8	1.8900	7.82	19.83	27.65	46.00	-18.35	AVG	
9	2.2139	5.71	19.83	25.54	46.00	-20.46	AVG	
10	2.3699	16.20	19.83	36.03	56.00	-19.97	QP	
11	8.2700	8.19	19.92	28.11	50.00	-21.89	AVG	
12	10.8139	8.37	20.01	28.38	50.00	-21.62	AVG	

Note: Result = Reading + Factor Over Limit = Result - Limit

Conducted Emission Test Data

Test Site:	1# Shielded Room
Operating Condition:	8-DPSK(2480MHz)
Test Specification:	AC 120V, 60Hz for adapter
Comment:	Neutral Line
Temp.(℃)/Hum.(%RH):	22.1℃/52%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.3339	25.09	19.82	44.91	59.35	-14.44	QP	
2	0.4820	21.73	19.84	41.57	56.30	-14.73	QP	
3	0.6220	23.11	19.86	42.97	56.00	-13.03	QP	
4	0.7780	12.59	19.86	32.45	46.00	-13.55	AVG	
5	1.2579	24.30	19.84	44.14	56.00	-11.86	QP	
6	1.2579	12.95	19.84	32.79	46.00	-13.21	AVG	
7	1.5859	9.49	19.84	29.33	46.00	-16.67	AVG	
8	1.6060	21.87	19.84	41.71	56.00	-14.29	QP	
9	1.9860	19.62	19.83	39.45	56.00	-16.55	QP	
10	1.9860	7.04	19.83	26.87	46.00	-19.13	AVG	
11	2.3020	5.50	19.83	25.33	46.00	-20.67	AVG	
12	9.2018	8.41	19.95	28.36	50.00	-21.64	AVG	

Note: Result = Reading + Factor Over Limit = Result - Limit

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

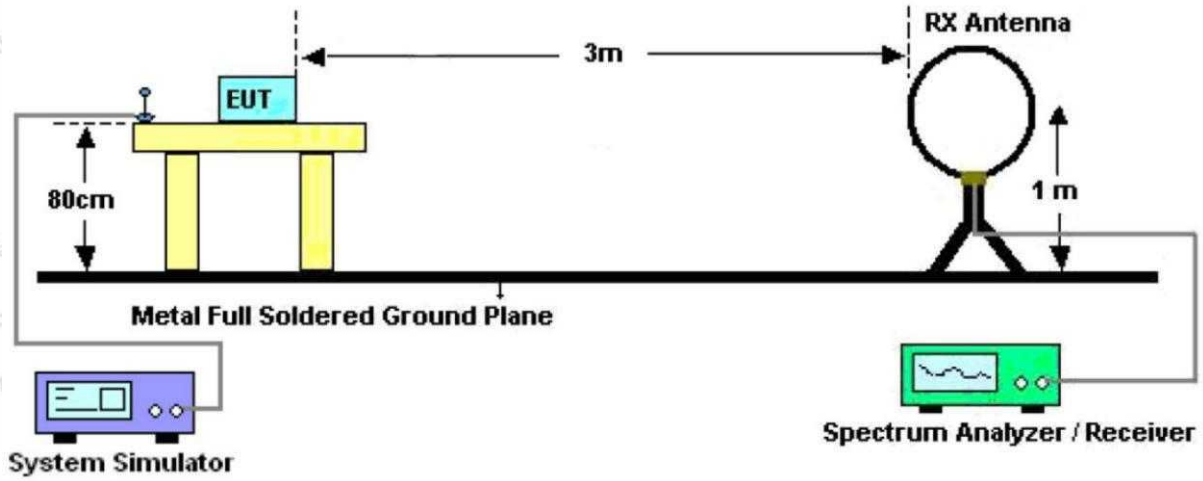


Figure 1. Below 30MHz

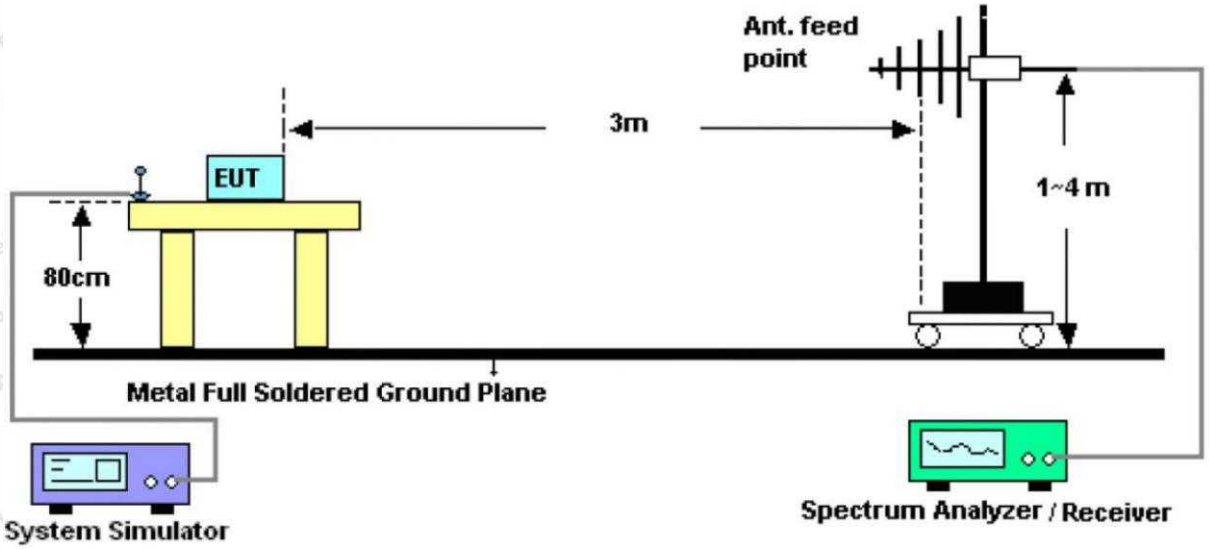


Figure 2. 30MHz to 1GHz

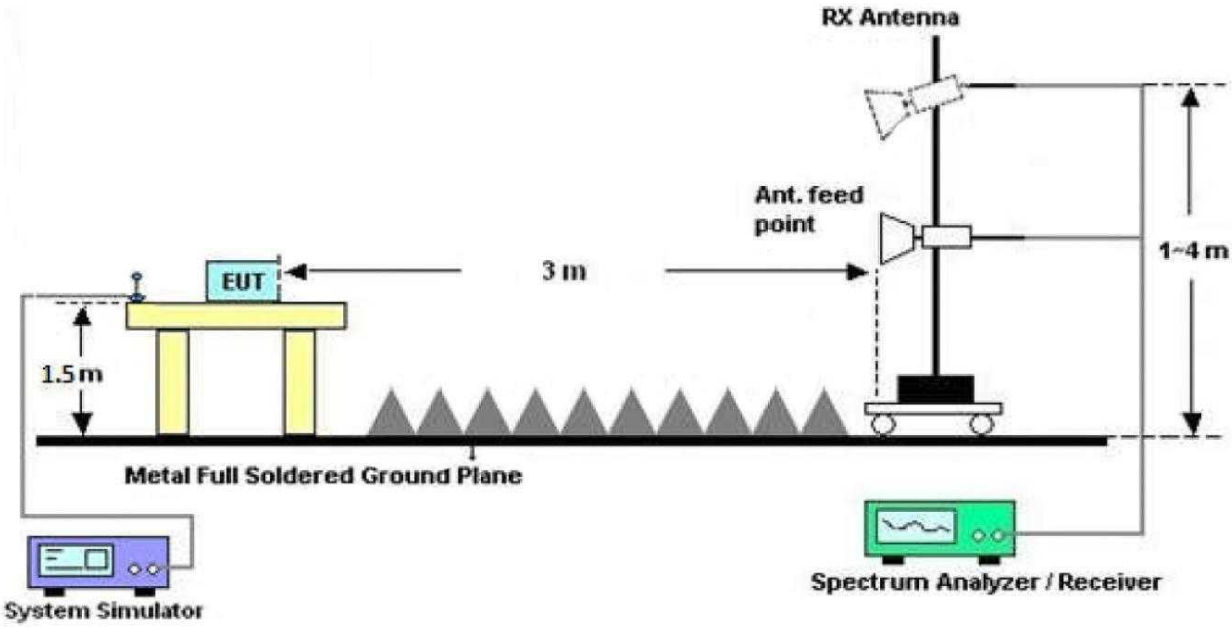


Figure 3. Above 1 GHz

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.

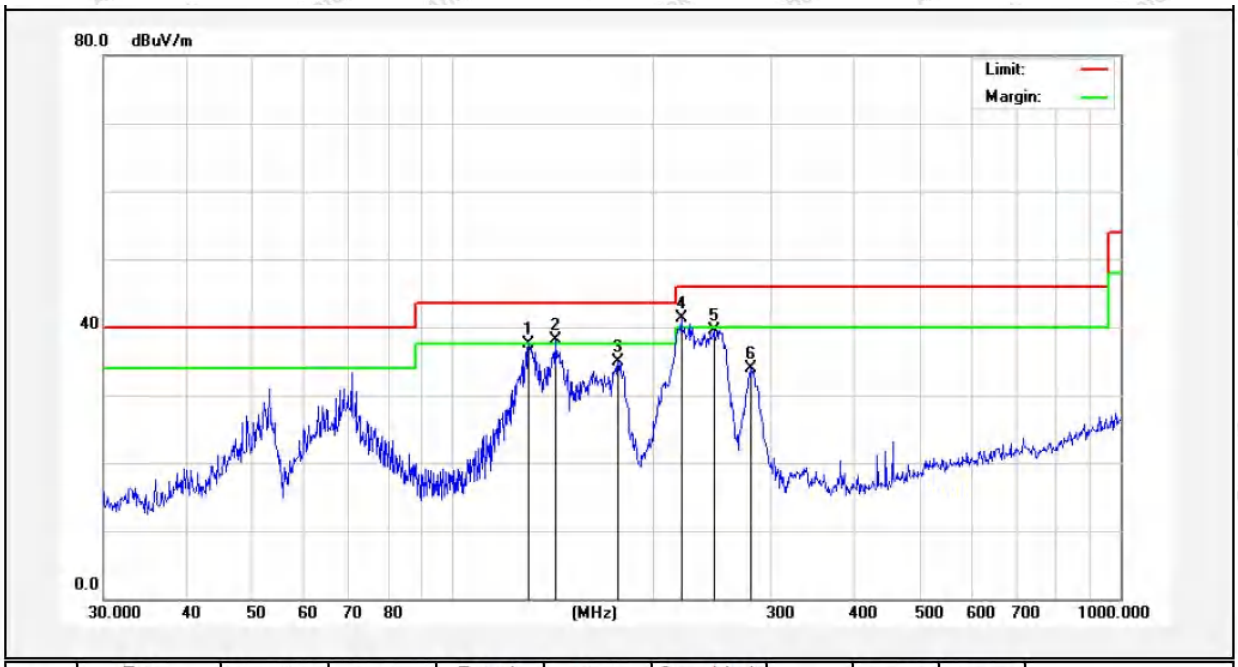
Test Results (30~1000MHz)

Test Mode: 8-DPSK(2480MHz)

Power Source: AC 120V, 60Hz for adapter

Polarization: Vertical

Temp.(℃)/Hum.(%RH): 22.1℃/52%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	129.9225	59.05	-21.46	37.59	43.50	-5.91	QP			
2	142.3241	60.22	-22.16	38.06	43.50	-5.44	QP			
3	176.8878	55.63	-20.76	34.87	43.50	-8.63	QP			
4	219.8446	60.28	-18.98	41.30	46.00	-4.70	QP			
5	245.9509	57.60	-18.07	39.53	46.00	-6.47	QP			
6	280.0237	50.86	-16.93	33.93	46.00	-12.07	QP			

Note: Result = Reading + Factor Over Limit = Result - Limit

Test Results (30~1000MHz)

Test Mode: 8-DPSK(2480MHz)

Power Source: AC 120V, 60Hz for adapter

Polarization: Horizontal

Temp.(℃)/Hum.(%RH): 22.1℃/52%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	70.5836	48.13	-22.23	25.90	40.00	-14.10	QP			
2	130.8369	58.35	-22.54	35.81	43.50	-7.69	QP			
3	177.5092	58.10	-23.29	34.81	43.50	-8.69	QP			
4	219.0749	61.46	-22.01	39.45	46.00	-6.55	QP			
5	249.4250	62.04	-21.51	40.53	46.00	-5.47	QP			
6	279.0436	60.54	-18.98	41.56	46.00	-4.44	QP			

Note: Result = Reading + Factor Over Limit = Result - Limit

Test Results (1GHz-25GHz)

Test Mode: CH00			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	29.51	15.27	44.78	74.00	-29.22	Vertical
7206.00	30.27	18.09	48.36	74.00	-25.64	Vertical
9608.00	31.89	23.76	55.65	74.00	-18.35	Vertical
12010.00	*			74.00		Vertical
14412.00	*			74.00		Vertical
4804.00	29.68	15.27	44.95	74.00	-29.05	Horizontal
7206.00	31.31	18.09	49.40	74.00	-24.60	Horizontal
9608.00	29.24	23.76	53.00	74.00	-21.00	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	18.89	15.27	34.16	54.00	-19.84	Vertical
7206.00	19.30	18.09	37.39	54.00	-16.61	Vertical
9608.00	20.91	23.76	44.67	54.00	-9.33	Vertical
12010.00	*			54.00		Vertical
14412.00	*			54.00		Vertical
4804.00	18.03	15.27	33.30	54.00	-20.70	Horizontal
7206.00	20.37	18.09	38.46	54.00	-15.54	Horizontal
9608.00	18.55	23.76	42.31	54.00	-11.69	Horizontal
12010.00	*			54.00		Horizontal
14412.00	*			54.00		Horizontal

Test Results (1GHz-25GHz)

Test Mode: CH39			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	29.53	15.42	44.95	74.00	-29.05	Vertical
7323.00	30.12	18.02	48.14	74.00	-25.86	Vertical
9764.00	30.90	23.80	54.70	74.00	-19.30	Vertical
12205.00	*			74.00		Vertical
14646.00	*			74.00		Vertical
4882.00	29.38	15.42	44.80	74.00	-29.20	Horizontal
7323.00	31.30	18.02	49.32	74.00	-24.68	Horizontal
9764.00	28.94	23.80	52.74	74.00	-21.26	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	18.62	15.42	34.04	54.00	-19.96	Vertical
7323.00	19.40	18.02	37.42	54.00	-16.58	Vertical
9764.00	20.77	23.80	44.57	54.00	-9.43	Vertical
12205.00	*			54.00		Vertical
14646.00	*			54.00		Vertical
4882.00	17.94	15.42	33.36	54.00	-20.64	Horizontal
7323.00	19.93	18.02	37.95	54.00	-16.05	Horizontal
9764.00	19.06	23.80	42.86	54.00	-11.14	Horizontal
12205.00	*			54.00		Horizontal
14646.00	*			54.00		Horizontal

Test Results (1GHz-25GHz)

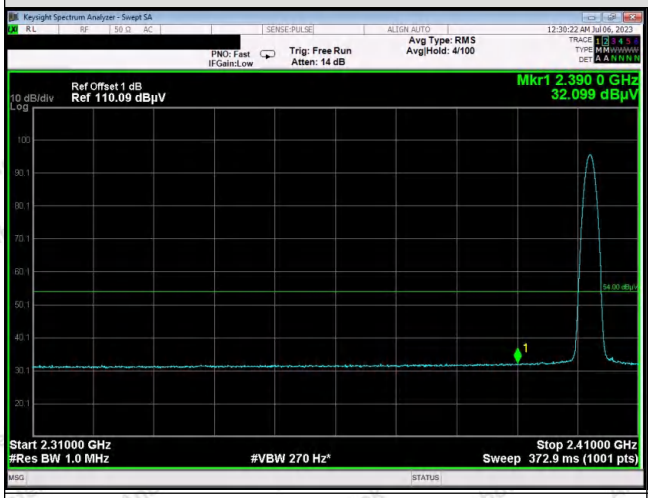
Test Mode: CH78			Test channel: Highest			
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	29.80	15.58	45.38	74.00	-28.62	Vertical
7440.00	30.13	17.93	48.06	74.00	-25.94	Vertical
9920.00	31.45	23.83	55.28	74.00	-18.72	Vertical
12400.00	*			74.00		Vertical
14880.00	*			74.00		Vertical
4960.00	29.45	15.58	45.03	74.00	-28.97	Horizontal
7440.00	31.33	17.93	49.26	74.00	-24.74	Horizontal
9920.00	29.62	23.83	53.45	74.00	-20.55	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	19.74	15.58	35.32	54.00	-18.68	Vertical
7440.00	20.41	17.93	38.34	54.00	-15.66	Vertical
9920.00	21.32	23.83	45.15	54.00	-8.85	Vertical
12400.00	*			54.00		Vertical
14880.00	*			54.00		Vertical
4960.00	19.38	15.58	34.96	54.00	-19.04	Horizontal
7440.00	21.30	17.93	39.23	54.00	-14.77	Horizontal
9920.00	18.96	23.83	42.79	54.00	-11.21	Horizontal
12400.00	*			54.00		Horizontal
14880.00	*			54.00		Horizontal

Remark:

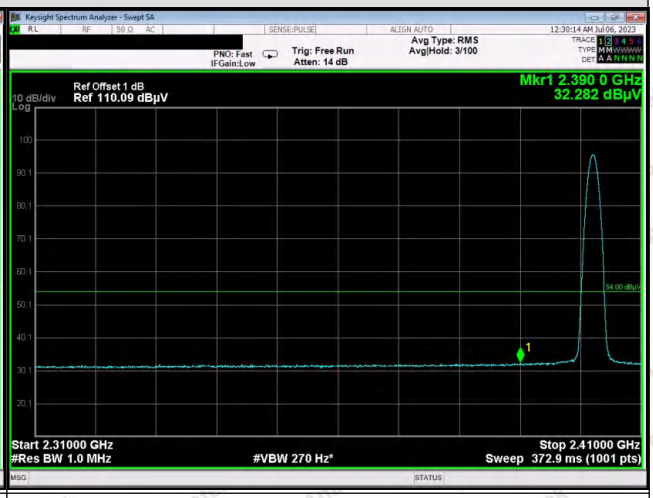
1. During the test, pre-scan the GFSK, π/4QPSK, 8DPSK modulation, and found the 8-DPSK modulation is worse case, the report only record this mode.
2. Result =Reading + Factor
3. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Radiated Band Edge:

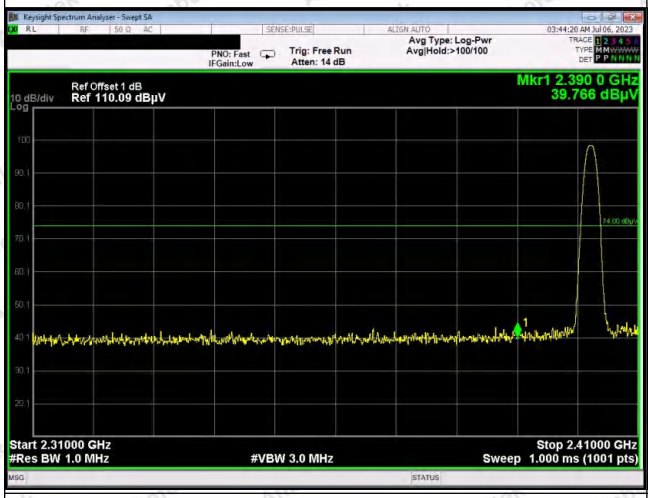
Test Mode: Lowest (CH00)



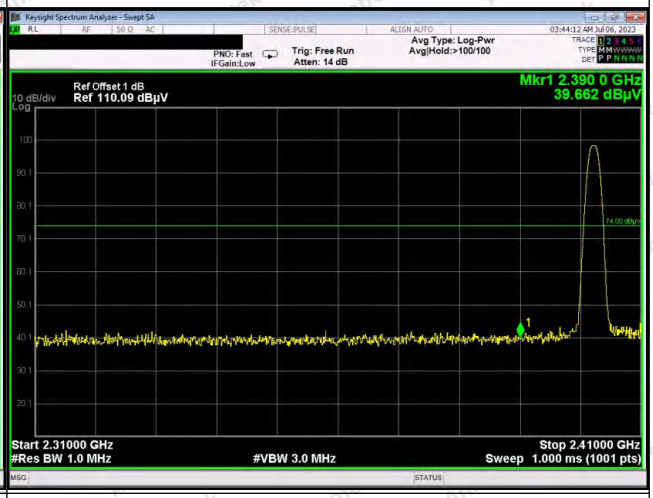
Average Value(Vertical)



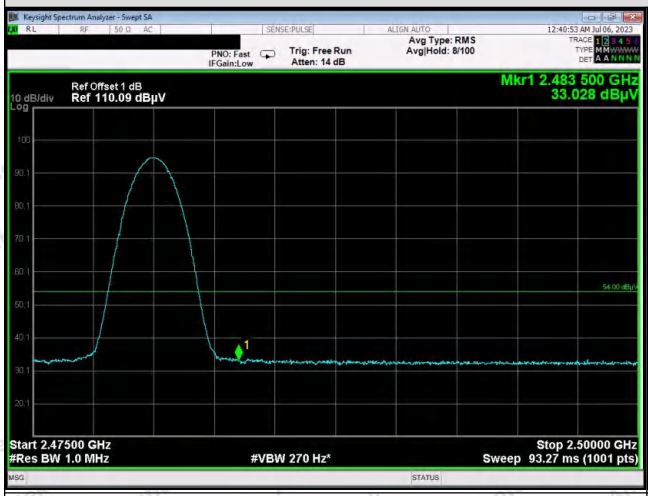
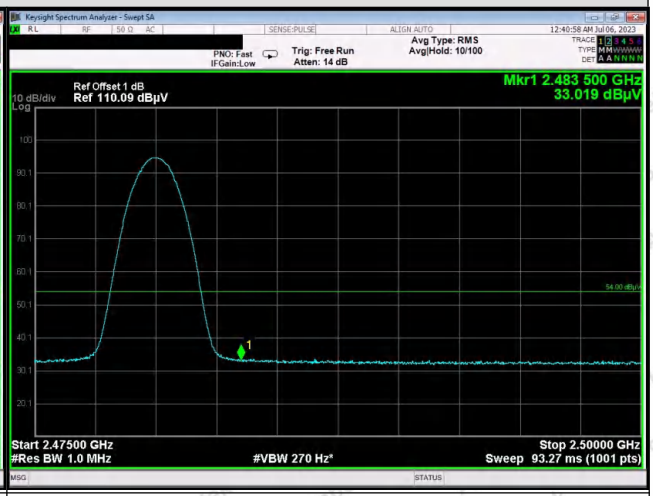
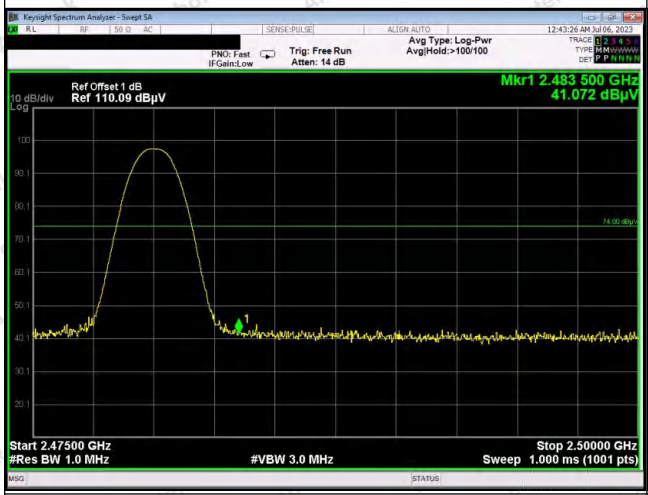
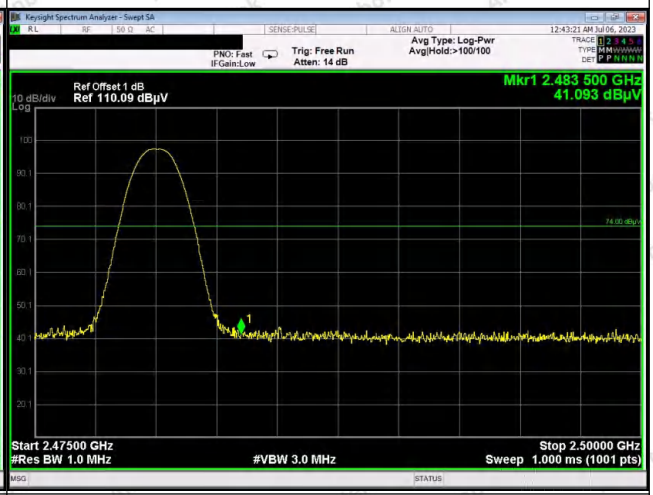
Average Value(Horizontal)



Peak Value(Vertical)



Peak Value(Horizontal)

Test Mode: Highest (CH78)	
	
Average Value(Vertical)	Average Value(Horizontal)
	
Peak Value(Vertical)	Peak Value(Horizontal)

Remark:

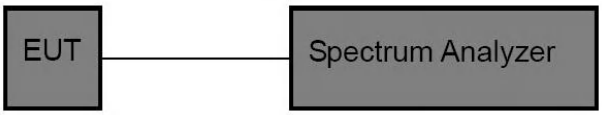
1. During the test, pre-scan the GFSK, π/4QPSK, 8DPSK modulation, and found the GFSK modulation is worse case, the report only record this mode.

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

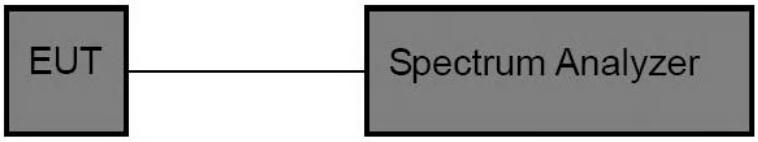
Please refer to Appendix C of the Appendix Test Data.

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 ≥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

Pass

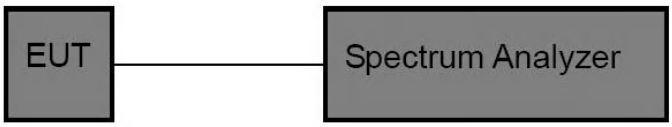
Please refer to Appendix A of the Appendix Test Data.

7. Carrier Frequency Separation Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)
Test Limit	2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W.

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. Test Data

Pass

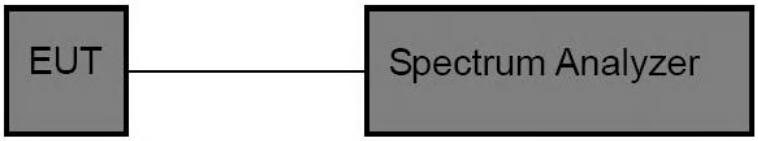
Please refer to Appendix D of the Appendix Test Data.

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 ≥ 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

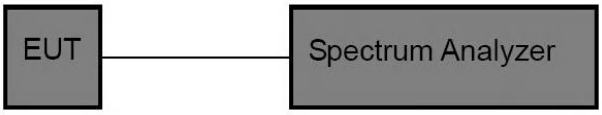
Please refer to Appendix F of the Appendix Test Data.

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 ≥ 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

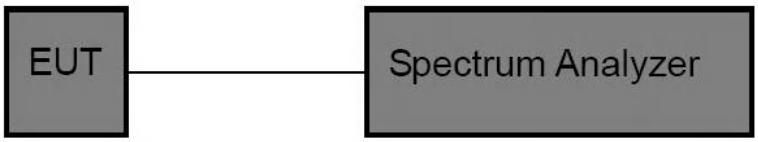
Please refer to Appendix E of the Appendix Test Data.

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 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

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

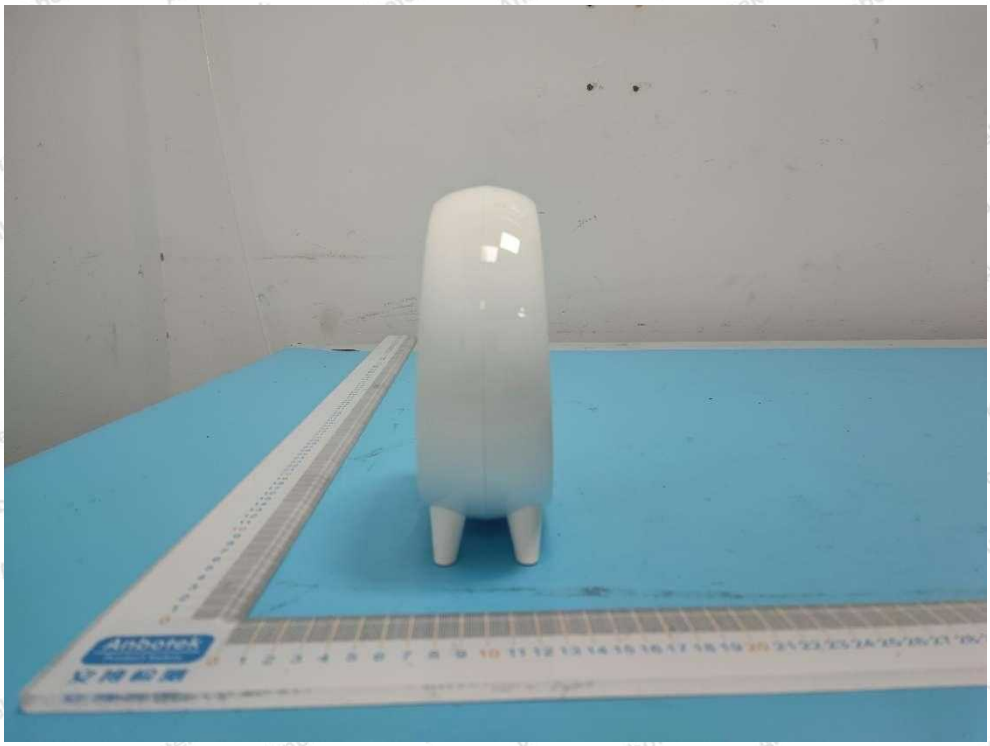
The antenna is PCB Antenna which permanently attached, and the best case gain of the antenna is -0.58dBi. It complies with the standard requirement.

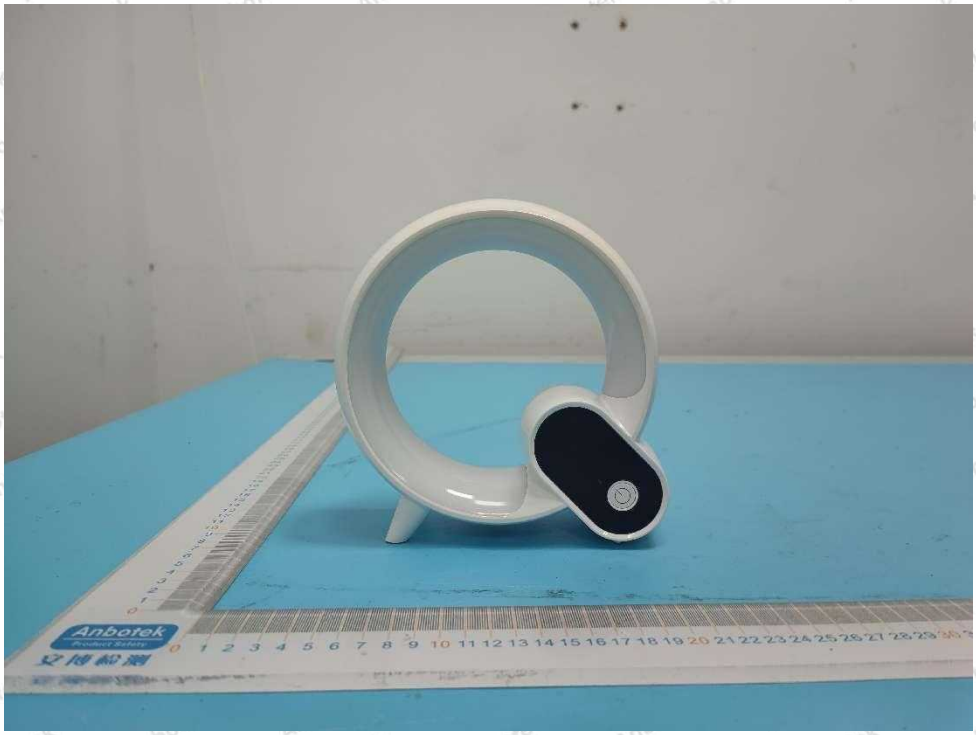
APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Conducted Emission Measurement

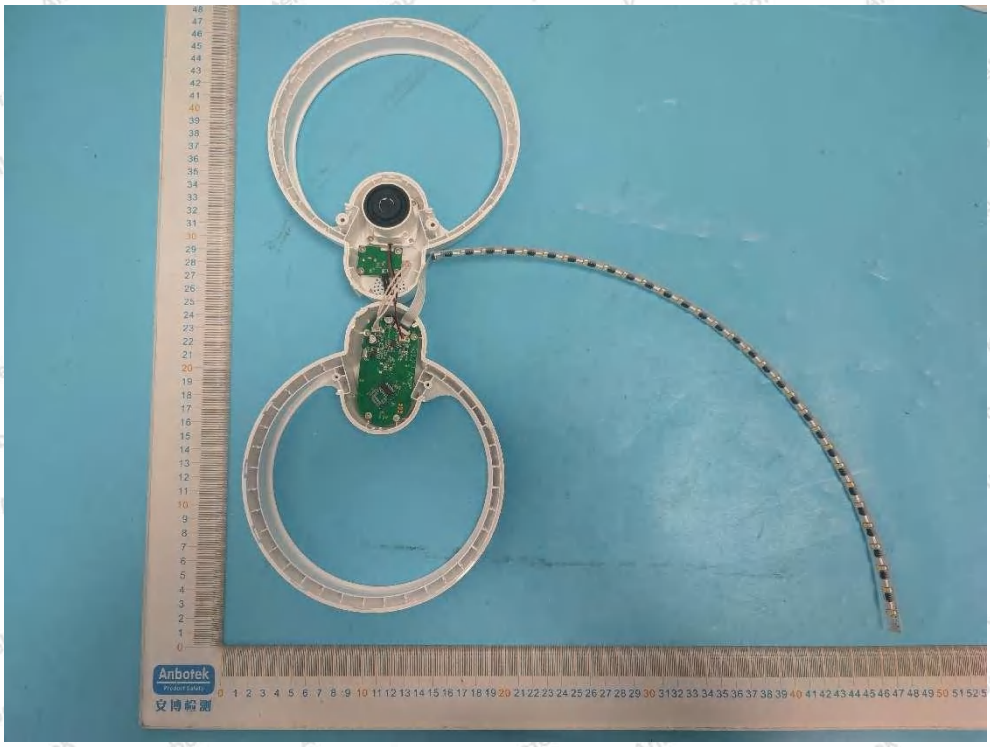
Photo of Radiation Emission Test

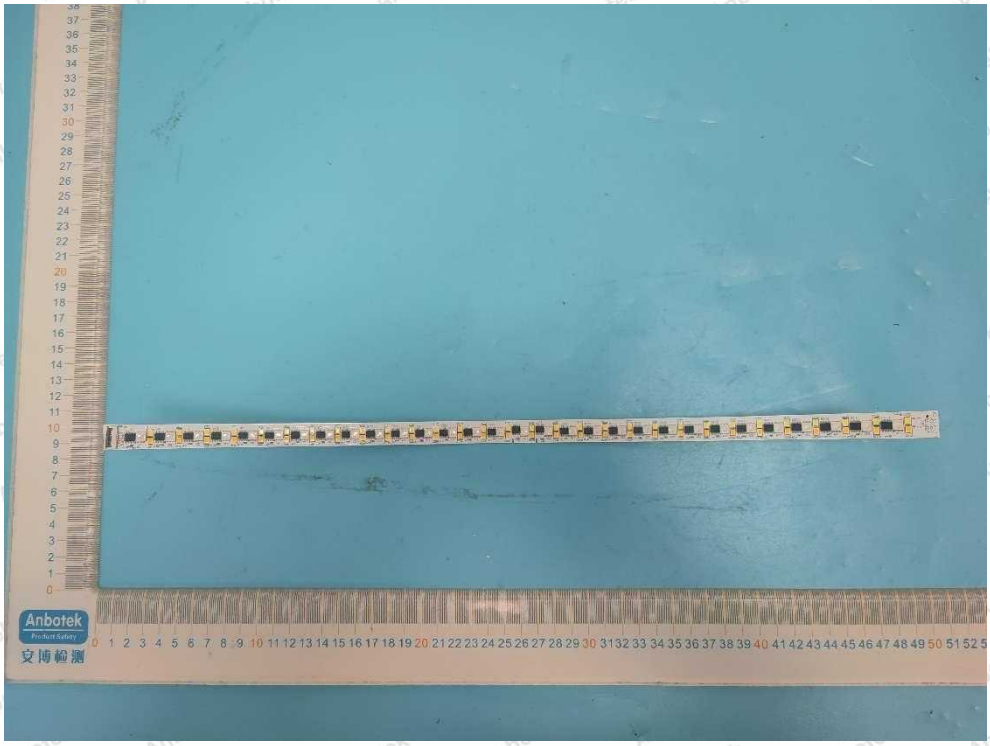
APPENDIX II -- EXTERNAL PHOTOGRAPH

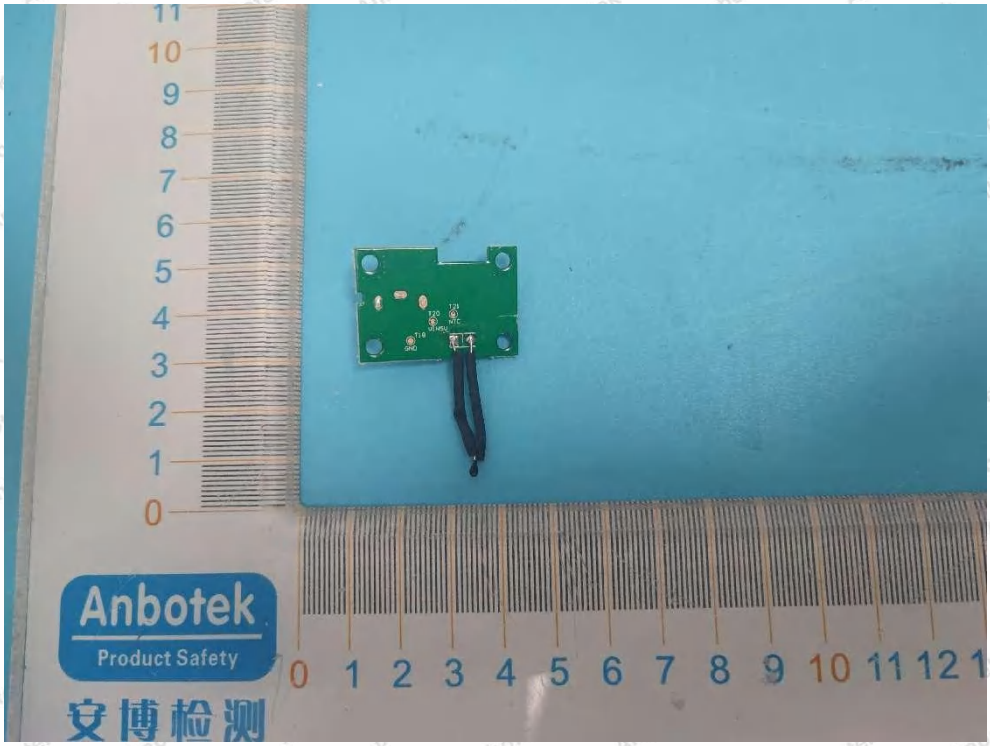


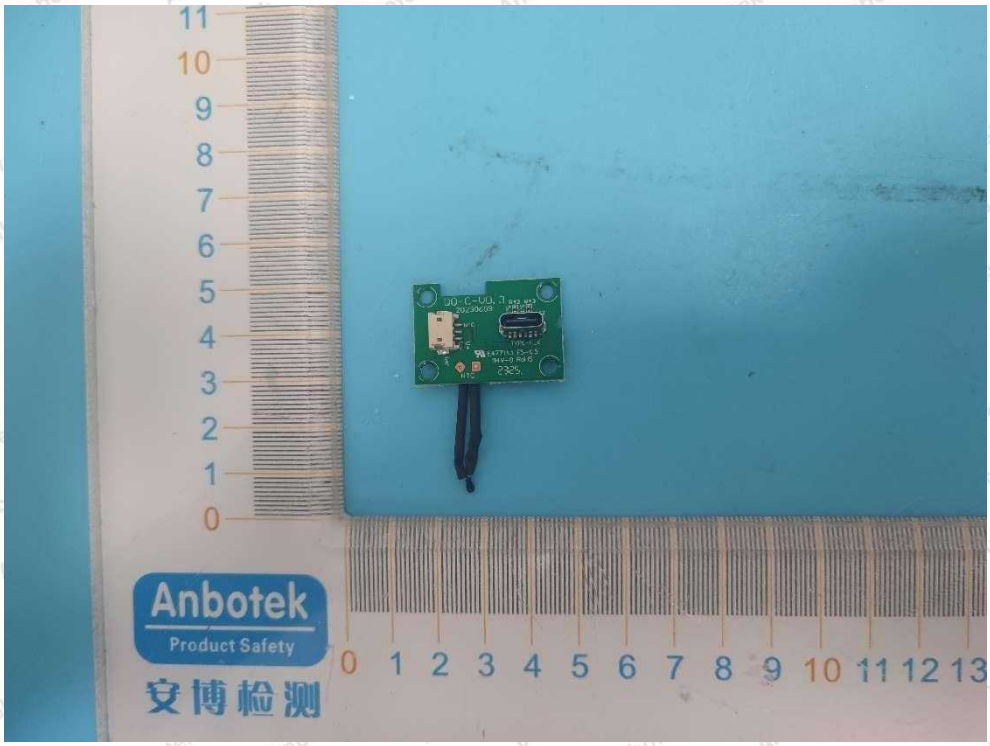


APPENDIX III -- INTERNAL PHOTOGRAPH

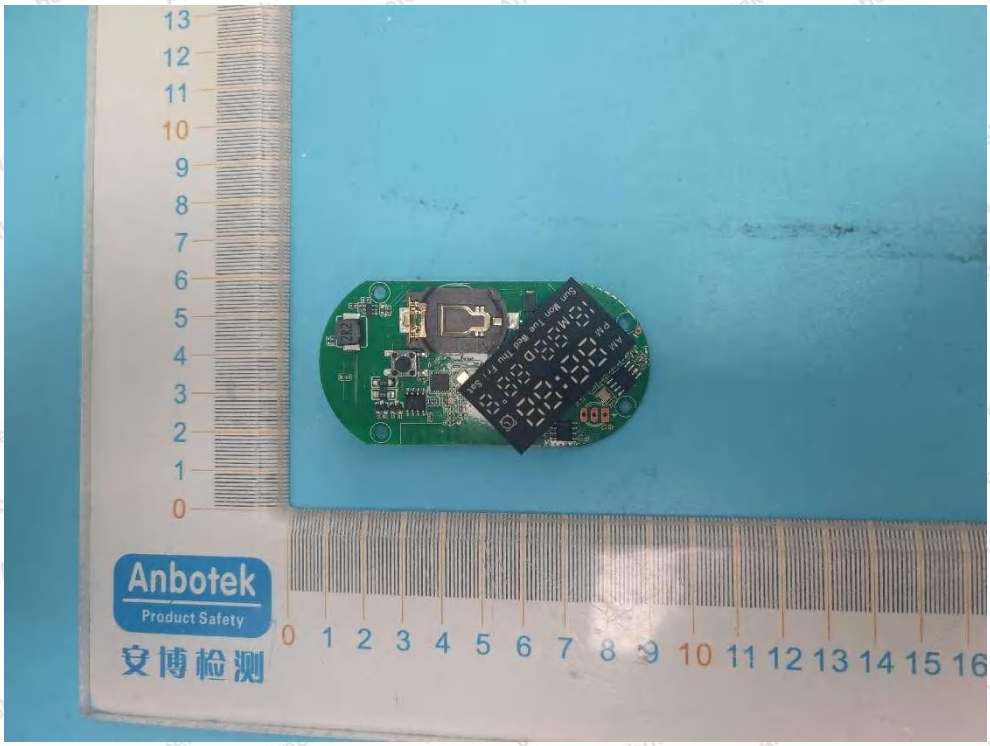


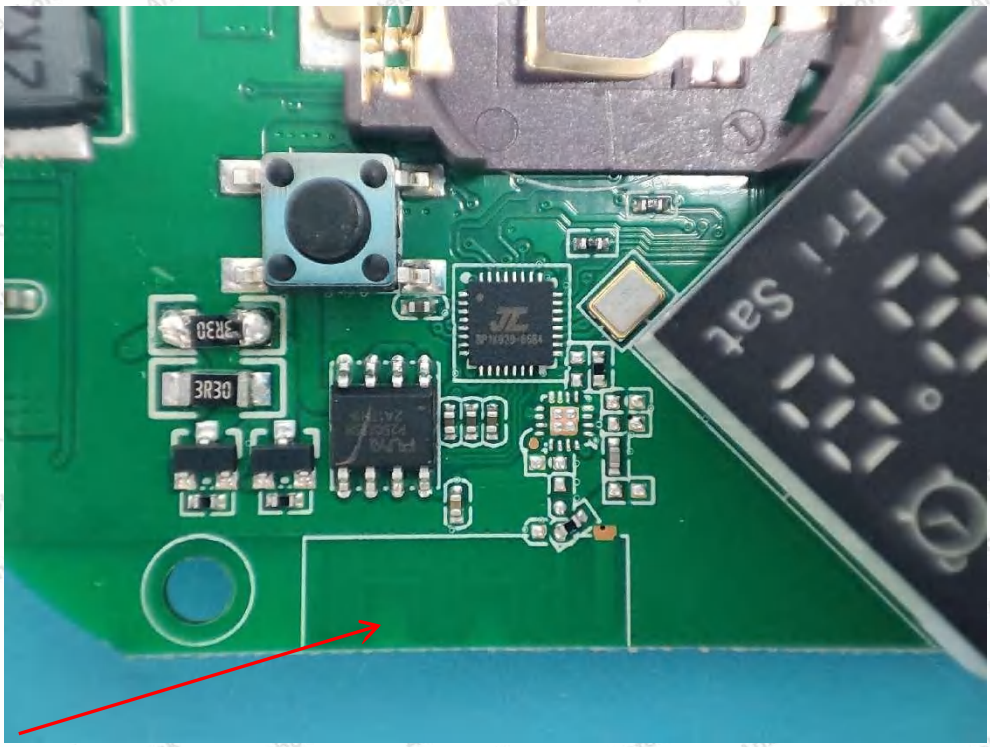





Anbotek
Product Safety
安博检测

QQ-A-V0.3
Anbotek
Product Safety
安博检测





ANT

LI-ION RECHARGEABLE BATTERY
LIR2032
3.6V

Appendix Test Data

Report No.:	18220WC30134901	Test Sample No.:	1-2-2
Start Test Date:	2023.06.30	Finish Test Date:	2023.07.06
Test Engineer:	Rick Luo	Auditor:	Edward. Pan
Temperature:	25.7℃	Relative Humidity:	48%
Pressure:	1012 hPa		

Appendix A: 20dB Emission Bandwidth

Test Result

TestMode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	1.047	2401.481	2402.528	---	---
		2441	1.056	2440.472	2441.528	---	---
		2480	1.059	2479.469	2480.528	---	---
2DH5	Ant1	2402	1.365	2401.328	2402.693	---	---
		2441	1.305	2440.355	2441.660	---	---
		2480	1.347	2479.337	2480.684	---	---
3DH5	Ant1	2402	1.311	2401.352	2402.663	---	---
		2441	1.296	2440.358	2441.654	---	---
		2480	1.299	2479.352	2480.651	---	---

Test Graphs

DH5_Ant1_2402

DH5_Ant1_2441

DH5_Ant1_2480

2DH5_Ant1_2402

2DH5_Ant1_2441

2DH5_Ant1_2480

3DH5_Ant1_2402

3DH5_Ant1_2441

3DH5_Ant1_2480

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 100/100
11:34:51 AM Jul 06, 2023
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.481500000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
Ref Offset 1 dB
10 dB/div
Ref 30.00 dBm
ΔMkr3 1.299 MHz
0.283 dB
Center 2.480000 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.200 ms (1001 pts)
1 N 1 f 2.479 352 GHz -23.324 dBm
2 N 1 f 2.479 850 GHz -2.878 dBm
3 Δ1 1 f (Δ) 1.299 MHz (Δ) 0.283 dB

Appendix B: Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.94906	2401.5263	2402.4754	---	---
		2441	0.95890	2440.5207	2441.4796	---	---
		2480	0.97170	2479.5150	2480.4867	---	---
2DH5	Ant1	2402	1.2256	2401.3969	2402.6225	---	---
		2441	1.2343	2440.3931	2441.6274	---	---
		2480	1.2451	2479.3844	2480.6295	---	---
3DH5	Ant1	2402	1.2270	2401.3863	2402.6133	---	---
		2441	1.2226	2440.3911	2441.6137	---	---
		2480	1.2215	2479.3919	2480.6134	---	---

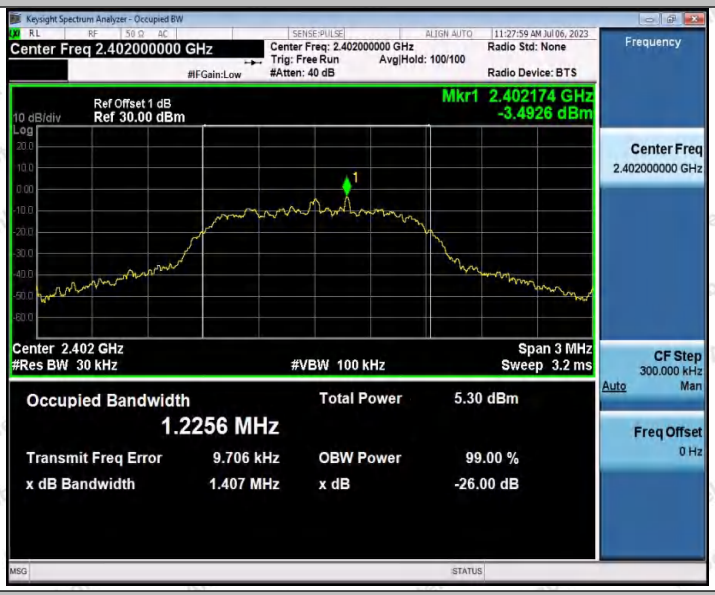
Test Graphs

DH5_Ant1_2402

DH5_Ant1_2441

DH5_Ant1_2480

2DH5_Ant1_2402



2DH5_Ant1_2441

2DH5_Ant1_2480

3DH5_Ant1_2402

3DH5_Ant1_2441

3DH5_Ant1_2480

Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 40 dB
Radio Std: None
Radio Device: BTS
Ref Offset 1 dB
10 dB/div
Ref 30.00 dBm
Mkr1 2.479982 GHz
-4.2571 dBm
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.2215 MHz
Total Power 6.07 dBm
Transmit Freq Error 2.676 kHz
OBW Power 99.00 %
x dB Bandwidth 1.444 MHz
x dB -26.00 dB
Frequency
Center Freq
2.480000000 GHz
CF Step
300.000 kHz
Auto Man
Freq Offset
0 Hz

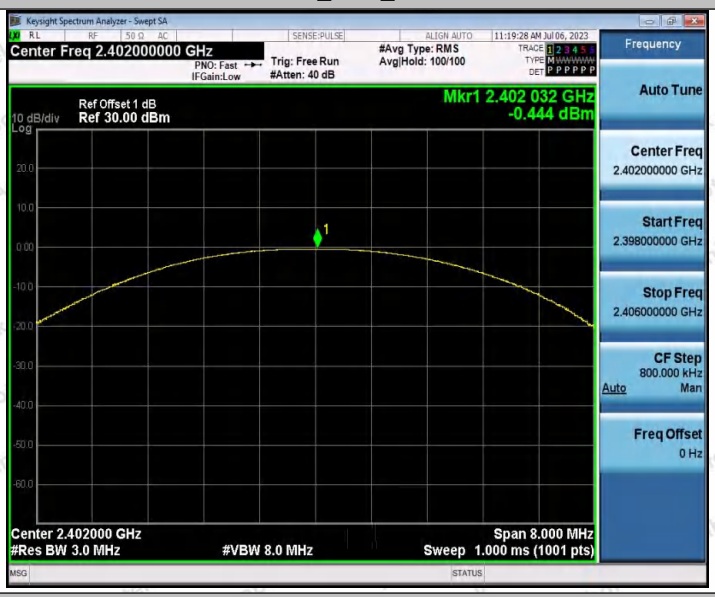
Appendix C: Maximum conducted output power

Test Result Peak

Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	Verdict
DH5	Ant1	2402	-0.44	≤20.97	PASS
		2441	-0.11	≤20.97	PASS
		2480	0.17	≤20.97	PASS
2DH5	Ant1	2402	0.44	≤20.97	PASS
		2441	0.72	≤20.97	PASS
		2480	0.97	≤20.97	PASS
3DH5	Ant1	2402	0.84	≤20.97	PASS
		2441	1.18	≤20.97	PASS
		2480	1.44	≤20.97	PASS

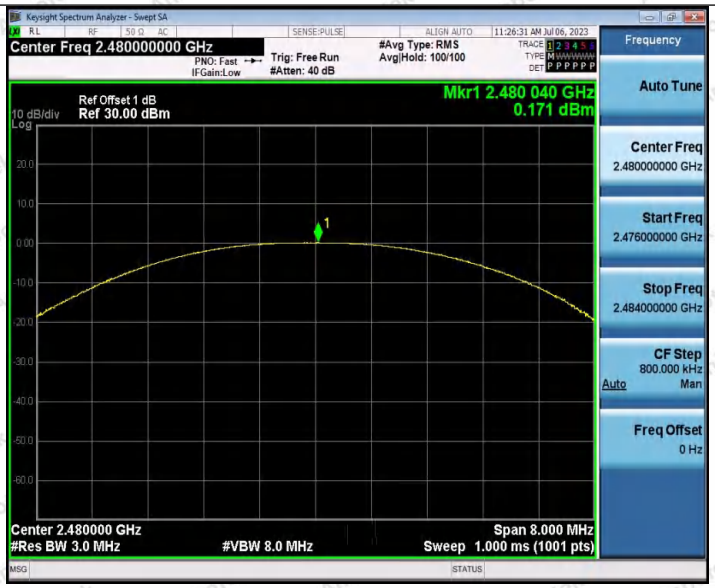
Test Graphs

DH5_Ant1_2402

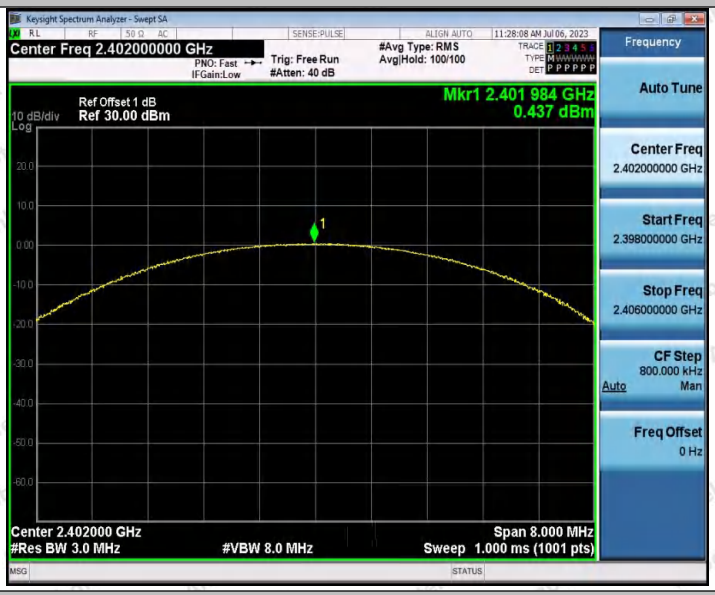


DH5_Ant1_2441

DH5_Ant1_2480



2DH5_Ant1_2402



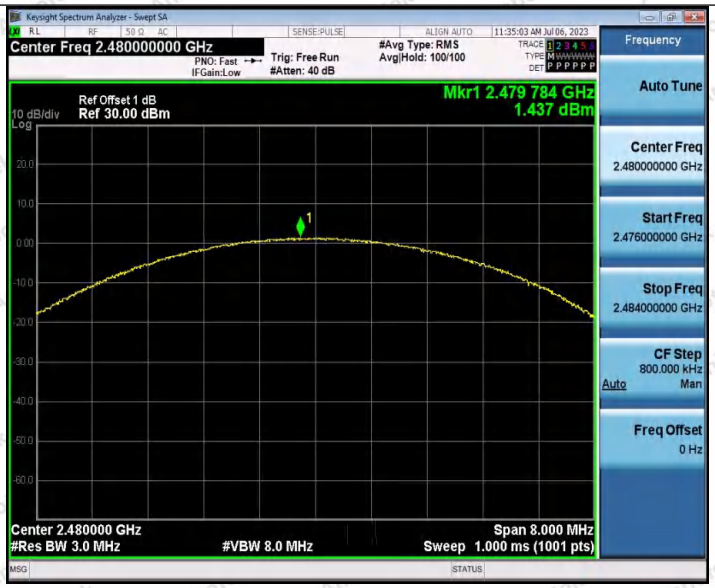
2DH5_Ant1_2441

2DH5_Ant1_2480

3DH5_Ant1_2402

3DH5_Ant1_2441

3DH5_Ant1_2480


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 100/100
11:35:03 AM Jul 06, 2023
Ref Offset 1 dB
10 dB/div Ref 30.00 dBm
Log
Mkr1 2.479 784 GHz
1.437 dBm
Center 2.480000 GHz
#Res BW 3.0 MHz
#VBW 8.0 MHz
Span 8.000 MHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.476000000 GHz
Stop Freq
2.484000000 GHz
CF Step
800.000 kHz
Auto Man
Freq Offset
0 Hz

Appendix D: Carrier frequency separation

Test Result

TestMode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	0.912	≥0.706	PASS
2DH5	Ant1	Hop	1.120	≥0.910	PASS
3DH5	Ant1	Hop	1.096	≥0.874	PASS

Test Graphs

DH5_Ant1_Hop

2DH5_Ant1_Hop

3DH5_Ant1_Hop

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
11:55:05 AM Jul 06, 2023
Ref Offset 1 dB
10 dB/div Ref 30.00 dBm
Log
ΔMkr2 1.096 MHz
0.048 dB
Start 2.440500 GHz
#Res BW 300 kHz
#VBW 300 kHz
Stop 2.442500 GHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441500000 GHz
Start Freq
2.440500000 GHz
Stop Freq
2.442500000 GHz
CF Step
200.000 kHz
Auto Man
Freq Offset
0 Hz

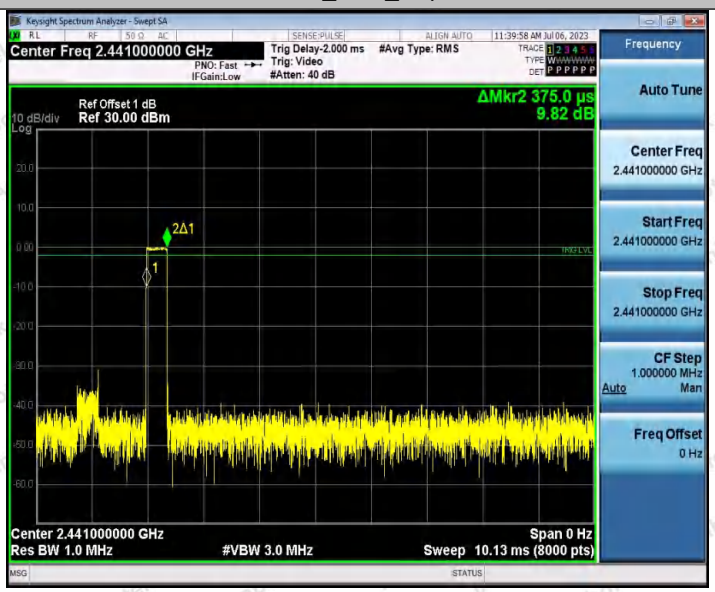
Appendix E: Time of occupancy

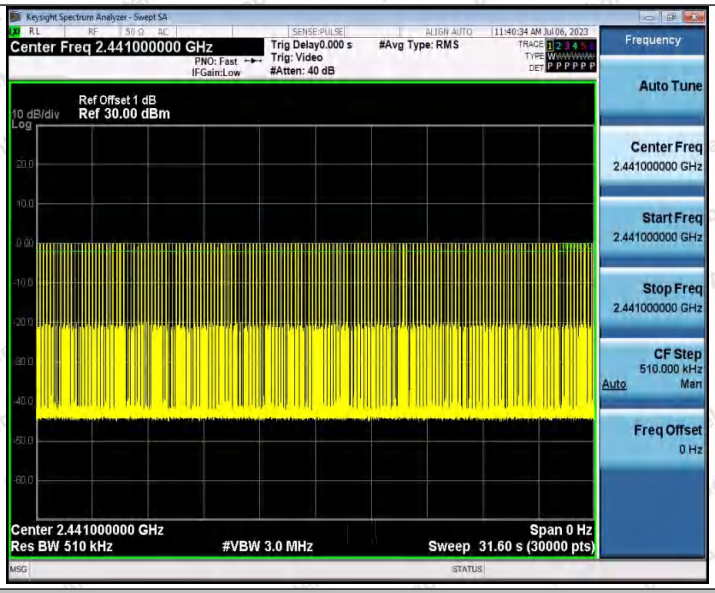
Test Result

TestMode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.375	319	0.12	≤0.4	PASS
DH3	Ant1	Hop	1.631	163	0.266	≤0.4	PASS
DH5	Ant1	Hop	2.879	95	0.274	≤0.4	PASS
2DH1	Ant1	Hop	0.385	318	0.122	≤0.4	PASS
2DH3	Ant1	Hop	1.638	162	0.265	≤0.4	PASS
2DH5	Ant1	Hop	2.884	102	0.294	≤0.4	PASS
3DH1	Ant1	Hop	0.385	319	0.123	≤0.4	PASS
3DH3	Ant1	Hop	1.635	154	0.252	≤0.4	PASS
3DH5	Ant1	Hop	2.885	115	0.332	≤0.4	PASS

Test Graphs

DH1_Ant1_Hop





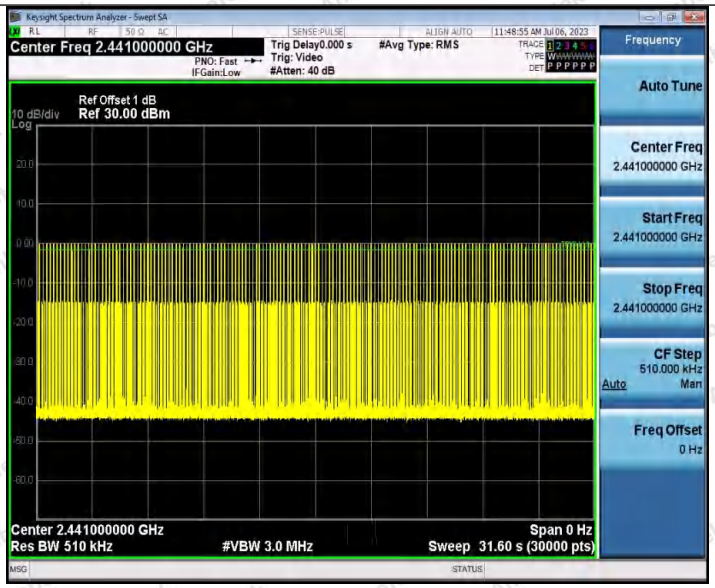
DH3_Ant1_Hop

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig Delay-2.000 ms
#Avg Type: RMS
Trig: Video
#Atten: 40 dB
PNO: Fast
IFGain:Low
Ref Offset 1 dB
10 dB/div Ref 30.00 dBm
ΔMkr2 1.631 ms
8.58 dB
2Δ1
1
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8000 pts)
Frequency
Auto Tune
Center Freq 2.441000000 GHz
Start Freq 2.441000000 GHz
Stop Freq 2.441000000 GHz
CF Step 1.000000 MHz
Auto Man
Freq Offset 0 Hz

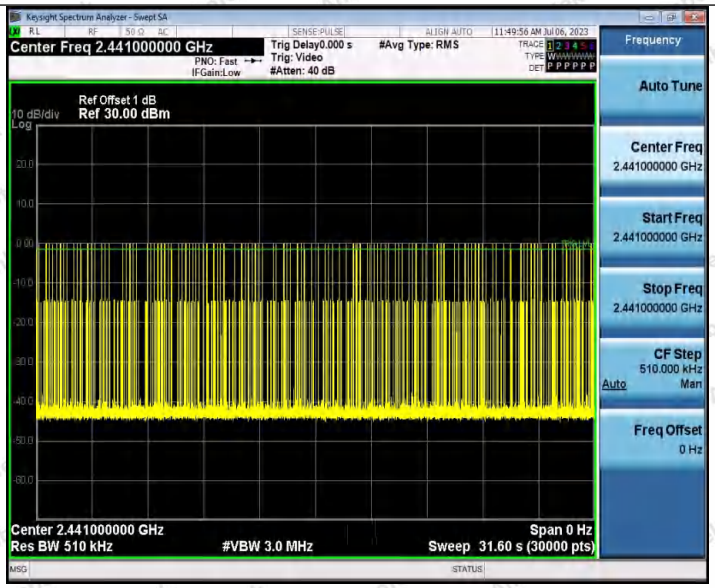
Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig Delay0.000 s
#Avg Type: RMS
Trig: Video
#Atten: 40 dB
PNO: Fast
IFGain:Low
Ref Offset 1 dB
10 dB/div Ref 30.00 dBm
Center 2.441000000 GHz
Res BW 510 kHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 31.60 s (30000 pts)
Frequency
Auto Tune
Center Freq 2.441000000 GHz
Start Freq 2.441000000 GHz
Stop Freq 2.441000000 GHz
CF Step 510.000 kHz
Auto Man
Freq Offset 0 Hz

DH5_Ant1_Hop

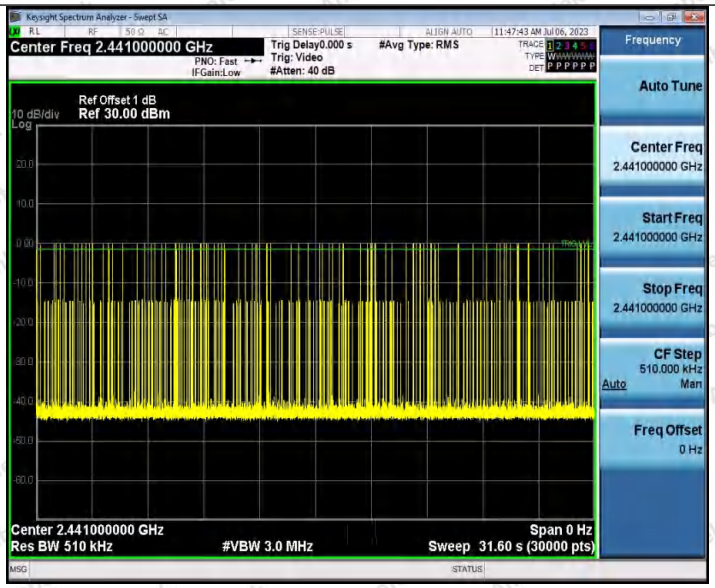
2DH1_Ant1_Hop



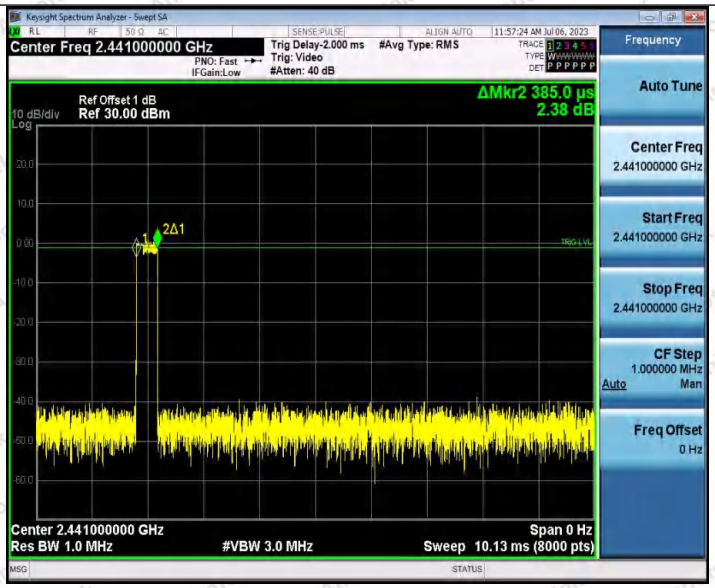
2DH3_Ant1_Hop

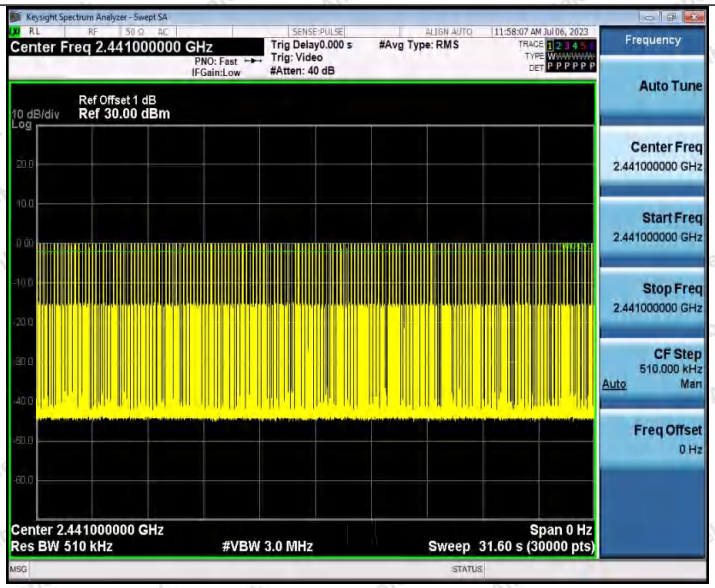


2DH5_Ant1_Hop

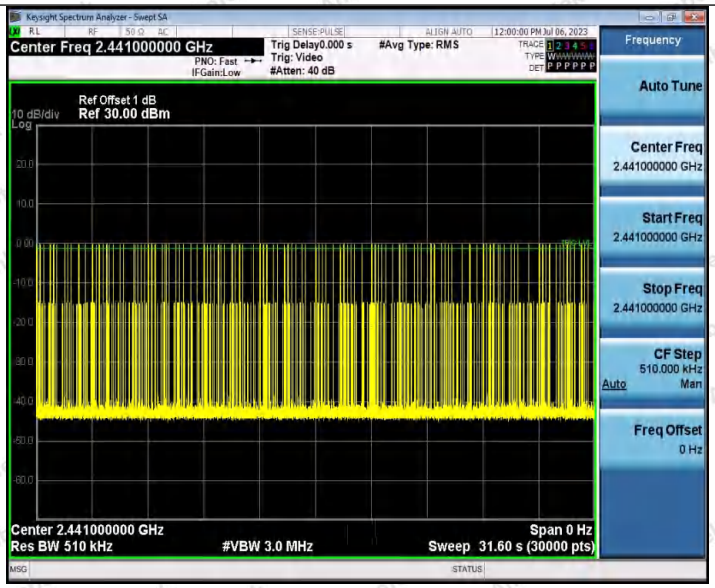


3DH1_Ant1_Hop



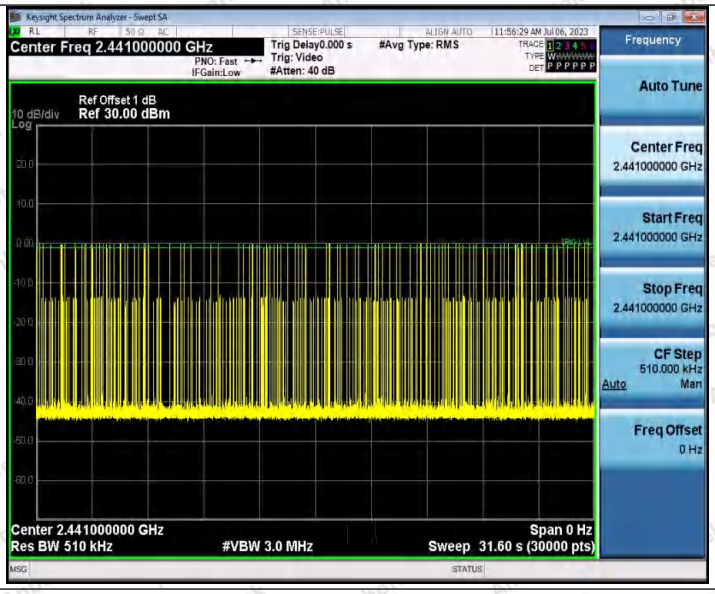


3DH3_Ant1_Hop



3DH5_Ant1_Hop

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig Delay-2.000 ms
Trig: Video
#Atten: 40 dB
#Avg Type: RMS
11:55:53 AM Jul 06, 2023
Frequency
Auto Tune
Ref Offset 1 dB
10 dB/div Ref 30.00 dBm
ΔMkr2 2.885 ms
3.82 dB
2Δ1
Center Freq 2.441000000 GHz
Start Freq 2.441000000 GHz
Stop Freq 2.441000000 GHz
CF Step 1.000000 MHz
Freq Offset 0 Hz
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8000 pts)


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig Delay0.000 s
Trig: Video
#Atten: 40 dB
#Avg Type: RMS
11:56:29 AM Jul 06, 2023
Frequency
Auto Tune
Ref Offset 1 dB
10 dB/div Ref 30.00 dBm
Center Freq 2.441000000 GHz
Start Freq 2.441000000 GHz
Stop Freq 2.441000000 GHz
CF Step 510.000 kHz
Freq Offset 0 Hz
Center 2.441000000 GHz
Res BW 510 kHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 31.60 s (30000 pts)

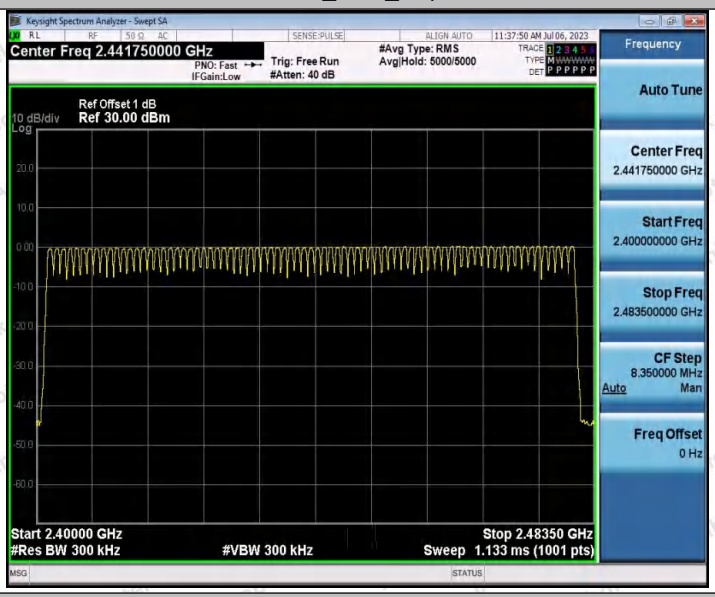
Appendix F: Number of hopping channels

Test Result

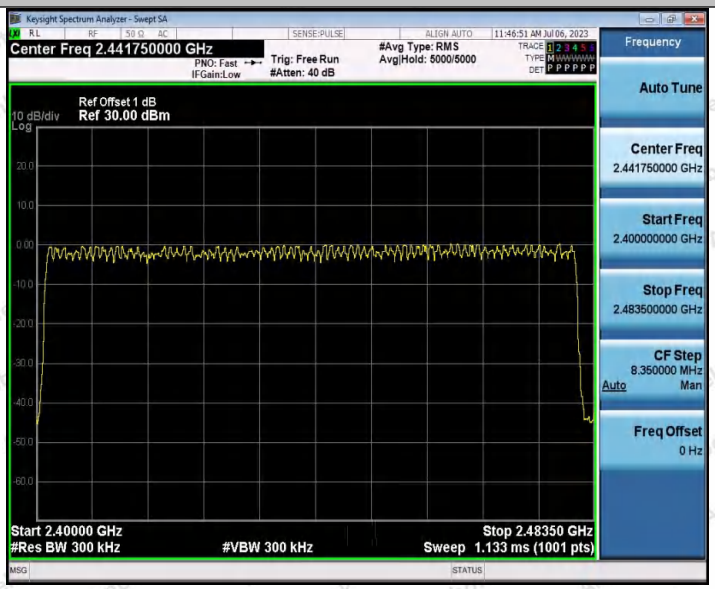
TestMode	Antenna	Frequency[MHz]	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	Ant1	Hop	79	≥15	PASS

Test Graphs

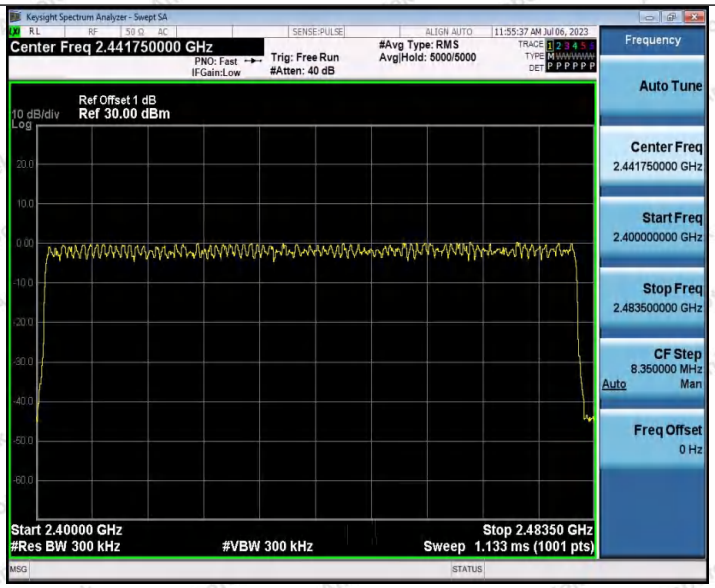
DH5_Ant1_Hop



2DH5_Ant1_Hop



3DH5_Ant1_Hop


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441750000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
11:55:37 AM Jul 06, 2023
Ref Offset 1 dB
10 dB/div Ref 30.00 dBm
Log
Start 2.40000 GHz
#Res BW 300 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 1.133 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441750000 GHz
Start Freq
2.400000000 GHz
Stop Freq
2.483500000 GHz
CF Step
8.350000 MHz
Auto Man
Freq Offset
0 Hz

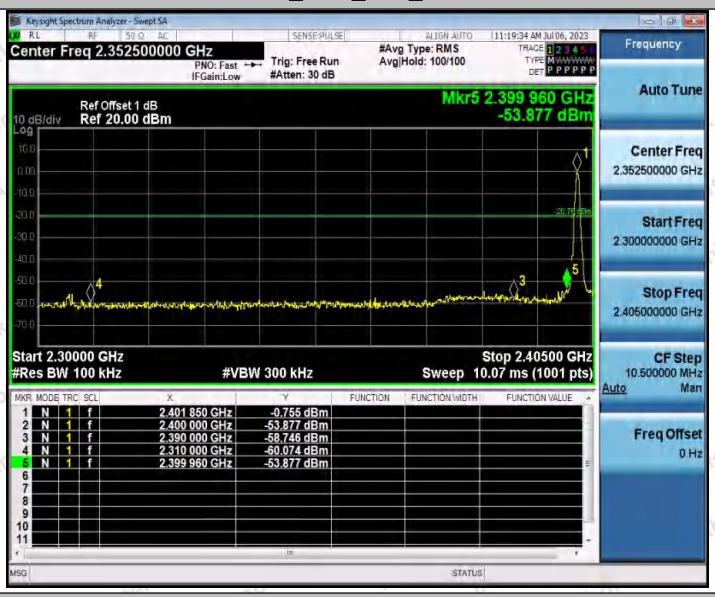
Appendix G: Band edge measurements

Test Result

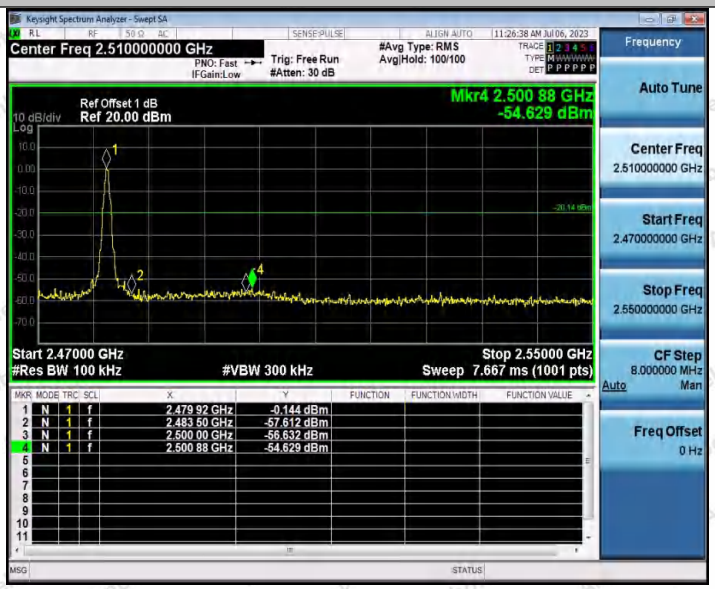
TestMode	Antenna	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	-0.76	-53.88	≤-20.76	PASS
		High	2480	-0.14	-54.63	≤-20.14	PASS
		Low	Hop_2402	-0.87	-53.82	≤-20.87	PASS
		High	Hop_2480	-0.53	-48.6	≤-20.53	PASS
2DH5	Ant1	Low	2402	-1.44	-50.38	≤-21.44	PASS
		High	2480	-0.89	-54.08	≤-20.89	PASS
		Low	Hop_2402	-3.97	-54.32	≤-23.97	PASS
		High	Hop_2480	-0.43	-53.11	≤-20.43	PASS
3DH5	Ant1	Low	2402	-0.74	-54.42	≤-20.74	PASS
		High	2480	-0.23	-54.25	≤-20.23	PASS
		Low	Hop_2402	-3.62	-51.96	≤-23.62	PASS
		High	Hop_2480	-0.17	-49.53	≤-20.17	PASS

Test Graphs

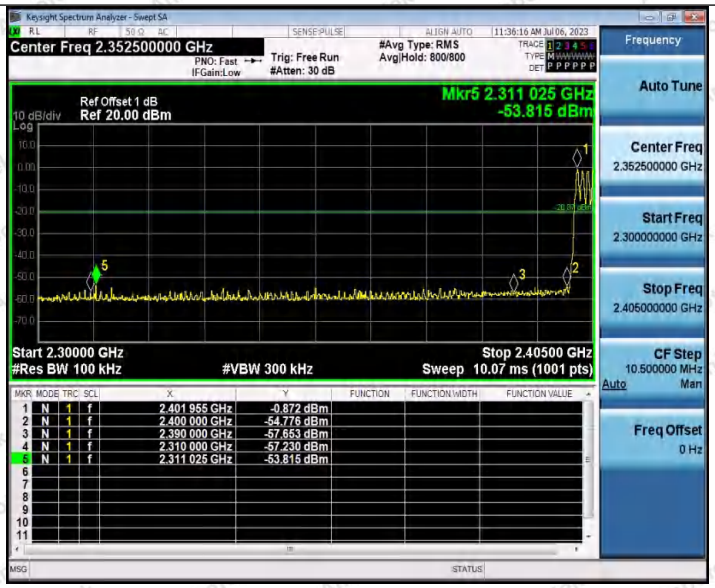
DH5_Ant1_Low_2402



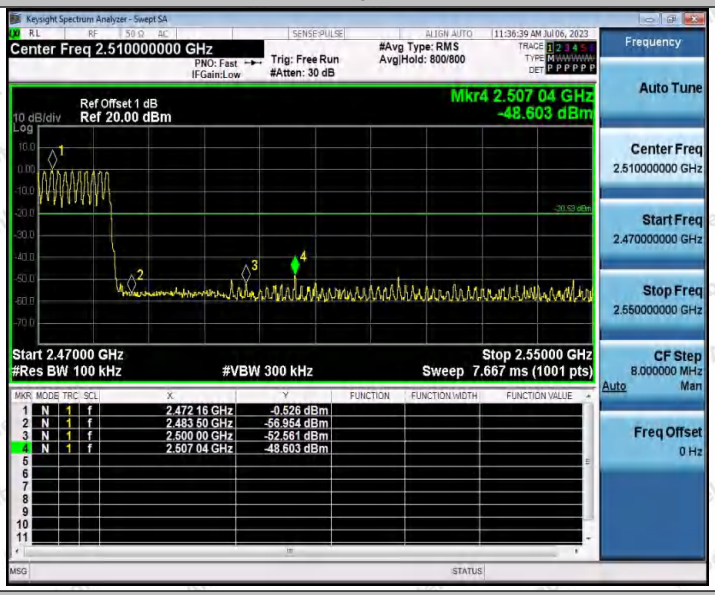
DH5_Ant1_High_2480



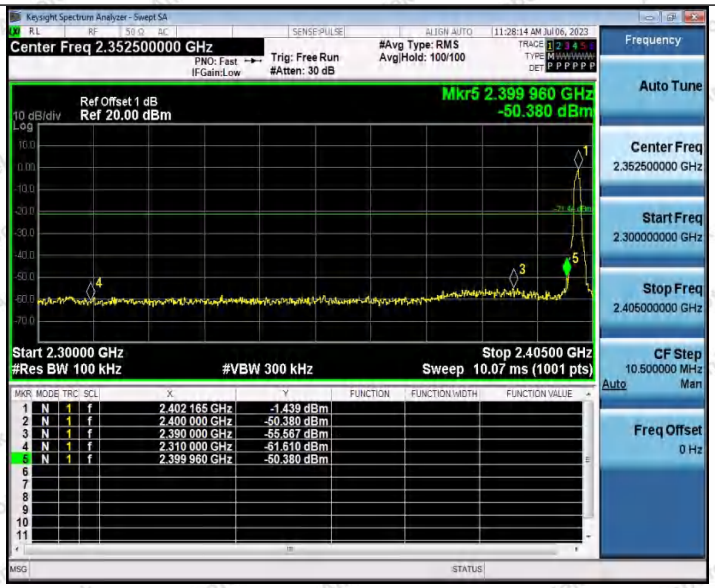
DH5_Ant1_Low_Hop_2402



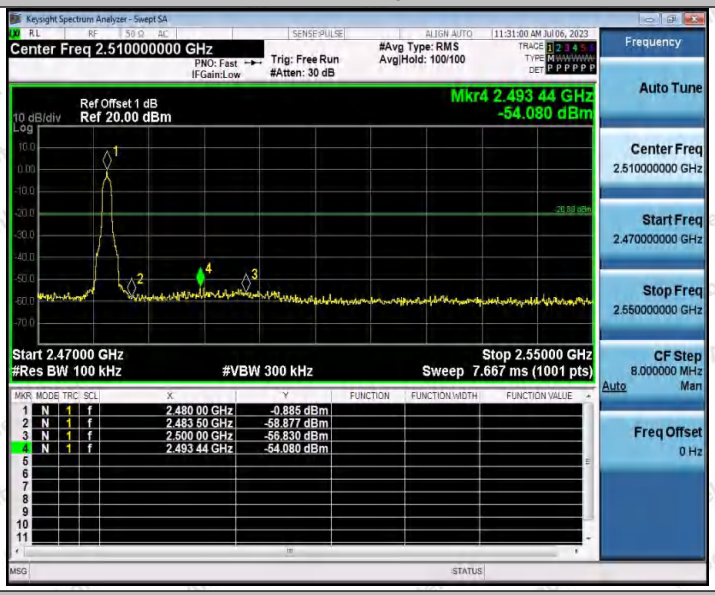
DH5_Ant1_High_Hop_2480



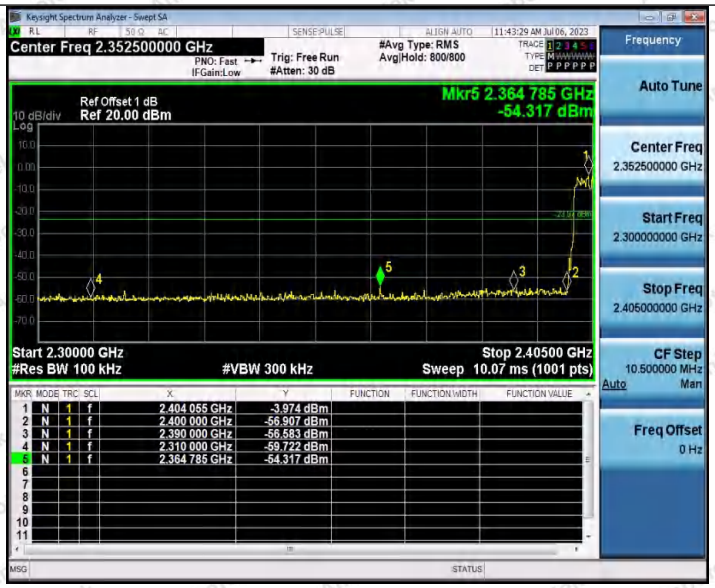
2DH5_Ant1_Low_2402



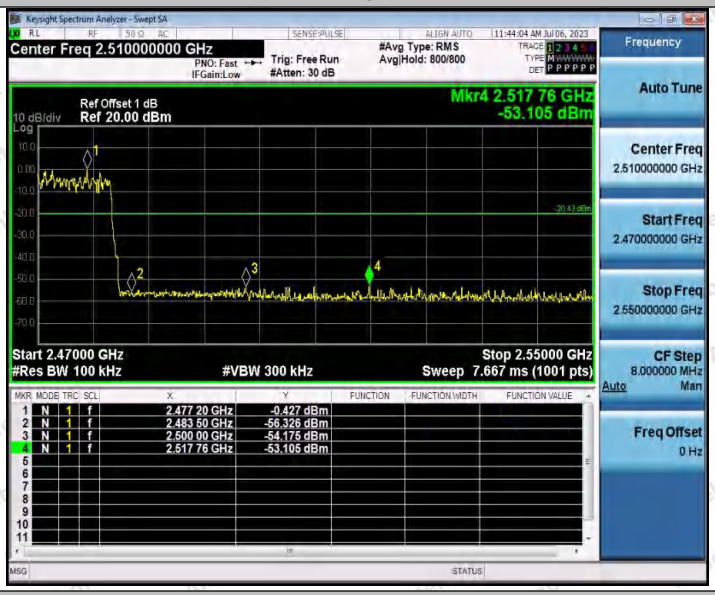
2DH5_Ant1_High_2480



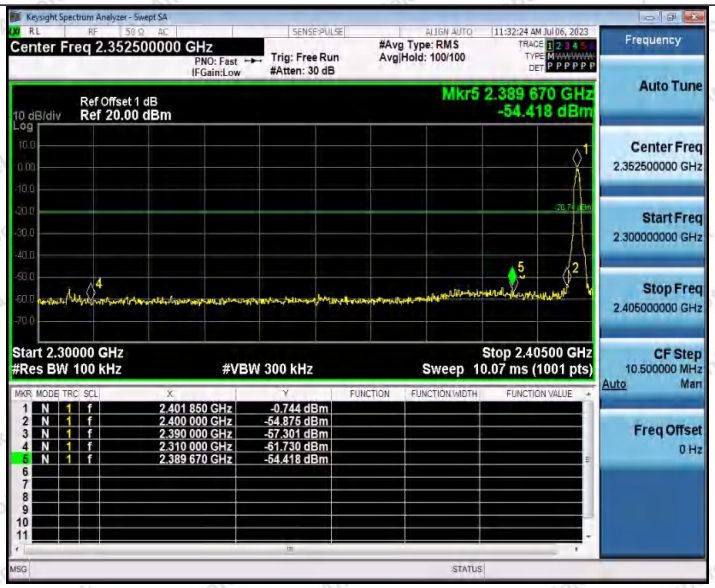
2DH5_Ant1_Low_Hop_2402



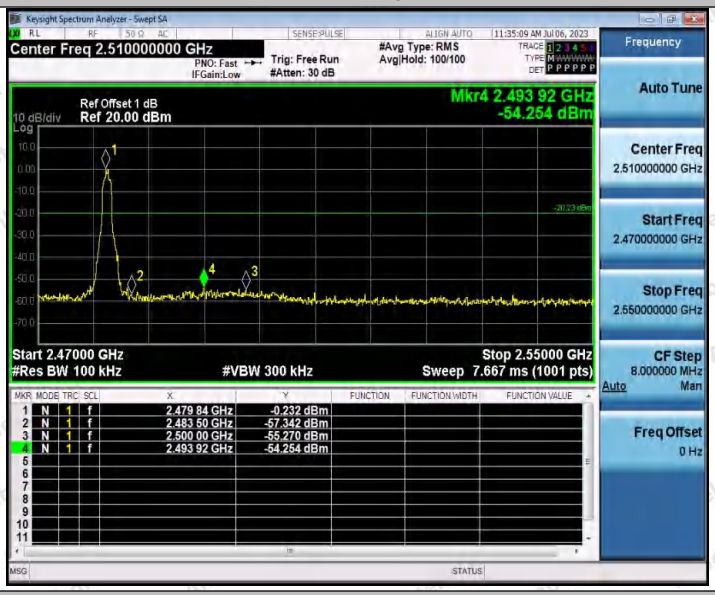
2DH5_Ant1_High_Hop_2480



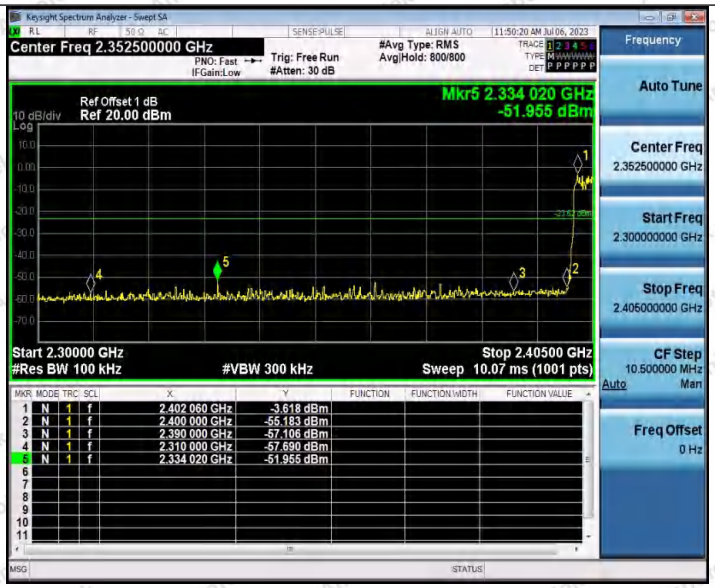
3DH5_Ant1_Low_2402



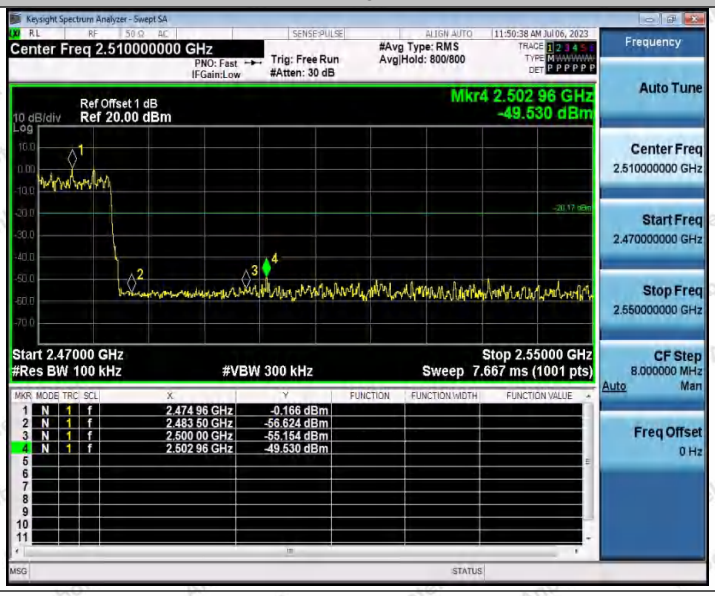
3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



3DH5_Ant1_High_Hop_2480



Appendix H: Conducted Spurious Emission

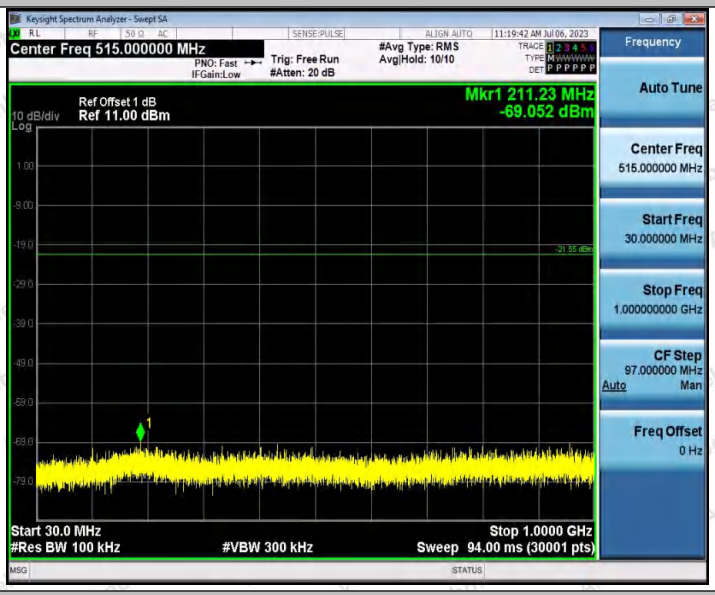
Test Result

TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	-1.55	-1.55	---	PASS
			30~1000	-1.55	-69.05	≤-21.55	PASS
			1000~26500	-1.55	-47.55	≤-21.55	PASS
		2441	Reference	-1.16	-1.16	---	PASS
			30~1000	-1.16	-68.68	≤-21.16	PASS
			1000~26500	-1.16	-47.84	≤-21.16	PASS
		2480	Reference	-0.89	-0.89	---	PASS
			30~1000	-0.89	-68.57	≤-20.89	PASS
			1000~26500	-0.89	-46.13	≤-20.89	PASS
2DH5	Ant1	2402	Reference	-0.99	-0.99	---	PASS
			30~1000	-0.99	-63.5	≤-20.99	PASS
			1000~26500	-0.99	-47.33	≤-20.99	PASS
		2441	Reference	-3.67	-3.67	---	PASS
			30~1000	-3.67	-68.62	≤-23.67	PASS
			1000~26500	-3.67	-48.9	≤-23.67	PASS
		2480	Reference	-1.06	-1.06	---	PASS
			30~1000	-1.06	-68.28	≤-21.06	PASS
			1000~26500	-1.06	-46.99	≤-21.06	PASS
3DH5	Ant1	2402	Reference	-4.49	-4.49	---	PASS
			30~1000	-4.49	-69.1	≤-24.49	PASS
			1000~26500	-4.49	-46.77	≤-24.49	PASS
		2441	Reference	-1.11	-1.11	---	PASS
			30~1000	-1.11	-68.79	≤-21.11	PASS
			1000~26500	-1.11	-48.29	≤-21.11	PASS
		2480	Reference	-0.27	-0.27	---	PASS
			30~1000	-0.27	-69.65	≤-20.27	PASS
			1000~26500	-0.27	-46.59	≤-20.27	PASS

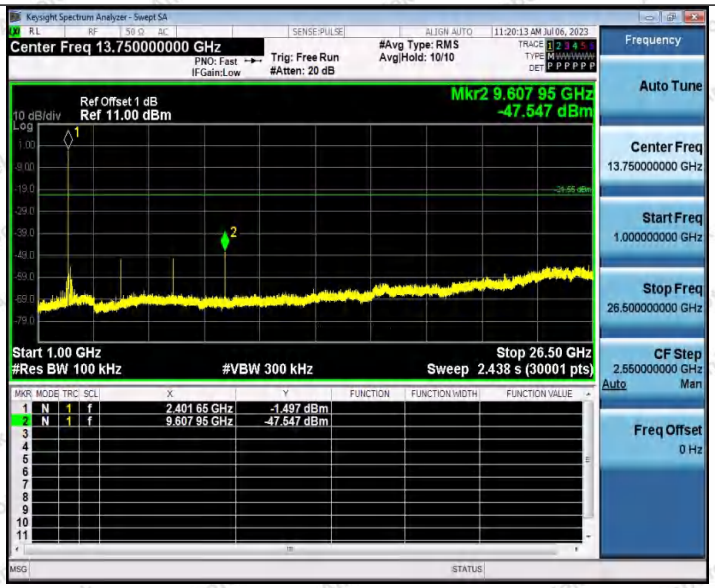
Test Graphs

DH5_Ant1_2402_0~Reference

DH5_Ant1_2402_30~1000

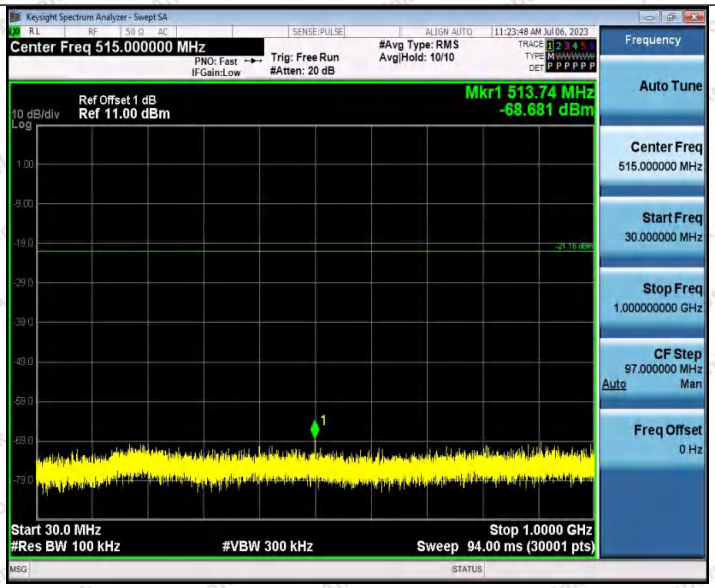


DH5_Ant1_2402_1000~26500

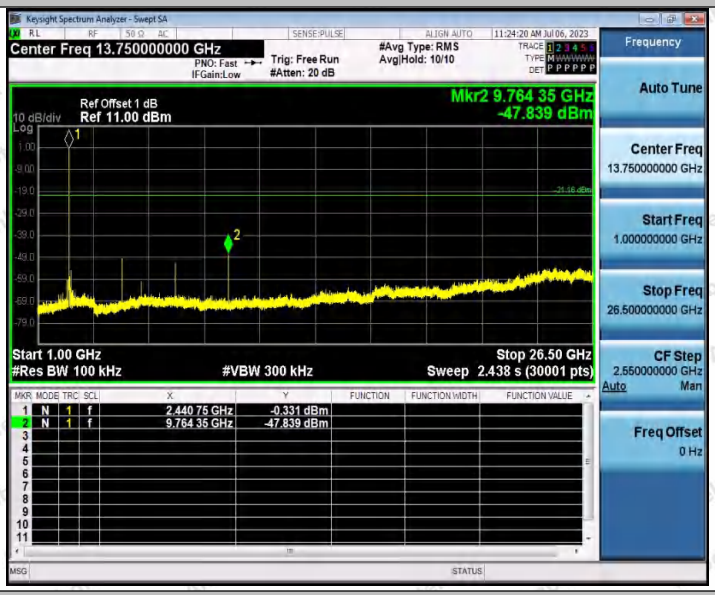


DH5_Ant1_2441_0~Reference

DH5_Ant1_2441_30~1000



DH5_Ant1_2441_1000~26500



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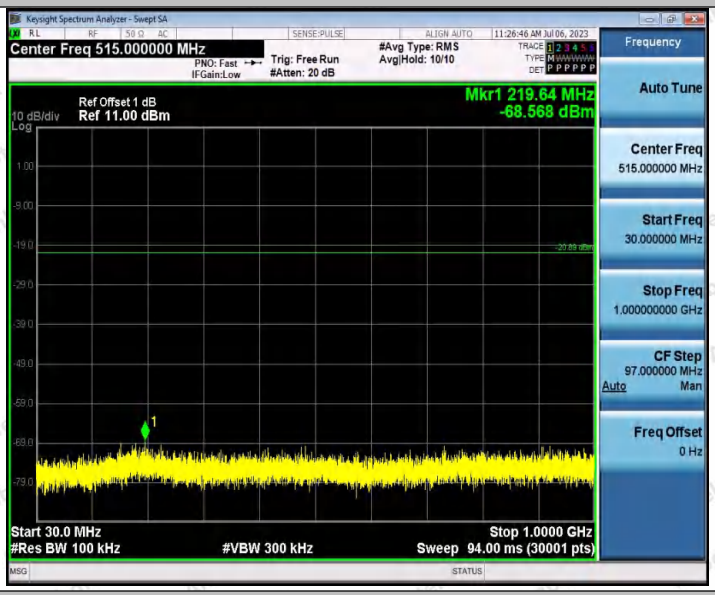

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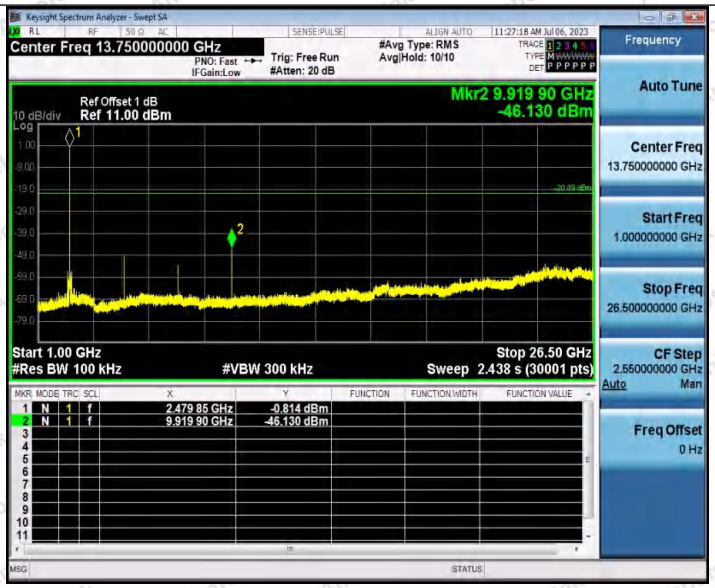

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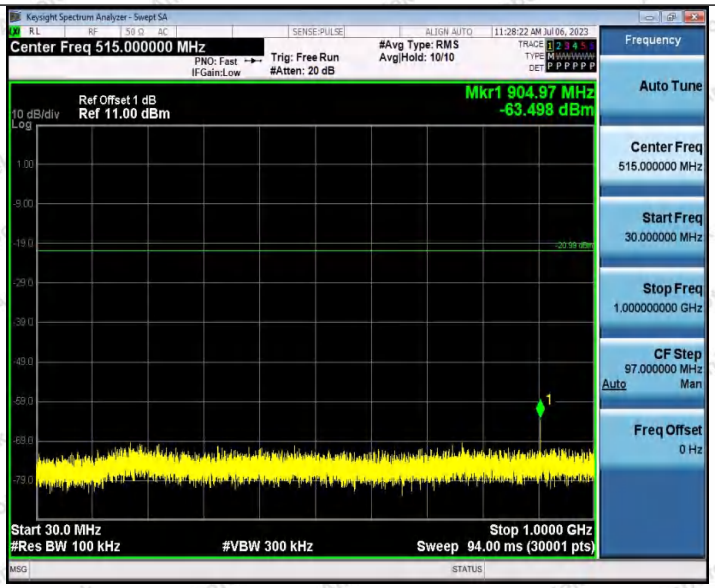

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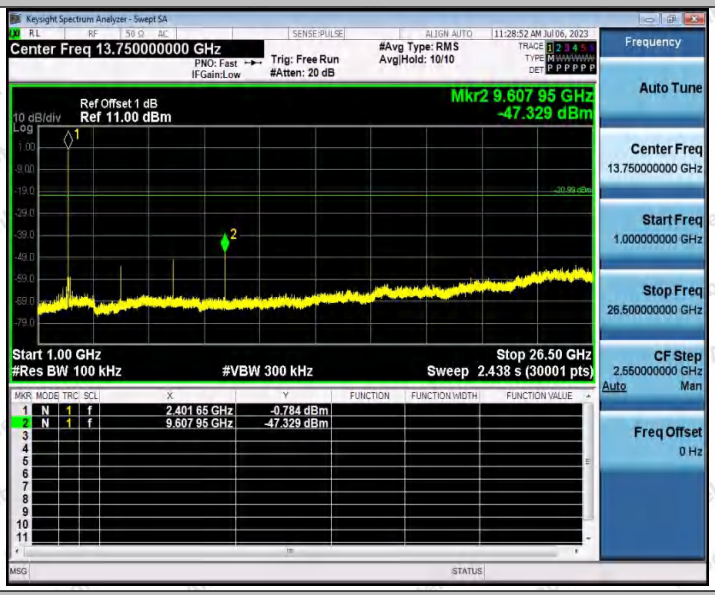

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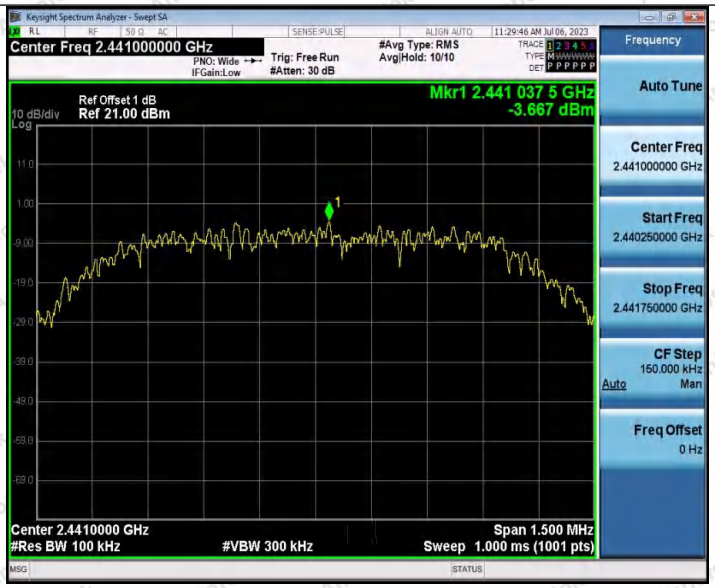

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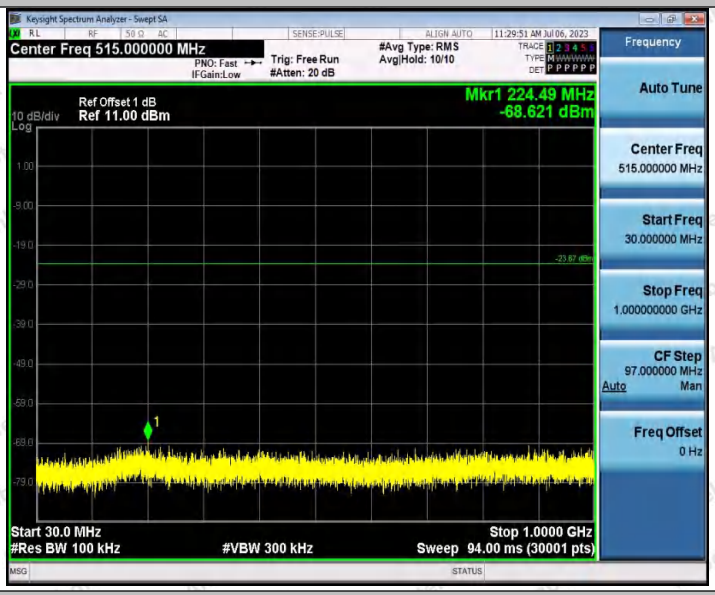

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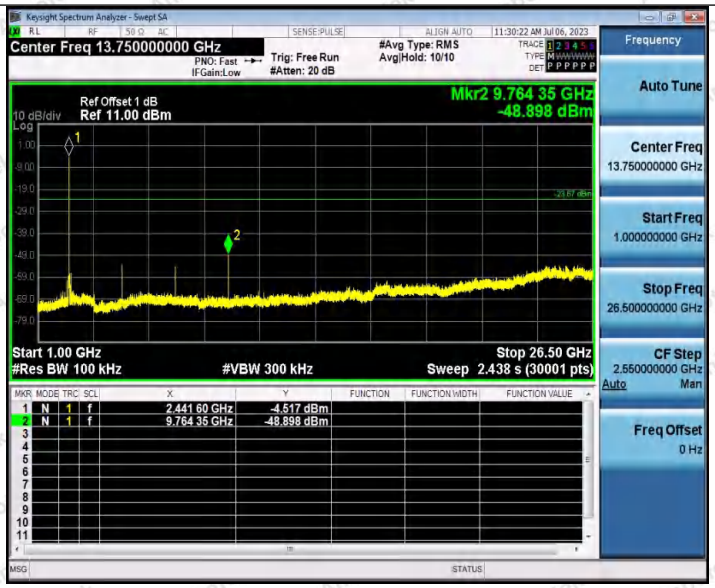

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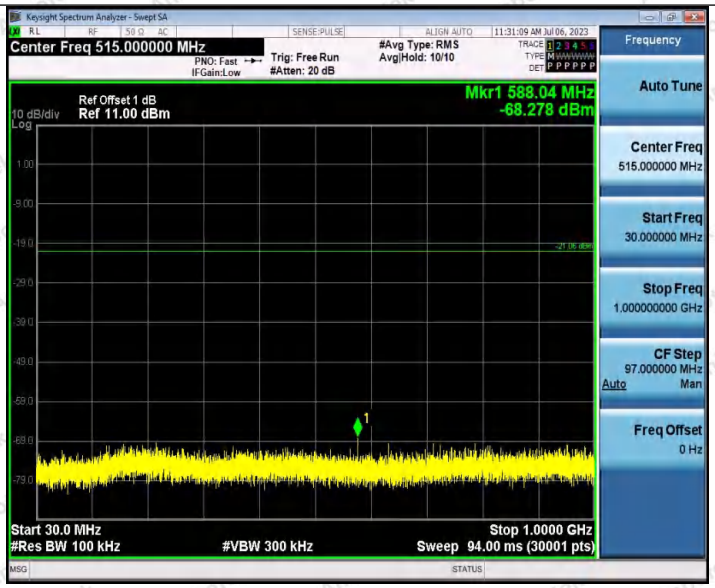
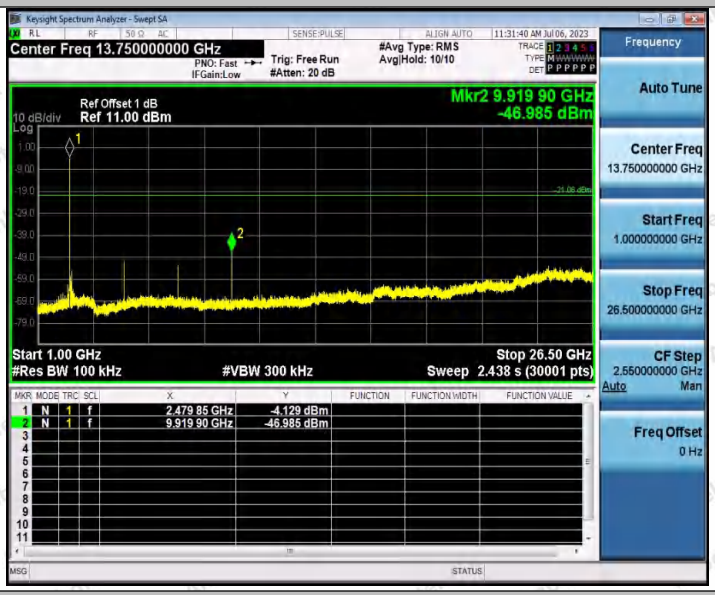


2DH5_Ant1_2480_1000~26500



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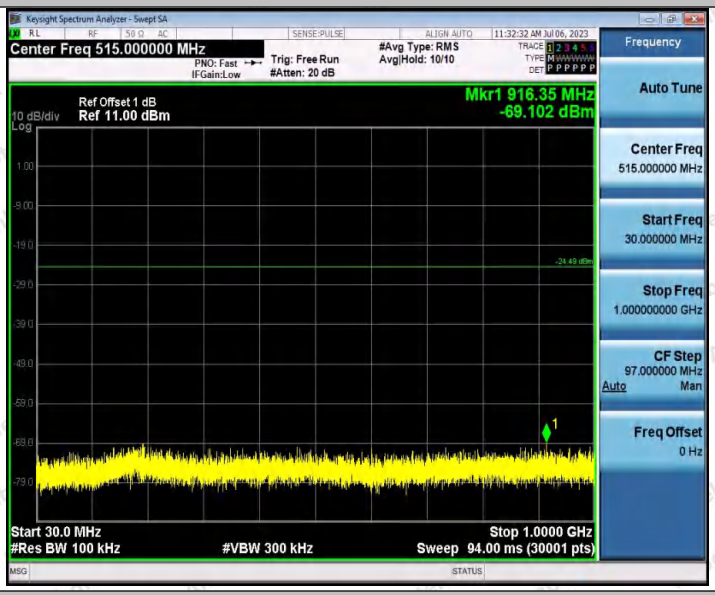

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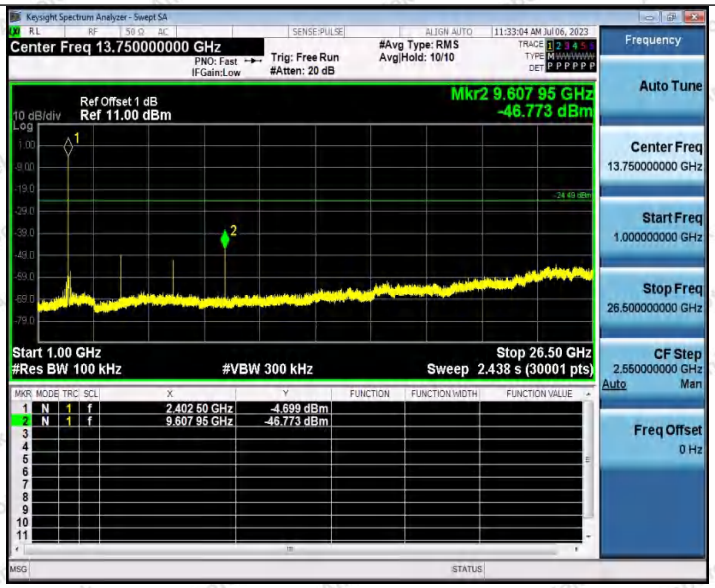

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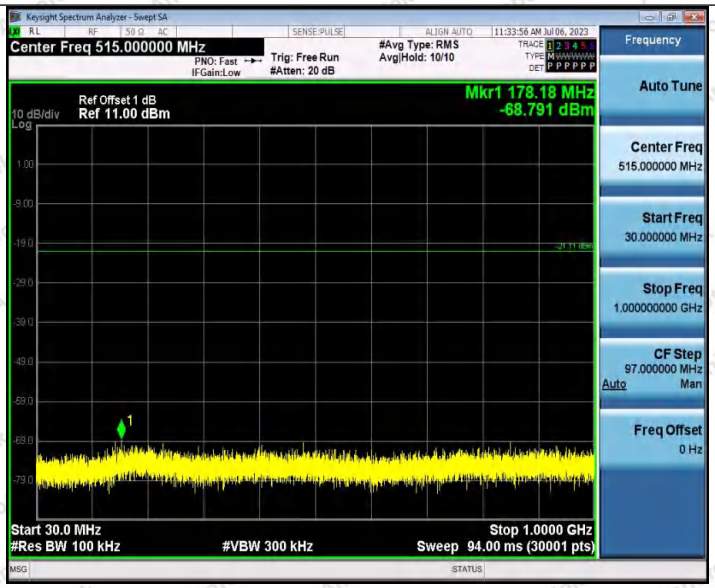

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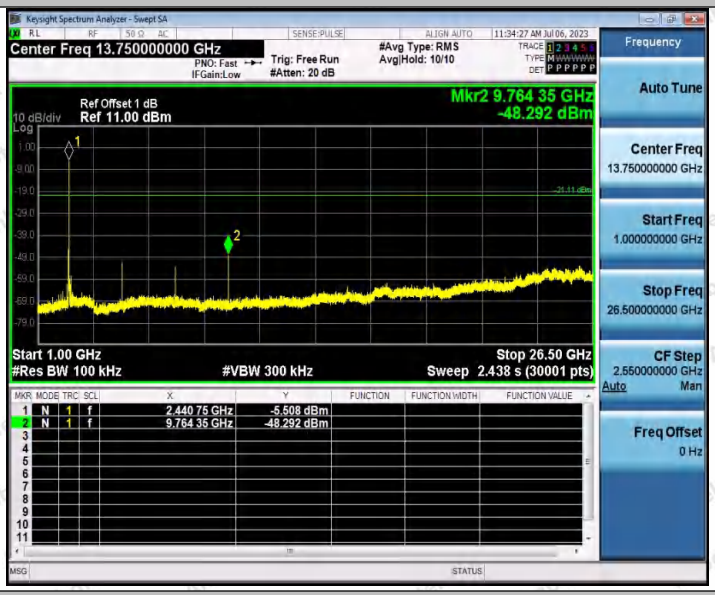

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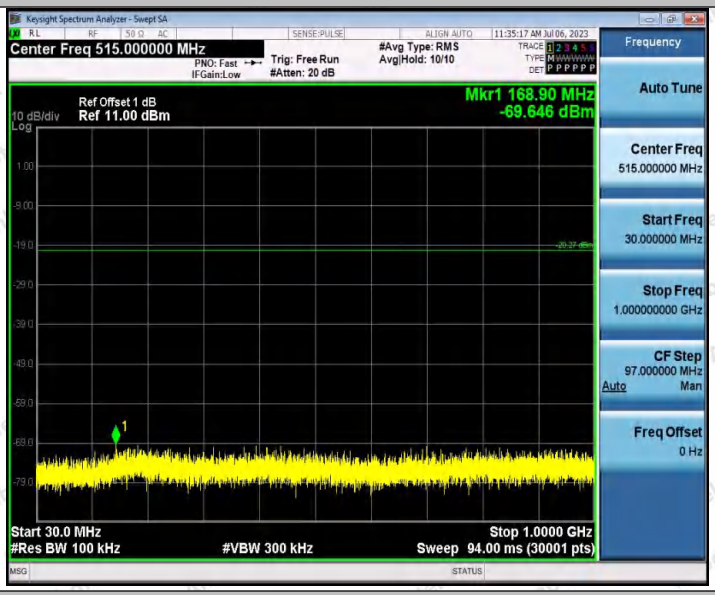
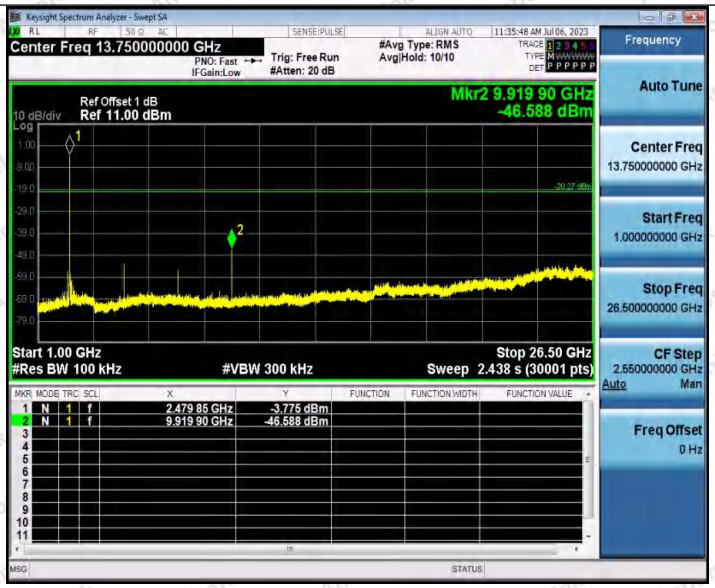
3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500


Keysight Spectrum Analyzer - Swept SA
Center Freq 13.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 10/10
11:35:48 AM Jul 06, 2023
Ref Offset 1 dB
10 dB/div Ref 11.00 dBm
Log
Mkr2 9.919 90 GHz
-46.588 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
1 N 1 f 2.479 85 GHz -3.775 dBm
2 N 1 f 9.919 90 GHz -46.588 dBm
Frequency
Auto Tune
Center Freq
13.750000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
26.500000000 GHz
CF Step
2.550000000 GHz
Auto Man
Freq Offset
0 Hz

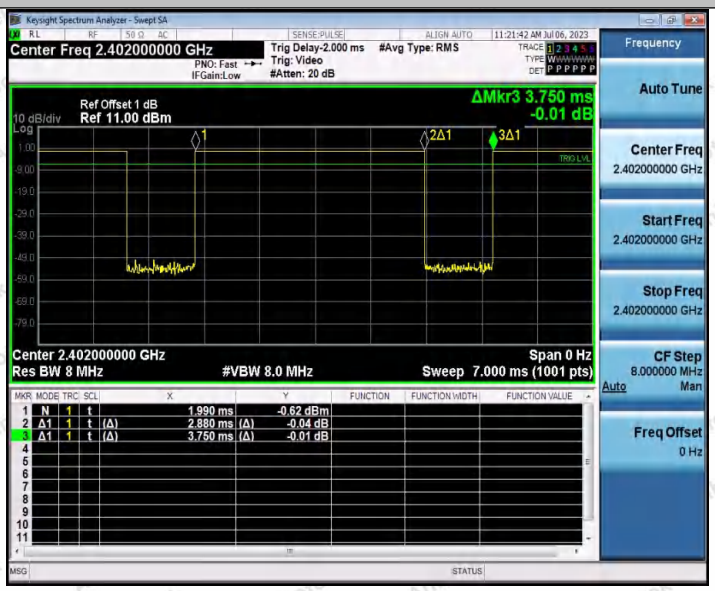
Appendix I: Duty Cycle

Test Result

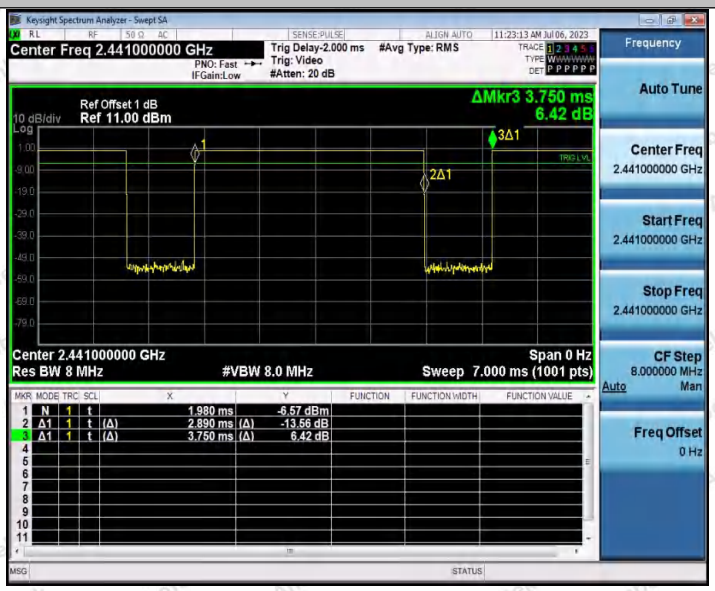
TestMode	Antenna	Frequency[MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
DH5	Ant1	2402	2.88	3.75	76.80	1.15
		2441	2.89	3.75	77.07	1.13
		2480	2.88	3.74	77.01	1.13
2DH5	Ant1	2402	2.89	3.75	77.07	1.13
		2441	2.88	3.74	77.01	1.13
		2480	2.89	3.75	77.07	1.13
3DH5	Ant1	2402	2.90	3.76	77.13	1.13
		2441	2.89	3.75	77.07	1.13
		2480	2.88	3.74	77.01	1.13

Test Graphs

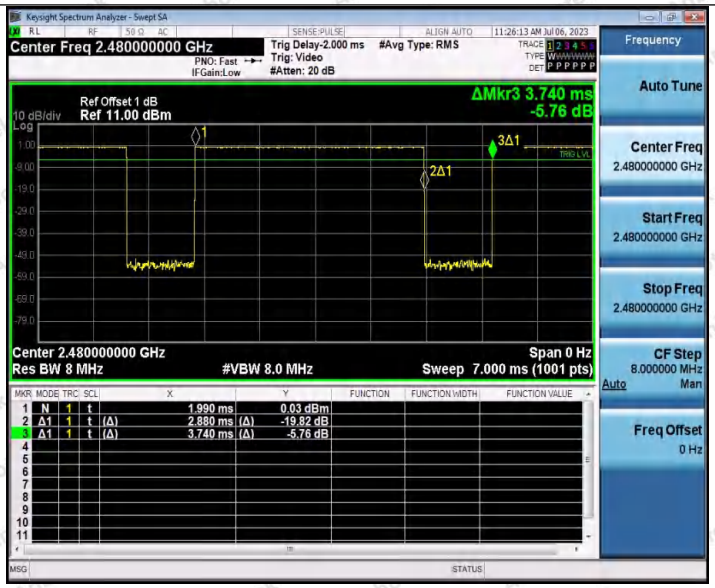
DH5_Ant1_2402



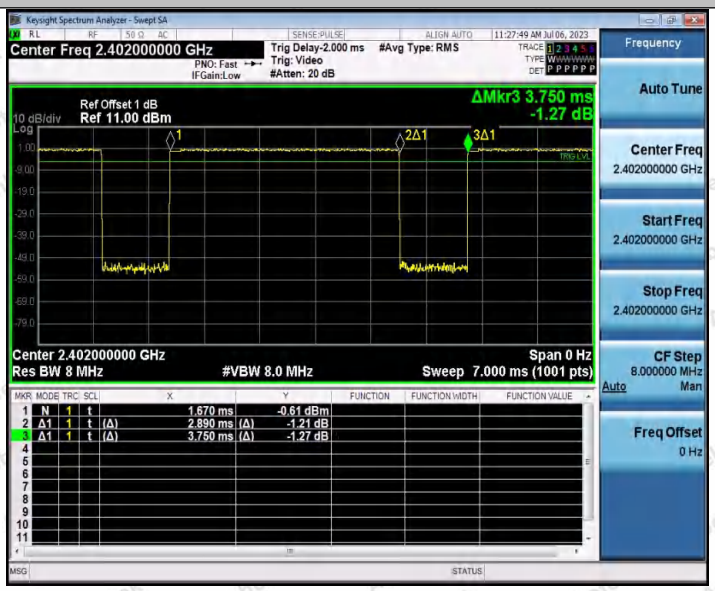
DH5_Ant1_2441



DH5_Ant1_2480



2DH5_Ant1_2402



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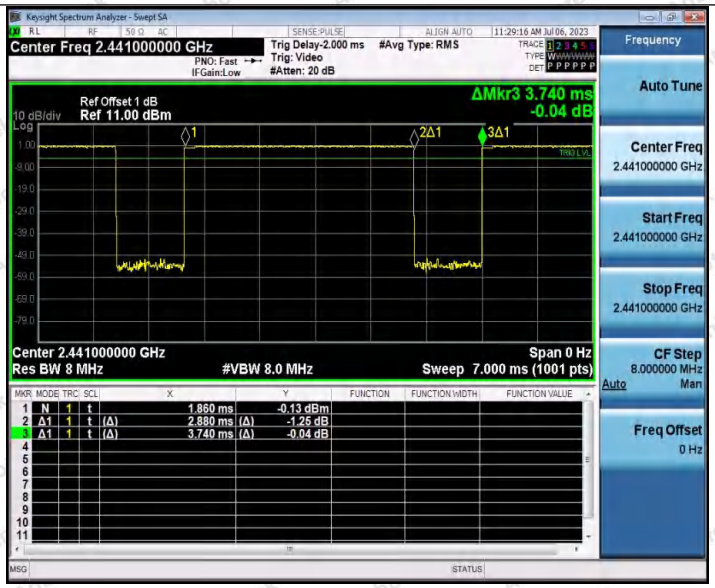

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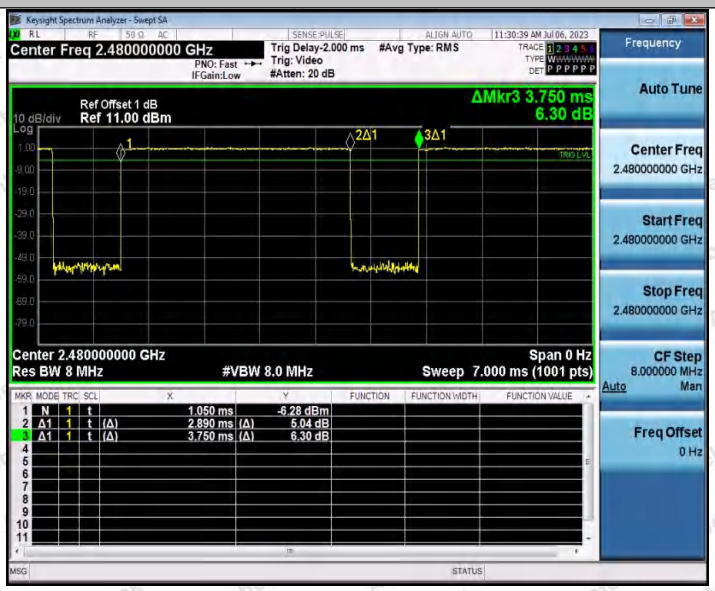

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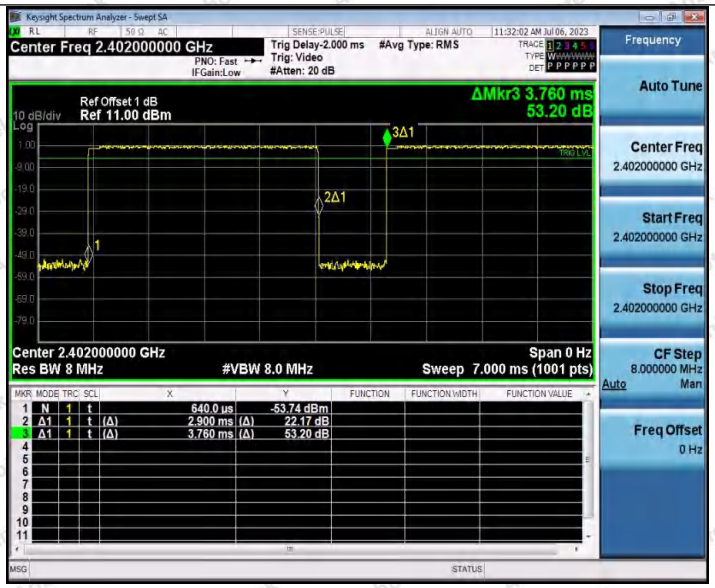

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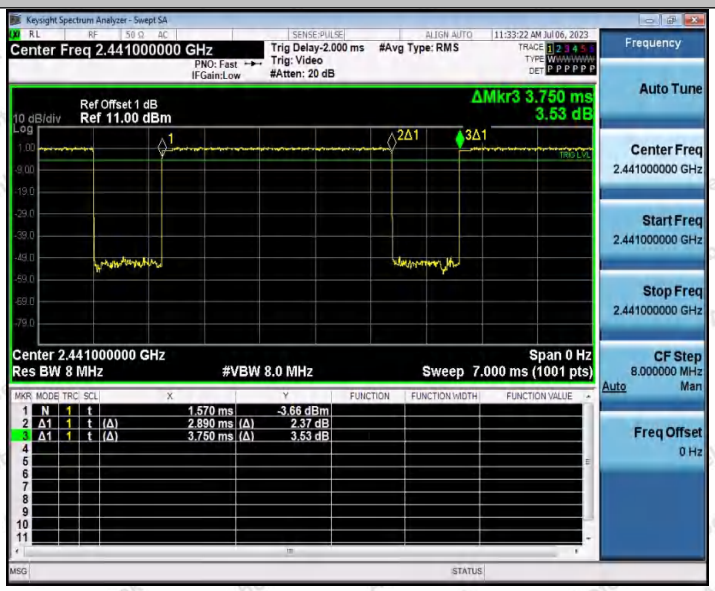

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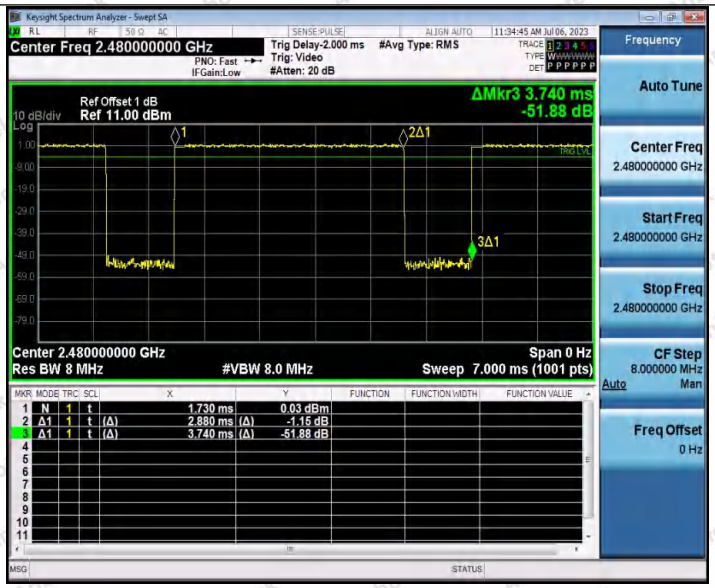

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